Manual on Codes

International Codes

VOLUME I.2

PART B – Binary Codes

PART C – Common Features to Binary and Alphanumeric Codes

2011 edition

Updated in 2013

World Meteorological Organization

WMO-No. 306

Weather • Climate • Water

Manual on Codes

International Codes

Volume I.2

(Annex II to WMO Technical Regulations)

Part B – Binary Codes

Part C – Common Features to Binary and Alphanumeric Codes

WMO-No. 306

2011 edition
Updated in 2013

World
Meteorological
Organization
Weather • Climate • Water

WMO-No. 306

Chair, Publications Board
World Meteorological Organization (WMO)
7 bis, avenue de la Paix
P.O. Box 2300
CH-1211 Geneva 2, Switzerland

Tel.: +41 (0) 22 730 84 03
Fax: +41 (0) 22 730 80 40
E-mail: publications@wmo.int

ISBN 978-92-63-10306-2

PUBLICATION REVISION TRACK RECORD

Date	*Part/ chapter/ section*	*Purpose of amendment*	*Proposed by*	*Approved by*
2012	Part B, b. List of binary codes; Part C, b. List of table-driven alphanumeric codes, and c. Common code tables	Consolidation of amendments approved by the fast-track procedure and the procedure for adoption of amendments between CBS sessions	CBS/OPAG-ISS/IPET-DRC	Fast-track procedure in April and September 2012, and procedure for adoption of amendments between CBS sessions in March 2012 (CBS/WIS/DRMM/DRC (PR-6630))
2013	Part B, b. List of binary codes; Part C, b. List of table-driven alphanumeric codes, and c. Common code tables	Consolidation of amendments approved by the fast-track procedure and the procedure for adoption of amendments between CBS sessions	CBS/OPAG-ISS/IPET-DRMM	Fast-track procedure in April and August 2013, and procedure for adoption of amendments between CBS sessions in May 2013 (CBS/WIS/DRMM/DRC (PR-6688))

EDITORIAL NOTE

Considering that code forms, regulations, tables and notes in Volume I.2 form the basis for correct encoding/decoding, all these must be abided by regardless of the use of "shall" or "should".

Typefaces employed in this volume therefore do not signify standard or recommended practices, and are used solely for legibility.

PREFACE

Coded messages are used for the international exchange of meteorological information comprising observational data provided by the WWW Global Observing System and processed data provided by the WWW Global Data-processing and Forecasting System. Coded messages are also used for the international exchange of observed and processed data required in specific applications of meteorology to various human activities and for exchanges of information related to meteorology.

The codes are composed of a set of CODE FORMS and BINARY CODES made up of SYMBOLIC LETTERS (or groups of letters) representing meteorological or, as the case may be, other geophysical elements. In messages, these symbolic letters (or groups of letters) are transcribed into figures indicating the value or the state of the elements described. SPECIFICATIONS have been defined for the various symbolic letters to permit their transcription into figures. In some cases, the specification of the symbolic letter is sufficient to permit a direct transcription into figures. In other cases, it requires the use of CODE FIGURES, the specifications of which are given in CODE TABLES. Furthermore, a certain number of SYMBOLIC WORDS and SYMBOLIC FIGURE GROUPS have been developed for use as code names, code words, symbolic prefixes or indicator groups.

Rules concerning the selection of code forms to be exchanged *for international purposes*, and the selection of their symbolic words, figure groups and letters, are laid down in the WMO *Technical Regulations*, Volume I, section 2.3 (2011 edition, updated in 2012). These code forms are contained in Volume I of the *Manual on Codes*, issued as Volume I.1 – Part A, and Volume I.2 – Part B and Part C.

Apart from these international codes, several sets of *regional codes* exist which are intended only for exchanges within a given WMO Region. These codes are contained in Volume II of the *Manual on Codes*. This volume also contains descriptions of:

– Regional coding procedures for the use of international code forms;

– National coding practices in the use of international or regional codes of which the Secretariat has been informed;

– National code forms.

A number of special codes which are used in messages exchanged over the WWW Global Telecommunication System circuits, and which comprise ice and satellite ephemeris codes, are included in Volume II as an Appendix.

This edition of Volume I.2 of the *Manual on Codes* replaces the 2010 edition.

CONTENTS

VOLUME I.2 – INTERNATIONAL CODES

	Page
Introduction	ix
Definitions	xiii
Part B – Binary Codes	
a. FM system of numbering binary codes	I.2 – Bi — 1
b. List of binary codes with their specifications and associated code tables	I.2 – Bi — 3
FM 92-XI Ext. GRIB – Edition 1 (Gridded binary)	I.2 – Bi — 3
FM 92 GRIB – General regularly distributed information in binary form	I.2 – GRIB Reg — 1
GRIB – Identification templates	I.2 – GRIB IT — 1
GRIB – Grid definition templates	I.2 – GRIB GDT — 1
GRIB – Product definition templates	I.2 – GRIB PDT — 1
GRIB – Data representation templates	I.2 – GRIB DRT — 1
GRIB – Data templates	I.2 – GRIB DT — 1
GRIB – Code and flag tables	I.2 – GRIB CF0 — 1
Attachment: Definition of a triangular grid based on an icosahedron	I.2 – Att.GRIB — 1
FM 94 BUFR – Binary universal form for the representation of meteorological data	I.2 – BUFR Reg — 1
BUFR Table A – Data category	I.2 – BUFR Table A — 1
BUFR/CREX Table B – Classification of elements	I.2 – BUFR/CREX Table B — 1
BUFR Table C – Data description operators	I.2 – BUFR Table C — 1
BUFR Table D – List of common sequences	I.2 – BUFR Table D — 1
Code tables and flag tables associated with BUFR/CREX Table B	I.2 – CODE/FLAG Tables — 1
Attachment: Definition of FM 94 BUFR using Backus-Naur Form	I.2 – Att.BUFR — 1
Part C – Common Features to Binary and Alphanumeric Codes	
a. FM system of numbering table-driven alphanumeric codes	I.2 – Co — 1
b. List of table-driven alphanumeric codes with their specifications and associated code tables	I.2 – CREX Reg — 1
FM 95 CREX – Character form for the representation and exchange of data	I.2 – CREX Reg — 1
CREX Table A – Data category	I.2 – CREX Table A — 1
CREX Table B – Classification of elements	I.2 – CREX Table B — 1
CREX Table C – Data description operators	I.2 – CREX Table C — 1
CREX Table D – List of common sequences	I.2 – CREX Table D — 1
Attachment: CREX template examples	I.2 – Att.CREX — 1
c. Common code tables to binary and alphanumeric codes	I.2 – Co Tab — 1
d. Regulations for reporting traditional observation data in Table-Driven Code Forms (TDCF): BUFR or CREX	I.2 – RegTradObs — 1
Attachment I: Examples of templates for the transmission in BUFR or CREX of other data types	I.2 – Att.I/Co — 1
Attachment II: List of alphanumeric code tables related to BUFR and CREX code tables and flag tables	I.2 – Att.II/Co — 1

INTRODUCTION

Volume I of the *Manual on Codes* contains WMO international codes for meteorological data and other geophysical data relating to meteorology; it constitutes Annex II of the WMO *Technical Regulations* and has therefore the status of a Technical Regulation. It is issued in two volumes: Volume I.1, containing PART A, and Volume I.2, containing PART B and PART C.

VOLUME I.1:

Part A – Alphanumeric Codes consists of five sections. The standard coding procedures are distinguished by the use of the term "shall" in the English text, and by suitable equivalent terms in the French, Russian and Spanish texts. Where national practices do not conform with these regulations, Members concerned shall formally notify the Secretary-General of WMO for the benefit of other Members.

VOLUME I.2:

Part B – Binary Codes consists of the list of binary codes with their specifications and associated code tables. Explanatory notes are sometimes added to regulations.

Part C – Common Features to Binary and Alphanumeric Codes consists of the list of table-driven alphanumeric codes with their specifications and associated code tables, and of common code tables to binary and alphanumeric codes.

The attachments (yellow background) to Volume I.2 do not have the status of WMO *Technical Regulations* and are given for information only.

PROCEDURES FOR AMENDING THE *MANUAL ON CODES*

1. General validation and implementation procedures

1.1 Proposal of amendments

Amendments to the *Manual on Codes* shall be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements for the proposed amendment. A contact point for technical matters shall be identified to facilitate collaboration for the validation and drafting of a recommendation.

1.2 Drafting recommendation

The Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM),[1] supported by the Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO Technical Regulations) and develop a draft recommendation to respond to the requirements, as appropriate.

1.3 Date of implementation

The IPET-DRMM should define a date of implementation in order to give sufficient time to WMO Members to implement the amendments after the date of notification; the IPET-DRMM should document the reasons to propose a time span of less than six months except for the fast-track procedure.

1.4 Procedures for approval

After a draft recommendation of the IPET-DRMM is validated in accordance with the procedure given in section 6 below, depending on the type of amendments, the IPET-DRMM may select one of the following procedures for the approval of the amendments:

- Fast-track procedure (see section 2 below);
- Procedure for the adoption of amendments between CBS sessions (see section 3 below);
- Procedure for the adoption of amendments during CBS sessions (see section 4 below).

[1] The IPET-DRMM, the ICT-ISS and the OPAG-ISS are the current bodies dealing with data representation and codes within CBS. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities appropriately.

1.5 Urgent introduction

Regardless of the above procedures, as an exceptional measure, the following procedure accommodates urgent user needs to introduce new entries in BUFR/CREX tables A, B and D, code and flag tables of BUFR, CREX and GRIB edition 2 and Common Code tables.

(a) A draft recommendation developed by IPET-DRMM shall be validated according to 6.1, 6.2 and 6.3 below.

(b) The draft recommendation for pre-operational use, which can be used in operational data and products, shall be approved by the chairs of IPET-DRMM and the Open Programme Area Group on Information Systems and Services (OPAG-ISS), and the president of CBS. The list of pre-operational entries is kept on-line on the WMO Web server;

(c) Pre-operational entries need to be approved by one of the procedures in 1.4 for operational use.

1.6 Version number

The version number of the master table will be incremented.

1.7 Issuing the updated version

Once amendments to the *Manual on Codes* are adopted, an updated version of the relevant part of the Manual shall be issued in the four languages: English, French, Russian and Spanish. The Secretariat will inform all WMO Members of the availability of a new updated version of that part at the date of notification mentioned in 1.3.

2. Fast-track procedure

2.1 Scope

The fast-track procedure can be used for additions to BUFR or CREX Tables A, B, and D with associated code tables or flag tables, to code or flag tables or templates in GRIB and to common tables C.

2.2 Endorsement

Draft recommendations developed by the IPET-DRMM, including a date of implementation of the amendments, must be endorsed by the chair of OPAG-ISS.

2.3 Approval

2.3.1 Minor adjustments

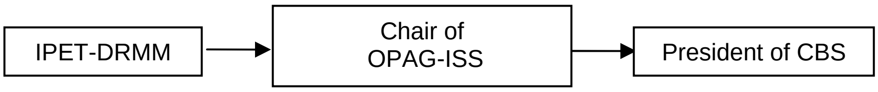
The filling of reserved and unused entries in the existing code and flag tables, and Common Code tables is considered as a minor adjustment, and will be done by the Secretary-General in consultation with the president of CBS.

2.3.2 Other types of amendments

For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the focal points for codes and data representation matters for comments, with a deadline of two months for the reply. It should then be submitted to the president of CBS for adoption on behalf of the Executive Council (EC).

2.4 Frequency

The implementation of amendments approved through the fast-track procedure can be twice a year in May and November.



or

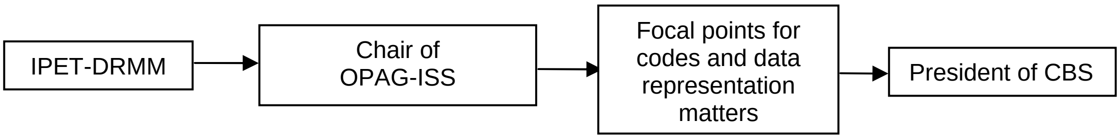


Figure 1. Adoption of amendments by fast-track procedure

3. Procedure for the adoption of amendments between CBS sessions

3.1 Approval of draft recommendation

For the direct adoption of amendments between CBS sessions, the draft recommendation developed by the IPET-DRMM, including a date of implementation of the amendments, shall be submitted to the chair of OPAG-ISS and president and vice-president of CBS for approval.

3.2 Circulation to Members

Upon approval of the president of CBS, the Secretariat sends the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments to be submitted within two months following the dispatch of the amendments.

3.3 Agreement

Those WMO Members not having replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments.

3.4 Coordination

WMO Members are invited to designate a focal point responsible to discuss any comments/disagreements with the IPET-DRMM. If the discussion between the IPET-DRMM and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the IPET-DRMM.

3.5 Notification

Once amendments are agreed by WMO Members, and after consultation with the chair of the OPAG-ISS and the president and vice-president of CBS, the Secretariat notifies at the same time the WMO Members and the members of the Executive Council of the approved amendments and of the date of their implementation.

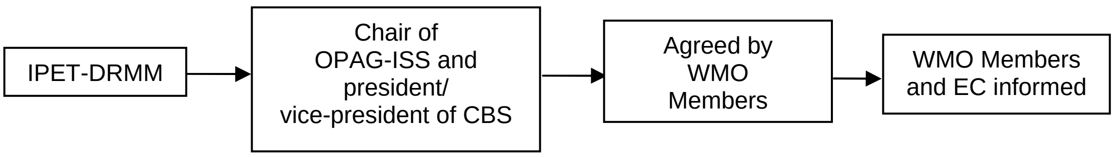


Figure 2. Adoption of amendments between CBS sessions

4. Procedure for the adoption of amendments during CBS sessions

For the adoption of amendments during CBS sessions, the IPET-DRMM submits its recommendation, including a date of implementation of the amendments, to the Implementation/Coordination Team on Information Systems and Services (ICT-ISS) of OPAG-ISS. The recommendation is then submitted to a CBS session and thereafter to an EC session.

IPET-DRMM → Meeting of the ICT-ISS → CBS session → EC session

Figure 3. Adoption of amendments during a CBS session

5. Procedure for the correction of existing entries in the BUFR and CREX tables

5.1 Introducing a new descriptor

If an erroneous specification of an entry is found in an operational BUFR or CREX element descriptor or sequence descriptor, a new descriptor should preferably be added to the appropriate table through the fast-track procedure or the procedure for adoption of amendments between CBS sessions. The new descriptor should be used instead of the old one for encoding (especially if it concerns data width). An appropriate explanation shall be added to the notes of the table to clarify the practice along with the date of the change. This situation is considered a minor adjustment according to 2.3.1 above

5.2 Correcting erroneous specification

As an exceptional measure for erroneous entries in Table B, if it is found absolutely necessary to correct an erroneous specification of an existing entry by changing its specification, the following rules shall apply:

5.2.1 The name and unit of an element descriptor shall remain unchanged except for minor clarifications.

5.2.2 Scale, reference value and bit width may be corrected to required values.

5.2.3 Such a change will be submitted through the fast-track procedure.

6. Validation procedure

6.1 Documentation of need and purpose

The need for, and the purpose of, the proposal for changes should be documented.

6.2 Documentation of result

This documentation must include the results of validation testing of the proposal as described below.

6.3 Testing with encoder/decoder

For new or modified WMO code and data representation forms, proposed changes should be tested by at least two centres, using two independently developed encoders and two independently developed decoders which incorporated the proposed change. Where the data originated from a necessarily unique source (for example, the data stream from an experimental satellite), the successful testing of a single encoder with at least two independent decoders would be considered adequate. Results should be made available to the IPET-DRMM with a view to verifying the technical specifications.

DEFINITIONS

Actual time of observation

(1) In the case of a surface synoptic observation, the time at which the barometer is read.

(2) In the case of upper-air observations, the time at which the balloon, parachute or rocket is actually released.

Alpine glow

Pink or yellow colouring assumed by mountain tops opposite the Sun when it is only just below the horizon before it rises and after it sets. This phenomenon vanishes after a brief interval of blue colouring, when the Earth's shadow reaches these summits.

Anomalous propagation

Propagation of radio energy in abnormal conditions of vertical distribution of refractive index, in association with abnormal distribution of atmospheric temperature and humidity. Use of the term is mainly confined to conditions in which abnormally large distances of propagation are attained.

Atmospheric – Sferic

Electromagnetic wave resulting from an electric discharge (lightning) in the atmosphere.

Automatic station

Meteorological station at which instruments make and transmit observations, the conversion to code form for international exchange being made either directly or at an editing station.

Aviation routine weather report

A statement of the observed meteorological conditions related to a specified time and location, issued on a routine basis for use in international air navigation.

BUFR – *Binary universal form for the representation of meteorological data*

BUFR is the name of a binary code for the exchange and storage of data.

BUFR *message*

A single complete BUFR entity.

Category

The lists of sequence descriptors tabulated in BUFR or CREX Table D are categorized according to their application; categories are provided for non-meteorological sequences, for various types of meteorological sequences, and for sequences which define reports, or major subsets of reports.

Class

A set of elements tabulated together in BUFR/CREX Table B.

Condensation trails (contrails)

Clouds which form in the wake of an aircraft when the atmosphere at flying level is sufficiently cold and humid.

Coordinate class

Classes 0–9 inclusive in BUFR/CREX Table B define elements which assist in the definition of elements from subsequent classes; each of these classes is referred to as a coordinate class.

CREX – Character form for the representation and exchange of data

CREX is the name of a table-driven alphanumeric code for the exchange and storage of data.

Data description operator

Operators which define replication or the operations listed in BUFR or CREX Table C.

Data entity

A single data item.

Data subset

A set of data corresponding to the data description in a BUFR or CREX message; for observational data, a data subset usually corresponds to one observation.

Day darkness

Sky covered with clouds with very strong optical thickness (dark clouds) having a threatening appearance.

Descriptor

An entity entered within the Data description section to describe or define data; a descriptor may take the form of an element descriptor, a replication operator, an operator descriptor, or a sequence descriptor.

Dry thunderstorm

A thunderstorm without precipitation reaching the ground (distinct from a nearby thunderstorm with precipitation reaching the ground but not at the station at the time of observation).

Dust wall or sand wall

Front of a duststorm or sandstorm, having the appearance of a gigantic high wall which moves more or less rapidly.

Element descriptor

A descriptor containing a code figure reference to BUFR/CREX Table B; the referenced entry defines an element, together with the units, scale factor, reference value and data width to be used to represent that element as data.

Equatorial regions

For the purpose of the analysis codes, the region between 30 °N and 30 °S latitudes.

Geometric altitude

Vertical distance (Z) of a level, a point or an object considered as a point, measured from mean sea level.

Geopotential

That potential with which the Earth's gravitational field is associated. It is equivalent to the potential energy of unit mass relative to a standard level (mean sea level by convention) and is numerically equal to the work which would be done against gravity in raising the unit mass from sea level to the level at which the mass is located.

Geopotential ø at geometric height *z* is given by

$$\phi = \int_0^z g \, dz$$

where *g* is the acceleration of gravity.

Geopotential height

Height of a point in the atmosphere expressed in units (geopotential metres) proportional to the geopotential at that height. Geopotential height expressed in geopotential metres is approximately equal to $\frac{g}{9.8}$ times the geometric height expressed in (geometric) metres, *g* being the local acceleration of gravity.

Haboob

A strong wind and duststorm or sandstorm in the northern and central Sudan. Its average duration is three hours; the average maximum wind velocity is over 15 m s^{-1}. The dust or sand forms a dense whirling wall which may be 1 000 m high; it is often preceded by isolated dust whirls. Haboobs usually occur after a few days of rising temperature and falling pressure.

Ice crust (ice slick)

(1) A type of snow crust; a layer of ice, thicker than a film crust, upon a snow surface. It is formed by the freezing of melt water or rainwater which has flowed into it.

(2) See *Ice rind.*

Ice rind

A thin but hard layer of sea ice, river ice or lake ice. Apparently this term is used in at least two ways: (a) for a new encrustation upon old ice; and (b) for a single layer of ice usually found in bays and fjords where fresh water freezes on top of slightly colder sea water.

Instrumental wave data

Data on measured characteristics relating to period and height of the wave motion of the sea surface.

Inversion (layer)

Atmospheric layer, horizontal or approximately so, in which the temperature increases with increasing height.

Isothermal layer

Atmospheric layer through which there is no change of temperature with height.

Jet stream

Flat tubular current of air, quasi-horizontal, whose axis is along a line of maximum speed and which is characterized not only by great speeds but also by strong transverse gradients of speed.

Line squall

Squall which occurs along a squall line.

Lithometeor

Meteor consisting of an ensemble of particles most of which are solid and non-aqueous. The particles are more or less suspended in the air, or lifted by the wind from the ground.

Mountain waves

Oscillatory motions of the atmosphere induced by flow over a mountain; such waves are formed over and to the lee of the mountain or mountain chain.

Normals

Period averages computed for over a uniform and relatively long period comprising at least three consecutive 10-year periods.

Obscured sky

Occasions of hydrometeors or lithometeors which are so dense as to make it impossible to tell whether there is cloud above or not.

Ocean weather station

A station aboard a suitably equipped and staffed ship that endeavours to remain at a fixed sea position and that makes and reports surface and upper-air observations and may also make and report subsurface observations.

Operator descriptor

A descriptor containing a code figure reference to BUFR or CREX Table C, together with data to be used as an operand.

Past weather

Predominant characteristic of weather which had existed at the station during a given period of time.

Persistent condensation trail

Long-lived condensation trails which have spread to form clouds having the appearance of Cirrus or patches of Cirrocumulus or Cirrostratus. It is sometimes impossible to distinguish such clouds from other Cirrus, Cirrocumulus or Cirrostratus.

Present weather

Weather existing at the time of observation, or under certain conditions, during the hour preceding the time of observation.

Prevailing visibility

The greatest visibility value, observed in accordance with the definition of "visibility", which is reached within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.

Note: This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility.

Purple light

Glow with a hue varying between pink and red, which is to be seen in the direction of the Sun before it rises and after it sets and is about 3° to 6° below the horizon. It takes the form of a segment of a more or less large luminous disc which appears above the horizon.

Reference value

All data are represented within a BUFR or CREX message by positive integers; to enable negative values to be represented, suitable negative base values are specified as reference values. The true value is obtained by addition of the reference value and the data as represented.

Replication descriptor

A special descriptor is reserved to define the replication operation; it is used to enable a given number of subsequent descriptors to be replicated a given number of times.

Runway visual range

The range over which the pilot of an aircraft on the centre line of the runway can see the runway markings or the lights delineating the runway or identifying its centre line.

Sea station

An observing station situated at sea. Sea stations include ships, ocean weather stations and stations on fixed or drifting platforms (rigs, platforms, lightships and buoys).

Section

A logical subdivision of a BUFR or CREX message, to aid description and definition.

Sequence descriptor

A descriptor used as a code figure to reference a single entry in BUFR or CREX Table D; the referenced entry contains a list of descriptors to be substituted for the sequence descriptor.

Severe line squall

Severe squall which occurs along squall line (see Line squall).

Snow haze

A suspension in the air of numerous minute snow particles, considerably reducing the visibility at the Earth’s surface (visibility in snow haze often decreases to 50 m). Snow haze is observed most frequently in Arctic regions, before or after a snow storm.

Squall

Atmospheric phenomenon characterized by a very large variation of wind speed: it begins suddenly, has a duration of the order of minutes and decreases rather suddenly in speed. It is often accompanied by a shower or thunderstorm.

Squall line

Fictitious moving line, sometimes of considerable extent, along which squall phenomena occur.

Sun pillar

Pillar of white light, which may or may not be continuous, which may be observed vertically above or below the sun. Sun pillars are most frequently observed near sunrise or sunset; they may extend to about 20° above the Sun, and generally end in a point. When a sun pillar appears together with a well-developed parhelic circle, a sun cross may appear at their intersection.

Synoptic hour

Hour, expressed in terms of UTC, at which, by international agreement, meteorological observations are made simultaneously throughout the globe.

Synoptic observation

A surface or upper-air observation made at standard time.

Synoptic surface observation

Synoptic observation, other than an upper-air observation, made by an observer or an automatic weather station on the Earth’s surface.

Template

Description of the standardized layout of a set of data entities.

Tropical (Tropic)

Pertaining to that region of the Earth's surface lying between the Tropic of Cancer and Tropic of Capricorn at 23° 30´N and S, respectively.

Tropical cyclone

Cyclone of tropical origin of small diameter (some hundreds of kilometres) with minimum surface pressure in some cases less than 900 hPa, very violent winds and torrential rain; sometimes accompanied by thunderstorms. It usually contains a central region, known as the "eye" of the storm, with a diameter of the order of some tens of kilometres, and with light winds and more or less lightly clouded sky.

Tropical revolving storm

Tropical cyclone.

Tropopause

(1) Upper limit of the troposphere. By convention, the "first tropopause" is defined as the lowest level at which the lapse rate decreases to 2° C km-1 or less, provided also the average lapse rate between this level and all higher levels within 2 km does not exceed 2° C km^{-1}.

(2) If, above the first tropopause, the average lapse rate between any level and all higher levels within 1 km exceeds 3° C km^{-1}, then a "second tropopause" is defined by the same criterion as under (1). This second tropopause may be either within or above the 1 km layer.

Twilight glow

See Purple light.

Twilight glow in the mountains (Alpenglühen)

See Alpine glow.

Unit of geopotential (H_m')

1 standard geopotential metre = 0.980 665 dynamic metre

$$H_m' = \frac{1}{9.80665} \int_0^z g\,(z)\,dz$$

where $g(z)$ = acceleration of gravity, in m s^{-2}, as a function of geometric height;

z = geometric height, in metres;

H_m' = geopotential, in geopotential metres.

Vertical visibility

Maximum distance at which an observer can see and identify an object on the same vertical as himself, above or below.

Visibility (for aeronautical purposes)

Visibility for aeronautical purposes is the greater of:

(a) The greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

(b) The greatest distance at which lights in the vicinity of 1000 candelas can be seen and identified against an unlit background.

Note: The two distances have different values in air of a given extinction coefficient, and the latter (b) varies with the background illumination. The former (a) is represented by the meteorological optical range (MOR).

Whiteout

Uniformly white appearance of the landscape when the ground is snow covered and the sky is uniformly covered with clouds. An atmospheric optical phenomenon of the polar regions in which the observer appears to be engulfed in a uniformly white glow. Neither shadows, horizon, nor clouds are discernible; sense of depth and orientation are lost; only very dark, nearby objects can be seen. Whiteout occurs over an unbroken snow cover and beneath a uniformly overcast sky, when, with the aid of the snowblink effect, the light from the sky is about equal to that from the snow surface. Blowing snow may be an additional cause. The phenomenon is experienced in the air as well as on the ground.

Wind (mean wind, spot wind)

Air motion relative to the Earth's surface. Unless it is otherwise specified, only the horizontal component is considered.

(1) *Mean wind:* For the purpose of upper air reports from aircraft, mean wind is derived from the drift of the aircraft when flying from one fixed point to another or obtained by flying on a circuit around a fixed observed point and an immediate wind deduced from the drift of the aircraft.

(2) *Spot wind:* For the purpose of upper-air reports from aircraft, the wind velocity, observed or predicted, for a specified location, height and time.

Zodiacal light

White or yellowish light which spreads out, in the night sky, more or less along the zodiac from the horizon on the side on which the Sun is hidden. It is observed when the sky is sufficiently dark and the atmosphere sufficiently clear.

PART B

BINARY CODES

a. **FM system of numbering binary codes**

b. **List of binary codes with their specifications and associated code tables**

FM 92-XI Ext. GRIB

FM 92 GRIB

Attachment: Definition of a triangular grid based on an icosahedron

FM 94 BUFR

Attachment: Definition of FM 94 BUFR using Backus-Naur Form

a. FM SYSTEM OF NUMBERING BINARY CODES

Each binary code bears a number, preceded by the letters FM. This number is followed by a Roman numeral to identify the session of CBS which either approved the binary code as a new one or made the latest amendment to its previous version. A binary code approved or amended by correspondence after a session of CBS receives the number of that session.

Furthermore, an indicator term is used to designate the binary code colloquially and is therefore called a “code name”.

Notes on nomenclature:

(a) Changes and augmentations to the structure of the GRIB data representation shall be identified as different “GRIB edition numbers”. The current edition number is 2. However, GRIB edition 1 (FM 92-XI Ext. GRIB) remains in use and is listed in this Manual.

Changes to the content of any of the tables, including the grid definitions, shall be identified as different “table versions”. Previous tables were Version 11; the version described in this edition is “Tables Version 12”. Further GRIB editions and table versions may be generated independently of one another in the future as requirements dictate;

(b) Changes and augmentations to the structure of the BUFR data representation shall be identified as different “BUFR edition numbers”. The previous edition number was 3. The new edition number is 4. Changes to the content of the parameter Tables A, B, C and D shall be identified as different “table versions”. The previous tables were Version 20; the changes described in this edition will become “Tables A, B, C and D, Version 21”.

Further BUFR editions and table versions may be generated independently of one another in the future as requirements dictate.

The FM system of numbering the binary codes, together with the corresponding code names and their reference list of CBS approved decision, is the following:

FM SYSTEM OF BINARY CODES

FM 92–XI Ext. GRIB edition 1 (gridded binary)	**Processed data in the form of grid-point values expressed in binary form** Res. 4 (EC-XXXVIII), Res. 1 (EC-XL), Rec. 23 (CBS-89), approved by the President of WMO, Rec. 22 (CBS-91), approved by the President of WMO, Rec. 15 (CBS-93), approved by the President of WMO, Rec. 16 (CBS-94), approved by the President of WMO, Res. 4 (EC-XLVII), Rec. 14 (CBS-95), approved by the President of WMO, Rec. 15 (CBS-96), approved by the President of WMO and Res. 8 (EC-LI)
FM 92–XIV GRIB	**General regularly distributed information in binary form** Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 8 (EC-LV), Res. 2 (EC-LVII), Res. 10 (EC-LIX), Res. 7 (EC-LXI) and adoption between CBS sessions (2010, 2012 and 2013)

FM 94–XIV BUFR **Binary universal form for the representation of meteorological data**

Res. 1 (EC-XL), Rec. 23 (CBS-89), approved by the President of WMO, Rec. 22 (CBS-91), approved by the President of WMO, Rec. 15 (CBS-93), approved by the President of WMO, Rec. 16 (CBS-94), approved by the President of WMO, Res. 4 (EC-XLVII), Rec. 14 (CBS-95), approved by the President of WMO, Rec. 15 (CBS-96), approved by the President of WMO, Res. 4 (EC-XLIX), Rec. 9 (CBS-97), approved by the President of WMO, Rec. 10 (CBS-98), approved by the President of WMO, Res. 8 (EC-LI), Rec. 8 (CBS-99), Rec. 9 (CBS-00), approved by the President of WMO, Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 8 (EC-LV), Res. 2 (EC-LVII), Res. 10 (EC-LIX), Res. 7 (EC-LXI), and adoption between CBS sessions (2010, 2012 and 2013)

b. LIST OF BINARY CODES WITH THEIR SPECIFICATIONS AND ASSOCIATED CODE TABLES

FM 92–XI Ext. GRIB edition 1 (gridded binary)

Processed data in the form of grid-point values expressed in binary form

C O D E F O R M :

SECTION 0	Indicator section
SECTION 1	Product definition section
SECTION 2	(Grid description section)
SECTION 3	(Bit-map section)
SECTION 4	Binary data section
SECTION 5	7777

Notes:

(1) GRIB is the name of the binary code for the exchange of processed data.

(2) The GRIB coded analysis or forecast consists of a continuous bit-stream made of a sequence of octets (1 octet = 8 bits).

(3) The octets of a GRIB message are grouped in sections:

Section number	*Name*	*Contents*
0	Indicator section	"GRIB", length of message, GRIB edition number
1	Product definition section	Length of section, identification of the coded analysis or forecast
2	Grid description section (optional)	Length of section, grid geometry, as necessary
3	Bit-map section (optional)	Length of section; the bit per grid point, placed in suitable sequence, indicates omission (bit 0) or inclusion (bit 1) of data at respective points
4	Binary data section	Length of section and data values
5	End section	7777

(4) Although the Grid description section is indicated as optional, it is strongly urged that it be included in all GRIB messages.

(5) It will be noted that the GRIB code is not suitable for visual data recognition without computer interpretation.

(6) The representation of data by means of series of bits is independent of any particular machine representation.

(7) Message and section lengths are expressed in octets. Section 0 has a fixed length of 8 octets; Section 5 has a fixed length of 4 octets. Sections 1, 2, 3 and 4 have a variable length which is included in the first three octets of each section.

(8) In the GRIB message, the bit length of "International Alphabet No. 5" is regarded as 8-bit, adding one bit "0" to the 7-bit of IA5 as the most significant bit.

R E G U L A T I O N S :

92.1 General

92.1.1 **The GRIB code shall be used for the exchange of processed data expressed in binary form.**

92.1.2 **The GRIB code shall always contain an even number of octets.**

92.1.3 **The beginning and the end of the code shall be identified by 4 octets coded according to the International Alphabet No. 5 to represent, respectively, the indicators GRIB and 7777 in Indicator section 0 and End section 5. All other octets included in the code shall represent data in binary form.**

92.1.4 **Each section included in the code shall always contain an even number of octets. This rule shall be applied by appending bits set to zero to the section where necessary.**

92.2 Section 0 – Indicator section

92.2.1 **Section 0 shall always be 8 octets long.**

92.2.2 **The first four octets shall always be character coded according to the International Alphabet No. 5 as GRIB.**

92.2.3 **The remainder of the section shall contain the length of the entire GRIB message (including the Indicator section) expressed in binary form over the left-most 3 octets (i.e. 24 bits), followed by the GRIB edition number, in binary, in the remaining octet.**

92.3 Section 1 – Product definition section

92.3.1 **The length of the section, in units of octets, shall be expressed in binary form over the group of the first three octets of the section, that is, over 24 bits.**

92.3.2 **Octet 8 of the section shall be used to indicate the inclusion or the omission of Sections 2 or 3 or of both of them.**

92.3.3 **Octets 29–40 are reserved for future use and need not be present. Octets 41 and following are set aside for use by the originating centre.**

92.4 Section 2 – Grid description section

Regulation 92.3.1 shall apply.

92.5 Section 3 – Bit-map section

92.5.1 **Regulation 92.3.1 shall apply.**

92.5.2 Octets 5 and 6 shall be used to indicate that the bit-map is either predetermined and *not* explicitly included, or that the bit-map follows.

92.6 **Section 4 – Binary data section**

92.6.1 Regulation 92.3.1 shall apply.

92.6.2 Data shall be coded using the minimum number of bits necessary to provide for the accuracy required by international agreement. This required accuracy/precision shall be achieved by scaling the data by multiplication by an appropriate power of 10 (which may be 0) prior to forming the non-negative differences, and then using the binary scaling to select the precision of the transmitted value.

92.6.3 Data shall be coded in the form of non-negative scaled differences from a reference value.

Notes:

(1) The reference value is normally the minimum value of the data set which is represented.

(2) The actual value Y (in the units of Code table 2) is linked to the coded value X, the reference value R, the binary scale factor E and the decimal scale factor D by means of the following formula:

$$Y \times 10^D = R + X \times 2^E$$

(3) When second-order grid-point packing is indicated, the actual value Y (in the units of Code table 2) is linked to the coded values X_i and X_j, the reference value R, the binary scale factor E and the decimal scale factor D by means of the following formula:

$$Y \times 10^D = R + (X_i + X_j) \times 2^E$$

92.6.4 The reference value shall be represented over 4 octets as a single precision floating point number, consisting of a leading sign bit, a 7-bit characteristic and a 24-bit binary fraction.

Notes:

(1) The characteristic is convertible to a power of 16 by subtracting 64 from its 7-bit representation.

(2) The reference value R is linked to the binary numbers s, A, B, representing the sign (1 bit) positive coded as "0", negative coded as "1", a biased exponent (exponent + 64) (7 bits), and the mantissa (24 bits), by means of the following formula:

$$R = (-1)^s \times 2^{(-24)} \times B \times 16^{(A-64)}$$

92.7 **Section 5 – End section**

The End section shall always be 4 octets long, character coded according to the International Alphabet No. 5 as 7777.

SPECIFICATIONS OF OCTET CONTENTS

Notes:

(1) Octets are numbered 1, 2, 3, etc., starting at the beginning of each section.

(2) In the following, bit positions within octets are referred to as bit 1 to bit 8, where bit 1 is the most significant and bit 8 is the least significant bit. Thus, an octet with only bit 8 set to 1 would have the integer value 1.

Section 0 – Indicator section

Octet No.	Contents
1–4	GRIB (coded according to the CCITT International Alphabet No. 5)
5–7	Total length of GRIB message (including Section 0)
8	GRIB edition number (currently 1)

Section 1 – Product definition section

Octet No.	Contents	
1–3	Length of section	
4	GRIB tables Version No. (currently 3 for international exchange) – Version numbers 128–254 are reserved for local use	
5	Identification of originating/generating centre (see Code table 0 = Common Code table C–1 in Part C/c.)	
6	Generating process identification number (allocated by originating centre)	
7	Grid definition (Number of grid used – from catalogue defined by originating centre)	
8	Flag (see Regulation 92.3.2 and Code table 1)	
9	Indicator of parameter (see Code table 2)	
10	Indicator of type of level (see Code table 3)	
11–12	Height, pressure, etc. of levels (see Code table 3)	
13	Year of century	Reference time of data – date and time of start of averaging or accumulation period
14	Month	
15	Day	
16	Hour	
17	Minute	
18	Indicator of unit of time range (see Code table 4)	
19	P1 – Period of time (number of time units) (0 for analyses or initialized analyses). Units of time given by octet 18	
20	P2 – Period of time (number of time units); or Time interval between successive analyses, initialized analyses or forecasts, undergoing averaging or accumulation. Units of time given by octet 18	
21	Time range indicator (see Code table 5)	
22–23	N – Number included in calculation when octet 21 (Code table 5) refers to a statistical process, such as average or accumulation; otherwise set to zero	
24	Number missing from calculation in case of statistical process	
25	Century of reference time of data	
26	Sub-centre identification (see common Code table C–1 in Part C/c., Note 3)	
27–28	Units decimal scale factor (D)	
29–40	Reserved: need not be present	
41–nn	Reserved for originating centre use	

Notes:

(1) Inclusion of the Section 2 – Grid description section (GDS) – is the preferred method of defining a grid.

(2) Where octet 7 defines a catalogued grid, that grid should also be defined in Section 2, provided the flag in octet 8 indicates inclusion of Section 2.

(3) Octet 7 must be set to 255 to indicate a non-catalogued grid, in which case the grid will be defined in Section 2.

(4) A negative value of D shall be indicated by setting the high-order bit (bit 1) in the left-hand octet to 1 (on).

(5) If a Grid description section is not included, then any u- or v-components of vector quantities in the message are to be resolved relative to the specified grid in the direction of increasing x and y (or i and j) coordinates respectively.

If a Grid description section is included in the message, which is the preferred option, then octet 17 of the GDS and Code table 7 will contain component resolution information.

(6) To specify year 2000, octet 13 of the section (year of the century) shall contain a value equal to 100 and octet 25 of the section (Century of reference time data) shall contain a value equal to 20. To specify year 2001, octet 13 of the section shall contain a value equal to 1 and octet 25 of the section shall contain a value equal to 21 (by International Convention, the date of 1 January 2000 is the first day of the hundredth year of the twentieth century and the date of 1 January 2001 is the first day of the first year of the twenty-first century); it is to be noted also that year 2000 is a leap year and that 29 February 2000 exists.

Section 2 – Grid description section

Octet No.	Contents
1–3	Length of section (octets)
4	NV – number of vertical coordinate parameters
5	PV – location (octet number) of the list of vertical coordinate parameters, if present; or PL – location (octet number) of the list of numbers of points in each row (if no vertical coordinate parameters are present), if present; or 255 (all bits set to 1) if neither are present
6	Data representation type (see Code table 6)
7–32	Grid definition (according to data representation type – octet 6 above)
33–42	Extensions of grid definition for rotation or stretching of the coordinate system or Lambert conformal projection or Mercator projection
33–44	Extensions of grid definition for space view perspective projection
33–52	Extensions of grid definition for stretched and rotated coordinate system
PV	List of vertical coordinate parameters (length = NV × 4 octets); if present, then PL = 4NV + PV
PL	List of numbers of points in each row (length = NROWS x 2 octets, where NROWS is the total number of rows defined within the grid description)

Notes:

(1) Vertical coordinate parameters are used in association with hybrid vertical coordinate systems.

(2) Hybrid systems, in the context, employ a means of representing vertical coordinates in terms of a mathematical combination of pressure and sigma coordinates. When used in conjunction with a surface pressure field and an appropriate mathematical expression, the vertical coordinate parameters may be used to interpret the hybrid vertical coordinate.

(3) Each vertical coordinate parameter is represented in 4 octets, using the scheme for representing floating point numbers described in Regulation 92.6.4.

Grid definition – latitude/longitude grid (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
7–8	Ni – number of points along a parallel
9–10	Nj – number of points along a meridian
11–13	La1 – latitude of first grid point
14–16	Lo1 – longitude of first grid point
17	Resolution and component flags (see Code table 7)
18–20	La2 – latitude of last grid point
21–23	Lo2 – longitude of last grid point
24–25	Di – i direction increment
26–27	Dj – j direction increment
28	Scanning mode (flags – see Flag/Code table 8)
29–32	Set to zero (reserved)
33–35	Latitude of the southern pole in millidegrees (integer) Latitude of pole of stretching in millidegrees (integer)
36–38	Longitude of the southern pole in millidegrees (integer) Longitude of pole of stretching in millidegrees (integer)
39–42	Angle of rotation (represented in the same way as the reference value) Stretching factor (representation as for the reference value)
43–45	Latitude of pole of stretching in millidegrees (integer)
46–48	Longitude of pole of stretching in millidegrees (integer)
49–52	Stretching factor (representation as for the reference value)

Notes:

(1) Latitude, longitude and increments are in millidegrees.

(2) Latitude values are limited to the range 0–90 000; bit 1 is set to 1 to indicate south latitude.

(3) Longitude values are limited to the range 0–360 000; bit 1 is set to 1 to indicate west longitude.

(4) The latitude and longitude of the last grid point and the first grid point should always be given for regular grids.

(5) Where items are not given, the appropriate octet(s) should have all bits set to 1.

(6) Three parameters define a general latitude/longitude coordinate system, formed by a general rotation of the sphere. One choice for these parameters is:

(a) The geographic latitude in degrees of the southern pole of the coordinate system, θ_p for example;

(b) The geographic longitude in degrees of the southern pole of the coordinate system, λ_p for example;

(c) The angle of rotation in degrees about the new polar axis (measured clockwise when looking from the southern to the northern pole) of the coordinate system, assuming the new axis to have been obtained by first rotating the sphere through λ_p degrees about the geographic polar axis, and then rotating through (90 + θ_p) degrees so that the southern pole moved along the (previously rotated) Greenwich meridian.

(7) For rotated grids, the vertical coordinate parameters start at octet 43 instead of 33.

(8) The stretching is defined by three parameters:

(a) The latitude in degrees (measured in the *model* coordinate system) of the “pole of stretching”;

(b) The longitude in degrees (measured in the *model* coordinate system) of the “pole of stretching”;

(c) The stretching factor C.

The stretching is defined by representing data uniformly in a coordinate system with longitude λ and latitude θ^1, where:

$$\theta^1 = \sin^{-1} \frac{(1 - C^2) + (1 + C^2) \sin \theta}{(1 + C^2) + (1 - C^2) \sin \theta}$$

and λ and θ are longitude and latitude in a coordinate system in which the “pole of stretching” is the northern pole. C = 1 gives uniform resolution, while C > 1 gives enhanced resolution around the pole of stretching.

(9) For stretched grids, the vertical coordinate parameters start at octet 43 instead of 33.

(10) For stretched and rotated latitude/longitude grids, the vertical coordinate parameters start at octet 53.

(11) The first and last grid points may not necessarily correspond to the first and last data points, respectively, if the bit-map section is used.

(12) **For data on a quasi-regular grid, in which all the rows or columns do not necessarily have the same number of grid points, either Ni (octets 7–8) or Nj (octets 9–10) and the corresponding Di (octets 24–25) or Dj (octets 26–27) shall be coded with all bits set to 1 (missing); the actual number of points along each parallel or meridian shall be coded.**

(13) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points. **The first point in each row (column) shall be positioned at the meridian (parallel) indicated by octets 11–16. The grid points shall be evenly spaced in latitude (longitude).**

Grid definition – Gaussian latitude/longitude grid (including rotated, stretched or stretched and rotated)

Octet No.	Contents
7–8	Ni – number of points along a parallel
9–10	Nj – number of points along a meridian
11–13	La1 – latitude of first grid point
14–16	Lo1 – longitude of first grid point
17	Resolution and component flags (see Code table 7)
18–20	La2 – latitude of last grid point
21–23	Lo2 – longitude of last grid point
24–25	Di – i direction increment
26–27	N – number of parallels between a pole and the equator
28	Scanning mode (flags – see Flag/Code table 8)

Octet No.	Contents
29–32	Set to zero (reserved)
33–35	Latitude of the southern pole in millidegrees (integer) Latitude of pole of stretching in millidegrees (integer)
36–38	Longitude of the southern pole in millidegrees (integer) Longitude of pole of stretching in millidegrees (integer)
39–42	Angle of rotation (represented in the same way as the reference value) Stretching factor (representation as for the reference value)
43–45	Latitude of pole of stretching in millidegrees (integer)
46–48	Longitude of pole of stretching in millidegrees (integer)
49–52	Stretching factor (representation as for the reference value)

Notes:

(1) Latitude, longitude and increments are in millidegrees.

(2) Latitude values are limited to the range 0–90 000; bit 1 is set to 1 to indicate south latitude.

(3) Longitude values are limited to the range 0–360 000; bit 1 is set to 1 to indicate west longitude.

(4) The number of parallels between a pole and the equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(5) The latitude and longitude of the last grid point and the first grid point should always be given for regular grids.

(6) Where items are not given, the appropriate octet(s) should have all bits set to 1.

(7) See Notes 6 to 11 under Grid definition – latitude/longitude grid (or equidistant cylindrical, or Plate Carrée) – page I.2 – Bi — 8.

(8) Quasi-regular Gaussian latitude/longitude grids are defined only for subsets of global grids containing full latitude rows (360°).

(9) **For data on a quasi-regular grid, in which all the rows do not necessarily have the same number of grid points, Ni (octets 7–8) and the corresponding Di (octets 24–25) shall be coded with all bits set to 1 (missing); the actual number of points along each parallel shall be coded.**

(10) A quasi-regular Gaussian latitude/longitude grid is only defined for the grid scanning mode with consecutive points on parallels (bit 3 set to zero in Code table 8). **The first point in each row shall be positioned at the meridian indicated by octets 14–16 and the last shall be positioned at the meridian indicated by octets 21–23. The grid points along each parallel shall be evenly spaced in longitude.**

Grid definition – spherical harmonic coefficients (including rotated, stretched or stretched and rotated)

Octet No.	Contents
7–8	J – pentagonal resolution parameter
9–10	K – pentagonal resolution parameter
11–12	M – pentagonal resolution parameter
13	Representation type (see Code table 9)
14	Representation mode (see Code table 10)
15–32	Set to zero (reserved)
33–35	Latitude of the southern pole in millidegrees (integer) Latitude of pole of stretching in millidegrees (integer)
36–38	Longitude of the southern pole in millidegrees (integer) Longitude of pole of stretching in millidegrees (integer)
39–42	Angle of rotation (represented in the same way as the reference value) Stretching factor (representation as for the reference value)
43–45	Latitude of pole of stretching in millidegrees (integer)
46–48	Longitude of pole of stretching in millidegrees (integer)
49–52	Stretching factor (representation as for the reference value)

Notes:

(1) The pentagonal representation of resolution is general. Some common truncations are special cases of the pentagonal one:

Triangular	M = J = K
Rhomboidal	K = J + M
Trapezoidal	K = J, K > M

(2) The representation type (octet 13) indicates the method used to define the norm.

(3) The representation mode (octet 14) indicates the order of the coefficients, whether global or hemispheric data are depicted, and the nature of the parameter stored (symmetric or antisymmetric).

(4) See Notes 6 to 11 under Grid definition – latitude/longitude grid (or equidistant cylindrical, or Plate Carrée) – page I.2 – Bi — 8.

Grid definition – polar stereographic

Octet No.	Contents
7–8	Nx – number of points along x-axis
9–10	Ny – number of points along y-axis
11–13	La1 – latitude of first grid point
14–16	Lo1 – longitude of first grid point
17	Resolution and component flags (see Code table 7)
18–20	LoV – orientation of the grid; i.e. the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the Y-coordinate increases (the orientation longitude may or may not appear on a particular grid)
21–23	Dx – X-direction grid length (see Note 2)
24–26	Dy – Y-direction grid length (see Note 2)
27	Projection centre flag (see Note 5)
28	Scanning mode (flags – see Flag/Code table 8)
29–32	Set to zero (reserved)

Notes:

(1) Latitude and longitude are in millidegrees (thousandths of a degree).

(2) Grid lengths are in units of metres, at the 60-degree parallel nearest to the pole on the projection plane.

(3) Latitude values are limited to the range 0–90 000; bit 1 is set to 1 to indicate south latitude.

(4) Longitude values are limited to the range 0–360 000; bit 1 is set to 1 to indicate west longitude.

(5) Octet 27 (projection centre flag):

bit 1 set to 0 if North Pole is on the projection plane

bit 1 set to 1 if South Pole is on the projection plane

(to be set up as flag table).

(6) Where items are not given, the appropriate octet(s) should have all bits set to 1.

(7) See Note 11 under Grid definition – latitude/longitude grid (or equidistant cylindrical, or Plate Carrée) – page I.2 – Bi — 8.

(8) The resolution flag (bit 1 of Code table 7) is not applicable.

Grid definition – Mercator

Octet No.	Contents
7–8	Ni – number of points along a parallel
9–10	Nj – number of points along a meridian
11–13	La1 – latitude of first grid point
14–16	Lo1 – longitude of first grid point
17	Resolution and component flags (see Code table 7)
18–20	La2 – latitude of last grid point
21–23	Lo2 – longitude of last grid point
24–26	Latin – latitude(s) at which the Mercator projection cylinder intersects the Earth
27	Set to zero (reserved)
28	Scanning mode (flags – see Flag/Code table 8)
29–31	Di – longitudinal direction grid length (see Note 2)
32–34	Dj – latitudinal direction grid length (see Note 2)
35–42	Set to zero (reserved)

Notes:

(1) Latitude and longitude are in millidegrees (thousandths of a degree).

(2) Grid lengths are in units of metres, at the parallel specified by Latin.

(3) Latitude values are limited to the range 0–90 000; bit 1 is set to 1 to indicate south latitude.

(4) Longitude values are limited to the range 0–360 000; bit 1 is set to 1 to indicate west longitude.

(5) The latitude and longitude of the last grid point from the first grid point should always be given.

(6) Where items are not given, the appropriate octet(s) should have all bits set to 1, the "missing" indicator.

(7) The first and last grid points may not necessarily correspond to the first and last data points, respectively, if the bit-map section is used.

Grid definition – Lambert conformal, secant or tangent, conic or bi-polar (normal or oblique), or Albers equal-area, secant or tangent, conic or bi-polar (normal or oblique), projection

Octet No.	Contents
7–8	Nx – number of points along x-axis
9–10	Ny – number of points along y-axis
11–13	La1 – latitude of first grid point
14–16	Lo1– longitude of first grid point
17	Resolution and component flags (see Code table 7)
18–20	LoV – orientation of the grid; i.e. the east longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid)
21–23	Dx – x-direction grid length (see Note 2)
24–26	Dy – y-direction grid length (see Note 2)
27	Projection centre flag (see Note 5)
28	Scanning mode (flags – see Flag/Code table 8)
29–31	Latin 1 – first latitude from the pole at which the secant cone cuts the sphere
32–34	Latin 2 – second latitude from the pole at which the secant cone cuts the sphere
35–37	Latitude of the southern pole in millidegrees (integer)
38–40	Longitude of the southern pole in millidegrees (integer)
41–42	Set to zero (reserved)

Notes:

(1) Latitude and longitude are in millidegrees (thousandths of a degree).

(2) Grid lengths are in units of metres, at the secant cone intersection parallel nearest to the pole on the projection plane.

(3) Latitude values are limited to the range 0–90 000; bit 1 is set to 1 to indicate south latitude.

(4) Longitude values are limited to the range 0–360 000; bit 1 is set to 1 to indicate west longitude.

(5) Octet 27 (projection centre flag):
bit 1 set to 0 if North Pole is on the projection plane
bit 1 set to 1 if South Pole is on the projection plane
bit 2 set to 0 if only one projection centre is used
bit 2 set to 1 if projection is bi-polar and symmetric.

(6) If Latin 1 = Latin 2, then the projection is on a tangent cone.

(7) The resolution flag (bit 1 of Code table 7) is not applicable.

Grid definition – Space view perspective or orthographic

Octet No.	Contents
7–8	Nx – number of points along x-axis (columns)
9–10	Ny – number of points along y-axis (rows or lines)
11–13	Lap – latitude of sub-satellite point
14–16	Lop – longitude of sub-satellite point
17	Resolution and component flags (see Code table 7)
18–20	dx – apparent diameter of Earth in grid lengths, in x-direction
21–23	dy – apparent diameter of Earth in grid lengths, in y-direction
24–25	Xp – x-coordinate of sub-satellite point
26–27	Yp – y-coordinate of sub-satellite point
28	Scanning mode (flags – see Flag/Code table 8)
29–31	Orientation of the grid; i.e. the angle in millidegrees between the increasing y-axis and the meridian of the sub-satellite point in the direction of increasing latitude (see Note 3)
32–34	Nr – altitude of the camera from the Earth's centre, measured in units of the Earth's (equatorial) radius (see Note 4)
35–36	Xo – x-coordinate of origin of sector image
37–38	Yo – y-coordinate of origin of sector image
39–44	Set to zero (reserved)

Notes:

(1) It is assumed that the satellite is at its nominal position, i.e. it is looking directly at its sub-satellite point.

(2) **Octets 32–34 shall be set to all ones (missing) to indicate the orthographic view (from infinite distance).**

(3) It is the angle between the increasing y-axis and the meridian 180°E if the sub-satellite point is the North Pole; or the meridian 0° if the sub-satellite point is the South Pole.

(4) The apparent angular size of the Earth will be given by 2 x Arcsin (1/Nr).

(5) The horizontal and vertical angular resolutions of the sensor (Rx and Ry), needed for navigation equations, can be calculated from the following:

Rx = 2 x Arcsin (1/Nr) / dx
Ry = 2 x Arcsin (1/Nr) / dy

Section 3 – Bit-map section

Octet No.	Contents
1–3	Length of section
4	Number of unused bits at end of Section 3
5–6	Table reference: If the octets contain zero, a bit-map follows If the octets contain a number, it refers to a predetermined bit-map provided by the centre
7–	The bit-map – contiguous bits with a bit to data point correspondence, ordered as defined in the grid definition

Section 4 – Binary data section

Octet No.	Contents
1–3	Length of section
4	Flag (see Code table 11) (first 4 bits). Number of unused bits at end of Section 4 (last 4 bits)
5–6	Scale factor (E)
7–10	Reference value (minimum of packed values)
11	Number of bits containing each packed value
12–	Variable, depending on the flag value in octet 4

Note: A negative value of E shall be indicated by setting the high-order bit (bit 1) in the left-hand octet to 1 (on).

Grid-point data – simple packing

Octet No.	Contents
12–	Binary data

Spherical harmonic coefficients – simple packing

Octet No.	Contents
12–15	Real part of (0.0) coefficient (stored in the same manner as the reference value (octets 7–10))
16–	Binary data

Grid-point data – second-order packing

Octet No.	Contents
12–13	N1 – octet number at which first-order packed data begin
14	Extended flags (see Code table 11)
15–16	N2 – octet number at which second-order packed data begin
17–18	P1 – number of first-order packed values
19–20	P2 – number of second-order packed values
21	Reserved
22–(xx–1)	Width(s) in bits of second-order packed values; each width is contained in 1 octet
xx–(N1–1)	Secondary bit-map, at least P2 bits long, padded to a whole number of octets with binary 0
N1–(N2–1)	P1 first-order packed values, padded to a whole number of octets with binary 0
N2–. . .	P2 second-order packed values

Notes:

(1) The binary data shall consist of P1 first-order packed values, of width given by the contents of octet 11, followed by P2 second-order packed values; there shall be one second-order packed value for each point of the defined grid, as modified by application of the bit-map in Section 3 – Bit-map section, if present.

(2) The width of the second-order packed values shall be indicated by the values of $W2_j$:

- (a) If bit 8 of the extended flags (Code table 11) is 0, all second-order packed values will have the same width, indicated by a single value $W2_1$;
- (b) If bit 8 of the extended flags (Code table 11) is 1, P1 values of the widths of second-order packed values ($W2_j$, j = 1..P1) will be given.

(3) The secondary bit-map, starting at octet xx, shall define with corresponding 1 bits the location where the use of the first-order packed values begins with reference to the defined grid (as modified by the bit-map, Section 3, if present); the first point of the grid, as modified by the bit-map in Section 3 if present, will always be present, and a corresponding 1 shall be set in the first bit of the secondary bit-map.

(4) **Where bit 7 of the extended flags (Code table 11) is 0, the secondary bit-map shall be omitted; and implied secondary bit-map shall be inferred such that a 1 bit is set for the first point of each row (or column) of the defined grid (row by row packing).**

(5) **The original represented data at any point shall be obtained by scanning the points in the order defined by the grid description, as modified by the (optional) bit-map section; each first-order packed value shall remain defined until the point at which the use of a subsequent first-order packed value begins, as defined by the secondary bit-map; the unpacked value shall be obtained by applying the reference value, the binary and the decimal scales to the sum of the first- and second-order values for each point, by the following formula:**

$$Y \times 10^{D} = R + (X_i + X_j) \times 2^{E}$$

where X_i **is the appropriate first-order packed value;**
X_j **is the appropriate second-order packed value.**

(6) If the number of bits $W2_j$, for the appropriate subset, is zero, no values for that subset are represented; i.e. the actual value for that subset is a constant given by $R + (X_i \times 2^{E})$. This is a form of run-length encoding in which a string of identical values is represented by one value; the replication count for that value is, implicitly, in the secondary bit-map.

Spherical harmonics – complex packing

Octet No.	Contents
12–13	N
14–15	IP (where IP = int (1000 x P))
16	J^1
17	K^1
18	M^1
19	Binary data
. . .	Unpacked binary data represented in 004 octets in the same way as the reference value (pairs of coefficients)
N	Packed binary data

Notes:

(1) Removal of the real (0.0) coefficient considerably reduces the variability of the coefficients and results in better packing.

(2) For some spherical harmonic representations, the (0.0) coefficient represents the mean value of the parameter represented.

(3) **For spherical harmonics – complex packing, J^1, K^1, M^1 are the pentagonal resolution parameters specifying the truncation of a subset of the data, which shall be represented unpacked (as is the reference value) and shall precede the packed data.**

P defines a scaling factor by which is packed not the field itself, but the modulus of ∇^{2P} of the field, where ∇^2 is the Laplacian operator. Thus the coefficients ϕ_n^m will be multiplied by $(n(n+1))^P$ before packing, and divided by this factor after unpacking.

N is a pointer to the start of the packed data (i.e. gives octet number)

$$(J^1, K^1, M^1 > 0 \text{ and } P\ 0, + \text{ or } -)$$

The representation mode (Code figure = 2 in Code table 10) in Section 2 shall indicate this type of packing, but as Section 2 is optional, the flag field in Section 4 may also be used to indicate the more complex method.

Section 5 – End section

7777	End of message (coded according to the CCITT International Alphabet No. 5)

CODE TABLES RELATIVE TO SECTION 1

Code table 0 – *Identification of originating/generating centre*

(See common Code table C–1 in Part C/c.)

Code table 1 – *Flag indication relative to Sections 2 and 3*

Bit No.	Value	Meaning
1	0	Section 2 omitted
	1	Section 2 included
2	0	Section 3 omitted
	1	Section 3 included
3–8	0	

Note: Bits enumerated from left to right.

Code table 2 – *Indicator of parameter*

Code figure	Field parameter	Unit
000	Reserved	
001	Pressure	Pa
002	Pressure reduced to MSL	Pa
003	Pressure tendency	Pa s^{-1}
004	Potential vorticity	K m^2 kg^{-1} s^{-1}
005	ICAO Standard Atmosphere reference height	m
006	Geopotential	m^2 s^{-2}
007	Geopotential height	gpm
008	Geometrical height	m
009	Standard deviation of height	m
010	Total ozone	Dobson
011	Temperature	K
012	Virtual temperature	K
013	Potential temperature	K
014	Pseudo-adiabatic potential temperature	K
015	Maximum temperature	K
016	Minimum temperature	K
017	Dewpoint temperature	K
018	Dewpoint depression (or deficit)	K
019	Lapse rate	K m^{-1}
020	Visibility	m
021	Radar spectra (1)	–
022	Radar spectra (2)	–
023	Radar spectra (3)	–
024	Parcel lifted index (to 500 hPa)	K
025	Temperature anomaly	K

(continued)

(Code table 2 – continued)

Code figure	Field parameter	Unit
026	Pressure anomaly	Pa
027	Geopotential height anomaly	gpm
028	Wave spectra (1)	–
029	Wave spectra (2)	–
030	Wave spectra (3)	–
031	Wind direction	Degree true
032	Wind speed	$m\ s^{-1}$
033	u-component of wind	$m\ s^{-1}$
034	v-component of wind	$m\ s^{-1}$
035	Stream function	$m^2\ s^{-1}$
036	Velocity potential	$m^2\ s^{-1}$
037	Montgomery stream function	$m^2\ s^{-2}$
038	Sigma coordinate vertical velocity	s^{-1}
039	Vertical velocity	$Pa\ s^{-1}$
040	Vertical velocity	$m\ s^{-1}$
041	Absolute vorticity	s^{-1}
042	Absolute divergence	s^{-1}
043	Relative vorticity	s^{-1}
044	Relative divergence	s^{-1}
045	Vertical u-component shear	s^{-1}
046	Vertical v-component shear	s^{-1}
047	Direction of current	Degree true
048	Speed of current	$m\ s^{-1}$
049	u-component of current	$m\ s^{-1}$
050	v-component of current	$m\ s^{-1}$
051	Specific humidity	$kg\ kg^{-1}$
052	Relative humidity	%
053	Humidity mixing ratio	$kg\ kg^{-1}$
054	Precipitable water	$kg\ m^{-2}$
055	Vapour pressure	Pa
056	Saturation deficit	Pa
057	Evaporation	$kg\ m^{-2}$
058	Cloud ice	$kg\ m^{-2}$
059	Precipitation rate	$kg\ m^{-2}\ s^{-1}$
060	Thunderstorm probability	%
061	Total precipitation	$kg\ m^{-2}$
062	Large scale precipitation	$kg\ m^{-2}$
063	Convective precipitation	$kg\ m^{-2}$
064	Snowfall rate water equivalent	$kg\ m^{-2}\ s^{-1}$
065	Water equivalent of accumulated snow depth	$kg\ m^{-2}$
066	Snow depth	m
067	Mixed layer depth	m
068	Transient thermocline depth	m
069	Main thermocline depth	m
070	Main thermocline anomaly	m

(continued)

(Code table 2 – continued)

Code figure	Field parameter	Unit
071	Total cloud cover	%
072	Convective cloud cover	%
073	Low cloud cover	%
074	Medium cloud cover	%
075	High cloud cover	%
076	Cloud water	kg m^{-2}
077	Best lifted index (to 500 hPa)	K
078	Convective snow	kg m^{-2}
079	Large scale snow	kg m^{-2}
080	Water temperature	K
081	Land cover (1 = land, 0 = sea)	Proportion
082	Deviation of sea level from mean	m
083	Surface roughness	m
084	Albedo	%
085	Soil temperature	K
086	Soil moisture content	kg m^{-2}
087	Vegetation	%
088	Salinity	kg kg^{-1}
089	Density	kg m^{-3}
090	Water run-off	kg m^{-2}
091	Ice cover (1 = ice, 0 = no ice)	Proportion
092	Ice thickness	m
093	Direction of ice drift	Degree true
094	Speed of ice drift	m s^{-1}
095	u-component of ice drift	m s^{-1}
096	v-component of ice drift	m s^{-1}
097	Ice growth rate	m s^{-1}
098	Ice divergence	s^{-1}
099	Snow melt	kg m^{-2}
100	Significant height of combined wind waves and swell	m
101	Direction of wind waves	Degree true
102	Significant height of wind waves	m
103	Mean period of wind waves	s
104	Direction of swell waves	Degree true
105	Significant height of swell waves	m
106	Mean period of swell waves	s
107	Primary wave direction	Degree true
108	Primary wave mean period	s
109	Secondary wave direction	Degree true
110	Secondary wave mean period	s
111	Net short-wave radiation flux (surface)	W m^{-2}
112	Net long-wave radiation flux (surface)	W m^{-2}
113	Net short-wave radiation flux (top of atmosphere)	W m^{-2}
114	Net long-wave radiation flux (top of atmosphere)	W m^{-2}
115	Long-wave radiation flux	W m^{-2}

(continued)

(Code table 2 – continued)

Code figure	Field parameter	Unit
116	Short-wave radiation flux	W m^{-2}
117	Global radiation flux	W m^{-2}
118	Brightness temperature	K
119	Radiance (with respect to wave number)	W m^{-1} sr^{-1}
120	Radiance (with respect to wave length)	W m^{-3} sr^{-1}
121	Latent heat flux	W m^{-2}
122	Sensible heat flux	W m^{-2}
123	Boundary layer dissipation	W m^{-2}
124	Momentum flux, u-component	N m^{-2}
125	Momentum flux, v-component	N m^{-2}
126	Wind mixing energy	J
127	Image data	
128–254	Reserved for originating centre use	
255	Missing value	

Notes:

(1) SI units only are used for GRIB; the accuracy or precision with which the data are represented is a function of the range of the values, the decimal and/or binary scaling, and the number of bits used; GRIB enables suitable scaling factors to be selected to obviate the need to define parameters in non-SI units.

(2) The code figures 0 to 127 are used to represent parameters which are exchanged between a number of centres; since the products generated by centres can be extremely diverse, code figures 128 to 254 are reserved for definition by the originating centre and may differ from centre to centre.

(3) **By convention, downward fluxes of radiation or other quantities shall be assigned negative values; upward fluxes of radiation or other quantities shall be assigned positive values.**

(4) The u- and v-components of vector quantities are defined in Code table 7.

(5) Provision is made for three types of spectra:
   (a) direction and frequency;
   (b) direction and radial number;
   (c) radial number and radial number.

(6) The "parcel lifted index" (as defined in the *International Meteorological Vocabulary* (WMO-No. 182) under the listing "lifted index") is defined as the temperature difference between the ambient 500 hPa temperature (T500) and that of a parcel of air lifted from the surface (Tparcel) following the dry and moist adiabatic process. Negative values of (T500 – Tparcel) suggest instability. The "best lifted index" is defined as the most unstable of a collection of parcel lifted indices, with parcel initial conditions defined for a collection of 30 hPa thick layers stacked one upon the other with the lowest resting on the ground. Commonly four to six such layers are used in the calculation.

Code table 3 – *Fixed levels or layers for which the data are included*

Note: **For reserved values, or if not defined, octets 11 and 12 shall contain zero.**

	Octet 10	Octet 11	Octet 12
Code figure	Meaning	Contents	
00	Reserved		
01	Ground or water surface		
02	Cloud base level		
03	Level of cloud tops		
04	Level of 0°C isotherm		

(continued)

(Code table 3 – continued)

	Octet 10	Octet 11	Octet 12
Code figure	Meaning	Contents	
05	Level of adiabatic condensation lifted from the surface		
06	Maximum wind level		
07	Tropopause		
08	Nominal top of atmosphere		
09	Sea bottom		
10–19	Reserved		
20	Isothermal level	Temperature in 1/100 K	
21–99	Reserved		
100	Isobaric surface	Pressure in hPa (2 octets)	
101	Layer between two isobaric surfaces	Pressure of top in kPa	Pressure of bottom in kPa
102	Mean sea level		
103	Specified altitude above mean sea level	Altitude in metres (2 octets)	
104	Layer between two specified altitudes above mean sea level	Altitude of top in hm	Altitude of bottom in hm
105	Specified height level above ground	Height in metres (2 octets)	
106	Layer between two specified height levels above ground	Height of top in hm	Height of bottom in hm
107	Sigma level	Sigma value in 1/10 000 (2 octets)	
108	Layer between two sigma levels	Sigma value of top in 1/100	Sigma value of bottom in 1/100
109	Hybrid level	Level number (2 octets)	
110	Layer between two hybrid levels	Level number of top	Level number of bottom
111	Depth below land surface	Depth in centimetres (2 octets)	
112	Layer between two depths below land surface	Depth of upper surface in cm	Depth of lower surface in cm
113	Isentropic (theta) level	Potential temperature in K (2 octets)	
114	Layer between two isentropic levels	475 K minus theta of top in K	475 K minus theta of bottom in K
115	Level at specified pressure difference from ground to level	Pressure difference in hPa (2 octets)	
116	Layer between two levels at specified pressure differences from ground to level	Pressure difference from ground to top level in hPa	Pressure difference from ground to bottom level in hPa
117	Potential vorticity surface	10^{-9} K m^2 kg^{-1} s^{-1}	
118	Reserved		
119	ETA* level	ETA value in 1/10000 (2 octets)	
120	Layer between two ETA* levels	ETA value at top of layer in 1/100	ETA value at bottom of layer in 1/100

(continued)

(Code table 3 – continued)

Code figure	Meaning (Octet 10)	Contents: Octet 11	Contents: Octet 12
121	Layer between two isobaric surfaces (high precision)	1100 hPa minus pressure of top in hPa	1100 hPa minus pressure of bottom in hPa
122–124	Reserved		
125	Specified height level above ground (high precision)	Height in centimetres (2 octets)	
126–127	Reserved		
128	Layer between two sigma levels (high precision)	1.1 minus sigma of top, in 1/1000 of sigma	1.1 minus sigma of bottom, in 1/1000 of sigma
129–140	Reserved		
141	Layer between two isobaric surfaces (mixed precision)	Pressure of top in kPa	1100 hPa minus pressure of bottom in hPa
142–159	Reserved		
160	Depth below sea level	Depth in metres (2 octets)	
161–199	Reserved		
200	Entire atmosphere (considered as a single layer)		
201	Entire ocean (considered as a single layer)		
202–209	Reserved		
210	Isobaric surface (high precision)	Pressure in Pa (2 octets)	
211–254	Reserved for local use		
255	Missing		

* The ETA vertical coordinate system involves normalizing the pressure at some point on a specific level by the mean sea level pressure at that point.

Code table 4 – *Unit of time*

Code figure	Meaning
0	Minute
1	Hour
2	Day
3	Month
4	Year
5	Decade (10 years)
6	Normal (30 years)
7	Century (100 years)
8–9	Reserved
10	3 hours
11	6 hours
12	12 hours
13	Quarter of an hour
14	Half an hour
15–253	Reserved
254	Second

Code table 5 – *Time range indicator*

Code figure	Meaning
0	Forecast product valid for reference time + P1 (P1 > 0), or Uninitialized analysis product for reference time (P1 = 0), or Image product for reference time (P1 = 0)
1	Initialized analysis product for reference time (P1 = 0)
2	Product with a valid time ranging between reference time + P1 and reference time + P2
3	Average (reference time + P1 to reference time + P2)
4	Accumulation (reference time + P1 to reference time + P2) product considered valid at reference time + P2
5	Difference (reference time + P2 minus reference time + P1) product considered valid at reference time + P2
6	Average (reference time - P1 to reference time - P2)
7	Average (reference time - P1 to reference time + P2)
8–9	Reserved
10	P1 occupies octets 19 and 20; product valid at reference time + P1
11–50	Reserved
51	Climatological mean value: multiple year averages of quantities which are themselves means over some period of time (P2) less than a year. The reference time (R) indicates the date and time of the start of a period of time, given by R to R + P2, over which a mean is formed; N indicates the number of such period-means that are averaged together to form the climatological value, assuming that the N period-mean fields are separated by one year. The reference time indicates the start of the N-year climatology. If P1 = 0 then the data averaged in the basic interval P2 are assumed to be continuous, i.e. all available data are simply averaged together. If P1 = 1 (the unit of time – octet 18, Code table 4 – is not relevant here) then the data averaged together in the basic interval P2 are valid only at the time (hour, minute) given in the reference time, for all the days included in the P2 period. The units of P2 are given by the contents of octet 18 and Code table 4.
52–112	Reserved
113	Average of N forecasts (or initialized analyses); each product has forecast period of P1 (P1 = 0 for initialized analyses); products have reference times at intervals of P2, beginning at the given reference time
114	Accumulation of N forecasts (or initialized analyses); each product has forecast period of P1 (P1 = 0 for initialized analyses); products have reference times at intervals of P2, beginning at the given reference time
115	Average of N forecasts, all with the same reference time; the first has a forecast period of P1, the remaining forecasts follow at intervals of P2
116	Accumulation of N forecasts, all with the same reference time; the first has a forecast period of P1, the remaining forecasts follow at intervals of P2
117	Average of N forecasts; the first has a forecast period of P1, the subsequent ones have forecast periods reduced from the previous one by an interval of P2; the reference time for the first is given in octets 13 to 17, the subsequent ones have reference times increased from the previous one by an interval of P2. Thus all the forecasts have the same valid time, given by the initial reference time + P1
118	Temporal variance, or covariance, of N initialized analyses; each product has forecast period of P1 = 0; products have reference times at intervals of P2, beginning at the given reference time
119	Standard deviation of N forecasts, all with the same reference time with respect to the time average of forecasts; the first forecast has a forecast period of P1, the remaining forecasts follow at intervals of P2
120–122	Reserved

(continued)

(Code table 5 – continued)

Code figure	Meaning
123	Average of N uninitialized analyses, starting at the reference time, at intervals of P2
124	Accumulation of N uninitialized analyses, starting at the reference time, at intervals of P2
125	Standard deviation of N forecasts, all with the same reference time with respect to time average of the time tendency of forecasts; the first forecast has a forecast period of P1, the remaining forecasts follow at intervals of P2
126–127	Reserved
128–254	Reserved for local use
255	Missing

Notes:

(1) For analysis products, or the first of a series of analysis products, the reference time (octets 13 to 17) indicates the valid time.

(2) For forecast products, or the first of a series of forecast products, the reference time indicates the valid time of the analysis upon which the (first) forecast is based.

(3) Initialized analysis products are allocated code figures distinct from those allocated to uninitialized analysis products.

(4) Code figure 10 allows the period of a forecast to be extended over two octets; this is to assist with extended range forecasts.

(5) Where products or a series of products are averaged or accumulated, the number involved is to be represented in octets 22 and 23 of Section 1, while any number missing is to be represented in octet 24.

(6) Forecasts of the accumulation or difference of some quantity (e.g. quantitative precipitation forecasts), indicated by values of 4 or 5 in octet 21, have a product valid time given by the reference time + P2; the period of accumulation, or difference, can be calculated as P2 – P1.

(7) A few examples may help to clarify the use of Code table 5:

For analysis products, P1 will be zero and the time range indicator will also be zero; for initialized products (sometimes called “zero hour forecasts”), P1 will be zero, but octet 21 will be set to 1.

For forecasts, typically, P1 will contain the number of hours of the forecast (the unit indicator given in octet 18 would be 1) and octet 21 would contain a zero.

Code value 115 would be used, typically, for multiple day mean forecasts, all derived from the same initial conditions.

Code value 117 would be used, typically, for Monte Carlo type calculations: many forecasts valid at the same time from different initial (reference) times.

Averages, accumulations and differences get a somewhat specialized treatment. If octet 21 (Code table 5) has a value between 2 and 5 (inclusive), then the reference time + P1 is the initial date/time and the reference time + P2 is the final date/time of the period over which averaging or accumulation takes place. If, however, octet 21 has a value of 113, 114, 115, 116, 117, 123 or 124, then P2 specifies the time interval between each of the fields (or the forecast initial times) that have been averaged or accumulated. These latter values of octet 21 require the qualities averaged to be equally separated in time; the former values, 3 and 4 in particular, allow for irregular or unspecified intervals of time between the fields that are averaged or accumulated.

CODE TABLES RELATIVE TO SECTION 2

Code table 6 – *Data representation type*

Code figure	Meaning
0	Latitude/longitude grid – equidistant cylindrical or Plate Carrée projection
1	Mercator projection
2	Gnomonic projection
3	Lambert conformal, secant or tangent, conic or bi-polar, projection
4	Gaussian latitude/longitude grid

(continued)

(Code table 6 – continued)

Code figure	Meaning
5	Polar stereographic projection
6	Universal Transverse Mercator (UTM) projection
7	Simple polyconic projection
8	Albers equal-area, secant or tangent, conic or bi-polar, projection
9	Miller's cylindrical projection
10	Rotated latitude/longitude grid
11–12	Reserved
13	Oblique Lambert conformal, secant or tangent, conic or bi-polar, projection
14	Rotated Gaussian latitude/longitude grid
15–19	Reserved
20	Stretched latitude/longitude grid
21–23	Reserved
24	Stretched Gaussian latitude/longitude grid
25–29	Reserved
30	Stretched and rotated latitude/longitude grids
31–33	Reserved
34	Stretched and rotated Gaussian latitude/longitude grids
35–49	Reserved
50	Spherical harmonic coefficients
51–59	Reserved
60	Rotated spherical harmonic coefficients
61–69	Reserved
70	Stretched spherical harmonics
71–79	Reserved
80	Stretched and rotated spherical harmonic coefficients
81–89	Reserved
90	Space view, perspective or orthographic
91–191	Reserved
192–254	Reserved for local use

Code tables relative to grid definition

Code table 7 – *Resolution and component flags*

Bit No.	Value	Meaning
1	0	Direction increments not given
	1	Direction increments given
2	0	Earth assumed spherical with radius 6367.47 km
	1	Earth assumed oblate spheroidal with size as determined by IAU in 1965 (6378.160 km, 6356.775 km, f = 1/297.0)
3–4		Reserved
5	0	Resolved u- and v-components of vector quantities relative to easterly and northerly directions
	1	Resolved u- and v-components of vector quantities relative to the defined grid in the direction of increasing x and y (or i and j) coordinates respectively
6–8	0	Reserved – set to zero

(continued)

Flag/Code table 8 – *Scanning mode*

Bit No.	Value	Meaning
1	0	Points scan in +i direction
	1	Points scan in –i direction
2	0	Points scan in –j direction
	1	Points scan in +j direction
3	0	Adjacent points in i direction are consecutive
	1	Adjacent points in j direction are consecutive

Notes:

(1) i direction: west to east along a parallel, or left to right along an X-axis.

(2) j direction: south to north along a meridian, or bottom to top along a Y-axis.

Code table 9 – *Spectral data representation type*

Code figure	Meaning
1	The Associated Legendre Functions of the first kind are defined by:

$$P_n^m(\mu) = \sqrt{(2n+1)\frac{(n-m)!}{(n+m)!}}\ \frac{1}{2^n n!}\ (1-\mu^2)^{m/2}\ \frac{d^{n+m}}{d\mu^{n+m}}\ (\mu^2-1)^n,\ \ m \geq 0,$$

$$P_n^{-m}(\mu) = P_n^m(\mu)$$

A field $X(\lambda, \mu)$ is represented by:

$$X(\lambda,\mu) = \sum_{m=-m}^{M} \sum_{n=|m|}^{N(m)} X_n^m P_n^m(\mu)\, e^{im\lambda}$$

where λ is the longitude,
μ the sine of latitude,
and X_n^{-m} the complex conjugate of X_n^m.

Code table 10 – *Spectral data representation mode*

Code figure	Meaning
1	The complex numbers X_n^m (see code figure 1, Code table 9 above) are stored for $m \geq 0$ as pairs of real numbers $Re(X_n^m)$, $Im(X_n^m)$ ordered with n increasing from m to N(m), first for m = 0 and then for m = 1, 2, . . . M. The real part of the (0.0) coefficient is stored in octets 12–15 of the Binary data section. The imaginary part of the (0.0) coefficient and the remaining coefficients are packed, and are stored in octets 16 onwards of the Binary data section.
2	Indicates spherical harmonics – complex packing

CODE TABLES RELATIVE TO SECTION 4

Code table 11 – *Flag*

Bit No.	Value	Meaning
1	0	Grid-point data
	1	Spherical harmonic coefficients
2	0	Simple packing
	1	Complex or second-order packing
3	0	Floating point values (in the original data) are represented
	1	Integer values (in the original data) are represented
4	0	No additional flags at octet 14
	1	Octet 14 contains additional flag bits

The following gives the meaning of the bits in octet 14 ONLY if bit 4 is set to 1. Otherwise octet 14 contains regular binary data.

Bit No.	Value	Meaning
5		Reserved – set to zero
6	0	Single datum at each grid point
	1	Matrix of values at each grid point
7	0	No secondary bit-maps
	1	Secondary bit-maps present
8	0	Second-order values constant width
	1	Second-order values different widths
9–12		Reserved for future use

Notes:

(1) Bit 4 shall be set to 1 to indicate that bits 5 to 12 are contained in octet 14 of the Binary data section.

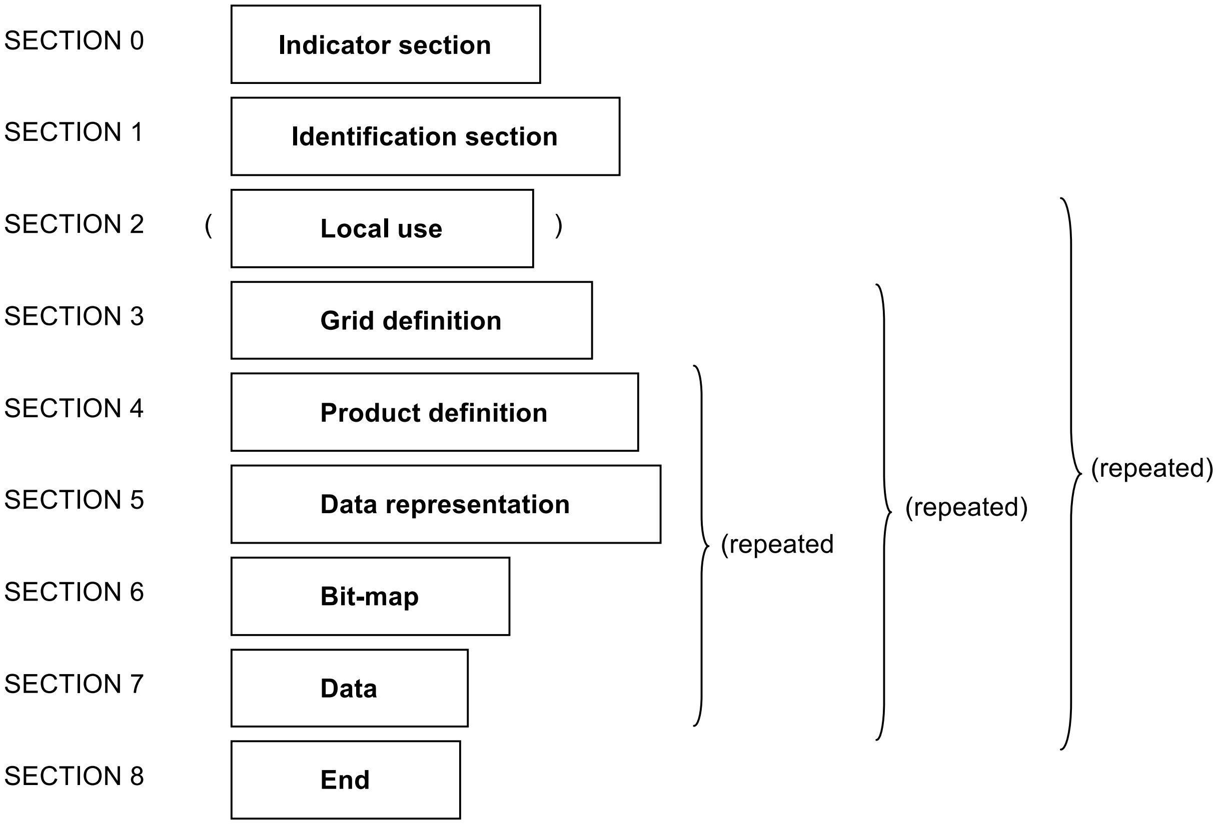
(2) Bit 3 shall be set to 1 to indicate that the data represented are integer values; where integer values are represented, any reference values, if not zero, should be rounded to integer before being applied.

(3) Where secondary bit-maps are present in the data (used in association with second-order packing and, optionally, with a matrix of values at each point), this shall be indicated by setting bit 7 to 1.

(4) The indicated meaning of bit 6 shall be retained in anticipation of the future reintroduction of a system to define a matrix of values at each grid point.

FM 92–XIV GRIB General regularly distributed information in binary form

C O D E F O R M :



Notes:

(1) GRIB is the name of a data representation form for general regularly distributed information in binary.

(2) Data encoded in GRIB consists of a continuous bit-stream made of a sequence of octets (1 octet = 8 bits).

(3) The octets of a GRIB message are grouped in sections:

Section number	*Name*	*Contents*
0	Indicator section	“GRIB”, discipline, GRIB edition number, length of message
1	Identification section	Length of section, section number, characteristics that apply to all processed data in the GRIB message
2	Local use section (optional)	Length of section, section number, additional items for local use by originating centres
3	Grid definition section	Length of section, section number, definition of grid surface and geometry of data values within the surface
4	Product definition section	Length of section, section number, description of the nature of the data
5	Data representation section	Length of section, section number, description of how the data values are represented
6	Bit-map section	Length of section, section number, indication of presence or absence of data at each of the grid points, as applicable
7	Data section	Length of section, section number, data values
8	End section	“7777”

(4) Sequences of GRIB sections 2 to 7, sections 3 to 7 or sections 4 to 7 may be repeated within a single GRIB message. All sections within such repeated sequences must be present and shall appear in the numerical order noted above. Unrepeated sections remain in effect until redefined.

(5) It will be noted that the GRIB code is not suitable for visual data recognition without computer interpretation.

(6) The representation of data by means of a series of bits is independent of any particular machine representation.

(7) Message and section lengths are expressed in octets. Octets are numbered 1, 2, 3, etc., starting at the beginning of each section. Therefore, octet numbers in a template refer to the respective section.

(8) Bit positions within octets are referred to as bit 1 to bit 8, where bit 1 is the most significant and bit 8 is the least significant. Thus, an octet with only bit 8 set to 1 would have the integer value 1.

(9) As used in “GRIB”, “International Alphabet No. 5” is regarded as an 8-bit alphabet with bit 1 set to zero.

(10) The IEEE single precision floating point representation is specified in the standard ISO/IEC 559–1985 and ANSI/IEEE 754–1985 (R1991), which should be consulted for more details. The representation occupies four octets and is:

seeeeeee emmmmmmm mmmmmmmm mmmmmmmm

where:

s is the sign bit, 0 means positive, 1 negative

e...e is an 8 bit biased exponent

m...m is the mantissa, with the first bit deleted.

The value of the number is given by the following table:

e...e	*m...m*	*Value of number*
0	Any	$(-1)^s\ (m...m)2^{-23}2^{-126} = (-1)^s(m...m)2^{-149}$
1...254	Any	$(-1)^s\ (1.0 + (m...m)2^{-23})2^{((e...e)-127)}$
255	0	Positive (s=0) or Negative (s=1) infinity
255	>0	NaN (Not a valid Number, result of illegal operation)

Normally, only biased exponent values from 1 through 254 inclusive are used, except for positive or negative zero which is represented by setting both the biased exponent and the mantissa to 0.

The numbers are stored with the high-order octet first. The sign bit will be the first bit of the first octet. The low-order bit of the mantissa will be the last (eighth) bit of the fourth octet.

This floating point representation has been chosen because it is in common use in modern computer hardware. Some computers use this representation with the order of the octets reversed. They will have to convert the representation, either by reversing the octets or by computing the floating point value directly using the above formulas.

REGULATIONS:

92.1 **General**

92.1.1 The GRIB code shall be used for the exchange and storage of general regularly distributed information expressed in binary form.

92.1.2 The beginning and the end of the code shall be identified by 4 octets coded according to the International Alphabet No. 5 to represent the indicators “GRIB” and “7777” in Indicator section 0 and End section 8, respectively. All other octets included in the code shall represent data in binary form.

92.1.3 Each section included in the code shall always end on an octet boundary. This rule shall be applied by appending bits set to zero to the section, where necessary.

92.1.4 All bits set to “1” for any value indicates that value is missing. This rule shall not apply to packed data.

92.1.5 If applicable, negative values shall be indicated by setting the most significant bit to “1”.

92.1.6 Latitude, longitude and angle values shall be in units of 10^{-6} degree, except for specific cases explicitly stated in some grid definitions.

92.1.7 The latitude values shall be limited to the range 0 to 90 degrees inclusive. The orientation shall be north latitude positive, south latitude negative. Bit 1 is set to 1 to indicate south latitude.

92.1.8 The longitude values shall be limited to the range 0 to 360 degrees inclusive. The orientation shall be east longitude positive, with only positive values being used.

92.1.9 The latitude and longitude of the first grid point and the last grid point shall always be given for regular grids.

92.1.10 Vector components at the North and South Poles shall be coded according to the following conventions.

92.1.10.1 If the resolution and component flags in section 3 (Flag table 3.3) indicate that the vector components are relative to the defined grid, the vector components at the Pole shall be resolved relative to the grid.

92.1.10.2 Otherwise, for projections where there are multiple points at a given pole, the vector components shall be resolved as if measured an infinitesimal distance from the Pole at the longitude corresponding to each grid point. At the North Pole, the West to East (x direction) component at a grid point with longitude L shall be resolved along the meridian 90 degrees East of L, and the South to North (y direction) component shall be resolved along the meridian 180 degrees from L. At the South Pole, the West to East component at a grid point with longitude L shall be resolved along the meridian 90 degrees East of L and the South to North component shall be resolved along L.

92.1.10.3 Otherwise, if there is only one Pole point, either on a cylindrical projection with all but one Pole point deleted, or on any projection (such as polar stereographic) where the Pole maps to a unique point, the West to East and South to North components shall be resolved along longitudes 270° and 0°, respectively at the North Pole and along longitudes 270° and 180°, respectively at the South Pole.

Note: This differs from the treatment of the Poles in the WMO traditional alphanumeric codes.

92.1.11 The first and last grid points shall not necessarily correspond to the first and last data points, respectively, if the bit-map is used.

92.1.12 Items in sections 3 and 4 which consist of a scale factor F and a scaled value V are related to the original value L as follows:

$L \times 10^F = V$

92.2 **Section 0 – Indicator section**

92.2.1 Section 0 shall always be 16 octets long.

92.2.2 The first four octets shall always be character coded according to the International Alphabet No. 5 as "GRIB".

92.2.3 The remainder of the section shall contain reserved octets, followed by the Discipline, the GRIB edition number, and the length of the entire GRIB message (including the Indicator section).

92.3 **Section 1 – Identification section**

92.3.1 The length of the section, in units of octets, shall be expressed over the group of the first four octets, i.e. over the first 32 bits.

92.3.2 The section number shall be expressed in the fifth octet.

92.3.3 Octets beyond 21 are for an Identification template. If no Identification template is used, optional section must not be present.

92.3.4 Calendar is assumed to be Gregorian unless otherwise stated in an Identification template.

92.4 **Section 2 – Local use section**

92.4.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.4.2 Section 2 is optional.

92.5 **Section 3 – Grid definition section**

92.5.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.6 **Section 4 – Product definition section**

92.6.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.6.2 To maintain orthogonal structure of GRIB Edition 2, parameter names in Code table 4.2 should not contain surface type and statistical process as part of the name.

92.7 **Section 5 – Data representation section**

92.7.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.8 **Section 6 – Bit-map section**

92.8.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.9 **Section 7 – Data section**

92.9.1 Regulations 92.3.1 and 92.3.2 shall apply.

92.9.2 Data shall be coded using the minimum number of bits necessary to provide the accuracy required by international agreement. This required accuracy/precision shall be achieved by scaling the data by multiplication by an appropriate power of 10 (the power may be 0) before forming the non-negative differences, and then using the binary scaling to select the precision of the transmitted value.

92.9.3 The data shall be packed by the method identified in section 5.

92.9.4 Data shall be coded in the form of non-negative scaled differences from a reference value of the whole field plus, if applicable, a local reference value.

Notes:

(1) A reference value is normally the minimum value of the data set which is represented.

(2) For grid-point values, complex packing features are intended to reduce the whole size of the GRIB message (data compression without loss of information with respect to simple packing). The basic concept is to reduce data size thanks to local redundancy. This is achieved just before packing, by splitting the whole set of scaled data values into groups, on which local references (such as local minima) are removed. It is done with some overhead, because extra descriptors are needed to manage the groups' characteristics. An optional pre-processing of the scaled values (spatial differencing) may also be applied before splitting into groups, and combined methods, along with use of alternate row scanning mode, are very efficient on interpolated data.

(3) For spectral data, complex packing is provided for better accuracy of packing. This is because many spectral coefficients have small values (regardless of the sign), especially for large wave numbers. The first principle is not to pack a subset of coefficients, associated with small wave numbers so that the amplitude of the packed coefficients is reduced. The second principle is to apply an operator to the remaining part of the spectrum: with appropriate tuning it leads to a more homogeneous set of values to pack.

(4) The original data value Y (in the units of Code table 4.2, unless Notes in Code table 4.10 apply) can be recovered with the formula:

$$Y \times 10^{D} = R + (X1 + X2) \times 2^{E}$$

For simple packing and all spectral data

E = Binary scale factor

D = Decimal scale factor

R = Reference value of the whole field

X1 = 0

X2 = Scaled (encoded) value.

For complex grid-point packing schemes, E, D and R are as above, but

X1 = Reference value (scaled integer) of the group the data value belongs to

X2 = Scaled (encoded) value with the group reference value (X1) removed.

92.10 **Section 8 – End section**

92.10.1 The end section shall always be 4 octets long, character coded according to the International Alphabet No. 5 as "7777".

SPECIFICATIONS OF OCTET CONTENTS

Section 0 – Indicator section

Octet No.	Contents
1–4	GRIB (coded according to the International Alphabet No. 5)
5–6	Reserved
7	Discipline – GRIB Master table number (see Code table 0.0)
8	GRIB edition number (currently 2)
9–16	Total length of GRIB message in octets (including Section 0)

Section 1 – Identification section

Octet No.	Contents	
1–4	Length of section in octets (21 or nn)	
5	Number of section (1)	
6–7	Identification of originating/generating centre (see Common Code table C–11)	
8–9	Identification of originating/generating subcentre (allocated by originating/ generating centre)	
10	GRIB Master tables version number (see Code table 1.0 and Note 1)	
11	Version number of GRIB Local tables used to augment Master tables (see Code table 1.1 and Note 2)	
12	Significance of reference time (see Code table 1.2)	
13–14	Year (4 digits)	Reference time of data
15	Month	
16	Day	
17	Hour	
18	Minute	
19	Second	
20	Production status of processed data in this GRIB message (see Code table 1.3)	
21	Type of processed data in this GRIB message (see Code table 1.4)	
22–23	Identification template number (optional, see Code table 1.5)	
24–nn	Identification template (optional, see template 1.X, where X is the identification template number given in octets 22–23)	

Notes:

(1) Local tables shall define those parts of the Master table which are reserved for local use except for the case described below. In any case, the use of Local tables in messages intended for non-local or international exchange is strongly discouraged.

(2) If octet 10 contains 255 then only Local tables are in use, the Local table version number (octet 11) must not be zero nor missing, and Local tables may include entries from the entire range of the tables.

(3) If octet 11 is zero, octet 10 must contain a valid Master table version number and only those parts of the tables not reserved for local use may be used.

Section 2 – Local use section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (2)
6–nn	Local use

Section 3 – Grid definition section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (3)
6	Source of grid definition (see Code table 3.0 and Note 1)
7–10	Number of data points
11	Number of octets for optional list of numbers (see Note 2)
12	Interpretation of list of numbers (see Code table 3.11)
13–14	Grid definition template number (= N) (see Code table 3.1)
15–xx	Grid definition template (see template 3.N, where N is the grid definition template number given in octets 13–14)
[xx+1]–nn	Optional list of numbers defining number of points (see Notes 2, 3 and 4)

Notes:

(1) If octet 6 is not zero, octets 15–xx (15–nn if octet 11 is zero) may not be supplied. This should be documented with all bits set to 1 (missing value) in the grid definition template number.

(2) An optional list of numbers may be used to document a quasi-regular grid. In such a case, octet 11 is non zero and gives the number of octets used per item on the list. For all other cases, such as regular grids, octets 11 and 12 are zero and no list is appended to the grid definition template.

(3) If a list of numbers defining number of points is present, it is appended at the end of the grid definition template (or directly after the grid definition template number if the template is missing), the length of the list is given by the grid definition. When the grid definition template is present, the length is given according to bit 3 of scanning mode flag octet (length is Nj or Ny for flag value 0). List ordering is implied by data scanning.

(4) Depending on code value given in octet 12, the list of numbers either:
- corresponds to the coordinate lines as given in the grid definition, or
- corresponds to a full circle, or
- does not apply.

Section 4 – Product definition section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (4)
6–7	Number of coordinate values after template or number of information according to 3D vertical coordinate GRIB2 message (see Notes 1 and 5)
8–9	Product definition template number (see Code table 4.0)
10–xx	Product definition template (see template 4.X, where X is the product definition template number given in octets 8–9)
[xx+1]–nn	Optional list of coordinate values or vertical grid information (see Notes 2, 3, 4 and 5)

Notes:

(1) Coordinate values are intended to document the vertical discretization associated with model data on hybrid coordinate vertical levels. A number of zero in octets 6–7 indicates that no such values are present. Otherwise the number corresponds to the whole set of values.

(2) Hybrid systems, in this context, employ a means of representing vertical coordinates in terms of a mathematical combination of pressure and sigma coordinates. When used in conjunction with a surface pressure field and an appropriate mathematical expression, the vertical coordinate parameters may be used to interpret the hybrid vertical coordinate.

(3) Hybrid coordinate values, if present, should be encoded in IEEE 32-bit floating point format. They are intended to be encoded as pairs.

(4) Two distinct pressure-based hybrid coordinate formulations can be expressed in GRIB Edition 2. If the hybrid coordinate being used is based on pressure, then level type 105 (Code table 4.5) shall be used to specify the vertical level type. If the formulation is based on the natural logarithm of pressure then level type 113 (Code table 4.5) shall be used. In both cases Notes 1 to 3 (above) apply fully.

(5) In the case of a generalized vertical height coordinate (fixed surface type 150), no pairs of coordinate values follow after the template, but six sets of additional information (each 4 octets long and encoded in IEEE 32-bit floating point format) follow, starting with the number of vertical levels and the identification number of the used vertical system in the additional GRIB2 message with the 3D vertical system. This identification number together with an UUID (Universally Unique IDentifier) in four parts allows a unique identification of the grid.

[xx+1] – [xx+4]	Number of vertical levels
[xx+5] – [xx+8]	Identification number of 3D vertical grid GRIB2 message (defined by originating centre)
[xx+9] – [xx+12]	UUID part 1 of 4
[xx+13] – [xx+16]	UUID part 2 of 4
[xx+17] – [xx+20]	UUID part 3 of 4
[xx+21] – [xx+24]	UUID part 4 of 4

Section 5 – Data representation section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (5)
6–9	Number of data points where one or more values are specified in Section 7 when a bit map is present, total number of data points when a bit map is absent.
10–11	Data representation template number (see Code table 5.0)
12–nn	Data representation template (see template 5.X, where X is the data representation template number given in octets 10–11)

Section 6 – Bit-map section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (6)
6	Bit-map indicator (see Code table 6.0 and the Note)
7–nn	Bit-map – Contiguous bits with a bit to data point correspondence, ordered as defined in Section 3. A bit set to 1 implies the presence of a data value at the corresponding data point, whereas a value of 0 implies the absence of such a value.

Note: If octet 6 is not zero, the length of the section is 6 and octets 7–nn are not present.

Section 7 – Data section

Octet No.	Contents
1–4	Length of section in octets (nn)
5	Number of section (7)
6–nn	Data in a format described by data template 7.X, where X is the data representation template number given in octets 10–11 of Section 5.

Section 8 – End section

Octet No.	Contents
1–4	“7777” (coded according to the International Alphabet No. 5)

TEMPLATE DEFINITIONS USED IN SECTION 1

Identification template 1.0 – calendar definition

Octet No.	Contents
24	Type of calendar (see Code table 1.6)

Identification template 1.1 – paleontological offset

Octet No.	Contents
24–25	Number of tens of thousands of years of offset

Notes:

(1) The year can be recovered with the formula:

Year (real/decoded) = Year + 10 000 x Offset

(2) Years before year 1 shall be coded as defined in ISO 8601 (year 1 is followed by year 0). If applicable, year –1 or before shall be indicated by setting the most significant bit of octets 13–14 and 24–25 to "1" in accordance with Regulation 92.1.5.

Identification template 1.2 – calendar definition and paleontological offset

Octet No.	Contents
24	Type of calendar (see Code table 1.6)
25–26	Number of tens of thousands of years of offset

Notes:

(1) The year can be recovered with the formula:

Year (real/decoded) = Year + 10 000 x Offset

(2) Years before year 1 shall be coded as defined in ISO 8601 (year 1 is followed by year 0). If applicable, year –1 or before shall be indicated by setting the most significant bit of octets 13–14 and 24–25 to "1" in accordance with Regulation 92.1.5.

TEMPLATE DEFINITIONS USED IN SECTION 3

Grid definition template 3.0 – latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47–50	La1 – latitude of first grid point (see Note 1)
51–54	Lo1 – longitude of first grid point (see Note 1)
55	Resolution and component flags (see Flag table 3.3)
56–59	La2 – latitude of last grid point (see Note 1)
60–63	Lo2 – longitude of last grid point (see Note 1)
64–67	Di – i direction increment (see Notes 1 and 5)
68–71	Dj – j direction increment (see Notes 1 and 5)
72	Scanning mode (flags – see Flag table 3.4)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Notes 2 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) For data on a quasi-regular grid, where all the rows or columns do not necessarily have the same number of grid points, either Ni (octets 31–34) or Nj (octets 35–38) and the corresponding Di (octets 64–67) or Dj (octets 68–71) shall be coded with all bits set to 1 (missing). The actual number of points along each parallel or meridian shall be coded in the octets immediately following the grid definition template (octets [xx+1]–nn), as described in the description of the grid definition section.

(3) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points or variable spacing. The first point in each row (column) shall be positioned at the meridian (parallel) indicated by octets 47–54. The grid points shall be evenly spaced in latitude (longitude).

(4) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth is derived from applying the appropriate scale factor to the value expressed in metres.

(5) It is recommended to use unsigned direction increments.

Grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as grid definition template 3.0 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) Three parameters define a general latitude/longitude coordinate system, formed by a general rotation of the sphere. One choice for these parameters is:

- (a) The geographic latitude in degrees of the southern pole of the coordinate system, θ_p for example;
- (b) The geographic longitude in degrees of the southern pole of the coordinate system, λ_p for example;
- (c) The angle of rotation in degrees about the new polar axis (measured clockwise when looking from the southern to the northern pole) of the coordinate system, assuming the new axis to have been obtained by first rotating the sphere through λ_p degrees about the geographic polar axis, and then rotating through $(90 + \theta_p)$ degrees so that the southern pole moved along the (previously rotated) Greenwich meridian.

(3) See Note 3 under grid definition template 3.0.

Grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as grid definition template 3.0 (see Note 1)
73–76	Latitude of the pole of stretching
77–80	Longitude of the pole of stretching
81–84	Stretching factor
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The stretching is defined by three parameters:

- (a) The latitude in degrees (measured in the model coordinate system) of the "pole of stretching";
- (b) The longitude in degrees (measured in the model coordinate system) of the "pole of stretching"; and
- (c) The stretching factor C in units of 10^{-6} represented as an integer.

The stretching is defined by representing data uniformly in a coordinate system with longitude λ and latitude θ^1, where:

$$\theta^1 = \sin^{-1} \frac{(1 - C^2) + (1 + C^2) \sin\theta}{(1 + C^2) + (1 - C^2) \sin\theta}$$

and λ and θ are longitude and latitude in a coordinate system in which the "pole of stretching" is the northern pole. C = 1 gives uniform resolution, while C > 1 gives enhanced resolution around the pole of stretching.

(3) See Note 3 under grid definition template 3.0.

Grid definition template 3.3 – stretched and rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as grid definition template 3.0 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–88	Latitude of the pole of stretching
89–92	Longitude of the pole of stretching
93–96	Stretching factor
97–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 3 under grid definition template 3.0.

Grid definition template 3.4 – variable resolution latitude/longitude

Octet No.	Contents
15	Shape of the earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47	Resolution and component flags (see Flag table 3.3 and Note 2)
48	Scanning mode (flags – see Flag table 3.4)
49–ii	List of longitudes (see Notes 1 and 3)
(ii+1)–jj	List of latitudes (see Notes 1 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the longitudes and latitudes. For these descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to the respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The resolution flag (bit 3–4 of Flag table 3.3) is not applicable.

(continued)

(Grid definition template 3.4 – continued)

(3) The list of Ni longitudes and Nj latitudes shall be coded in the octets immediately following the grid definition template in octets 49 to ii and octets ii+1 to jj respectively, where ii = 48 + 4Ni and jj = 48 + 4Ni + 4Nj.

(4) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth is derived from applying appropriate scale factor to the value expressed in metres.

Grid definition template 3.5 – variable resolution rotated latitude/longitude

Octet No.	Contents
15–48	Same as grid definition template 3.4 (see Note 1)
49–52	Latitude of the southern pole of projection (see Note 4)
53–56	Longitude of the southern pole of projection (see Note 4)
57–60	Angle of rotation of projection (see Note 4)
61–ii	List of longitudes (see Notes 1 and 3)
(ii+1)–jj	List of latitudes (see Notes 1 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the longitudes and latitudes. For these descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to the respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) Three parameters define a general latitude/longitude coordinate system, formed by a general rotation of the sphere. One choice for these parameters is:
   (a) The geographic latitude in degrees of the southern pole of the coordinate system, e.g., θ_p;
   (b) The geographic longitude in degrees of the southern pole of the coordinate system, e.g., λ_p;
   (c) The angle of rotation in degrees about the new polar axis (measured clockwise when looking from the southern to the northern pole) of the coordinate system, assuming the new axis to have been obtained by first rotating the sphere through λ_p degrees about the geographic polar axis, and then rotating through (90 + θ_p) degrees so that the southern pole moved along the (previously rotated) Greenwich meridian.

(3) For the list of Ni longitude bounds and Nj latitude bounds at the end of the section:
ii = 60 + 4Ni and jj = 60 + 4Ni +4Nj

(4) Regulation 92.1.6 applies.

Grid definition template 3.10 – Mercator

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude(s) at which the Mercator projection intersects the Earth (Latitude(s) where Di and Dj are specified)

(continued)

(Grid definition template 3.10 – continued)

Octet No.	Contents
52–55	La2 – latitude of last grid point
56–59	Lo2 – longitude of last grid point
60	Scanning mode (flags – see Flag table 3.4)
61–64	Orientation of the grid, angle between i direction on the map and the Equator (see Note 1)
65–68	Di – longitudinal direction grid length (see Note 2)
69–72	Dj – latitudinal direction grid length (see Note 2)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Notes 2 and 3 of grid definition template 3.1)

Notes:

(1) Limited to the range of 0 to 90 degrees; if the angle of orientation of the grid is neither 0 nor 90 degrees, Di and Dj must be equal to each other.

(2) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(3) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.12 – transverse Mercator

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Ni – number of points along i-axis
35–38	Nj – number of points along j-axis
39–42	LaR – geographic latitude of reference point
43–46	LoR – geographic longitude of reference point
47	Resolution and component flags (see Flag table 3.3)
48–51	m – scale factor at reference point ratio of distance on map to distance on spheroid (IEEE 32-bit floating-point values)
52–55	XR – false easting, i-direction coordinate of reference point in units of 10^{-2} m
56–59	YR – false northing, j-direction coordinate of reference point in units of 10^{-2} m
60	Scanning mode (flags – see Flag table 3.4)
61–64	Di – i-direction increment length in units of 10^{-2} m
65–68	Dj – j-direction increment length in units of 10^{-2} m
69–72	x1 – i-direction coordinate of the first grid point in units of 10^{-2} m
73–76	y1 – j-direction coordinate of the first grid point in units of 10^{-2} m
77–80	x2 – i-direction coordinate of the last grid point in units of 10^{-2} m
81–84	y2 – j-direction coordinate of the last grid point in units of 10^{-2} m

Grid definition template 3.20 – polar stereographic projection

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3 and Note 1)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – orientation of the grid (see Note 2)
56–59	Dx – x-direction grid length (see Note 3)
60–63	Dy – y-direction grid length (see Note 3)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)

Notes:

(1) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(2) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(3) Grid length is in units of 10^{-3} m at the latitude specified by LaD.

(4) Bit 2 of the projection flag is not applicable to the polar stereographic projection.

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.30 – Lambert conformal

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – longitude of meridian parallel to y-axis along which latitude increases as the y-coordinate increases
56–59	Dx – x-direction grid length (see Note 1)

(continued)

(Grid definition template 3.30 – continued)

Octet No.	Contents
60–63	Dy – y-direction grid length (see Note 1)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)
66–69	Latin 1 – first latitude from the pole at which the secant cone cuts the sphere
70–73	Latin 2 – second latitude from the pole at which the secant cone cuts the sphere
74–77	Latitude of the southern pole of projection
78–81	Longitude of the southern pole of projection

Notes:

(1) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(2) If Latin 1 = Latin 2, then the projection is on a tangent cone.

(3) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(4) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.31 – Albers equal area

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – longitude of meridian parallel to y-axis along which latitude increases as the y-coordinate increases
56–59	Dx – x-direction grid length (see Note 1)
60–63	Dy – y-direction grid length (see Note 1)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)
66–69	Latin 1 – first latitude from the pole at which the secant cone cuts the sphere
70–73	Latin 2 – second latitude from the pole at which the secant cone cuts the sphere
74–77	Latitude of the southern pole of projection
78–81	Longitude of the southern pole of projection

Notes:

(1) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(2) If Latin 1 = Latin 2, then the projection is on a tangent cone.

(3) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(continued)

(Grid definition template 3.31 – continued)

(4) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.40 – Gaussian latitude/longitude

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47–50	La1 – latitude of first grid point (see Note 1)
51–54	Lo1 – longitude of first grid point (see Note 1)
55	Resolution and component flags (see Flag table 3.3)
56–59	La2 – latitude of last grid point (see Note 1)
60–63	Lo2 – longitude of last grid point (see Note 1)
64–67	Di – i direction increment (see Notes 1 and 5)
68–71	N – number of parallels between a pole and the Equator (see Note 2)
72	Scanning mode (flags – see Flag table 3.4)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

(4) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points. The first point in each row (column) shall be positioned at the meridian (parallel) indicated by octets 47–54. The grid points shall be evenly spaced in latitude (longitude).

(5) It is recommended to use unsigned direction increments.

Grid definition template 3.41 – rotated Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 4 under grid definition template 3.40.

Grid definition template 3.42 – stretched Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the pole of stretching
77–80	Longitude of the pole of stretching
81–84	Stretching factor
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 4 under grid definition template 3.40.

Grid definition template 3.43 – stretched and rotated Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–88	Latitude of the pole of stretching
89–92	Longitude of the pole of stretching
93–96	Stretching factor
97–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 5)

(continued)

(Grid definition template 3.43 – continued)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(5) See Note 4 under grid definition template 3.40.

Grid definition template 3.50 – spherical harmonic coefficients

Octet No.	Contents
15–18	J – pentagonal resolution parameter
19–22	K – pentagonal resolution parameter
23–26	M – pentagonal resolution parameter
27	Representation type indicating the method used to define the norm (see Code table 3.6)
28	Representation mode indicating the order of the coefficients (see Code table 3.7)

Note: The pentagonal representation of resolution is general. Some common truncations are special cases of the pentagonal one:

Triangular: M = J = K

Rhomboidal: K = J + M

Trapezoidal: K = J, K > M

Grid definition template 3.51 – rotated spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the southern pole of projection
33–36	Longitude of the southern pole of projection
37–40	Angle of rotation of projection

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.52 – stretched spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the pole of stretching
33–36	Longitude of the pole of stretching
37–40	Stretching factor

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.53 – stretched and rotated spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the southern pole of projection
33–36	Longitude of the southern pole of projection
37–40	Angle of rotation of projection
41–44	Latitude of pole of stretching
45–48	Longitude of pole of stretching
49–52	Stretching factor

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.90 – space view perspective or orthographic

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along x-axis (columns)
35–38	Ny – number of points along y-axis (rows or lines)
39–42	Lap – latitude of sub-satellite point
43–46	Lop – longitude of sub-satellite point
47	Resolution and component flags (see Flag table 3.3)
48–51	dx – apparent diameter of Earth in grid lengths, in x-direction
52–55	dy – apparent diameter of Earth in grid lengths, in y-direction
56–59	Xp – x-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)
60–63	Yp – y-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)
64	Scanning mode (flags – see Flag table 3.4)
65–68	Orientation of the grid; i.e. the angle between the increasing y-axis and the meridian of the sub-satellite point in the direction of increasing latitude (see Note 3)
69–72	Nr – altitude of the camera from the Earth's centre, measured in units of the Earth's (equatorial) radius multiplied by a scale factor of 10^6 (see Notes 4 and 5)
73–76	Xo – x-coordinate of origin of sector image
77–80	Yo – y-coordinate of origin of sector image

Notes:

(1) It is assumed that the satellite is at its nominal position, i.e. it is looking directly at its sub-satellite point.

(2) Octets 69–72 shall be set to all ones (missing) to indicate the orthographic view (from infinite distance).

(3) It is the angle between the increasing y-axis and the meridian 180°E if the sub-satellite point is the North Pole; or the meridian 0° if the sub-satellite point is the South Pole.

(4) The apparent angular size of the Earth will be given by 2 x arcsin $((10^6)/\mathrm{Nr})$.

(5) For orthographic view from infinite distance, the value of Nr should be encoded as missing (all bits set to 1).

(continued)

(Grid definition template 3.90 – continued)

(6) The horizontal and vertical angular resolutions of the sensor (Rx and Ry), needed for navigation equation, can be calculated from the following:

$$Rx = 2 \times \arcsin((10^6)/Nr)/dx$$

$$Ry = 2 \times \arcsin((10^6)/Nr)/dy$$

(7) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

(8) General reference information pertaining to the projections used for satellite data can be found in Section 4.4 of "LRIT/HRIT Global Specification", Doc. No. CGMS 03, issue 2.6, dated 12 August 1999 (http://www.eumetsat.int/Home/Main/AboutEUMETSAT/International Relations/CGMS/groups/cps/documents/document/pdf_cgms_03.pdf, page 20 onwards).

Grid definition template 3.100 – triangular grid based on an icosahedron (see Attachment, Volume I.2, Part B, Att.GRIB)

Octet No.	Contents
15	n2 – exponent of 2 for the number of intervals on main triangle sides
16	n3 – exponent of 3 for the number of intervals on main triangle sides
17–18	ni – number of intervals on main triangle sides of the icosahedron
19	nd – number of diamonds
20–23	Latitude of the pole point of the icosahedron on the sphere
24–27	Longitude of the pole point of the icosahedron on the sphere
28–31	Longitude of the centre line of the first diamond of the icosahedron on the sphere
32	Grid point position (see Code table 3.8)
33	Numbering order of diamonds (flags – see Flag table 3.9)
34	Scanning mode for one diamond (flags – see Flag table 3.10)
35–38	nt – total number of grid points

Notes:

(1) For more details see in Part B of this volume the Attachment entitled “Definition of a triangular grid based on an icosahedron” (I.2–Att.GRIB–1 to 8).

(2) The origin of the grid is an icosahedron with 20 triangles and 12 vertices. The triangles are combined to nd quadrangles, the so-called diamonds (e.g. if nd = 10, two of the icosahedron triangles form a diamond, and if nd = 5, 4 icosahedron triangles form a diamond). There are two resolution values called n2 and n3 describing the division of each triangle side. Each triangle side is divided into ni equal parts, where $ni = 3^{n3} \times 2^{n2}$ with n3 either equal to 0 or to 1. In the example of the Attachment, the numbering order of the rectangles is anti-clockwise with a view from the pole point on both hemispheres. Diamonds 1 to 5 are northern hemisphere and diamonds 6 to 10 are southern hemisphere.

(3) The exponent of 3 for the number of divisions of triangle sides is used only with a value of either 0 or 1.

(4) The total number of grid points for one global field depends on the grid point position. If e.g. the grid points are located at the vertices of the triangles, then nt = (ni + 1) x (ni + 1) x nd since grid points at diamond edges are contained in both adjacent diamonds and for the same reason the pole points are contained in each of the five adjacent diamonds.

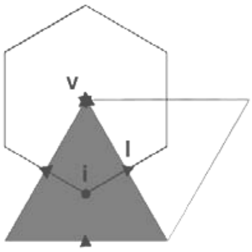
Grid definition template 3.101 – general unstructured grid

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16–18	Number of grid used (defined by originating centre)
19	Number of grid in reference (to allow annotating for Arakawa C-grid on arbitrary grid) (see Note)
20–35	Universally Unique Identifier of horizontal grid

(continued)

(Grid definition template 3.101 – continued)

Note: The number given refers to a specific grid required for formulating differential operators. The grid may consist of a centre and an arbitrary surrounding polygon. As model variables may be defined on vertices of the polygons or in the middle of a polygon edge, this generates some different grid descriptions, because each of those is defining their own centre and surrounding polygon. Each of these dependent grids needs their own set of centre longitude/latitude and the longitude/latitude of the boundary polygon vertices. The following picture shows a triangle as base, a hexagon around the triangle's vertices and a quadrilateral around the edge midpoints.



(a) Triangles (i) (pressure, temperature, ...)
(b) Quadrilaterals (l) (wind velocity ...)
(c) Hexagons (or pentagons, respectively) (v) (vorticity, ...)

Grid definition template 3.110 – equatorial azimuthal equidistant projection

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along x-axis
35–38	Ny – number of points along y-axis
39–42	La1 – latitude of tangency point (centre of grid)
43–46	Lo1 – longitude of tangency point
47	Resolution and component flags (see Flag table 3.3)
48–51	Dx – x-direction grid length in units of 10^{-3} m as measured at the point of the axis
52–55	Dy – y-direction grid length in units of 10^{-3} m as measured at the point of the axis
56	Projection centre flag
57	Scanning mode (see Flag table 3.4)

Note: A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.120 – azimuth-range projection

Octet No.	Contents
15–18	Nb – number of data bins along radials (see Note)
19–22	Nr – number of radials
23–26	La1 – latitude of centre point
27–30	Lo1 – longitude of centre point
31–34	Dx – spacing of bins along radials
35–38	Dstart – offset from origin to inner bound

(continued)

(Grid definition template 3.120 – continued)

Octet No.	Contents
39	Scanning mode (flags – see Flag table 3.4)
	40–(39+4Nr) For each of Nr radials:
(40+4(X–1))–(41+4(X–1))	Azi – starting azimuth, degrees x 10 (degrees as north)
(42+4(X–1))–(43+4(X–1))	Adelta – azimuthal width, degrees x 100 (+ clockwise, – counterclockwise), with X = 1 to Nr

Note: A data bin is a data point representing the volume centred on it.

Grid definition template 3.140 – Lambert azimuthal equal area projection

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22-25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47–50	Standard parallel
51–54	Central longitude
55	Resolution and component flags (see Flag table 3.3)
56–59	Dx – x-direction grid length (see Note)
60–63	Dy – y-direction grid length (see Note)
64	Scanning mode (see Flag table 3.4)

Note: Grid lengths are in units of 10^{-3} m, at the latitude specified by the standard parallel.

Grid definition template 3.1000 – cross-section grid with points equally spaced on the horizontal

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Number of horizontal points
35–38	Basic angle of the initial production domain (see Note 1)
39–42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)
43–46	La1 – latitude of first grid point (see Note 1)

(continued)

(Grid definition template 3.1000 – continued)

Octet No.	Contents
47–50	Lo1 – longitude of first grid point (see Note 1)
51	Scanning mode (flags – see Flag table 3.4)
52–55	La2 – latitude of last grid point (see Note 1)
56–59	Lo2 – longitude of last grid point (see Note 1)
60	Type of horizontal line (see Code table 3.20)
61–62	Number of vertical points
63	Physical meaning of vertical coordinate (see Code table 3.15)
64	Vertical dimension coordinate values definition (see Code table 3.21)
65–66	NC – number of coefficients or values used to specify vertical coordinates
67–(66+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes. For these last descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.1100 – Hovmöller diagram grid with points equally spaced on the horizontal

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
15	Shape of the Earth (see Code table 3.2)
16	Scale factor of radius of spherical Earth
17–20	Scaled value of radius of spherical Earth
21	Scale factor of major axis of oblate spheroid Earth
22–25	Scaled value of major axis of oblate spheroid Earth
26	Scale factor of minor axis of oblate spheroid Earth
27–30	Scaled value of minor axis of oblate spheroid Earth
31–34	Number of horizontal points
35–38	Basic angle of the initial production domain (see Note 1)
39–42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)
43–46	La1 – latitude of first grid point (see Note 1)
47–50	Lo1 – longitude of first grid point (see Note 1)
51	Scanning mode (flags – see Flag table 3.4)
52–55	La2 – latitude of last grid point (see Note 1)
56–59	Lo2 – longitude of last grid point (see Note 1)
60	Type of horizontal line (see Code table 3.20)
61–64	NT – number of time steps
65	Unit of offset from reference time (see Code table 4.4)
66–69	Offset from reference of first time (negative value when first bit set)
70	Type of time increment (see Code table 4.11)
71	Unit of time increment (see Code table 4.4)
72–75	Time increment (negative value when first bit set)
	76–82 Last date/time
76–77	Year
78	Month
79	Day
80	Hour
81	Minute
82	Second

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes. For these last descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.1200 – time section grid

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
15–18	NT – number of time steps
19	Unit of offset from reference time (see Code table 4.4)
20–23	Offset from reference of first time (negative value when first bit set)
24	Type of time increment (see Code table 4.11)
25	Unit of time increment (see Code table 4.4)
26–29	Time increment (negative value when first bit set)
	30–36 Last date/time
30–31	Year
32	Month
33	Day
34	Hour
35	Minute
36	Second
37–38	Number of vertical points
39	Physical meaning of vertical coordinate (see Code table 3.15)
40	Vertical dimension coordinate values definition (see Code table 3.21)
41–42	NC – number of coefficients or values used to specify vertical coordinates
43–(42+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)

TEMPLATE DEFINITIONS USED IN SECTION 4

Product definition template 4.0 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Type of ensemble forecast (see Code table 4.6)
36	Perturbation number
37	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.2 – derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.3 – derived forecasts based on a cluster of ensemble members over a rectangular area at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high-resolution control belongs
39	Number of cluster to which the low-resolution control belongs

(continued)

(Product definition template 4.3 – continued)

Octet No.	Contents
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Northern latitude of cluster domain
46–49	Southern latitude of cluster domain
50–53	Eastern longitude of cluster domain
54–57	Western longitude of cluster domain
58	N_c – number of forecasts in the cluster
59	Scale factor of standard deviation in the cluster
60–63	Scaled value of standard deviation in the cluster
64	Scale factor of distance of the cluster from ensemble mean
65–68	Scaled value of distance of the cluster from ensemble mean
69–(68+N_c)	List of N_c ensemble forecast numbers (N_c is given in octet 58)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.4 – derived forecasts based on a cluster of ensemble members over a circular area at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high-resolution control belongs
39	Number of cluster to which the low-resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Latitude of central point in cluster domain
46–49	Longitude of central point in cluster domain
50–53	Radius of cluster domain
54	N_c – number of forecasts in the cluster

(continued)

(Product definition template 4.4 – continued)

Octet No.	Contents
55	Scale factor of standard deviation in the cluster
56–59	Scaled value of standard deviation in the cluster
60	Scale factor of distance of the cluster from ensemble mean
61–64	Scaled value of distance of the cluster from ensemble mean
65–(64+N_c)	List of N_c ensemble forecast numbers (N_c is given in octet 54)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.5 – probability forecasts at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Forecast probability number
36	Total number of forecast probabilities
37	Probability type (see Code table 4.9)
38	Scale factor of lower limit
39–42	Scaled value of lower limit
43	Scale factor of upper limit
44–47	Scaled value of upper limit

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.6 – percentile forecasts at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.6 – continued)

Octet No.	Contents
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Percentile value (from 100% to 0%)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.7 – analysis or forecast error at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) This template should not be used. Product definition template 4.0 should be used instead.

Product definition template 4.8 – average, accumulation and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.8 – continued)

Octet No.	Contents
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35–36	Year – Time of end of overall time interval
37	Month – Time of end of overall time interval
38	Day – Time of end of overall time interval
39	Hour – Time of end of overall time interval
40	Minute – Time of end of overall time interval
41	Second – Time of end of overall time interval
42	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
43–46	Total number of data values missing in statistical process
	47–58 Specification of the outermost (or only) time range over which statistical processing is done
47	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
48	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
49	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
50–53	Length of the time range over which statistical processing is done, in units defined by the previous octet
54	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
55–58	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	59–nn These octets are included only if n > 1, where nn = 46 + 12 x n
59–70	As octets 47 to 58, next innermost step of processing
71–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 47 to 58, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 48, 60, 72, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.9 – probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Forecast probability number
36	Total number of forecast probabilities
37	Probability type (see Code table 4.9)
38	Scale factor of lower limit
39–42	Scaled value of lower limit
43	Scale factor of upper limit
44–47	Scaled value of upper limit
48–49	Year of end of overall time interval
50	Month of end of overall time interval
51	Day of end of overall time interval
52	Hour of end of overall time interval
53	Minute of end of overall time interval
54	Second of end of overall time interval
55	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
56–59	Total number of data values missing in the statistical process
	60–71 Specification of the outermost (or only) time range over which statistical processing is done
60	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
61	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
62	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
63–66	Length of the time range over which statistical processing is done, in units defined by the previous octet
67	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
68–71	Time increment between successive fields, in units defined by the previous octet (see Note 3)

(continued)

(Product definition template 4.9 – continued)

Octet No.	Contents
	72–nn These octets are included only if n > 1, where nn = 59 + 12 x n
72–83	As octets 60 to 71, next innermost step of processing
84–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary.

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 46, 58, 70, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.10 – percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to the WMO Secretariat (Observing and Information Systems Department) to assist for validation.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time for data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by previous octet (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Percentile value (from 100% to 0%)
36–37	Year of end of overall time interval
38	Month of end of overall time interval
39	Day of end of overall time interval
40	Hour of end of overall time interval
41	Minute of end of overall time interval
42	Second of end of overall time interval
43	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
44–47	Total number of data values missing in the statistical process

(continued)

(Product definition template 4.10 – continued)

Octet No.	Contents
	48–59 Specification of the outermost (or only) time range over which statistical processing is done
48	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
49	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
50	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
51–54	Length of the time range over which statistical processing is done, in units defined by the previous octet
55	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
56–59	Time increment between successive fields, in units defined by the previous octet (see Note 3)
	60–nn These octets are included only if n > 1, where nn = 47 + 12 x n
60–71	As octets 48–59, next innermost step of processing
72–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 48 to 59, repeated as necessary.

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by raingauge.

Product definition template 4.11 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Type of ensemble forecast (see Code table 4.6)
36	Perturbation number

(continued)

(Product definition template 4.11 – continued)

Octet No.	Contents
37	Number of forecasts in ensemble
38–39	Year of end of overall time interval
40	Month of end of overall time interval
41	Day of end of overall time interval
42	Hour of end of overall time interval
43	Minute of end of overall time interval
44	Second of end of overall time interval
45	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
46–49	Total number of data values missing in statistical process
	50–61 Specification of the outermost (or only) time range over which statistical processing is done
50	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
51	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
52	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
53–56	Length of the time range over which statistical processing is done, in units defined by the previous octet
57	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
58–61	Time increment between successive fields, in units defined by the previous octet (see Note 3)
	62–nn These octets are included only if n > 1, where nn = 49 + 12 x n
62–73	As octets 50 to 61, next innermost step of processing
74–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 50 to 61, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 51, 63, 75, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.12 – derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.12 – continued)

Octet No.	Contents
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37–38	Year of end of overall time interval
39	Month of end of overall time interval
40	Day of end of overall time interval
41	Hour of end of overall time interval
42	Minute of end of overall time interval
43	Second of end of overall time interval
44	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
45–48	Total number of data values missing in statistical process
	49–60 Specification of the outermost (or only) time range over which statistical processing is done
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
52–55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
57–60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	61–nn These octets are included only if n > 1, where nn = 48 + 12 x n
61–72	As octets 49 to 60, next innermost step of processing
73–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 50, 62, 74, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.13 – derived forecasts based on a cluster of ensemble members over a rectangular area at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high-resolution control belongs
39	Number of cluster to which the low-resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Northern latitude of cluster domain
46–49	Southern latitude of cluster domain
50–53	Eastern longitude of cluster domain
54–57	Western longitude of cluster domain
58	N_C – number of forecasts in the cluster
59	Scale factor of standard deviation in the cluster
60–63	Scaled value of standard deviation in the cluster
64	Scale factor of distance of the cluster from ensemble mean
65–68	Scaled value of distance of the cluster from ensemble mean
69–70	Year of end of overall time interval
71	Month of end of overall time interval
72	Day of end of overall time interval
73	Hour of end of overall time interval
74	Minute of end of overall time interval
75	Second of end of overall time interval
76	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
77–80	Total number of data values missing in statistical process
	81–92 Specification of the outermost (or only) time range over which statistical processing is done
81	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)

(continued)

(Product definition template 4.13 – continued)

Octet No.	Contents
82	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
83	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
84–87	Length of the time range over which statistical processing is done, in units defined by the previous octet
88	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
89–92	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	93–nn These octets are included only if n > 1, where nn = 80 + 12 x n
93–104	As octets 81 to 92, next innermost step of processing
105–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 81 to 92, repeated as necessary
(nn+1)–(nn+N_C)	List of N_C ensemble forecast numbers (N_C is given in octet 58)

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 82, 94, 106,....). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.14 – derived forecasts based on a cluster of ensemble members over a circular area at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)

(continued)

(Product definition template 4.14 – continued)

Octet No.	Contents
37	Cluster identifier
38	Number of cluster to which the high-resolution control belongs
39	Number of cluster to which the low-resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Latitude of central point in cluster domain
46–49	Longitude of central point in cluster domain
50–53	Radius of cluster domain
54	N_C – number of forecasts in the cluster
55	Scale factor of standard deviation in the cluster
56–59	Scaled value of standard deviation in the cluster
60	Scale factor of distance of the cluster from ensemble mean
61–64	Scaled value of distance of the cluster from ensemble mean
65–66	Year of end of overall time interval
67	Month of end of overall time interval
68	Day of end of overall time interval
69	Hour of end of overall time interval
70	Minute of end of overall time interval
71	Second of end of overall time interval
72	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
73–76	Total number of data values missing in statistical process
	77–88 Specification of the outermost (or only) time range over which statistical processing is done
77	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
78	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
79	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
80–83	Length of the time range over which statistical processing is done, in units defined by the previous octet
84	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
85–88	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	89–nn These octets are included only if n > 1, where nn = 76 + 12 x n
89–110	As octets 77 to 88, next innermost step of processing
111–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 77 to 88, repeated as necessary
(nn+1)–(nn+N_C)	List of N_C ensemble forecast numbers (N_C is given in octet 54)

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(continued)

(Product definition template 4.14 – continued)

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 78, 90, 112, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.15 – average, accumulation, extreme values, or other statistically processed values over a spatial area at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	Statistical process used within the spatial area defined by octet 36 (see Code table 4.10)
36	Type of spatial processing used to arrive at given data value from the source data (see Code table 4.15)
37	Number of data points used in spatial processing defined in octet 36

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.20 – radar product

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Number of radar sites used
14	Indicator of unit of time range
15–18	Site latitude (in 10^{-6} degree)
19–22	Site longitude (in 10^{-6} degree)
23–24	Site elevation (metres)
25–28	Site ID (alphanumeric)
29–30	Site ID (numeric)
31	Operating mode (see Code table 4.12)
32	Reflectivity calibration constant (tenths of dB)
33	Quality control indicator (see Code table 4.13)
34	Clutter filter indicator (see Code table 4.14)
35	Constant antenna elevation angle (tenths of degree true)
36–37	Accumulation interval (minutes)
38	Reference reflectivity for echo top (dB)
39–41	Range bin spacing (metres)
42–43	Radial angular spacing (tenths of degree true)

Product definition template 4.30 – satellite product

Note: This template is deprecated. Template 4.31 should be used instead.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Observation generating process identifier (defined by originating centres)
14	Number of contributing spectral bands (NB)
	Repeat the following 10 octets for each contributing band (nb = 1, NB)
(15+10(nb–1))–(16+10(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(17+10(nb–1))–(18+10(nb–1))	Satellite numbers of band nb (code table defined by originating/generating centre)
(19+10(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(20+10(nb–1))	Scale factor of central wave number of band nb
(21+10(nb–1))–(24+10(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Note: For “satellite series of band nb”, “satellite numbers of band nb” and “instrument types of band nb”, it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

Product definition template 4.31 – satellite product

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Observation generating process identifier (defined by originating centres)
14	Number of contributing spectral bands (NB)
	Repeat the following 11 octets for each contributing band (nb = 1, NB)
(15+11(nb–1))–(16+11(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(17+11(nb–1))–(18+11(nb–1))	Satellite numbers of band nb (code table defined by originating/generating centre)
(19+11(nb–1))–(20+11(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(21+11(nb–1))	Scale factor of central wave number of band nb
(22+11(nb–1))–(25+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Note: For “satellite series of band nb”, “satellite numbers of band nb” and “instrument types of band nb”, it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

Product definition template 4.32 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier
15–16	Hours of observational data cut-off after reference time (see Note 2)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Number of contributing spectral bands (NB)
	Repeat the following 11 octets for each contributing band (nb = 1, NB)
(24+11(nb–1))–(25+11(nb–1))	Satellite series of band nb (Code table defined by originating/generating centre)
(26+11(nb–1))–(27+11(nb–1))	Satellite number of band nb (Code table defined by originating/generating centre)
(28+11(nb–1))–(29+11(nb–1))	Instrument types of band nb (Code table defined by originating/generating centre)
(30 +11(nb–1))	Scale factor of central wave number of band nb
(31+11(nb–1))–(34+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Notes:

(1) For "satellite series of band nb", "satellite numbers of band nb" and "instrument types of band nb", it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

(2) Hours greater than 65534 will be coded as 65534.

Product definition template 4.33 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Number of contributing spectral bands (NB)
	24– Repeat the following 11 octets for each contributing band (nb = 1, NB)
(24+11(nb–1))–(25+11(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(26+11(nb–1))–(27+11(nb–1))	Satellite number of band nb (code table defined by originating/generating centre)
(28+11(nb–1))–(29+11(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(30+11(nb–1))	Scale factor of central wave number of band nb
(31+11(nb–1))–(34+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})
(24+11NB)	Type of ensemble forecast (see Code table 4.6)
(24+11NB+1)	Perturbation number
(24+11NB+2)	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.34 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval for simulated (synthetic) satellite data

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier
15–16	Hours of observational data cut-off after reference time (see Note 1)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Number of contributing spectral bands (NB)
	24– Repeat the following 11 octets for each contributing band (nb = 1, NB)
(24+11(nb–1))–(25+11(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(26+11(nb–1))–(27+11(nb–1))	Satellite number of band nb (code table defined by originating/generating centre)
(28+11(nb–1))–(29+11(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(30+11(nb–1))	Scale factor of central wave number of band nb
(31+11(nb–1))–(34+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})
(24+11NB)	Type of ensemble forecast (see Code table 4.6)
(25+11NB)	Perturbation number

(continued)

(Product definition template 4.34 – continued)

Octet No.	Contents
(26+11NB)	Number of forecasts in ensemble
(27+11NB)–(28+11NB)	Year of end of overall time interval
(29+11NB)	Month of end of overall time interval
(30+11NB)	Day of end of overall time interval
(31+11NB)	Hour of end of overall time interval
(32+11NB)	Minute of end of overall time interval
(33+11NB)	Second of end of overall time interval
(34+11NB)	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
(35+11NB)–(38+11NB)	Total number of data values missing in statistical process
	(39+11NB)– Repeat the following 12 octets for each time range spec (i = 1, n)
(39+11NB+12(i–1))	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
(40+11NB+12(i–1))	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
(41+11NB+12(i–1))	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
(42+11NB+12(i–1))–(45+11NB+12(i–1))	Length of the time range over which statistical processing is done, in units defined by the previous octet
(46+11NB+12(i–1))	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
(47+11NB+12(i–1))–(50+11NB+12(i–1))	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs and the rainfall measured by a rain gauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 51, 62, 73, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.40 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17–18	Hours of observational data cut-off after reference time (see Note)
19	Minutes of observational data cut-off after reference time
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.41 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.42 – average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note 1)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37–38	Year
39	Month
40	Day
41	Hour
42	Minute
43	Second
44	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
45–48	Total number of data values missing in statistical process
	49–60 Specification of the outermost (or only) time range over which statistical processing is done
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
52–55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
57–60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	61–nn These octets are included only if n > 1, where nn = 48 + 12 x n
61–72	As octets 49 to 60, next innermost step of processing
73–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(continued)

(Product definition template 4.42 – continued)

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 50, 62, 74, …). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.43 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note 1)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble
40–41	Year of end of overall time interval
42	Month of end of overall time interval
43	Day of end of overall time interval
44	Hour of end of overall time interval
45	Minute of end of overall time interval
46	Second of end of overall time interval
47	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
48–51	Total number of data values missing in statistical process
	52–63 Specification of the outermost (or only) time range over which statistical processing is done
52	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
53	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
54	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)

(continued)

(Product definition template 4.43 – continued)

Octet No.	Contents
55–58	Length of the time range over which statistical processing is done, in units defined by the previous octet
59	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
60–63	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	64–nn These octets are included only if n > 1, where nn = 51 + 12 x n
64–75	As octets 52 to 63, next innermost step of processing
76–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 52 to 63, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 53, 65, 77, …). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.44 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Aerosol type (see Code table 4.233)
14	Type of interval for first and second sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
25	Type of generating process (see Code table 4.3)
26	Background generating process identifier (defined by originating centre)
27	Analysis or forecast generating process identifier (defined by originating centre)
28–29	Hours of observational data cut-off after reference time (see Note)
30	Minutes of observational data cut-off after reference time
31	Indicator of unit of time range (see Code table 4.4)
32–33	Forecast time in units defined by octet 31
34	Type of first fixed surface (see Code table 4.5)
35	Scale factor of first fixed surface
36–39	Scaled value of first fixed surface
40	Type of second fixed surface (see Code table 4.5)
41	Scale factor of second fixed surface
42–45	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.45 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Aerosol type (see Code table 4.233)
14	Type of interval for first and second sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
25	Type of generating process (see Code table 4.3)
26	Background generating process identifier (defined by originating centre)
27	Forecast generating process identifier (defined by originating centre)
28–29	Hours after reference time of data cut-off (see Note)
30	Minutes after reference time of data cut-off
31	Indicator of unit of time range (see Code table 4.4)
32–35	Forecast time in units defined by octet 31
36	Type of first fixed surface (see Code table 4.5)
37	Scale factor of first fixed surface
38–41	Scaled value of first fixed surface
42	Type of second fixed surface (see Code table 4.5)
43	Scale factor of second fixed surface
44–47	Scaled value of second fixed surface
48	Type of ensemble forecast (see Code table 4.6)
49	Perturbation number
50	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.46 – average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Aerosol type (see Code table 4.233)
14	Type of interval for first and second sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
25	Type of generating process (see Code table 4.3)
26	Background generating process identifier (defined by originating centre)
27	Analysis or forecast generating process identifier (defined by originating centre)
28–29	Hours after reference time of data cut-off (see Note 1)
30	Minutes after reference time of data cut-off

(continued)

(Product definition template 4.46 – continued)

Octet No.	Contents
31	Indicator of unit of time range (see Code table 4.4)
32–35	Forecast time in units defined by octet 31 (see Note 2)
36	Type of first fixed surface (see Code table 4.5)
37	Scale factor of first fixed surface
38–41	Scaled value of first fixed surface
42	Type of second fixed surface (see Code table 4.5)
43	Scale factor of second fixed surface
44–47	Scaled value of second fixed surface
48–49	Year – time of end of overall time interval
50	Month – time of end of overall time interval
51	Day – time of end of overall time interval
52	Hour – time of end of overall time interval
53	Minute – time of end of overall time interval
54	Second – time of end of overall time interval
55	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
56–59	Total number of data values missing in statistical process
	60–71 Specification of the outermost (or only) time range over which statistical processing is done
60	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
61	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
62	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
63–66	Length of the time range over which statistical processing is done, in units defined by the previous octet
67	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
68–71	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	72–nn These octets are included only if n > 1, where nn = 59 + 12 x n
72–83	As octets 60 to 71, next innermost step of processing
84–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 61, 72, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.47 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13–14	Aerosol type (see Code table 4.233)
15	Type of interval for first and second sizes (see Code table 4.91)
16	Scale factor of first size
17–20	Scaled value of first size in metres
21	Scale factor of second size
22–25	Scaled value of second size in metres
26	Background generating process identifier (defined by originating centre)
27	Forecast generating process identifier (defined by originating centre)
28–29	Hours after reference time of data cut-off (see Note 1)
30	Minutes after reference time of data cut-off
31	Indicator of unit of time range (see Code table 4.4)
32–35	Forecast time in units defined by octet 31 (see Note 2)
36	Type of first fixed surface (see Code table 4.5)
37	Scale factor of first fixed surface
38–41	Scaled value of first fixed surface
42	Type of second fixed surface (see Code table 4.5)
43	Scale factor of second fixed surface
44–47	Scaled value of second fixed surface
48	Type of ensemble forecast (see Code table 4.6)
49	Perturbation number
50	Number of forecasts in ensemble
51–52	Year of end of overall time interval
53	Month of end of overall time interval
54	Day of end of overall time interval
55	Hour of end of overall time interval
56	Minute of end of overall time interval
57	Second of end of overall time interval
58	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
59–62	Total number of data values missing in statistical process
	63–74 Specification of the outermost (or only) time range over which statistical processing is done
63	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
64	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
65	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
66–69	Length of the time range over which statistical processing is done, in units defined by the previous octet
70	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
71–74	Time increment between successive fields, in units defined by the previous octet (see Note 3)

(continued)

(Product definition template 4.47 – continued)

Octet No.	Contents
	75–nn These octets are included only if n > 1, where nn = 62 + 12 x n
75–86	As octets 63 to 74, next innermost step of processing
87–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 63 to 74, repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 63, 75, ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.48 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Aerosol type (see Common Code table C–14)
14	Type of interval for first and second size (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
25	Type of interval for first and second wavelength (see Code table 4.91)
26	Scale factor of first wavelength
27–30	Scaled value of first wavelength in metres
31	Scale factor of second wavelength
32–35	Scaled value of second wavelength in metres
36	Type of generating process (see Code table 4.3)
37	Background generating process identifier (defined by originating centre)
38	Analysis or forecast generating process identifier (defined by originating centre)
39–40	Hours of observational data cut-off after reference time (see Note)
41	Minutes of observational data cut-off after reference time
42	Indicator of unit of time range (see Code table 4.4)
43–46	Forecast time in units defined by octet 42
47	Type of first fixed surface (see Code table 4.5)
48	Scale factor of first fixed surface
49–52	Scaled value of first fixed surface
53	Type of second fixed surface (see Code table 4.5)
54	Scale factor of second fixed surface
55–58	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.51 – categorical forecasts at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	NC – number of categories
	Repeat the following 12 octets for each category (i = 1,NC)
(36+12(i–1))	Code figure
(37+12(i–1))	Type of interval for first and second limits (see Code table 4.91)
(38+12(i–1))	Scale factor of first limit
(39+12(i–1))–(42+12(i–1))	Scaled value of first limit
(43+12(i–1))	Scale factor of second limit
(44+12(i–1))–(47+12(i–1))	Scaled value of second limit

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.53 – partitioned parameters at a horizontal level or in a horizontal layer at a point in time

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2 and Notes 2 and 3)
12	Partition Table Number (PTN) (see Notes 1 and 3)
13	Number of Partitions (NP) (see Note 1)
14–(14+2NP–1)	Partition set (list all partition numbers in the partition) (see Code table 4.PTN and Note 1)
(14+2NP)–(15+2NP)	Partition number (PN) (see Code table 4.PTN and Note 3)
(16+2NP)	Type of generating process (see Code table 4.3)
(17+2NP)	Background generating process identifier (defined by originating centre)
(18+2NP)	Analysis or forecast generating process identifier (defined by originating centre)
(19+2NP)–(20+2NP)	Hours of observational data cut-off after reference time (see Note 1)
(21+2NP)	Minutes of observational data cut-off after reference time
(22+2NP)	Indicator of unit of time range (see Code table 4.4)
(23+2NP)–(26+2NP)	Forecast time in units defined by previous octet
(27+2NP)	Type of first fixed surface (see Code table 4.5)
(28+2NP)	Scale factor of first fixed surface
(29+2NP)–(32+2NP)	Scaled value of first fixed surface

(continued)

(Product definition template 4.53 – continued)

Octet No.	Contents
(33+2NP)	Type of second fixed surface (see Code table 4.5)
(34+2NP)	Scale factor of second fixed surface
(35+2NP)–(38+2NP)	Scaled value of second fixed surface

Notes:

(1) A single partition with code value PN from the partition set composed by the NP partitions is represented in the template. The code values of the NP partitions are expressed in octets 14 to 14+2NP–1. The NP partitions are linked by the normalization formula stating that the sum of all the NP partitions must be equal to a normalization term (N) on each point of the grid.

(2) Only parameters expressing fractions or percentages can be used in this template. Code tables shall state clearly that they are meant to be used in partitioned parameters context.

(3) The word "fraction" or the word "percentage" has to be explicitly used in the name of the parameter to refer to a normalization term N = 1 in the case of "fraction" and N = 100 in the case of percentage.

Product definition template 4.54 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for partitioned parameters

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2 and Notes 2 and 3)
12	Partition Table Number (PTN) (see Notes 1 and 3)
13	Number of Partitions (NP) (see Note 1)
14–(14+2NP–1)	Partition set (list all partition numbers in the partition) (see Code table 4.PTN and Note 1)
(14+2NP)–(15+2NP)	Partition number (PN) (see Code table 4.PTN and Note 3)
(16+2NP)	Type of generating process (see Code table 4.3)
(17+2NP)	Background generating process identifier (defined by originating centre)
(18+2NP)	Analysis or forecast generating process identifier (defined by originating centre)
(19+2NP)–(20+2NP)	Hours of observational data cut-off after reference time (see Note 1)
(21+2NP)	Minutes of observational data cut-off after reference time
(22+2NP)	Indicator of unit of time range (see Code table 4.4)
(23+2NP)–(26+2NP)	Forecast time in units defined by octet (22+2NP)
(27+2NP)	Type of first fixed surface (see Code table 4.5)
(28+2NP)	Scale factor of first fixed surface
(29+2NP)–(32+2NP)	Scaled value of first fixed surface
(33+2NP)	Type of second fixed surface (see Code table 4.5)
(34+2NP)	Scale factor of second fixed surface
(35+2NP)–(38+2NP)	Scaled value of second fixed surface
(39+2NP)	Type of ensemble forecast (see Code table 4.6)
(40+2NP)	Perturbation number
(41+2NP)	Number of forecasts in ensemble

Notes:

(1) A single partition with code value PN from the partition set composed by the NP partitions is represented in the template. The code values of the NP partitions are expressed in octets 14 to 14+2NP–1. The NP partitions are linked by the normalization formula stating that the sum of all the NP partitions must be equal to a normalization term (N) on each point of the grid.

(2) Only parameters expressing fractions or percentages can be used in this template. Code tables shall state clearly that they are meant to be used in partitioned parameters context.

(3) The word "fraction" or the word "percentage" has to be explicitly used in the name of the parameter to refer to a normalization term N = 1 in the case of "fraction" and N = 100 in the case of percentage.

Product definition template 4.91 – categorical forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)
15–16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35	NC – number of categories
	Repeat the following 12 octets for each category (i = 1,NC)
(36+12(i–1))	Code figure
(37+12(i–1))	Type of interval for first and second limits (see Code table 4.91)
(38+12(i–1))	Scale factor of first limit
(39+12(i–1))–(42+12(i–1))	Scaled value of first limit
(43+12(i–1))	Scale factor of second limit
(44+12(i–1))–(47+12(i–1))	Scaled value of second limit
(48+12(NC–1))–(49+12(NC–1))	Year of end of overall time interval
(50+12(NC–1))	Month of end of overall time interval
(51+12(NC–1))	Day of end of overall time interval
(52+12(NC–1))	Hour of end of overall time interval
(53+12(NC–1))	Minute of end of overall time interval
(54+12(NC–1))	Second of end of overall time interval
(55+12(NC–1))	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
(56+12(NC–1))–(59+12(NC–1))	Total number of data values missing in statistical process
	60–71 Specification of the outermost (or only) time range over which statistical processing is done
(60+12(NC–1))	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
(61+12(NC–1))	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
(62+12(NC–1))	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
(63+12(NC–1))–(66+12(NC–1))	Length of the time range over which statistical processing is done, in units defined by the previous octet
(67+12(NC–1))	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
(68+12(NC–1))–(71+12(NC–1))	Time increment between successive fields, in units defined by the previous octet (see Note 3)

(continued)

(Product definition template 4.91 – continued)

Octet No.	Contents
	72–nn These octets are included only if n > 1, where nn = 72+12(n–1) +12(NC–1)
(72+12(NC–1))–(83+12(NC–1))	As octets (60+12(NC–1)) to (71+12(NC–1)), next innermost step of processing
(84+12(NC–1))–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets (60+12(NC –1)) to (71+12(NC –1)), repeated as necessary

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets (60+12(NC –1)), (73+12(NC –1)), (85+12(NC –1)), ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast times.

Product definition template 4.254 – CCITT IA5 character string

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–15	Number of characters

Product definition template 4.1000 – cross-section of analysis and forecast at a point in time

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1001 – cross-section of averaged or otherwise statistically processed analysis or forecast over a range of time

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note 1)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23–26	Total number of data values missing in the statistical process
27	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
28	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
29	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
30–33	Length of the time range over which statistical processing is done, in units defined by the previous octet
34	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
35–38	Time increment between successive fields, in units defined by the previous octet (see Note 2)

(continued)

(Product definition template 4.1001 – continued)

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

Product definition template 4.1002 – cross-section of analysis and forecast, averaged or otherwise statistically processed over latitude or longitude

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Horizontal dimension processed (see Code table 4.220)
24	Treatment of missing data (e.g. below ground) (see Code table 4.221)
25	Type of statistical processing (see Code table 4.10)
26–29	Start of range
30–33	End of range
34–35	Number of values

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1100 – Hovmöller-type grid with no averaging or other statistical processing

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface

(continued)

(Product definition template 4.1100 – continued)

Octet No.	Contents
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1101 – Hovmöller-type grid with averaging or other statistical processing

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests. (Octets 35–50 are very similar to octets 43–58 of product definition template 4.8, but the meaning of some fields differs slightly.)

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note 1)
17	Minutes of observational data cut-off after reference time
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code table 4.5)
24	Scale factor of first fixed surface
25–28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code table 4.5)
30	Scale factor of second fixed surface
31–34	Scaled value of second fixed surface
35–38	Total number of data values missing in the statistical process
39	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
40	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
41	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
42–45	Length of the time range over which statistical processing is done, in units defined by the previous octet
46	Indicator of unit of time for increment between the successive fields used (see Code table 4.4)
47–50	Time increment between successive fields, in units defined by the previous octet (see Note 3)

Notes:

(1) Hours greater than 65534 will be coded as 65534.

(2) Reference = reference time (section 1) + forecast range (PDT) + offset and increments from reference time (GDT).

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge.

TEMPLATE DEFINITIONS USED IN SECTION 5

Data representation template 5.0 – Grid point data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–15	Reference value (R) (IEEE 32-bit floating-point value)
16–17	Binary scale factor (E)
18–19	Decimal scale factor (D)
20	Number of bits used for each packed value for simple packing, or for each group reference value for complex packing or spatial differencing
21	Type of original field values (see Code table 5.1)

Note: Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.1 – Matrix values at grid point – simple packing

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to WMO Secretariat (Observing and Information Systems Department) to assist for validation.

Note: For most templates, details of the packing process are described in Regulation 92.9.4

Octet No.	Contents
12–21	Same as data representation template 5.0
22	0, no matrix bit maps present; 1–matrix bit maps present
23–26	Number of data values encoded in Section 7
27–28	NR – first dimension (rows) of each matrix
29–30	NC – second dimension (columns) of each matrix
31	First dimension coordinate value definition (Code table 5.2)
32	NC1 – number of coefficients or values used to specify first dimension coordinate function
33	Second dimension coordinate value definition (Code table 5.2)
34	NC2 – number of coefficients or values used to specify second dimension coordinate function
35	First dimension physical significance (Code table 5.3)
36	Second dimension physical significance (Code table 5.3)
37–(36+NC1x4)	Coefficients to define first dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point value)
(37+NC1x4)–(36+4(NC1+NC2))	Coefficients to define second dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point value)

Notes:

(1) This form of representation enables a matrix of values to be depicted at each grid point; the two dimensions of the matrix may represent coordinates expressed in terms of two elemental parameters (e.g. direction and frequency for wave spectra). The numeric values of these coordinates, beyond that of simple subscripts, can be given in a functional form, or as a collection of explicit numbers.

(2) Some simple coordinate functional forms are tabulated in Code table 5.2. Where a more complex coordinate function applies, the coordinate values shall be explicitly denoted by the inclusion of the actual set of values rather than the coefficients. This shall be indicated by a code figure 0 from Code table 5.2; the number of explicit values coded shall be equal to the appropriate dimension of the matrix for which values are presented and they shall follow octet 36 in place of the coefficients.

(3) Matrix bit maps will be present only if indicated by octet 22. If present, there shall be one bit map for each grid point with data values, as defined by the primary bit map in Section 6, each of length (NR x NC) bits: a bit set to 1 will indicate a data element at the corresponding location within the matrix. Bit maps shall be represented end-to-end, without regard for octet boundaries; the last bit map shall, if necessary, be followed by bits set to zero to fill any partially used octet.

(4) Matrices restricted to scanning in the +i direction (left to right) and in the –j direction (top to bottom).

Data representation template 5.2 – Grid point data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–21	Same as data representation template 5.0
22	Group splitting method used (see Code table 5.4)
23	Missing value management used (see Code table 5.5)
24–27	Primary missing value substitute
28–31	Secondary missing value substitute
32–35	NG – number of groups of data values into which field is split
36	Reference for group widths (see Note 12)
37	Number of bits used for the group widths (after the reference value in octet 36 has been removed)
38–41	Reference for group lengths (see Note 13)
42	Length increment for the group lengths (see Note 14)
43–46	True length of last group
47	Number of bits used for the scaled group lengths (after subtraction of the reference value given in octets 38–41 and division by the length increment given in octet 42)

Notes:

(1) Group lengths have no meaning for row by row packing, where groups are coordinate lines (so the grid description section and possibly the bit-map section are enough); for consistency, associated field width and reference should then be encoded as 0.

(2) For row by row packing with a bit-map, there should always be as many groups as rows. In case of rows with only missing values, all associated descriptors should be coded as zero.

(3) Management of widths into a reference and increments, together with management of lengths as scaled incremental values, are intended to save descriptor size (which is an issue as far as compression gains are concerned).

(4) Management of explicitly missing values is an alternative to bit-map use within Section 6; it is intended to reduce the whole GRIB message size.

(5) There may be two types of missing value(s), such as to make a distinction between static misses (for instance, due to a land/sea mask) and occasional misses.

(6) As an extra option, substitute value(s) for missing data may be specified. If not wished (or not applicable), all bits should be set to 1 for relevant substitute value(s).

(7) If substitute value(s) are specified, type of content should be consistent with original field values (floating-point - and then IEEE 32-bit encoded-, or integer).

(8) If primary missing values are used, such values are encoded within appropriate group with all bits set to 1 at packed data level.

(9) If secondary missing values are used, such values are encoded within appropriate group with all bits set to 1, except the last one set to 0, at packed data level.

(10) A group containing only missing values (of either type) will be encoded as a constant group (null width, no associated data) and the group reference will have all bits set to 1 for primary type, and all bits set to 1, except the last bit set to 0, for secondary type.

(11) If necessary, group widths and/or field width of group references may be enlarged to avoid ambiguities between missing value indicator(s) and true data.

(12) The group width is the number of bits used for every value in a group.

(13) The group length (L) is the number of values in a group.

(14) The essence of the complex packing method is to subdivide a field of values into NG groups, where the values in each group have similar sizes. In this procedure, it is necessary to retain enough information to recover the group lengths upon decoding. The NG group lengths for any given field can be described by Ln = ref + Kn x len_inc, n = 1, NG, where ref is given by octets 38–41 and len_inc by octet 42. The NG values of K (the scaled group lengths) are stored in the data section, each with the number of bits specified by octet 47. Since the last group is a special case which may not be able to be specified by this relationship, the length of the last group is stored in octets 43–46.

(15) See data template 7.2 and associated Notes for complementary information.

Data representation template 5.3 – Grid point data – complex packing and spatial differencing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–47	Same as data representation template 5.2
48	Order of spatial differencing (see Code table 5.6)
49	Number of octets required in the data section to specify extra descriptors needed for spatial differencing (octets 6–ww in data template 7.3)

Notes:

(1) Spatial differencing is a pre-processing before group splitting at encoding time. It is intended to reduce the size of sufficiently smooth fields, when combined with a splitting scheme as described in data representation template 5.2. At order 1, an initial field of values f is replaced by a new field of values g, where $g_1 = f_1$, $g_2 = f_2 – f_1$, …, $g_n = f_n – f_{n–1}$. At order 2, the field of values g is itself replaced by a new field of values h, where $h_1 = f_1$, $h_2 = f_2$, $h_3 = g_3 – g_2$, …, $h_n = g_n – g_{n–1}$. To keep values positive, the overall minimum of the resulting field (either g_{min} or h_{min}) is removed. At decoding time, after bit string unpacking, the original scaled values are recovered by adding the overall minimum and summing up recursively.

(2) For differencing of order n, the first n values in the array that are not missing are set to zero in the packed array. These dummy values are not used in unpacking.

(3) See data template 7.3 and associated Notes for complementary information.

Data representation template 5.4 – Grid point data – IEEE floating point data

Octet No.	Contents
12	Precision (see Code table 5.7)

Data representation template 5.40 – Grid point data – JPEG 2000 code stream format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–15	Reference value (R) (IEEE 32-bit floating-point value)
16–17	Binary scale factor (E)
18–19	Decimal scale factor (D)
20	Number of bits required to hold the resulting scaled and referenced data values (i.e. depth of the grayscale image) (see Note 2)
21	Type of original field values (see Code table 5.1)
22	Type of compression used (see Code table 5.40)
23	Target compression ratio, M:1 (with respect to the bit-depth specified in octet 20), when octet 22 indicates lossy compression. Otherwise, set to missing (see Note 3)

Notes:

(1) The purpose of this template is to scale the grid point data to obtain the desired precision, if appropriate, and then subtract out the reference value from the scaled field as is done using data representation template 5.0. After this, the resulting grid point field can be treated as a grayscale image and is then encoded into the JPEG 2000 code stream format. To unpack the data field, the JPEG 2000 code stream is decoded back into an image, and the original field is obtained from the image data as described in Regulation 92.9.4, Note 4.

(2) The JPEG 2000 standard specifies that the bit-depth must be in the range of 1 to 38 bits.

(3) The compression ratio M:1 (e.g. 20:1) specifies that the encoded stream should be less than ((1/M) x depth x number of data points) bits, where depth is specified in octet 20 and the number of data points in octets 6–9 of the data representation section.

(continued)

(Data representation template 5.40 – continued)

(4) The order of the data points should remain as specified in the scanning mode flags (Flag table 3.4) set in the appropriate grid definition template, even though the JPEG 2000 standard specifies that an image is stored starting at the top left corner. Assuming that the encoding software is expecting the image data in raster order (left to right across rows for each row), users should set the image width to Ni (or Nx) and the height to Nj (or Ny) if bit 3 of the scanning mode flag equals 0 (adjacent points in i (x) order), when encoding the "image". If bit 3 of the scanning mode flags equals 1 (adjacent points in j (y) order), it may be advantageous to set the image width to Nj (or Ny) and the height to Ni (or Nx).

(5) This template should not be used when the data points are not available on a rectangular grid, such as occurs if some data points are bit-mapped out or if section 3 describes a quasi-regular grid. If it is necessary to use this template on such a grid, the data field can be treated as a one-dimensional image where the height is set to 1 and the width is set to the total number of data points specified in octets 6–9.

(6) Negative values of E or D shall be represented according to Regulation 92.1.5.

(7) JPEG 2000 should not be used for bit-mapped or quasi-regular grid data.

Data representation template 5.41 – Grid point data – Portable Network Graphics (PNG) format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–15	Reference value (R) (IEEE 32-bit floating-point value)
16–17	Binary scale factor (E)
18–19	Decimal scale factor (D)
20	Number of bits required to hold the resulting scaled and referenced data values (i.e. depth of the image) (see Note 2)
21	Type of original field values (see Code table 5.1)

Notes:

(1) The purpose of this template is to scale the grid point data to obtain the desired precision, if appropriate, and then subtract out the reference value from the scaled field, as is done using data representation template 5.0. After this, the resulting grid point field can be treated as an image and is then encoded into PNG format. To unpack the data field, the PNG stream is decoded back into an image, and the original field is obtained from the image data as described in Regulation 92.9.4, Note 4.

(2) PNG does not support all bit-depths in an image, so it is necessary to define which depths can be used and how they are to be treated. For grayscale images, PNG supports depths of 1, 2, 4, 8 or 16 bits. Red-Green-Blue (RGB) colour images can have depths of 8 or 16 bits with an optional alpha sample. Valid values for octet 20 can be:

1, 2, 4, 8, or 16	:	Treat as grayscale image
24	:	Treat as RGB colour image (each component having 8-bit depth)
32	:	Treat as RGB w/ alpha sample colour image (each component having 8-bit depth)

(3) The order of the data points should remain as specified in the scanning mode flags (Flag table 3.4) set in the appropriate grid definition template, even though the PNG standard specifies that an image is stored starting at the top left corner and scans each row from left to right, starting with the top row. Users should set the image width to Ni (or Nx) and the height to Nj (or Ny) if bit 3 of the scanning mode flag equals 0 (adjacent points in i (x) order), when encoding the "image". If bit 3 of the scanning mode flags equals 1 (adjacent points in j (y) order), it may be advantageous to set the image width to Nj (or Ny) and the height to Ni (or Nx).

(4) This template should not be used when the data points are not available on a rectangular grid, such as occurs if some data points are bit-mapped out or if section 3 describes a quasi-regular grid. If it is necessary to use this template on such a grid, the data field can be treated as a one-dimensional image where the height is set to 1 and the width is set to the total number of data points specified in octets 6–9.

(5) Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.50 – Spectral data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–15	Reference value (R) (IEEE 32-bit floating-point value)
16–17	Binary scale factor (E)
18–19	Decimal scale factor (D)
20	Number of bits used for each packed value (field width)
21–24	Real part of (0.0) coefficient (IEEE 32-bit floating-point value)

Notes:

(1) Removal of the real part of (0.0) coefficient from packed data is intended to reduce the variability of the coefficients, in order to improve packing accuracy.

(2) For some spectral representations, the (0.0) coefficient represents the mean value of the parameter represented.

(3) Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.51 – Spherical harmonics data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–20	Same as data representation template 5.50
21–24	P – Laplacian scaling factor (expressed in 10^{-6} units)
25–26	J_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
27–28	K_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
29–30	M_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
31–34	T_S – total number of values in the unpacked subset (see Note 1)
35	Precision of the unpacked subset (see Code table 5.7)

Notes:

(1) The unpacked subset is a set of values defined in the same way as the full set of values (on a spectrum limited to J_S, K_S and M_S), but on which scaling and packing are not applied. Associated values are stored in octets 6 onwards of Section 7.

(2) The remaining coefficients are multiplied by $(n \times (n+1))^P$, scaled and packed. The operator associated with this multiplication is derived from the Laplacian operator on the sphere.

(3) The retrieval formula for a coefficient of wave number n is then:

$Y = (R + X \times 2^E) \times 10^{-D} \times (n \times (n+1))^{-P}$ where X is the packed scaled value associated with the coefficient.

Data representation template 5.61 – Grid point data – simple packing with logarithm pre-processing

Preliminary note: This template is experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
12–15	Reference value (R) (IEEE 32-bit floating-point value)
16–17	Binary scale factor (E)
18–19	Decimal scale factor (D)
20	Number of bits used for each packed value
21–24	Pre-processing parameter (B) (IEEE 32-bit floating-point value)

(continued)

(Data representation template 5.61 – continued)

Notes:

(1) This template is appropriately designed for data sets with all non-negative values and a wide variability range (more then 5 orders of magnitude). It must not be used for data sets with negative values or smaller variability range.

(2) A logarithm pre-processing algorithm is used to fit the variability range into one or two order of magnitudes before using the simple packing algorithm. It requires a parameter (B) to assure that all values passed to the logarithm function are positive. Thus scaled values are Z = ln (Y+B), where Y are the original values, ln is the natural logarithm (or Napierian) function and B is chosen so that Y+B > 0.

(3) Best practice follows for choosing the B pre-processing parameter.

   (a) If the data set minimum value is positive, B can be safely put to zero.

   (b) If the data set minimum is zero, all values must be scaled to become greater than zero and B can be equal to the minimum positive value in the data set.

(4) Data shall be packed using data template 7.

Data representation template 5.200 – Grid point data – run length packing with level values

Octet No.	Contents
12	Number of bits used for each packed value in the run length packing with level value
13–14	MV – maximum value within the levels that are used in the packing
15–16	MVL – maximum value of level (predefined)
17	Decimal scale factor of representative value of each level
18–(19+2(lv–1))	List of MVL scaled representative values of each level from lv = 1 to MVL

TEMPLATE DEFINITIONS USED IN SECTION 7

Data template 7.0 – Grid point data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Data template 7.1 – Matrix values at grid point – simple packing

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to WMO Secretariat to assist for validation.

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Note: Group descriptors mentioned above may not be physically present; if associated field width is 0.

Data template 7.2 – Grid point data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–xx	NG group reference values (X1 in the decoding formula), each of which is encoded using the number of bits specified in octet 20 of data representation template 5.0. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary
[xx+1]–yy	NG group widths, each of which is encoded using the number of bits specified in octet 37 of data representation template 5.2. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary
[yy+1]–zz	NG scaled group lengths, each of which is encoded using the number of bits specified in octet 47 of data representation template 5.2. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary (see Note 14 of data representation template 5.2)
[zz+1]–nn	Packed values (X2 in the decoding formula), where each value is a deviation from its respective group reference value

Notes:

(1) Group descriptors mentioned above may not be physically present; if associated field width is 0.

(2) Group lengths have no meaning for row by row packing; for consistency, associated field width should then be encoded as 0. So no specific test for row by row case is mandatory at decoding software level to handle encoding/decoding of group descriptors.

(3) Scaled group lengths, if present, are encoded for each group. But the true last group length (unscaled) should be taken from data representation template.

(4) For groups with a constant value, associated field width is 0, and no incremental data are physically present.

Data template 7.3 – Grid point data – complex packing and spatial differencing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–ww	First value(s) of original (undifferenced) scaled data values, followed by the overall minimum of the differences. The number of values stored is 1 greater than the order of differentiation, and the field width is described at octet 49 of data representation template 5.3 (see Note 1)
[ww+1]–xx	NG group reference values (X1 in the decoding formula), each of which is encoded using the number of bits specified in octet 20 of data representation template 5.0. Bits set to zero shall be appended where necessary to ensure this sequence of numbers ends on an octet boundary
[xx+1]–nn	Same as for data representation template 7.2

Notes:

(1) Referring to the notation in Note 1 of data representation template 5.3, at order 1, the values stored in octets 6–ww are g_1 and g_{min}. At order 2, the values stored are h_1, h_2, and h_{min}.

(2) Extra descriptors related to spatial differencing are added before the splitting descriptors, to reflect the separation between the two approaches. It enables to share software parts between cases with and without spatial differencing.

(3) The position of overall minimum after initial data values is a choice that enables less software management.

(4) Overall minimum will be negative in most cases. First bit should indicate the sign: 0 if positive, 1 if negative.

Data template 7.4 – Grid point data – IEEE floating point data

Octet No.	Contents
6–nn	Binary data values

Data template 7.40 – Grid point data – JPEG 2000 code stream format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	JPEG 2000 code stream as described in Part 1 of the JPEG 2000 standard (ISO/IEC 15444-1:2000)

Note: For simplicity, image data should be packed specifying a single component (i.e. grayscale image) instead of a multi-component colour image.

Data template 7.41 – Grid point data – Portable Network Graphics (PNG) format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	PNG encoded image

Note: If octet 20 of data representation template 5.41 specifies the data are packed into either 1, 2, 4, 8, or 16 bits, then encode the "image" as a grayscale image. If octet 20 specifies 24 bits, encode the "image" as a Red-Green-Blue (RGB) colour image with 8-bit depth for each colour component, and finally if octet 20 is 32, encode the "image" as an RGB colour image with an alpha sample using 8-bit depth for each of the four components.

Data template 7.50 – Spectral data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Data template 7.51 – Spherical harmonics – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–(5+I$\times T_S$)	Data values from the unpacked subset (IEEE floating-point values on I octets)
(6+I$\times T_S$)–nn	Binary data values – binary string, with each (scaled) data value out of the unpacked subset

Notes:

(1) Values ordering within the unpacked subset is defined according to the source of grid definition associated with the data.

(2) Number of octets associated with each value of the unpacked subset (I) is defined in Code table 5.7, according to the actual value in octet 35 of data representation template 5.51.

(3) Values ordering within the packed data is done according to the source of grid definition, skipping the values processed in the unpacked subset.

CODE TABLE USED IN SECTION 0

Code table 0.0 – *Discipline of processed data in the GRIB message, number of GRIB Master table*

Code figure	Meaning
0	Meteorological products
1	Hydrological products
2	Land surface products
3	Space products
4–9	Reserved
10	Oceanographic products
11–191	Reserved
192–254	Reserved for local use
255	Missing

CODE TABLES USED IN SECTION 1

Code table 1.0 – *GRIB master tables version number*

Code figure	Meaning
0	Experimental
1	Version implemented on 7 November 2001
2	Version implemented on 4 November 2003
3	Version implemented on 2 November 2005
4	Version implemented on 7 November 2007
5	Version implemented on 4 November 2009
6	Version implemented on 15 September 2010
7	Version implemented on 4 May 2011
8	Version implemented on 2 November 2011
9	Version implemented on 2 May 2012
10	Version implemented on 7 November 2012
11	Version implemented on 8 May 2013
12	Version implemented on 14 November 2013
13	Pre-operational to be implemented by next amendment
14–254	Future versions
255	Missing

Code table 1.1 – *GRIB local tables version number*

Code figure	Meaning
0	Local tables not used. Only table entries and templates from the current master table are valid
1–254	Number of local tables version used
255	Missing

Code table 1.2 – *Significance of reference time*

Code figure	Meaning
0	Analysis
1	Start of forecast
2	Verifying time of forecast
3	Observation time
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 1.3 – *Production status of data*

Code figure	Meaning
0	Operational products
1	Operational test products
2	Research products
3	Re-analysis products
4	THORPEX Interactive Grand Global Ensemble (TIGGE)
5	THORPEX Interactive Grand Global Ensemble (TIGGE) test
6–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 1.4 – *Type of data*

Code figure	Meaning
0	Analysis products
1	Forecast products
2	Analysis and forecast products
3	Control forecast products
4	Perturbed forecast products
5	Control and perturbed forecast products
6	Processed satellite observations
7	Processed radar observations
8	Event probability
9–191	Reserved
192–254	Reserved for local use
255	Missing

Note: An initialized analysis is considered a zero-hour forecast.

Code table 1.5 – *Identification template number*

Code figure	Meaning
0	Calendar definition
1	Paleontological offset
2	Calendar definition and paleontological offset
3–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 1.6 – *Type of calendar*

Code figure	Meaning	Comments
0	Gregorian	
1	360-day	
2	365-day	Essentially a non-leap year
3	Proleptic Gregorian	Extends the Gregorian calendar indefinitely in the past
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

CODE AND FLAG TABLES USED IN SECTION 3

Code table 3.0 – *Source of grid definition*

Code figure	Meaning	Comments
0	Specified in Code table 3.1	
1	Predetermined grid definition	Defined by originating centre
2–191	Reserved	
192–254	Reserved for local use	
255	A grid definition does not apply to this product	

Code table 3.1 – *Grid definition template number*

Code figure	Meaning	Comments
0	Latitude/longitude	Also called equidistant cylindrical, or Plate Carrée
1	Rotated latitude/longitude	
2	Stretched latitude/longitude	
3	Stretched and rotated latitude/longitude	
4	Variable resolution latitude/longitude	
5	Variable resolution rotated latitude/longitude	
6–9	Reserved	
10	Mercator	
11–19	Reserved	
20	Polar stereographic projection	Can be south or north
21–29	Reserved	
30	Lambert conformal	Can be secant or tangent, conical or bipolar
31	Albers equal area	
32–39	Reserved	
40	Gaussian latitude/longitude	
41	Rotated Gaussian latitude/longitude	
42	Stretched Gaussian latitude/longitude	
43	Stretched and rotated Gaussian latitude/longitude	
44–49	Reserved	
50	Spherical harmonic coefficients	
51	Rotated spherical harmonic coefficients	
52	Stretched spherical harmonic coefficients	
53	Stretched and rotated spherical harmonic coefficients	
54–89	Reserved	
90	Space view perspective or orthographic	
91–99	Reserved	
100	Triangular grid based on an icosahedron	
101	General unstructured grid	
102–109	Reserved	
110	Equatorial azimuthal equidistant projection	
111–119	Reserved	
120	Azimuth-range projection	
121–139	Reserved	
140	Lambert azimuthal equal area projection	
141–999	Reserved	

(continued)

(Code table 3.1 – continued)

Code figure	Meaning
1000	Cross-section grid with points equally spaced on the horizontal
1001–1099	Reserved
1100	Hovmöller diagram grid with points equally spaced on the horizontal
1101–1199	Reserved
1200	Time section grid
1201–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 3.2 – *Shape of the Earth*

Code figure	Meaning
0	Earth assumed spherical with radius = 6 367 470.0 m
1	Earth assumed spherical with radius specified (in m) by data producer
2	Earth assumed oblate spheroid with size as determined by IAU in 1965 (major axis = 6 378 160.0 m, minor axis = 6 356 775.0 m, f = 1/297.0)
3	Earth assumed oblate spheroid with major and minor axes specified (in km) by data producer
4	Earth assumed oblate spheroid as defined in IAG-GRS80 model (major axis = 6 378 137.0 m, minor axis = 6 356 752.314 m, f = 1/298.257 222 101)
5	Earth assumed represented by WGS84 (as used by ICAO since 1998)
6	Earth assumed spherical with radius of 6 371 229.0 m
7	Earth assumed oblate spheroid with major or minor axes specified (in m) by data producer
8	Earth model assumed spherical with radius of 6 371 200 m, but the horizontal datum of the resulting latitude/longitude field is the WGS84 reference frame
9	Earth represented by the Ordnance Survey Great Britain 1936 Datum, using the Airy 1830 Spheroid, the Greenwich meridian as 0 longitude, and the Newlyn datum as mean sea level, 0 height
10–191	Reserved
192–254	Reserved for local use
255	Missing

Note: WGS84 is a geodetic system that uses IAG-GRS80 as a basis.

Flag table 3.3 – *Resolution and component flags*

Bit No.	Value	Meaning
1–2		Reserved
3	0	i direction increments not given
	1	i direction increments given
4	0	j direction increments not given
	1	j direction increments given
5	0	Resolved u- and v- components of vector quantities relative to easterly and northerly directions
	1	Resolved u- and v- components of vector quantities relative to the defined grid in the direction of increasing x and y (or i and j) coordinates, respectively
6–8		Reserved – set to zero

Flag table 3.4 – *Scanning mode*

Bit No.	Value	Meaning
1	0	Points of first row or column scan in the +i (+x) direction
	1	Points of first row or column scan in the –i (–x) direction
2	0	Points of first row or column scan in the –j (–y) direction
	1	Points of first row or column scan in the +j (+y) direction
3	0	Adjacent points in i (x) direction are consecutive
	1	Adjacent points in j (y) direction is consecutive
4	0	All rows scan in the same direction
	1	Adjacent rows scans in the opposite direction
5–8		Reserved

Notes:

(1) i direction: west to east along a parallel or left to right along an x-axis.

(2) j direction: south to north along a meridian, or bottom to top along a y-axis.

(3) If bit number 4 is set, the first row scan is as defined by previous flags.

Flag table 3.5 – *Projection centre*

Bit No.	Value	Meaning
1	0	North Pole is on the projection plane
	1	South Pole is on the projection plane
2	0	Only one projection centre is used
	1	Projection is bipolar and symmetric

Code table 3.6 – *Spectral data representation type*

Code figure	Meaning
1	The associated Legendre functions of the first kind are defined by:

$$P_n^m(\mu) = \sqrt{(2n+1)\frac{(n-m)!}{(n+m)!}}\,\frac{1}{2^n n!}(1-\mu^2)^{m/2}\frac{d^{n+m}}{d\mu^{n+m}}(\mu^2-1)^n, m \geq 0$$

$$P_n^{-m}(\mu) = P_n^m(\mu)$$

A field F*(λ,* μ) is represented by:

$$F(\lambda,\mu) = \sum_{m=-m}^{M}\sum_{n=|m|}^{N(m)} F_n^m P_n^m(\mu) e^{im\lambda}$$

where λ is the longitude,

μ the sine of latitude,

and F_n^{-m} the complex conjugate of F_n^m

Code table 3.7 – *Spectral data representation mode*

Code figure	Meaning
0	Reserved
1	The complex numbers F_n^m (see code figure 1 in Code table 3.6) are stored for m ≥ 0 as pairs of real numbers Re(F_n^m), Im(F_n^m) ordered with n increasing from m to N(m), first for m = 0 and then for m = 1, 2, ... M (see Note)
2–254	Reserved
255	Missing

Note: Values of N(m) for common truncation cases:

Triangular:	M = J = K,	N(m) = J
Rhomboidal:	K = J + M,	N(m) = J + m
Trapezoidal:	K = J, K > M,	N(m) = J

Code table 3.8 – *Grid point position*

Code figure	Meaning
0	Grid points at triangle vertices
1	Grid points at centres of triangles
2	Grid points at midpoints of triangle sides
3–191	Reserved
192–254	Reserved for local use
255	Missing

Flag table 3.9 – *Numbering order of diamonds as seen from the corresponding pole*

Bit No.	Value	Meaning
1	0	Clockwise orientation
	1	Anti-clockwise (i.e. counter-clockwise) orientation
2–8		Reserved

Flag table 3.10 – *Scanning mode for one diamond*

Bit No.	Value	Meaning
1	0	Points scan in +i direction, i.e. from pole to Equator
	1	Points scan in –i direction, i.e. from Equator to pole
2	0	Points scan in +j direction, i.e. from west to east
	1	Points scan in –j direction, i.e. from east to west
3	0	Adjacent points in i direction are consecutive
	1	Adjacent points in j direction are consecutive
4–8		Reserved

Code table 3.11 – *Interpretation of list of numbers at end of section 3*

Code figure	Meaning
0	There is no appended list
1	Numbers define number of points corresponding to full coordinate circles (i.e. parallels), coordinate values on each circle are multiple of the circle mesh, and extreme coordinate values given in grid definition (i.e. extreme longitudes) may not be reached in all rows
2	Numbers define number of points corresponding to coordinate lines delimited by extreme coordinate values given in grid definition (i.e. extreme longitudes) which are present in each row
3	Numbers define the actual latitudes for each row in the grid. The list of numbers are integer values of the valid latitudes in microdegrees (scaled by 10^{-6}) or in unit equal to the ratio of the basic angle and the subdivisions number for each row, in the same order as specified in the "scanning mode flag" (bit no. 2) (see Note 2)
4–254	Reserved
255	Missing

Notes:

(1) For entry 1, it should be noted that depending on values of extreme (first/last) coordinates, and regardless of bit-map, effective number of points per row may be less than the number of points on the current circle.

(2) The value for the constant direction increment Di (or Dx) in the accompanying grid definition template should be set to all ones (missing).

Code table 3.15 – *Physical meaning of vertical coordinate*

Code figure	Meaning	Unit
0–19	Reserved	
20	Temperature	K
21–99	Reserved	
100	Pressure	Pa
101	Pressure deviation from mean sea level	Pa
102	Altitude above mean sea level	m
103	Height above ground (see Note 1)	m
104	Sigma coordinate	
105	Hybrid coordinate	
106	Depth below land surface	m
107	Potential temperature (theta)	K
108	Pressure deviation from ground to level	Pa
109	Potential vorticity	$K\ m^{-2}\ kg^{-1}\ s^{-1}$
110	Geometrical height	m
111	Eta coordinate (see Note 2)	
112	Geopotential height	gpm
113	Logarithmic hybrid coordinate	
114–159	Reserved	
160	Depth below sea level	m
161–191	Reserved	
192–254	Reserved for local use	
255	Missing	

(continued)

(Code table 3.15 – continued)

Notes:

(1) Negative values associated to this coordinate will indicate depth below ground surface. If values are all below surface, use of entry 10^6 is recommended, with positive coordinate values instead.

(2) The Eta vertical coordinate system involves normalizing the pressure at some point on a specific level by the mean sea level pressure at that point.

Code table 3.20 – *Type of horizontal line*

Code figure	Meaning
0	Rhumb
1	Great circle
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 3.21 – *Vertical dimension coordinate values definition*

Code figure	Meaning
0	Explicit coordinate values set
1	Linear coordinates f(1) = C1 f(n) = f(n–1) + C2
2–10	Reserved
11	Geometric coordinates f(1) = C1 f(n) = C2 × f(n–1)
12–191	Reserved
192–254	Reserved for local use
255	Missing

CODE TABLES USED IN SECTION 4

Code table 4.0 – *Product definition template number*

Code figure	Meaning
0	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time
1	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
2	Derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer at a point in time
3	Derived forecasts based on a cluster of ensemble members over a rectangular area at a horizontal level or in a horizontal layer at a point in time
4	Derived forecasts based on a cluster of ensemble members over a circular area at a horizontal level or in a horizontal layer at a point in time
5	Probability forecasts at a horizontal level or in a horizontal layer at a point in time
6	Percentile forecasts at a horizontal level or in a horizontal layer at a point in time
7	Analysis or forecast error at a horizontal level or in a horizontal layer at a point in time
8	Average, accumulation, extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
9	Probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
10	Percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
11	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
12	Derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
13	Derived forecasts based on a cluster of ensemble members over a rectangular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
14	Derived forecasts based on a cluster of ensemble members over a circular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
15	Average, accumulation, extreme values, or other statistically processed values over a spatial area at a horizontal level or in a horizontal layer at a point in time
16–19	Reserved
20	Radar product
21–29	Reserved
30	Satellite product (deprecated)
31	Satellite product
32	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data
33	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data
34	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval for simulated (synthetic) satellite data
35–39	Reserved
40	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
41	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
42	Average, accumulation and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

(continued)

(Code table 4.0 – continued)

Code figure	Meaning
43	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents
44	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for aerosol
45	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for aerosol
46	Average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol
47	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non continuous time interval for aerosol
48	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol
49–50	Reserved
51	Categorical forecasts at a horizontal level or in a horizontal layer at a point in time
52	Reserved
53	Partitioned parameters at a horizontal level or in a horizontal layer at a point in time
54	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for partitioned parameters
55-–90	Reserved
91	Categorical forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
92–253	Reserved
254	CCITT IA5 character string
255–999	Reserved
1000	Cross-section of analysis and forecast at a point in time
1001	Cross-section of averaged or otherwise statistically processed analysis or forecast over a range of time
1002	Cross-section of analysis and forecast, averaged or otherwise statistically processed over latitude or longitude
1003–1099	Reserved
1100	Hovmöller-type grid with no averaging or other statistical processing
1101	Hovmöller-type grid with averaging or other statistical processing
1102–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 4.1 – *Parameter category by product discipline*

Note: When a new category is to be added to Code table 4.1 and more than one discipline applies, the choice of discipline should be made based on the intended use of the product.

Product discipline 0 – Meteorological products

Category	Description
0	Temperature
1	Moisture
2	Momentum
3	Mass
4	Short-wave radiation
5	Long-wave radiation
6	Cloud
7	Thermodynamic stability indices
8	Kinematic stability indices
9	Temperature probabilities
10	Moisture probabilities
11	Momentum probabilities
12	Mass probabilities
13	Aerosols
14	Trace gases (e.g. ozone, CO_2)
15	Radar
16	Forecast radar imagery
17	Electrodynamics
18	Nuclear/radiology
19	Physical atmospheric properties
20	Atmospheric chemical constituents
21–189	Reserved
190	CCITT IA5 string
191	Miscellaneous
192–254	Reserved for local use
255	Missing

Note: Entries 9, 10, 11 and 12 are deprecated.

Product discipline 1 – Hydrological products

Category	Description
0	Hydrology basic products
1	Hydrology probabilities
2	Inland water and sediment properties
3–191	Reserved
192–254	Reserved for local use
255	Missing

Product discipline 2 – Land surface products

Category	Description
0	Vegetation/biomass
1	Agri-/aquacultural special products
2	Transportation-related products

(continued)

(Code table 4.1 – continued)

Category	Description
3	Soil products
4	Fire weather products
5–191	Reserved
192–254	Reserved for local use
255	Missing

Product discipline 3 – Space products

Category	Description
0	Image format products (see Note 1)
1	Quantitative products (see Note 2)
2–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) Data are numeric without units, although they might be given quantitative meaning through a code table defined external to this document. The emphasis is on a displayable “picture” of some phenomenon, perhaps with certain enhanced features. Generally, each datum is an unsigned, one octet integer, but some image format products might have another datum size. The size of a datum is indicated in section 5.

(2) Data are in specified physical units.

Product discipline 10 – Oceanographic products

Category	Description
0	Waves
1	Currents
2	Ice
3	Surface properties
4	Sub-surface properties
5–190	Reserved
191	Miscellaneous
192–254	Reserved for local use
255	Missing

Code table 4.2 – *Parameter number by product discipline and parameter category*

Notes:

(1) By convention, the flux sign is positive if downwards.

(2) When a new parameter is to be added to Code table 4.2 and more than one category applies, the choice of category should be made based on the intended use of the product. The discipline and category are an important part of any product definition, so it is possible to have the same parameter name in more than one category. For example, “water temperature” in discipline 10 (oceanographic products), category 4 (sub-surface properties) is used for reporting water temperature in the ocean or open sea, and is not the same as “water temperature” in discipline 1 (hydrological products), category 2 (inland water and sediment properties), which is used for reporting water temperature in freshwater lakes and rivers.

Product discipline 0 – Meteorological products, parameter category 0: temperature

Number	Parameter	Units
0	Temperature	K
1	Virtual temperature	K
2	Potential temperature	K
3	Pseudo-adiabatic potential temperature or equivalent potential temperature	K
4	Maximum temperature*	K
5	Minimum temperature*	K
6	Dewpoint temperature	K
7	Dewpoint depression (or deficit)	K
8	Lapse rate	K m^{-1}
9	Temperature anomaly	K
10	Latent heat net flux	W m^{-2}
11	Sensible heat net flux	W m^{-2}
12	Heat index	K
13	Wind chill factor	K
14	Minimum dewpoint depression*	K
15	Virtual potential temperature	K
16	Snow phase change heat flux	W m^{-2}
17	Skin temperature	K
18	Snow temperature (top of snow)	K
19	Turbulent transfer coefficient for heat	Numeric
20	Turbulent diffusion coefficient for heat	m^2 s^{-1}
21–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

Product discipline 0 – Meteorological products, parameter category 1: moisture

Number	Parameter	Units
0	Specific humidity	kg kg^{-1}
1	Relative humidity	%
2	Humidity mixing ratio	kg kg^{-1}
3	Precipitable water	kg m^{-2}
4	Vapour pressure	Pa
5	Saturation deficit	Pa

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
6	Evaporation	kg m^{-2}
7	Precipitation rate*	kg m^{-2} s^{-1}
8	Total precipitation***	kg m^{-2}
9	Large-scale precipitation (non-convective)***	kg m^{-2}
10	Convective precipitation***	kg m^{-2}
11	Snow depth	m
12	Snowfall rate water equivalent*	kg m^{-2} s^{-1}
13	Water equivalent of accumulated snow depth***	kg m^{-2}
14	Convective snow***	kg m^{-2}
15	Large-scale snow***	kg m^{-2}
16	Snow melt	kg m^{-2}
17	Snow age	d
18	Absolute humidity	kg m^{-3}
19	Precipitation type	(Code table 4.201)
20	Integrated liquid water	kg m^{-2}
21	Condensate	kg kg^{-1}
22	Cloud mixing ratio	kg kg^{-1}
23	Ice water mixing ratio	kg kg^{-1}
24	Rain mixing ratio	kg kg^{-1}
25	Snow mixing ratio	kg kg^{-1}
26	Horizontal moisture convergence	kg kg^{-1} s^{-1}
27	Maximum relative humidity*	%
28	Maximum absolute humidity*	kg m^{-3}
29	Total snowfall***	m
30	Precipitable water category	(Code table 4.202)
31	Hail	m
32	Graupel (snow pellets)	kg kg^{-1}
33	Categorical rain	(Code table 4.222)
34	Categorical freezing rain	(Code table 4.222)
35	Categorical ice pellets	(Code table 4.222)
36	Categorical snow	(Code table 4.222)
37	Convective precipitation rate	kg m^{-2} s^{-1}
38	Horizontal moisture divergence	kg kg^{-1} s^{-1}
39	Per cent frozen precipitation	%
40	Potential evaporation	kg m^{-2}
41	Potential evaporation rate	W m^{-2}
42	Snow cover	%
43	Rain fraction of total cloud water	Proportion
44	Rime factor	Numeric
45	Total column integrated rain	kg m^{-2}
46	Total column integrated snow	kg m^{-2}
47	Large scale water precipitation (non-convective)***	kg m^{-2}
48	Convective water precipitation***	kg m^{-2}
49	Total water precipitation***	kg m^{-2}
50	Total snow precipitation***	kg m^{-2}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
51	Total column water (Vertically integrated total water (vapour + cloud water/ice))	kg m^{-2}
52	Total precipitation rate**	kg m^{-2} s^{-1}
53	Total snowfall rate water equivalent**	kg m^{-2} s^{-1}
54	Large scale precipitation rate	kg m^{-2} s^{-1}
55	Convective snowfall rate water equivalent	kg m^{-2} s^{-1}
56	Large scale snowfall rate water equivalent	kg m^{-2} s^{-1}
57	Total snowfall rate	m s^{-1}
58	Convective snowfall rate	m s^{-1}
59	Large scale snowfall rate	m s^{-1}
60	Snow depth water equivalent	kg m^{-2}
61	Snow density	kg m^{-3}
62	Snow evaporation	kg m^{-2}
63	Reserved	
64	Total column integrated water vapour	kg m^{-2}
65	Rain precipitation rate	kg m^{-2} s^{-1}
66	Snow precipitation rate	kg m^{-2} s^{-1}
67	Freezing rain precipitation rate	kg m^{-2} s^{-1}
68	Ice pellets precipitation rate	kg m^{-2} s^{-1}
69	Total column integrated cloud water	kg m^{-2}
70	Total column integrated cloud ice	kg m^{-2}
71	Hail mixing ratio	kg kg^{-1}
72	Total column integrated hail	kg m^{-2}
73	Hail precipitation rate	kg m^{-2} s^{-1}
74	Total column integrated graupel	kg m^{-2}
75	Graupel (snow pellets) precipitation rate	kg m^{-2} s^{-1}
76	Convective rain rate	kg m^{-2} s^{-1}
77	Large scale rain rate	kg m^{-2} s^{-1}
78	Total column integrated water (all components including precipitation)	kg m^{-2}
79	Evaporation rate	kg m^{-2} s^{-1}
80	Total condensate	kg kg^{-1}
81	Total column-integrated condensate	kg m^{-2}
82	Cloud ice mixing-ratio	kg kg^{-1}
83	Specific cloud liquid water content	kg kg^{-1}
84	Specific cloud ice water content	kg kg^{-1}
85	Specific rainwater content	kg kg^{-1}
86	Specific snow water content	kg kg^{-1}
87–89	Reserved	
90	Total kinematic moisture flux	kg kg^{-1} m s^{-1}
91	u-component (zonal) kinematic moisture flux	kg kg^{-1} m s^{-1}
92	v-component (meridional) kinematic moisture flux	kg kg^{-1} m s^{-1}
93–191	Reserved	
192–254	Reserved for local use	
255	Missing	

(continued)

(Code table 4.2 – continued)

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** Total precipitation/snowfall rate stands for the sum of convective and large-scale precipitation/snowfall rate.

*** Statistical process 1 (Accumulation) does not change units. It is recommended to use another parameter with “rate” in its name and accumulation in PDT.

Product discipline 0 – Meteorological products, parameter category 2: momentum

Number	Parameter	Units
0	Wind direction (from which blowing)	degree true
1	Wind speed	$m\ s^{-1}$
2	u-component of wind	$m\ s^{-1}$
3	v-component of wind	$m\ s^{-1}$
4	Stream function	$m^2\ s^{-1}$
5	Velocity potential	$m^2\ s^{-1}$
6	Montgomery stream function	$m^2\ s^{-2}$
7	Sigma coordinate vertical velocity	s^{-1}
8	Vertical velocity (pressure)	$Pa\ s^{-1}$
9	Vertical velocity (geometric)	$m\ s^{-1}$
10	Absolute vorticity	s^{-1}
11	Absolute divergence	s^{-1}
12	Relative vorticity	s^{-1}
13	Relative divergence	s^{-1}
14	Potential vorticity	$K\ m^2\ kg^{-1}\ s^{-1}$
15	Vertical u-component shear	s^{-1}
16	Vertical v-component shear	s^{-1}
17	Momentum flux, u-component	$N\ m^{-2}$
18	Momentum flux, v-component	$N\ m^{-2}$
19	Wind mixing energy	J
20	Boundary layer dissipation	$W\ m^{-2}$
21	Maximum wind speed*	$m\ s^{-1}$
22	Wind speed (gust)	$m\ s^{-1}$
23	u-component of wind (gust)	$m\ s^{-1}$
24	v-component of wind (gust)	$m\ s^{-1}$
25	Vertical speed shear	s^{-1}
26	Horizontal momentum flux	$N\ m^{-2}$
27	u-component storm motion	$m\ s^{-1}$
28	v-component storm motion	$m\ s^{-1}$
29	Drag coefficient	Numeric
30	Frictional velocity	$m\ s^{-1}$
31	Turbulent diffusion coefficient for momentum	$m^2\ s^{-1}$
32	Eta coordinate vertical velocity	s^{-1}
33	Wind fetch	m
34	Normal wind component**	$m\ s^{-1}$
35	Tangential wind component**	$m\ s^{-1}$

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
36–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.
** In relation to local coordinate axes at a cell edge.

Product discipline 0 – Meteorological products, parameter category 3: mass

Number	Parameter	Units
0	Pressure	Pa
1	Pressure reduced to MSL	Pa
2	Pressure tendency	Pa s^{-1}
3	ICAO Standard Atmosphere Reference Height	m
4	Geopotential	m^2 s^{-2}
5	Geopotential height	gpm
6	Geometric height	m
7	Standard deviation of height	m
8	Pressure anomaly	Pa
9	Geopotential height anomaly	gpm
10	Density	kg m^{-3}
11	Altimeter setting	Pa
12	Thickness	m
13	Pressure altitude	m
14	Density altitude	m
15	5-wave geopotential height	gpm
16	Zonal flux of gravity wave stress	N m^{-2}
17	Meridional flux of gravity wave stress	N m^{-2}
18	Planetary boundary layer height	m
19	5-wave geopotential height anomaly	gpm
20	Standard deviation of sub-grid scale orography	m
21	Angle of sub-gridscale orography	rad
22	Slope of sub-gridscale orography	Numeric
23	Gravity wave dissipation	W m^{-2}
24	Anisotropy of sub-gridscale orography	Numeric
25	Natural logarithm of pressure in Pa	Numeric
26	Exner pressure	Numeric
27–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 4: short-wave radiation

Number	Parameter	Units
0	Net short-wave radiation flux (surface)*	W m^{-2}
1	Net short-wave radiation flux (top of atmosphere)*	W m^{-2}
2	Short-wave radiation flux*	W m^{-2}
3	Global radiation flux	W m^{-2}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
4	Brightness temperature	K
5	Radiance (with respect to wave number)	$W\ m^{-1}\ sr^{-1}$
6	Radiance (with respect to wave length)	$W\ m^{-3}\ sr^{-1}$
7	Downward short-wave radiation flux	$W\ m^{-2}$
8	Upward short-wave radiation flux	$W\ m^{-2}$
9	Net short wave radiation flux	$W\ m^{-2}$
10	Photosynthetically active radiation	$W\ m^{-2}$
11	Net short-wave radiation flux, clear sky	$W\ m^{-2}$
12	Downward UV radiation	$W\ m^{-2}$
13–49	Reserved	
50	UV index (under clear sky)**	Numeric
51	UV index**	Numeric
52–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** The Global Solar UVI is formulated using the International Commission on Illumination (CIE) reference action spectrum for UV-induced erythema on the human skin (ISO 17166:1999/CIE S 007/E-1998).

It is a measure of the UV radiation that is relevant to and defined for a horizontal surface. The UVI is a unitless quantity defined by the formula:

$$I_{UV} = k_{er} \cdot \int_{250nm}^{400nm} E_{\lambda} \cdot s_{er}(\lambda) d\lambda$$

where E_λ is the solar spectral irradiance expressed in W / (m^2·nanometre) at wavelength λ and dλ is the wave-length interval used in the summation. S_{er} λ is the erythema reference action spectrum, and k_{er} is a constant equal to 40 m^2 / W.

Product discipline 0 – Meteorological products, parameter category 5: long-wave radiation

Number	Parameter	Units
0	Net long-wave radiation flux (surface)*	$W\ m^{-2}$
1	Net long-wave radiation flux (top of atmosphere)*	$W\ m^{-2}$
2	Long-wave radiation flux*	$W\ m^{-2}$
3	Downward long-wave radiation flux	$W\ m^{-2}$
4	Upward long-wave radiation flux	$W\ m^{-2}$
5	Net long-wave radiation flux	$W\ m^{-2}$
6	Net long-wave radiation flux, clear sky	$W\ m^{-2}$
7–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

Product discipline 0 – Meteorological products, parameter category 6: cloud

Number	Parameter	Units
0	Cloud ice	$kg\ m^{-2}$
1	Total cloud cover	%

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
2	Convective cloud cover	%
3	Low cloud cover	%
4	Medium cloud cover	%
5	High cloud cover	%
6	Cloud water	kg m^{-2}
7	Cloud amount	%
8	Cloud type	(Code table 4.203)
9	Thunderstorm maximum tops	m
10	Thunderstorm coverage	(Code table 4.204)
11	Cloud base	m
12	Cloud top	m
13	Ceiling	m
14	Non-convective cloud cover	%
15	Cloud work function	J kg^{-1}
16	Convective cloud efficiency	Proportion
17	Total condensate*	kg kg^{-1}
18	Total column-integrated cloud water*	kg m^{-2}
19	Total column-integrated cloud ice*	kg m^{-2}
20	Total column-integrated condensate*	kg m^{-2}
21	Ice fraction of total condensate	Proportion
22	Cloud cover	%
23	Cloud ice mixing ratio*	kg kg^{-1}
24	Sunshine	Numeric
25	Horizontal extent of cumulonimbus (CB)	%
26	Height of convective cloud base	m
27	Height of convective cloud top	m
28	Number of cloud droplets per unit mass of air	kg^{-1}
29	Number of cloud ice particles per unit mass of air	kg^{-1}
30	Number density of cloud droplets	m^{-3}
31	Number density of cloud ice particles	m^{-3}
32	Fraction of cloud cover	Numeric
33	Sunshine duration	s
34	Surface long-wave effective total cloudiness	Numeric
35	Surface short-wave effective total cloudiness	Numeric
36–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. Use another parameter in parameter category 1: moisture instead.

Product discipline 0 – Meteorological products, parameter category 7: thermodynamic stability indices

Number	Parameter	Units
0	Parcel lifted index (to 500 hPa)	K
1	Best lifted index (to 500 hPa)	K

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
2	K index	K
3	KO index	K
4	Total totals index	K
5	Sweat index	Numeric
6	Convective available potential energy	$J\ kg^{-1}$
7	Convective inhibition	$J\ kg^{-1}$
8	Storm relative helicity	$J\ kg^{-1}$
9	Energy helicity index	Numeric
10	Surface lifted index	K
11	Best (4-layer) lifted index	K
12	Richardson number	Numeric
13	Showalter index	K
14	Reserved	
15	Updraft helicity	$m^2\ s^{-2}$
16–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 13: aerosols

Number	Parameter	Units
0	Aerosol type	(Code table 4.205)
1–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 14: trace gases

Number	Parameter	Units
0	Total ozone	DU
1	Ozone mixing ratio	$kg\ kg^{-1}$
2	Total column integrated ozone	DU
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 15: radar

Number	Parameter	Units
0	Base spectrum width	$m\ s^{-1}$
1	Base reflectivity	dB
2	Base radial velocity	$m\ s^{-1}$
3	Vertically integrated liquid water (VIL)	$kg\ m^{-2}$
4	Layer-maximum base reflectivity	dB
5	Precipitation	$kg\ m^{-2}$
6	Radar spectra (1)	–
7	Radar spectra (2)	–

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
8	Radar spectra (3)	–
9	Reflectivity of cloud droplets	dB
10	Reflectivity of cloud ice	dB
11	Reflectivity of snow	dB
12	Reflectivity of rain	dB
13	Reflectivity of graupel	dB
14	Reflectivity of hail	dB
15–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product Discipline 0 – Meteorological products, parameter category 16: forecast radar imagery

Number	Parameter	Units
0	Equivalent radar reflectivity factor for rain	$mm^6 m^{-3}$
1	Equivalent radar reflectivity factor for snow	$mm^6 m^{-3}$
2	Equivalent radar reflectivity factor for parameterized convection	$mm^6 m^{-3}$
3	Echo top	m
4	Reflectivity	dB
5	Composite reflectivity	dB
6–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Note: Decibel (dB) is a logarithmic measure of the relative power, or of the relative values of two flux densities, especially of sound intensities and radio and radar power densities. In radar meteorology, the logarithmic scale (dBZ) is used for measuring radar reflectivity factor (obtained from the American Meteorological Society *Glossary of Meteorology*).

Product discipline 0 – Meteorological products, parameter category 18: nuclear/radiology

Number	Parameter	Units
0	Air concentration of caesium 137	$Bq m^{-3}$
1	Air concentration of iodine 131	$Bq m^{-3}$
2	Air concentration of radioactive pollutant	$Bq m^{-3}$
3	Ground deposition of caesium 137	$Bq m^{-2}$
4	Ground deposition of iodine 131	$Bq m^{-2}$
5	Ground deposition of radioactive pollutant	$Bq m^{-2}$
6	Time-integrated air concentration of caesium pollutant (see Note 1)	$Bq s m^{-3}$
7	Time-integrated air concentration of iodine pollutant (see Note 1)	$Bq s m^{-3}$
8	Time-integrated air concentration of radioactive pollutant (see Note 1)	$Bq s m^{-3}$
9	Reserved	
10	Air concentration	$Bq m^{-3}$
11	Wet deposition	$Bq m^{-2}$
12	Dry deposition	$Bq m^{-2}$
13	Total deposition (wet + dry)	$Bq m^{-2}$
14–191	Reserved	

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Statistical process 1 (Accumulation) does not change units. It is recommended to use another parameter without the word "time-integrated" in its name and accumulation in PDT.

(2) Parameters from 10 onward may be used in combination with product definition templates 4.40 – 4.43 and Common Code table C–14 (Code table 4.230) to represent any type of radioisotope.

Product discipline 0 – Meteorological products, parameter category 19: physical atmospheric properties

Number	Parameter	Units
0	Visibility	m
1	Albedo	%
2	Thunderstorm probability	%
3	Mixed layer depth	m
4	Volcanic ash	(Code table 4.206)
5	Icing top	m
6	Icing base	m
7	Icing	(Code table 4.207)
8	Turbulence top	m
9	Turbulence base	m
10	Turbulence	(Code table 4.208)
11	Turbulent kinetic energy	J kg^{-1}
12	Planetary boundary-layer regime	(Code table 4.209)
13	Contrail intensity	(Code table 4.210)
14	Contrail engine type	(Code table 4.211)
15	Contrail top	m
16	Contrail base	m
17	Maximum snow albedo (see Note 1)	%
18	Snow free albedo	%
19	Snow albedo	%
20	Icing	%
21	In-cloud turbulence	%
22	Clear air turbulence (CAT)	%
23	Supercooled large droplet probability (see Note 2)	%
24	Convective turbulent kinetic energy	J kg^{-1}
25	Weather	(Code table 4.225)
26	Convective outlook	(Code table 4.224)
27	Icing scenario	(Code table 4.227)
28–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

(2) Supercooled large droplets (SLD) are defined as those with a diameter greater than 50 microns.

(continued)

(Code table 4.2 – continued)

Product discipline 0 – Meteorological products, parameter category 20: atmospheric chemical constituents

Number	Parameter	Units
0	Mass density (concentration)	kg m^{-3}
1	Column-integrated mass density (see Note)	kg m^{-2}
2	Mass mixing ratio (mass fraction in air)	kg kg^{-1}
3	Atmosphere emission mass flux	kg m^{-2} s^{-1}
4	Atmosphere net production mass flux	kg m^{-2} s^{-1}
5	Atmosphere net production and emission mass flux	kg m^{-2} s^{-1}
6	Surface dry deposition mass flux	kg m^{-2} s^{-1}
7	Surface wet deposition mass flux	kg m^{-2} s^{-1}
8	Atmosphere re-emission mass flux	kg m^{-2} s^{-1}
9	Wet deposition by large-scale precipitation mass flux	kg m^{-2} s^{-1}
10	Wet deposition by convective precipitation mass flux	kg m^{-2} s^{-1}
11	Sedimentation mass flux	kg m^{-2} s^{-1}
12	Dry deposition mass flux	kg m^{-2} s^{-1}
13	Transfer from hydrophobic to hydrophilic	kg kg^{-1} s^{-1}
14	Transfer from SO_2 (sulphur dioxide) to SO_4 (sulphate)	kg kg^{-1} s^{-1}
15–49	Reserved	
50	Amount in atmosphere	mol
51	Concentration in air	mol m^{-3}
52	Volume mixing ratio (fraction in air)	mol mol^{-1}
53	Chemical gross production rate of concentration	mol m^{-3} s^{-1}
54	Chemical gross destruction rate of concentration	mol m^{-3} s^{-1}
55	Surface flux	mol m^{-2} s^{-1}
56	Changes of amount in atmosphere (see Note)	mol s^{-1}
57	Total yearly average burden of the atmosphere	mol
58	Total yearly averaged atmospheric loss (see Note)	mol s^{-1}
59	Aerosol number concentration	m^{-3}
60–99	Reserved	
100	Surface area density (aerosol)	m^{-1}
101	Vertical visual range	m
102	Aerosol optical thickness	Numeric
103	Single scattering albedo	Numeric
104	Asymmetry factor	Numeric
105	Aerosol extinction coefficient	m^{-1}
106	Aerosol absorption coefficient	m^{-1}
107	Aerosol lidar backscatter from satellite	m^{-1} sr^{-1}
108	Aerosol lidar backscatter from the ground	m^{-1} sr^{-1}
109	Aerosol lidar extinction from satellite	m^{-1}
110	Aerosol lidar extinction from the ground	m^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
111–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Note: FirstFixedSurface and SecondFixedSurface of Code table 4.5 (Fixed surface types and units) to define the vertical extent, i.e. FirstFixedSurface can be set to 1 (Ground or water surface) and SecondFixedSurface set to 7 (Tropopause) for a restriction to the troposphere.

Product discipline 0 – Meteorological products, parameter category 190: CCITT IA5 string

Number	Parameter	Units
0	Arbitrary text string	CCITT IA5
1–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 191: miscellaneous

Number	Parameter	Units
0	Seconds prior to initial reference time (defined in Section 1)	s
1	Geographical latitude	°N
2	Geographical longitude	°E
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 1 – Hydrological products, parameter category 0: hydrology basic products

Number	Parameter	Units
0	Flash flood guidance (Encoded as an accumulation over a floating subinterval of time between the reference time and valid time)	kg m^{-2}
1	Flash flood runoff (Encoded as an accumulation over a floating subinterval of time)	kg m^{-2}
2	Remotely sensed snow cover	(Code table 4.215)
3	Elevation of snow-covered terrain	(Code table 4.216)
4	Snow water equivalent per cent of normal	%
5	Baseflow-groundwater runoff	kg m^{-2}
6	Storm surface runoff	kg m^{-2}
7–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Remotely sensed snow cover is expressed as a field of dimensionless, thematic values. The currently accepted values are for no-snow/no-cloud, 50, for clouds, 100, and for snow, 250 (see Code table 4.215).

(2) A data field representing snow coverage by elevation portrays at which elevations there is a snow pack. The elevation values typically range from 0 to 90 in 100-metre increments. A value of 253 is used to represent a no-snow/no-cloud data point. A value of 254 is used to represent a data point at which snow elevation could not be estimated because of clouds obscuring the remote sensor (when using aircraft or satellite measurements).

(continued)

(Code table 4.2 – continued)

(3) Snow water equivalent per cent of normal is stored in per cent of normal units. For example, a value of 110 indicates 110 per cent of the normal snow water equivalent for a given depth of snow.

Product discipline 1 – Hydrological products, parameter category 1: hydrology probabilities

Number	Parameter	Units
0	Conditional per cent precipitation amount fractile for an overall period (Encoded as an accumulation)	kg m^{-2}
1	Per cent precipitation in a sub-period of an overall period (Encoded as per cent accumulation over the sub-period)	%
2	Probability of 0.01 inch of precipitation (POP)	%
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 1 – Hydrological products, parameter category 2: inland water and sediment properties

Number	Parameter	Units
0	Water depth	m
1	Water temperature	K
2	Water fraction	Proportion
3	Sediment thickness	m
4	Sediment temperature	K
5	Ice thickness	m
6	Ice temperature	K
7	Ice cover	Proportion
8	Land cover (0 = water, 1 = land)	Proportion
9	Shape factor with respect to salinity profile	–
10	Shape factor with respect to temperature profile in thermocline	–
11	Attenuation coefficient of water with respect to solar radiation	m^{-1}
12	Salinity	kg kg^{-1}

Product discipline 2 – Land surface products, parameter category 0: vegetation/biomass

Number	Parameter	Units
0	Land cover (0 = sea, 1 = land)	Proportion
1	Surface roughness	m
2	Soil temperature***	K
3	Soil moisture content*	kg m^{-2}
4	Vegetation	%
5	Water runoff	kg m^{-2}
6	Evapotranspiration	kg^{-2} s^{-1}
7	Model terrain height	m
8	Land use	(Code table 4.212)

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
9	Volumetric soil moisture content**	Proportion
10	Ground heat flux*	W m^{-2}
11	Moisture availability	%
12	Exchange coefficient	kg m^{-2} s^{-1}
13	Plant canopy surface water	kg m^{-2}
14	Blackadar's mixing length scale	m
15	Canopy conductance	m s^{-1}
16	Minimal stomatal resistance	s m^{-1}
17	Wilting point*	Proportion
18	Solar parameter in canopy conductance	Proportion
19	Temperature parameter in canopy	Proportion
20	Humidity parameter in canopy conductance	Proportion
21	Soil moisture parameter in canopy conductance	Proportion
22	Soil moisture***	kg m^{-3}
23	Column-integrated soil water***	kg m^{-2}
24	Heat flux	W m^{-2}
25	Volumetric soil moisture	m^3 m^{-3}
26	Wilting point	kg m^{-3}
27	Volumetric wilting point	m^3 m^{-3}
28	Leaf area index	Numeric
29	Evergreen forest cover	Proportion
30	Deciduous forest cover	Proportion
31	Normalized differential vegetation index (NDVI)	Numeric
32	Root depth of vegetation	m
33–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** It is recommended not to use this parameter, but another one with a more descriptive unit.

*** Parameter deprecated. Use another parameter in parameter category 3: soil products instead.

Product discipline 2 – Land surface products, parameter category 3: soil products

Number	Parameter	Units
0	Soil type	(Code table 4.213)
1	Upper layer soil temperature*	K
2	Upper layer soil moisture*	kg m^{-3}
3	Lower layer soil moisture*	kg m^{-3}
4	Bottom layer soil temperature*	K
5	Liquid volumetric soil moisture (non-frozen)**	Proportion
6	Number of soil layers in root zone	Numeric
7	Transpiration stress-onset (soil moisture)**	Proportion
8	Direct evaporation cease (soil moisture)**	Proportion

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
9	Soil porosity**	Proportion
10	Liquid volumetric soil moisture (non-frozen)	$m^3 m^{-3}$
11	Volumetric transpiration stress-onset (soil moisture)	$m^3 m^{-3}$
12	Transpiration stress-onset (soil moisture)	$kg m^{-3}$
13	Volumetric direct evaporation cease (soil moisture)	$m^3 m^{-3}$
14	Direct evaporation cease (soil moisture)	$kg m^{-3}$
15	Soil porosity	$m^3 m^{-3}$
16	Volumetric saturation of soil moisture	$m^3 m^{-3}$
17	Saturation of soil moisture	$kg m^{-3}$
18	Soil temperature	K
19	Soil moisture	$kg m^{-3}$
20	Column-integrated soil moisture	$kg m^{-2}$
21	Soil ice	$kg m^{-3}$
22	Column-integrated soil ice	$kg m^{-2}$
23–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** It is recommended not to use this parameter, but another one with a more descriptive unit.

Product discipline 2 – Land surface products, parameter category 4: fire weather products

Number	Parameter	Units
0	Fire outlook	Code table 4.224
1	Fire outlook due to dry thunderstorm	Code table 4.224
2	Haines index	Numeric
3	Fire burned area	%
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 3 – Space products, parameter category 0: image format products

Number	Parameter	Units
0	Scaled radiance	Numeric
1	Scaled albedo	Numeric
2	Scaled brightness temperature	Numeric
3	Scaled precipitable water	Numeric
4	Scaled lifted index	Numeric
5	Scaled cloud top pressure	Numeric
6	Scaled skin temperature	Numeric
7	Cloud mask	Code table 4.217
8	Pixel scene type	Code table 4.218
9	Fire detection indicator	Code table 4.223
10–191	Reserved	
192–254	Reserved for local use	
255	Missing	

(continued)

(Code table 4.2 – continued)

Product discipline 3 – Space products, parameter category 1: quantitative products

Number	Parameter	Units
0	Estimated precipitation	kg m^{-2}
1	Instantaneous rain rate	kg m^{-2} s^{-1}
2	Cloud top height	m
3	Cloud top height quality indicator	Code table 4.219
4	Estimated u component of wind	m s^{-1}
5	Estimated v component of wind	m s^{-1}
6	Number of pixel used	Numeric
7	Solar zenith angle	°
8	Relative azimuth angle	°
9	Reflectance in 0.6 micron channel	%
10	Reflectance in 0.8 micron channel	%
11	Reflectance in 1.6 micron channel	%
12	Reflectance in 3.9 micron channel	%
13	Atmospheric divergence	s^{-1}
14	Cloudy brightness temperature	K
15	Clear-sky brightness temperature	K
16	Cloudy radiance (with respect to wave number)	W m^{-1} sr^{-1}
17	Clear-sky radiance (with respect to wave number)	W m^{-1} sr^{-1}
18	Reserved	
19	Wind speed	m s^{-1}
20	Aerosol optical thickness at 0.635 μm	
21	Aerosol optical thickness at 0.810 μm	
22	Aerosol optical thickness at 1.640 μm	
23	Angstrom coefficient	
24–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 0: waves

Number	Parameter	Units
0	Wave spectra (1)	–
1	Wave spectra (2)	–
2	Wave spectra (3)	–
3	Significant height of combined wind waves and swell	m
4	Direction of wind waves	degree true
5	Significant height of wind waves	m
6	Mean period of wind waves	s
7	Direction of swell waves	degree true
8	Significant height of swell waves	m
9	Mean period of swell waves	s
10	Primary wave direction	degree true
11	Primary wave mean period	s
12	Secondary wave direction	degree true

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
13	Secondary wave mean period	s
14	Direction of combined wind waves and swell	degree true
15	Mean period of combined wind waves and swell	s
16	Coefficient of drag with waves	–
17	Friction velocity	m s^{-1}
18	Wave stress	N m^{-2}
19	Normalized wave stress	–
20	Mean square slope of waves	–
21	u-component surface Stokes drift	m s^{-1}
22	v-component surface Stokes drift	m s^{-1}
23	Period of maximum individual wave height	s
24	Maximum individual wave height	m
25	Inverse mean wave frequency	s
26	Inverse mean frequency of wind waves	s
27	Inverse mean frequency of total swell	s
28	Mean zero-crossing wave period	s
29	Mean zero-crossing period of wind waves	s
30	Mean zero-crossing period of total swell	s
31	Wave directional width	–
32	Directional width of wind waves	–
33	Directional width of total swell	–
34	Peak wave period	s
35	Peak period of wind waves	s
36	Peak period of total swell	s
37	Altimeter wave height	m
38	Altimeter corrected wave height	m
39	Altimeter range relative correction	–
40	10-metre neutral wind speed over waves	m s–1
41	10-metre wind direction over waves	°
42	Wave energy spectrum	m^2 s rad^{-1}
43	Kurtosis of the sea-surface elevation due to waves	–
44	Benjamin–Feir index	–
45	Spectral peakedness factor	s^{-1}
46–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Further information concerning the wave parameters can be found in the *Guide to Wave Analysis and Forecasting* (WMO-No. 702).

Product discipline 10 – Oceanographic products, parameter category 1: currents

Number	Parameter	Units
0	Current direction	degree true
1	Current speed	m s^{-1}
2	u-component of current	m s^{-1}
3	v-component of current	m s^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 2: ice

Number	Parameter	Units
0	Ice cover	Proportion
1	Ice thickness	m
2	Direction of ice drift	degree true
3	Speed of ice drift	$m\ s^{-1}$
4	u-component of ice drift	$m\ s^{-1}$
5	v-component of ice drift	$m\ s^{-1}$
6	Ice growth rate	$m\ s^{-1}$
7	Ice divergence	s^{-1}
8	Ice temperature	K
9	Ice internal pressure	Pa m
10–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 3: surface properties

Number	Parameter	Units
0	Water temperature	K
1	Deviation of sea level from mean	m
2–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 4: subsurface properties

Number	Parameter	Units
0	Main thermocline depth	m
1	Main thermocline anomaly	m
2	Transient thermocline depth	m
3	Salinity	$kg\ kg^{-1}$
4	Ocean vertical heat diffusivity	$m^2\ s^{-1}$
5	Ocean vertical salt diffusivity	$m^2\ s^{-1}$
6	Ocean vertical momentum diffusivity	$m^2\ s^{-1}$
7	Bathymetry	m
8–10	Reserved	
11	Shape factor with respect to salinity profile	–
12	Shape factor with respect to temperature profile in thermocline	–
13	Attenuation coefficient of water with respect to solar radiation	m^{-1}
14	Water depth	m

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
15	Water temperature	K
16–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 191: miscellaneous

Number	Parameter	Units
0	Seconds prior to initial reference time (defined in Section 1)	s
1	Meridional overturning stream function	$m^3 s^{-1}$
2–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Code table 4.3 – *Type of generating process*

Code figure	Meaning
0	Analysis
1	Initialization
2	Forecast
3	Bias corrected forecast
4	Ensemble forecast
5	Probability forecast
6	Forecast error
7	Analysis error
8	Observation
9	Climatological
10	Probability-weighted forecast
11	Bias-corrected ensemble forecast
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.4 – *Indicator of unit of time range*

Code figure	Meaning
0	Minute
1	Hour
2	Day
3	Month
4	Year
5	Decade (10 years)
6	Normal (30 years)
7	Century (100 years)
8–9	Reserved
10	3 hours
11	6 hours
12	12 hours
13	Second
14–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.5 – *Fixed surface types and units*

Code figure	Meaning	Unit
0	Reserved	
1	Ground or water surface	–
2	Cloud base level	–
3	Level of cloud tops	–
4	Level of 0°C isotherm	–
5	Level of adiabatic condensation lifted from the surface	–
6	Maximum wind level	–
7	Tropopause	–
8	Nominal top of the atmosphere	–
9	Sea bottom	–
10	Entire atmosphere	–
11	Cumulonimbus (CB) base	m
12	Cumulonimbus (CB) top	m
13–19	Reserved	
20	Isothermal level	K
21–99	Reserved	
100	Isobaric surface	Pa
101	Mean sea level	
102	Specific altitude above mean sea level	m
103	Specified height level above ground	m
104	Sigma level	"sigma" value
105	Hybrid level	–
106	Depth below land surface	m
107	Isentropic (theta) level	K
108	Level at specified pressure difference from ground to level	Pa
109	Potential vorticity surface	$K\ m^2\ kg^{-1}\ s^{-1}$
110	Reserved	
111	Eta level	–
112	Reserved	
113	Logarithmic hybrid level	
114	Snow level	Numeric
115–116	Reserved	
117	Mixed layer depth	m
118	Hybrid height level	–
119	Hybrid pressure level	–
120–149	Reserved	
150	Generalized vertical height coordinate (see Note 5)	
151–159	Reserved	
160	Depth below sea level	m
161	Depth below water surface	m
162	Lake or river bottom	–
163	Bottom of sediment layer	–
164	Bottom of thermally active sediment layer	–
165	Bottom of sediment layer penetrated by thermal wave	–
166	Mixing layer	–

(continued)

(Code table 4.5 – continued)

Code figure	Meaning	Unit
167–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) The Eta vertical coordinate system involves normalizing the pressure at some point on a specific level by the mean sea level pressure at that point.

(2) Hybrid height level (Code figure 118) can be defined as:
z(k) = A(k) + B(k) x orog
(k = 1,...,NLevels; orog = orography; z(k) = height in metres at level k)

(3) Hybrid pressure level, for which Code figure 119 shall be used instead of 105, can be defined as:
p(k) = A(k) + B(k) x sp
(k = 1,...,NLevels; sp = surface pressure; p(k) = pressure at level k)

(4) Ice internal pressure or stress (Pa m) is the integrated pressure across the vertical thickness of a layer of ice. It is produced when concentrated ice reacts to external forces such as wind and ocean currents.

(5) The definition of a generalized vertical height coordinate implies the absence of coordinate values in Section 4 but the presence of an external 3D-GRIB message that specifies the height of every model grid point in metres (see Notes to Section 4 in the section above entitled Specification of Octet Contents), i.e., this GRIB message will contain the field with discipline = 0, category = 3, parameter = 6 (Geometric height).

Code table 4.6 – *Type of ensemble forecast*

Code figure	Meaning
0	Unperturbed high-resolution control forecast
1	Unperturbed low-resolution control forecast
2	Negatively perturbed forecast
3	Positively perturbed forecast
4	Multi-model forecast
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.7 – *Derived forecast*

Code figure	Meaning
0	Unweighted mean of all members
1	Weighted mean of all members
2	Standard deviation with respect to cluster mean
3	Standard deviation with respect to cluster mean, normalized
4	Spread of all members
5	Large anomaly index of all members (see Note 1)
6	Unweighted mean of the cluster members
7	Interquartile range (range between the 25th and 75th quantile)
8	Minimum of all ensemble members (see Note 2)
9	Maximum of all ensemble members (see Note 2)
10–191	Reserved
192–254	Reserved for local use
255	Missing

(continued)

(Code table 4.7 – continued)

Notes:

(1) Large anomaly index is defined as {(number of members whose anomaly is higher than 0.5 x SD) – (number of members whose anomaly is lower than –0.5 x SD)} / (number of members) at each grid point, where SD is defined as observed climatological standard deviation.

(2) It should be noted that the reference for "minimum of all ensemble members" and "maximum of all ensemble members" is the set of ensemble members and not a time interval and should not be confused with the maximum and minimum described by PDT 4.8.

Code table 4.8 – *Clustering method*

Code figure	Meaning
0	Anomaly correlation
1	Root mean square
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.9 – *Probability type*

Code figure	Meaning
0	Probability of event below lower limit
1	Probability of event above upper limit
2	Probability of event between lower and upper limits (the range includes the lower limit but not the upper limit)
3	Probability of event above lower limit
4	Probability of event below upper limit
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.10 – *Type of statistical processing*

Code figure	Meaning
0	Average
1	Accumulation (see Note 1)
2	Maximum
3	Minimum
4	Difference (value at the end of time range minus value at the beginning)
5	Root mean square
6	Standard deviation
7	Covariance (temporal variance) (see Note 2)
8	Difference (value at the start of time range minus value at the end)
9	Ratio (see Note 3)
10	Standardized anomaly
11	Summation
12–191	Reserved
192–254	Reserved for local use
255	Missing

(continued)

(Code table 4.10 – continued)

Notes:

(1) The original data value (Y in the note 4 of Regulation 92.9.4) has units of Code table 4.2 multiplied by second, unless otherwise noted on Code table 4.2.

(2) The original data value has squared units of Code table 4.2.

(3) The original data value is non-dimensional number without units.

Code table 4.11 – *Type of time intervals*

Code figure	Meaning
0	Reserved
1	Successive times processed have same forecast time, start time of forecast is incremented
2	Successive times processed have same start time of forecast, forecast time is incremented
3	Successive times processed have start time of forecast incremented and forecast time decremented so that valid time remains constant
4	Successive times processed have start time of forecast decremented and forecast time incremented so that valid time remains constant
5	Floating subinterval of time between forecast time and end of overall time interval*
6–191	Reserved
192–254	Reserved for local use
255	Missing

* Code figure 5 applies to instances where a single time subinterval was used to calculate the statistically processed field. The exact starting and ending times of the subinterval are not given, but it is known that it is contained inclusively between the beginning time and the ending time of the overall interval.

Code table 4.12 – *Operating mode*

Code figure	Meaning
0	Maintenance mode
1	Clear air
2	Precipitation
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.13 – *Quality control indicator*

Code figure	Meaning
0	No quality control applied
1	Quality control applied
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.14 – *Clutter filter indicator*

Code figure	Meaning
0	No clutter filter used
1	Clutter filter used
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.15 – *Type of spatial processing used to arrive at given data value from the source data*

Code figure	Meaning
0	Data is calculated directly from the source grid with no interpolation (see Note 1)
1	Bilinear interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
2	Bicubic interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
3	Using the value from the source grid grid-point which is nearest to the nominal grid-point
4	Budget interpolation using the 4 source grid grid-point values surrounding the nominal grid-point (see Note 2)
5	Spectral interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
6	Neighbor-budget interpolation using the 4 source grid grid-point values surrounding the nominal grid-point (see Note 3)
7–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) This method assumes that each field really represents box averages/maxima/minima where each box extends halfway to its neighboring grid point in each direction to represent averages/maxima/minima of values from the source grid with no interpolation.

(2) Budget interpolation means a low-order interpolation method that quasi-conserves area averages. It would be appropriate for interpolating budget fields such as precipitation. This method assumes that the field really represents box averages/maxima/minima where each box extends halfway to its neighboring grid point in each direction. The method actually averages bilinearly interpolated values in a square array of points distributed within each output grid box.

(3) Performs a budget interpolation at the grid point nearest to the nominal grid point.

Code table 4.91 – *Type of Interval*

Code figure	Meaning
0	Smaller than first limit
1	Greater than second limit
2	Between first and second limit. The range includes the first limit but not the second limit
3	Greater than first limit
4	Smaller than second limit
5	Smaller or equal first limit
6	Greater or equal second limit
7	Between first and second. The range includes the first limit and the second limit
8	Greater or equal first limit

(continued)

(Code table 4.91 – continued)

Code figure	Meaning
9	Smaller or equal second limit
10	Between first and second limit. The range includes the second limit but not the first limit
11	Equal to first limit
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.201 – *Precipitation type*

Code figure	Meaning
0	Reserved
1	Rain
2	Thunderstorm
3	Freezing rain
4	Mixed/ice
5	Snow
6–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.202 – *Precipitable water category*

Code figure	Meaning
0–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.203 – *Cloud type*

Code figure	Meaning
0	Clear
1	Cumulonimbus
2	Stratus
3	Stratocumulus
4	Cumulus
5	Altostratus
6	Nimbostratus
7	Altocumulus
8	Cirrostratus
9	Cirrocumulus
10	Cirrus
11	Cumulonimbus – ground-based fog beneath the lowest layer
12	Stratus – ground-based fog beneath the lowest layer
13	Stratocumulus – ground-based fog beneath the lowest layer
14	Cumulus – ground-based fog beneath the lowest layer

(continued)

(Code table 4.203 – continued)

Code figure	Meaning
15	Altostratus – ground-based fog beneath the lowest layer
16	Nimbostratus – ground-based fog beneath the lowest layer
17	Altocumulus – ground-based fog beneath the lowest layer
18	Cirrostratus – ground-based fog beneath the lowest layer
19	Cirrocumulus – ground-based fog beneath the lowest layer
20	Cirrus – ground-based fog beneath the lowest layer
21–190	Reserved
191	Unknown
192–254	Reserved for local use
255	Missing

Note: Code figures 11–20 indicate all four layers were used and ground-based fog is beneath the lowest layer.

Code table 4.204 – *Thunderstorm coverage*

Code figure	Meaning
0	None
1	Isolated (1–2%)
2	Few (3–5%)
3	Scattered (16–45%)
4	Numerous (> 45%)
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.205 – *Presence of aerosol*

Code figure	Meaning
0	Aerosol not present
1	Aerosol present
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.206 – *Volcanic ash*

Code figure	Meaning
0	Not present
1	Present
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.207 – *Icing*

Code figure	Meaning
0	None
1	Light
2	Moderate
3	Severe
4	Trace
5	Heavy
6–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.208 – *Turbulence*

Code figure	Meaning
0	None (smooth)
1	Light
2	Moderate
3	Severe
4	Extreme
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.209 – *Planetary boundary-layer regime*

Code figure	Meaning
0	Reserved
1	Stable
2	Mechanically driven turbulence
3	Forced convection
4	Free convection
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.210 – *Contrail intensity*

Code figure	Meaning
0	Contrail not present
1	Contrail present
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.211 – *Contrail engine type*

Code figure	Meaning
0	Low bypass
1	High bypass
2	Non-bypass
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.212 – *Land use*

Code figure	Meaning
0	Reserved
1	Urban land
2	Agriculture
3	Range land
4	Deciduous forest
5	Coniferous forest
6	Forest/wetland
7	Water
8	Wetlands
9	Desert
10	Tundra
11	Ice
12	Tropical forest
13	Savannah
14–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.213 – *Soil type*

Code figure	Meaning
0	Reserved
1	Sand
2	Loamy sand
3	Sandy loam
4	Silt loam
5	Organic (redefined)
6	Sandy clay loam
7	Silt clay loam
8	Clay loam
9	Sandy clay
10	Silty clay
11	Clay
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.215 – *Remotely sensed snow coverage*

Code figure	Meaning
0–49	Reserved
50	No-snow/no-cloud
51–99	Reserved
100	Clouds
101–249	Reserved
250	Snow
251–254	Reserved for local use
255	Missing

Code table 4.216 – *Elevation of snow-covered terrain*

Code figure	Meaning
0–90	Elevation in increments of 100 m
91–253	Reserved
254	Clouds
255	Missing

Code table 4.217 – *Cloud mask type*

Code figure	Meaning
0	Clear over water
1	Clear over land
2	Cloud
3	No data
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.218 – *Pixel scene type*

Code figure	Meaning
0	No scene identified
1	Green needle-leafed forest
2	Green broad-leafed forest
3	Deciduous needle-leafed forest
4	Deciduous broad-leafed forest
5	Deciduous mixed forest
6	Closed shrub-land
7	Open shrub-land
8	Woody savannah
9	Savannah
10	Grassland
11	Permanent wetland
12	Cropland
13	Urban

(continued)

(Code table 4.218 – continued)

Code figure	Meaning
14	Vegetation / crops
15	Permanent snow / ice
16	Barren desert
17	Water bodies
18	Tundra
19–96	Reserved
97	Snow / ice on land
98	Snow / ice on water
99	Sun-glint
100	General cloud
101	Low cloud / fog / Stratus
102	Low cloud / Stratocumulus
103	Low cloud / unknown type
104	Medium cloud / Nimbostratus
105	Medium cloud / Altostratus
106	Medium cloud / unknown type
107	High cloud / Cumulus
108	High cloud / Cirrus
109	High cloud / unknown
110	Unknown cloud type
111–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.219 – *Cloud top height quality indicator*

Code figure	Meaning
0	Nominal cloud top height quality
1	Fog in segment
2	Poor quality height estimation
3	Fog in segment and poor quality height estimation
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.220 – *Horizontal dimension processed*

Code figure	Meaning
0	Latitude
1	Longitude
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.221 – *Treatment of missing data*

Code figure	Meaning
0	Not included
1	Extrapolated
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.222 – *Categorical result*

Code figure	Meaning
0	No
1	Yes
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.223 – *Fire detection indicator*

Code figure	Meaning
0	No fire detected
1	Possible fire detected
2	Probable fire detected
3	Missing

Code table 4.224 – *Categorical outlook*

Code figure	Meaning
0	No risk area
1	Reserved
2	General thunderstorm risk area
3	Reserved
4	Slight risk area
5	Reserved
6	Moderate risk area
7	Reserved
8	High risk area
9–10	Reserved
11	Dry thunderstorm (dry lightning) risk area
12–13	Reserved
14	Critical risk area
15–17	Reserved
18	Extremely critical risk area
19–254	Reserved
255	Missing

Code table 4.225 – *Weather*

(see FM 94 BUFR/FM 95 CREX Code table 0 20 003 – Present weather)

Code table 4.227 – *Icing scenario (weather/cloud classification)*

Code figure	Meaning
0	None
1	General
2	Convective
3	Stratiform
4	Freezing
5–191	Reserved
192–254	Reserved for local use
255	Missing value

Code table 4.230 – *Atmospheric chemical constituent type*

(See Common Code table C–14)

Code table 4.233 – *Aerosol type*

(See Common Code table C–14)

Code table 4.234 – *Canopy cover fraction (to be used as partitioned parameter in product definition template 4.53 or 4.54)*

Code figure	Meaning
1	Crops, mixed farming
2	Short grass
3	Evergreen needleleaf trees
4	Deciduous needleleaf trees
5	Deciduous broadleaf trees
6	Evergreen broadleaf trees
7	Tall grass
8	Desert
9	Tundra
10	Irrigated crops
11	Semidesert
12	Ice caps and glaciers
13	Bogs and marshes
14	Inland water
15	Ocean
16	Evergreen shrubs
17	Deciduous shrubs
18	Mixed forest
19	Interrupted forest
20	Water and land mixtures

Code table 4.236 – *Soil texture fraction (to be used as partitioned parameter in product definition template 4.53 or 4.54)*

Code figure	Meaning
1	Coarse
2	Medium
3	Medium-fine
4	Fine
5	Very-fine
6	Organic
7	Tropical-organic

CODE TABLES USED IN SECTION 5

Code table 5.0 – *Data representation template number*

Code figure	Meaning
0	Grid point data – simple packing
1	Matrix value at grid point – simple packing
2	Grid point data – complex packing
3	Grid point data – complex packing and spatial differencing
4	Grid point data – IEEE floating point data
5–39	Reserved
40	Grid point data – JPEG 2000 code stream format
41	Grid point data – Portable Network Graphics (PNG)
42–49	Reserved
50	Spectral data – simple packing
51	Spherical harmonics data – complex packing
52–60	Reserved
61	Grid point data – simple packing with logarithm pre-processing
62–199	Reserved
200	Run length packing with level values
201–49151	Reserved
49152–65534	Reserved for local use
65535	Missing

Code table 5.1 – *Type of original field values*

Code figure	Meaning
0	Floating point
1	Integer
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.2 – *Matrix coordinate value function definition*

Code figure	Meaning
0	Explicit coordinate values set
1	Linear coordinates f(1) = C1 f(n) = f(n–1) + C2
2–10	Reserved
11	Geometric coordinates f(1) = C1 f(n) = C2 × f(n–1)
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.3 – *Matrix coordinate parameter*

Code figure	Meaning
1	Direction degrees true
2	Frequency (s^{-1})
3	Radial number (2pi/lambda) (m^{-1})
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.4 – *Group splitting method*

Code figure	Meaning
0	Row by row splitting
1	General group splitting
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.5 – *Missing value management for complex packing*

Code figure	Meaning
0	No explicit missing values included within data values
1	Primary missing values included within data values
2	Primary and secondary missing values included within data values
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.6 – *Order of spatial differencing*

Code figure	Meaning
0	Reserved
1	First-order spatial differencing
2	Second-order spatial differencing
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.7 – *Precision of floating-point numbers*

Code figure	Meaning
0	Reserved
1	IEEE 32-bit (I=4 in section 7)
2	IEEE 64-bit (I=8 in section 7)
3	IEEE 128-bit (I=16 in section 7)
4–254	Reserved
255	Missing

Code table 5.40 – *Type of compression*

Code figure	Meaning
0	Lossless
1	Lossy
2–254	Reserved
255	Missing

CODE TABLES USED IN SECTION 6

Code table 6.0 – *Bit map indicator*

Code figure	Meaning
0	A bit map applies to this product and is specified in this Section
1–253	A bit map predetermined by the originating/generating centre applies to this product and is not specified in this Section
254	A bit map defined previously in the same "GRIB" message applies to this product
255	A bit map does not apply to this product

ATTACHMENT

DEFINITION OF A TRIANGULAR GRID BASED ON AN ICOSAHEDRON

A triangular grid based on an icosahedron was first introduced in a meteorological model by Sadourny and others (1968) and Williamson (1969). The approach outlined here, especially the code implementation, is based on the work of Baumgardner (1995).

To construct the triangular grid based on an icosahedron, the unit-sphere, i.e. a sphere with radius 1, is divided into 20 spherical triangles of equal size by placing a plane icosahedron into the sphere (Figure 1). The 12 vertices of the icosahedron touch the sphere, one vertex coincides with the north pole (NP), the opposite one with the south pole (SP), for simplicity.

The 12 vertices are connected by great circles to form 20 main spherical triangles. Since each of the 12 vertices is surrounded by five main spherical triangles (Figure 2), the angles between two sides of the main triangles are $2\pi/5$ or 72°.

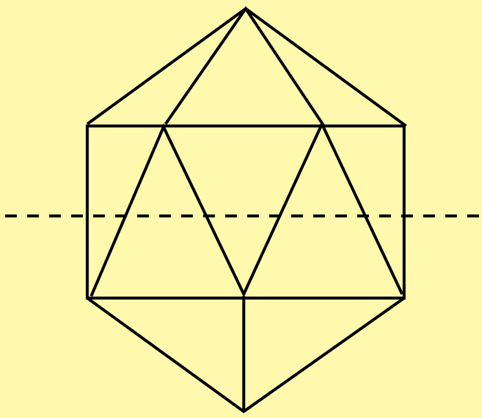


Figure 1. Plane icosahedron consisting of 20 plane triangles.

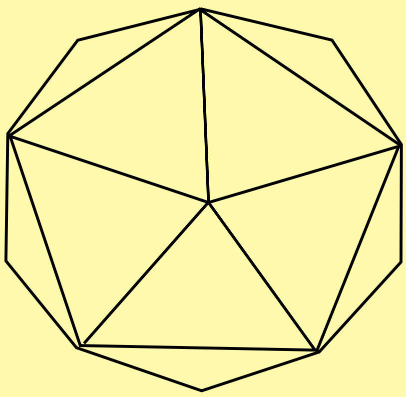


Figure 2. The five main spherical triangles at the north pole.

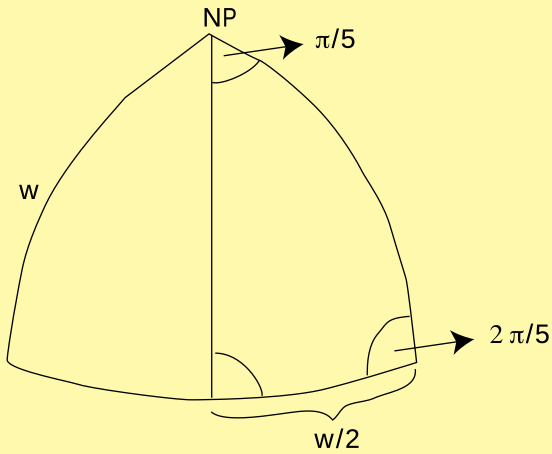


Figure 3. One main spherical triangle at the North Pole.

The length w of a main triangle side follows from Figure 3 and equation (1):

$$\cos\frac{1}{2}w = \frac{\cos\frac{\pi}{5}}{\sin 2\frac{\pi}{5}} = \frac{1}{2\sin\frac{\pi}{5}} \tag{1}$$

Thus w ≈ 1.107 149. On the unit-sphere, w is identical to $\pi/2$ minus φ with the latitude φ of the lower corner of the triangle. Thus w is a measure of the latitude of the lower vertices of the triangle in Figure 3.

Two adjacent main spherical triangles are combined to form a “diamond”, i.e. a logical square block. Five of the diamonds originate from the north pole and five from the south pole. The numbering and order of the diamonds are outlined in Figure 4.

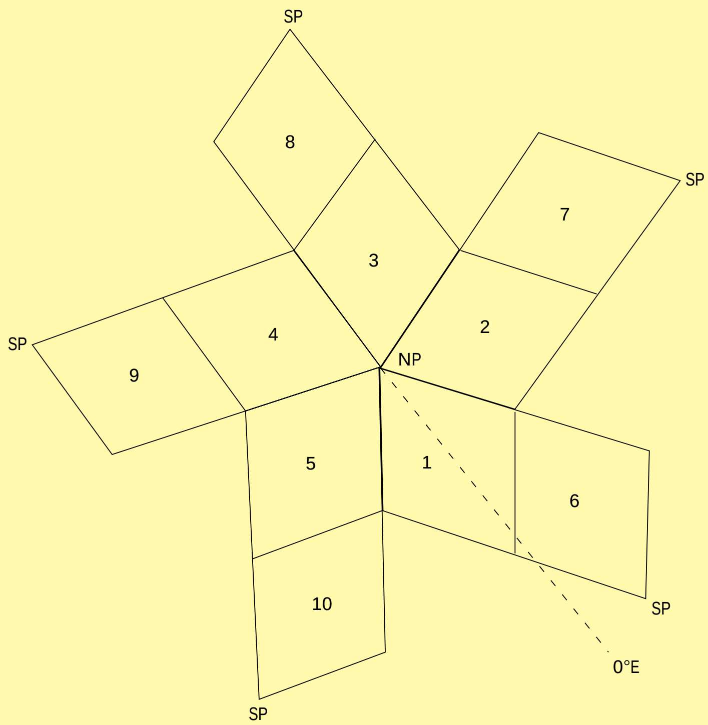


Figure 4. The 20 main spherical triangles combined to 10 diamonds.

Diamonds 1 to 5 are the "northern" ones, i.e. they start at the north pole, while diamonds 6 to 10 start at the south pole. The so-called home vertex of each diamond (in the order 1, 6, 2, 7, 3, 8, 4, 9, 5, 10) is shifted by $\pi/5$ to the east starting at $-\pi/5$ for the first diamond. Thus the 10 home vertices have the geographical coordinates (λ and φ) on the unit-sphere as presented in Table 1.

Table 1
Geographical coordinates (λ and φ) of the home vertices of the 10 diamonds

Diamond #	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
λ	$-\pi/5$	$\pi/5$	$3\pi/5$	$5\pi/5$	$-3\pi/5$	0	$2\pi/5$	$4\pi/5$	$-4\pi/5$	$-2\pi/5$
φ	$\pi/2-w$	$\pi/2-w$	$\pi/2-w$	$\pi/2-w$	$\pi/2-w$	$w-\pi/2$	$w-\pi/2$	$w-\pi/2$	$w-\pi/2$	$w-\pi/2$

A Cartesian coordinate system is placed into the unit-sphere with the origin in the centre of the sphere, the z-axis towards the north pole and the x-axis in the direction of the Greenwich meridian. The Cartesian coordinates (x, y, z) of a point on the unit-sphere follow from equation (2):

$$\begin{aligned} x &= \cos\lambda \cos\varphi = \cos\lambda \sin w \\ y &= \sin\lambda \cos\varphi = \sin\lambda \sin w \\ z &= \sin\varphi = \cos w \end{aligned} \tag{2}$$

Thus the two pole vertices have the Cartesian coordinates (0, 0, 1) and (0, 0, –1), respectively.

The geographical coordinates (λ, φ) of a point on the unit-sphere with the Cartesian coordinates (x, y, z) follow from equation (3) which may be derived from equation (2):

$$\begin{aligned} \lambda &= \arctan \frac{y}{x} \\ \varphi &= \arcsin z \end{aligned} \tag{3}$$

For the grid generation, the sides (w) of the 20 main triangles are iteratively subdivided into ni equal parts to form sub-triangles. Each point in a main triangle is now surrounded by six triangles (Figure 5) and is, therefore, in the centre of a hexagon (see also Figure 6). However, the points which form the vertices of the icosahedron

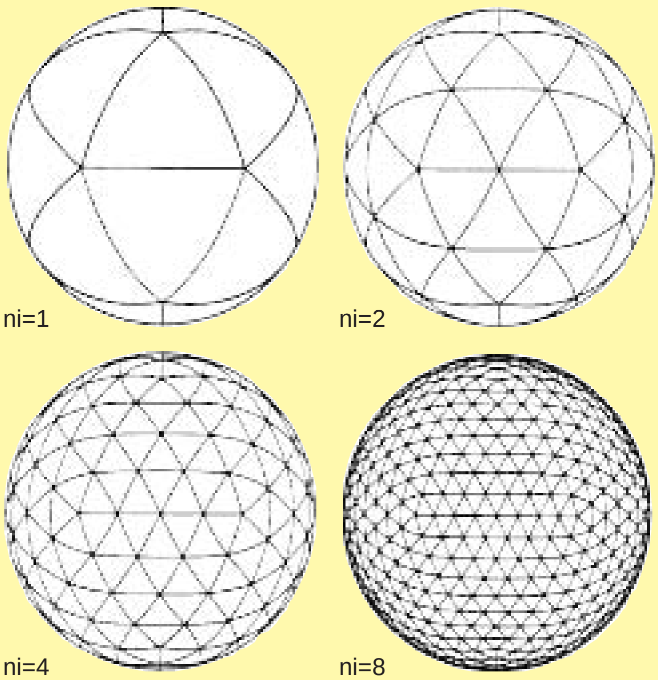


Figure 5. Spherical triangular grids for different values ni of the subdivision of the main spherical triangles.

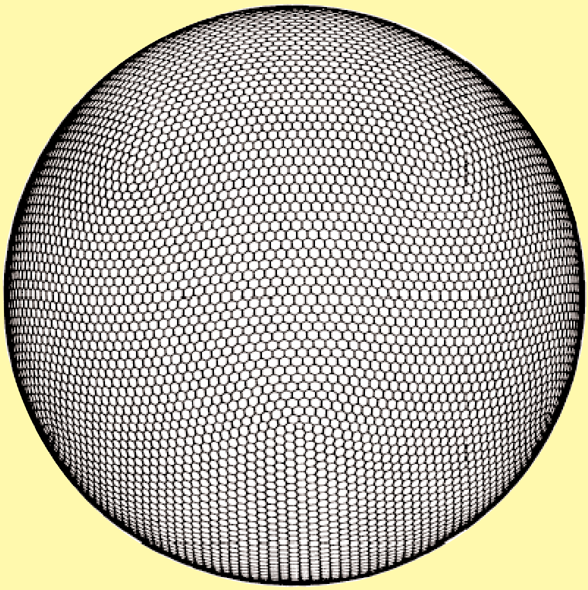


Figure 6. Polygons which represent the area of representativeness of a triangular grid-point.

are surrounded by only five triangles and therefore these 12 special points are the centres of pentagons. For the first subdivision, w may be divided into three parts, later on, only bisections are allowed. This restriction is due to the use of a multi-grid (MG) solver for the Helmholtz equations in the semi-implicit time stepping. MG solvers work efficiently with such mesh refinements. Thus the number (ni) of subdivisions of w is factorized according to equation (4):

$$ni = 3^{n3}\, 2^{n2} \tag{4}$$

with n3 = 0 or 1 and n2 ≥ 0. Figure 5 shows the resulting grids for ni = 1, 2, 4 and 8, i.e. n2 = 0, 1, 2, 3 with n3=0.

The model grid-points (nodes) are located at the vertices of the triangles; thus there are $(ni+1)^2$ grid-points within one diamond. Of these $(ni+1)^2$ grid-points, ni × ni are "uniquely" identified with each diamond; one extra row and column is shared between neighbouring diamonds.

On Earth with a mean radius R_E = 637 122 9 m, the length (L) of a side of a main triangle is $L = wR_E$ = 705 389 8 m. The mesh size (Δ) of the triangular grid with ni equal intervals on the side of a main triangle is not constant within a diamond but varies by 20 per cent at most on the sphere and is approximately given by using equation (5). For example, for ni = 32, Δ varies between 220 and 263 km, for ni = 64, Δ varies between 110 and 132 km and for ni = 128, Δ varies between 55 and 66 km:

$$\Delta \approx \frac{wR_E}{ni} \tag{5}$$

The number N of grid-points, not counting the common edges of the diamond, is given by equation (6):

$$N = 10\, {}_{ni}{}^{2} + 2 \tag{6}$$

Table 2*a* gives the mesh size , the number (N) of grid-points and the time step (Δt) for different values of ni, if only bisections are performed, i.e. $ni = 2^{n2}$. The time step (Δt) is calculated under the assumption that an air parcel does not leave the region of the six surrounding triangles during the period of twice the time step, i.e. $2\,\Delta t < h/v_{Max}$, with the height (h) of the spherical triangle (which is the shortest distance for leaving a triangle) and v_{Max}, the maximum wind speed (≈125 m s^{-1}) assuming that the fast gravity waves are treated semi-implicitly. The height (h) of a spherical triangle approximately follows from equation (7) and is about 5 per cent smaller than the mesh size (Δ):

$$h \approx \arcsin\left(\sin\frac{w}{ni}\,\sin\frac{2\pi}{5}\right) R_E \tag{7}$$

Table 2*a*
Mesh size (Δ), height (h), number (N) of grid-points and time step (Δt) for the spherical triangular mesh using only bisections

ni	16	32	64	128	256
Δ (km)	441	220	110	55	28
h (km)	420	210	105	52	26
N	2 562	10 242	40 962	163 842	655 362
Δt (s)	1 600	800	400	200	100

Table 2*b*
Mesh size (Δ), height (h), number (N) of grid-points and time step (Δt) for the spherical triangular mesh using first a trisection followed by bisections

ni	12	24	48	96	192
Δ (km)	588	294	147	73	37
h (km)	559	279	140	69	35
N	1 442	5 762	23 042	92 162	368 642
Δt (s)	2 200	1 100	550	275	138

Each grid-point is representative for a spherical polygon with six vertices (Figure 6) except the 12 vertices of the icosahedron which are surrounded by five triangles only. The grid-point indices are defined as presented in Figure 7.

The start address (0, 1) reflects the philosophy that the ni × ni grid-points which are "uniquely" identified within each diamond have the indices 1 to ni for rows and columns. The extra row and column needed for communication between neighbouring diamonds is lying in one case at the beginning of the first coordinate and in the other case at the end of the second. Thus points outside the range (1:ni, 1:ni) belong to the neighbouring diamonds and have to be communicated during each time step. Grid-point (0, 1), respectively, is the north pole for diamonds 1 to 5, and the south pole for diamonds 6 to 10.

The calculation of the subdivision of the great circle between two points P_1 (with location vector x_1) and P_2 (with location vector x_2) can be derived from Figure 8.

Since x_1 and x_2 define the great circle plane through P_1 and P_2, all points (P) with the location vector (x) on the great circle may be written as a linear combination of x_1 and x_2:

$$x = \alpha\, x_1 + \beta\, x_2 \tag{8}$$

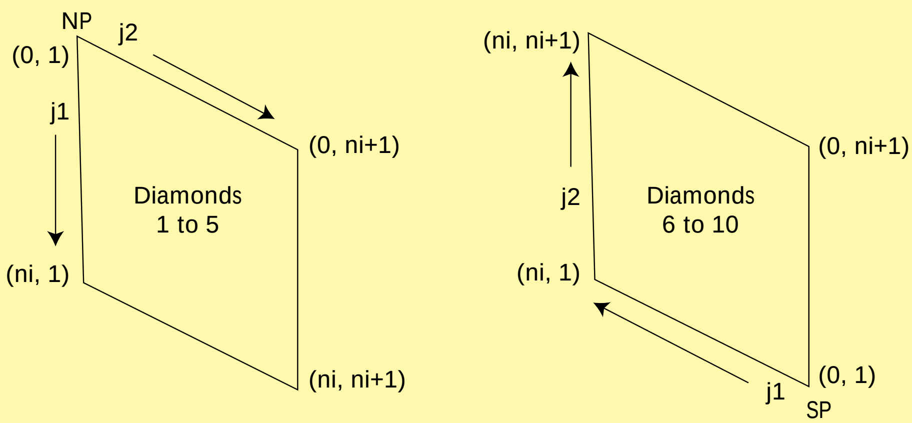


Figure 7. Grid-point indices for a northern (left) and southern (right) diamond.

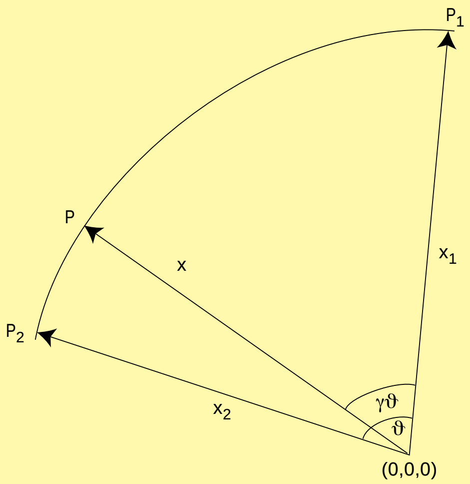


Figure 8. Calculation of the subdivision of the great circle through the points P_1 and P_2 on the unit-sphere.

The coefficients α and β are derived from the condition that x is a vector on the unit-sphere and the angle between x and x_1 is given by $\gamma\vartheta$ with γ between 0 and 1 and ϑ being the angle between x_1 and x_2, i.e. the length of the great circle between P_1 and P_2:

$$x \text{ x } x = 1 = \alpha^2 + \beta^2 + 2\alpha\,\beta \cos\vartheta$$

$$x \text{ x } x_1 = \cos(\gamma\,\vartheta) = \alpha + \beta\cos\vartheta \qquad (9)$$

Substituting α from the second equation into the first one, the coefficients follow from equation (10):

$$\alpha = \frac{\sin\left(\left(1 \pm \gamma\right)\vartheta\right)}{\sin\vartheta}$$

$$\beta = \frac{\sin(\gamma \quad \vartheta)}{\sin\vartheta} \qquad (10)$$

The angle ϑ between x_1 and x_2 follows from the scalar product $x_1 \times x_2$ or by calculating the distance (d) between x_1 and x_2 and observing that $\sin\vartheta/2 = d/2$.

The grid-point coordinates (x, y, z) of all triangle vertices on the unit-sphere are derived from equation (8) using the coefficients of equation (10). The $(ni+1)^2$ grid-points in a diamond form the vertices of 2 ni^2 triangles (Figure 9) and half of those point northward and half southward.

To calculate the coordinates (x_c, y_c, z_c) of the triangle centres P_c, the coordinates of the three triangle vertices P_1, P_2 and P_3 are summed and normalized as in equation (11):

$$x_c = (x_1 + x_2 + x_3) \quad x_N$$

$$y_c = (y_1 + y_2 + y_3) \quad x_N$$

$$z_c = (z_1 + z_2 + z_3) \quad x_N \qquad (11)$$

with

$$x_N = \frac{1}{\sqrt{(x_1 + x_2 + x_3)^2 + (y_1 + y_2 + y_3)^2 + \ (z_1 + z_2 + z_3)^2}}$$

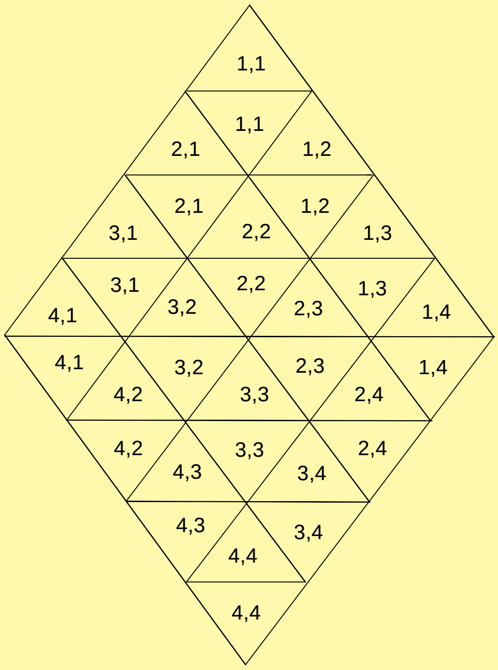


Figure 9. The 2 ni^2 triangles in a diamond defined by the $(ni+1)^2$ vertices for ni = 4.

The area of the 2 ni^2 triangles in a diamond can be calculated by using equation (12) which is due to Huilier. The triangle sides are denoted by a, b and c. On the unit-sphere, the excess angle is equal to the area of the spherical triangle:

$$\tan\frac{\varepsilon}{4} = \sqrt{\tan\frac{s}{2}\tan\frac{s-a}{2}\tan\frac{s-b}{2}\tan\frac{s-c}{2}} \tag{12}$$

with:

$$s = \frac{1}{2}(a+b+c)$$

Since each grid-point is surrounded by six triangles (five triangles at the 12 special points), the grid-point is the centre of a hexagon (pentagon at the 12 special points) as is illustrated in Figure 10. The coordinates of

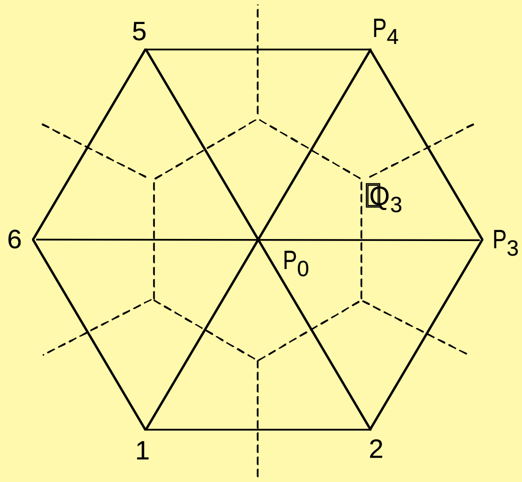


Figure 10. Hexagon connected to a grid-point of the triangular mesh.

the vertices of the hexagon, i.e. points Q_1, Q_2, ... , Q_6, are in a good approximation given by averaging the Cartesian coordinates of the three surrounding triangles vertices and normalizing to unit length, thus they follow from equation (11).

The grid-point in the centre of the hexagon is denoted by 0, the six surrounding triangles (and their vertices) by 1 to 6 counting counter-clockwise. We define point Q_i, i.e. a vertex of the hexagon, equidistant from the three vertices P_0, P_i, and P_{i+1} such that Q_i and Q_{i+1} is the perpendicular bisection of the great circle P_0P_{i+1} (Figure 10). The coordinates of Q_i are needed for the calculation of the topographical fields like orography, land fraction, roughness length as mean values over the area of the hexagons. Here, high-resolution datasets are averaged over the hexagon area.

FM 94–XIV BUFR — Binary universal form for the representation of meteorological data

R E P R E S E N T A T I O N   F O R M :

SECTION 0	**Indicator**
SECTION 1	**Identification**
SECTION 2	(**Optional**)
SECTION 3	**Data description**
SECTION 4	**Data**
SECTION 5	**777**

Notes:

(1) BUFR is the name of a binary code for the exchange and storage of data.

(2) The BUFR message consists of a continuous bit-stream made of a sequence of octets (1 octet = 8 bits).

(3) The terms “BUFR message” and “section” describe logical entities to assist BUFR definition.

(4) A BUFR message consists of one or more subsets of related meteorological data defined, described and represented by a single BUFR entity. For observational data, each data subset usually corresponds to one observation.

(5) The octets of a BUFR message are grouped in sections:

Section number	*Name*	*Contents*
0	Indicator section	“BUFR”, length of message, BUFR edition number
1	Identification section	Length of section, identification of the message
2	Optional section	Length of section and additional items for local use by automatic data processing centres
3	Data description section	Length of section, number of data subsets, data category flag, data compression flag and a collection of descriptors which define the form and content of individual data elements
4	Data section	Length of section and binary data
5	End section	7777

(6) It will be noted that the BUFR representation is not suitable for visual data recognition without computer interpretation.

(7) The representation of data by means of a series of bits is independent of any particular machine representation.

(8) Message and section lengths are expressed in octets. Section 0 has a fixed length of 8 octets; Section 5 has a fixed length of 4 octets. Sections 1, 2, 3 and 4 have a variable length which is included in the first three octets of each section.

(9) In the BUFR message, the bit length for “International Alphabet No. 5” is regarded as 8-bit, adding one bit “0” to the 7-bit of IA5 as the most significant bit.

R E G U L A T I O N S :

94.1 **General**

94.1.1 The BUFR form shall be used for the binary representation of meteorological data for exchange and storage. BUFR is particularly suitable for meteorological data that cannot be represented using FM 92 GRIB.

94.1.2 The beginning and the end of the code form shall be identified by 4 octets coded according to the International Alphabet No. 5 to represent, respectively, the indicators BUFR and 7777 in Indicator section 0 and End section 5. All other octets included in the code shall represent data in binary form.

94.1.3 Each section included in the code form shall always contain an integer multiple of 8 bits (octet). This rule shall be applied by appending bits set to zero to the section where necessary.

94.1.4 By convention, reserved values in sections 1 to 4 shall be set to zero.

94.1.5 Missing values shall be set to fields of all ones (e.g. each octet shall be set to 11111111 binary). This shall apply to code tables as well as data elements; flag tables shall be augmented to contain a missing indicator bit where this is deemed to be necessary. This regulation does not apply to the data description operator qualifiers in Class 31 of Table B.

94.1.6 The convention for representing missing data for compressed data within the binary Data section shall be to set the corresponding increments to fields of all ones.

94.1.7 When a local reference value for a set of element values for compressed data is represented as all ones, this shall imply that all values in the set are missing.

94.2 **Section 0 – Indicator section**

Section 0 shall be 8 octets long. Octets 1 to 4 shall be character coded according to the International Alphabet No. 5 as BUFR. The remainder of the section shall contain the length of the entire BUFR message (including the Indicator section) expressed in binary form over octets 5 to 7 (i.e. 24 bits), followed by the BUFR edition number, in binary, in octet 8.

94.3 **Section 1 – Identification section**

94.3.1 The length of the section, in units of octets, shall be expressed in binary form over the group of the first three octets of the section.

94.3.2 Octet 8 of the section shall be used to indicate the inclusion or the omission of section 2.

94.4 **Section 2 – Optional section**

94.4.1 Regulation 94.3.1 shall apply.

94.4.2 Octet 5 and subsequent octets shall contain additional items as may be defined within each centre for its own use.

94.5 Section 3 – Data description section

94.5.1 Regulation 94.3.1 shall apply.

94.5.2 Octets 5 and 6 of the section shall be used as a 16-bit number to indicate the number of data subsets within the BUFR message. Octet 7 shall be used to indicate whether observed data or other data are reported, and whether data are compressed or not. Octet 8 and subsequent octets shall contain a collection of descriptors which define the form and content of individual data elements in the Data section. A “data subset” shall be defined as the subset of data described by one single application of this collection of descriptors.

94.5.3 *Data description syntax for* BUFR

94.5.3.1 Data description shall consist of one or more descriptors. Each descriptor shall occupy 2 octets and contain 3 parts: F (2 bits), X (6 bits) and Y (8 bits).

94.5.3.2 If F = 0, the descriptor shall be called an “element descriptor”. An element descriptor shall define a single data item by reference to Table B.

Notes:

(1) X denotes the Table B class, Y denotes the element within that class. The corresponding data item is depicted according to the definition contained in Table B, unless otherwise modified.

(2) The definition(s) of one or more data item(s) may be modified by means of data description operators.

94.5.3.3 Element descriptors corresponding to the following classes in Table B shall remain in effect until superseded by redefinition:

Class	
01	Identification
02	Instrumentation
03	Reserved
04	Location (time)
05	Location (horizontal – 1)
06	Location (horizontal – 2)
07	Location (vertical)
08	Significance qualifiers
09	Reserved

Note: Redefinition is effected by the occurrence of element descriptors which contradict the preceding element descriptors from these classes. If two or more elements from the same class do not contradict one another, they all apply.

94.5.3.4 The consecutive occurrence of two identical element descriptors or identical sets of element descriptors from Classes 04 to 07 inclusive shall denote a range of values bounded by the corresponding element values. This enables the definition of layers and simple time periods.

94.5.3.5 The definition of line, areas, volumes and more complex time attributes shall be accomplished using descriptors from Classes 04 to 07 in association with suitable descriptors from Class 08.

94.5.3.6 The consecutive occurrence of two or more non-identical element descriptors from Classes 04 to 07 inclusive shall infer that all such elements remain in effect until redefined, unless such elements define an increment.

94.5.3.7 Data items defined by element descriptors in Class 10 or above shall not behave as coordinates with respect to subsequent data.

94.5.3.8 Increments: Any occurrence of an element descriptor from Classes 04 to 07 which defines an increment shall indicate that the location corresponding to that class shall be incremented by the corresponding data value. In the case of successive increments from the same class, this means that each increment shall apply in a cumulative manner, with all preceding increments remaining in effect.

Displacements: In contrast, any displacement descriptor from Classes 04 to 07 does not redefine the location corresponding to that class, but shall define only a transient displaced location from the location corresponding to that class. In the case of successive displacements from the same class, this means that each displacement shall apply independently and in a non-cumulative manner to the location corresponding to that class.

94.5.3.9 If a BUFR message is made up of more than one subset, each subset shall be treated as though it was the first subset encountered.

94.5.4 ***The replication operation***

94.5.4.1 If F = 1, the descriptor shall be called a "replication descriptor". For this case, X shall indicate the number of descriptors to be repeated, and Y the total number of occurrences (replications) of the repeated subsequence.

Note: Where a replication operation includes delayed replication(s) within the scope of its replication, the replication (or repetition) factor descriptor(s) from Class 31 shall be counted for X, except the one (if any) located immediately after the replication description for which X is being calculated, as in the following example:

106000 031001 008002 103000 031001 005002 006002 010002.

94.5.4.2 A value of Y = 0 associated with the replication descriptor shall indicate delayed replication. In this case, the replication data description operator shall be completed by the next element descriptor, which shall define a data item indicating the number of replications. This descriptor may also indicate (by its value of Y) that the following datum is to be replicated together with the following descriptor.

94.5.4.3 Time or location increment descriptors, from Classes 04 to 07 inclusive, may be associated with replication descriptors in the following way: when an increment descriptor immediately precedes a replication descriptor, or is separated from it by one or more operator descriptors from Table C, this shall infer that all such increments be applied for each replication; the application of the increments shall have effect from the beginning of each defined replication, including the first.

94.5.5 ***Further operations on element and sequence descriptors***

94.5.5.1 If F = 2, the descriptor shall be called an "operator descriptor". An operator descriptor shall define an operation by reference to Table C.

Notes:

(1) X denotes the value corresponding to an operator defined within Table C.

(2) Y contains a value to be used as an operand in completing the defined operation.

94.5.5.2 When the Y operand of any operator descriptor, or a count associated with it, refers to a specific number of descriptors preceding the operator, this shall infer that those preceding descriptors are all from Table B or C, i.e. all references to Table D descriptors shall have been completely resolved. Any forward reference to descriptors shall infer that the descriptors are enumerated as they are found in the original record, i.e. Table D descriptors are not expanded.

94.5.5.3 A data present bit-map shall be defined as a set of N one bit values corresponding to N data entities described by N element descriptors (including element descriptors for delayed replication, if present); the data description of a data present bit-map is comprised of a replication operator followed by the element descriptor for the data present indicator.

Notes:

(1) Where an operator descriptor requires a data present bit-map of length N to complete the operator definition, the N consecutive element descriptors which correspond to the N data entities to which the N bit values refer shall end with the element descriptor which immediately precedes the first such operator, or with the element descriptor which immediately precedes the first occurrence of such an operator following the occurrence of a cancel backward reference operator.

(2) All references to previously defined element descriptors effected through the application of operators which are qualified by data present bit-maps shall refer to the element descriptors concerned including any modifications resulting from change data width, change reference value, and change scale factor.

(3) The define data present bit-map for re-use operator enables a data present bit-map to be defined and later re-used; the definition of a data present bit-map shall remain defined until the occurrence of a cancel defined data present bit-map operator or a cancel backward data reference operator.

(4) Where an operator descriptor is qualified by a data present bit-map of length N there shall be defined a number of values of the type indicated by that operator together with subsequent appropriate element descriptors; the number of values defined shall correspond to the number of bits set to zero in the data present bit-map; the description of each data item shall be obtained by substituting the appropriate element descriptors, modified by the operator, at each subsequent occurrence of a marker operator.

94.5.6 *Indirect reference to descriptors*

94.5.6.1 If F = 3, the descriptor shall be called a “sequence descriptor”. A sequence descriptor shall define a list of element descriptors, replication descriptors, operator descriptors and/or sequence descriptors by reference to Table D.

Note: X denotes the Table D category, Y denotes the entry within the category. Table D entries contain lists of commonly associated descriptors for convenience.

94.5.6.2 A sequence descriptor shall be equivalent to the corresponding list of descriptors in Table D.

Note: If a sequence descriptor is included within the scope of a replication descriptor 1 X Y, the number of descriptors to be repeated shall be modified if the sequence descriptor is replaced by the corresponding list of descriptors from Table D.

94.5.7 *Unit rules*

94.5.7.1 The unit of an element descriptor, when not defined as a code table, flag table or CCITT5, should be based on the International System of Units (SI), established by the eleventh General Conference on Weights and Measures in 1960, and extended at the 1980 Conference. Alternatively, in exceptional cases, consideration may be given to other standard common units used by the data producer and the users, where a convincing case can be made that those units are more appropriate for the intended purpose of the descriptor. In such cases, priority shall be given to units contained in WMO Common Table C-6 or, in the case of descriptors for aviation products, ICAO Annex 5.

94.5.7.2 In cases where an element descriptor is defined as a code table that references values requiring units, Regulation 94.5.7.1 shall apply.

94.6 Section 4 – Data section

94.6.1 Regulation 94.3.1 shall apply.

94.6.2 Reported values shall be coded using the number of bits for each parameter indicated by reference to the sequence descriptors, replication descriptors, operator descriptors, element descriptors and associated tables.

94.6.3 Values shall be coded in the order indicated by the sequence descriptors, replication descriptors, operator descriptors and element descriptors.

Notes:

(1) Where more than one data subset is included in a single BUFR message without data compression:

- (i) The first set of data values shall be in the order defined by the data description, and shall represent the first data subset;
- (ii) Subsequent sets of data values shall also be in the order defined by the data description, representing subsequent data subsets.

(2) Where more than one data subset is included in a single BUFR message, data compression may be used as follows:

- (i) Values for each data element are grouped into sets, and the sets shall be in the order defined by the data description; the first value in each set shall represent a minimum value for the set; for character data the first value in the set shall be set to all bits zero; however, if the character data values in all subsets are identical, the first value shall represent the character string; this value is termed a “local reference value”, R^o, with respect to the subsequent set of data;
- (ii) Local reference values shall be coded according to Regulation 94.6.2;
- (iii) If all values of an element are missing, R^o shall be coded with all bits set to 1s;
- (iv) The local reference value shall be followed by a 6-bit quantity specifying the number of bits for each increment or for character data, specifying the number of octets needed for representing the character string in the data subsets. However, if the character data values in all subsets are identical, sub-note vii shall apply;
- (v) Integer values (V), other than character values and missing values, will then be obtained as:

  $$V = R + R^o + I$$

  where R = table reference value

  R^o = local reference value

  I = increment;

  Actual data values (V_a) will be then obtained by:

  $$V_a = V \times 10^{-S}$$

  where S = table scale value
- (vi) Missing values will be denoted by setting all bits of the corresponding I to 1s;
- (vii) Data elements all having the same value throughout a set shall be signified by coding the number of bits required for storing I as zero; in such cases, the increments shall be omitted;
- (viii) When operators qualified by a data present bit-map are present, it is required that the length and contents of the bit-map shall be identical for each data subset if data compression is to be used;
- (ix) When delayed replication is present, it is required that the number of replications shall be identical for each data subset if data compression is to be used. In such cases, sub-note vii shall apply when coding the number of replications.

94.7 **Section 5 – End section**

The End section shall always be 4 octets long, character coded according to the International Alphabet No. 5 as 7777.

SPECIFICATIONS OF OCTET CONTENTS

Notes:

(1) Octets are numbered 1, 2, 3, etc., starting at the beginning of each section.

(2) In the following, bit positions within octets are referred to as bit 1 to bit 8, where bit 1 is the most significant and bit 8 is the least significant bit. Thus, an octet with only bit 8 set to 1 would have the integer value 1.

(3) Specific features for different editions, when different, will be clearly indicated below in sequence.

Section 0 – Indicator section

Octet No.	Contents
1–4	BUFR (coded according to the CCITT International Alphabet No. 5)
5–7	Total length of BUFR message (including Section 0)
8	BUFR edition number (4)

Section 1 – Identification section

Octet No.	Contents		
1–3	Length of section		
4	BUFR master table (zero if standard WMO FM 94 BUFR tables are used – see Note 2)		
5–6	Identification of originating/generating centre (see Common Code table C-11)		
7–8	Identification of originating/generating sub-centre (allocated by originating/generating centre – see Common Code table C-12)		
9	Update sequence number (zero for original messages and for messages containing only delayed reports; incremented for the other updates)		
10	Bit 1 = 0	No optional section	
	= 1	Optional section follows	
	Bits 2-8	Set to zero (reserved)	
11	Data category (Table A)		
12	International data sub-category (see Common Code table C-13 and Note 3)		
13	Local data sub-category (defined locally by automatic data-processing (ADP) centres – see Note 3)		
14	Version number of master table – see Notes 2 and 5		
15	Version number of local tables used to augment master table in use – see Note 2		
16–17	Year (4 digits)		Most typical time for the BUFR message contents – see Note 4
18	Month		
19	Day		
20	Hour		
21	Minute		
22	Second		
23–	Optional – for local use by ADP centres		

Notes:

(1) If a BUFR message is corrected, the corrected message shall be produced at least as a complete subset, containing all data items. Operator 2 04 YYY qualified by descriptor 0 31 021 may be used to indicate which data item or items were corrected.

(2) A BUFR master table may be defined for a scientific discipline other than meteorology. This shall be indicated by non-zero numeric values in octet 4. Such a table will be developed when a recognized organization exists with the necessary expertise to maintain such a master table, and when at least one of the following situations also exists:

– Requirements cannot be met using Master Table 0.

– There is expected to be a minimal amount of overlap with respect to the entries in Master Table 0.

The current list of master tables, along with their associated values in octet 4, is as follows:

0	Meteorology maintained by the World Meteorological Organization (WMO)
10	Oceanography maintained by the Intergovernmental Oceanographic Commission (IOC) of UNESCO

Whenever a new master table is developed, the following criteria shall apply:

– Table C may not be changed, nor may Classes 00 and 31 of Table B. These would remain identical for any of the master tables.

– For Classes 01 through 09 (coordinate classes) and Class 33 of Table B, and for Categories 00 and 01 of Table D, these classes and categories must have the same name and be used for the same types of descriptors as in Master Table 0; however, individual descriptors within these classes and categories would be left to the discretion of the Organization defining the particular master table in question.

– For Table A and all remaining classes of Table B and categories of Table D, these would be left to the discretion of the Organization defining the particular master table in question.

For all master tables (including Master Table 0):

– Each revision of the master tables shall be given a new version number.

– Local tables shall define those parts of the master table which are reserved for local use, thus version numbers of local tables may be changed at will by the originating centre. If no local table is used, the version number of the local table shall be encoded as 0.

(3) The local data sub-category is maintained for backwards-compatibility with BUFR editions 0-3, since many ADP centres have made extensive use of such values in the past. The international data sub-category introduced with BUFR edition 4 is intended to provide a mechanism for better understanding of the overall nature and intent of messages exchanged between ADP centres. These two values (i.e. local sub-category and international sub-category) are intended to be supplementary to one another, so both may be used within a particular BUFR message.

(4) When accuracy of the time does not define a time unit, then the value for this unit shall be set to zero (e.g. for a SYNOP observation at 09 UTC, minute = 0, second = 0.

(5) For Master Table 0, the master table version numbers are as follows:

0	Experimental
1	Version implemented on 1 November 1988
2	Version implemented on 1 November 1993
3	Version implemented on 2 November 1994
4	Version implemented on 8 November 1995
5	Version implemented on 6 November 1996
6	Version implemented on 5 November 1997
7	Version implemented on 4 November 1998
8	Version implemented on 3 May 2000
9	Version implemented on 8 November 2000
10	Version implemented on 7 November 2001
11	Version implemented on 5 November 2003
12	Version implemented on 2 November 2005
13	Version implemented on 7 November 2007
14	Version implemented on 4 November 2009
15	Version implemented on 15 September 2010
16	Version implemented on 4 May 2011
17	Version implemented on 2 November 2011
18	Version implemented on 2 May 2012
19	Version implemented on 7 November 2012
20	Pre-operational to be implemented by next amendment

Section 2 – Optional section

Octet No.	Contents
1–3	Length of section
4	Set to zero (reserved)
5–	Reserved for local use by ADP centres

Section 3 – Data description section

Octet No.	Contents	
1–3	Length of section	
4	Set to zero (reserved)	
5–6	Number of data subsets	
7	Bit 1 = 1	Observed data
	= 0	Other data
	Bit 2 = 1	Compressed data
	= 0	Non-compressed data
	Bits 3–8	Set to zero (reserved)
8–	A collection of element descriptors, replication descriptors, operator descriptors and sequence descriptors, which define the form and contents of individual data elements comprising one data subset in the Data section	

Notes:

(1) The collection of descriptors, beginning at octet 8, is called the "data description".

(2) Each descriptor occupies 2 octets and contains 3 parts:

F	X	Y
2 bits	6 bits	8 bits

(3) If F = 0, the descriptor is an element descriptor. The values of X and Y refer directly to a single entry in Table B, X indicating the class and Y the entry within that class.

(4) If F = 1, the descriptor is a replication descriptor defining the replication data description operator according to Regulations 94.5.4.1 and 94.5.4.2. The values of X and Y define the scope of the operator and the number of replications, respectively. If Y = 0, delayed replication is defined; the next element descriptor will define a data item giving the number of replications; this descriptor may also indicate (by its value of Y) that the following datum is to be replicated together with the following descriptor.

(5) If F = 2, the descriptor is an operator descriptor. The value of X indicates an operation in Table C. The meaning of Y depends on the operation.

(6) If F = 3, the descriptor is a sequence descriptor. The values of X and Y refer directly to a single entry in Table D. Each entry in Table D contains a list of element descriptors, data description operators, and/or sequence descriptors. A sequence descriptor is defined to be equivalent to the corresponding list of descriptors at the Table D entry.

(7) "Other data", as identified in octet 7, could, for example, be forecast information generated from a numerical model.

Section 4 – Data section

Octet No.	Contents
1–3	Length of Data section (octets)
4	Set to zero (reserved)
5–	Binary data as defined by sequence descriptors

Notes:

(1) The binary data in non-compressed form may be described as follows:

$R_{11}, R_{12}, R_{13}, \ldots R_{1s}$

$R_{21}, R_{22}, R_{23}, \ldots R_{2s}$

. . . .

. . . .

. . . .

$R_{n1}, R_{n2}, R_{n3}, \ldots R_{ns}$

where R_{ij} is the j^{th} value of the i^{th} data subset, s is the number of values per data subset, and n is the number of data subsets in the BUFR message; the data subsets each occupy an identical number of bits, unless delayed replication is used, and are *not* necessarily aligned on octet boundaries.

(2) The binary data in compressed form may be described as follows:

R_1^o, $NBINC_1$, I_{11}, I_{12}, . . . , I_{1n}

R_2^o, $NBINC_2$, I_{21}, I_{22}, . . . , I_{2n}

. . . .

. . . .

. . . .

R_s^o, $NBINC_s$, I_{s1}, I_{s2}, . . . , I_{sn}

where R_1^o, R_2^o, . . . R_s^o are local reference values for the set of values for each data element (number of bits as Table B). $NBINC_1$ . . . $NBINC_s$ contain, as 6-bit quantities, the number of bits occupied by the increments (I_{11} . . . I_{1n}) . . . (I_{s1} . . . I_{sn}). s is the number of data elements per data subset and n is the number of data subsets per BUFR message. If $NBINC_1$ = 0, all values of element I are equal to R_1^o; in such cases, the increments shall be omitted. For character data, NBINC shall contain the number of octets occupied by the character element. However, if the character data in all subsets are identical NBINC=0.

(3) Associated fields are treated as separate data items and precede the data;

e.g.

ASSOCIATED FIELDS	DATA
N bits	M bits

Binary data with associated fields may be described as follows:

A_{11}, R_{11}, A_{12}, R_{12}, . . . A_{1s}, R_{1s}

A_{21}, R_{21}, A_{22}, R_{22}, . . . A_{2s}, R_{2s}

. . . .

. . . .

. . . .

A_{n1}, R_{n1}, A_{n2}, R_{n2}, . . . A_{ns}, R_{ns}

where A_{ij} R_{ij} is the j^{th} combined associated field value and data value of the i^{th} data subset, s is the number of values per data subset, and n is the number of data subsets in the BUFR message.

(4) Binary data in compressed form with associated fields may be described as follows:

A_1^o, $NBINC_{A1}$, I_{A11}, I_{A12}, . . . I_{A1n}

R_1^o, $NBINC_{R1}$, I_{R11}, I_{R12}, . . . I_{R1n}

. . . .

. . . .

. . . .

A_s^o, $NBINC_{As}$, I_{As1}, I_{As2}, . . . I_{Asn}

R_s^o, $NBINC_{Rs}$, I_{Rs1}, I_{Rs2}, . . . I_{Rsn}

where A_1^o, R_1^o, . . . A_s^o, R_s^o are local reference values for the set of associated field values and the set of values for each data element.

R^o uses bit length from Table B. A^o uses bit length from descriptor 2 04 YYY.

Section 5 – End section

Octet No.	Contents
1–4	7777 (coded according to the CCITT International Alphabet No. 5)

BUFR TABLES, CODE TABLES AND FLAG TABLES

FM 94 BUFR refers to three types of tables: BUFR tables, code tables and flag tables.

BUFR tables

Tables containing information used to describe, classify and define the contents of a BUFR message are called BUFR tables. Four BUFR tables are defined: Tables A, B, C and D. Entry numbering shall be the same in BUFR tables and CREX tables (see definition of FM 95 CREX in Part C, Common Features to Binary and Alphanumeric Codes) for the same entity represented. Table B entries shall be listed in the common BUFR/CREX Table B. Table D common sequences shall not be defined in both BUFR Table D and CREX Table D, unless otherwise a conversion between both Tables D is not simple, that is, the conversion is not completed by simple replacement of part “F” of each descriptor. A new BUFR Table D sequence shall be assigned a number not used by any CREX Table D sequence. Similarly, if a CREX Table D sequence is not defined in BUFR Table D, it shall be assigned a number not used by any BUFR sequence.

Code tables and flag tables

BUFR Table B defines some elements by means of code tables or flag tables. Within this general description are included code tables referenced by code figures, and flag tables where each bit is set to 0 or 1 to indicate a false or true value with respect to a specific criterion. The concept of a flag table is especially useful where combinations of criteria are represented. Within BUFR, all code tables and flag tables refer to elements defined within BUFR Table B; they are numbered according to the X and Y values of the corresponding Table B reference.

BUFR TABLE RELATIVE TO SECTION 1

BUFR Table A – *Data category*

Code figure	Meaning
0	Surface data – land
1	Surface data – sea
2	Vertical soundings (other than satellite)
3	Vertical soundings (satellite)
4	Single level upper-air data (other than satellite)
5	Single level upper-air data (satellite)
6	Radar data
7	Synoptic features
8	Physical/chemical constituents
9	Dispersal and transport
10	Radiological data
11	BUFR tables, complete replacement or update
12	Surface data (satellite)
13	Forecasts
14	Warnings
15–19	Reserved
20	Status information
21	Radiances (satellite measured)
22	Radar (satellite) but not altimeter and scatterometer
23	Lidar (satellite)
24	Scatterometry (satellite)
25	Altimetry (satellite)
26	Spectrometry (satellite)
27	Gravity measurement (satellite)
28	Precision orbit (satellite)
29	Space environment (satellite)
30	Calibration datasets (satellite)
31	Oceanographic data
32–100	Reserved
101	Image data (satellite)
102–239	Reserved
240–254	For experimental use
255	Other category

BUFR TABLES RELATIVE TO SECTION 3

BUFR/CREX Table B – *Classification of elements*

F	X	Class	Comments
0	00	BUFR/CREX table entries	
0	01	Identification	Identifies origin and type of data
0	02	Instrumentation	Defines instrument types used
0	03	Reserved	
0	04	Location (time)	Defines time and time derivatives
0	05	Location (horizontal – 1)	Defines geographical position, including horizontal derivatives, in association with Class 06 (first dimension of horizontal space)
0	06	Location (horizontal – 2)	Defines geographical position, including horizontal derivatives, in association with Class 05 (second dimension of horizontal space)
0	07	Location (vertical)	Defines height, altitude, pressure level, including vertical derivatives of position
0	08	Significance qualifiers	Defines special character of data
0	09	Reserved	
0	10	Non-coordinate location (vertical)	Height, altitude, pressure and derivatives observed or measured, *not* defined as a vertical location
0	11	Wind and turbulence	Wind speed, direction, etc.
0	12	Temperature	
0	13	Hydrographic and hydrological elements	Humidity, rainfall, snowfall, etc.
0	14	Radiation and radiance	
0	15	Physical/chemical constituents	
0	19	Synoptic features	
0	20	Observed phenomena	Defines present/past weather, special phenomena, etc.
0	21	Radar data	
0	22	Oceanographic elements	
0	23	Dispersal and transport	
0	24	Radiological elements	
0	25	Processing information	
0	26	Non-coordinate location (time)	Defines time and time derivatives that are not coordinates
0	27	Non-coordinate location (horizontal – 1)	Defines geographical positions, in conjunction with Class 28, that are not coordinates
0	28	Non-coordinate location (horizontal – 2)	Defines geographical positions, in conjunction with Class 27, that are not coordinates
0	29	Map data	
0	30	Image	
0	31*	Data description operator qualifiers	Elements used in conjunction with data description operators
0	33	Quality information	
0	35	Data monitoring information	
0	40	Satellite data	

* This class does not exist in CREX.

(continued)

(BUFR/CREX Table B – continued)

Notes:

(1) Where a code table or flag table is appropriate, “code table” or “flag table”, respectively is entered in the UNITS column.

(2) The code tables and flag tables associated with Table B are numbered to correspond with the F, X and Y part of the table reference.

(3) To encode values into BUFR, the data (with units as specified in the UNIT column) must be multiplied by 10 to the power SCALE. Then subtract the REFERENCE VALUE to give the coded value found in Section 4 of the BUFR message. For example, a measured latitude is –45.76 degrees. The coarse accuracy descriptor is 0 05 002 and the encoded value is $-45.76 \times 10^2 - (-9000) = 4424$.

(4) Where UNITS are given as CCITT IA5, data shall be coded as character data left justified within the field width indicated using CCITT International Alphabet No. 5, and blank filled to the full field width indicated.

(5) Classes 48 to 63 are reserved for local use; all other classes are reserved for future development.

(6) Entries 192 to 255 within all classes are reserved for local use.

(7) The use of local descriptors, as defined in Notes 5 and 6, in messages intended for non-local or international exchange is strongly discouraged. They should be kept to the barest minimum possible and must also be by-passed by the use of descriptor 2 06 YYY.

(8) First-order statistics are included in Table B only when they are produced, as such, by the observing system.

(9) In all flag tables within the BUFR specification, bits are numbered from 1 to N from the most significant to least significant within a data of N bits, i.e. bit No.1 is the leftmost and bit No. N is the rightmost bit within the data width. The bit No. N (least significant bit) is set to 1 only if all the bits are set to 1 within the data width of the flag table to represent a missing value.

Class 00 – BUFR/CREX* table entries

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F* X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 00 001	Table A: entry	CCITT IA5	0	0	24	Character	0	3
0 00 002	Table A: data category description, line 1	CCITT IA5	0	0	256	Character	0	32
0 00 003	Table A: data category description, line 2	CCITT IA5	0	0	256	Character	0	32
0 00 004	BUFR/CREX Master table (see Note 1)	CCITT IA5	0	0	16	Character	0	2
0 00 005	BUFR/CREX edition number	CCITT IA5	0	0	24	Character	0	3
0 00 006	BUFR Master table version number (see Note 2)	CCITT IA5	0	0	16	Character	0	2
0 00 007	CREX Master table version number (see Note 3)	CCITT IA5	0	0	16	Character	0	2
0 00 008	BUFR Local table version number (see Note 4)	CCITT IA5	0	0	16	Character	0	2
0 00 010	F descriptor to be added or defined	CCITT IA5	0	0	8	Character	0	1
0 00 011	X descriptor to be added or defined	CCITT IA5	0	0	16	Character	0	2
0 00 012	Y descriptor to be added or defined	CCITT IA5	0	0	24	Character	0	3
0 00 013	Element name, line 1	CCITT IA5	0	0	256	Character	0	32
0 00 014	Element name, line 2	CCITT IA5	0	0	256	Character	0	32
0 00 015	Units name	CCITT IA5	0	0	192	Character	0	24
0 00 016	Units scale sign	CCITT IA5	0	0	8	Character	0	1
0 00 017	Units scale	CCITT IA5	0	0	24	Character	0	3
0 00 018	Units reference sign	CCITT IA5	0	0	8	Character	0	1
0 00 019	Units reference value	CCITT IA5	0	0	80	Character	0	10
0 00 020	Element data width	CCITT IA5	0	0	24	Character	0	3
0 00 024	Code figure	CCITT IA5	0	0	64	Character	0	8
0 00 025	Code figure meaning	CCITT IA5	0	0	496	Character	0	62

(continued)

(Class 00 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F* X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 00 026	Bit number	CCITT IA5	0	0	48	Character	0	6
0 00 027	Bit number meaning	CCITT IA5	0	0	496	Character	0	62
0 00 030	Descriptor defining sequence	CCITT IA5	0	0	48	Character	0	6

* For CREX descriptors F = B, not 0.

Notes:

(1) Master tables are described in Note 2 to Section 1 of the BUFR regulations (part of the regulation entitled "Specifications of octet contents").

(2) BUFR master table version numbers are described in Notes 2 and 5 to Section 1 of BUFR regulations.

(3) CREX master table version numbers are described in Note 5 to Section 1 of CREX regulations.

(4) For local table version number, see last part of Note 2 to Section 1 of BUFR regulations.

Class 01 –BUFR/CREX Identification

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 01 001	WMO block number	Numeric	0	0	7	Numeric	0	2
0 01 002	WMO station number	Numeric	0	0	10	Numeric	0	3
0 01 003	WMO Region number/geographical area	Code table	0	0	3	Code table	0	1
0 01 004	WMO Region sub-area (see Note 9)	Numeric	0	0	3	Numeric	0	1
0 01 005	Buoy/platform identifier	Numeric	0	0	17	Numeric	0	5
0 01 006	Aircraft flight number	CCITT IA5	0	0	64	Character	0	8
0 01 007	Satellite identifier	Code table	0	0	10	Code table	0	4
0 01 008	Aircraft registration number or other identification	CCITT IA5	0	0	64	Character	0	8
0 01 009	Type of commercial aircraft	CCITT IA5	0	0	64	Character	0	8
0 01 010	Stationary buoy platform identifier; e.g. C-MAN buoys	CCITT IA5	0	0	64	Character	0	8
0 01 011	Ship or mobile land station identifier	CCITT IA5	0	0	72	Character	0	9
0 01 012	Direction of motion of moving observing platform *	degree true	0	0	9	degree true	0	3
0 01 013	Speed of motion of moving observing platform*	$m\ s^{-1}$	0	0	10	$m\ s^{-1}$	0	3
0 01 014	Platform drift speed (high precision)	$m\ s^{-1}$	2	0	10	$m\ s^{-1}$	2	4
0 01 015	Station or site name	CCITT IA5	0	0	160	Character	0	20
0 01 018	Short station or site name	CCITT IA5	0	0	40	Character	0	5
0 01 019	Long station or site name	CCITT IA5	0	0	256	Character	0	32
0 01 020	WMO Region sub-area	Numeric	0	0	4	Numeric	0	2
0 01 021	Synoptic feature identifier	Numeric	0	0	14	Numeric	0	4
0 01 022	Name of feature (see Note 11)	CCITT IA5	0	0	224	Character	0	28

* Descriptors 0 01 012 and 0 01 013 may relate to parameters of various meanings and the corresponding values may be integrated on different periods.

(continued)

(Class 01 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 01 023	Observation sequence number	Numeric	0	0	9	Numeric	0	3
0 01 024	Wind speed source	Code table	0	0	5	Code table	0	2
0 01 025	Storm identifier (see Note 1)	CCITT IA5	0	0	24	Character	0	3
0 01 026	WMO storm name*	CCITT IA5	0	0	64	Character	0	8
0 01 027	WMO long storm name	CCITT IA5	0	0	80	Character	0	10
0 01 028	Aerosol optical depth (AOD) source	Code table	0	0	5	Code table	0	2
0 01 029	SSI source	Code table	0	0	5	Code table	0	2
0 01 030	Numerical model identifier (see Note 13)	CCITT IA5	0	0	128	Character	0	16
0 01 031	Identification of originating/ generating centre (see Note 10)	Code table	0	0	16	Code table	0	5
0 01 032	Generating application	Code table defined by originating/ generating centre (Notes 3, 4 and 5)	0	0	8	Code table	0	3
0 01 033	Identification of originating/ generating centre	Common Code table C–1	0	0	8	Common Code table C–1	0	3
0 01 034	Identification of originating/ generating sub-centre	Common Code table C–12	0	0	8	Common Code table C–12	0	3
0 01 035	Originating centre	Common Code table C–11	0	0	16	Common Code table C–11	0	5
0 01 036	Agency in charge of operating the observing platform	Code table	0	0	20	Code table	0	7

* Descriptor 0 01 027 should be used instead of 0 01 026 to encode this element.

(continued)

(Class 01 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 01 037	SIGMET sequence identifier	CCITT IA5	0	0	24	Character	0	3
0 01 038	Source of sea ice fraction	Code table	0	0	5	Code table	0	2
0 01 039	Graphical Area Forecast (GFA) sequence identifier	CCITT IA5	0	0	40	Character	0	5
0 01 040	Processing centre ID code	CCITT IA5	0	0	48	Character	0	6
0 01 041	Absolute platform velocity – first component (see Note 6)	$m\ s^{-1}$	5	–1073741824	31	$m\ s^{-1}$	5	10
0 01 042	Absolute platform velocity – second component (see Note 6)	$m\ s^{-1}$	5	–1073741824	31	$m\ s^{-1}$	5	10
0 01 043	Absolute platform velocity – third component (see Note 6)	$m\ s^{-1}$	5	–1073741824	31	$m\ s^{-1}$	5	10
0 01 050	Platform transmitter ID number	Numeric	0	0	17	Numeric	0	6
0 01 051	Platform transmitter ID number	CCITT IA5	0	0	96	Character	0	12
0 01 052	Platform transmitter ID	Code table	0	0	3	Code table	0	1
0 01 053	Tsunameter report sequence number triggered by a tsunami event	Numeric	0	0	7	Numeric	0	2
0 01 060	Aircraft reporting point (Beacon identifier)	CCITT IA5	0	0	64	Character	0	8
0 01 062	Short ICAO location indicator	CCITT IA5	0	0	32	Character	0	4
0 01 063	ICAO location indicator	CCITT IA5	0	0	64	Character	0	8
0 01 064	Runway designator	CCITT IA5	0	0	32	Character	0	4
0 01 065	ICAO region identifier	CCITT IA5	0	0	256	Character	0	32
0 01 075	Tide station identification	CCITT IA5	0	0	40	Character	0	5
0 01 079	Unique identifier for the profile	CCITT IA5	0	0	64	Character	0	8
0 01 080	Ship line number according to SOOP	CCITT IA5	0	0	32	Character	0	4
0 01 081	Radiosonde serial number	CCITT IA5	0	0	160	Character	0	20
0 01 082	Radiosonde ascension number (see Note 12)	Numeric	0	0	14	Numeric	0	4
0 01 083	Radiosonde release number (see Note 12)	Numeric	0	0	3	Numeric	0	1
0 01 085	Observing platform manufacturer's model	CCITT IA5	0	0	160	Character	0	20

(continued)

(Class 01 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 01 086	Observing platform manufacturer's serial number	CCITT IA5	0	0	256	Character	0	32
0 01 087	WMO marine observing platform extended identifier	Numeric	0	0	23	Numeric	0	7
0 01 090	Technique for making up initial perturbations	Code table	0	0	8	Code table	0	3
0 01 091	Ensemble member number	Numeric	0	0	10	Numeric	0	4
0 01 092	Type of ensemble forecast	Code table	0	0	8	Code table	0	3
0 01 093	Balloon lot number	CCITT IA5	0	0	96	Character	0	12
0 01 094	WBAN number	Numeric	0	0	17	Numeric	0	5
0 01 095	Observer identification	CCITT IA5	0	0	32	Character	0	4
0 01 096	Station acquisition	CCITT IA5	0	0	160	Character	0	20
0 01 099	Unique product definition	CCITT IA5	0	0	248	Character	0	31
0 01 101	State identifier	Code table	0	0	10	Code table	0	3
0 01 102	National station number	Numeric	0	0	30	Numeric	0	9
0 01 103	IMO Number. Unique Lloyd's register	Numeric	0	0	24	Numeric	0	7
0 01 110	Aircraft tail number	CCITT IA5	0	0	48	Character	0	6
0 01 111	Origination airport	CCITT IA5	0	0	24	Character	0	3
0 01 112	Destination airport	CCITT IA5	0	0	24	Character	0	3
0 01 113	Template version number defined by originating centre	Numeric	1	0	9	Numeric	1	3
0 01 124	Grid point identifier	Numeric	0	0	24	Numeric	0	8
0 01 144	Snapshot identifier	Numeric	0	0	31	Numeric	0	10

Notes:

(1) The storm identifier (descriptor 0 01 025) has the following meaning: the first two characters shall be a numeric sequence number assigned by the originator of the message; the third character is a letter indicating the ocean basin where the storm is located, as follows:

W NW Pacific Ocean

(continued)

(Class 01 – continued)

E NE Pacific Ocean to 140°W
C NE Pacific Ocean 140°W – 180°W
L N Atlantic Ocean, including Caribbean and Gulf of Mexico
A N Arabian Sea
B Bay of Bengal
S S Indian Ocean
P S Pacific Ocean
F RSMC Nadi's zone in South Pacific
U Australia
O South China Sea
T East China Sea

There is no requirement that differing observers coordinate sequence numbers even though they both may be reporting the same storm.

(2) WMO long storm name (descriptor 0 01 027): the storm name "Nameless" shall be used in those cases where an identifiable tropical disturbance has not reached tropical storm strength and has not been assigned an official name.

(3) Where a centre other than the originating centre generates quality information, replacement or substitute values, and/or statistical information, the centre may be indicated by using 0 01 033.

(4) A generating centre may wish to indicate a reference to the application that generated quality information, etc.; it may use descriptor 0 01 032 for this purpose. However, the corresponding code tables will vary from centre to centre.

(5) Code table 0 01 032 is to be generated by each centre.

(6) The components of absolute platform velocity (0 01 041, 0 01 042, 0 01 043) are defined as follows:

- First component: From the Earth's centre to 0 degree longitude at the Equator: velocity of the platform along this line relative to the Earth's centre.
- Second component: From the Earth's centre to 90 degrees East longitude at the Equator: velocity of the platform along this line relative to the Earth's centre.
- Third component: From the Earth's centre to the north pole: velocity of the platform along this line relative to the Earth's centre.

(7) The values for descriptors 0 01 041, 0 01 042 and 0 01 043 have been chosen to be suitable for polar orbiting satellites in approximately Sun-synchronous orbits. Geostationary orbits would require greater data widths for distance and slightly less for speed.

(8) Left handed x, y and z axes have been chosen for descriptors 0 01 041, 0 01 042 and 0 01 043.

(9) Descriptor 0 01 020 should be used instead of 0 01 004 for encoding this element.

(10) Descriptor 0 01 033 shall be used instead of descriptor 0 01 031 for encoding originating/generating centre. Code table 0 01 034 is to be established by the associated originating/generating centre identified by descriptor 0 01 033 and provided to the Secretariat for publication.

(11) For 0 01 022, the character string representing the "Name of feature" should be of the form: "Type of phenomenon" – "Location or geographical name" e.g. "volcano – Popocatepetl", "oil fire – Kuwait").

(continued)

(Class 01 – continued)

(12) Descriptor 0 01 082 is to be used for reporting the sequential number of the current radiosonde reporting period (e.g. synoptic cycle) within a given year or other similar locally defined length of time. Descriptor 0 01 083 is to be used in the case of multiple sequential radiosonde releases during a single reporting period (e.g. synoptic cycle), in order to indicate which particular release generated the corresponding data values.

(13) The value of this feature could be a string of characters, which contain the name of the model and other useful elements such as the model mesh.

(14) Stationary position of ship shall be reported by 0 01 012 set to 0 and 0 01 013 set to 0. Course of ship unknown (D_s = 9) shall be reported by 0 01 012 set to 509.

Class 02 – BUFR/CREX Instrumentation

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 02 001	Type of station	Code table	0	0	2	Code table	0	1
0 02 002	Type of instrumentation for wind measurement	Flag table	0	0	4	Flag table	0	2
0 02 003	Type of measuring equipment used	Code table	0	0	4	Code table	0	2
0 02 004	Type of instrumentation for evaporation measurement or type of crop for which evapotranspiration is reported	Code table	0	0	4	Code table	0	2
0 02 005	Precision of temperature observation	K	2	0	7	K	2	3
0 02 011	Radiosonde type	Code table	0	0	8	Code table	0	3
0 02 012	Radiosonde computational method	Code table	0	0	4	Code table	0	2
0 02 013	Solar and infrared radiation correction	Code table	0	0	4	Code table	0	2
0 02 014	Tracking technique/status of system used	Code table	0	0	7	Code table	0	3
0 02 015	Radiosonde completeness	Code table	0	0	4	Code table	0	2
0 02 016	Radiosonde configuration	Flag table	0	0	5	Flag table	0	2
0 02 017	Correction algorithms for humidity measurements	Code table	0	0	5	Code table	0	2
0 02 019	Satellite instruments	Code table	0	0	11	Code table	0	4
0 02 020	Satellite classification	Code table	0	0	9	Code table	0	3
0 02 021	Satellite instrument data used in processing*	Flag table	0	0	9	Flag table	0	3
0 02 022	Satellite data-processing technique used	Flag table	0	0	8	Flag table	0	3
0 02 023	Satellite-derived wind computation method	Code table	0	0	4	Code table	0	2

* Descriptor 0 02 152 should be used instead of 0 02 021 for encoding this element.

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 024	Integrated mean humidity computational method	Code table	0	0	4	Code table	0	2
0 02 025	Satellite channel(s) used in computation	Flag table	0	0	25	Flag table	0	9
0 02 026	Cross-track resolution	m	2	0	12	m	2	4
0 02 027	Along-track resolution	m	2	0	12	m	2	4
0 02 028	Segment size at nadir in x-direction	m	0	0	18	m	0	6
0 02 029	Segment size at nadir in y-direction	m	0	0	18	m	0	6
0 02 030	Method of current measurement	Code table	0	0	3	Code table	0	1
0 02 031	Duration and time of current measurement	Code table	0	0	5	Code table	0	2
0 02 032	Indicator for digitization	Code table	0	0	2	Code table	0	1
0 02 033	Method of salinity/depth measurement	Code table	0	0	3	Code table	0	1
0 02 034	Drogue type	Code table	0	0	5	Code table	0	2
0 02 035	Cable length	m	0	0	9	m	0	3
0 02 036	Buoy type	Code table	0	0	2	Code table	0	1
0 02 037	Method of tidal observation	Code table	0	0	3	Code table	0	1
0 02 038	Method of water temperature and/or salinity measurement	Code table	0	0	4	Code table	0	2
0 02 039	Method of wet-bulb temperature measurement	Code table	0	0	3	Code table	0	1
0 02 040	Method of removing velocity and motion of platform from current	Code table	0	0	4	Code table	0	2
0 02 041	Method for estimating reports related to synoptic features	Code table	0	0	6	Code table	0	2
0 02 042	Indicator for sea-surface current speed	Code table	0	0	2	Code table	0	1
0 02 044	Indicator for method of calculating spectral wave data	Code table	0	0	4	Code table	0	2

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 045	Indicator for type of platform	Code table	0	0	4	Code table	0	2
0 02 046	Wave measurement instrumentation	Code table	0	0	4	Code table	0	2
0 02 047	Deep-ocean tsunameter type	Code table	0	0	7	Code table	0	2
0 02 048	Satellite sensor indicator	Code table	0	0	4	Code table	0	2
0 02 049	Geostationary satellite data-processing technique used	Flag table	0	0	8	Flag table	0	3
0 02 050	Geostationary sounder satellite channels used	Flag table	0	0	20	Flag table	0	7
0 02 051	Indicator to specify observing method for extreme temperatures	Code table	0	0	4	Code table	0	2
0 02 052	Geostationary imager satellite channels used	Flag table	0	0	6	Flag table	0	2
0 02 053	GOES-I/M brightness temperature characteristics	Code table	0	0	4	Code table	0	2
0 02 054	GOES-I/M soundings parameter characteristics	Code table	0	0	4	Code table	0	2
0 02 055	Geostationary soundings statistical parameters	Code table	0	0	4	Code table	0	2
0 02 056	Geostationary soundings accuracy statistics	Code table	0	0	4	Code table	0	2
0 02 057	Origin of first-guess information for GOES-I/M soundings	Code table	0	0	4	Code table	0	2
0 02 058	Valid times of first-guess information for GOES-I/M soundings	Code table	0	0	4	Code table	0	2
0 02 059	Origin of analysis information for GOES-I/M soundings	Code table	0	0	4	Code table	0	2
0 02 060	Origin of surface information for GOES-I/M soundings	Code table	0	0	4	Code table	0	2
0 02 061	Aircraft navigational system	Code table	0	0	3	Code table	0	1
0 02 062	Type of aircraft data relay system	Code table	0	0	4	Code table	0	2
0 02 063	Aircraft roll angle	°	2	–18000	16	°	2	5
0 02 064	Aircraft roll angle quality	Code table	0	0	2	Code table	0	1

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 065	ACARS ground-receiving station	CCITT IA5	0	0	40	Character	0	5
0 02 066	Radiosonde ground receiving system	Code table	0	0	6	Code table	0	2
0 02 067	Radiosonde operating frequency	Hz	–5	0	15	Hz	–5	5
0 02 070	Original specification of latitude/longitude	Code table	0	0	4	Code table	0	2
0 02 071	Spectrographic wavelength	m	13	0	30	m	13	10
0 02 072	Spectrographic width	m	13	0	30	m	13	10
0 02 080	Balloon manufacturer	Code table	0	0	6	Code table	0	2
0 02 081	Type of balloon	Code table	0	0	5	Code table	0	2
0 02 082	Weight of balloon	kg	3	0	12	kg	3	4
0 02 083	Type of balloon shelter	Code table	0	0	4	Code table	0	2
0 02 084	Type of gas used in balloon	Code table	0	0	4	Code table	0	2
0 02 085	Amount of gas used in balloon	kg	3	0	13	kg	3	4
0 02 086	Balloon flight train length	m	1	0	10	m	1	4
0 02 091	Entry sensor 4/20 mA	A	4	0	10	A	4	3
0 02 095	Type of pressure sensor	Code table	0	0	5	Code table	0	2
0 02 096	Type of temperature sensor	Code table	0	0	5	Code table	0	2
0 02 097	Type of humidity sensor	Code table	0	0	5	Code table	0	2
0 02 099	Polarization	Code table	0	0	3	Code table	0	1
0 02 100	Radar constant*	dB	1	0	12	dB	1	4
0 02 101	Type of antenna	Code table	0	0	4	Code table	0	2
0 02 102	Antenna height above tower base	m	0	0	8	m	0	3
0 02 103	Radome	Flag table	0	0	2	Flag table	0	1

* This constant is defined as follows: Z = P + radar constant
where Z = the reflectivity of target in beam direction (dBZ);
P = the input receiver power above 1 mW (dBm).
This constant is used to normalize the signal to the equivalent 100 km range.

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 104	Antenna polarization	Code table	0	0	4	Code table	0	2
0 02 105	Maximum antenna gain	dB	0	0	6	dB	0	2
0 02 106	3-dB beamwidth	°	1	0	6	°	1	2
0 02 107	Sidelobe suppression	dB	0	0	6	dB	0	2
0 02 108	Crosspol discrimination (on axis)	dB	0	0	6	dB	0	2
0 02 109	Antenna speed (azimuth)	degree/s	2	0	12	degree/s	2	4
0 02 110	Antenna speed (elevation)	degree/s	2	0	12	degree/s	2	4
0 02 111	Radar incidence angle	°	1	0	10	°	1	4
0 02 112	Radar look angle	°	1	0	12	°	1	4
0 02 113	Number of azimuth looks	Numeric	0	0	4	Numeric	0	2
0 02 114	Antenna effective surface area	m^2	0	0	15	m^2	0	5
0 02 115	Type of surface observing equipment	Code table	0	0	5	Code table	0	2
0 02 116	Percentage of 320 MHz band processed	%	0	0	7	%	0	3
0 02 117	Percentage of 80 MHz band processed	%	0	0	7	%	0	3
0 02 118	Percentage of 20 MHz band processed	%	0	0	7	%	0	3
0 02 119	RA-2 instrument operations	Code table	0	0	3	Code table	0	1
0 02 120	Ocean wave frequency	Hz	3	0	10	Hz	3	4
0 02 121	Mean frequency	Hz	–8	0	7	Hz	–8	3
0 02 122	Frequency agility range	Hz	–6	–128	8	Hz	–6	3
0 02 123	Peak power	W	–4	0	7	W	–4	3
0 02 124	Average power	W	–1	0	7	W	–1	3
0 02 125	Pulse repetition frequency	Hz	–1	0	8	Hz	–1	3
0 02 126	Pulse width	s	7	0	6	s	7	2

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 127	Receiver intermediate frequency	Hz	–6	0	7	Hz	–6	3
0 02 128	Intermediate frequency bandwidth	Hz	–5	0	6	Hz	–5	2
0 02 129	Minimum detectable signal	dB	0	–150	5	dB	0	3
0 02 130	Dynamic range	dB	0	0	7	dB	0	3
0 02 131	Sensitivity time control (STC)	Flag table	0	0	2	Flag table	0	1
0 02 132	Azimuth pointing accuracy	°	2	0	6	°	2	2
0 02 133	Elevation pointing accuracy	°	2	0	6	°	2	2
0 02 134	Antenna beam azimuth	°	2	0	16	°	2	5
0 02 135	Antenna elevation	°	2	–9000	15	°	2	5
0 02 136	Range processed by range attenuation correction	m	–3	0	16	m	–3	5
0 02 137	Radar dual PRF ratio	Code table	0	0	4	Code table	0	2
0 02 138	Antenna rotation direction	Code table	0	0	2	Code table	0	1
0 02 139	SIRAL instrument configuration	Code table	0	0	2	Code table	0	1
0 02 140	Satellite radar beam azimuth angle (see Note 4)	°	0	0	9	°	0	3
0 02 141	Measurement type	CCITT IA5	0	0	24	Character	0	3
0 02 142	Ozone instrument serial number/ identification (see Note 5)	CCITT IA5	0	0	32	Character	0	4
0 02 143	Ozone instrument type	Code table	0	0	7	Code table	0	3
0 02 144	Light source type for Brewer spectrophotometer	Code table	0	0	4	Code table	0	2
0 02 145	Wavelength setting for Dobson instruments	Code table	0	0	4	Code table	0	2
0 02 146	Source conditions for Dobson instruments	Code table	0	0	4	Code table	0	2
0 02 148	Data collection and/or location system	Code table	0	0	5	Code table	0	2
0 02 149	Type of data buoy	Code table	0	0	6	Code table	0	2

(continued)

(Class 02 – continued)

TABLE REFERENCE		BUFR				CREX		
F X Y	ELEMENT NAME	UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	Code table	0	0	6	Code table	0	2
0 02 151	Radiometer identifier	Code table	0	0	11	Code table	0	4
0 02 152	Satellite instrument used in data processing (see Note 6)	Flag table	0	0	31	Flag table	0	10
0 02 153	Satellite channel centre frequency	Hz	–8	0	26	Hz	–8	8
0 02 154	Satellite channel band width	Hz	–8	0	26	Hz	–8	8
0 02 155	Satellite channel wavelength	m	9	0	16	m	9	5
0 02 156	Percentage of valid KU ocean retracker measurements	%	0	0	7	%	0	3
0 02 157	Percentage of valid S ocean retracker measurements	%	0	0	7	%	0	3
0 02 158	RA-2 instrument	Flag table	0	0	9	Flag table	0	3
0 02 159	MWR instrument	Flag table	0	0	8	Flag table	0	3
0 02 160	Wave length of the radar	Code table	0	0	4	Code table	0	2
0 02 163	Height assignment method	Code table	0	0	4	Code table	0	2
0 02 164	Tracer correlation method	Code table	0	0	3	Code table	0	1
0 02 165	Radiance type flags	Flag table	0	0	15	Flag table	0	5
0 02 166	Radiance type	Code table	0	0	4	Code table	0	2
0 02 167	Radiance computational method	Code table	0	0	4	Code table	0	2
0 02 168	Hydrostatic pressure of lower end of cable (thermistor string)	Pa	–3	0	16	kPa	0	5
0 02 169	Anemometer type	Code table	0	0	4	Code table	0	2
0 02 170	Aircraft humidity sensors	Code table	0	0	6	Code table	0	2
0 02 171	Instrument serial number for water temperature profile measurement	CCITT IA5	0	0	64	Character	0	8
0 02 172	Product type for retrieved atmospheric gases	Code table	0	0	8	Code table	0	3
0 02 173	Square of the off-nadir angle (see Note 7)	$degree^2$	4	0	10	$degree^2$	4	4
0 02 174	Mean across track pixel number	Numeric	0	0	9	Numeric	0	3
0 02 175	Method of precipitation measurement	Code table	0	0	4	Code table	0	2
0 02 176	Method of state of ground measurement	Code table	0	0	4	Code table	0	2

(continued)

(Class 02 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 02 177	Method of snow depth measurement	Code table	0	0	4	Code table	0	2
0 02 178	Method of liquid content measurement of precipitation	Code table	0	0	4	Code table	0	2
0 02 179	Type of sky condition algorithm	Code table	0	0	4	Code table	0	2
0 02 180	Main present weather detecting system	Code table	0	0	4	Code table	0	2
0 02 181	Supplementary present weather sensor	Flag table	0	0	21	Flag table	0	7
0 02 182	Visibility measurement system	Code table	0	0	4	Code table	0	2
0 02 183	Cloud detection system	Code table	0	0	4	Code table	0	2
0 02 184	Type of lightning detection sensor	Code table	0	0	4	Code table	0	2
0 02 185	Method of evaporation measurement	Code table	0	0	4	Code table	0	2
0 02 186	Capability to detect precipitation phenomena	Flag table	0	0	30	Flag table	0	10
0 02 187	Capability to detect other weather phenomena	Flag table	0	0	18	Flag table	0	6
0 02 188	Capability to detect obscuration	Flag table	0	0	21	Flag table	0	7
0 02 189	Capability to discriminate lightning strikes	Flag table	0	0	12	Flag table	0	4
0 02 190	Lagrangian drifter submergence (% time submerged)	%	0	0	7	%	0	3
0 02 191	Geopotential height calculation	Code table	0	0	4	Code table	0	2

Notes:

(1) This class shall contain elements to describe the instrumentation used to obtain the meteorological elements reported.

(2) This class may also contain elements relating to observational procedures.

(3) Some indication of expected accuracy may be implied in conjunction with certain elements in this class.

(4) Note that descriptor 0 02 140 is the azimuth angle measured anticlockwise from satellite heading vector.

(5) In descriptor 0 02 142: Ozone instrument serial number/identification is four characters long. For Japanese Dobson instruments, omit the leading digit(s).

(6) Descriptor 0 02 019 should be used instead of descriptor 0 02 152 for single satellite instrument identification.

(7) Square of off-nadir angle computed from Ku waveform-derived parameters, Unit 10^{-4} deg^2, Common minimum value 0, Common maximum value 900.

Class 04 – BUFR/CREX Location (time)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 04 001	Year	a	0	0	12	a	0	4
0 04 002	Month	mon	0	0	4	mon	0	2
0 04 003	Day	d	0	0	6	d	0	2
0 04 004	Hour	h	0	0	5	h	0	2
0 04 005	Minute	min	0	0	6	min	0	2
0 04 006	Second	s	0	0	6	s	0	2
0 04 007	Seconds within a minute (microsecond accuracy)	s	6	0	26	s	6	8
0 04 011	Time increment	a	0	–1024	11	a	0	4
0 04 012	Time increment	mon	0	–1024	11	mon	0	4
0 04 013	Time increment	d	0	–1024	11	d	0	4
0 04 014	Time increment	h	0	–1024	11	h	0	4
0 04 015	Time increment	min	0	–2048	12	min	0	4
0 04 016	Time increment	s	0	–4096	13	s	0	4
0 04 017	Reference time period for accumulated or extreme data	min	0	–1440	12	min	0	4
0 04 021	Time period or displacement	a	0	–1024	11	a	0	4
0 04 022	Time period or displacement	mon	0	–1024	11	mon	0	4
0 04 023	Time period or displacement	d	0	–1024	11	d	0	4
0 04 024	Time period or displacement	h	0	–2048	12	h	0	4
0 04 025	Time period or displacement	min	0	–2048	12	min	0	4
0 04 026	Time period or displacement	s	0	–4096	13	s	0	4
0 04 031	Duration of time relating to following value	h	0	0	8	h	0	3
0 04 032	Duration of time relating to following value	min	0	0	6	min	0	2

(continued)

(Class 04 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 04 041	Time difference, UTC – LMT (see Note 6)	min	0	–1440	12	min	0	4
0 04 043	Day of the year	d	0	0	9	d	0	3
0 04 051	Principal time of daily reading of maximum temperature	h	0	0	5	h	0	2
0 04 052	Principal time of daily reading of minimum temperature	h	0	0	5	h	0	2
0 04 053	Number of days with precipitation equal to or more than 1 mm	Numeric	0	0	6	Numeric	0	2
0 04 059	Times of observation used to compute the reported mean values	Flag table	0	0	6	Flag table	0	2
0 04 065	Short time increment	min	0	–128	8	min	0	2
0 04 066	Short time increment	s	0	–128	8	s	0	2
0 04 073	Short time period or displacement	d	0	–128	8	d	0	2
0 04 074	Short time period or displacement	h	0	–128	8	h	0	2
0 04 075	Short time period or displacement	min	0	–128	8	min	0	2
0 04 080	Averaging period for following value	Code table	0	0	4	Code table	0	2
0 04 086	Long time period or displacement	s	0	–8192	15	s	0	5

Notes:

(1) The significance of time periods or displacements may be indicated using the time significance code corresponding to table reference 0 08 021.

(2) Where more than one time period or displacement is required to define complex time structures, they shall be defined in immediate succession, and the following ordering shall apply: ensemble period (if required), followed by forecast period (if required), followed by period for averaging or accumulation (if required).

(3) Time periods or displacements and time increments require an initial time location to be defined prior to their use, followed where appropriate by a time significance definition.

(4) The time location, when used with forecast values, shall indicate the time of the initial state for the forecast, or the beginning of the forecast period; when used with ensemble means of forecast values, the time location shall indicate the initial state or the beginning of the first forecast over which ensemble means are derived.

(5) Negative time periods or displacements shall be used to indicate time periods or displacements preceding the currently defined time.

(6) Descriptor 0 04 041 has been replaced by the combination of 0 08 025 and 0 26 003 and should not be used for encoding this element.

(7) All times are Universal Time Coordinated (UTC) unless otherwise noted.

Class 05 – BUFR/CREX Location (horizontal – 1)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 05 001	Latitude (high accuracy)	°	5	–9000000	25	°	5	7
0 05 002	Latitude (coarse accuracy)	°	2	–9000	15	°	2	4
0 05 011	Latitude increment (high accuracy)	°	5	–9000000	25	°	5	7
0 05 012	Latitude increment (coarse accuracy)	°	2	–9000	15	°	2	4
0 05 015	Latitude displacement (high accuracy)	°	5	–9000000	25	°	5	7
0 05 016	Latitude displacement (coarse accuracy)	°	2	–9000	15	°	2	4
0 05 021	Bearing or azimuth	degree true	2	0	16	degree true	2	5
0 05 022	Solar azimuth	degree true	2	0	16	degree true	2	5
0 05 023	Sun to satellite azimuth difference	°	1	–1800	12	°	1	4
0 05 030	Direction (spectral)	°	0	0	12	°	0	4
0 05 031	Row number	Numeric	0	0	12	Numeric	0	4
0 05 033	Pixel size on horizontal – 1	m	–1	0	16	m	–1	5
0 05 034	Along track row number	Numeric	0	0	11	Numeric	0	4
0 05 035	Maximum size of x-dimension	Numeric	0	0	12	Numeric	0	4
0 05 036	Ship transect number according to SOOP	Numeric	0	0	7	Numeric	0	2
0 05 040	Orbit number	Numeric	0	0	24	Numeric	0	8
0 05 041	Scan line number	Numeric	0	0	8	Numeric	0	3
0 05 042	Channel number	Numeric	0	0	6	Numeric	0	2
0 05 043	Field of view number	Numeric	0	0	8	Numeric	0	3
0 05 044	Satellite cycle number	Numeric	0	0	11	Numeric	0	4
0 05 045	Field of regard number	Numeric	0	0	8	Numeric	0	3
0 05 052	Channel number increment	Numeric	0	0	5	Numeric	0	2
0 05 053	Field of view number increment	Numeric	0	0	5	Numeric	0	2
0 05 060	Y angular position from centre of gravity	°	6	–8000000	24	°	6	8
0 05 061	Z angular position from centre of gravity	°	6	–8000000	24	°	6	8

(continued)

(Class 05 – continued)

Notes:

(1) Values of latitude and latitude increments are limited to the range –90 degrees to +90 degrees.

(2) South latitude shall be assigned negative values.

(3) North to south increments shall be assigned negative values.

(4) Bearing or azimuth shall only be used with respect to a stated location, and shall not redefine that location.

(5) The pixel size on horizontal – 1 is given at location where map scale factor is unity.

Class 06 – BUFR/CREX Location (horizontal – 2)

TABLE REFERENCE		BUFR				CREX		
F X Y	ELEMENT NAME	UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 06 001	Longitude (high accuracy)	°	5	–18000000	26	°	5	8
0 06 002	Longitude (coarse accuracy)	°	2	–18000	16	°	2	5
0 06 011	Longitude increment (high accuracy)	°	5	–18000000	26	°	5	8
0 06 012	Longitude increment (coarse accuracy)	°	2	–18000	16	°	2	5
0 06 015	Longitude displacement (high accuracy)	°	5	–18000000	26	°	5	8
0 06 016	Longitude displacement (coarse accuracy)	°	2	–18000	16	°	2	5
0 06 021	Distance	m	–1	0	13	m	–1	4
0 06 029	Wave number	m^{-1}	1	0	22	m^{-1}	1	7
0 06 030	Wave number (spectral)	rad m^{-1}	5	0	13	rad m^{-1}	5	4
0 06 031	Column number	Numeric	0	0	12	Numeric	0	4
0 06 033	Pixel size on horizontal – 2	m	–1	0	16	m	–1	5
0 06 034	Cross-track cell number	Numeric	0	0	7	Numeric	0	3
0 06 035	Maximum size of y-dimension	Numeric	0	0	12	Numeric	0	4
0 06 040	Radius of confidence	m	0	0	13	m	0	4

Notes:

(1) Values of longitude are limited to the range –180 degrees to +180 degrees.

(2) West longitude shall be assigned negative values.

(3) East to west increments shall be assigned negative values.

(4) Distance shall only be used with respect to a stated location and a bearing, azimuth or elevation; it shall not redefine that location.

(5) The pixel size on horizontal – 2 is given at location where map scale factor is unity.

Class 07 – BUFR/CREX Location (vertical)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 07 001	Height of station (see Note 1)	m	0	–400	15	m	0	5
0 07 002	Height or altitude	m	–1	–40	16	m	–1	5
0 07 003	Geopotential	$m^2 s^{-2}$	–1	–400	17	$m^2 s^{-2}$	–1	6
0 07 004	Pressure	Pa	–1	0	14	Pa	–1	5
0 07 005	Height increment	m	0	–400	12	m	0	4
0 07 006	Height above station	m	0	0	15	m	0	5
0 07 007	Height	m	0	–1000	17	m	0	6
0 07 008	Geopotential	$m^2 s^{-2}$	0	–10000	20	$m^2 s^{-2}$	0	7
0 07 009	Geopotential height	gpm	0	–1000	17	gpm	0	5
0 07 010	Flight level	m	0	–1024	16	ft	–1	5
0 07 012	Grid point altitude	m	2	–50000	20	m	2	7
0 07 021	Elevation (see Note 2)	°	2	–9000	15	°	2	5
0 07 022	Solar elevation	°	2	–9000	15	°	2	5
0 07 024	Satellite zenith angle	°	2	–9000	15	°	2	5
0 07 025	Solar zenith angle	°	2	–9000	15	°	2	5
0 07 026	Satellite zenith angle	°	4	–900000	21	°	4	7
0 07 030	Height of station ground above mean sea level (see Note 3)	m	1	–4000	17	m	1	5
0 07 031	Height of barometer above mean sea level (see Note 4)	m	1	–4000	17	m	1	5
0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 5)	m	2	0	16	m	2	5
0 07 033	Height of sensor above water surface (see Note 6)	m	1	0	12	m	1	4
0 07 035	Maximum size of z-dimension	Numeric	0	0	12	Numeric	0	4

(continued)

(Class 07 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 07 036	Level index of z	Numeric	0	0	12	Numeric	0	4
0 07 040	Impact parameter (see Note 7)	m	1	62000000	22	m	1	8
0 07 061	Depth below land surface	m	2	0	14	m	2	5
0 07 062	Depth below sea/water surface	m	1	0	17	m	1	6
0 07 063	Depth below sea/water surface (cm)	m	2	0	20	m	2	7
0 07 064	Representative height of sensor above station (see Note 8)	m	0	0	4	m	0	2
0 07 065	Water pressure	Pa	–3	0	17	Pa	–3	6
0 07 070	Drogue depth	m	0	0	10	m	0	4

Notes:

(1) Regarding data from ground-based stations, this descriptor should be used for archived data only. Descriptors 0 07 030 and 0 07 031 should be used and preferred to represent ground elevation and elevation of barometer, respectively, as defined in *Weather Reporting* (WMO-No. 9), Volume A – Observing Stations. Regarding marine stations, this descriptor refers to the height above mean sea level of the deck of marine platform where the instruments stand.

(2) Elevation shall only be used with respect to a stated location and a bearing, azimuth or distance; it shall not redefine that location.

(3) Height of station ground above mean sea level is defined as the height above mean sea level of the ground on which the raingauge stands or, if there is no raingauge, the ground beneath the thermometer screen. If there is neither raingauge nor screen, it is the average level of terrain in the vicinity of the station (Reference: *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8), 1996).

(4) Height of barometer above mean sea level, referring to the location of barometer of a station, does not redefine the descriptor 0 07 030.

(5) Height of sensor above local ground (or deck of marine platform) is the actual height of sensor above ground (or deck of marine platform) at the point where the sensor is located. This descriptor does not redefine the descriptors 0 07 030 or 0 07 033. Previously defined value of 0 07 032 may be cancelled by setting 0 07 032 to a "missing value".

(6) Height of sensor above water surface is the height of sensor above water surface of sea or lake. This descriptor does not redefine descriptors 0 07 030 or 0 07 032. Previously defined value 0 07 033 may be cancelled by setting 0 07 033 to a "missing value".

(7) For an atmospheric limb sounder, the “impact parameter” is the distance between the ray asymptote and the centre of curvature of the Earth’s surface at the tangent point.

(8) Representative height of sensor above station is the standard height of a sensor required by WMO documentation. The value of the following meteorological element should be adjusted using a formula. For example, standard height recommended in WMO documentation for surface wind sensors is 10 metres. If the sensor is placed at a different height, the wind speed may be adjusted using a formula.

Class 08 – BUFR/CREX Significance qualifiers

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 08 001	Vertical sounding significance	Flag table	0	0	7	Flag table	0	3
0 08 002	Vertical significance (surface observations)	Code table	0	0	6	Code table	0	2
0 08 003	Vertical significance (satellite observations)	Code table	0	0	6	Code table	0	2
0 08 004	Phase of aircraft flight	Code table	0	0	3	Code table	0	1
0 08 005	Meteorological attribute significance	Code table	0	0	4	Code table	0	2
0 08 006	Ozone vertical sounding significance	Flag table	0	0	9	Flag table	0	3
0 08 007	Dimensional significance	Code table	0	0	4	Code table	0	2
0 08 008	Radiation vertical sounding significance	Flag table	0	0	9	Flag table	0	3
0 08 009	Detailed phase of flight	Code table	0	0	4	Code table	0	2
0 08 010	Surface qualifier (temperature data)	Code table	0	0	5	Code table	0	2
0 08 011	Meteorological feature	Code table	0	0	6	Code table	0	2
0 08 012	Land/sea qualifier	Code table	0	0	2	Code table	0	1
0 08 013	Day/night qualifier	Code table	0	0	2	Code table	0	1
0 08 014	Qualifier for runway visual range	Code table	0	0	4	Code table	0	2
0 08 016	Change qualifier of a trend-type forecast or an aerodrome forecast	Code table	0	0	3	Code table	0	1
0 08 017	Qualifier of the time when the forecast change is expected	Code table	0	0	2	Code table	0	1
0 08 018	SEAWINDS land/ice surface type	Flag table	0	0	17	Flag table	0	6
0 08 019	Qualifier for following centre identifier	Code table	0	0	4	Code table	0	2
0 08 020	Total number of missing entities (with respect to accumulation or average)	Numeric	0	0	16	Numeric	0	5
0 08 021	Time significance	Code table	0	0	5	Code table	0	2

(continued)

(Class 08 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 08 022	Total number (with respect to accumulation or average)	Numeric	0	0	16	Numeric	0	5
0 08 023	First-order statistics	Code table	0	0	6	Code table	0	2
0 08 024	Difference statistics	Code table	0	0	6	Code table	0	2
0 08 025	Time difference qualifier (see Note 5)	Code table	0	0	4	Code table	0	2
0 08 026	Matrix significance	Code table	0	0	6	Code table	0	2
0 08 029	Surface type	Code table	0	0	8	Code table	0	3
0 08 030	*Manual on Codes* (Volume I.1, Section C) Code table from which data are derived	Numeric	0	0	13	Numeric	0	4
0 08 031	Data category – CREX table A	Numeric	0	0	8	Numeric	0	3
0 08 033	Method of derivation of percentage confidence (see Note 6)	Code table	0	0	7	Code table	0	3
0 08 035	Type of monitoring exercise	Code table	0	0	3	Code table	0	1
0 08 036	Type of centre or station performing monitoring	Code table	0	0	3	Code table	0	1
0 08 039	Time significance (Aviation forecast)	Code table	0	0	6	Code table	0	2
0 08 040	Flight level significance	Code table	0	0	6	Code table	0	2
0 08 041	Data significance	Code table	0	0	5	Code table	0	2
0 08 042	Extended vertical sounding significance	Flag table	0	0	18	Flag table	0	6
0 08 043	Atmospheric chemical or physical constituent type	Code table	0	0	8	Code table	0	3
0 08 044	CAS registry number	CCITT IA5	0	0	88	Character	0	11
0 08 046	Atmospheric chemical or physical constituent type	Common Code table C–14	0	0	16	Common Code table C–14	0	5
0 08 049	Number of observations	Numeric	0	0	8	Numeric	0	3

(continued)

(Class 08 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 08 050	Qualifier for number of missing values in calculation of statistic	Code table	0	0	4	Code table	0	2
0 08 051	Qualifier for number of missing values in calculation of statistic	Code table	0	0	3	Code table	0	1
0 08 052	Condition for which number of days of occurrence follows	Code table	0	0	5	Code table	0	2
0 08 053	Day of occurrence qualifier	Code table	0	0	2	Code table	0	1
0 08 054	Qualifier for wind speed or wind gusts	Code table	0	0	3	Code table	0	1
0 08 060	Sample scanning mode significance	Code table	0	0	4	Code table	0	2
0 08 065	Sun-glint indicator	Code table	0	0	2	Code table	0	1
0 08 066	Semi-transparency indicator	Code table	0	0	2	Code table	0	1
0 08 070	TOVS/ATOVS product qualifier	Code table	0	0	4	Code table	0	2
0 08 072	Pixel(s) type	Code table	0	0	3	Code table	0	1
0 08 074	Altimeter echo type	Code table	0	0	2	Code table	0	1
0 08 075	Ascending/descending orbit qualifier	Code table	0	0	2	Code table	0	1
0 08 076	Type of band	Code table	0	0	6	Code table	0	2
0 08 077	Radiometer sensed surface type	Code table	0	0	7	Code table	0	3
0 08 079	Product status	Code table	0	0	4	Code table	0	2
0 08 080	Qualifier for GTSPP quality flag	Code table	0	0	6	Code table	0	2
0 08 081	Type of equipment	Code table	0	0	6	Code table	0	2
0 08 082	Modification of sensor height to another value	Code table	0	0	3	Code table	0	1
0 08 083	Nominal value indicator	Flag table	0	0	15	Flag table	0	5
0 08 085	Beam identifier	Code table	0	0	3	Code table	0	1
0 08 086	Vertical significance for NWP	Flag table	0	0	12	Flag table	0	4
0 08 090	Decimal scale of following significands	Numeric	0	–127	8	Numeric	0	3

(continued)

(Class 08 – continued)

Notes:

(1) Where values are accumulated or averaged (for example over a time period), the total number of values from which the accumulated or averaged values are obtained may be represented using reference 0 08 022.

(2) A previously defined significance may be cancelled by transmitting a “missing” from the appropriate code or flag table.

(3) First-order statistics have values with a similar range and the same dimensions as the corresponding reported values (e.g., maxima, minima, means).

(4) Difference statistics are difference values; they have dimensions similar to the corresponding reported values with respect to units, but assume a range centred on zero (e.g. the difference between reported and analysed values, the difference between reported and forecast values).

(5) Descriptor 0 08 025 is to be used with 0 26 003 (time difference).

(6) Descriptor 0 08 033 is to be used by preceding the element 0 33 007 as part of quality control information in order to specify the method used to calculate the percentage confidence.

(7) When descriptor 0 08 043 is used to specify particulate matter (PM) under a given size threshold, descriptor 0 08 045 may also be used to further specify a subset of the PM population on the basis of ion composition.

(8) Descriptor 0 08 090 is to be used to establish the decimal scale of one or more subsequent numerical element descriptors requiring a large dynamic range of values. The numerical element descriptor(s) will contain the scaled value of the measurement(s) with the required number of significant digits. The actual value will be obtained, at the application level, by multiplying the scaled value by the given decimal scale: (scaled value x $10^{\text{decimal scale}}$).

Class 10 – BUFR/CREX Non-coordinate location (vertical)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 10 001	Height of land surface	m	0	–400	15	m	0	5
0 10 002	Height	m	–1	–40	16	m	–1	5
0 10 003	Geopotential	$m^2 s^{-2}$	–1	–400	17	$m^2 s^{-2}$	–1	6
0 10 004	Pressure	Pa	–1	0	14	Pa	–1	5
0 10 007	Height	m	0	–1000	17	m	0	6
0 10 008	Geopotential	$m^2 s^{-2}$	0	–10000	20	$m^2 s^{-2}$	0	7
0 10 009	Geopotential height	gpm	0	–1000	17	gpm	0	5
0 10 010	Minimum pressure reduced to mean sea level	Pa	–1	0	14	Pa	–1	5
0 10 011	Maximum pressure reduced to mean sea level	Pa	–1	0	14	Pa	–1	5
0 10 031	In direction of the North Pole, distance from the Earth's centre (see Notes 2 and 3)	m	2	–1073741824	31	m	2	10
0 10 032	Satellite distance to Earth's centre	m	1	0	27	m	2	9
0 10 033	Altitude (platform to ellipsoid)	m	1	0	27	m	2	9
0 10 034	Earth's radius	m	1	0	27	m	2	9
0 10 035	Earth's local radius of curvature	m	1	62000000	22	m	1	8
0 10 036	Geoid undulation (see Note 4)	m	2	–15000	15	m	2	6
0 10 040	Number of retrieved layers	Numeric	0	0	10	Numeric	0	4
0 10 050	Standard deviation altitude	m	2	0	16	m	2	5
0 10 051	Pressure reduced to mean sea level	Pa	–1	0	14	Pa	–1	5
0 10 052	Altimeter setting (QNH)	Pa	–1	0	14	Pa	–1	5
0 10 053	Global navigation satellite system altitude	m	0	–1000	17	m	0	5
0 10 060	Pressure change	Pa	–1	–1024	11	Pa	–1	4
0 10 061	3-hour pressure change	Pa	–1	–500	10	Pa	–1	4

(continued)

(Class 10 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 10 062	24-hour pressure change	Pa	–1	–1000	11	Pa	–1	4
0 10 063	Characteristic of pressure tendency	Code table	0	0	4	Code table	0	2
0 10 064	SIGMET cruising level	Code table	0	0	3	Code table	0	1
0 10 070	Indicated aircraft altitude	m	0	–400	16	m	0	5
0 10 079	Off-nadir angle of the satellite from platform data	°	4	0	16	°	4	5
0 10 080	Viewing zenith angle	°	2	–9000	15	°	2	5
0 10 081	Altitude of COG above reference ellipsoid	m	3	0	31	m	3	10
0 10 082	Instantaneous altitude rate	$m\ s^{-1}$	3	–65536	17	$m\ s^{-1}$	3	6
0 10 083	Squared off-nadir angle of the satellite from platform data	$degree^2$	2	0	16	$degree^2$	2	5
0 10 084	Squared off-nadir angle of the satellite from waveform data	$degree^2$	2	0	16	$degree^2$	2	5
0 10 085	Mean sea-surface height	m	3	–131072	18	m	3	6
0 10 086	Geoid's height	m	3	–131072	18	m	3	6
0 10 087	Ocean depth/land elevation	m	1	–131072	18	m	1	6
0 10 088	Total geocentric ocean tide height (solution 1)	m	3	–32768	16	m	3	5
0 10 089	Total geocentric ocean tide height (solution 2)	m	3	–32768	16	m	3	5
0 10 090	Long period tide height	m	3	–32768	16	m	3	5
0 10 091	Tidal loading height	m	3	–32768	16	m	3	5
0 10 092	Solid Earth tide height	m	3	–32768	16	m	3	5
0 10 093	Geocentric pole tide height	m	3	–32768	16	m	3	5
0 10 095	Height of atmosphere used	m	0	0	16	m	0	5
0 10 096	Mean dynamic topography	m	3	–131072	18	m	3	6

(continued)

(Class 10 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 10 097	Mean sea-surface height from altimeter only	m	3	–131072	18	m	3	6
0 10 098	Loading tide height geocentric ocean tide solution 1	m	4	–2000	12	m	4	4
0 10 099	Loading tide height geocentric ocean tide solution 2	m	4	–2000	12	m	4	4
0 10 100	Non-equilibrium long period tide height	m	4	–2000	12	m	4	4
0 10 101	Squared off-nadir angle of the satellite from waveform data	$degree^2$	2	–32768	16	$degree^2$	2	5
0 10 102	Sea-surface height anomaly	m	3	–32768	16	m	3	5

Notes:

(1) Vertical elements and pressure shall be used to define values of these elements independent of the element or variable denoting the vertical coordinate.

(2) The value for descriptor 0 10 031 has been chosen to be suitable for polar orbiting satellites in approximately Sun-synchronous orbits. Geostationary orbits would require greater data widths for distance and slightly less for speed.

(3) Left handed x, y and z axes have been chosen for descriptor 0 10 031.

(4) The “geoid undulation” is the difference between the reference ellipsoid (WGS-84) and the geoid height (EGM96) at the geographic location of the observation, both referenced to the centre of mass of the Earth.

Class 11 – BUFR/CREX Wind and turbulence

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 11 001	Wind direction	degree true	0	0	9	degree true	0	3
0 11 002	Wind speed	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 003	u-component	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 004	v-component	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 005	w-component	$Pa\ s^{-1}$	1	–512	10	$Pa\ s^{-1}$	1	4
0 11 006	w-component	$m\ s^{-1}$	2	–4096	13	$m\ s^{-1}$	2	4
0 11 010	Wind direction associated with wind speed which follows	degree true	0	0	9	degree true	0	3
0 11 011	Wind direction at 10 m	degree true	0	0	9	degree true	0	3
0 11 012	Wind speed at 10 m	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 013	Wind direction at 5 m	degree true	0	0	9	degree true	0	3
0 11 014	Wind speed at 5 m	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 016	Extreme counterclockwise wind direction of a variable wind	degree true	0	0	9	degree true	0	3
0 11 017	Extreme clockwise wind direction of a variable wind	degree true	0	0	9	degree true	0	3
0 11 019	Steadiness of wind (see Note 6)	%	0	0	7	%	0	3
0 11 021	Relative vorticity	s^{-1}	9	–65536	17	s^{-1}	9	6
0 11 022	Divergence	s^{-1}	9	–65536	17	s^{-1}	9	6
0 11 023	Velocity potential	$m^2\ s^{-1}$	–2	–65536	17	$m^2\ s^{-1}$	–2	6
0 11 030	Extended degree of turbulence	Code table	0	0	6	Code table	0	2
0 11 031	Degree of turbulence	Code table	0	0	4	Code table	0	2
0 11 032	Height of base of turbulence	m	–1	–40	16	m	–1	5
0 11 033	Height of top of turbulence	m	–1	–40	16	m	–1	5
0 11 034	Vertical gust velocity	$m\ s^{-1}$	1	–1024	11	$m\ s^{-1}$	1	4
0 11 035	Vertical gust acceleration	$m\ s^{-2}$	2	–8192	14	$m\ s^{-2}$	2	5

(continued)

(Class 11 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 11 036	Maximum derived equivalent vertical gust speed	$m\ s^{-1}$	1	0	10	$m\ s^{-1}$	1	4
0 11 037	Turbulence index	Code table	0	0	6	Code table	0	2
0 11 038	Time of occurrence of peak eddy dissipation rate	Code table	0	0	5	Code table	0	2
0 11 039	Extended time of occurrence of peak eddy dissipation rate	Code table	0	0	6	Code table	0	2
0 11 040	Maximum wind speed (mean wind)	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 041	Maximum wind gust speed	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 042	Maximum wind speed (10-minute mean wind)	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 043	Maximum wind gust direction	degree true	0	0	9	degree true	0	3
0 11 044	Mean wind direction for surface – 1 500 m (5 000 feet)	degree true	0	0	9	degree true	0	3
0 11 045	Mean wind speed for surface – 1 500 m (5 000 feet)	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 046	Maximum instantaneous wind speed	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 047	Maximum instantaneous wind speed over 10 minutes	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 049	Standard deviation of wind direction	degree true	0	0	9	degree true	0	3
0 11 050	Standard deviation of horizontal wind speed	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 051	Standard deviation of vertical wind speed	$m\ s^{-1}$	1	0	8	$m\ s^{-1}$	1	3
0 11 052	Formal uncertainty in wind speed	$m\ s^{-1}$	2	0	13	$m\ s^{-1}$	2	5
0 11 053	Formal uncertainty in wind direction	degree true	2	0	15	degree true	2	5
0 11 054	Mean wind direction for 1 500 – 3 000 m	degree true	0	0	9	degree true	0	3
0 11 055	Mean wind speed for 1 500 – 3 000 m	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4

(continued)

(Class 11 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 11 061	Absolute wind shear in 1 km layer below	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 062	Absolute wind shear in 1 km layer above	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 070	Designator of the runway affected by wind shear (including ALL)	CCITT IA5	0	0	32	Character	0	4
0 11 071	Turbulent vertical momentum flux	$m^2\ s^{-2}$	3	–128	14	$m^2\ s^{-2}$	3	5
0 11 072	Turbulent vertical buoyancy flux	$K\ m\ s^{-1}$	3	–128	11	$K\ m\ s^{-1}$	3	4
0 11 073	Turbulent kinetic energy	$m^2\ s^{-2}$	2	–1024	13	$m^2\ s^{-2}$	2	4
0 11 074	Dissipation energy	$m^2\ s^{-2}$	2	–1024	10	$m^2\ s^{-2}$	2	4
0 11 075	Mean turbulence intensity (eddy dissipation rate)	$m^{2/3}\ s^{-1}$	2	0	8	$m^{2/3}\ s^{-1}$	2	3
0 11 076	Peak turbulence intensity (eddy dissipation rate)	$m^{2/3}\ s^{-1}$	2	0	8	$m^{2/3}\ s^{-1}$	2	3
0 11 077	Reporting interval or averaging time for eddy dissipation rate	s	0	0	12	s	0	4
0 11 081	Model wind direction at 10 m	degree true	2	0	16	degree true	2	5
0 11 082	Model wind speed at 10 m	$m\ s^{-1}$	2	0	14	$m\ s^{-1}$	2	4
0 11 083	Wind speed	$km\ h^{-1}$	0	0	9	$km\ h^{-1}$	0	3
0 11 084	Wind speed	kt	0	0	8	kt	0	3
0 11 085	Maximum wind gust speed	$km\ h^{-1}$	0	0	9	$km\ h^{-1}$	0	3
0 11 086	Maximum wind gust speed	kt	0	0	8	kt	0	3
0 11 095	u-component of the model wind vector	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 096	v-component of the model wind vector	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 097	Wind speed from altimeter	$m\ s^{-1}$	2	0	12	$m\ s^{-1}$	2	4
0 11 098	Wind speed from radiometer	$m\ s^{-1}$	2	0	12	$m\ s^{-1}$	2	4

(continued)

(Class 11 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 11 100	Aircraft true airspeed	$m\ s^{-1}$	1	0	12	$m\ s^{-1}$	1	4
0 11 101	Aircraft ground speed u-component	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 102	Aircraft ground speed v-component	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 11 103	Aircraft ground speed w-component	$m\ s^{-1}$	1	–512	10	$m\ s^{-1}$	1	3
0 11 104	Aircraft true heading	degree true	0	0	9	degree true	0	3
0 11 105	EDR algorithm version	Numeric	0	0	6	Numeric	0	2
0 11 106	Running minimum confidence	Numeric	1	0	4	Numeric	1	2
0 11 107	Maximum number bad inputs	Numeric	0	0	5	Numeric	0	2
0 11 108	Peak location	Numeric	1	0	4	Numeric	1	2
0 11 109	Number of good EDR	Numeric	0	0	4	Numeric	0	2

* EDR = Eddy dissipation rate

Notes:

(1) West to east u-components shall be assigned positive values.

(2) South to north v-components shall be assigned positive values.

(3) Upward w-components shall be assigned positive values where units are $m\ s^{-1}$.

(4) Downward w-components shall be assigned positive values where units are $Pa\ s^{-1}$.

(5) Wind reporting standards:

	Speed	*Direction*
No observation	Missing	Missing
Calm	0	0
Normal observation	> 0	1–360°
Speed only	> 0	Missing
Direction only	Missing	1–360°
“Light and variable”	> 0	0

(6) The steadiness factor (descriptor 0 11 019) is the ratio of speed of the monthly mean vector wind to the speed of the monthly mean scalar wind expressed as a percentage. It is reported to the nearest one per cent.

(7) Surface wind direction measured at a station within 1° of the North Pole or within 1° of the South Pole shall be reported in such a way that the azimuth ring shall be aligned with its zero coinciding with the Greenwich 0° meridian.

Class 12 – BUFR/CREX Temperature

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 12 001	Temperature/air temperature	K	1	0	12	°C	1	3
0 12 002	Wet-bulb temperature	K	1	0	12	°C	1	3
0 12 003	Dewpoint temperature	K	1	0	12	°C	1	3
0 12 004	Air temperature at 2 m	K	1	0	12	°C	1	3
0 12 005	Wet-bulb temperature at 2 m	K	1	0	12	°C	1	3
0 12 006	Dewpoint temperature at 2 m	K	1	0	12	°C	1	3
0 12 007	Virtual temperature	K	1	0	12	°C	1	3
0 12 011	Maximum temperature, at height and over period specified	K	1	0	12	°C	1	3
0 12 012	Minimum temperature, at height and over period specified	K	1	0	12	°C	1	3
0 12 013	Ground minimum temperature, past 12 hours	K	1	0	12	°C	1	3
0 12 014	Maximum temperature at 2 m, past 12 hours	K	1	0	12	°C	1	3
0 12 015	Minimum temperature at 2 m, past 12 hours	K	1	0	12	°C	1	3
0 12 016	Maximum temperature at 2 m, past 24 hours	K	1	0	12	°C	1	3
0 12 017	Minimum temperature at 2 m, past 24 hours	K	1	0	12	°C	1	3
0 12 021	Maximum temperature at 2 m	K	2	0	16	°C	2	4
0 12 022	Minimum temperature at 2 m	K	2	0	16	°C	2	4
0 12 023	Temperature	°C	0	–99	8	°C	0	2
0 12 024	Dewpoint temperature	°C	0	–99	8	°C	0	2
0 12 030	Soil temperature	K	1	0	12	°C	1	3
0 12 049	Temperature change over specified period	K	0	–30	6	°C	0	2
0 12 051	Standard deviation temperature	K	1	0	10	°C	1	3
0 12 052	Highest daily mean temperature	K	1	0	12	°C	1	3

(continued)

(Class 12 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 12 053	Lowest daily mean temperature	K	1	0	12	°C	1	3
0 12 061	Skin temperature	K	1	0	12	°C	1	3
0 12 062	Equivalent black body temperature	K	1	0	12	°C	1	3
0 12 063	Brightness temperature	K	1	0	12	°C	1	3
0 12 064	Instrument temperature	K	1	0	12	K	1	4
0 12 065	Standard deviation brightness temperature	K	1	0	12	K	1	4
0 12 066	Antenna temperature	K	2	0	16	°C	2	5
0 12 070	Warm load temperature	K	2	0	16	K	2	5
0 12 071	Coldest cluster temperature	K	1	0	12	K	1	4
0 12 072	Radiance	$W\ m^{-2}\ sr^{-1}$	6	0	31	$W\ m^{-2}\ sr^{-1}$	6	9
0 12 075	Spectral radiance	$W\ m^{-3}\ sr^{-1}$	–3	0	16	$W\ m^{-3}\ sr^{-1}$	–3	5
0 12 076	Radiance (see Note 2)	$W\ m^{-2}\ sr^{-1}$	3	0	16	$W\ m^{-2}\ sr^{-1}$	3	5
0 12 080	Brightness temperature real part	K	2	–10000	16	K	2	5
0 12 081	Brightness temperature imaginary part	K	2	–10000	16	K	2	5
0 12 082	Pixel radiometric accuracy	K	2	0	12	K	2	4
0 12 101	Temperature/air temperature	K	2	0	16	°C	2	4
0 12 102	Wet-bulb temperature	K	2	0	16	°C	2	4
0 12 103	Dewpoint temperature	K	2	0	16	°C	2	4
0 12 104	Air temperature at 2 m	K	2	0	16	°C	2	4
0 12 105	Web-bulb temperature at 2 m	K	2	0	16	°C	2	4
0 12 106	Dewpoint temperature at 2 m	K	2	0	16	°C	2	4
0 12 107	Virtual temperature	K	2	0	16	°C	2	4
0 12 111	Maximum temperature, at height and over period specified	K	2	0	16	°C	2	4
0 12 112	Minimum temperature, at height and over period specified	K	2	0	16	°C	2	4

(continued)

(Class 12 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 12 113	Ground minimum temperature, past 12 hours	K	2	0	16	°C	2	4
0 12 114	Maximum temperature at 2 m, past 12 hours	K	2	0	16	°C	2	4
0 12 115	Minimum temperature at 2 m, past 12 hours	K	2	0	16	°C	2	4
0 12 116	Maximum temperature at 2 m, past 24 hours	K	2	0	16	°C	2	4
0 12 117	Minimum temperature at 2 m, past 24 hours	K	2	0	16	°C	2	4
0 12 118	Maximum temperature at height specified, past 24 hours	K	2	0	16	°C	2	4
0 12 119	Minimum temperature at height specified, past 24 hours	K	2	0	16	°C	2	4
0 12 120	Ground temperature	K	2	0	16	°C	2	4
0 12 121	Ground minimum temperature	K	2	0	16	°C	2	4
0 12 122	Ground minimum temperature of the preceding night	K	2	0	16	°C	2	4
0 12 130	Soil temperature	K	2	0	16	°C	2	4
0 12 131	Snow temperature	K	2	0	16	°C	2	4
0 12 132	Ice surface temperature	K	2	0	16	°C	2	4
0 12 151	Standard deviation of daily mean temperature	K	2	0	12	°C	2	4
0 12 152	Highest daily mean temperature	K	2	0	16	°C	2	4
0 12 153	Lowest daily mean temperature	K	2	0	16	°C	2	4
0 12 158	Noise-equivalent delta temperature while viewing cold target	K	2	0	12	°C	2	4
0 12 159	Noise-equivalent delta temperature while viewing warm target	K	2	0	12	°C	2	4
0 12 161	Skin temperature	K	2	0	16	°C	2	4
0 12 162	Equivalent black body temperature	K	2	0	16	°C	2	4
0 12 163	Brightness temperature	K	2	0	16	°C	2	4
0 12 164	Instrument temperature	K	2	0	16	K	2	5

(continued)

(Class 12 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 12 165	Direct sun brightness temperature	K	0	0	23	K	0	7
0 12 166	Snapshot accuracy	K	1	–4000	13	K	1	4
0 12 167	Radiometric accuracy (pure polarization)	K	1	0	9	K	1	3
0 12 168	Radiometric accuracy (cross polarization)	K	1	0	9	K	1	3
0 12 171	Coldest cluster temperature	K	2	0	16	K	2	5
0 12 180	Averaged 12 micron BT for all clear pixels at nadir	K	2	0	16	K	2	5
0 12 181	Averaged 11 micron BT for all clear pixels at nadir	K	2	0	16	K	2	5
0 12 182	Averaged 3.7 micron BT for all clear pixels at nadir	K	2	0	16	K	2	5
0 12 183	Averaged 12 micron BT for all clear pixels, forward view	K	2	0	16	K	2	5
0 12 184	Averaged 11 micron BT for all clear pixels, forward view	K	2	0	16	K	2	5
0 12 185	Averaged 3.7 micron BT for all clear pixels, forward view	K	2	0	16	K	2	5
0 12 186	Mean nadir sea-surface temperature	K	2	0	16	K	2	5
0 12 187	Mean dual view sea-surface temperature	K	2	0	16	K	2	5
0 12 188	Interpolated 23.8 GHz brightness T from MWR	K	2	0	16	K	2	5
0 12 189	Interpolated 36.5 GHz brightness T from MWR	K	2	0	16	K	2	5

Notes:

(1) Where the expression "at height and over period specified" is entered under element name, an appropriate vertical location shall be specified using descriptors from Class 07, together with an appropriate period using descriptors from Class 04.

(2) Descriptor 0 12 076 should be used instead of descriptor 0 12 072 to encode radiance.

Class 13 – BUFR/CREX Hydrographic and hydrological elements

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 13 001	Specific humidity	$kg\ kg^{-1}$	5	0	14	$kg\ kg^{-1}$	5	5
0 13 002	Mixing ratio	$kg\ kg^{-1}$	5	0	14	$kg\ kg^{-1}$	5	5
0 13 003	Relative humidity	%	0	0	7	%	0	3
0 13 004	Vapour pressure	Pa	–1	0	10	Pa	–1	4
0 13 005	Vapour density	$kg\ m^{-3}$	3	0	7	$kg\ m^{-3}$	3	3
0 13 006	Mixing heights	m	–1	–40	16	m	–1	5
0 13 007	Minimum relative humidity	%	0	0	7	%	0	3
0 13 008	Maximum relative humidity	%	0	0	7	%	0	3
0 13 009	Relative humidity (see Note 6)	%	1	–1000	12	%	1	4
0 13 011	Total precipitation/total water equivalent	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	5
0 13 012	Depth of fresh snow	m	2	–2	12	m	2	4
0 13 013	Total snow depth	m	2	–2	16	m	2	5
0 13 014	Rainfall/water equivalent of snow (averaged rate)	$kg\ m^{-2}\ s^{-1}$	4	0	12	$kg\ m^{-2}\ s^{-1}$	4	4
0 13 015	Snowfall (averaged rate)	$m\ s^{-1}$	7	0	12	$m\ s^{-1}$	7	4
0 13 016	Precipitable water	$kg\ m^{-2}$	0	0	7	$kg\ m^{-2}$	0	3
0 13 019	Total precipitation past 1 hour	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	4
0 13 020	Total precipitation past 3 hours	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	5
0 13 021	Total precipitation past 6 hours	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	5
0 13 022	Total precipitation past 12 hours	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	5
0 13 023	Total precipitation past 24 hours	$kg\ m^{-2}$	1	–1	14	$kg\ m^{-2}$	1	5
0 13 031	Evapotranspiration	$kg\ m^{-2}$	0	0	7	$kg\ m^{-2}$	0	3
0 13 032	Evaporation/evapotranspiration (see Note 5)	$kg\ m^{-2}$	1	0	8	$kg\ m^{-2}$	1	3
0 13 033	Evaporation/evapotranspiration	$kg\ m^{-2}$	1	0	10	$kg\ m^{-2}$	1	4
0 13 038	Superadiabatic indicator	Code table	0	0	2	Code table	0	1

(continued)

(Class 13 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 13 039	Terrain type (ice/snow)	Code table	0	0	3	Code table	0	1
0 13 040	Surface flag	Code table	0	0	4	Code table	0	2
0 13 041	Pasquill-Gifford stability category	Code table	0	0	4	Code table	0	2
0 13 042	Parcel lifted index (to 500 hPa) (see Notes 3 and 4)	K	0	–20	6	K	0	2
0 13 043	Best lifted index (to 500 hPa) (see Notes 3 and 4)	K	0	–20	6	K	0	2
0 13 044	K index	K	0	–30	8	K	0	3
0 13 045	KO index	K	0	–30	8	K	0	3
0 13 046	Maximum buoyancy	K	0	–30	8	K	0	3
0 13 047	Modified Showalter stability index (see Note 7)	K	0	–60	6	°C	0	2
0 13 048	Water fraction	%	1	0	10	%	1	4
0 13 051	Frequency group, precipitation	Code table	0	0	4	Code table	0	2
0 13 052	Highest daily amount of precipitation	kg m^{-2}	1	–1	14	kg m^{-2}	1	5
0 13 055	Intensity of precipitation	kg m^{-2} s^{-1}	4	0	8	mm h^{-1}	1	4
0 13 056	Character and intensity of precipitation	Code table	0	0	4	Code table	0	2
0 13 057	Time of beginning or end of precipitation	Code table	0	0	4	Code table	0	2
0 13 058	Size of precipitating element	m	4	0	7	mm	1	3
0 13 059	Number of flashes (thunderstorm)	Numeric	0	0	7	Numeric	0	3
0 13 060	Total accumulated precipitation	kg m^{-2}	1	–1	17	kg m^{-2}	1	5
0 13 071	Upstream water level	m	2	0	14	m	2	4
0 13 072	Downstream water level	m	2	0	14	m	2	4
0 13 073	Maximum water level	m	2	0	14	m	2	4
0 13 074	Ground water level	m	2	0	18	m	2	6
0 13 080	Water pH	pH unit	1	0	10	pH unit	1	3

(continued)

(Class 13 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 13 081	Water conductivity	$S\ m^{-1}$	3	0	14	$S\ m^{-1}$	3	4
0 13 082	Water temperature	K	1	0	12	K	1	4
0 13 083	Dissolved oxygen	$kg\ m^{-3}$	6	0	15	$kg\ m^{-3}$	6	5
0 13 084	Turbidity	lm	0	0	14	lm	0	4
0 13 085	Oxidation Reduction Potential (ORP)	V	3	0	14	V	3	4
0 13 090	Radiometer water vapour content	$kg\ m^{-2}$	1	0	10	$kg\ m^{-2}$	1	4
0 13 091	Radiometer liquid content	$kg\ m^{-2}$	2	0	8	$kg\ m^{-2}$	2	3
0 13 093	Cloud optical thickness	Numeric	0	0	8	Numeric	0	3
0 13 095	Total column water vapour	$kg\ m^{-2}$	4	0	19	$kg\ m^{-2}$	4	6
0 13 096	MWR water vapour content	$kg\ m^{-2}$	2	0	14	$kg\ m^{-2}$	2	5
0 13 097	MWR liquid water content	$kg\ m^{-2}$	2	0	14	$kg\ m^{-2}$	2	5
0 13 098	Integrated water vapour density	$kg\ m^{-2}$	8	0	30	$kg\ m^{-2}$	8	10
0 13 099	Log_{10} of integrated cloud particle density	$log(m^{-2})$	1	0	7	$log(m^{-2})$	1	3
0 13 100	Log_{10} of integrated cloud particle area	$log(m^{2}\ m^{-2})$	1	–70	7	$log(m^{2}\ m^{-2})$	1	2
0 13 101	Log_{10} of integrated cloud particle volume	$log(m^{3}\ m^{-2})$	1	–140	7	$log(m^{3}\ m^{-2})$	1	3
0 13 110	Mass mixing ratio	%	0	0	7	%	0	3
0 13 111	Soil moisture	$g\ kg^{-1}$	0	0	10	$g\ kg^{-1}$	0	4
0 13 112	Object wetness duration	s	0	0	17	s	0	5
0 13 114	Rate of ice accretion	$kg\ m^{-2}\ h^{-1}$	1	0	11	$kg\ m^{-2}\ h^{-1}$	1	4
0 13 115	Ice thickness (see Note 9)	m	2	0	19	m	2	6
0 13 117	Snow density (liquid water content)	$kg\ m^{-3}$	0	0	10	$kg\ m^{-3}$	0	3

(continued)

(Class 13 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 13 118	Depth of fresh snow (high accuracy) (see Note 10)	m	3	–2	14	m	3	5
0 13 155	Intensity of precipitation (high accuracy) (see Note 8)	kg m^{-2} s^{-1}	5	–1	16	mm h^{-1}	2	5

Notes:

(1) A precipitation value of –0.1 kg m^{-2} before scaling (–1 after scaling or in CREX) shall indicate a "trace" (non-measurable, less than 0.05 kg m^{-2}).

(2) A snow depth value of –0.01 m before scaling (–1 after scaling or in CREX) shall indicate a little (less than 0.005 m) snow. A value of –0.02 m (–2 after scaling or in CREX) shall indicate "snow cover not continuous".

(3) The “parcel lifted index” (as defined in the *International Meteorological Vocabulary* (WMO-No. 182) under the listing “lifted index”) is defined as the temperature difference between the ambient 500-hPa temperature (T500) and that of a parcel of air lifted from the surface (Tparcel) following the dry and moist adiabatic process. Negative values of (T500 – Tparcel) suggest instability. The “best lifted index” is defined as the most unstable of a collection of parcel lifted indices, with parcel initial conditions defined for a collection of 30-hPa thick layers stacked one upon the other with the lowest resting on the ground. Commonly four to six such layers are used in the calculation.

(4) Since the two lifted indices (0 13 042 and 0 13 043) are defined as temperature differences, they may take on negative values, even though the units are kelvin; hence the non-zero reference value.

(5) Descriptor 0 13 033 should be used instead of descriptor 0 13 032 to encode evaporation/evapotranspiration.

(6) Concerning descriptor 0 13 009, the originators of these data want to be able to retain the raw (i.e. unprocessed) relative humidity value reported by the sensor in order to be able to track, among other things, when a sensor begins to malfunction. The latter case is when a negative value might occur. For worldwide exchange with other countries, it is possible that only the processed data would ever be sent.

(7) The “Modified Showalter stability index” is defined as the temperature difference between the ambient 500-hPa temperature and the temperature a parcel of air, initially at a selected base level, would have if brought from its condensation level to the 500-hPa surface by a moist adiabatic process. Positive values denote stable conditions, while negative values denote unstable conditions. The base level is 850 hPa, 800 hPa or 750 hPa if the station elevation is less than 1000, 1000 to 1400 or 1401 to 2000 gpm above mean sea level, respectively.

(8) An intensity of precipitation value of –0.00001 kg m^{-2} s^{-1} before scaling (–1 after scaling) and of –0.01 mm h^{-1} before scaling (–1 after scaling) shall indicate a "trace" in BUFR and in CREX, respectively.

(9) Ice thickness 0 13 115 shall be preceded by 0 08 029 (Surface type) set to 11, 12, 13 or 14 to specify river, lake, sea or glacier, respectively.

(10) Depth of fresh snow (0 13 118) set to –0.001 before scaling (–1 after scaling or in CREX) shall indicate a little snow (less than 0.0005 m). Depth of fresh snow (0 13 118) set to –0.002 before scaling (–2 after scaling or in CREX) shall indicate “snow cover not continuous”.

Class 14 – BUFR/CREX Radiation and radiance

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 14 001	Long-wave radiation, integrated over 24 hours	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 002	Long-wave radiation, integrated over period specified	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 003	Short-wave radiation, integrated over 24 hours	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 004	Short-wave radiation, integrated over period specified	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 011	Net long-wave radiation, integrated over 24 hours	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 012	Net long-wave radiation, integrated over period specified	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 013	Net short-wave radiation, integrated over 24 hours	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 014	Net short-wave radiation, integrated over period specified	$J\ m^{-2}$	–3	–65536	17	$J\ m^{-2}$	–3	5
0 14 015	Net radiation, integrated over 24 hours	$J\ m^{-2}$	–4	–16384	15	$J\ m^{-2}$	–4	5
0 14 016	Net radiation, integrated over period specified	$J\ m^{-2}$	–4	–16384	15	$J\ m^{-2}$	–4	5
0 14 017	Instantaneous long-wave radiation	$W\ m^{-2}$	0	–512	10	$W\ m^{-2}$	0	4
0 14 018	Instantaneous short-wave radiation	$W\ m^{-2}$	0	–2048	12	$W\ m^{-2}$	0	4
0 14 019	Surface albedo	%	0	0	7	%	0	3
0 14 020	Global solar radiation, integrated over 24 hours	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5
0 14 021	Global solar radiation, integrated over period specified	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5
0 14 022	Diffuse solar radiation, integrated over 24 hours	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5

(continued)

(Class 14 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 14 023	Diffuse solar radiation, integrated over period specified	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5
0 14 024	Direct solar radiation, integrated over 24 hours	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5
0 14 025	Direct solar radiation, integrated over period specified	$J\ m^{-2}$	–4	0	15	$J\ m^{-2}$	–4	5
0 14 026	Albedo at the top of clouds	%	0	0	7	%	0	3
0 14 027	Albedo	%	0	0	7	%	0	3
0 14 028	Global solar radiation (high accuracy), integrated over period specified	$J\ m^{-2}$	–2	0	20	$J\ m^{-2}$	–2	6
0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	$J\ m^{-2}$	–2	0	20	$J\ m^{-2}$	–2	6
0 14 030	Direct solar radiation (high accuracy), integrated over period specified	$J\ m^{-2}$	–2	0	20	$J\ m^{-2}$	–2	6
0 14 031	Total sunshine	min	0	0	11	min	0	4
0 14 032	Total sunshine	h	0	0	10	h	0	4
0 14 033	Total sunshine	%	0	0	9	%	0	3
0 14 034	Sunshine over period specified	min	0	0	11	min	0	4
0 14 035	Solar radiation flux	$W\ m^{-2}$	1	0	14	$W\ m^{-2}$	1	5
0 14 042	Bidirectional reflectance	%	0	0	7	%	0	3
0 14 043	Channel radiance	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	4	0	23	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	4	7
0 14 044	Channel radiance	$W\ m^{-2}\ sr^{-1}\ cm$	7	–100000	22	$W\ m^{-2}\ sr^{-1}\ cm$	7	7
0 14 045	Channel radiance (see Note 4)	$W\ m^{-2}\ sr^{-1}\ cm$	0	0	11	$W\ m^{-2}\ sr^{-1}\ cm$	0	4
0 14 046	Scaled IASI radiance (see Note 6)	$W\ m^{-2}\ sr^{-1}\ m$	0	–5000	16	$W\ m^{-2}\ sr^{-1}\ m$	0	5
0 14 047	Scaled mean AVHRR radiance	$W\ m^{-2}\ sr^{-1}\ m$	0	0	31	$W\ m^{-2}\ sr^{-1}\ m$	0	10
0 14 048	Scaled standard deviation AVHRR radiance	$W\ m^{-2}\ sr^{-1}\ m$	0	0	31	$W\ m^{-2}\ sr^{-1}\ m$	0	10

(continued)

(Class 14 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 14 050	Emissivity (see Note 5)	%	1	0	10	%	1	4
0 14 051	Direct solar radiation integrated over last hour	$J\ m^{-2}$	–3	0	14	$J\ m^{-2}$	–3	4
0 14 052	Global upward solar radiation, integrated over period specified	$J\ m^{-2}$	–2	–1048574	20	$J\ m^{-2}$	–2	7
0 14 053	Net radiation (high accuracy), integrated over period specified	$J\ m^{-2}$	–2	–1048574	21	$J\ m^{-2}$	–2	7
0 14 054	Photosynthetically active radiation, integrated over period specified	$J\ m^{-2}$	–3	0	16	$J\ m^{-2}$	–3	5
0 14 055	Solar activity index	Numeric	0	–32768	16	Numeric	0	5
0 14 056	Background luminance	$Cd\ m^{-2}$	0	0	18	$Cd\ m^{-2}$	0	6
0 14 057	Soil heat flux	$J\ m^{-2}$	–2	–1048574	21	$J\ m^{-2}$	–2	7
0 14 072	Global UV irradiation (see Note 8)	$J\ m^{-2}$	0	–4000000	23	$J\ m^{-2}$	0	7

Notes:

(1) Downward radiation shall be assigned positive values.

(2) Upward radiation shall be assigned negative values.

(3) Where the expression “period specified” is entered under element name, an appropriate period shall be specified using descriptors from Class 04.

(4) Channel radiance (0 14 045) uses cm to represent the wave number.

(5) Emissivity is the ratio of the amount of energy emitted from a particular object compared to the amount that would be emitted by a blackbody at the same temperature (i.e. the Planck function). Multiplying by 100 gives a per cent (and provides 2 digits of precision at the same time).

(6) An offset has been introduced for the scaled IASI radiances (0 14 046). This is to accommodate the negative radiances which can be measured at some wave numbers, either due to effects of noise or remaining after apodization. The offset is an order of magnitude larger than the expected maximum negative excursion based on instrument noise, and so would leave sufficient margin. At the same time the dynamic range is not significantly degraded.

(7) Channel radiance (0 14 043) uses μm to represent the wave number.

(8) Global UV irradiation (0 14 072) is UV energy integrated over period specified for spectral band specified. 0 14 072 shall be preceded by a time period descriptor and by 0 02 071 (Spectrographic wavelength) and 0 02 072 (Spectrographic width). For example, if 0 14 072 is used for global UV-B irradiation, 0 02 071 and 0 02 072 shall specify spectral band 280 to 315 nm.

Class 15 – BUFR/CREX Physical/chemical constituents

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 15 001	Total ozone	DU	0	0	10	DU	0	4
0 15 002	Air mass (slant path at 22 km)	Numeric	2	0	10	Numeric	2	3
0 15 003	Measured ozone partial pressure (sounding) (see Note 1)	Pa	4	0	9	nbar	0	3
0 15 004	Ozone sounding correction factor (CF) (see Note 2)	Numeric	3	0	11	Numeric	3	4
0 15 005	Ozone p (see Note 3)	DU	0	0	10	DU	0	3
0 15 008	Significand of volumetric mixing ratio	Numeric	0	0	10	Numeric	0	4
0 15 011	Log_{10} of integrated electron density	log (m^{-2})	3	14000	13	log (m^{-2})	3	4
0 15 012	Total electron count per square metre	m^{-2}	–16	0	6	m^{-2}	–16	2
0 15 015	Maximum image spectral component before normalization	Numeric	0	0	31	Numeric	0	10
0 15 020	Integrated ozone density	kg m^{-2}	8	0	21	kg m^{-2}	8	7
0 15 021	Integrated mass density	kg m^{-2}	11	0	31	kg m^{-2}	11	10
0 15 024	Optical depth	Numeric	4	0	24	Numeric	4	8
0 15 025	Type of pollutant	Code table	0	0	4	Code table	0	2
0 15 026	Concentration of pollutant (mol mol^{-1})	mol mol^{-1}	9	0	9	mol mol^{-1}	9	3
0 15 027	Concentration of pollutant (kg m^{-3})	kg m^{-3}	9	0	10	kg m^{-3}	9	4
0 15 029	Extinction coefficient	m^{-1}	9	0	30	m^{-1}	9	10
0 15 030	Aerosol contamination index (see Note 6)	Numeric	2	–1000	12	Numeric	2	4
0 15 031	Atmospheric path delay in satellite signal	m	4	10000	15	m	4	5
0 15 032	Estimated error in atmospheric path delay	m	4	0	10	m	4	4
0 15 033	Difference in path delays for limb views at extremes of scan	m	5	–10000	15	m	5	5

(continued)

(Class 15 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 15 034	Estimated error in path delay difference	m	5	0	14	m	5	5
0 15 035	Component of zenith path delay due to water vapour	m	4	0	14	m	4	5
0 15 036	Atmospheric refractivity (see Note 5)	N units	3	0	19	N units	3	6
0 15 037	Bending angle	rad	8	–100000	23	rad	8	7
0 15 041	Sulphur dioxide index (see Note 7)	Numeric	2	–1200	14	Numeric	2	4
0 15 042	Reflectance	%	2	0	14	%	2	5
0 15 045	Sulphur dioxide (see Note 8)	DU	2	–2000	15	DU	2	5
0 15 046	Volcano contamination index (see Note 9)	Numeric	2	–1000	11	Numeric	2	4
0 15 049	Aerosol Angstrom wavelength exponent	Numeric	3	–2000	14	Numeric	3	5
0 15 051	Meteorological optical range	m	0	0	18	m	0	6
0 15 052	Log_{10} of number density of aerosol particles with diameter greater than 5 nm	$log(m^{-3})$	1	60	6	$log(m^{-3})$	1	3
0 15 053	Log_{10} of number density of aerosol particles with diameter greater than 14 nm	$log(m^{-3})$	2	600	9	$log(m^{-3})$	2	4
0 15 054	Log_{10} of number density of aerosol particles with diameter between 0.25 and 2.5 µm	$log(m^{-3})$	2	550	9	$log(m^{-3})$	2	4
0 15 055	Non volatile aerosol ratio	Numeric	2	0	7	Numeric	2	3
0 15 062	Aerosol optical thickness	Numeric	3	–1000	14	Numeric	3	5

Notes:

(1) 0 15 003 is partial pressure of ozone, measured at the pressure level identified by 0 07 004.

(2) 0 15 004 (CF) is defined as:

CF = TOI/TOS where TOI is the integrated ozone value obtained "simultaneously to a sounding" from a Dobson or Brewer spectrophotometer at the site or "nearby" and TOS is the total ozone obtained from the sounding. TOS is the sum of the integrated ozone below the lowest pressure level reached by the sounding and the estimate of the amount above. In the absence of any spectrophotometer measurement, CF = Missing value.

(continued)

(Class 15 – continued)

(3) 0 15 005 is the value obtained as the result of the vertical integration of the sounding values (0 15 003) measured below the lowest pressure level reached by the sonde, multiplied by 0 15 004.

(4) DU = Dobson unit.

(5) The refractivity, N, is related to the refractive index, n, by the formula $N = 10^6 (n - 1)$. N is therefore dimensionless but values computed by the formula are by convention described as being in "N units".

(6) For this descriptor, numbers less than –1 indicate a predominance of scattering aerosols, increasing in concentration as the number becomes more negative. Numbers greater than +1 indicate a predominance of absorptive aerosols, increasing in concentration as the number becomes more positive. Numbers between –1 and +1 indicate clouds or noise.

(7) For this descriptor, numbers greater than +6 indicate sulphur dioxide contamination, increasing in intensity as the number becomes more positive. The number is computed from a measurement in Dobson Units, but for a specific temperature and assumed concentration profile that may not be close to the true state of the atmosphere. Because of these deficiencies, it is reported as a numeric index.

(8) For this descriptor, negative values indicate noise, poor calibration or presence of absorbing aerosols. Preserving these values allows for better subsequent estimates of calibration bias.

(9) For this descriptor, the units represent the climatological standard deviation of the tropospheric ozone value for a given latitude. For example, a value of 5.0 indicates a profile with a tropospheric ozone value 5.0 standard deviations larger than the climatological average.

Class 19 – BUFR/CREX Synoptic features

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 19 001	Type of synoptic feature	Code table	0	0	6	Code table	0	2
0 19 002	Effective radius of feature (see Note 1)	m	–2	0	12	m	–2	4
0 19 003	Wind speed threshold (see Note 2)	m s^{-1}	0	0	8	m s^{-1}	0	3
0 19 004	Effective radius with respect to wind speeds above threshold (see Note 2)	m	–2	0	12	m	–2	4
0 19 005	Direction of motion of feature (see Note 3)	degree true	0	0	9	degree true	0	3
0 19 006	Speed of motion of feature (see Note 3)	m s^{-1}	2	0	14	m s^{-1}	2	5
0 19 007	Effective radius of feature	m	–3	0	12	m	–3	4
0 19 008	Vertical extent of circulation	Code table	0	0	3	Code table	0	1
0 19 009	Effective radius with respect to wind speeds above threshold (large storms)	m	–3	0	12	m	–3	4
0 19 010	Method for tracking the centre of synoptic feature	Code table	0	0	4	Code table	0	2
0 19 100	Time interval to calculate the movement of the tropical cyclone	Code table	0	0	4	Code table	0	2
0 19 101	Accuracy of the position of the centre of the tropical cyclone	Code table	0	0	4	Code table	0	2
0 19 102	Shape and definition of the eye of the tropical cyclone	Code table	0	0	3	Code table	0	1
0 19 103	Diameter of major axis of the eye of the tropical cyclone	Code table	0	0	4	Code table	0	2
0 19 104	Change in character of the eye during the 30 minutes	Code table	0	0	4	Code table	0	2
0 19 105	Distance between the end of spiral band and the centre	Code table	0	0	4	Code table	0	2
0 19 106	Identification number of tropical cyclone	Numeric	0	0	7	Numeric	0	3

(continued)

(Class 19 – continued)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 19 107	Time interval over which the movement of the tropical cyclone has been calculated	Code table	0	0	4	Code table	0	2
0 19 108	Accuracy of geographical position of the tropical cyclone	Code table	0	0	3	Code table	0	1
0 19 109	Mean diameter of the overcast cloud of the tropical cyclone	Code table	0	0	4	Code table	0	2
0 19 110	Apparent 24-hour change in intensity of the tropical cyclone	Code table	0	0	4	Code table	0	2
0 19 111	Current Intensity (CI) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0 19 112	Data Tropical (DT) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0 19 113	Cloud pattern type of the DT-number	Code table	0	0	4	Code table	0	2
0 19 114	Model Expected Tropical (MET) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0 19 115	Trend of the past 24-hour change (+: Developed, –: Weakened)	Numeric	1	–30	6	Numeric	1	2
0 19 116	Pattern Tropical (PT) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0 19 117	Cloud picture type of the PT-number	Code table	0	0	3	Code table	0	1
0 19 118	Final Tropical (T) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0 19 119	Type of the final T-number	Code table	0	0	3	Code table	0	1
0 19 150	Typhoon International Common Number (Typhoon Committee)	CCITT IA5	0	0	32	Character	0	4

Notes:

(1) The effective radius of feature shall be defined with respect to the radius of the 1000-hPa isobars at mean sea level.

(2) Maximum wind and effective radius of maximum wind shall be indicated by means of the 0 19 003 and 0 19 004 entries.

(3) For a stationary feature, both 0 19 005 (Direction of motion of feature) and 0 19 006 (Speed of motion of feature) shall be reported as 0.

Class 20 – BUFR/CREX Observed phenomena

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0 20 001	Horizontal visibility	m	–1	0	13	m	–1	4
0 20 002	Vertical visibility	m	–1	0	7	m	–1	3
0 20 003	Present weather (see Note 1)	Code table	0	0	9	Code table	0	3
0 20 004	Past weather (1) (see Note 2)	Code table	0	0	5	Code table	0	2
0 20 005	Past weather (2) (see Note 2)	Code table	0	0	5	Code table	0	2
0 20 006	Flight rules	Code table	0	0	3	Code table	0	1
0 20 008	Cloud distribution for aviation	Code table	0	0	5	Code table	0	2
0 20 009	General weather indicator (TAF/METAR)	Code table	0	0	4	Code table	0	2
0 20 010	Cloud cover (total) (see Note 5)	%	0	0	7	%	0	3
0 20 011	Cloud amount	Code table	0	0	4	Code table	0	2
0 20 012	Cloud type	Code table	0	0	6	Code table	0	2
0 20 013	Height of base of cloud	m	–1	–40	11	m	–1	4
0 20 014	Height of top of cloud	m	–1	–40	11	m	–1	4
0 20 015	Pressure at base of cloud	Pa	–1	0	14	Pa	–1	5
0 20 016	Pressure at top of cloud	Pa	–1	0	14	Pa	–1	5
0 20 017	Cloud top description	Code table	0	0	4	Code table	0	2
0 20 018	Tendency of runway visual range	Code table	0	0	2	Code table	0	1
0 20 019	Significant present or forecast weather (see Note 15)	CCITT IA5	0	0	72	Character	0	9
0 20 020	Significant recent weather phenomena (see Note 15)	CCITT IA5	0	0	32	Character	0	4
0 20 021	Type of precipitation	Flag table	0	0	30	Flag table	0	10
0 20 022	Character of precipitation	Code table	0	0	4	Code table	0	2
0 20 023	Other weather phenomena	Flag table	0	0	18	Flag table	0	6
0 20 024	Intensity of phenomena	Code table	0	0	3	Code table	0	1
0 20 025	Obscuration	Flag table	0	0	21	Flag table	0	7

(continued)

(Class 20 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 20 026	Character of obscuration	Code table	0	0	4	Code table	0	2
0 20 027	Phenomena occurrence	Flag table	0	0	9	Flag table	0	3
0 20 028	Expected change in intensity	Code table	0	0	3	Code table	0	1
0 20 029	Rain flag	Code table	0	0	2	Code table	0	1
0 20 031	Ice deposit (thickness)	m	2	0	7	m	2	3
0 20 032	Rate of ice accretion (estimated)	Code table	0	0	3	Code table	0	1
0 20 033	Cause of ice accretion	Flag table	0	0	4	Flag table	0	2
0 20 034	Sea ice concentration	Code table	0	0	5	Code table	0	2
0 20 035	Amount and type of ice	Code table	0	0	4	Code table	0	2
0 20 036	Ice situation	Code table	0	0	5	Code table	0	2
0 20 037	Ice development	Code table	0	0	5	Code table	0	2
0 20 038	Bearing of ice edge (see Note 3)	degree true	0	0	12	degree true	0	3
0 20 039	Ice distance	m	–1	0	13	m	–1	4
0 20 040	Evolution of drift snow	Code table	0	0	4	Code table	0	2
0 20 041	Airframe icing	Code table	0	0	4	Code table	0	2
0 20 042	Airframe icing present	Code table	0	0	2	Code table	0	1
0 20 043	Peak liquid water content	$kg\ m^{-3}$	4	0	7	$kg\ m^{-3}$	4	2
0 20 044	Average liquid water content	$kg\ m^{-3}$	4	0	7	$kg\ m^{-3}$	4	2
0 20 045	Supercooled large droplet (SLD) conditions	Code table	0	0	2	Code table	0	1
0 20 048	Evolution of feature	Code table	0	0	4	Code table	0	2
0 20 050	Cloud index	Code table	0	0	8	Code table	0	3
0 20 051	Amount of low clouds	%	0	0	7	%	0	3
0 20 052	Amount of middle clouds	%	0	0	7	%	0	3
0 20 053	Amount of high clouds	%	0	0	7	%	0	3

(continued)

(Class 20 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 20 054	True direction from which a phenomenon or clouds are moving or in which they are observed (see Note 17)	degree true	0	0	9	degree true	0	3
0 20 055	State of sky in the tropics	Code table	0	0	4	Code table	0	2
0 20 056	Cloud phase	Code table	0	0	3	Code table	0	1
0 20 058	Visibility seawards from a coastal station	m	–1	0	13	m	–1	4
0 20 059	Minimum horizontal visibility	m	–1	0	9	m	–1	3
0 20 060	Prevailing horizontal visibility (see Note 7)	m	–1	0	10	m	–1	4
0 20 061	Runway visual range (RVR)	m	0	0	12	m	0	4
0 20 062	State of the ground (with or without snow)	Code table	0	0	5	Code table	0	2
0 20 063	Special phenomena	Code table	0	0	10	Code table	0	4
0 20 065	Snow cover (see Note 4)	%	0	0	7	%	0	3
0 20 066	Maximum diameter of hailstones	m	3	0	8	m	3	3
0 20 067	Diameter of deposit	m	3	0	9	m	3	3
0 20 070	Minimum number of atmospherics	Numeric	0	0	7	Numeric	0	3
0 20 071	Accuracy of fix and rate of atmospherics	Code table	0	0	4	Code table	0	2
0 20 081	Cloud amount in segment	%	0	0	7	%	0	3
0 20 082	Amount segment cloud free	%	0	0	7	%	0	3
0 20 083	Amount of segment covered by scene	%	0	0	7	%	0	3
0 20 085	General condition of runway	Code table	0	0	4	Code table	0	1
0 20 086	Runway deposits	Code table	0	0	4	Code table	0	1
0 20 087	Runway contamination	Code table	0	0	4	Code table	0	1
0 20 088	Depth of runway deposits	m	3	0	12	m	0	4

(continued)

(Class 20 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 20 089	Runway friction coefficient	Code table	0	0	7	Code table	0	2
0 20 090	Special clouds	Code table	0	0	4	Code table	0	2
0 20 091	Vertical visibility	ft	–2	0	10	ft	–2	3
0 20 092	Height of base of cloud	ft	–2	0	10	ft	–2	3
0 20 093	Height of inversion	m	–1	0	8	m	–1	3
0 20 095	Ice probability	Numeric	3	0	10	Numeric	3	4
0 20 096	Ice age ("A" parameter)	dB	2	–4096	13	dB	2	4
0 20 101	Locust (acridian) name	Code table	0	0	4	Code table	0	2
0 20 102	Locust (maturity) colour	Code table	0	0	4	Code table	0	2
0 20 103	Stage of development of locusts	Code table	0	0	4	Code table	0	2
0 20 104	Organization state of swarm or band of locusts	Code table	0	0	4	Code table	0	2
0 20 105	Size of swarm or band of locusts and duration of passage of swarm	Code table	0	0	4	Code table	0	2
0 20 106	Locust population density	Code table	0	0	4	Code table	0	2
0 20 107	Direction of movements of locust swarm	Code table	0	0	4	Code table	0	2
0 20 108	Extent of vegetation	Code table	0	0	4	Code table	0	2
0 20 111	x-axis error ellipse major component (see Notes 8 and 9)	m	–1	0	17	m	–1	6
0 20 112	y-axis error ellipse minor component (see Notes 8 and 9)	m	–1	0	17	m	–1	6
0 20 113	z-axis error ellipse component (see Note 9)	m	–1	0	17	m	–1	6
0 20 114	Angle of x-axis in error ellipse (see Note 10)	°	2	–18000	16	°	2	5
0 20 115	Angle of z-axis in error ellipse (see Note 11)	°	2	–18000	16	°	2	5

(continued)

(Class 20 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 20 116	Emission height of cloud stroke	m	0	0	16	m	0	5
0 20 117	Amplitude of lightning strike	A	–1	–32000	16	A	–1	5
0 20 118	Lightning detection error	m	0	0	19	m	0	6
0 20 119	Lightning discharge polarity	Code table	0	0	2	Code table	0	1
0 20 121	Threshold value for polarity decision (see Note 12)	V	3	0	16	V	3	5
0 20 122	Threshold value for polarity decision (see Note 13)	A	0	0	16	A	0	5
0 20 123	Minimum threshold for detection (see Note 14)	V m^{-1}	3	0	16	V m^{-1}	3	5
0 20 124	Lightning stroke or flash	Code table	0	0	2	Code table	0	1
0 20 126	Lightning rate of discharge	h^{-1}	0	0	23	h^{-1}	0	7
0 20 127	Lightning – distance from station	m	–3	0	8	m	–3	3
0 20 128	Lightning – direction from station	degree true	1	0	12	degree true	1	4
0 20 130	Cloud hydrometeor concentration (see Note 16)	Numeric	0	0	10	Numeric	0	3
0 20 131	Effective radius of cloud hydrometeors	m	5	0	6	m	5	2
0 20 132	Cloud liquid water content	kg m^{-3}	5	0	11	kg m^{-3}	5	4
0 20 133	Hydrometeor radius	m	5	0	6	m	5	2
0 20 135	Ice mass (on a rod)	kg m^{-1}	1	0	10	kg m^{-1}	1	3
0 20 136	Supplementary cloud type	Code table	0	0	9	Code table	0	3
0 20 137	Evolution of clouds	Code table	0	0	4	Code table	0	2

Notes:

(1) When encoding present weather reported from an automatic weather station, the appropriate combination of descriptors 0 20 021, 0 20 022, 0 20 023, 0 20 024, 0 20 025, 0 20 026 and 0 20 027 should be used and preferred. Descriptor 0 20 003 should be used only when descriptors mentioned above are not applicable.

(continued)

(Class 20 – continued)

(2) When encoding past weather reported from an automatic weather station, the appropriate combination of descriptors 0 20 021, 0 20 022, 0 20 023, 0 20 024, 0 20 025, 0 20 026 and 0 20 027 should be used and preferred. Descriptors 0 20 004 or 0 20 005 should be used only when descriptors mentioned above are not applicable.

(3) The data width for descriptor 0 20 038 originally defined to be 12 is wrong. 9 bits are sufficient as for all the other “degree true” quantities. However, the 12-bit width is maintained for historical consistency. Also: A bearing of ice edge value 0 shall indicate “Ship in shore or flaw lead”.

(4) Snow cover will be reported for each satellite pixel as a percentage of coverage of the pixel. It does not seem feasible to try to use existing descriptor 0 20 062 for such a purpose because the use of that descriptor additionally implies details on, e.g. snow drifts, wet compared to dry snow that a satellite obviously cannot accurately detect.

(5) A cloud cover (total) value 113 shall indicate “Sky obscured by fog and/or other meteorological phenomena".

(6) When encoding height of cloud base between 20 050 and 21 000 m, 0 20 013 shall be set to 20 050; when encoding height of cloud base above 21 000 m, 0 20 013 shall be set to 20 060.

(7) A prevailing visibility value of 10 000 m before scaling (after scaling 1000) shall be used to report prevailing visibility 10 km or more.

(8) If x=y then it is a radial error, and the angle (see 0 20 114) will be zero.

(9) If x=y=z then it is a spherical error, and the angle (see 0 20 115) will be zero.

(10) Angle of the error defined by 0 20 113 and 0 20 114. Cartesian with sign bit.

(11) Angle of the error defined by 0 20 112, 0 20 113 and 0 20 114. Cartesian with sign bit.

(12) 0 20 121 used in combination with 0 25 035, or all zero if not defined. Typically +1.000 V.

(13) 0 20 122 used in combination with 0 25 035, or all zero if not defined. Typically +2000 A.

(14) Minimum signal level acceptable for processing, e.g. 0.005 V or 5 mV, or typically just above the noise floor of the detector.

(15) 0 20 019 (Significant present or forecast weather) and 0 20 020 (Significant recent weather phenomena) shall be used in accordance with Code table 4678 (Reference: *Manual on Codes* (WMO-No. 306), Volume I.1).

(16) Cloud hydrometeor concentration 0 20 130 represents the number of hydrometeors in 1 dm^3.

(17) 0 20 054 (True direction of a phenomenon or clouds) shall be used to indicate true direction from which a phenomenon or clouds are moving or in which they are observed. 0 20 054 value 0 shall indicate "stationary or no clouds" or "observed at the station", whereas value 500 shall indicate "observed in all directions" and value 501 shall indicate "unknown or clouds invisible".

Class 21 – BUFR/CREX Radar data

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 001	Horizontal reflectivity	dB	0	–64	7	dB	0	3
0 21 002	Vertical reflectivity	dB	0	–64	7	dB	0	3
0 21 003	Differential reflectivity	dB	1	–5	7	dB	1	3
0 21 005	Linear depolarization ratio	dB	0	–65	6	dB	0	2
0 21 006	Circular depolarization ratio	dB	0	–65	6	dB	0	2
0 21 011	Doppler mean velocity in x-direction	$m\ s^{-1}$	0	–128	8	$m\ s^{-1}$	0	3
0 21 012	Doppler mean velocity in y-direction	$m\ s^{-1}$	0	–128	8	$m\ s^{-1}$	0	3
0 21 013	Doppler mean velocity in z-direction	$m\ s^{-1}$	0	–128	8	$m\ s^{-1}$	0	3
0 21 014	Doppler mean velocity (radial)	$m\ s^{-1}$	1	–4096	13	$m\ s^{-1}$	1	4
0 21 017	Doppler velocity spectral width	$m\ s^{-1}$	1	0	8	$m\ s^{-1}$	1	3
0 21 018	Extended NYQUIST velocity	$m\ s^{-1}$	1	0	10	$m\ s^{-1}$	1	4
0 21 019	High NYQUIST velocity	$m\ s^{-1}$	1	0	10	$m\ s^{-1}$	1	3
0 21 021	Echo tops	m	–3	0	4	m	–3	2
0 21 022	Range bin offset	m	1	0	14	m	1	5
0 21 023	Range bin size	m	0	0	14	m	0	5
0 21 024	Azimuth offset	°	1	0	12	°	1	4
0 21 025	Azimuthal resolution	°	1	0	8	°	1	3
0 21 030	Signal to noise ratio	dB	0	–32	8	dB	0	3
0 21 031	Vertically integrated liquid-water content	$kg\ m^{-2}$	0	0	7	$kg\ m^{-2}$	0	3
0 21 036	Radar rainfall intensity	$m\ s^{-1}$	7	0	12	$m\ s^{-1}$	7	4
0 21 041	Bright-band height	m	–2	0	8	m	–2	3
0 21 051	Signal power above 1 mW	dB	0	–256	8	dB	0	3
0 21 062	Backscatter	dB	2	–5000	13	dB	2	4
0 21 063	Radiometric resolution (noise value)	%	1	0	10	%	1	4

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 064	Clutter noise estimate	Numeric	0	0	8	Numeric	0	3
0 21 065	Missing packet counter	Numeric	0	–127	8	Numeric	0	3
0 21 066	Wave scatterometer product confidence data	Flag table	0	0	12	Flag table	0	4
0 21 067	Wind product confidence data	Flag table	0	0	13	Flag table	0	5
0 21 068	Radar altimeter product confidence data	Flag table	0	0	8	Flag table	0	3
0 21 069	SST product confidence data	Flag table	0	0	10	Flag table	0	4
0 21 070	SST product confidence data (SADIST-2)	Flag table	0	0	23	Flag table	0	6
0 21 071	Peakiness	Numeric	0	0	16	Numeric	0	5
0 21 072	Satellite altimeter calibration status	Flag table	0	0	4	Flag table	0	2
0 21 073	Satellite altimeter instrument mode	Flag table	0	0	9	Flag table	0	3
0 21 075	Image spectrum intensity	Numeric	0	0	8	Numeric	0	3
0 21 076	Representation of intensities	Code table	0	0	3	Code table	0	1
0 21 077	Altitude correction (ionosphere)	m	3	0	14	m	3	5
0 21 078	Altitude correction (dry troposphere)	m	3	0	9	m	3	3
0 21 079	Altitude correction (wet troposphere)	m	3	2000	10	m	3	4
0 21 080	Altitude correction (calibration constant)	m	3	0	11	m	3	4
0 21 081	Open loop correction (height-time loop)	m	3	0	10	m	3	4
0 21 082	Open loop correction (auto gain control)	dB	3	–3000	14	dB	3	5
0 21 083	Warm target calibration	Numeric	0	0	16	Numeric	0	5
0 21 084	Cold target calibration	Numeric	0	0	16	Numeric	0	5

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 085	ATSR sea-surface temperature across-track band number	Numeric	0	0	4	Numeric	0	2
0 21 086	Number of pixels in nadir only, average	Numeric	0	0	9	Numeric	0	3
0 21 087	Number of pixels in dual view, average	Numeric	0	0	9	Numeric	0	3
0 21 088	Wet backscatter	dB	2	–5000	13	dB	2	4
0 21 091	Radar signal Doppler spectrum 0th moment	dB	0	–100	8	dB	0	3
0 21 092	RASS signal Doppler spectrum 0th moment, referring to RASS signal	dB	0	–100	8	dB	0	3
0 21 093	Ku band peakiness	Numeric	3	0	16	Numeric	3	5
0 21 094	S band peakiness	Numeric	3	0	16	Numeric	3	5
0 21 101	Number of vector ambiguities	Numeric	0	0	3	Numeric	0	1
0 21 102	Index of selected wind vector	Numeric	0	0	3	Numeric	0	1
0 21 103	Total number of sigma-0 measurements	Numeric	0	0	5	Numeric	0	2
0 21 104	Likelihood computed for solution	Numeric	3	–30000	15	Numeric	3	5
0 21 105	Normalized radar cross-section	dB	2	–10000	14	dB	2	5
0 21 106	Kp variance coefficient (alpha)	Numeric	3	0	14	Numeric	3	5
0 21 107	Kp variance coefficient (beta)	Numeric	8	0	16	Numeric	8	5
0 21 109	SEAWINDS wind vector cell quality	Flag table	0	0	17	Flag table	0	6
0 21 110	Number of inner-beam sigma-0 (forward of satellite)	Numeric	0	0	6	Numeric	0	2
0 21 111	Number of outer-beam sigma-0 (forward of satellite)	Numeric	0	0	6	Numeric	0	2
0 21 112	Number of inner-beam sigma-0 (aft of satellite)	Numeric	0	0	6	Numeric	0	2

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 113	Number of outer-beam sigma-0 (aft of satellite)	Numeric	0	0	6	Numeric	0	2
0 21 114	Kp variance coefficient (gamma)	dB	3	–140000	18	dB	3	6
0 21 115	SEAWINDS sigma-0 quality	Flag table	0	0	17	Flag table	0	6
0 21 116	SEAWINDS sigma-0 mode	Flag table	0	0	17	Flag table	0	6
0 21 117	Sigma-0 variance quality control	Numeric	2	0	16	Numeric	2	5
0 21 118	Attenuation correction on sigma-0	dB	2	–10000	14	dB	2	5
0 21 119	Wind scatterometer geophysical model function	Code table	0	0	6	Code table	0	2
0 21 120	Probability of rain	Numeric	3	0	10	Numeric	3	4
0 21 121	SEAWINDS NOF* rain index	Numeric	0	0	8	Numeric	0	3
0 21 122	Attenuation correction on sigma-0 (from tB)	dB	2	–10000	14	dB	2	5
0 21 123	SEAWINDS normalized radar cross-section	dB	2	–30000	15	dB	2	5
0 21 128	Number of valid points per second used to derive previous parameters	Numeric	0	0	8	Numeric	0	3
0 21 130	Spectrum total energy	Numeric	6	0	28	Numeric	6	9
0 21 131	Spectrum max energy	Numeric	6	0	28	Numeric	6	9
0 21 132	Direction of spectrum max on higher resolution grid	°	3	0	19	°	3	6
0 21 133	Wavelength of spectrum max on higher resolution grid	m	3	0	29	m	3	9
0 21 134	Range resolution of cress covariance spectrum	rad m^{-1}	3	0	19	rad m^{-1}	3	6
0 21 135	Real part of cross spectra polar grid number of bins	Numeric	3	–524288	20	Numeric	3	7

* NOF = Normalized objective function

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 136	Imaginary part of cross spectra polar grid number of bins	Numeric	3	–524288	20	Numeric	3	7
0 21 137	Ku band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 138	Std Ku band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 139	Ku band net instrumental correction for AGC	dB	2	–2048	12	dB	2	4
0 21 140	S band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 141	Std S band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 142	S band net instrumental correction for AGC	dB	2	–1024	11	dB	2	4
0 21 143	Ku band rain attenuation	dB	2	–1073741824	31	dB	2	10
0 21 144	Altimeter rain flag	Flag table	0	0	2	Flag table	0	1
0 21 145	Ku band automatic gain control	dB	2	0	13	dB	2	4
0 21 146	RMS Ku band automatic gain control	dB	2	0	8	dB	2	3
0 21 147	Number of valid points for Ku band automatic gain control	Numeric	0	0	5	Numeric	0	2
0 21 150	Beam collocation	Code table	0	0	2	Code table	0	1
0 21 151	Estimated error in sigma-0 at 40 degrees incidence angle	dB	2	0	9	dB	2	3
0 21 152	Slope at 40 degrees incidence angle	dB $degree^{-1}$	2	–80	7	dB $degree^{-1}$	2	2
0 21 153	Estimated error in slope at 40 degrees incidence angle	dB $degree^{-1}$	2	–40	6	dB $degree^{-1}$	2	2
0 21 154	Soil moisture sensitivity	dB	2	0	12	dB	2	4
0 21 155	Wind vector cell quality	Flag table	0	0	24	Flag table	0	8

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 156	Backscatter distance	Numeric	1	–4096	13	Numeric	1	4
0 21 157	Loss per unit length of atmosphere used	dB m^{-1}	10	0	22	dB m^{-1}	10	7
0 21 158	ASCAT Kp estimate quality	Code table	0	0	2	Code table	0	1
0 21 159	ASCAT sigma-0 usability	Code table	0	0	2	Code table	0	1
0 21 160	ASCAT use of synthetic data	Numeric	3	0	10	Numeric	3	4
0 21 161	ASCAT synthetic data quantity	Numeric	3	0	10	Numeric	3	4
0 21 162	ASCAT satellite orbit and attitude quality	Numeric	3	0	10	Numeric	3	4
0 21 163	ASCAT solar array reflection contamination	Numeric	3	0	10	Numeric	3	4
0 21 164	ASCAT telemetry presence and quality	Numeric	3	0	10	Numeric	3	4
0 21 165	ASCAT extrapolated reference function presence	Numeric	3	0	10	Numeric	3	4
0 21 166	Land fraction	Numeric	3	0	10	Numeric	3	4
0 21 169	Ice presence indicator	Code table	0	0	2	Code table	0	1
0 21 170	C band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 171	RMS C band corrected ocean backscatter coefficient	dB	2	–32768	16	dB	2	5
0 21 172	C band net instrumental correction for AGC	dB	2	–2048	12	dB	2	4
0 21 173	C band automatic gain control	dB	2	0	13	dB	2	4
0 21 174	RMS C band automatic gain control	dB	2	0	9	dB	2	3
0 21 175	Number of valid points for C band automatic gain control	Numeric	0	0	10	Numeric	0	4

(continued)

(Class 21 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 176	High frequency variability correction	m	3	0	16	m	3	5
0 21 177	Corrected OCOG* backscatter coefficient	dB	2	0	16	dB	2	5
0 21 178	STD of 20 Hz OCOG backscatter coefficient	dB	2	0	16	dB	2	5
0 21 179	Number of 20 Hz valid points for OCOG backscatter coefficient	Numeric	0	0	16	Numeric	0	5
0 21 180	Number of 20 Hz valid points for ocean backscatter coefficient	Numeric	0	0	8	Numeric	0	3
0 21 181	20 Hz ocean backscatter coefficient	dB	2	0	16	dB	2	5
0 21 182	20 Hz Ku band peakiness	Numeric	3	0	16	Numeric	3	5

* OCOG = Offset centre of gravity

Class 22 – BUFR/CREX Oceanographic elements

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 001	Direction of waves	degree true	0	0	9	degree true	0	3
0 22 002	Direction of wind waves	degree true	0	0	9	degree true	0	3
0 22 003	Direction of swell waves	degree true	0	0	9	degree true	0	3
0 22 004	Direction of current (see Note 7)	degree true	0	0	9	degree true	0	3
0 22 005	Direction of sea-surface current	degree true	0	0	9	degree true	0	3
0 22 011	Period of waves	s	0	0	6	s	0	2
0 22 012	Period of wind waves	s	0	0	6	s	0	2
0 22 013	Period of swell waves	s	0	0	6	s	0	2
0 22 021	Height of waves	m	1	0	10	m	1	4
0 22 022	Height of wind waves	m	1	0	10	m	1	4
0 22 023	Height of swell waves	m	1	0	10	m	1	4
0 22 025	Standard deviation wave height	m	2	0	10	m	2	4
0 22 026	Standard deviation of significant wave height	m	2	0	10	m	2	4
0 22 031	Speed of current	$m\ s^{-1}$	2	0	13	$m\ s^{-1}$	2	4
0 22 032	Speed of sea-surface current	$m\ s^{-1}$	2	0	13	$m\ s^{-1}$	2	4
0 22 035	Tidal elevation with respect to local chart datum	m	2	0	14	m	2	4
0 22 036	Meteorological residual tidal elevation (surge or offset)	m	2	0	14	m	2	4
0 22 037	Tidal elevation with respect to national land datum	m	3	–10000	15	m	3	5
0 22 038	Tidal elevation with respect to local chart datum	m	3	–10000	15	m	3	5
0 22 039	Meteorological residual tidal elevation (surge or offset) (see Note 4)	m	3	–5000	13	m	3	4

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 040	Meteorological residual tidal elevation (surge or offset) (see Note 4)	m	3	–5000	14	m	3	5
0 22 041	Sea-surface temperature (15-day running mean)	K	1	0	12	K	1	4
0 22 042	Sea/water temperature	K	1	0	12	K	1	4
0 22 043	Sea/water temperature	K	2	0	15	K	2	5
0 22 044	Sound velocity	$m\ s^{-1}$	1	0	14	$m\ s^{-1}$	1	5
0 22 045	Sea/water temperature	K	3	0	19	K	3	6
0 22 046	Sea ice fraction	Numeric	2	0	7	Numeric	2	3
0 22 049	Sea-surface temperature	K	2	0	15	K	2	5
0 22 050	Standard deviation sea-surface temperature	K	2	0	8	K	2	3
0 22 055	Float cycle number	Numeric	0	0	10	Numeric	0	3
0 22 056	Direction of profile	Code table	0	0	2	Code table	0	1
0 22 059	Sea-surface salinity	‰	2	0	14	‰	2	5
0 22 060	Lagrangian drifter drogue status	Code table	0	0	3	Code table	0	1
0 22 061	State of the sea	Code table	0	0	4	Code table	0	2
0 22 062	Salinity	‰	2	0	14	‰	2	5
0 22 063	Total water depth	m	0	0	14	m	0	5
0 22 064	Salinity	‰	3	0	17	‰	3	6
0 22 065	Water pressure	Pa	–3	0	17	Pa	–3	6
0 22 066	Water conductivity	$S\ m^{-1}$	6	0	26	$S\ m^{-1}$	6	8
0 22 067	Instrument type for water temperature profile measurement	Code table	0	0	10	Code table	0	4
0 22 068	Water temperature profile recorder types	Code table	0	0	7	Code table	0	3
0 22 069	Spectral wave density	$m^2\ Hz^{-1}$	3	0	22	$m^2\ Hz^{-1}$	3	7

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 070	Significant wave height	m	2	0	13	m	2	4
0 22 071	Spectral peak wave period	s	1	0	9	s	1	3
0 22 072	Spectral peak wave length	m	0	0	13	m	0	4
0 22 073	Maximum wave height	m	2	0	13	m	2	4
0 22 074	Average wave period	s	1	0	9	s	1	3
0 22 075	Average wave length	m	0	0	13	m	0	4
0 22 076	Direction from which dominant waves are coming	degree true	0	0	9	degree true	0	3
0 22 077	Directional spread of dominant wave	°	0	0	9	°	0	3
0 22 078	Duration of wave record	s	0	0	12	s	0	4
0 22 079	Length of wave record	m	0	0	16	m	0	5
0 22 080	Waveband central frequency	Hz	3	0	10	Hz	3	4
0 22 081	Waveband central wave number	m^{-1}	5	0	13	m^{-1}	5	4
0 22 082	Maximum non-directional spectral wave density	m^2 s	2	0	20	m^2 s	2	7
0 22 083	Maximum non-directional spectral wave number	m^3	2	0	20	m^3	2	7
0 22 084	Band containing maximum non-directional spectral wave density	Numeric	0	0	7	Numeric	0	3
0 22 085	Spectral wave density ratio	Numeric	0	0	7	Numeric	0	3
0 22 086	Mean direction from which waves are coming	degree true	0	0	9	degree true	0	3
0 22 087	Principal direction from which waves are coming	degree true	0	0	9	degree true	0	3
0 22 088	First normalized polar coordinate from Fourier coefficients	Numeric	2	0	7	Numeric	2	3
0 22 089	Second normalized polar coordinate from Fourier coefficients	Numeric	2	0	7	Numeric	2	3

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 090	Non-directional spectral estimate by wave frequency	m^2 s	2	0	20	m^2 s	2	7
0 22 091	Non-directional spectral estimate by wave number	m^3	2	0	20	m^3	2	7
0 22 092	Directional spectral estimate by wave frequency	m^2 rad^{-1} s	2	0	20	m^2 rad^{-1} s	2	7
0 22 093	Directional spectral estimate by wave number	m^4	2	0	20	m^4	2	7
0 22 094	Total number of wave bands	Numeric	0	0	7	Numeric	0	3
0 22 095	Directional spread of individual waves	°	0	0	8	°	0	3
0 22 096	Spectral band width	s^{-1}	3	0	4	s^{-1}	3	2
0 22 097	Mean wavelength > 731 m of image spectrum at low wave numbers	m	0	0	14	m	0	5
0 22 098	Wavelength spread (wavelength > 731 m) at low wave numbers	m	0	0	14	m	0	5
0 22 099	Mean direction at low wave numbers (wavelength > 731 m)	degree true	0	0	9	degree true	0	3
0 22 100	Direction spread at low wave numbers (wavelength > 731 m)	°	0	0	9	°	0	3
0 22 101	Total energy (wavelength > 731m) at low wave numbers	Numeric	0	0	31	Numeric	0	10
0 22 120	Tide station automated water level check	Code table	0	0	5	Code table	0	2
0 22 121	Tide station manual water level check	Code table	0	0	5	Code table	0	2
0 22 122	Tide station automated meteorological data check	Code table	0	0	5	Code table	0	2
0 22 123	Tide station manual meteorological data check	Code table	0	0	5	Code table	0	2

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 141	Sea-surface temperature (15-day running mean)	K	2	0	15	K	2	5
0 22 142	Square of significant wave height	m^2	3	–33554432	26	m^2	3	8
0 22 143	STD of 20 Hz SWH squared	m^2	3	–8388608	24	m^2	3	8
0 22 144	Number of 20 Hz valid points for SWH squared	Numeric	0	0	9	Numeric	0	3
0 22 145	STD of 20 Hz ocean range	m	3	–33554432	31	m	3	10
0 22 146	OCOG range	m	3	0	31	m	3	10
0 22 147	STD of 20 Hz OCOG range	m	3	–8388608	31	m	3	10
0 22 148	Number of 20 Hz valid points for ocean range	Numeric	0	0	9	Numeric	0	3
0 22 149	20 Hz significant wave height squared	m^2	3	–33554432	26	m^2	3	8
0 22 150	Number of 18 Hz valid points for Ku band	Numeric	0	0	10	Numeric	0	4
0 22 151	Ku band ocean range	m	3	0	31	m	3	10
0 22 152	STD of 18 Hz Ku band ocean range	m	3	0	16	m	3	5
0 22 153	Number of 18 Hz valid points for S band	Numeric	0	0	10	Numeric	0	4
0 22 154	S band ocean range	m	3	0	31	m	3	10
0 22 155	STD of 18 Hz S band ocean range	m	3	0	16	m	3	5
0 22 156	Ku band significant wave height	m	3	0	16	m	3	5
0 22 157	STD of 18 Hz Ku band ocean range	m	3	0	16	m	3	5
0 22 158	S band significant wave height	m	3	0	16	m	3	5
0 22 159	STD of 18 Hz S band significant wave height	m	3	0	16	m	3	5
0 22 160	Normalized inverse wave age	Numeric	6	0	21	Numeric	6	7
0 22 161	Wave spectra	m^4	4	0	27	m^4	4	9

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 162	RMS of 20 Hz Ku band ocean range	m	3	0	16	m	3	5
0 22 163	Number of 20Hz valid points for Ku band	Numeric	0	0	10	Numeric	0	4
0 22 164	RMS 20 Hz Ku band significant wave height	m	3	0	16	m	3	5
0 22 165	Number of 20 Hz valid points for Ku band significant wave height	Numeric	0	0	10	Numeric	0	4
0 22 166	Ku band net instrumental correction for significant wave height	m	3	–1000	11	m	3	4
0 22 167	Number of valid points for Ku band backscatter	Numeric	0	0	10	Numeric	0	4
0 22 168	C band ocean range	m	3	0	31	m	3	10
0 22 169	RMS of C band ocean range	m	3	0	16	m	3	5
0 22 170	Number of 20 Hz valid points for C band	Numeric	0	0	10	Numeric	0	4
0 22 171	C band significant wave height	m	3	0	16	m	3	5
0 22 172	RMS 20 Hz C band significant wave height	m	3	0	16	m	3	5
0 22 173	Number of 20 Hz valid points for C band significant wave height	Numeric	0	0	10	Numeric	0	4
0 22 174	C band net instrumental correction for significant wave height	m	3	–1000	11	m	3	4
0 22 175	Number of valid points for C band backscatter	Numeric	0	0	10	Numeric	0	4
0 22 177	Height of XBT/XCTD launcher	m	0	0	6	m	0	3
0 22 178	XBT/XCTD launcher type	Code table	0	0	8	Code table	0	3
0 22 182	Water column height (see Note 9)	m	3	0	23	m	3	7

(continued)

(Class 22 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 184	Water column height deviation from the reference value	m	3	–2000	12	m	3	4
0 22 185	BPR transmission count	Numeric	0	0	10	Numeric	0	3

Notes:

(1) The significant wave height is defined as four times the square root of the energy spectrum integrated over direction and frequency. It corresponds to about the height that one third of all waves exceed.

(2) The dominant wave is the one that has the maximum energy in the energy spectrum.

(3) Mean wave direction is the angle alpha 1 and principal wave direction is the angle alpha 2, in the expression S(f, alpha) approximately equals:

c_{11} × (0.5 + r_1 × cos (alpha – alpha 1) + r_2 × cos (2 (alpha – alpha 2))) / pi

in which S(f, alpha) is the wave directional spectrum and c_{11} is the non-directional spectrum, and the right hand side of this expression is the first two terms of the Fourier series expansion of S(f, alpha). If the mean and principal directions differ significantly (e.g. more than 15 degrees) for a given frequency, crossing seas are indicated.

(4) Descriptor 0 22 040 should be used instead of 0 22 039 for encoding meteorological residual tidal elevation (surge or offset).

(5) Additional information:

0 22 097 nominal input range 0 – 10000

0 22 098 nominal input range 0 – 10000

0 22 099 nominal input range 0 – 359

0 22 100 nominal input range 0 – 359

0 22 101 nominal input range 0 – 2 x 10^6, but may be greater because of uncertainty.

(6) Descriptors 0 22 001, 0 22 002, 0 22 003: the direction given in these entries is the direction which waves are coming from.

(7) Descriptor 0 22 004: the direction given in this entry is the direction towards which current is flowing.

(continued)

(Class 22 – continued)

(8) Wind waves and waves reporting standards:

Observation	Speed	Direction
No observation	Missing	Missing
Calm	0	0
Normal observation	>0	1–360
Speed only	>0	Missing
Direction only	Missing	1–360
"Light and variable"	>0	0

(9) The maximum deployment depth of deep-ocean tsunameters such as the PMEL Deep-Ocean Assessment and Reporting of Tsunamis (DART II) is about 6 000 m.

Class 23 – BUFR/CREX Dispersal and transport

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 23 001	Accident early notification – article applicable	Code table	0	0	3	Code table	0	1
0 23 002	Activity or facility involved in incident	Code table	0	0	5	Code table	0	2
0 23 003	Type of release	Code table	0	0	3	Code table	0	1
0 23 004	Countermeasures taken near border	Code table	0	0	3	Code table	0	1
0 23 005	Cause of incident	Code table	0	0	2	Code table	0	1
0 23 006	Incident situation	Code table	0	0	3	Code table	0	1
0 23 007	Characteristics of release	Code table	0	0	3	Code table	0	1
0 23 008	State of current release	Code table	0	0	2	Code table	0	1
0 23 009	State of expected release	Code table	0	0	2	Code table	0	1
0 23 016	Possibility of significant chemical toxic health effect	Code table	0	0	2	Code table	0	1
0 23 017	Flow discharge of major recipient	$m^3 s^{-1}$	6	0	20	$m^3 s^{-1}$	6	7
0 23 018	Release behaviour over time	Code table	0	0	3	Code table	0	1
0 23 019	Actual release height	m	0	–15000	17	m	0	6
0 23 021	Effective release height	m	0	–15000	17	m	0	6
0 23 022	Distance of release point or site of incident	m	0	0	24	m	0	8
0 23 023	Main transport speed in the atmosphere	$m s^{-1}$	1	0	12	$m s^{-1}$	1	4
0 23 024	Main transport speed in water	$m s^{-1}$	2	0	13	$m s^{-1}$	2	4
0 23 025	Main transport speed in ground water	$m s^{-1}$	2	0	13	$m s^{-1}$	2	4
0 23 027	Main transport direction in the atmosphere	degree true	0	0	9	degree true	0	3
0 23 028	Main transport direction in water	degree true	0	0	9	degree true	0	3
0 23 029	Main transport direction in ground water	degree true	0	0	9	degree true	0	3

(continued)

(Class 23 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 23 031	Possibility that plume will encounter precipitation in State in which incident occurred	Code table	0	0	2	Code table	0	1
0 23 032	Plume will encounter change in wind direction and/or speed flag	Code table	0	0	2	Code table	0	1
0 23 040	Flow discharge – river	$m^3 s^{-1}$	1	0	22	$m^3 s^{-1}$	1	7
0 23 041	Flow discharge – well	$m^3 s^{-1}$	3	0	16	$m^3 s^{-1}$	3	5

Class 24 – BUFR/CREX Radiological elements

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 24 001	Estimate of amount of radioactivity released up to specified time	Bq	–11	0	28	Bq	–11	9
0 24 002	Estimated maximum potential release	Bq	–11	0	28	Bq	–11	9
0 24 003	Composition of release	Code table	0	0	5	Code table	0	2
0 24 004	Element name	CCITT IA5	0	0	16	Character	0	2
0 24 005	Isotope mass	Numeric	0	0	9	Numeric	0	3
0 24 011	Dose	mSv*	2	0	32	mSv*	2	10
0 24 012	Trajectory dose (defined location and expected time of arrival)	mSv	2	0	32	mSv	2	10
0 24 013	Gamma dose in air along the main transport path (defined location and time period)	mSv	2	0	32	mSv	2	10
0 24 014	Gamma radiation dose rate (see Note 2)	nSv h^{-1}	1	0	14	nSv h^{-1}	1	4
0 24 021	Air concentration (of named isotope type including gross beta)	Bq m^{-3}	2	0	32	Bq m^{-3}	2	10
0 24 022	Concentration in precipitation (of named isotope type)	Bq l^{-1}	2	0	32	Bq l^{-1}	2	10
0 24 023	Pulse rate of beta radiation	s^{-1}	1	0	14	s^{-1}	1	4
0 24 024	Pulse rate of gamma radiation	s^{-1}	1	0	14	s^{-1}	1	4

* millisievert

Notes:

(1) Useful ranges used above:
10^{11} Bq to 10^{19} Bq for releases;
10^{-2} Bq to 10^{7} Bq and 10^{-2} mSv to 10^{7} mSv for concentration and doses.

(2) Gamma radiation dose rate 0 24 014 is intended to be used for reporting of this element under normal conditions, nuclear accidents excluded.

Class 25 – BUFR/CREX Processing information

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 001	Range-gate length	m	–1	0	6	m	–1	2
0 25 002	Number of gates averaged	Numeric	0	0	4	Numeric	0	2
0 25 003	Number of integrated pulses	Numeric	0	0	8	Numeric	0	3
0 25 004	Echo processing	Code table	0	0	2	Code table	0	1
0 25 005	Echo integration	Code table	0	0	2	Code table	0	1
0 25 006	Z to R conversion	Code table	0	0	3	Code table	0	1
0 25 007	Z to R conversion factor	Numeric	0	0	12	Numeric	0	4
0 25 008	Z to R conversion exponent	Numeric	2	0	9	Numeric	2	3
0 25 009	Calibration method (see Note 3)	Flag table	0	0	4	Flag table	0	2
0 25 010	Clutter treatment	Code table	0	0	4	Code table	0	2
0 25 011	Ground occultation correction (screening)	Code table	0	0	2	Code table	0	1
0 25 012	Range attenuation correction	Code table	0	0	2	Code table	0	1
0 25 013	Bright-band correction	Flag table	0	0	2	Flag table	0	1
0 25 014	Azimuth clutter cut-off (see Note 1)	Numeric	0	0	12	Numeric	0	4
0 25 015	Radome attenuation correction	Flag table	0	0	2	Flag table	0	1
0 25 016	Clear-air attenuation correction	dB m^{-1}	5	0	6	dB m^{-1}	5	2
0 25 017	Precipitation attenuation correction	Flag table	0	0	2	Flag table	0	1
0 25 018	A to Z law for attenuation factor	Numeric	7	0	6	Numeric	7	2
0 25 019	A to Z law for attenuation exponent	Numeric	2	0	7	Numeric	2	3
0 25 020	Mean speed estimation	Code table	0	0	2	Code table	0	1
0 25 021	Wind computation enhancement	Flag table	0	0	8	Flag table	0	3
0 25 022	GHRSST* rejection flag	Flag table	0	0	9	Flag table	0	3
0 25 023	GHRSST confidence flag	Flag table	0	0	9	Flag table	0	3
0 25 024	GHRSST data quality	Code table	0	0	4	Code table	0	2

* GHRSST = GODAE high-resolution sea-surface temperature

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 025	Battery voltage	V	1	0	9	V	1	3
0 25 026	Battery voltage (large range)	V	1	0	12	V	1	4
0 25 028	Operator or manufacturer defined parameter	Numeric	1	–16384	15	Numeric	1	5
0 25 029	Calibration method (see Note 3)	Flag table	0	0	6	Flag table	0	2
0 25 030	Running mean sea-surface temperature usage	Code table	0	0	2	Code table	0	1
0 25 031	NWP-generated vertical profile thinning method	Code table	0	0	3	Code table	0	1
0 25 032	Wind profiler mode information (see Note 2)	Code table	0	0	2	Code table	0	1
0 25 033	Wind profiler submode information (see Note 2)	Code table	0	0	2	Code table	0	1
0 25 034	Wind profiler quality control test results (see Note 2)	Flag table	0	0	4	Flag table	0	2
0 25 035	Decision method for polarity (see Note 5)	Code table	0	0	3	Code table	0	1
0 25 036	Atmospherics location method	Code table	0	0	4	Code table	0	2
0 25 037	SST bias	K	2	–127	8	K	2	3
0 25 038	Difference between SST and analysis	K	1	–127	8	K	1	3
0 25 040	CO_2 wind product derivation	Code table	0	0	4	Code table	0	2
0 25 041	Moving platform direction reporting method	Code table	0	0	2	Code table	0	1
0 25 042	Moving platform speed reporting method	Code table	0	0	2	Code table	0	1
0 25 043	Wave sampling interval (time)	s	4	0	15	s	4	5
0 25 044	Wave sampling interval (space)	m	2	0	14	m	2	5
0 25 045	HIRS channel combination	Flag table	0	0	21	Flag table	0	7

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 046	MSU channel combination	Flag table	0	0	5	Flag table	0	2
0 25 047	SSU channel combination	Flag table	0	0	4	Flag table	0	2
0 25 048	AMSU-A channel combination	Flag table	0	0	16	Flag table	0	6
0 25 049	AMSU-B channel combination	Flag table	0	0	6	Flag table	0	2
0 25 050	Principal component score	Numeric	4	–131072	18	Numeric	4	6
0 25 051	AVHRR channel combination	Flag table	0	0	7	Flag table	0	3
0 25 052	Log_{10} of principal components normalized fit to data	Numeric	4	0	15	Numeric	4	5
0 25 053	Observation quality	Flag table	0	0	12	Flag table	0	4
0 25 054	SSMIS subframe ID number	Numeric	0	0	5	Numeric	0	2
0 25 055	Multiplexer housekeeping	K	2	0	16	K	2	5
0 25 060	Software identification (see Note 2)	Numeric	0	0	14	Numeric	0	5
0 25 061	Software identification and version number	CCITT IA5	0	0	96	Character	0	12
0 25 062	Database identification	Numeric	0	0	14	Numeric	0	5
0 25 063	Central processor or system identifier (see Note 6)	Code table	0	0	8	Code table	0	3
0 25 065	Orientation correction (azimuth)	°	2	–1000	11	°	2	4
0 25 066	Orientation correction (elevation)	°	2	–1000	11	°	2	4
0 25 067	Radiosonde release point pressure correction	Pa	0	–8000	14	Pa	0	4
0 25 068	Number of archive recomputes	Numeric	0	0	7	Numeric	0	3
0 25 069	Flight level pressure corrections	Flag table	0	0	8	Flag table	0	3
0 25 070	Major frame count	Numeric	0	0	4	Numeric	0	2
0 25 071	Frame count	Numeric	0	0	5	Numeric	0	2
0 25 075	Satellite antenna corrections version number	Numeric	0	0	5	Numeric	0	2

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 076	Log_{10} of (temperature-radiance central wave number) for ATOVS	log (m^{-1})	8	0	30	log (m^{-1})	8	10
0 25 077	Bandwidth correction coefficient 1 for ATOVS	Numeric	5	–100000	18	Numeric	5	7
0 25 078	Bandwidth correction coefficient 2 for ATOVS	Numeric	5	0	17	Numeric	5	6
0 25 079	Albedo-radiance solar filtered irradiance for ATOVS	W m^{-2}	4	0	24	W m^{-2}	4	8
0 25 080	Albedo-radiance equivalent filter width for ATOVS	m	10	0	14	m	10	5
0 25 081	Incidence angle	°	3	0	17	°	3	6
0 25 082	Azimuth angle	°	3	0	19	°	3	6
0 25 083	Faraday rotational angle	°	3	0	19	°	3	6
0 25 084	Geometric rotational angle	°	5	0	26	°	5	8
0 25 085	Fraction of clear pixels in HIRS FOV	Numeric	0	0	7	Numeric	0	3
0 25 086	Depth correction indicator	Code table	0	0	2	Code table	0	1
0 25 090	Orbit state flag	Code table	0	0	4	Code table	0	2
0 25 091	Structure constant of the refraction index (C_n^2)	dB	3	–18192	13	dB	3	5
0 25 092	Acoustic propagation velocity	m s^{-1}	2	28000	14	m s^{-1}	2	5
0 25 093	RASS computation correction	Flag table	0	0	8	Flag table	0	3
0 25 095	Altimeter state flag	Flag table	0	0	2	Flag table	0	1
0 25 096	Radiometer state flag	Flag table	0	0	5	Flag table	0	2
0 25 097	Three-dimensional error estimate of the navigator orbit	Code table	0	0	4	Code table	0	2
0 25 098	Altimeter data quality flag	Flag table	0	0	9	Flag table	0	3
0 25 099	Altimeter correction quality flag	Flag table	0	0	9	Flag table	0	3

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 100	XBT/XCTD fall rate equation coefficient a	Numeric	5	0	20	Numeric	5	6
0 25 101	XBT/XCTD fall rate equation coefficient b	Numeric	5	–500000	21	Numeric	5	6
0 25 102	Number of missing lines excluding data gaps	Numeric	0	0	8	Numeric	0	3
0 25 103	Number of directional bins	Numeric	0	0	8	Numeric	0	3
0 25 104	Number of wavelength bins	Numeric	0	0	8	Numeric	0	3
0 25 105	First directional bin	°	3	0	19	°	3	6
0 25 106	Directional bin step	°	3	0	19	°	3	6
0 25 107	First wavelength bin	m	3	0	29	m	3	9
0 25 108	Last wavelength bin	m	3	0	29	m	3	9
0 25 110	Image processing summary	Flag table	0	0	10	Flag table	0	4
0 25 111	Number of input data gaps	Numeric	0	0	8	Numeric	0	3
0 25 120	RA2-L2-processing flag	Code table	0	0	2	Code table	0	1
0 25 121	RA2-L2-processing quality	%	0	0	7	%	0	3
0 25 122	Hardware configuration for RF	Code table	0	0	2	Code table	0	1
0 25 123	Hardware configuration for HPA	Code table	0	0	2	Code table	0	1
0 25 124	MWR-L2-processing flag	Code table	0	0	2	Code table	0	1
0 25 125	MWR-L2-processing quality	%	0	0	7	%	0	3
0 25 126	Model dry tropospheric correction	m	3	–32768	16	m	3	5
0 25 127	Inverted barometer correction	m	3	–32768	16	m	3	5
0 25 128	Model wet tropospheric correction	m	3	–32768	16	m	3	5
0 25 129	MWR derived wet tropospheric correction	m	3	–32768	16	m	3	5
0 25 130	RA2 ionospheric correction on Ku band	m	3	–32768	16	m	3	5
0 25 131	Ionospheric correction from Doris on Ku band	m	3	–32768	16	m	3	5

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 132	Ionospheric correction from model on Ku band	m	3	–32768	16	m	3	5
0 25 133	Sea state bias correction on Ku band	m	3	–32768	16	m	3	5
0 25 134	RA2 ionospheric correction on S band	m	3	–32768	16	m	3	5
0 25 135	Ionospheric correction from Doris on S band	m	3	–32768	16	m	3	5
0 25 136	Ionospheric correction from model on S band	m	3	–32768	16	m	3	5
0 25 137	Sea state bias correction on S band	m	3	–32768	16	m	3	5
0 25 138	Average signal-to-noise ratio	Numeric	0	–2048	12	Numeric	0	4
0 25 140	Start channel	Numeric	0	0	14	Numeric	0	5
0 25 141	End channel	Numeric	0	0	14	Numeric	0	5
0 25 142	Channel scale factor	Numeric	0	0	6	Numeric	0	2
0 25 143	Linear coefficient	Numeric	6	–5000000	24	Numeric	6	8
0 25 150	Method of tropical cyclone intensity analysis using satellite data	Code table	0	0	4	Code table	0	2
0 25 160	Ku band net instrumental correction	m	4	–120000	18	m	4	6
0 25 161	C band net instrumental correction	m	4	–120000	18	m	4	6
0 25 162	Sea state bias correction on C band	m	4	–6000	13	m	4	4
0 25 163	Altimeter ionospheric correction on Ku band	m	3	–32768	16	m	3	5
0 25 164	Radiometer wet tropospheric correction	m	4	–5000	13	m	4	4
0 25 170	Sampling interval (time)	s	0	0	10	s	0	4
0 25 171	Sample averaging period	s	0	0	10	s	0	4
0 25 172	Number of samples	Numeric	0	0	10	Numeric	0	4
0 25 174	SMOS information flag	Flag table	0	0	14	Flag table	0	5
0 25 175	Modified residual (see Note 7)	Numeric	2	0	13	Numeric	2	4

(continued)

(Class 25 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 25 180	LRM* per cent	%	2	0	16	%	2	5
0 25 181	L2 processing flag	Code table	0	0	2	Code table	0	1
0 25 182	L1 processing flag	Code table	0	0	2	Code table	0	1
0 25 183	L1 processing quality	%	2	0	14	%	2	5
0 25 184	L2 product status	Code table	0	0	2	Code table	0	1

* LRM = Low resolution mode

Notes:

(1) 0 25 014 nominal input range 0 – 2300.

(2) The actual meaning of this quantity may be obtained from the originator of the data.

(3) Descriptor 0 25 009 is deprecated. 0 25 029 should be used instead.

(4) Descriptor 0 25 143 is intended for numerical, non-dimensional values to be used as coefficients in statistical or linear processing. Each instance of 0 25 143 should be characterized by using an appropriate significance qualifier, such as 0 08 026.

(5) Certain sensors use a current decision above a threshold, others directly measure the voltage deflection.

(6) Flash Location Processor or system identity so as to identify where the event location was developed in multi-integrated system. Typically, a value of 1.

(7) Modified residual calculated from the loci of the sensors and signal to noise ratios for the flash.

Class 26 – BUFR/CREX Non-coordinate location (time)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 26 001	Principal time of daily reading in UTC of maximum temperature	h	1	0	12	h	1	3
0 26 002	Principal time of daily reading in UTC of minimum temperature	h	1	0	12	h	1	3
0 26 003	Time difference	min	0	–1440	12	min	0	4
0 26 010	Hours included	Flag table	0	0	26	Flag table	0	9
0 26 020	Duration of precipitation	min	0	0	11	min	0	4
0 26 021	Year	a	0	0	12	a	0	4
0 26 022	Month	mon	0	0	4	mon	0	2
0 26 023	Day	d	0	0	6	d	0	2
0 26 030	Measurement integration time	s	2	0	8	s	2	3

Note: Descriptor 0 26 003 is to be used with 0 08 025 (time difference qualifier).

Class 27 – BUFR/CREX Non-coordinate location (horizontal – 1)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 27 001	Latitude (high accuracy)	°	5	–9000000	25	°	5	7
0 27 002	Latitude (coarse accuracy)	°	2	–9000	15	°	2	4
0 27 003	Alternate latitude (coarse accuracy)	°	2	–9000	15	°	2	4
0 27 004	Alternate latitude (high accuracy)	°	5	–9000000	25	°	5	7
0 27 010	Footprint axis 1	m	–1	0	14	m	–1	5
0 27 020	Satellite location counter	Numeric	0	0	16	Numeric	0	5
0 27 021	Satellite sublocation dimension	Numeric	0	0	16	Numeric	0	5
0 27 031	In direction of 0 degrees longitude, distance from the Earth's centre	m	2	–1073741824	31	m	2	10
0 27 080	Viewing azimuth angle	degree true	2	0	16	degree true	0	5

Notes:

(1) The alternate latitude may be used when the computation of the position yields multiple solutions and there is no a priori way to distinguish between them.

(2) The satellite location counter is calculated as:
counter = superswath No. x 1000 + box No. x 10 + minibox No.

(3) The satellite sublocation dimension is calculated as:
dimension = minibox dimension + box dimension

where: minibox dimension = lines x 1000 + spots x 100
box dimension = lines x 10 + spots

(4) The value for descriptor 0 27 031 has been chosen to be suitable for polar orbiting satellites in approximately Sun-synchronous orbits. Geostationary orbits would require greater data widths for distance and slightly less for speed.

(5) Left-handed x, y and z axes have been chosen for descriptor 0 27 031.

Class 28 – BUFR/CREX Non-coordinate location (horizontal – 2)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 28 001	Longitude (high accuracy)	°	5	–18000000	26	°	5	8
0 28 002	Longitude (coarse accuracy)	°	2	–18000	16	°	2	5
0 28 003	Alternate longitude (coarse accuracy)	°	2	–18000	16	°	2	5
0 28 004	Alternate longitude (high accuracy)	°	5	–18000000	26	°	5	8
0 28 010	Footprint axis 2	m	–1	0	14	m	–1	5
0 28 031	In direction 90 degrees East, distance from the Earth's centre	m	2	–1073741824	31	m	2	10

Notes:

(1) The alternate longitude may be used when the computation of the position yields multiple solutions and there is no a priori way to distinguish between them.

(2) The value for descriptor 0 28 031 has been chosen to be suitable for polar orbiting satellites in approximately Sun-synchronous orbits. Geostationary orbits would require greater data widths for distance and slightly less for speed.

(3) Left handed x, y and z axes have been chosen for descriptor 0 28 031.

Class 29 – BUFR/CREX Map data

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 29 001	Projection type	Code table	0	0	3	Code table	0	1
0 29 002	Coordinate grid type	Code table	0	0	3	Code table	0	1

Class 30 – BUFR/CREX Image

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 30 001	Pixel value (4 bits)	Numeric	0	0	4	Numeric	0	2
0 30 002	Pixel value (8 bits)	Numeric	0	0	8	Numeric	0	3
0 30 004	Pixel value (16 bits)	Numeric	0	0	16	Numeric	0	5
0 30 010	Number of grid points	Numeric	0	0	13	Numeric	0	4
0 30 021	Number of pixels per row	Numeric	0	0	12	Numeric	0	4
0 30 022	Number of pixels per column	Numeric	0	0	12	Numeric	0	4
0 30 031	Picture type	Code table	0	0	4	Code table	0	2
0 30 032	Combination with other data	Flag table	0	0	16	Flag table	0	6
0 30 033	Number of bins along the radial	Numeric	0	0	12	Numeric	0	4
0 30 034	Number of azimuths	Numeric	0	0	12	Numeric	0	4

Notes:

(1) Pixel data width can be changed with descriptor 2 01 YYY.

(2) In order to distinguish unambiguously the cases of missing data and saturated pixels, n-bit image data should be encoded using a data width of n+1. Where such a descriptor is not already available in Class 30, operator descriptor 2 01 YYY should be used to modify the data width of the existing entry as required.

Class 31 – BUFR Data description operator qualifiers

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 31 000	Short delayed descriptor replication factor	Numeric	0	0	1			
0 31 001	Delayed descriptor replication factor	Numeric	0	0	8			
0 31 002	Extended delayed descriptor replication factor	Numeric	0	0	16			
0 31 011	Delayed descriptor and data repetition factor	Numeric	0	0	8	**Non-existent in CREX**		
0 31 012	Extended delayed descriptor and data repetition factor	Numeric	0	0	16			
0 31 021	Associated field significance	Code table	0	0	6			
0 31 031	Data present indicator	Flag table	0	0	1			

Notes:

(1) The “delayed descriptor and data repetition factor” is intended for run-length encoding (e.g. scanning an image). It specifies a count N which applies to both descriptor and data, i.e. the value of the single element defined by the following descriptor is repeated N times (at intervals already specified).

(2) Descriptor 0 31 031, used in conjunction with quality control or statistics operators 2 22 YYY through 2 32 YYY, shall indicate the presence of quality control information when the indicator value is set to zero. It may be used in conjunction with the replication operator 1 01 YYY to construct a table of data present/not present indicators, forming a data present bit-map as defined in Regulation 94.5.5.3. This makes it possible to present quality control information and statistical information for selected data corresponding to element descriptors which precede the 2 22 YYY to 2 32 YYY operators.

(3) Other applications of the data present indicator may be developed.

Class 33 – BUFR/CREX Quality information

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 33 002	Quality information	Code table	0	0	2	Code table	0	1
0 33 003	Quality information	Code table	0	0	3	Code table	0	1
0 33 005	Quality information (AWS data)	Flag table	0	0	30	Flag table	0	10
0 33 006	Internal measurement status information (AWS)	Code table	0	0	3	Code table	0	1
0 33 007	Per cent confidence	%	0	0	7	%	0	3
0 33 015	Data quality check indicator	Code table	0	0	6	Code table	0	2
0 33 020	Quality control indication of following value	Code table	0	0	3	Code table	0	1
0 33 021	Quality of following value	Code table	0	0	2	Code table	0	1
0 33 022	Quality of buoy satellite transmission	Code table	0	0	2	Code table	0	1
0 33 023	Quality of buoy location	Code table	0	0	2	Code table	0	1
0 33 024	Station elevation quality mark (for mobile stations)	Code table	0	0	4	Code table	0	2
0 33 025	ACARS interpolated values indicator	Code table	0	0	3	Code table	0	1
0 33 026	Moisture quality	Code table	0	0	6	Code table	0	2
0 33 027	Location quality class (range of radius of 66 % confidence)	Code table	0	0	3	Code table	0	1
0 33 028	Snapshot overall quality	Code table	0	0	3	Code table	0	1
0 33 030	Scan line status flags for ATOVS	Flag table	0	0	24	Flag table	0	8
0 33 031	Scan line quality flags for ATOVS	Flag table	0	0	24	Flag table	0	8
0 33 032	Channel quality flags for ATOVS	Flag table	0	0	24	Flag table	0	8
0 33 033	Field of view quality flags for ATOVS	Flag table	0	0	24	Flag table	0	8
0 33 035	Manual/automatic quality control	Code table	0	0	4	Code table	0	2
0 33 036	Nominal confidence threshold	%	0	0	7	%	0	3
0 33 037	Wind correlation error	Flag table	0	0	20	Flag table	0	7

(continued)

(Class 33 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 33 038	Quality flags for ground-based GNSS data	Flag table	0	0	10	Flag table	0	4
0 33 039	Quality flags for radio occultation data	Flag table	0	0	16	Flag table	0	6
0 33 040	Confidence interval	%	0	0	7	%	0	3
0 33 041	Attribute of following value	Code table	0	0	2	Code table	0	1
0 33 042	Type of limit represented by following value	Code table	0	0	3	Code table	0	1
0 33 043	AST confidence	Flag table	0	0	8	Flag table	0	3
0 33 044	ASAR quality information	Flag table	0	0	15	Flag table	0	5
0 33 045	Probability of following event (see Notes 1 and 3)	%	0	0	7	%	0	3
0 33 046	Conditional probability of following event with respect to specified conditioning event (see Notes 1, 2 and 3)	%	0	0	7	%	0	3
0 33 047	Measurement confidence data	Flag table	0	0	31	Flag table	0	11
0 33 048	Confidence measure of SAR inversion	Code table	0	0	2	Code table	0	1
0 33 049	Confidence measure of wind retrieval	Code table	0	0	2	Code table	0	1
0 33 050	Global GTSPP quality flag	Code table	0	0	4	Code table	0	2
0 33 052	S band ocean retracking quality	Flag table	0	0	21	Flag table	0	7
0 33 053	Ku band ocean retracking quality	Flag table	0	0	21	Flag table	0	7
0 33 060	GqisFlagQual – individual IASI-System quality flag	Code table	0	0	2	Code table	0	1
0 33 061	GqisQualIndex – indicator for instrument noise performance (contributions from spectral and radiometric calibration)	%	0	0	7	%	0	3
0 33 062	GqisQualIndexLoc – indicator for geometric quality index	%	0	0	7	%	0	3

(continued)

(Class 33 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 33 063	GqisQualIndexRad – indicator for instrument noise performance (contributions from radiometric calibration)	%	0	0	7	%	0	3
0 33 064	GqisQualIndexSpect – indicator for instrument noise performance (contributions from spectral calibration)	%	0	0	7	%	0	3
0 33 065	GqisSysTecSondQual – output of system TEC (Technical Expertise Centre) quality function	Numeric	0	0	24	Numeric	0	8
0 33 070	Total ozone quality	Code table	0	0	4	Code table	0	2
0 33 071	Profile ozone quality	Code table	0	0	4	Code table	0	2
0 33 072	Ozone error	Code table	0	0	5	Code table	0	2
0 33 075	Scan-level quality flags	Flag table	0	0	13	Flag table	0	5
0 33 076	Calibration quality flags	Flag table	0	0	9	Flag table	0	3
0 33 077	Field-of-view quality flags	Flag table	0	0	19	Flag table	0	7
0 33 078	Geolocation quality	Code table	0	0	4	Code table	0	2
0 33 079	Granule level quality flags	Flag table	0	0	16	Flag table	0	6
0 33 080	Scan level quality flags	Flag table	0	0	20	Flag table	0	7
0 33 081	Channel data quality flags	Flag table	0	0	12	Flag table	0	4
0 33 082	Geolocation quality flags	Flag table	0	0	16	Flag table	0	6
0 33 083	Radiance data quality flags	Flag table	0	0	16	Flag table	0	6
0 33 084	Pixel level quality flags	Flag table	0	0	16	Flag table	0	6
0 33 085	Aerosol optical thickness quality flags	Flag table	0	0	18	Flag table		
0 33 086	Quality of pixel level retrieval	Code table	0	0	3	Code table	0	1
0 33 087	Extent of satellite within South Atlantic anomaly (based on climatological data)	Code table	0	0	4	Code table	0	1
0 33 088	Ozone total column quality flag	Flag table	0	0	18	Flag table	0	6

(continued)

(Class 33 – continued)

Notes:

(1) When using descriptor 0 33 045 or 0 33 046, operator 2 41 000 shall be used in order to define the following event to which the reported probability value applies.

(2) When using descriptor 0 33 046, operator 2 42 000 shall precede the occurrence of this descriptor in order to define the event upon which the reported probability value is conditioned.

(3) When defining an event for use with descriptor 0 33 045 or 0 33 046, descriptor 0 33 042 may be employed in order to indicate that the following value is actually a bound for a range of values.

Class 35 – BUFR/CREX Data monitoring information

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 35 000	FM and regional code number	Code table	0	0	10	Code table	0	3
0 35 001	Time frame for monitoring	Code table	0	0	3	Code table	0	1
0 35 011	Number of reports actually received	Numeric	0	0	14	Numeric	0	4
0 35 021	Bulletin being monitored (TTAAii)	CCITT IA5	0	0	48	Character	0	6
0 35 022	Bulletin being monitored (YYGGgg)	CCITT IA5	0	0	48	Character	0	6
0 35 023	Bulletin being monitored (CCCC)	CCITT IA5	0	0	32	Character	0	4
0 35 024	Bulletin being monitored (BBB)	CCITT IA5	0	0	24	Character	0	3
0 35 030	Discrepancies in the availability of expected data	Code table	0	0	4	Code table	0	1
0 35 031	Qualifier on monitoring results	Code table	0	0	7	Code table	0	2
0 35 032	Cause of missing data	Code table	0	0	4	Code table	0	1
0 35 033	Observation and collection deficiencies	Code table	0	0	7	Code table	0	2
0 35 034	Statistical trends for availability of data (during the survey period(s))	Code table	0	0	3	Code table	0	1
0 35 035	Reason for termination	Code table	0	0	5	Code table	0	2

Class 40 – BUFR/CREX Satellite data

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 40 001	Surface soil moisture (ms)	%	1	0	10	%	1	4
0 40 002	Estimated error in surface soil moisture	%	1	0	10	%	1	4
0 40 003	Mean surface soil moisture	Numeric	3	0	10	Numeric	3	4
0 40 004	Rain fall detection	Numeric	3	0	10	Numeric	3	4
0 40 005	Soil moisture correction flag	Flag table	0	0	8	Flag table	0	3
0 40 006	Soil moisture processing flag	Flag table	0	0	16	Flag table	0	6
0 40 007	Soil moisture quality	%	1	0	10	%	1	4
0 40 008	Frozen land surface fraction	%	1	0	10	%	1	4
0 40 009	Inundation and wetland fraction	%	1	0	10	%	1	4
0 40 010	Topographic complexity	%	1	0	10	%	1	4
0 40 011	Interpolation flag	Flag table	0	0	8	Flag table	0	3
0 40 012	Radiometer data quality flag	Flag table	0	0	8	Flag table	0	3
0 40 013	Radiometer brightness temperature interpretation flag	Code table	0	0	3	Code table	0	1
0 40 014	High-frequency fluctuations of the sea-surface topography correction	m	4	–3000	13	m	4	4
0 40 015	Normalized differential vegetation index (NDVI)	Numeric	2	–100	8	Numeric	2	3
0 40 016	Residual RMS in band	Numeric	3	0	14	Numeric	3	5
0 40 017	Non-normalized principal component score	Numeric	0	–1073741824	31	Numeric	0	10
0 40 018	GIacAvgImagIIS – average of imager measurements	$W\ m^{-2}\ sr^{-1}\ m$	6	0	24	$W\ m^{-2}\ sr^{-1}\ m$	6	8
0 40 019	GIacVarImagIIS – variance of imager measurements	$W\ m^{-2}\ sr^{-1}\ m$	6	0	24	$W\ m^{-2}\ sr^{-1}\ m$	6	8
0 40 020	GqisFlagQualDetailed – quality flag for the system	Flag table	0	0	17	Flag table	0	6

(continued)

(Class 40 – continued)

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
F X Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 40 021	Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice	%	0	0	7	%	0	3
0 40 022	Number of missing, bad or failed AVHRR pixels	Numeric	0	0	7	Numeric	0	3
0 40 023	Auxiliary altimeter state flags	Flag table	0	0	5	Flag table	0	2
0 40 024	Meteorological map availability	Code table	0	0	3	Code table	0	1
0 40 025	Interpolation flag for mean diurnal tide	Code table	0	0	2	Code table	0	1
0 40 026	Score quantization factor	Numeric	2	0	16	Numeric	2	5

BUFR Table C – *Data description operators*

TABLE REFERENCE F X	OPERAND	OPERATOR NAME	OPERATION DEFINITION
2 01	YYY	Change data width	Add (YYY–128) bits to the data width given for each data element in Table B, other than CCITT IA5 (character) data, code or flag tables.
2 02	YYY	Change scale	Add YYY–128 to the scale for each data element in Table B, other than CCITT IA5 (character) data, code or flag tables.
2 03	YYY	Change reference values	Subsequent element descriptors define new reference values for corresponding Table B entries. Each new reference value is represented by YYY bits in the Data section. Definition of new reference values is concluded by coding this operator with YYY = 255. Negative reference values shall be represented by a positive integer with the left-most bit (bit 1) set to 1.
2 04	YYY	Add associated field	Precede each data element with YYY bits of information. This operation associates a data field (e.g. quality control information) of YYY bits with each data element.
2 05	YYY	Signify character	YYY characters (CCITT International Alphabet No. 5) are inserted as a data field of YYY x 8 bits in length.
2 06	YYY	Signify data width for the immediately following local descriptor	YYY bits of data are described by the immediately following descriptor.
2 07	YYY	Increase scale, reference value and data width	For Table B elements, which are not CCITT IA5 (character data), code tables, or flag tables: 1. Add YYY to the existing scale factor 2. Multiply the existing reference value by 10^{YYY} 3. Calculate ((10 x YYY) + 2) ÷ 3, disregard any fractional remainder and add the result to the existing bit width.
2 08	YYY	Change width of CCITT IA5 field	YYY characters from CCITT International Alphabet No. 5 (representing YYY x 8 bits in length) replace the specified data width given for each CCITT IA5 element in Table B.
2 21	YYY	Data not present	Data values present in Section 4 (Data section) corresponding to the following YYY descriptors shall be limited to data from Classes 01–09, and Class 31.
2 22	000	Quality information follows	The values of Class 33 elements which follow relate to the data defined by the data present bit-map.
2 23	000	Substituted values operator	The substituted values which follow relate to the data defined by the data present bit-map.

(continued)

(BUFR Table C – continued)

TABLE REFERENCE F X	OPERAND	OPERATOR NAME	OPERATION DEFINITION
2 23	255	Substituted values marker operator	This operator shall signify a data item containing a substituted value; the element descriptor for the substituted value is obtained by the application of the data present bit-map associated with the substituted values operator.
2 24	000	First-order statistical values follow	The statistical values which follow relate to the data defined by the data present bit-map.
2 24	255	First-order statistical values marker operator	This operator shall signify a data item containing a first-order statistical value of the type indicated by the preceding 0 08 023 element descriptor; the element descriptor to which the first-order statistic relates is obtained by the application of the data present bit-map associated with the first-order statistical values follow operator; first-order statistical values shall be represented as defined by this element descriptor.
2 25	000	Difference statistical values follow	The statistical values which follow relate to the data defined by the data present bit-map.
2 25	255	Difference statistical values marker operator	This operator shall signify a data item containing a difference statistical value of the type indicated by the preceding 0 08 024 element descriptor; the element descriptor to which the difference statistical value relates is obtained by the application of the data present bit-map associated with the difference statistical values follow operator; difference statistical values shall be represented as defined by this element descriptor, but with a reference value of -2^n and a data width of (n+1), where n is the data width given by the original descriptor. This special reference value allows the statistical difference values to be centred around zero.
2 32	000	Replaced/retained values follow	The replaced/retained values which follow relate to the data defined by the data present bit-map.
2 32	255	Replaced/retained value marker operator	This operator shall signify a data item containing the original of an element which has been replaced by a substituted value. The element descriptor for the retained value is obtained by the application of the data present bit-map associated with the substituted values operator.
2 35	000	Cancel backward data reference	This operator terminates all previously defined backward reference and cancels any previously defined data present bit-map; it causes the next data present bit-map to refer to the data descriptors which immediately precede the operator to which it relates.
2 36	000	Define data present bit-map	This operator defines the data present bit-map which follows for possible re-use; only one data present bit-map may be defined between this operator and the cancel use defined data present bit-map operator.

(continued)

(BUFR Table C – continued)

TABLE REFERENCE F X	OPERAND	OPERATOR NAME	OPERATION DEFINITION
2 37	000	Use defined data present bit-map	This operator causes the defined data present bit-map to be used again.
2 37	255	Cancel use defined data present bit-map	This operator cancels the re-use of the defined data present bit-map.
2 41	000	Define event	This operator denotes the beginning of the definition of an event (see Note 19).
2 41	255	Cancel define event	This operator denotes the conclusion of the event definition that was begun via the previous 2 41 000 operator.
2 42	000	Define conditioning event	This operator denotes the beginning of the definition of a conditioning event (see Note 19).
2 42	255	Cancel define conditioning event	This operator denotes the conclusion of the conditioning event definition that was begun via the previous 2 42 000 operator.
2 43	000	Categorical forecast values follow	The values which follow are categorical forecast values (see Note 20).
2 43	255	Cancel categorical forecast values follow	This operator denotes the conclusion of the definition of categorical forecast values that was begun via the previous 2 43 000 operator.

Notes:

(1) The operations specified by operator descriptors 2 01, 2 02, 2 03, 2 04, 2 07 and 2 08 remain defined until cancelled or until the end of the data subset.

(2) If change scale is used, then it may be necessary for the originator of the message to supply an appropriately rescaled reference value and data width.

(3) Cancellation of the use of the redefined value shall be effected by the inclusion of the appropriate operand with Y set to 0. The value shall then revert to the original Table B value.

(4) Nesting of operator descriptors must guarantee unambiguous interpretation. In particular, operators defined within a set of replicated descriptors must be cancelled or completed within that set, and the 2 07 operator may neither be nested within any of the 2 01, 2 02, and 2 03 operators, nor vice-versa.

(5) Nesting of the operator descriptor 2 04 is defined such that:

   (a) Each new definition adds to the currently defined associated field. The order of the included associated information shall correspond with the order in which the associated fields have been defined.

   (b) Each cancellation (2 04 000) cancels only the most recently defined addition to the associated field.

(6) When the descriptor 2 04 YYY is to be used, it shall precede the first of the data descriptors to which it applies.

(7) The data description operator 2 04 YYY, other than 2 04 000, shall be followed immediately by the descriptor 0 31 021 to indicate the meaning of the associated field.

(8) In the data stream, the 6 bits described by 0 31 021 shall precede the YYY bits.

(continued)

(BUFR Table C – continued)

(9) Once an associated field has been established and given meaning, the meaning may be changed by a re-application of descriptor 0 31 021. The associated field needs not to be cancelled in order to change the meaning. Further, if an associated field is cancelled, and then re-established, it must be given a meaning by a proper application of the 0 31 021 descriptor, as described in Notes 5 to 8, i.e. a previous assignment of meaning does not remain in force when the associated field is cancelled.

(10) Data description operators shall not be applied to Table B, Class 31 entries.

(11) The operation 2 05 permits the inclusion of plain language.

(12) The operator 2 06 YYY allows for the inclusion of local descriptors in a message, with their associated data, which can then be by-passed by a receiver of the message. It can be applied to element descriptors (F = 0) only.

(13) If "replaced/retained" values are indicated, this shall imply that the data element in the original part of the message has been replaced with a (presumably) better value; the original value has been retained in the message following the replaced/retained operator. If multiple replacements for the same data element are to be included, they shall be ordered such that the original datum shall be last, the first replacement shall precede it, the next precede that, etc. Each (set of) replaced/retained data values shall be indicated by the inclusion of the 2 32 000 operator.

(14) If "substituted values” are indicated, this shall imply that the data element in the original part of the message is thought to be of poor quality. However, it has been left in the original message as received; an improved value has been placed within the message following the substituted values operator. If multiple substitutions for the same data element are to be included, they shall be ordered such that the first substitution shall be first, the next substitution shall follow it, the next follow that, etc. Thus, the (presumed) “best” value will be found at the end of the collection of substituted values. Each (set of) substituted data values shall be indicated by the inclusion of the 2 23 000 operator.

(15) Operator 2 21 YYY allows for the construction of a BUFR message containing only coordinate (Classes 01–09), delayed replication (Class 31) and quality control information. The message could be linked back to the original data-containing message by comparison of the coordinate information in the two messages, or, in a local context, through “database” information in Section 2.

(16) First-order statistics have values with a similar range and the same dimensions as the corresponding reported values (e.g. maxima, minima, means).

(17) Difference statistics are difference values; they have dimensions the same as the corresponding reported values with respect to units, but assume a range centred on zero (e.g. the difference between reported and analysed values, the difference between reported and forecast values).

(18) No operator descriptors are reserved for local use.

(19) An event, as defined for use with operators 2 41 000 and 2 42 000, is a set of one or more circumstances described using appropriate Table B descriptors along with their corresponding data values. The grouping of such descriptors together as a single “event” allows them to be collectively assigned as the target of a separate descriptor such as 0 33 045 or 0 33 046. When defining a circumstance within an event, descriptor 0 33 042 may be employed preceding the appropriate Table B descriptor in order to indicate that the corresponding value is actually a bound for a range of values.

(20) A categorical forecast value represents a “best guess” from among a set of related, and often mutually exclusive, data values or categories. Operator 2 43 000 may be used to designate one or more values as categorical forecast values, and descriptor 0 33 042 may be employed preceding any such value in order to indicate that that value is actually a bound for a range of values.

BUFR Table D – *List of common sequences*

F	X	Category of sequences
3	00	BUFR table entries sequences
3	01	Location and identification sequences
3	02	Meteorological sequences common to surface data
3	03	Meteorological sequences common to vertical soundings data
3	04	Meteorological sequences common to satellite observations
3	05	Meteorological or hydrological sequences common to hydrological observations
3	06	Meteorological or oceanographic sequences common to oceanographic observations
3	07	Surface report sequences (land)
3	08	Surface report sequences (sea)
3	09	Vertical sounding sequences (conventional data)
3	10	Vertical sounding sequences (satellite data)
3	11	Single level report sequences (conventional data)
3	12	Single level report sequences (satellite data)
3	13	Sequences common to image data
3	14	Reserved
3	15	Oceanographic report sequences
3	16	Synoptic feature sequences
3	18	Radiological report sequences
3	21	Radar report sequences
3	22	Chemical and aerosol sequences
3	40	Additional satellite report sequences

Notes:

(1) From a conceptual point of view, Table D is *not* necessary:

- (a) The Data description section can fully and completely describe the data using only element descriptors, operator descriptors and the rules of description;
- (b) Such a means of defining the data would involve considerable overheads in terms of the length of the Data description section. Table D is a device to reduce these overheads;
- (c) Each entry within Table D contains a list of descriptors. Each sequence descriptor that references to Table D may be "expanded" by replacing it with the list corresponding to that entry. The process of "expansion" is well defined, provided it results in a set of element descriptors and operator descriptors;
- (d) Descriptors listed in entries to Table D may themselves refer to Table D, provided no circularity results on repeated expansion;
- (e) The initial Table D has been limited to lists of descriptors likely to be used frequently. Every attempt has been made not to produce initial tables that are too comprehensive. *Minor differences of reporting practice can be accommodated by not endeavouring to reduce each observation type to a single descriptor.* Indeed, much more flexibility is retained if the Data description section is envisaged as containing three or four descriptors.

(2) It should be noted that, initially, effort has been concentrated on the requirements for observational data. Extensions to forecast data, time series data, products, etc., follow logically, and can be added at an appropriate future date.

(3) Category 01 contains common sequences of non-meteorological descriptors; categories 02 to 06 contain common sequences of meteorological descriptors; categories 07 to 21 contain sequences which define reports, or major subsets of reports.

(4) Underwater soundings are included, with some minor omissions, to illustrate the facility to describe data of slightly different contents.

(5) Satellite data have been split to maximize the benefits of data compression. Compound combinations may easily be defined using the descriptors available.

(6) Satellite observation data benefit enormously from being split into fragments (1, 2, 3 . . . 7), then applying data compression to many locations within each fragment. Again, BUFR flexibility enables compound forms to be defined if desired.

(7) Categories 48 to 63 are reserved for local use; all other categories are reserved for future development.

(8) Entries 192 to 255 within all categories are reserved for local use.

Category 00 – BUFR table entries sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 00 002	0 00 002	Table A: data category description, line 1	
	0 00 003	Table A: data category description, line 2	
		(F, X, Y of descriptor to be added or defined)	
3 00 003	0 00 010	F descriptor to be added or defined	
	0 00 011	X descriptor to be added or defined	
	0 00 012	Y descriptor to be added or defined	
3 00 004	3 00 003	F, X, Y of descriptor to be added or defined	
	0 00 013	Element name, line 1	
	0 00 014	Element name, line 2	
	0 00 015	Units name	
	0 00 016	Units scale sign	
	0 00 017	Units scale	
	0 00 018	Units reference sign	
	0 00 019	Units reference value	
	0 00 020	Element data width	
3 00 010	3 00 003	F, X, Y of descriptor to be added or defined	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 00 030	Descriptor defining sequence	
		(Code table definition)	
3 00 015	0 00 030	Descriptor defining sequence	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 00 024	Code figure	
	0 00 025	Code figure meaning	
		(Flag table definition)	
3 00 016	0 00 030	Descriptor defining sequence	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 00 026	Bit number	
	0 00 027	Bit number meaning	

Notes:

(1) These entries include the facility to update the Table A code figure and data description.

(2) It is better to use different Class 00 descriptors for the defining and defined elements, in the same way as different descriptors correspond to pressure considered as a coordinate and pressure measured at a given point; otherwise special rules would be needed to interpret such message.

Entries 0 00 010 to 0 00 012 define F, X and Y for Tables B and D; entry 0 00 030 is a descriptor used as data and provides the F, X and Y values defining a sequence for Table D entries.

(3) It could be argued that, as only additions are possible, only complete lines should be allowed; but it is conceivable that local areas will require changes as well as additions, so it is better and in any case clearer to provide descriptions for all the fields.

Category 01 – Location and identification sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(WMO block and station numbers)	
3 01 001	0 01 001	WMO block number	
	0 01 002	WMO station number	
3 01 002	0 01 003	WMO Region number/geographical area	
	0 01 004	WMO Region sub-area	
	0 01 005	Buoy/platform identifier	
		(Ship's call sign and motion)	
3 01 003	0 01 011	Ship or mobile land station identifier	Ship's call sign
	0 01 012	Direction of motion of moving observing platform	
	0 01 013	Speed of motion of moving observing platform	
		(Surface station identification)	
3 01 004	0 01 001	WMO block number	
	0 01 002	WMO station number	
	0 01 015	Station or site name	
	0 02 001	Type of station	
		(Originating centre/sub-centre)	
3 01 005	0 01 035	Originating centre	
	0 01 034	Identification of originating/generating sub-centre	
		(Year, month, day)	
3 01 011	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
		(Hour, minute)	
3 01 012	0 04 004	Hour	
	0 04 005	Minute	
		(Hour, minute, second)	
3 01 013	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
		(Time period)	
3 01 014	1 02 002	Replicate 2 descriptors 2 times	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
		(Latitude/longitude (high accuracy))	
3 01 021	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Latitude/longitude (high accuracy), height of station)	
3 01 022	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 07 001	Height of station	
		(Latitude/longitude (coarse accuracy))	
3 01 023	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
		(Latitude/longitude (coarse accuracy), height of station)	
3 01 024	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 07 001	Height of station	
		(Latitude/longitude (coarse accuracy), day/time)	
3 01 025	3 01 023	Latitude/longitude (coarse accuracy)	
	0 04 003	Day	
	3 01 012	Hour, minute	
		(Latitude/longitude (high accuracy), time period (day, hour, minute))	
3 01 026	3 01 021	Latitude/longitude (high accuracy)	
	0 04 003	Day	Time period in days
	0 04 003	Day	
	0 04 004	Hour	Time period in hours
	0 04 004	Hour	
	0 04 005	Minute	Time period in minutes
	0 04 005	Minute	
		(Description of a feature in 3-D or 2-D)	
3 01 027	0 08 007	Dimensional significance	= 0 Point, = 1 Line, = 2 Area, = 3 Volume
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor (see Note 5)	
	3 01 028	Horizontal section of a feature described as a polygon, circle, line or point	
	0 08 007	Dimensional significance	Set to missing (cancel)
		(Horizontal section of a feature described as a polygon, circle, line or point)	
3 01 028	0 08 040	Flight level significance	
	0 33 042	Type of limit represented by following value	
	0 07 010	Flight level	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor (see Note 6)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 19 007	Effective radius of feature (see Note 7)	
	0 08 040	Flight level significance	Set to missing (cancel)

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Identification)	
3 01 029	0 01 018	Short station or site name	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
		(Identification – with physical location)	
3 01 030	0 01 018	Short station or site name	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
		(Identification and type of station, date/time, location (high accuracy), height of station)	
3 01 031	3 01 001	WMO block and station numbers	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 022	Latitude/longitude (high accuracy), height of station	
		(Identification and type of station, date/time, location (coarse accuracy), height of station)	
3 01 032	3 01 001	WMO block and station numbers	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
		(Buoy/platform – fixed)	
3 01 033	0 01 005	Buoy/platform identifier	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
		(Buoy/platform – fixed)	
3 01 034	0 01 005	Buoy/platform identifier	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	
		(Buoy/platform – moving) (see Note 4)	
3 01 035	0 01 005	Buoy/platform identifier	
	0 01 012	Direction of motion of moving observing platform	
	0 01 013	Speed of motion of moving observing platform	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ship)	
3 01 036	3 01 003	Ship's call sign and motion	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	
		(Land station for vertical soundings)	
3 01 037	3 01 001	WMO block and station numbers	
	0 02 011	Radiosonde type	
	0 02 012	Radiosonde computational method	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 022	Latitude/longitude (high accuracy), height of station	
		(Land station for vertical soundings)	
3 01 038	3 01 001	WMO block and station numbers	
	0 02 011	Radiosonde type	
	0 02 012	Radiosonde computational method	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
		(Ship for vertical soundings)	
3 01 039	3 01 003	Ship's call sign and motion	
	0 02 011	Radiosonde type	
	0 02 012	Radiosonde computational method	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	
		(Ship for vertical soundings)	
3 01 040	3 01 003	Ship's call sign and motion	
	0 02 011	Radiosonde type	
	0 02 012	Radiosonde computational method	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
		(Satellite identifier, instrument, data-processing technique, date/time)	
3 01 041	0 01 007	Satellite identifier	
	0 02 021	Satellite instrument data used in processing	
	0 02 022	Satellite data-processing technique used	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Satellite identifier, instrument, data-processing technique, date/time, location)	
3 01 042	3 01 041	Satellite identifier, instrument, data-processing technique, date/time	
	3 01 021	Latitude/longitude (high accuracy)	
		(Satellite identifier, wind computation method, date/time, location)	
3 01 043	0 01 007	Satellite identifier	
	0 02 023	Satellite-derived wind computation method	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
		(Satellite identifier, humidity computation method, date/time, location)	
3 01 044	0 01 007	Satellite identifier	
	0 02 024	Integrated mean humidity computational method	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
		(Satellite location and velocity)	
3 01 045	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 01 138	Change data width	16 bits long
	2 02 131	Change scale	Scale: 3
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	3 04 030	Location of platform	Relative to the Earth’s centre
	3 04 031	Speed of platform	Relative to the Earth’s centre
		(Satellite identifier, direction of motion, sensor, model function, software, resolution)	
3 01 046	0 01 007	Satellite identifier	
	0 01 012	Direction of motion of moving observing platform	
	0 02 048	Satellite sensor indicator	
	0 21 119	Wind scatterometer geophysical model function	
	0 25 060	Software identification	
	2 02 124	Change scale	
	0 02 026	Cross-track resolution	
	0 02 027	Along-track resolution	
	2 02 000	Change scale	Cancel
	0 05 040	Orbit number	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(ERS product header)	
3 01 047	0 01 007	Satellite identifier	
	0 25 060	Software identification	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 01 012	Direction of motion of moving observing platform	
	3 01 045	Satellite location and velocity	
	0 02 021	Satellite instrument data used in processing	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 01 138	Change data width	16 bits long
	2 02 131	Change scale	Scale: 3
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	3 01 023	Latitude/longitude (coarse accuracy)	
		(Radar parameters)	
3 01 048	0 02 104	Antenna polarization	
	0 02 121	Mean frequency	
	0 02 113	Number of azimuth looks	
	0 02 026	Cross-track resolution	
	0 02 027	Along-track resolution	
	0 02 111	Radar incidence angle	
	0 02 140	Satellite radar beam azimuth angle	
	2 02 127	Change scale	Scale: –1
	0 01 013	Speed of motion of moving observing platform	Radar platform velocity
	2 02 126	Change scale	Scale: –2
	0 07 001	Height of station	Radar platform altitude
	2 02 000	Change scale	Cancel
	0 25 010	Clutter treatment	
	0 21 064	Clutter noise estimate	
		(Radar beam data)	
3 01 049	0 02 111	Radar incidence angle	
	0 02 112	Radar look angle	
	0 21 062	Backscatter	
	0 21 063	Radiometric resolution (noise value)	
	0 21 065	Missing packet counter	
		(Flight number, navigational system, date/time, location, phase of flight)	
3 01 051	0 01 006	Aircraft flight number	
	0 02 061	Aircraft navigational system	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 08 004	Phase of aircraft flight	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Identification and type of station, date/time, location (high accuracy), movement)	
3 01 055	0 01 005	Buoy/platform identifier	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 01 012	Direction of motion of moving observing platform	
	0 01 014	Platform drift speed (high precision)	
		(Universal lightning event)	
		Date/time of lightning event	
3 01 058	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 01 152	Change data width	
	2 02 135	Change scale	
	0 04 006	Second	
	2 02 000	Change scale	
	2 01 000	Change data width	
		Horizontal and vertical coordinates of lightning event	
	3 01 021	Latitude/longitude (high accuracy)	
	0 20 111	x-axis error ellipse major component	
	0 20 112	y-axis error ellipse minor component	
	0 20 113	z-axis error ellipse component	
	0 20 114	Angle of x-axis in error ellipse	
	0 20 115	Angle of z-axis in error ellipse	
	0 20 116	Emission height of cloud stroke	
		Emission information	
	0 20 117	Amplitude of lightning strike	
	0 20 118	Lightning detection error	
	0 20 119	Lightning discharge polarity	
	0 25 035	Decision method for polarity	V or A
	0 20 121	Threshold value for polarity decision	
	0 20 122	Threshold value for polarity decision	
	0 20 123	Minimum threshold for detection	
	0 20 124	Lightning stroke or flash	
	0 25 175	Modified residual	
	0 20 023	Other weather phenomena	Cloud to ground or cloud to cloud identification
		Sensor processing	
	0 25 063	Central processor or system identifier	
	2 02 136	Change scale	
	2 01 136	Change data width	
	0 02 121	Mean frequency	Define centre frequency, if used
	2 01 000	Change data width	
	2 02 000	Change scale	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 01 058 *(continued)*	0 25 061	Software identification and version number	
	0 02 184	Type of lightning detection sensor	
	0 02 189	Capability to discriminate lightning strikes	
	0 25 036	Atmospherics location method	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	Number of sensors contributing
	3 01 059	Identification of sensor site and instrumentation	
		(Identification of sensor site and instrumentation)	
3 01 059	3 01 021	Latitude/longitude (high accuracy)	Sensor
	0 07 030	Height of station ground above mean sea level	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Sensor for lightning
		(Radar location(s))	
3 01 062	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 01 001	WMO block and station numbers	
		(ACARS identification)	
3 01 065	0 01 006	Aircraft flight number (see Note 1)	
	0 01 008	Aircraft registration number or other identification (see Note 1)	
	0 02 001	Type of station	
	0 02 002	Type of instrumentation for wind measurement	
	0 02 005	Precision of temperature observation	
	0 02 062	Type of aircraft data relay system	
	0 02 070	Original specification of latitude/longitude	
	0 02 065	ACARS ground-receiving station	
		(ACARS location)	
3 01 066	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 004	Pressure	
	0 02 064	Aircraft roll angle quality	
	0 08 004	Phase of aircraft flight	
		(Ozone instrumentation – Brewer spectrophotometer)	
3 01 070	0 02 143	Ozone instrument type	
	0 02 142	Ozone instrument serial number/identification	
	0 02 144	Light source type for Brewer spectrophotometer	
		(Satellite identifier/Generating resolution)	
3 01 071	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/generating centre	
	0 02 020	Satellite classification	
	0 02 028	Segment size at nadir in x-direction	
	0 02 029	Segment size at nadir in y-direction	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Satellite identification)	
3 01 072	3 01 071	Satellite identifier/Generating resolution	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
		(Ozone instrumentation – Dobson spectrophotometer)	
3 01 074	0 02 143	Ozone instrument type	
	0 02 142	Ozone instrument serial number/identification	
	0 02 145	Wavelength setting for Dobson instruments	
	0 02 146	Source conditions for Dobson instruments	
		(Sounding identification)	
3 01 075	3 01 001	WMO block and station numbers	
	0 01 015	Station or site name	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	0 08 021	Time significance	= 18 Launch time
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
		(Ozone sounding instrumentation)	
3 01 076	0 02 011	Radiosonde type	
	0 02 143	Ozone instrument type	
	0 02 142	Ozone instrument serial number/identification	
		(National station identification)	
3 01 089	0 01 101	State identifier	
	0 01 102	National station number	
		(Surface station identification; time, horizontal and vertical coordinates)	
3 01 090	3 01 004	Surface station identification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
		(Surface station instrumentation)	
3 01 091	0 02 180	Main present weather detecting system	
	0 02 181	Supplementary present weather sensor	
	0 02 182	Visibility measurement system	
	0 02 183	Cloud detection system	
	0 02 184	Type of lightning detection sensor	
	0 02 179	Type of sky condition algorithm	
	0 02 186	Capability to detect precipitation phenomena	
	0 02 187	Capability to detect other weather phenomena	
	0 02 188	Capability to detect obscuration	
	0 02 189	Capability to discriminate lightning strikes	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Mobile surface station identification, date/time, horizontal and vertical coordinates)	
3 01 092	0 01 011	Ship or mobile land station identifier	
	0 01 003	WMO Region number/geographical area	
	0 02 001	Type of station	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
	0 33 024	Station elevation quality mark (for mobile stations)	
		(Ship identification, movement, date/time, horizontal and vertical coordinates)	
3 01 093	3 01 036	Ship	Ship identification
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
		(Identification of launch site and instrumentation for wind measurements)	
3 01 110	3 01 001	WMO block and station numbers	
	0 01 011	Ship or mobile land station identifier	
	0 02 011	Radiosonde type	
	0 02 014	Tracking technique/status of system used	
	0 02 003	Type of measuring equipment used	
		(Identification of launch site and instrumentation for P, T, U and wind measurements)	
3 01 111	3 01 001	WMO block and station numbers	
	0 01 011	Ship or mobile land station identifier	
	0 02 011	Radiosonde type	
	0 02 013	Solar and infrared radiation correction	
	0 02 014	Tracking technique/status of system used	
	0 02 003	Type of measuring equipment used	
		(Identification of launch point and instrumentation of dropsonde)	
3 01 112	0 01 006	Aircraft flight number	
	0 02 011	Radiosonde type	
	0 02 013	Solar and infrared radiation correction	
	0 02 014	Tracking technique/status of system used	
	0 02 003	Type of measuring equipment used	
		(Date/time of launch) (see Note 3)	
3 01 113	0 08 021	Time significance	= 18 Launch time
	3 01 011	Year, month, day	Launch time
	3 01 013	Hour, minute, second	Launch time

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Horizontal and vertical coordinates of launch site)	
3 01 114	3 01 021	Latitude/longitude (high accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
	0 07 007	Height	Release of sonde above mean sea level
	0 33 024	Station elevation quality mark (for mobile stations)	
		(Radiosonde abbreviated header and launch information)	
3 01 120	3 01 001	WMO block and station numbers	
	0 01 094	WBAN number	
	0 02 011	Radiosonde type	
	3 01 121	Radiosonde launch point location	
		(Radiosonde launch point location)	
3 01 121	0 08 041	Data significance	= 3 Balloon launch point
	3 01 122	Date/time (to hundredths of second)	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 031	Height of barometer above mean sea level	
	0 07 007	Height	Release of radiosonde above mean sea level
		(Date/time (to hundredths of second)) (see Note 3)	
3 01 122	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 01 135	Change data width	
	2 02 130	Change scale	
	0 04 006	Second	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
		(Radiosonde full header information)	
3 01 123	1 02 002	Replicate 2 descriptors 2 times	
	0 08 041	Data significance	= 0 Parent site, = 1 Observation site
	0 01 062	Short ICAO location indicator	
	3 01 001	WMO block and station numbers	
	0 01 094	WBAN number	
	0 02 011	Radiosonde type	
	0 01 018	Short station or site name	
	0 01 095	Observer identification	
	0 25 061	Software identification and version number	
	0 25 068	Number of archive recomputes	
	0 01 082	Radiosonde ascension number	
	0 01 083	Radiosonde release number	
	0 01 081	Radiosonde serial number	
	0 02 067	Radiosonde operating frequency	

(continued)

(Category 01 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 01 123 *(continued)*	0 02 066	Radiosonde ground receiving system	
	0 02 014	Tracking technique/status of system used	
	0 25 067	Radiosonde release point pressure correction	
	0 25 065	Orientation correction (azimuth)	
	0 25 066	Orientation correction (elevation)	
	0 02 095	Type of pressure sensor	
	0 02 096	Type of temperature sensor	
	0 02 097	Type of humidity sensor	
	0 02 016	Radiosonde configuration	
	0 02 083	Type of balloon shelter	
	0 02 080	Balloon manufacturer	
	0 02 081	Type of balloon	
	0 01 093	Balloon lot number	
	0 02 084	Type of gas used in balloon	
	0 02 085	Amount of gas used in balloon	
	0 02 086	Balloon flight train length	
	0 02 082	Weight of balloon	
	0 08 041	Data significance	= 2 Balloon manufacture date
	3 01 011	Year, month, day	
		(ASCAT header information)	
3 01 125	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 25 060	Software identification	
	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 012	Direction of motion of moving observing platform	

Notes:

(1) As supplied by originating sub-centre ARINC, this value is a pseudo-value rather than the actual value. The relationship between this pseudo-value and the true value is known only by ARINC.

(2) Descriptors from 3 01 041 to 3 01 049 and 3 01 062, 3 01 071, and 3 01 072 should not be used in CREX for transmission.

(3) Time of launch shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be set to zero.

(4) Descriptor 3 01 055 should be used instead of 3 01 035 to encode moving buoy/platform information.

(5) This replication factor shall have a value of "1" when a 2-D feature is being described, whereas 3-D features may be described via any one of the following methods:

   (a) Via two or more horizontal sections in successive ascending flight levels. In this case, each section shall be described by an identical number of latitude/longitude points listed in identical order (i.e. where each point x of section n is to be joined via a straight line to point x of section n+1), in order to ensure that the overall shape of the 3-D feature is unambiguously described. In this case, all values reported for 0 33 042 shall be "missing".

   (b) Via a single horizontal section with an appropriate value reported for 0 33 042, as follows. In all such cases, the corresponding horizontal section description applies throughout the entire region.

      (i) A value of "0" to indicate a region above (but not including) the reported flight level and with unspecified upper bound.

(continued)

(Category 01 – continued)

(ii) A value of “1” to indicate a region above (and including) the reported flight level and with unspecified upper bound.

(iii) A value of “2” to indicate a region below (but not including) the reported flight level and extending to the surface.

(iv) A value of “3” to indicate a region below (and including) the reported flight level and extending to the surface.

(c) Via two replications of the same horizontal section at the same reported flight level, in order to indicate a region extending both below and above (and including!) the reported flight level. In this case, the values reported for the two replications of 0 33 042 shall be as follows:

(i) Values of “3” and “1”, respectively, to indicate a region beginning from below a reported flight level, but continuing through that level upward to some unspecified point above (e.g. TOP ABV FL100).

(ii) Values of “1” and “3”, respectively, to indicate a region beginning from above a reported flight level, but continuing through that level downward to some unspecified point below (e.g. CIGS BLW FL010).

(6) This replication factor shall have a value of “1” when a circle or point is being described, and it shall have a value of “2” when a line is being described. A polygon, on the other hand, shall be described via a sequence of three or more contiguous points in accordance with the note to code table 0 08 007.

(7) The value reported for 0 19 007 shall be “missing” unless the horizontal section being described is a circle.

(8) Descriptor 3 01 002 should not be used.

Category 02 – Meteorological sequences common to surface data

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Pressure and 3-hour pressure change)	
3 02 001	0 10 004	Pressure	Station level
	0 10 051	Pressure reduced to mean sea level	
	0 10 061	3-hour pressure change	
	0 10 063	Characteristic of pressure tendency	
		(High altitude station)	
3 02 002	0 10 004	Pressure	Station level
	0 07 004	Pressure	Pressure level
	0 10 003	Geopotential	Pressure level
	0 10 061	3-hour pressure change	
	0 10 063	Characteristic of pressure tendency	
		(Wind, temperature, humidity, visibility, weather)	
3 02 003	0 11 011	Wind direction at 10 m	
	0 11 012	Wind speed at 10 m	
	0 12 004	Air temperature at 2 m	
	0 12 006	Dewpoint temperature at 2 m	
	0 13 003	Relative humidity	
	0 20 001	Horizontal visibility	
	0 20 003	Present weather	
	0 20 004	Past weather (1)	
	0 20 005	Past weather (2)	
		(General cloud information)	
3 02 004	0 20 010	Cloud cover (total)	
	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	
	0 20 013	Height of base of cloud	
	0 20 012	Cloud type	
	0 20 012	Cloud type	
	0 20 012	Cloud type	
		(Cloud layer)	
3 02 005	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	
	0 20 012	Cloud type	
	0 20 013	Height of base of cloud	
		(Pressure and 24-hour pressure change)	
3 02 006	0 10 004	Pressure	Station level
	0 10 051	Pressure reduced to mean sea level	
	0 10 062	24-hour pressure change	
	0 10 063	Characteristic of pressure tendency	
		(Low altitude station)	
3 02 011	3 02 001	Pressure and 3-hour pressure change	
	3 02 003	Wind, temperature, humidity, visibility, weather	
	3 02 004	General cloud information	Significant cloud layer

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(High altitude station)	
3 02 012	3 02 002	High altitude station	Pressure and pressure change
	3 02 003	Wind, temperature, humidity, visibility, weather	
	3 02 004	General cloud information	Significant cloud layer
		(Basic surface report)	
3 02 013	3 02 006	Pressure and 24-hour pressure change	
	3 02 003	Wind, temperature, humidity, visibility, weather	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	
		(Waves)	
3 02 021	0 22 001	Direction of waves	
	0 22 011	Period of waves	
	0 22 021	Height of waves	
		(Wind waves)	
3 02 022	0 22 002	Direction of wind waves	
	0 22 012	Period of wind waves	
	0 22 022	Height of wind waves	
		(Swell waves)	
3 02 023	0 22 003	Direction of swell waves	
	0 22 013	Period of swell waves	
	0 22 023	Height of swell waves	
		(Wind and swell waves)	
3 02 024	3 02 022	Wind waves	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 023	Swell waves	2 systems of swell
		(Pressure information)	
3 02 031	3 02 001	Pressure and 3-hour pressure change	
	0 10 062	24-hour pressure change	
	0 07 004	Pressure	Standard level
	0 10 009	Geopotential height	
		(Temperature and humidity data)	
3 02 032	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature and humidity measurement
	0 12 101	Temperature/air temperature	Scale: 2
	0 12 103	Dewpoint temperature	Scale: 2
	0 13 003	Relative humidity	
		(Visibility data)	
3 02 033	0 07 032	Height of sensor above local ground (or deck of marine platform)	Visibility measurement
	0 20 001	Horizontal visibility	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Precipitation past 24 hours)	
3 02 034	0 07 032	Height of sensor above local ground (or deck of marine platform)	Precipitation measurement
	0 13 023	Total precipitation past 24 hours	
		(Basic synoptic “instantaneous” data)	
3 02 035	3 02 032	Temperature and humidity data	
	3 02 033	Visibility data	
	3 02 034	Precipitation past 24 hours	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	3 02 004	General cloud information	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	Individual cloud layer or mass
		(Clouds with bases below station level)	
3 02 036	1 05 000	Delayed replication of 5 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	
	0 20 012	Cloud type	
	0 20 014	Height of top of cloud	
	0 20 017	Cloud top description	
		(State of ground, snow depth, ground minimum temperature)	
3 02 037	0 20 062	State of the ground (with or without snow)	
	0 13 013	Total snow depth	
	0 12 113	Ground minimum temperature, past 12 hours	Scale: 2
		(Present and past weather)	
3 02 038	0 20 003	Present weather	
	0 04 024	Time period or displacement	Hours
	0 20 004	Past weather (1)	
	0 20 005	Past weather (2)	
		(Sunshine data (from 1 hour and 24 hour period))	
3 02 039	0 04 024	Time period or displacement	Hours
	0 14 031	Total sunshine	
		(Precipitation measurement)	
3 02 040	0 07 032	Height of sensor above local ground (or deck of marine platform)	Precipitation measurement
	1 02 002	Replicate 2 descriptors 2 times	
	0 04 024	Time period or displacement	Hours
	0 13 011	Total precipitation/total water equivalent	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Extreme temperature data)	
3 02 041	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature measurement
	0 04 024	Time period or displacement	
	0 04 024	Time period or displacement (see Notes 1 and 2)	
	0 12 111	Maximum temperature, at height and over period specified	Scale: 2
	0 04 024	Time period or displacement	
	0 04 024	Time period or displacement (see Note 2)	
	0 12 112	Minimum temperature, at height and over period specified	Scale: 2
		(Wind data)	
3 02 042	0 07 032	Height of sensor above local ground (or deck of marine platform)	Wind measurement
	0 02 002	Type of instrumentation for wind measurement	
	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 minutes, or number of minutes after a significant change of wind
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 08 021	Time significance	Set to missing
	1 03 002	Replicate 3 descriptors 2 times	
	0 04 025	Time period or displacement	Minutes
	0 11 043	Maximum wind gust direction	
	0 11 041	Maximum wind gust speed	
		(Basic synoptic “period” data)	
3 02 043	3 02 038	Present and past weather	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 039	Sunshine data (from 1 hour and 24 hour period)	
	3 02 040	Precipitation measurement	
	3 02 041	Extreme temperature data	
	3 02 042	Wind data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		(Evaporation data)	
3 02 044	0 04 024	Time period or displacement	Hours
	0 02 004	Type of instrumentation for evaporation measurement or type of crop for which evapotranspiration is reported	
	0 13 033	Evaporation/evapotranspiration	
		(Radiation data (from 1 hour and 24 hour period))	
3 02 045	0 04 024	Time period or displacement	Hours
	0 14 002	Long-wave radiation, integrated over period specified	
	0 14 004	Short-wave radiation, integrated over period specified	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 02 045	0 14 016	Net radiation, integrated over period specified	
(continued)	0 14 028	Global solar radiation (high accuracy), integrated over period specified	
	0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	
	0 14 030	Direct solar radiation (high accuracy), integrated over period specified	
		(Temperature change)	
3 02 046	0 04 024	Time period or displacement	
	0 04 024	Time period or displacement (see Note 3)	
	0 12 049	Temperature change over specified period	
		(Direction of cloud drift)	
3 02 047	1 02 003	Replicate 2 descriptors 3 times	
	0 08 002	Vertical significance (surface observations)	
	0 20 054	True direction from which a phenomenon or clouds are moving	
		(Direction and elevation of cloud)	
3 02 048	0 05 021	Bearing or azimuth	
	0 07 021	Elevation	Elevation angle
	0 20 012	Cloud type	
	0 05 021	Bearing or azimuth	Set to missing (cancel)
	0 07 021	Elevation	Set to missing (cancel)
		(Cloud information reported with vertical soundings)	
3 02 049	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	Low or middle clouds N_h
	0 20 013	Height of base of cloud	h
	0 20 012	Cloud type	Low clouds C_L
	0 20 012	Cloud type	Middle clouds C_M
	0 20 012	Cloud type	High clouds C_H
	0 08 002	Vertical significance (surface observations)	Set to missing
		(Radiosonde surface observation)	
3 02 050	0 08 041	Data significance	= 5 Surface observation displacement from launch point
	0 05 021	Bearing or azimuth	
	0 07 005	Height increment	
	2 02 130	Change scale	
	0 06 021	Distance	
	2 02 000	Change scale	Cancel
	0 08 041	Data significance	= 4 Surface observation
	2 01 131	Change data width	
	2 02 129	Change scale	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 02 050 *(continued)*	0 02 115	Type of surface observing equipment	
	0 10 004	Pressure	
	0 02 115	Type of surface observing equipment	
	0 13 003	Relative humidity	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 02 115	Type of surface observing equipment	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 02 115	Type of surface observing equipment	
	1 02 002	Replicate 2 descriptors 2 times	
	0 12 101	Temperature/air temperature	
	0 04 024	Time period or displacement	Hours
	0 02 115	Type of surface observing equipment	
	0 12 103	Dewpoint temperature	
	0 12 102	Wet-bulb temperature	
	1 01 003	Replicate 1 descriptor 3 times	
	0 20 012	Cloud type	
	0 20 011	Cloud amount	
	0 20 013	Height of base of cloud	
	1 01 002	Replicate 1 descriptor 2 times	
	0 20 003	Present weather	
3 02 051	0 10 004	Pressure	
	0 10 051	Pressure reduced to mean sea level	
	0 07 004	Pressure	Vertical location
	0 10 003	Geopotential	
	0 12 004	Air temperature at 2 m	
	0 12 051	Standard deviation temperature	
	0 12 016	Maximum temperature at 2 m, past 24 hours	
	0 12 017	Minimum temperature at 2 m, past 24 hours	
	0 13 004	Vapour pressure	
	1 02 004	Replicate 2 descriptors 4 times	
	0 08 051	Qualifier for number of missing values in calculation of statistic	
	0 08 020	Total number of missing entities (with respect to accumulation or average)	
		(Ship temperature and humidity data)	
3 02 052	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature and humidity measurement
	0 07 033	Height of sensor above water surface	Temperature and humidity measurement
	0 12 101	Temperature/air temperature	Scale: 2
	0 02 039	Method of wet-bulb temperature measurement	
	0 12 102	Wet-bulb temperature	Scale: 2
	0 12 103	Dewpoint temperature	Scale: 2
	0 13 003	Relative humidity	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ship visibility data)	
3 02 053	0 07 032	Height of sensor above local ground (or deck of marine platform)	Visibility measurement
	0 07 033	Height of sensor above water surface	Visibility measurement
	0 20 001	Horizontal visibility	
		(Ship "instantaneous" data)	
3 02 054	3 02 052	Ship temperature and humidity data	
	3 02 053	Ship visibility data	
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	3 02 034	Precipitation past 24 hours	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	3 02 004	General cloud information	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	
		(Icing and ice)	
3 02 055	0 20 031	Ice deposit (thickness)	
	0 20 032	Rate of ice accretion (estimated)	
	0 20 033	Cause of ice accretion	
	0 20 034	Sea ice concentration	
	0 20 035	Amount and type of ice	
	0 20 036	Ice situation	
	0 20 037	Ice development	
	0 20 038	Bearing of ice edge	
		(Sea/water temperature)	
3 02 056	0 02 038	Method of water temperature and/or salinity measurement	
	0 07 063	Depth below sea/water surface (cm)	Sea-surface temperature measurement
	0 22 043	Sea/water temperature	
	0 07 063	Depth below sea/water surface (cm)	Set to missing (cancel)
		(Ship marine data)	
3 02 057	3 02 056	Sea/water temperature	Sea-surface temperature, method of measurement, and depth below sea surface
	3 02 021	Waves	
	3 02 024	Wind and swell waves	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ship extreme temperature data)	
3 02 058	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature measurement
	0 07 033	Height of sensor above water surface	Temperature measurement
	0 04 024	Time period or displacement	
	0 04 024	Time period or displacement (see Notes 1 and 2)	
	0 12 111	Maximum temperature, at height and over period specified	Scale: 2
	0 04 024	Time period or displacement	
	0 04 024	Time period or displacement (see Note 2)	
	0 12 112	Minimum temperature, at height and over period specified	Scale: 2
		(Ship wind data)	
3 02 059	0 07 032	Height of sensor above local ground (or deck of marine platform)	Wind measurement
	0 07 033	Height of sensor above water surface	Wind measurement
	0 02 002	Type of instrumentation for wind measurement	
	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 minutes, or number of minutes after a significant change of wind
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 08 021	Time significance	Set to missing
	1 03 002	Replicate 3 descriptors 2 times	
	0 04 025	Time period or displacement	Minutes
	0 11 043	Maximum wind gust direction	
	0 11 041	Maximum wind gust speed	
		(Ship "period" data)	
3 02 060	3 02 038	Present and past weather	
	3 02 040	Precipitation measurement	
	3 02 058	Ship extreme temperature data	
	3 02 059	Ship wind data	
		(Dangerous weather phenomena)	
3 02 066	0 20 023	Other weather phenomena	
	0 20 024	Intensity of phenomena	
	0 20 027	Phenomena occurrence	
	0 20 054	True direction from which a phenomenon or clouds are moving	
	0 20 023	Other weather phenomena	
	0 20 027	Phenomena occurrence	
	0 20 054	True direction from which a phenomenon or clouds are moving	
	0 20 025	Obscuration	
	0 20 026	Character of obscuration	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 02 066 *(continued)*	0 20 027	Phenomena occurrence	
	0 20 040	Evolution of drift snow	
	0 20 066	Maximum diameter of hailstones	
	0 20 027	Phenomena occurrence	
	0 20 021	Type of precipitation	
	0 20 067	Diameter of deposit	
	0 20 027	Phenomena occurrence	
		(Visibility data)	
3 02 069	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 33 041	Attribute of following value	
	0 20 001	Horizontal visibility	
		(Wind data)	
3 02 070	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 11 043	Maximum wind gust direction	
	0 11 041	Maximum wind gust speed	
	0 11 016	Extreme counterclockwise wind direction of a variable wind	
	0 11 017	Extreme clockwise wind direction of a variable wind	
		(Wind data from one-hour period)	
3 02 071	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 minutes, or number of minutes after a significant change of wind, if any
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 08 021	Time significance	Set to missing
	1 03 002	Replicate 3 descriptors 2 times	
	0 04 025	Time period or displacement	= –10 minutes in the first replication, = –60 minutes in the second replication
	0 11 043	Maximum wind gust direction	
	0 11 041	Maximum wind gust speed	
	0 04 025	Time period or displacement	= –10 minutes
	0 11 016	Extreme counterclockwise wind direction of a variable wind	
	0 11 017	Extreme clockwise wind direction of a variable wind	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Temperature and humidity data)	
3 02 072	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 12 101	Temperature/air temperature	Scale: 2
	0 12 103	Dewpoint temperature	Scale: 2
	0 13 003	Relative humidity	
		(Cloud data)	
3 02 073	0 20 010	Cloud cover (total)	
	1 05 004	Replicate 5 descriptors 4 times	
	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	
	0 20 012	Cloud type	
	0 33 041	Attribute of following value	
	0 20 013	Height of base of cloud	
		(Present and past weather)	
3 02 074	0 20 003	Present weather	
	0 04 025	Time period or displacement	
	0 20 004	Past weather (1)	
	0 20 005	Past weather (2)	
		(Intensity of precipitation, size of precipitation element)	
3 02 075	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 minutes
	0 13 055	Intensity of precipitation	
	0 13 058	Size of precipitating element	
	0 08 021	Time significance	Set to missing
		(Precipitation, obscuration and other phenomena)	
3 02 076	0 20 021	Type of precipitation	
	0 20 022	Character of precipitation	
	0 26 020	Duration of precipitation	
	0 20 023	Other weather phenomena	
	0 20 024	Intensity of phenomena	
	0 20 025	Obscuration	
	0 20 026	Character of obscuration	
		(Extreme temperature data)	
3 02 077	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 04 025	Time period or displacement	
	0 12 111	Maximum temperature, at height and over period specified	Scale: 2
	0 12 112	Minimum temperature, at height and over period specified	Scale: 2

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 02 077 *(continued)*	0 07 032	Height of sensor above local ground (or deck of marine platform)	Ground temperature
	0 04 025	Time period or displacement	
	0 12 112	Minimum temperature, at height and over period specified	Scale: 2 **|** Ground temperature
		(State of ground and snow depth measurement)	
3 02 078	0 02 176	Method of state of ground measurement	
	0 20 062	State of the ground (with or without snow)	
	0 02 177	Method of snow depth measurement	
	0 13 013	Total snow depth	
		(Precipitation measurement)	
3 02 079	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 02 175	Method of precipitation measurement	
	0 02 178	Method of liquid content measurement of precipitation	
	0 04 025	Time period or displacement	
	0 13 011	Total precipitation/total water equivalent	
		(Evaporation measurement)	
3 02 080	0 02 185	Method of evaporation measurement	
	0 04 025	Time period or displacement	
	0 13 033	Evaporation/evapotranspiration	
		(Total sunshine data)	
3 02 081	0 04 025	Time period or displacement	
	0 14 031	Total sunshine	
		(Radiation data)	
3 02 082	0 04 025	Time period or displacement	
	0 14 002	Long-wave radiation, integrated over period specified	
	0 14 004	Short-wave radiation, integrated over period specified	
	0 14 016	Net radiation, integrated over period specified	
	0 14 028	Global solar radiation (high accuracy), integrated over period specified	
	0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	
	0 14 030	Direct solar radiation (high accuracy), integrated over period specified	
		(First-order statistics of P, W, T, U data)	
3 02 083	0 04 025	Time period or displacement	
	0 08 023	First-order statistics	
	0 10 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 12 101	Temperature/air temperature	Scale: 2
	0 13 003	Relative humidity	
	0 08 023	First-order statistics	Set to missing

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(“Instantaneous” data of sequence 3 07 096)	
3 02 084	3 02 031	Pressure information	
	3 02 072	Temperature and humidity data	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	1 01 005	Replicate 1 descriptor 5 times	
	3 07 063	Depth below land surface and soil temperature	
	0 07 061	Depth below land surface	Set to missing (cancel)
		Visibility data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 069	Visibility data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
		Marine data	
	1 05 000	Delayed replication of 5 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 20 031	Ice deposit (thickness)	
	0 20 032	Rate of ice accretion (estimated)	
	0 02 038	Method of water temperature and/or salinity measurement	
	0 22 043	Sea/water temperature	Scale: 2
	3 02 021	Waves	
		State of ground and snow depth measurement	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 078	State of ground and snow depth measurement	
	0 12 113	Ground minimum temperature, past 12 hours	Scale: 2
		Cloud data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 004	General cloud information	
	1 05 000	Delayed replication of 5 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	
	0 20 012	Cloud type	
	0 33 041	Attribute of following value	
	0 20 013	Height of base of cloud	
	3 02 036	Clouds with bases below station level	
		Direction of cloud drift 6$D_L D_M D_H$	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
		Direction and elevation of cloud 57C$D_a e_c$	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 048	Direction and elevation of cloud	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		("Period" data of sequence 3 07 096)	
		Present and past weather data	
3 02 085	1 05 000	Delayed replication of 5 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 20 003	Present weather	
	1 03 002	Replicate 3 descriptors 2 times	
	0 04 024	Time period or displacement	= –1 hour in the first replication, = –x hours in the second replication, x corresponding to the time period of W_1W_2 in the SYNOP report
	0 20 004	Past weather (1)	
	0 20 005	Past weather (2)	
		Intensity of precipitation, size of precipitation element	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 175	Intensity of precipitation, size of precipitation element	
		Precipitation, obscuration and other phenomena	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 04 025	Time period or displacement	= –10 minutes
	3 02 076	Precipitation, obscuration and other phenomena	
		Lightning data	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 04 025	Time period or displacement	= –10 minutes
	0 13 059	Number of flashes (thunderstorm)	
		Wind data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 minutes, or number of minutes after a significant change of wind
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 08 021	Time significance	Set to missing
	1 03 003	Replicate 3 descriptors 3 times	
	0 04 025	Time period or displacement	= –10 minutes in the first replication, = –60 minutes in the second replication, = –60x3 or 60x6 minutes in the third replication
	0 11 043	Maximum wind gust direction	
	0 11 041	Maximum wind gust speed	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 02 085 *(continued)*	0 04 025	Time period or displacement	= –10 minutes
	0 11 016	Extreme counterclockwise wind direction of a variable wind	
	0 11 017	Extreme clockwise wind direction of a variable wind	
		Extreme temperature data	
	3 02 077	Extreme temperature data	
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	3 02 041	Extreme temperature data	
		Precipitation measurement	
	1 06 000	Delayed replication of 6 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 02 175	Method of precipitation measurement	
	0 02 178	Method of liquid content measurement of precipitation	
	1 02 005	Replicate 2 descriptors 5 times	
	0 04 024	Time period or displacement	= –1 hour in the first replication, = –3, –6, –12 and –24 hours in the other replications
	0 13 011	Total precipitation/total water equivalent	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		Evaporation data	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 02 185	Method of evaporation measurement	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 044	Evaporation data	
		Total sunshine data	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 039	Sunshine data (from 1 hour and 24 hour period)	
		Radiation data	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24 hour period)	
		Temperature change group $54g_0s_nd_T$	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 046	Temperature change	
		First-order statistics of P, W, T, U data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 083	First-order statistics of P, W, T, U data	

(continued)

(Category 02 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Locust information)	
3 02 089	0 20 101	Locust (acridian) name	L_n
	0 20 102	Locust (maturity) colour	L_c
	0 20 103	Stage of development of locusts	L_d
	0 20 104	Organization state of swarm or band of locusts	L_g
	0 20 105	Size of swarm or band of locusts and duration of passage of swarm	s_L
	0 20 106	Locust population density	d_L
	0 20 107	Direction of movements of locust swarm	D_L
	0 20 108	Extent of vegetation	v_e
		(Sea/water temperature high precision)	
3 02 090	0 02 038	Method of water temperature and/or salinity measurement	
	0 07 063	Depth below sea/water surface (cm)	Sea-surface temperature measurement
	0 22 045	Sea/water temperature	
		(Intensity of precipitation, size of precipitation element)	
3 02 175	0 08 021	Time significance	
	0 04 025	Time period or displacement	
	0 13 155	Intensity of precipitation (high accuracy)	
	0 13 058	Size of precipitating element	
	0 08 021	Time significance	

Notes:

(1) Within RA IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 0 04 024 has to be included two times. If the period ends at the nominal time of the report, value of the second 0 04 024 shall be set to 0.

(2) Within RA III, the maximum daytime temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 0 04 024 has to be included two times. If the period ends at the nominal time of the report, value of the second 0 04 024 shall be set to 0.

(3) To construct the required time range, descriptor 0 04 024 has to be included two times.

Category 03 – Meteorological sequences common to vertical soundings data

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 03 001	0 07 003	Geopotential	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Wind at pressure level)	
3 03 002	0 07 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
3 03 003	0 07 004	Pressure	
	0 10 003	Geopotential	
	0 12 001	Temperature/air temperature	
	0 12 003	Dewpoint temperature	
3 03 004	0 07 004	Pressure	
	0 10 003	Geopotential	
	0 12 001	Temperature/air temperature	
	0 12 003	Dewpoint temperature	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Wind at height)	
3 03 011	0 07 003	Geopotential	
	0 08 001	Vertical sounding significance	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Wind at pressure level)	
3 03 012	0 07 004	Pressure	
	0 08 001	Vertical sounding significance	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Geopotential, temperature, humidity, wind at pressure level)	
3 03 013	0 07 004	Pressure	
	0 08 001	Vertical sounding significance	
	0 10 003	Geopotential	
	0 12 001	Temperature/air temperature	
	0 13 003	Relative humidity	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Geopotential, temperature, dewpoint temperature, wind at pressure level)	
3 03 014	0 07 004	Pressure	
	0 08 001	Vertical sounding significance	
	0 10 003	Geopotential	
	0 12 001	Temperature/air temperature	

(continued)

(Category 03 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 03 014 *(continued)*	0 12 003	Dewpoint temperature	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Layer, quality)	
3 03 021	0 07 004	Pressure	Define layer
	0 07 004	Pressure	
	2 04 007	Add associated field	7 bits long
	0 31 021	Associated field significance	
3 03 022	3 03 021	Layer, quality	
	0 10 003	Geopotential	Layer mean thickness
	2 04 000	Add associated field	Cancel
		(Layer mean temperature)	
3 03 023	3 03 021	Layer, quality	
	0 12 001	Temperature/air temperature	Layer mean
	2 04 000	Add associated field	Cancel
		(Precipitable water)	
3 03 024	3 03 021	Layer, quality	
	0 13 016	Precipitable water	
	2 04 000	Add associated field	Cancel
		(Satellite channel and brightness temperature)	
3 03 025	0 02 025	Satellite channel(s) used in computation	
	2 04 007	Add associated field	7 bits long
	0 31 021	Associated field significance	
	0 12 063	Brightness temperature	
	2 04 000	Add associated field	Cancel
3 03 026	0 07 004	Pressure	
	0 08 003	Vertical significance (satellite observations)	
	2 04 007	Add associated field	7 bits long
	0 31 021	Associated field significance	
	0 12 001	Temperature/air temperature	
	2 04 000	Add associated field	Cancel
3 03 027	0 07 004	Pressure	
	2 04 007	Add associated field	7 bits long
	0 31 021	Associated field significance	
	0 10 003	Geopotential	
	2 04 000	Add associated field	Cancel

(continued)

(Category 03 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Significance data, land/sea, skin temperature)	
3 03 031	0 07 004	Pressure	
	0 08 003	Vertical significance (satellite observations)	Base of sounding
	0 07 021	Elevation	Local zenith
	0 07 022	Solar elevation	Solar zenith
	0 08 012	Land/sea qualifier	
	0 12 061	Skin temperature	
		(Cloud)	
3 03 032	0 20 011	Cloud amount	
	0 20 016	Pressure at top of cloud	
		(Cloud)	
3 03 033	0 20 010	Cloud cover (total)	
	0 20 016	Pressure at top of cloud	
		(Radiosonde duration of flight and termination information)	
3 03 040	0 08 041	Data significance	= 7 Flight level termination point
	0 04 025	Time period or displacement	Minutes
	0 04 026	Time period or displacement	Seconds
	3 01 021	Latitude/longitude (high accuracy)	
	3 01 122	Date/time (to hundredths of second)	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 25 069	Flight level pressure corrections	
	0 07 004	Pressure	
	0 13 003	Relative humidity	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 02 013	Solar and infrared radiation correction	
	0 12 101	Temperature/air temperature	
	0 10 009	Geopotential height	
	1 02 002	Replicate 2 descriptors 2 times	
	0 08 040	Flight level significance	
	0 35 035	Reason for termination	
		(Wind sequence)	
3 03 041	0 02 152	Satellite instrument used in data processing	
	0 02 023	Satellite-derived wind computation method	
	0 07 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	0 12 071	Coldest cluster temperature	

(continued)

(Category 03 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Wind data at a pressure level with radiosonde position)	
3 03 050	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 004	Pressure	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Wind shear data at a pressure level with radiosonde position)	
3 03 051	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 004	Pressure	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 11 061	Absolute wind shear in 1 km layer below	
	0 11 062	Absolute wind shear in 1 km layer above	
		(Wind data at a height level with radiosonde position)	
3 03 052	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 009	Geopotential height	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Wind shear data at a height level with radiosonde position)	
3 03 053	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 009	Geopotential height	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 11 061	Absolute wind shear in 1 km layer below	
	0 11 062	Absolute wind shear in 1 km layer above	
		(Temperature, dewpoint and wind data at a pressure level with radiosonde position)	
3 03 054	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 004	Pressure	
	0 10 009	Geopotential height	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 12 101	Temperature/air temperature	Scale: 2

(continued)

(Category 03 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 03 054 *(continued)*	0 12 103	Dewpoint temperature	Scale: 2
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Temperature, dewpoint, relative humidity and wind data at a height level with radiosonde position)	
3 03 055	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	0 07 009	Geopotential height	
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 12 101	Temperature/air temperature	Scale: 2
	0 13 009	Relative humidity	
	0 12 103	Dewpoint temperature	Scale: 2
	0 11 001	Wind direction	
	0 11 002	Wind speed	

Notes:

(1) Descriptors 3 03 021 to 3 03 027 are not available in CREX.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds).

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

Category 04 – Meteorological sequences common to satellite observations

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Cloud top pressure, temperature, wind)	
3 04 001	0 08 003	Vertical significance (satellite observations)	
	0 10 004	Pressure	
	0 12 001	Temperature/air temperature	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Cloud top pressure, wind)	
3 04 002	0 08 003	Vertical significance (satellite observations)	
	0 10 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
		(Surface temperature)	
3 04 003	0 08 003	Vertical significance (satellite observations)	
	0 12 001	Temperature/air temperature	
		(Cloud top pressure, cloud cover, temperature)	
3 04 004	0 08 003	Vertical significance (satellite observations)	
	0 10 004	Pressure	
	0 20 010	Cloud cover (total)	
	0 12 001	Temperature/air temperature	
		(Layer mean relative humidity)	
3 04 005	0 02 024	Integrated mean humidity computational method	
	0 07 004	Pressure	Define layer
	0 07 004	Pressure	
	0 13 003	Relative humidity	
		(Radiation)	
3 04 006	0 14 001	Long-wave radiation, integrated over 24 hours	Outgoing long-wave radiation
	0 14 001	Long-wave radiation, integrated over 24 hours	Incoming long-wave radiation
	0 14 003	Short-wave radiation, integrated over 24 hours	Outgoing short-wave radiation
		(GOES-I/M info)	
3 04 011	0 02 163	Height assignment method	
	0 02 164	Tracer correlation method	
	0 08 012	Land/sea qualifier	
	0 07 024	Satellite zenith angle	
	0 02 057	Origin of first-guess information for GOES-I/M soundings	
	0 08 021	Time significance	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	

(continued)

(Category 04 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 04 011 *(continued)*	0 08 021	Time significance	
	0 04 024	Time period or displacement	
	1 10 004	Replicate 10 descriptors 4 times	
	0 08 021	Time significance	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	0 08 021	Time significance	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	1 03 010	Replicate 3 descriptors 10 times	
	0 02 163	Height assignment method	
	0 07 004	Pressure	
	0 12 001	Temperature/air temperature	
		(Location of platform)	
3 04 030	0 27 031	In direction of 0 degrees longitude, distance from the Earth's centre	
	0 28 031	In direction 90 degrees East, distance from the Earth's centre	
	0 10 031	In direction of the North Pole, distance from the Earth's centre	
		(Speed of platform)	
3 04 031	0 01 041	Absolute platform velocity – first component	
	0 01 042	Absolute platform velocity – second component	
	0 01 043	Absolute platform velocity – third component	
		(Cloud fraction)	
3 04 032	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	0 20 081	Cloud amount in segment	
	0 20 082	Amount segment cloud free	
	0 20 012	Cloud type	
		(Clear sky radiance)	
3 04 033	0 02 152	Satellite instrument used in data processing	
	0 02 166	Radiance type	
	0 02 167	Radiance computational method	
	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	0 12 075	Spectral radiance	
	0 12 076	Radiance	
	0 12 063	Brightness temperature	

(continued)

(Category 04 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Latitude/longitude, solar elevation, number of layers)	
3 04 034	1 02 004	Replicate 2 descriptors 4 times	
	0 27 001	Latitude (high accuracy)	
	0 28 001	Longitude (high accuracy)	
	0 07 022	Solar elevation	
	0 05 043	Field of view number	
	0 20 010	Cloud cover (total)	
	0 20 016	Pressure at top of cloud	
	0 33 003	Quality information	
	0 10 040	Number of retrieved layers	
		(All sky radiance data)	
3 04 035	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	0 12 063	Brightness temperature	
	0 08 001	Meteorological feature	Pixel type: clear
	0 12 063	Brightness temperature	Clear
	0 08 001	Meteorological feature	Pixel type: cloudy
	0 12 063	Brightness temperature	Cloudy
	0 08 001	Meteorological feature	Cancel
	0 08 003	Vertical significance (satellite observations)	Low cloud
	0 12 063	Brightness temperature	Low cloud
	0 08 003	Vertical significance (satellite observations)	Mid cloud
	0 12 063	Brightness temperature	Mid cloud
	0 08 003	Vertical significance (satellite observations)	High cloud
	0 12 063	Brightness temperature	High cloud
	0 08 003	Vertical significance (satellite observations)	Cancel
		(Cloud coverage)	
3 04 036	0 20 082	Amount segment cloud free	
	0 08 012	Land/sea qualifier	Sea
	0 20 082	Amount segment cloud free	Sea
	0 08 012	Land/sea qualifier	Cancel
	0 20 081	Cloud amount in segment	
	0 08 003	Vertical significance (satellite observations)	Low cloud
	0 20 081	Cloud amount in segment	Low cloud
	0 08 003	Vertical significance (satellite observations)	Mid cloud
	0 20 081	Cloud amount in segment	Mid cloud
	0 08 003	Vertical significance (satellite observations)	High cloud
	0 20 081	Cloud amount in segment	High cloud
	0 08 003	Vertical significance (satellite observations)	Cancel
		(All sky radiance data)	
3 04 037	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	0 12 063	Brightness temperature	
	0 08 011	Meteorological feature	Pixel type: clear
	0 12 063	Brightness temperature	Clear
	0 08 011	Meteorological feature	Pixel type: cloudy
	0 12 063	Brightness temperature	Cloudy

(continued)

(Category 04 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 04 037 *(continued)*	0 08 011	Meteorological feature	Cancel
	0 08 003	Vertical significance (satellite observations)	Low cloud
	0 12 063	Brightness temperature	Low cloud
	0 08 003	Vertical significance (satellite observations)	Mid cloud
	0 12 063	Brightness temperature	Mid cloud
	0 08 003	Vertical significance (satellite observations)	High cloud
	0 12 063	Brightness temperature	High cloud

Note: 3 04 035 is deprecated.

Category 05 – Meteorological or hydrological sequences common to hydrological observations

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(SADC-HYCOS single measurement)	
3 05 001	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 13 060	Total accumulated precipitation	
	0 13 071	Upstream water level	
		(SADC-HYCOS environmental measurement)	
3 05 002	3 01 012	Hour, minute	
	0 12 001	Temperature/air temperature	
	0 13 003	Relative humidity	
	0 14 051	Direct solar radiation integrated over last hour	
	0 13 060	Total accumulated precipitation	
	0 13 072	Downstream water level	
	0 13 080	Water pH	
	0 13 081	Water conductivity	
	0 13 082	Water temperature	
	0 13 083	Dissolved oxygen	
	0 13 084	Turbidity	
		(SADC-HYCOS measurement array definition)	
3 05 003	3 01 012	Hour, minute	First single measurement minus increment
	0 04 065	Short time increment	Time interval between measurements
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 05 001	SADC-HYCOS single measurement	
		(SADC-HYCOS report)	
3 05 004	3 01 030	Identification – with physical location	
	3 05 002	SADC-HYCOS environmental measurement	
	3 05 003	SADC-HYCOS measurement array definition	
		(MEDHYCOS measurement)	
3 05 006	0 13 072	Downstream water level	
	0 13 082	Water temperature	
	0 13 019	Total precipitation past 1 hour	
	0 12 001	Temperature/air temperature	
	0 13 073	Maximum water level	
	0 13 060	Total accumulated precipitation	
		(MEDHYCOS report)	
3 05 007	3 01 029	Identification	
	3 01 012	Hour, minute	Time of first measurement
	0 04 065	Short time increment	Time interval between measurements
	1 01 000	Delayed replication of 1 descriptor	

(continued)

(Category 05 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 05 007	0 31 001	Delayed descriptor replication factor	
(continued)	3 05 006	MEDHYCOS measurement	Single measurement
		(AOCHYCOS – Chad measurement)	
3 05 008	3 05 006	MEDHYCOS measurement	Same as MEDHYCOS type measurement
	0 12 030	Soil temperature	At –50 cm
		(AOCHYCOS – Chad report)	
3 05 009	3 01 029	Identification	
	3 01 012	Hour, minute	Time of first measurement
	0 04 065	Short time increment	Time interval between measurements
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 05 008	AOCHYCOS – Chad measurement	Single measurement
		(MEDHYCOS-Measurement type 2)	
3 05 010	3 05 008	AOCHYCOS-Chad measurement	Same as AOCHYCOS type measurement
	0 02 091	Entry sensor 4/20 mA	No. 1
	0 02 091	Entry sensor 4/20 mA	No. 2
		(MEDHYCOS report type 2)	
3 05 011	3 01 029	Identification	
	3 01 012	Hour, minute	Time of first measurement
	0 04 065	Short time increment	Time interval between measurements
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 05 010	MEDHYCOS-Measurement type 2	Single measurement
		(Meteorological parameters associated with hydrological data)	
3 05 016	0 14 021	Global solar radiation, integrated over period specified	
	0 07 004	Pressure	Atmospheric pressure
	0 13 003	Relative humidity	
	0 11 002	Wind speed	
	0 11 001	Wind direction	
	0 11 041	Maximum wind gust speed	
	0 11 043	Maximum wind gust direction	
		(Water quality measurement)	
3 05 017	0 13 080	Water pH	
	0 13 081	Water conductivity	
	0 13 083	Dissolved oxygen	
	0 13 085	Oxydation Reduction Potential (ORP)	
	0 13 084	Turbidity	

(continued)

(Category 05 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(MEDHYCOS report with meteorology and water quality data)	
3 05 018	3 01 029	Identification	
	3 01 012	Hour, minute	Time of first measurement
	0 04 065	Short time increment	Hour increment
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	3 05 008	AOCHYCOS-Chad measurement	Same as AOCHYCOS type measurement
	3 05 016	Meteorological parameters associated with hydrological data	
	3 05 017	Water quality measurement	

Category 06 – Meteorological or oceanographic sequences common to oceanographic observations

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Depth, temperature)	
3 06 001	0 02 032	Indicator for digitization	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 062	Depth below sea/water surface	
	0 22 042	Sea/water temperature	
		(Current)	
3 06 002	0 02 031	Duration and time of current measurement	
	0 22 004	Direction of current	
	0 22 031	Speed of current	
		(Surface wind and temperature)	
3 06 003	0 02 002	Type of instrumentation for wind measurement	
	0 11 011	Wind direction at 10 m	
	0 11 012	Wind speed at 10 m	
	0 12 004	Air temperature at 2 m	
		(Depth, temperature, salinity)	
3 06 004	0 02 032	Indicator for digitization	
	0 02 033	Method of salinity/depth measurement	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 062	Depth below sea/water surface	
	0 22 043	Sea/water temperature	
	0 22 062	Salinity	
3 06 005	0 02 031	Duration and time of current measurement	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 062	Depth below sea/water surface	
	0 22 004	Direction of current	
	0 22 031	Speed of current	
		(Under water sounding (optional) parameters)	
3 06 006	3 06 003	Surface wind and temperature	
	3 06 002	Current	
	0 22 063	Total water depth	
		(Buoy spare block parameters)	
3 06 007	0 01 012	Direction of motion of moving observing platform	
	0 01 014	Platform drift speed (high precision)	
	3 06 008	Buoy instrumentation parameters	
	0 04 024	Time period or displacement	
	0 27 003	Alternate latitude (coarse accuracy)	
	0 28 003	Alternate longitude (coarse accuracy)	

(continued)

(Category 06 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Buoy instrumentation parameters)	
3 06 008	0 02 034	Drogue type	
	0 02 035	Cable length	
	0 02 036	Buoy type	
		(Tide report identification, water level checks, time increments)	
3 06 019	0 01 075	Tide station identification	Alphanumeric
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 22 042	Sea/water temperature	
	0 22 120	Tide station automated water level check	
	0 22 121	Tide station manual water level check	
	0 04 015	Time increment (see Note 1)	Minutes
	0 04 065	Short time increment	
		(Tide report identification, water level checks, time period or displacement, time increment) (see Note 2)	
3 06 020	0 01 075	Tide station identification	Alphanumeric
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 22 042	Sea/water temperature	
	0 22 120	Tide station automated water level check	
	0 22 121	Tide station manual water level check	
	0 04 075	Short time period or displacement	
	0 04 065	Short time increment	
		(Meteorological parameters in tide station)	
3 06 021	0 01 075	Tide station identification	Alphanumeric
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 22 122	Tide station automated meteorological data check	
	0 22 123	Tide station manual meteorological data check	
	0 12 001	Temperature/air temperature	
	3 03 002	Wind at pressure level	
		(Tidal elevation)	
3 06 022	0 01 075	Tide station identification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 22 038	Tidal elevation with respect to local chart datum	
	0 22 039	Meteorological residual tidal elevation (surge or offset)	
3 06 023	0 01 015	Station or site name	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 22 038	Tidal elevation with respect to local chart datum	
	0 22 039	Meteorological residual tidal elevation (surge or offset)	
	0 22 120	Tide station automated water level check	
	0 22 121	Tide station manual water level check	

(continued)

(Category 06 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Tide elevation series) (see Note 3)	
3 06 024	3 06 020	Tide report identification, water level checks, time period or displacement, time increment	
	1 02 006	Replicate 2 descriptors 6 times	
	0 22 038	Tidal elevation with respect to local chart datum	
	0 22 039	Meteorological residual tidal elevation (surge or offset)	
		(Tide elevation series)	
3 06 025	3 06 019	Tide report identification, water level checks, time increments	
	1 02 006	Replicate 2 descriptors 6 times	
	0 22 038	Tidal elevation with respect to local chart datum	
	0 22 039	Meteorological residual tidal elevation (surge or offset)	
		(Sequence for representation of DART buoy identification, transmitter ID, type of tsunameter and the time the message is transmitted to the ground system)	
3 06 027	0 01 005	Buoy/platform identifier	
	0 01 052	Platform transmitter ID	
	0 02 047	Deep-ocean tsunameter type	
	3 01 011	Year, month, day	Time the message is transmitted to the ground system
	3 01 013	Hour, minute, second	
		(Sequence for representation of time of observation and DART buoy position daily report)	
3 06 028	3 06 027	Sequence for representation of DART buoy identification, transmitter ID, type of tsunameter and the time the message is transmitted to the ground system	
	3 01 011	Year, month, day	Observation time
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
		(Sequence for representation of tsunameter sampling information for water column heights in the time series report)	
3 06 029	0 25 170	Sampling interval (time)	Seconds
	0 25 171	Sample averaging period	Seconds
	0 25 172	Number of samples	
		(Sequence for representation of DART buoy standard hourly report)	
3 06 030	3 06 027	Sequence for representation of DART buoy identification, transmitter ID, type of tsunameter and the time the message is transmitted to the ground system	
	3 06 029	Sequence for representation of tsunameter sampling information for water column heights in the time series report	
	1 11 000	Delayed replication of 11 descriptors	

(continued)

(Category 06 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 06 030 *(continued)*	0 31 001	Delayed descriptor replication factor	
	0 33 002	Quality information	Message status
	3 01 011	Year, month, day	Reference date/time for the time series
	3 01 013	Hour, minute, second	
	0 25 025	Battery voltage	BPR CPU
	0 25 025	Battery voltage	Acoustic modem DSP
	0 25 026	Battery voltage (large range)	Acoustic modem
	0 22 185	BPR transmission count	
	0 04 015	Time increment	Added to reset the reference time
	0 04 065	Short time increment	Added to each data value in the time series
	1 01 004	Replicate 1 descriptor 4 times	
	0 22 182	Water column height	
		(Sequence for representation of DART buoy tsunami event reports and extended tsunami event reports)	
3 06 031	3 06 027	Sequence for representation of DART buoy identification, transmitter ID, type of tsunameter and the time the message is transmitted to the ground system	
	3 06 029	Sequence for representation of tsunameter sampling information for water column heights in the time series report	
	0 01 053	Tsunameter report sequence number triggered by a tsunami event	
	0 33 002	Quality information	Message status
	3 01 011	Year, month, day	Time when tsunami is detected
	3 01 013	Hour, minute, second	
	3 01 011	Year, month, day	Reference date/time for the time series
	3 01 013	Hour, minute, second	
	0 22 185	BPR transmission count	
	0 22 182	Water column height	Determination of actual value reported in the time series
	0 04 016	Time increment	Added to reset the reference time
	0 04 066	Short time increment	Added to each data value in the time series
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 22 184	Water column height deviation from the reference value	

Notes:

(1) Range of value for parameter 0 04 015 limited from –99 to 99; CREX common sequence D 06 019 being the original sequence with 2 characters only for the corresponding descriptor.

(2) This sequence is deprecated because of incorrect usage of descriptor 0 04 075; sequence 3 06 019 should be used instead.

(3) This sequence is deprecated because of incorrect usage of descriptor 0 04 075 in sequence 3 06 020; sequence 3 06 025 should be used instead.

Category 07 – Surface report sequences (land)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Low altitude station)	
3 07 001	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	3 02 011	Low altitude station	Basic surface report
		(Low altitude station)	
3 07 002	3 01 032	Identification and type of station, date/time, location (coarse accuracy), height of station	
	3 02 011	Low altitude station	Basic surface report
		(Low altitude station)	
3 07 003	3 07 001	Low altitude station	Location (high accuracy) and basic report
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	
		(Low altitude station)	
3 07 004	3 07 002	Low altitude station	Location (coarse accuracy) and basic report
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	
		(Low altitude station)	
3 07 005	3 07 001	Low altitude station	Location (high accuracy) and basic report
	1 01 004	Replicate 1 descriptor 4 times	
	3 02 005	Cloud layer	4 layers
		(Low altitude station)	
3 07 006	3 07 002	Low altitude station	Location (coarse accuracy) and basic report
	1 01 004	Replicate 1 descriptor 4 times	
	3 02 005	Cloud layer	4 layers
		(High altitude station)	
3 07 007	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	3 02 012	High altitude station	Basic surface report
		(High altitude station)	
3 07 008	3 01 032	Identification and type of station, date/time, location (coarse accuracy), height of station	
	3 02 012	High altitude station	Basic surface report

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 009	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	3 02 013	Basic surface report	
		(Main part of data for representation of METAR/SPECI code in BUFR)	
3 07 011	0 01 063	ICAO location indicator	
	0 02 001	Type of station	
	3 01 011	Year, month, day	YY
	3 01 012	Hour, minute	GG, gg
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	0 07 006	Height above station	Height of an anemometer
	0 11 001	Wind direction	
	0 11 016	Extreme counterclockwise wind direction of a variable wind	
	0 11 017	Extreme clockwise wind direction of a variable wind	
	0 11 002	Wind speed	
	0 11 041	Maximum wind gust speed	
	0 07 006	Height above station	Height of a thermometer
	0 12 001	Temperature/air temperature	
	0 12 003	Dewpoint temperature	
	0 10 052	Altimeter setting (QNH)	
	0 20 009	General weather indicator (TAF/METAR)	
		(Horizontal visibility)	
3 07 012	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	Up to 3
	0 08 023	First-order statistics	
	0 05 021	Bearing or azimuth	Direction of visibility observed
	0 20 001	Horizontal visibility	
		(Runway visual range)	
3 07 013	1 06 000	Delayed replication of 6 descriptors	
	0 31 001	Delayed descriptor replication factor	Up to 4
	0 01 064	Runway designator	
	0 08 014	Qualifier for runway visual range	
	0 20 061	Runway visual range (RVR)	
	0 08 014	Qualifier for runway visual range	
	0 20 061	Runway visual range (RVR)	
	0 20 018	Tendency of runway visual range	
		(Significant present or forecast weather)	
3 07 014	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Up to 3
	0 20 019	Significant present or forecast weather	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Clouds group(s))	
3 07 015	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud layer	$N_sN_sN_s$, CC, $h_sh_sh_s$
	0 20 002	Vertical visibility	
		(Significant recent weather phenomena)	
3 07 016	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Up to 3
	0 20 020	Significant recent weather phenomena	
		(Wind shear on runway(s))	
3 07 017	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 11 070	Designator of the runway affected by wind shear (including ALL)	
		(Trend-type landing forecast)	
3 07 018	0 08 016	Change qualifier of a trend-type forecast or an aerodrome forecast	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	Up to 2
	0 08 017	Qualifier of the time when the forecast change is expected	FM, TL, AT
	3 01 012	Hour, minute	GG, gg
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	Up to 1
	0 07 006	Height above station	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 11 041	Maximum wind gust speed	
	0 20 009	General weather indicator (TAF/METAR)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Up to 1
	0 20 001	Horizontal visibility	
	3 07 014	Significant present or forecast weather	w´w´
		(Short METAR/SPECI)	
3 07 020	3 07 011	Main part of data for representation of METAR/SPECI code in BUFR	
	3 07 014	Significant present or forecast weather	w´w´
	3 07 016	Significant recent weather phenomena	REw´w´
		(Total sequence for representation of METAR/SPECI code in BUFR)	
3 07 021	3 07 011	Main part of data for representation of METAR/SPECI code in BUFR	
	3 07 012	Horizontal visibility	D_vVVVV
	3 07 013	Runway visual range	$D_RD_R/V_RV_RV_RV_R$

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 021	3 07 014	Significant present or forecast weather	w´w´
(continued)	3 07 015	Clouds group(s)	
	3 07 016	Significant recent weather phenomena	REw´w´
	3 07 017	Wind shear on runway(s)	
	3 07 018	Trend-type landing forecast	
	3 07 015	Clouds group(s)	
		(Ground-based GNSS data)	
3 07 022	0 01 015	Station or site name	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 022	Latitude/longitude (high accuracy), height of station	
	0 08 021	Time significance	= 23 Monitoring period
	0 04 025	Time period or displacement	
	0 10 004	Pressure	
	0 12 001	Temperature/air temperature	
	0 13 003	Relative humidity	
	0 33 038	Quality flags for ground-based GNSS data	
	0 08 022	Total number (with respect to accumulation or average)	Number of GNSS satellites used
	1 06 025	Replicate 6 descriptors 25 times	
	0 02 020	Satellite classification	
	0 01 050	Platform transmitter ID number	
	0 05 021	Bearing or azimuth	
	0 07 021	Elevation	
	0 15 031	Atmospheric path delay in satellite signal	
	0 15 032	Estimated error in atmospheric path delay	
	0 08 060	Sample scanning mode significance	= 5 North/South
	0 15 033	Difference in path delays for limb views at extremes of scan	
	0 15 034	Estimated error in path delay difference	
	0 08 060	Sample scanning mode significance	= 6 East/West
	0 15 033	Difference in path delays for limb views at extremes of scan	
	0 15 034	Estimated error in path delay difference	
	0 15 035	Component of zenith path delay due to water vapour	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 13 016	Precipitable water	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 15 011	Log_{10} of integrated electron density	
		(Ozone data – single observation)	
3 07 030	0 15 001	Total ozone	
	0 15 002	Air mass (slant path at 22 km)	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ozone data – averaged observations)	
3 07 031	0 08 022	Total number (with respect to accumulation or average)	Number of measurements
	0 08 023	First-order statistics	= 4 Mean value
	0 15 001	Total ozone	Average value of ozone measurement
	0 08 023	First-order statistics	= 9 Best estimate of standard deviation
	0 15 001	Total ozone	Best estimate of standard deviation of the ozone measurement
	0 08 023	First-order statistics	= 11 Harmonic mean
	0 15 002	Air mass (slant path at 22 km)	Harmonic mean value of the air-mass
		(Total ozone measurement from a Brewer ground-based spectrophotometer obtained from a single observation)	
3 07 041	3 01 001	WMO block and station numbers	
	0 01 015	Station or site name	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	3 01 011	Year, month, day	Ozone measurement
	3 01 012	Hour, minute	Ozone measurement
	3 01 070	Ozone instrumentation – Brewer spectrophotometer	
	3 07 030	Ozone data – single observation	
		(Total ozone measurement from a Brewer ground-based spectrophotometer obtained from averaged observations)	
3 07 042	3 01 001	WMO block and station numbers	
	0 01 015	Station or site name	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	3 01 011	Year, month, day	Ozone measurement
	3 01 012	Hour, minute	Ozone measurement
	0 08 021	Time significance	= 8 Ensemble mean
	0 04 025	Time period or displacement	Time period (minutes) for the computation of the average
	3 01 070	Ozone instrumentation – Brewer spectrophotometer	
	3 07 031	Ozone data – averaged observations	
		(Total ozone measurement from a Dobson ground-based spectrophotometer obtained from a single observation)	
3 07 043	3 01 001	WMO block and station numbers	
	0 01 015	Station or site name	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	3 01 011	Year, month, day	Ozone measurement
	3 01 012	Hour, minute	Ozone measurement
	3 01 074	Ozone instrumentation – Dobson spectrophotometer	
	3 07 030	Ozone data – single observation	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Total ozone measurement from a Dobson ground-based spectrophotometer obtained from averaged observations)	
3 07 044	3 01 001	WMO block and station numbers	
	0 01 015	Station or site name	
	3 01 024	Latitude/longitude (coarse accuracy), height of station	
	3 01 011	Year, month, day	Ozone measurement
	3 01 012	Hour, minute	Ozone measurement
	0 08 021	Time significance	= 8 Ensemble mean
	0 04 025	Time period or displacement	Time period (minutes) for the computation of the average
	3 01 074	Ozone instrumentation – Dobson spectrophotometer	
	3 07 031	Ozone data – averaged observations	
		(Main part of METAR/SPECI), replacing 3 07 011	
3 07 045	0 01 063	ICAO location indicator	CCCC
	0 08 079	Product status	METAR SPECI COR
	0 02 001	Type of station	AUTO
	3 01 011	Year, month, day	YY
	3 01 012	Hour, minute	GGgg
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	= 10 m (if the actual value is not available)
	0 11 001	Wind direction	ddd
	0 11 016	Extreme counterclockwise wind direction of a variable wind	$d_nd_nd_n$
	0 11 017	Extreme clockwise wind direction of a variable wind	$d_xd_xd_x$
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 083	Wind speed (see Note 5)	ff – km/h
	0 11 084	Wind speed (see Note 5)	ff – kt
	0 11 002	Wind speed (see Note 5)	ff – m/s
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 085	Maximum wind gust speed (see Note 6)	f_mf_m – km/h
	0 11 086	Maximum wind gust speed (see Note 6)	f_mf_m – kt
	0 11 041	Maximum wind gust speed (see Note 6)	f_mf_m – m/s
	0 08 054	Qualifier for wind speed or wind gusts	Set to missing (cancel)
	0 07 032	Height of sensor above local ground (or deck of marine platform)	= 2 m (if the actual value is not available)
	0 12 023	Temperature	T´T´ – Celsius
	0 12 024	Dewpoint temperature	$T´_dT´_d$ – Celsius
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 10 052	Altimeter setting (QNH)	$QP_HP_HP_HP_H$
	0 20 009	General weather indicator (TAF/METAR)	CAVOK

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(METAR/SPECI visibility)	
3 07 046	0 20 060	Prevailing horizontal visibility	VVVV or VVVVNDV
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	Up to 2
	0 05 021	Bearing or azimuth	Direction of minimum visibility observed D_v
	0 20 059	Minimum horizontal visibility	$V_NV_NV_NV_N$
		(METAR/SPECI/TAF clouds), replacing 3 07 015	
3 07 047	1 05 000	Delayed replication of 5 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 002	Vertical significance (surface observations)	
	0 20 011	Cloud amount	$N_sN_sN_s$
	0 20 012	Cloud type	CC
	0 20 013	Height of base of cloud	$h_sh_sh_s$ – m
	0 20 092	Height of base of cloud	$h_sh_sh_s$ – ft
	0 20 002	Vertical visibility	$VVh_sh_sh_s$ – m
	0 20 091	Vertical visibility	$VVh_sh_sh_s$ – ft
		(Trend type forecast), replacing 3 07 018	
3 07 048	0 08 016	Change qualifier of a trend-type forecast or an aerodrome forecast	TTTTT NOSIG
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	= 0, 1 or 2
	0 08 017	Qualifier of the time when the forecast change is expected	TT
	3 01 012	Hour, minute	GGgg
	1 12 000	Delayed replication of 12 descriptors	
	0 31 000	Short delayed descriptor replication factor	= 0 or 1
	0 07 032	Height of sensor above local ground (or deck of marine platform)	= 10 m (if the actual value is not available)
	0 11 001	Wind direction	ddd
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 083	Wind speed (see Note 5)	ff – km/h
	0 11 084	Wind speed (see Note 5)	ff – kt
	0 11 002	Wind speed (see Note 5)	ff – m/s
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 085	Maximum wind gust speed (see Note 6)	f_mf_m – km/h
	0 11 086	Maximum wind gust speed (see Note 6)	f_mf_m – kt
	0 11 041	Maximum wind gust speed (see Note 6)	f_mf_m – m/s
	0 08 054	Qualifier for wind speed or wind gusts	Set to missing (cancel)
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 20 009	General weather indicator (TAF/METAR)	CAVOK NSW NSC
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	= 0 or 1
	0 20 060	Prevailing horizontal visibility	VVVV
	3 07 014	Significant present and forecast weather	Weather intensity and phenomena w´w´
	3 07 047	METAR/SPECI/TAF clouds, replacing 3 07 015	$N_sN_sN_sh_sh_sh_s$

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Sea conditions)	
3 07 049	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	= 0 or 1
	0 22 043	Sea/water temperature	T_sT_s
	0 22 021	Height of waves	S´
		(Runway state)	
3 07 050	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	= 0 or 1
	0 20 085	General condition of runway	SNOCLO
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 01 064	Runway designator	D_RD_R
	0 20 085	General condition of runway	CLRD//
	1 05 000	Delayed replication of 5 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 01 064	Runway designator	D_RD_R
	0 20 086	Runway deposits	E_R
	0 20 087	Runway contamination	C_R
	0 20 088	Depth of runway deposits	e_Re_R
	0 20 089	Runway friction coefficient	B_RB_R
		(Full METAR/SPECI), replacing 3 07 021	
3 07 051	3 07 045	Main part of METAR/SPECI, replacing 3 07 011	
	3 07 046	METAR/SPECI visibility	VVVV or VVVVNDV $V_NV_NV_NV_ND_V$
	3 07 013	Runway visual range	$RD_RD_R/V_RV_RV_RV_R$
	3 07 014	Significant present and forecast weather	Weather intensity and phenomena w´w´
	3 07 047	METAR/SPECI/TAF clouds, replacing 3 07 015	$N_sN_sN_sh_sh_sh_s$
	3 07 016	Significant recent weather phenomena	REw´w´
	3 07 017	Wind shear on runway(s)	WS RD_RD_R
	3 07 049	Sea conditions	WT_sT_s/SS´
	3 07 050	Runway state	$RD_RD_R/E_RC_Re_Re_RB_RB_R$
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	= 0 to 3 normally
	3 07 048	Trend type forecast, replacing 3 07 018	
		(Aerodrome forecast identification and time interval)	
3 07 052	0 01 063	ICAO location indicator	CCCC
	0 08 039	Time significance (Aviation forecast)	= 0 Issue time of forecast
	3 01 011	Year, month, day	YY
	3 01 012	Hour, minute	GGgg
	0 08 079	Product status	COR CNL AMD NIL

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 052 *(continued)*	0 08 039	Time significance (Aviation forecast)	= 1 Time of commencement of period of the forecast
	3 01 011	Year, month, day	Y_1Y_1
	3 01 012	Hour, minute	G_1G_1
	0 08 039	Time significance (Aviation forecast)	= 2 Time of ending of period of the forecast
	3 01 011	Year, month, day	Y_2Y_2
	3 01 012	Hour, minute	G_2G_2
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
		(Forecast weather at an aerodrome)	
3 07 053	0 07 032	Height of sensor above local ground (or deck of marine platform)	= 10 m (if the actual value is not available)
	0 11 001	Wind direction	ddd
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 083	Wind speed (see Note 5)	ff – km/h
	0 11 084	Wind speed (see Note 5)	ff – kt
	0 11 002	Wind speed (see Note 5)	ff – m/s
	0 08 054	Qualifier for wind speed or wind gusts	P
	0 11 085	Maximum wind gust speed (see Note 6)	f_mf_m – km/h
	0 11 086	Maximum wind gust speed (see Note 6)	f_mf_m – kt
	0 11 041	Maximum wind gust speed (see Note 6)	f_mf_m – m/s
	0 08 054	Qualifier for wind speed or wind gusts	Set to missing (cancel)
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 20 009	General weather indicator (TAF/METAR)	CAVOK NSW NSC
	0 20 060	Prevailing horizontal visibility	VVVV
	3 07 014	Significant present and forecast weather	w´w´
	3 07 047	METAR/SPECI/TAF clouds, replacing 3 07 015	$N_sN_sN_sh_sh_sh_s$
		(Forecast of extreme temperatures)	
3 07 054	0 07 032	Height of sensor above local ground (or deck of marine platform)	= 2 m (if the actual value is not available)
	0 08 039	Time significance (Aviation forecast)	= 3 Forecast time of maximum temperature
	0 04 003	Day	
	0 04 004	Hour	G_FG_F
	0 08 023	First-order statistics	= 3 Minimum
	0 12 023	Temperature	T_FT_F – Celsius
	0 08 039	Time significance (Aviation forecast)	= 4 Forecast time of minimum temperature
	0 04 003	Day	
	0 04 004	Hour	G_FG_F
	0 08 023	First-order statistics	= 2 Maximum

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 054 *(continued)*	0 12 023	Temperature	T_FT_F – Celsius
	0 08 023	First-order statistics	Set to missing (cancel)
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		(Change indicator and forecast changes)	
3 07 055	0 33 045	Probability of following event	C_2C_2
	0 08 016	Change qualifier of a trend-type forecast or an aerodrome forecast	TTTTTT
	0 08 039	Time significance (Aviation forecast)	= 5 Time of beginning of the forecast change
	0 04 003	Day	
	3 01 012	Hour, minute	GGgg
	0 08 039	Time significance (Aviation forecast)	= 6 Time of ending of the forecast change
	0 04 003	Day	
	3 01 012	Hour, minute	G_eG_e
	3 07 053	Forecast weather at an aerodrome	During or after change
		(Aerodrome forecast – full TAF)	
3 07 056	3 07 052	Aerodrome forecast identification and time interval	
	3 07 053	Forecast weather at an aerodrome	
	3 07 054	Forecast of extreme temperatures	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 07 055	Change indicator and forecast changes	
		(Soil temperature below land surface)	
3 07 060	0 07 061	Depth below land surface	
	0 12 030	Soil temperature	
		(Soil temperature data at number of depths not exceeding five – high accuracy position)	
3 07 061	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	1 01 005	Replicate 1 descriptor 5 times	
	3 07 060	Soil temperature below land surface	
		(Soil temperature data at number of depths not exceeding five – coarse accuracy position)	
3 07 062	3 01 032	Identification and type of station, date/time, location (coarse accuracy), height of station	
	1 01 005	Replicate 1 descriptor 5 times	
	3 07 060	Soil temperature below land surface	
		(Depth below land surface and soil temperature)	
3 07 063	0 07 061	Depth below land surface	
	0 12 130	Soil temperature	Scale: 2

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Monthly values of a land station)	
3 07 071	3 01 090	Surface station identification; time, horizontal and vertical coordinates (see Note 1)	
	0 04 074	Short time period or displacement (see Note 1)	= UTC – LST
	0 04 023	Time period or displacement	Number of days in the month
		Monthly mean values of pressure, temperature, extreme temperatures and vapour pressure	
	0 08 023	First-order statistics	= 4 Mean value
	0 10 004	Pressure	
	0 10 051	Pressure reduced to mean sea level	
	0 07 004	Pressure	Standard level **|** Set to missing for lowland stations
	0 10 009	Geopotential height	Standard level **|** Set to missing for lowland stations
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 12 101	Temperature/air temperature	
	0 02 051	Indicator to specify observing method for extreme temperatures	
	0 04 051	Principal time of daily reading of maximum temperature	
	0 12 118	Maximum temperature at height specified, past 24 hours	
	0 04 052	Principal time of daily reading of minimum temperature	
	0 12 119	Minimum temperature at height specified, past 24 hours	
	0 13 004	Vapour pressure	
	0 08 023	First-order statistics	Set to missing
	0 12 151	Standard deviation of daily mean temperature	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	1 02 005	Replicate 2 descriptors 5 times	
	0 08 050	Qualifier for number of missing values in calculation of statistic	= 1 Pressure, = 2 Temperature, = 4 Vapour pressure, = 7 Maximum temperature, = 8 Minimum temperature
	0 08 020	Total number of missing entities (with respect to accumulation or average)	Days
		Sunshine duration	
	0 14 032	Total sunshine	
	0 14 033	Total sunshine	
	0 08 050	Qualifier for number of missing values in calculation of statistic	= 6 Sunshine duration
	0 08 020	Total number of missing entities (with respect to accumulation or average)	Days

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 071 *(continued)*		*Number of days of occurrence*	
	1 02 018	Replicate 2 descriptors 18 times	
	0 08 052	Condition for which number of days of occurrence follows	
	0 08 022	Total number (with respect to accumulation or average)	Days
		Occurrence of extreme values of temperature and wind speed	
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 12 152	Highest daily mean temperature	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 12 153	Lowest daily mean temperature	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 08 023	First-order statistics	= 2 Maximum value
	0 12 101	Temperature/air temperature	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 08 023	First-order statistics	= 3 Minimum value
	0 12 101	Temperature/air temperature	
	0 08 023	First-order statistics	Set to missing
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 02 002	Type of instrumentation for wind measurement	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 11 046	Maximum instantaneous wind speed	
	0 08 053	Day of occurrence qualifier	Set to missing (cancel)
		Precipitation	
	0 04 003	Day (see Note 2)	= 1
	0 04 004	Hour (see Note 2)	= 6
	0 04 023	Time period or displacement (see Note 2)	Number of days in the month
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 13 060	Total accumulated precipitation	
	0 13 051	Frequency group, precipitation	
	0 04 053	Number of days with precipitation equal to or more than 1 mm	
	0 08 050	Qualifier for number of missing values in calculation of statistic	= 5 Precipitation

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 071 *(continued)*	0 08 020	Total number of missing entities (with respect to accumulation or average)	Days
		Numbers of days of occurrence	
	1 02 006	Replicate 2 descriptors 6 times	
	0 08 052	Condition for which number of days of occurrence follows	
	0 08 022	Total number (with respect to accumulation or average)	Days
		Occurrence of extreme precipitation	
	0 08 053	Day of occurrence qualifier	= 0 On 1 day only, = 1 On 2 or more days
	0 04 003	Day	
	0 13 052	Highest daily amount of precipitation	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		(Monthly normals for a land station)	
3 07 072	0 04 001	Year	Beginning of the reference period
	0 04 001	Year	Ending of the reference period
	0 04 002	Month	
	0 04 003	Day (see Note 1)	= 1
	0 04 004	Hour (see Note 1)	= 0
	0 04 074	Short time period or displacement (see Note 1)	= UTC – LST
	0 04 022	Time period or displacement	= 1
		Normals of monthly mean pressure, temperature, vapour pressure and of standard deviation	
	0 08 023	First-order statistics	= 4 Mean value
	0 10 004	Pressure	
	0 10 051	Pressure reduced to mean sea level	
	0 07 004	Pressure	Standard level
	0 10 009	Geopotential height	Standard level
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 12 101	Temperature/air temperature	
	0 02 051	Indicator to specify observing method for extreme temperatures	= 2
	0 04 051	Principal time of daily reading of maximum temperature	
	0 12 118	Maximum temperature at height specified, past 24 hours	
	0 04 052	Principal time of daily reading of minimum temperature	
	0 12 119	Minimum temperature at height specified, past 24 hours	
	0 13 004	Vapour pressure	
	0 12 151	Standard deviation of daily mean temperature	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 072		*Normal of sunshine duration*	
(continued)	0 14 032	Total sunshine	
	0 08 023	First-order statistics	Set to missing
		Normals of precipitation	
	0 04 001	Year	Beginning of the reference period
	0 04 001	Year	Ending of the reference period
	0 04 002	Month	
	0 04 003	Day (see Note 2)	= 1
	0 04 004	Hour (see Note 2)	= 6
	0 04 022	Time period or displacement	= 1
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 08 023	First-order statistics	= 4 Mean value
	0 13 060	Total accumulated precipitation	
	0 04 053	Number of days with precipitation equal to or more than 1 mm	
	0 08 023	First-order statistics	Set to missing
	1 02 008	Replicate 2 descriptors 8 times	
	0 08 050	Qualifier for number of missing values in calculation of statistic (see Note 4)	= 1 Pressure, = 2 Temperature, = 3 Extreme temperatures, = 4 Vapour pressure, = 5 Precipitation, = 6 Sunshine duration, = 7 Maximum temperature, = 8 Minimum temperature
	0 08 020	Total number of missing entities (with respect to accumulation or average) (see Note 4)	Years
		(Representation of CLIMAT data of the actual month and for monthly normals)	
3 07 073	3 07 071	Monthly values of a land station	
	3 07 072	Monthly normals for a land station	
		(Sequence for representation of synoptic reports from fixed land stations suitable for SYNOP data and for maritime data from coastal stations)	
3 07 079	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 079 *(continued)*	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 22 061	State of the sea	
	0 20 058	Visibility seawards from a coastal station	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 056	Sea/water temperature	Sea/water surface temperature, method of measurement, depth below water surface
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 055	Icing and ice	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 046	Temperature change	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data)	
3 07 080	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data in compliance with reporting practices in RA I)	
3 07 081	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 081 *(continued)*	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	0 12 122	Ground minimum temperature of the preceding night	
	0 13 056	Character and intensity of precipitation	
	0 13 057	Time of beginning or end of precipitation	
	0 20 101	Locust (acridian) name	
	0 20 102	Locust (maturity) colour	
	0 20 103	Stage of development of locusts	
	0 20 104	Organization state of swarm or band of locusts	
	0 20 105	Size of swarm or band of locusts and duration of passage of swarm	
	0 20 106	Locust population density	
	0 20 107	Direction of movements of locust swarm	
	0 20 108	Extent of vegetation	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data in compliance with reporting practices in RA II)	
3 07 082	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	0 12 121	Ground minimum temperature	At the time of observation
	0 12 122	Ground minimum temperature of the preceding night	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data in compliance with reporting practices in RA III)	
3 07 083	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	0 12 122	Ground minimum temperature of the preceding night	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data in compliance with reporting practices in RA IV)	
3 07 084	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	0 20 055	State of sky in the tropics	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	2 05 001	Signify character	Character field of 1 character
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data in compliance with reporting practices in RA VI)	
3 07 086	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 02 031	Pressure information	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 086 *(continued)*	3 02 035	Basic synoptic "instantaneous" data	
	3 02 036	Clouds with bases below station level	
	0 08 002	Vertical significance (surface observations)	Set to missing (cancel)
	3 02 037	State of ground, snow depth, ground minimum temperature	
	3 02 066	Dangerous weather phenomena	
	3 02 043	Basic synoptic "period" data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
		("Instantaneous" parameters of sequence 3 07 089)	
		Surface station identification, time, horizontal and vertical coordinates	
3 07 087	3 01 001	WMO block and station numbers	IIiii
	0 02 001	Type of station	i_x
	3 01 011	Year, month, day	YY
	3 01 012	Hour, minute	GG, gg
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
		Pressure data	
	3 02 001	Pressure and 3-hour pressure change	$P_oP_oP_oP_o$, PPPP, ppp, a
	0 10 062	24-hour pressure change	$p_{24}p_{24}p_{24}$
	0 07 004	Pressure	Standard level a_3 = 925, 850, 700, ..hPa **|** Set to missing for lowland stations
	0 10 009	Geopotential height	Standard level hhh **|** Set to missing for lowland stations
		Temperature and humidity	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature measurement
	0 12 101	Temperature/air temperature	s_nTTT **|** Scale: 2
	0 12 103	Dewpoint temperature	$s_nT_dT_dT_d$ **|** Scale: 2
	0 13 003	Relative humidity	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		Visibility	
	0 20 001	Horizontal visibility	VV

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 087 *(continued)*		*Cloud data*	
	3 02 004	General cloud information	Cloud cover (total) N: If N = 9, then 0 20 010 = 113, if N = /, then 0 20 010 = missing **|** Vertical significance: If C_L are observed, then 0 08 002 = 7 **|** Low cloud: If C_L are not observed and C_M are observed, then 0 08 002 = 8 **|** Middle cloud: If only C_H are observed, 0 08 002 = 0, if N = 9, then 0 08 002 = 5, if N = 0, then 0 08 002 = 62, if N = /, then 0 08 002 = missing **|** Cloud amount (of low or middle clouds) N_h: If N = 0, then 0 20 011 = 0, if N = 9, then 0 20 011 = 9, if N = /, then 0 20 011 = missing **|** Height of base of cloud h: If N = 0 or /, then 0 20 013 = missing **|** Cloud type (low clouds) C_L: 0 20 012 = C_L + 30, if N = 0, then 0 20 012 = 30, if N = 9 or /, then 0 20 012 = 62 **|** Cloud type (middle clouds) C_M: 0 20 012 = C_M + 20, if N = 0, then 0 20 012 = 20, if N = 9 or / or C_M = /, then 0 20 012 = 61 **|** Cloud type (high clouds) C_H: 0 20 012 = C_H + 10, if N = 0, then 0 20 012 = 10, if N = 9 or / or C_H = /, then 0 20 012 = 60
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 087 *(continued)*	3 02 005	Cloud layer	Vertical significance: In any Cb layer, 0 08 002 = 4, else in the first replication, if N = 9, then 0 08 002 = 5, if N = /, then 0 08 002 = missing, else 0 08 002 = 1, in the other replications 0 08 002 = 2, 3, 4 **|** Cloud amount N_s: In the first replication, if N = /, then 0 20 011 = missing, else 0 20 011 = N_s, in the other replications 0 20 011 = N_s **|** Cloud type C: If N = 9 or /, then 0 20 012 = missing, else 0 20 012 = C **|** Height of base of cloud h_sh_s
		(“Period” parameters of sequence 3 07 089)	
		Present and past weather	
3 07 088	0 20 003	Present weather	ww
	0 04 024	Time period or displacement	= –6 at 00, 06, 12, 18 UTC, = –3 at 03, 09, 15, 21 UTC
	0 20 004	Past weather (1)	W_1
	0 20 005	Past weather (2)	W_2
		Evaporation	
	0 04 024	Time period or displacement	= –24 (hours)
	0 02 004	Type of instrumentation for evaporation measurement or type of crop for which evapotranspiration is reported	i_E
	0 13 033	Evaporation/evapotranspiration	EEE
		Sunshine	
	1 02 002	Replicate 2 descriptors 2 times	
	0 04 024	Time period or displacement	= –24 (hours) in the first replication, = –1 (hour) in the second replication
	0 14 031	Total sunshine	SSS in the first replication, SS in the second replication
		Precipitation	
	1 02 002	Replicate 2 descriptors 2 times	
	0 04 024	Time period or displacement	t_R
	0 13 011	Total precipitation/total water equivalent	RRR **|** = 0 No precipitation, = –0.1 Trace

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 088		*Extreme temperatures*	
(continued)	0 07 032	Height of sensor above local ground (or deck of marine platform)	Temperature measurement
	0 04 024	Time period or displacement	= –12 (hours)
	0 12 111	Maximum temperature, at height and over period specified	$s_nT_xT_xT_x$
	0 04 024	Time period or displacement	= –12 (hours)
	0 12 112	Minimum temperature, at height and over period specified	$s_nT_nT_nT_n$
		Wind data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Wind measurement
	0 02 002	Type of instrumentation for wind measurement	i_w
	0 08 021	Time significance	= 2 Time averaged
	0 04 025	Time period or displacement	= –10 (minutes) or number of minutes after a significant change of wind, if any
	0 11 001	Wind direction	dd **|** If dd = 00 Calm or dd = 99 Variable, 0 11 001 = 0
	0 11 002	Wind speed	ff
	0 08 021	Time significance	Set to missing (cancel)
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data manually encoded in CREX)	
3 07 089	3 07 087	“Instantaneous” parameters of sequence 3 07 089	
	3 07 088	“Period” parameters of sequence 3 07 089	
		(Sequence for representation of synoptic reports from a mobile land station suitable for SYNOP MOBIL data)	
3 07 090	3 01 092	Mobile surface station identification, date/time, horizontal and vertical coordinates	
	3 02 031	Pressure information	
	3 02 035	Basic synoptic “instantaneous” data	
	3 02 036	Clouds with bases below station level	
	3 02 047	Direction of cloud drift	
	0 08 002	Vertical significance (surface observations)	
	3 02 048	Direction and elevation of cloud	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	3 02 043	Basic synoptic “period” data	
	3 02 044	Evaporation data	
	1 01 002	Replicate 1 descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and 24-hour period)	
	3 02 046	Temperature change	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(BUFR template for surface observations from one-hour period with national and WMO station identification)	
3 07 091	3 01 089	National station identification	
	3 01 090	Surface station identification; time, horizontal and vertical co-ordinates	
	0 08 010	Surface qualifier (temperature data)	
	3 01 091	Surface station instrumentation	
	3 02 001	Pressure and 3-hour pressure change	
	0 07 004	Pressure	Standard level
	0 10 009	Geopotential height	Standard level
	3 02 072	Temperature and humidity data	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	1 01 005	Replicate 1 descriptor 5 times	
	3 07 063	Depth below land surface and soil temperature	
	0 07 061	Depth below land surface	Set to missing (cancel)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 069	Visibility data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	1 05 000	Delayed replication of 5 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 20 031	Ice deposit (thickness)	
	0 20 032	Rate of ice accretion (estimated)	
	0 02 038	Method of water temperature and/or salinity measurement	
	0 22 043	Sea/water temperature	Scale: 2
	3 02 021	Waves	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 078	State of ground and snow depth measurement	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 073	Cloud data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 074	Present and past weather	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 175	Intensity of precipitation, size of precipitation element	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 04 025	Time period or displacement	= –10 (minutes)
	3 02 076	Precipitation, obscuration and other phenomena	
	3 02 071	Wind data from one-hour period	
	3 02 077	Extreme temperature data	

(continued)

(Category 07 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 07 091 *(continued)*	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 079	Precipitation measurement	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 080	Evaporation measurement	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 081	Total sunshine data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 082	Radiation data	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 04 025	Time period or displacement	= –10 (minutes)
	0 13 059	Number of flashes (thunderstorm)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 02 083	First-order statistics of P, W, T, U data	
	0 33 005	Quality information (AWS data)	
	0 33 006	Internal measurement status information (AWS)	
		(Sequence for representation of SYNOP with supplementary information on one-hour observations)	
3 07 096	3 01 090	Surface station identification; time, horizontal and vertical coordinates	
	3 01 089	National station identification	
	0 08 010	Surface qualifier (temperature data)	
	3 01 091	Surface station instrumentation	
	3 02 084	"Instantaneous" data of sequence 3 07 096	
	3 02 085	"Period" data of sequence 3 07 096	
	0 33 005	Quality information (AWS data)	
	0 33 006	Internal measurement status information (AWS)	

Notes:

(1) The time identification refers to the beginning of the one-month period.

(2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.

(3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

(4) The number of missing years within the reference period from the calculation of normal for mean extreme air temperature should be given, if available, for both the calculation of normal maximum temperature and for the calculation of normal minimum temperature in addition to the number of missing years for the extreme air temperatures reported under 0 08 020 preceded by 0 08 050 in which figure 3 is used.

(continued)

(Category 07 – continued)

(5) Within 3 07 045, 3 07 048 and 3 07 053, wind speed shall be reported in the same units as in the original TAC data and:

0 11 083 shall be set to missing, if wind speed is reported in knots or m s^{-1} in TAC data,

0 11 084 shall be set to missing, if wind speed is reported in km h^{-1} or m s^{-1} in TAC data.

(6) Within 3 07 045, 3 07 048 and 3 07 053, maximum wind speed (gusts) shall be reported in the same units as in the original TAC data and:

0 11 085 shall be set to missing, if maximum wind speed is reported in knots or m s^{-1} in TAC data,

0 11 086 shall be set to missing, if maximum wind speed is reported in km h^{-1} or m s^{-1} in TAC data.

Category 08 – Surface report sequences (sea)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Buoy/platform – fixed)	
3 08 001	3 01 033	Buoy/platform – fixed	Identification, type, date/time, position (high accuracy)
	3 02 011	Low altitude station	Basic surface report
	0 22 042	Sea/water temperature	
		(Buoy/platform – fixed)	
3 08 002	3 01 034	Buoy/platform – fixed	Identification, type, date/time, position (coarse accuracy)
	3 02 011	Low altitude station	Basic surface report
	0 22 042	Sea/water temperature	
		(Buoy/platform – moving) (see Note 4)	
3 08 003	3 01 035	Buoy/platform – moving	Identification, movement, type, date/time, position (coarse accuracy)
	3 02 011	Low altitude station	Basic surface report
	0 22 042	Sea/water temperature	
		(Ship)	
3 08 004	3 01 036	Ship	Identification, movement, type, date/time, position (coarse accuracy)
	3 02 011	Low altitude station	Basic surface report
	0 22 042	Sea/water temperature	
3 08 005	3 08 004	Ship	Basic ship report
	3 02 024	Wind and swell waves	
		(Buoy Section 1 optional parameters)	
3 08 006	0 10 004	Pressure	
	0 10 061	3-hour pressure change	
	0 10 063	Characteristic of pressure tendency	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 12 004	Air temperature at 2 m	
	0 13 003	Relative humidity	
	0 22 042	Sea/water temperature	
3 08 007	3 01 055	Identification and type of station, date/time, location (high accuracy), movement	
	3 02 011	Low altitude station	Basic surface report
	0 07 062	Depth below sea/water surface	
	0 22 042	Sea/water temperature	

(continued)

(Category 08 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Sequence for representation of synoptic reports from a sea station suitable for ship data)	
3 08 009	3 01 093	Ship identification, movement, date/time, horizontal and vertical coordinates	
	3 02 001	Pressure and 3-hour pressure change	
	3 02 054	Ship “instantaneous” data	
	0 08 002	Vertical significance (surface observations)	
	3 02 055	Icing and ice	
	3 02 057	Ship marine data	
	3 02 060	Ship “period” data	
		(TRACKOB template)	
3 08 010	0 01 011	Ship or mobile land station identifier	
	1 13 000	Delayed replication of 13 descriptors	
	0 31 001	Delayed descriptor replication factor	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 04 080	Averaging period for following value	
	0 22 049	Sea-surface temperature	
	0 04 080	Averaging period for following value	
	0 22 059	Sea-surface salinity	
	0 04 080	Averaging period for following value	
	0 22 005	Direction of sea-surface current	
	0 02 042	Indicator for sea-surface current speed	
	0 22 032	Speed of sea-surface current	
	0 02 042	Indicator for sea-surface current speed	Cancel
	0 04 080	Averaging period for following value	Cancel
		(Monthly values from an ocean weather station – CLIMAT SHIP)	
3 08 011	0 01 011	Ship or mobile land station identifier	Ship’s call sign
	0 02 001	Type of station	
	3 01 011	Year, month, day (see Note 1)	
	3 01 012	Hour, minute (see Note 1)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 030	Height of station ground above mean sea level (see Note 3)	
	0 07 031	Height of barometer above mean sea level (see Note 3)	
		Monthly mean values of pressure, temperature, vapour pressure and sea/water temperature	
	0 04 074	Short time period or displacement) (see Note 1)	= UTC – LST
	0 04 023	Time period or displacement	= Number of days in the month
	0 08 023	First-order statistics	= 4 Mean value
	0 10 051	Pressure reduced to mean sea level	

(continued)

(Category 08 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 08 011 *(continued)*	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	Temperature measurement
	0 07 033	Height of sensor above water surface (see Note 3)	Temperature measurement
	0 12 101	Temperature/air temperature	
	0 13 004	Vapour pressure	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	3 02 056	Sea/water temperature	Sea-surface temperature, method of measurement, and depth below sea surface
	0 08 023	First-order statistics	Set to missing
		Precipitation	
	0 04 003	Day (see Note 2)	= 1
	0 04 004	Hour (see Note 2)	= 6
	0 04 023	Time period or displacement (see Note 2)	= Number of days in the month
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	
	0 13 060	Total accumulated precipitation	
	0 13 051	Frequency group, precipitation	
	0 04 053	Number of days with precipitation equal to or more than 1 mm	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
		(Monthly normals from an ocean weather station)	
3 08 012	0 04 001	Year	Beginning of the reference period
	0 04 001	Year	Ending of the reference period
	0 04 002	Month	
	0 04 003	Day (see Note 1)	= 1
	0 04 004	Hour (see Note 1)	= 0
	0 04 074	Short time period or displacement (see Note 1)	= UTC – LST
	0 04 022	Time period or displacement	= 1
		Normals of monthly mean pressure, temperature, vapour pressure and sea/water temperature	
	0 08 023	First-order statistics	= 4 Mean value
	0 10 051	Pressure reduced to mean sea level	
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	Temperature measurement
	0 07 033	Height of sensor above water surface (see Note 3)	Temperature measurement
	0 12 101	Temperature/air temperature	
	0 13 004	Vapour pressure	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)

(continued)

(Category 08 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 08 012 *(continued)*	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	3 02 056	Sea/water temperature	Sea-surface temperature, method of measurement, and depth below sea surface
	0 08 023	First-order statistics	Set to missing
	0 04 001	Year	Beginning of the reference period
	0 04 001	Year	Ending of the reference period
	0 04 002	Month	
	0 04 003	Day (see Note 2)	= 1
	0 04 004	Hour (see Note 2)	= 6
	0 04 022	Time period or displacement	= 1
		Normals of precipitation	
	0 07 032	Height of sensor above local ground (or deck of marine platform) (see Note 3)	Precipitation measurement
	0 08 023	First-order statistics	= 4 Mean value
	0 13 060	Total accumulated precipitation	
	0 04 053	Number of days with precipitation equal to or more than 1 mm	
	0 08 023	First-order statistics	Set to missing
		(Representation of CLIMAT SHIP data of the actual month and for monthly normals)	
3 08 013	3 08 011	Monthly values from an ocean weather station – CLIMAT SHIP	
	3 08 012	Monthly normals from an ocean weather station	

Notes:

(1) The time identification refers to the beginning of the one-month period.

(2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.

(3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

(4) Descriptor 3 08 007 should be used instead of 3 08 003 to encode moving buoy/platform information.

Category 09 – Vertical sounding sequences (conventional data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Vertical wind profile)	
3 09 001	3 01 037	Land station for vertical soundings	Identification, etc. (land station, high accuracy position)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 011	Wind at height	
		(Vertical wind profile)	
3 09 002	3 01 038	Land station for vertical soundings	Identification, etc. (land station, coarse accuracy position)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 011	Wind at height	
		(Vertical wind profile)	
3 09 003	3 01 037	Land station for vertical soundings	Identification, etc. (land station, high accuracy position)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 012	Wind at pressure level	
		(Vertical wind profile)	
3 09 004	3 01 038	Land station for vertical soundings	Identification, etc. (land station, coarse accuracy position)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 012	Wind at pressure level	
		(Vertical sounding with relative humidity)	
3 09 005	3 01 037	Land station for vertical soundings	Identification, etc. (land station, high accuracy position)
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 013	Geopotential, temperature, humidity, wind at pressure level	
		(Vertical sounding with relative humidity)	
3 09 006	3 01 038	Land station for vertical soundings	Identification, etc. (land station, coarse accuracy position)
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 013	Geopotential, temperature, humidity, wind at pressure level	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Vertical sounding with dewpoint data)	
3 09 007	3 01 037	Land station for vertical soundings	Identification, etc. (land station, high accuracy position)
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 014	Geopotential, temperature, dewpoint temperature, wind at pressure level	
		(Vertical sounding with dewpoint data)	
3 09 008	3 01 038	Land station for vertical soundings	Identification, etc. (land station, coarse accuracy position)
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 014	Geopotential, temperature, dewpoint temperature, wind at pressure level	
		(Vertical wind profile)	
3 09 011	3 01 039	Ship for vertical soundings	Ship's identification, etc.
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 011	Wind at height	
		(Vertical wind profile)	
3 09 012	3 01 039	Ship for vertical soundings	Ship's identification, etc.
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 012	Wind at pressure level	
		(Vertical sounding with relative humidity)	
3 09 013	3 01 039	Ship for vertical soundings	Ship's identification, etc.
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 013	Geopotential, temperature, humidity, wind at pressure level	
		(Vertical sounding with dewpoint data)	
3 09 014	3 01 039	Ship for vertical soundings	Ship's identification, etc.
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 014	Geopotential, temperature, dewpoint temperature, wind at pressure level	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Vertical wind profile)	
3 09 015	3 01 040	Ship for vertical soundings	Ship's identification, etc.
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 011	Wind at height	
		(Vertical wind profile)	
3 09 016	3 01 040	Ship for vertical soundings	Ship's identification, etc.
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 012	Wind at pressure level	
		(Vertical sounding with relative humidity)	
3 09 017	3 01 040	Ship for vertical soundings	Ship's identification, etc.
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 013	Geopotential, temperature, humidity, wind at pressure level	
		(Vertical sounding with dewpoint data)	
3 09 018	3 01 040	Ship for vertical soundings	Ship's identification, etc.
	3 02 004	General cloud information	Significant cloud layer
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 014	Geopotential, temperature, dewpoint temperature, wind at pressure level	
		(Wind profiler – wind data sounding)	
3 09 019	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	0 02 003	Type of measuring equipment used	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 011	Wind at height	
		(Wind profiler – Cartesian coordinates)	
3 09 020	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	0 02 003	Type of measuring equipment used	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 003	Geopotential	
	0 11 003	u-component	
	0 11 004	v-component	
	0 11 005	w-component	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ozone sonde flight data) (see Note 1)	
3 09 030	0 15 004	Ozone sounding correction factor (CF)	
	0 15 005	Ozone p	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 04 015	Time increment	Since launch time, if needed, in minutes
	0 08 006	Ozone vertical sounding significance	
	0 07 004	Pressure	
	0 15 003	Measured ozone partial pressure (sounding)	
		(Ozone sonde flight data)	
3 09 031	0 15 004	Ozone sounding correction factor (CF)	
	0 15 005	Ozone p	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 04 025	Time period or displacement	Since launch time in minutes
	0 08 006	Ozone vertical sounding significance	
	0 07 004	Pressure	
	0 15 003	Measured ozone partial pressure (sounding)	
		(Ozone sounding not coupled to a ground-based spectrophotometer) (see Note 2)	
3 09 040	3 01 075	Sounding identification	
	3 01 076	Ozone sounding instrumentation	
	3 09 030	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is a single value) (see Note 2)	
3 09 041	3 07 041	Total ozone measurement from a Brewer ground-based spectrophotometer obtained from a single observation	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 030	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is an averaged value) (see Note 2)	
3 09 042	3 07 042	Total ozone measurement from a Brewer ground-based spectrophotometer obtained from averaged observations	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 030	Ozone sonde flight data	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is a single value) (see Note 2)	
3 09 043	3 07 043	Total ozone measurement from a Dobson ground-based spectrophotometer obtained from a single observation	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 030	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is an averaged value) (see Note 2)	
3 09 044	3 07 044	Total ozone measurement from a Dobson ground-based spectrophotometer obtained from averaged observations	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 030	Ozone sonde flight data	
		(Ozone sounding not coupled to a ground-based spectrophotometer)	
3 09 045	3 01 075	Sounding identification	
	3 01 076	Ozone sounding instrumentation	
	3 09 031	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is a single value)	
3 09 046	3 07 041	Total ozone measurement from a Brewer ground-based spectrophotometer obtained from a single observation	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 031	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is an averaged value)	
3 09 047	3 07 042	Total ozone measurement from a Brewer ground-based spectrophotometer obtained from averaged observations	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 031	Ozone sonde flight data	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is a single value)	
3 09 048	3 07 043	Total ozone measurement from a Dobson ground-based spectrophotometer obtained from a single observation	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 031	Ozone sonde flight data	
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is an averaged value)	
3 09 049	3 07 044	Total ozone measurement from a Dobson ground-based spectrophotometer obtained from averaged observations	Description of the ground-based part
	3 01 075	Sounding identification	Identification of the ozone sounding part
	3 01 076	Ozone sounding instrumentation	
	3 09 031	Ozone sonde flight data	
		(Sequence for representation of PILOT, PILOT SHIP and PILOT MOBIL observation type data with pressure as the vertical coordinate)	
3 09 050	3 01 110	Identification of launch site and instrumentation for wind measurements	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 050	Wind data at a pressure level with radiosonde position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 051	Wind shear data at a pressure level with radiosonde position	
		(Sequence for representation of PILOT, PILOT SHIP and PILOT MOBIL observation type data with height as the vertical coordinate)	
3 09 051	3 01 110	Identification of launch site and instrumentation for wind measurements	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 052	Wind data at a height level with radiosonde position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 053	Wind shear data at a height level with radiosonde position	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Sequence for representation of TEMP, TEMP SHIP and TEMP MOBIL observation type data)	
3 09 052	3 01 111	Identification of launch site and instrumentation for P, T, U and wind measurements	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	3 02 049	Cloud information reported with vertical soundings	
	0 22 043	Sea/water temperature	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 054	Temperature, dewpoint and wind data at a pressure level with radiosonde position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 051	Wind shear data at a pressure level with radiosonde position	
		(Sequence for representation of TEMP DROP observation type data)	
3 09 053	3 01 112	Identification of launch point and instrumentation of dropsonde	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 054	Temperature, dewpoint and wind data at a pressure level with radiosonde position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 051	Wind shear data at a pressure level with radiosonde position	
		(Sequence for representation of CLIMAT TEMP and CLIMAT TEMP SHIP data)	
3 09 054	3 01 001	WMO block and station numbers	Identification of launch site
	0 01 011	Ship or mobile land station identifier	Ship's call sign
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 031	Height of barometer above mean sea level	
	0 07 007	Height	Release of sonde above mean sea level
		Monthly mean data	
	0 04 023	Time period or displacement	Number of days in the month
	0 04 059	Times of observation used to compute the reported mean values	
	1 15 000	Delayed replication of 15 descriptors	
	0 31 001	Delayed descriptor replication factor	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 054 *(continued)*	0 08 001	Vertical sounding significance	
	0 08 023	First-order statistics	= 4 Mean value
	0 07 004	Pressure	
	0 10 009	Geopotential height	
	0 12 101	Temperature/air temperature	
	0 12 103	Dewpoint temperature	
	0 08 023	First-order statistics	= 32 Vector mean
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 08 023	First-order statistics	Set to missing
	0 11 019	Steadiness of wind	
	0 08 050	Qualifier for number of missing values in calculation of statistic	= 2 Temperature
	0 08 020	Total number of missing entities (with respect to accumulation or average)	Days
	0 08 050	Qualifier for number of missing values in calculation of statistic	= 9 Wind
	0 08 020	Total number of missing entities (with respect to accumulation or average)	Days
		(Template for the representation of high resolution radiosonde data with geopotential height as the vertical coordinate)	
3 09 055	3 01 111	Identification of launch site and instrumentation for P, T, U and wind measurements	
	0 25 061	Software identification and version number	
	0 01 081	Radiosonde serial number	
	0 01 082	Radiosonde ascension number	
	0 02 067	Radiosonde operating frequency	
	0 02 095	Type of pressure sensor	
	0 02 096	Type of temperature sensor	
	0 02 097	Type of humidity sensor	
	0 02 081	Type of balloon	
	0 02 082	Weight of balloon	
	0 02 084	Type of gas used in balloon	
	0 02 191	Geopotential height calculation	
	3 01 113	Date/time of launch (see Note 6)	
	3 01 114	Horizontal and vertical coordinates of launch site	
	0 10 004	Pressure	
	3 02 032	Temperature and humidity data	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 02 002	Type of instrumentation for wind measurement	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 20 003	Present weather	
	3 02 049	Cloud information reported with vertical soundings	
	0 22 043	Sea/water temperature	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 055 *(continued)*	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 055	Temperature, dewpoint, relative humidity and wind data at a height level with radiosonde position (see Notes 7, 8 and 9)	
		(Radiosonde complete registration and surface observation)	
3 09 060	3 01 123	Radiosonde full header information	
	3 01 121	Radiosonde launch point location	
	3 02 050	Radiosonde surface observation	
	3 03 040	Radiosonde duration of flight and termination information	
		(Raw PTU)	
3 09 061	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 25 069	Flight level pressure corrections	
	0 07 004	Pressure	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 33 007	Per cent confidence	Pressure
	0 33 035	Manual/automatic quality control	Pressure
	0 33 015	Data quality check indicator	Pressure
	0 13 009	Relative humidity	
	0 33 007	Per cent confidence	Relative humidity
	0 33 035	Manual/automatic quality control	Relative humidity
	0 33 015	Data quality check indicator	Relative humidity
	0 02 013	Solar and infrared radiation correction	
	0 12 101	Temperature/air temperature	
	0 33 007	Per cent confidence	Temperature
	0 33 035	Manual/automatic quality control	Temperature
	0 33 015	Data quality check indicator	Temperature
		(Raw GPS unsmoothed wind)	
3 09 062	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	0 05 001	Latitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Latitude
	0 33 015	Data quality check indicator	Latitude
	0 06 001	Longitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Longitude

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 062 *(continued)*	0 33 015	Data quality check indicator	Longitude
	0 07 007	Height	
	0 33 035	Manual/automatic quality control	Height
	0 33 015	Data quality check indicator	Height
	0 11 003	u-component	
	0 33 035	Manual/automatic quality control	u-component
	0 33 015	Data quality check indicator	u-component
	0 11 004	v-component	
	0 33 035	Manual/automatic quality control	v-component
	0 33 015	Data quality check indicator	v-component
	0 33 007	Per cent confidence	Raw GPS unsmoothed wind
		(Raw GPS smoothed wind)	
3 09 063	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	0 05 001	Latitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Latitude
	0 33 015	Data quality check indicator	Latitude
	0 06 001	Longitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Longitude
	0 33 015	Data quality check indicator	Longitude
	0 07 007	Height	
	0 33 035	Manual/automatic quality control	Height
	0 33 015	Data quality check indicator	Height
	0 11 003	u-component	
	0 33 035	Manual/automatic quality control	u-component
	0 33 015	Data quality check indicator	u-component
	0 11 004	v-component	
	0 33 035	Manual/automatic quality control	v-component
	0 33 015	Data quality check indicator	v-component
	0 33 007	Per cent confidence	Raw GPS smoothed wind
		(Processed PTU)	
3 09 064	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	2 01 131	Change data width	
	2 02 129	Change scale	
	1 04 002	Replicate 4 descriptors 2 times	
	0 25 069	Flight level pressure corrections	
	0 07 004	Pressure	
	0 33 035	Manual/automatic quality control	Pressure
	0 33 015	Data quality check indicator	Pressure

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 064	0 13 003	Relative humidity	
(continued)	0 33 035	Manual/automatic quality control	Relative humidity
	0 33 015	Data quality check indicator	Relative humidity
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	1 04 002	Replicate 4 descriptors 2 times	
	0 02 013	Solar and infrared radiation correction	
	0 12 101	Temperature/air temperature	
	0 33 035	Manual/automatic quality control	Temperature
	0 33 015	Data quality check indicator	Temperature
	0 12 103	Dewpoint temperature	
	0 33 035	Manual/automatic quality control	Dewpoint temperature
	0 33 015	Data quality check indicator	Dewpoint temperature
	0 10 009	Geopotential height	
	0 33 035	Manual/automatic quality control	Geopotential height
	0 33 015	Data quality check indicator	Geopotential height
		(Processed GPS)	
3 09 065	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	0 05 001	Latitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Latitude
	0 33 015	Data quality check indicator	Latitude
	0 06 001	Longitude (high accuracy)	
	0 33 035	Manual/automatic quality control	Longitude
	0 33 015	Data quality check indicator	Longitude
	0 07 007	Height	
	0 33 035	Manual/automatic quality control	Height
	0 33 015	Data quality check indicator	Height
	0 11 003	u-component	
	0 33 035	Manual/automatic quality control	u-component
	0 33 015	Data quality check indicator	u-component
	0 11 004	v-component	
	0 33 035	Manual/automatic quality control	v-component
	0 33 015	Data quality check indicator	v-component
		(Standard and significant levels)	
3 09 066	3 01 120	Radiosonde abbreviated header and launch information	
	0 08 041	Data significance	= 6 Flight level observation
	3 01 122	Date/time (to hundredths of second)	
	0 08 040	Flight level significance	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 25 069	Flight level pressure corrections	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 066 *(continued)*	0 07 004	Pressure	
	0 13 003	Relative humidity	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 02 013	Solar and infrared radiation correction	
	0 12 101	Temperature/air temperature	
	0 12 103	Dewpoint temperature	
	0 10 009	Geopotential height	
	0 10 007	Height	
	0 11 002	Wind speed	
	0 11 001	Wind direction	
		(Vertical profile for numerical weather prediction data) *Identification*	
3 09 070	0 01 035	Originating centre	
	0 01 032	Generating application	
	0 01 015	Station or site name	
	0 01 063	ICAO location indicator	
	3 01 001	WMO block and station numbers	
		Location and reference time	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	Reference time of the forecast (T-zero)
	3 01 021	Latitude/longitude (high accuracy)	
	2 07 001	Increase scale, reference value and data width	Increase scale factor by 1; reference value and data width are recalculated in accordance with the Table C specification of operator 2 07 YYY
	0 10 001	Height of land surface (see Note 3)	Station elevation (non coordinate)
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 086	Vertical significance for NWP	Bit 9 set to 1 Virtual station height
	0 07 030	Height of station ground above mean sea level	Elevation of model terrain at the lat/lon of station. As qualified by 0 08 086, this value is both station and model specific.
		Vertical profile metadata	
	0 25 031	NWP-generated vertical profile thinning method (see Note 4)	
	0 08 021	Time significance	= 4 Forecast, = 16 Analysis, = 27 First guess

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 070 *(continued)*	0 04 014	Time increment	Validity time of the forecast expressed as a Delta T from reference time. In the case of an analysis or 00 hour forecast, the value is set to zero
		Point data at station height (including column-integrated data)	
	0 10 004	Pressure	
	0 10 051	Pressure reduced to mean sea level	
	0 10 009	Geopotential height	
	0 20 010	Cloud cover (total)	
	0 13 095	Total column water vapour	
		Replication loop for levels	
	1 28 000	Delayed replication of 28 descriptors	
	0 31 002	Extended delayed descriptor replication factor	The number of levels used in the vertical profile is determined by this replication. The number of levels is discretionary and comprises all agl levels and pressure levels
		Data on pressure coordinates	
	1 13 000	Delayed replication of 13 descriptors	
	0 31 000	Short delayed descriptor replication factor	= 1 Vertical coordinate is pressure, = 0 Otherwise
	0 08 086	Vertical significance for NWP	Bit 1 set to 0 and other bits as appropriate
	0 07 004	Pressure (see Note 5)	
	0 11 001	Wind direction	Degrees true
	0 11 002	Wind speed	m/s
	0 12 101	Temperature/air temperature	
	0 12 102	Wet-bulb temperature	
	0 12 103	Dewpoint temperature	
	0 10 009	Geopotential height	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	= 1 Optional enhanced model data is to be included
	0 11 021	Relative vorticity	
	0 11 022	Divergence	
	0 11 005	w-component	Vertical motion
		Data at 10 metres above ground level	
	1 04 000	Delayed replication of 4 descriptors	

(continued)

(Category 09 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 09 070 *(continued)*	0 31 000	Short delayed descriptor replication factor	= 1 Vertical coordinate is 10 metres above ground level, = 0 Otherwise
	0 08 086	Vertical significance for NWP	Bit 1 set to 1, bit 8 set to 1
	0 07 006	Height above station	= 10 m
	0 11 001	Wind direction	Degrees true
	0 11 002	Wind speed	m/s
		Data at 2 metres above ground level	
	1 05 000	Delayed replication of 5 descriptors	
	0 31 000	Short delayed descriptor replication factor	= 1 Vertical coordinate is 2 metres above ground level, = 0 Otherwise
	0 08 086	Vertical significance for NWP	
	0 07 006	Height above station	= 2 m
	0 12 101	Temperature/air temperature	
	0 12 102	Wet-bulb temperature	
	0 12 103	Dewpoint temperature	
		(Sequence for representation of PILOT in the area of ASECNA)	
3 09 071	3 01 001	WMO block and station numbers	
	0 02 014	Tracking technique/status of system used	
	0 02 003	Type of measuring equipment used	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 07 007	Height	Release of balloon
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 009	Geopotential height	
	0 11 001	Wind direction	
	0 11 002	Wind speed	

Notes:

(1) Sequence 3 09 030 is deprecated because of incorrect usage of descriptor 0 04 015; sequence 3 09 031 should be used instead.

(2) This sequence is deprecated because it includes deprecated sequence 3 09 030; sequence 3 09 045, 3 09 046, 3 09 047, 3 09 048 and 3 09 049 should be used instead of 3 09 040, 3 09 041, 3 09 042, 3 09 043 and 3 09 044, respectively.

(3) This value is the official or best estimate of the actual elevation of the station. It is provided for comparison with the model's virtual terrain elevation. The two can be substantially different in rugged terrain. The scale factor is increased to make the value directly comparable with 0 07 030 below.

(4) In this instance, the term "thinning" refers to a method that may be applied to select a subset of levels from a model that may have many native vertical levels. Selecting only a subset reduces the size of the pseudo-sounding, at the possible cost of information loss and extra processing.

(continued)

(Category 09 – continued)

(5) Non-surface levels on the model's native vertical coordinate are transposed to pressure coordinate. This makes the levels more readily intelligible for human interpretation and easier to use by generic display applications. The levels may correspond exactly to native model levels, or be interpolated between model levels to pressure levels chosen by the generating centre.

(6) Time of launch 3 01 013 in the sequence shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(7) Long time displacement 0 04 086 in the sequence represents the time offset from the launch time 3 01 013 (in seconds).

(8) Latitude displacement 0 05 015 in the sequence represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 in the sequence represents the longitude offset from the longitude of the launch site.

(9) If the radiosonde is equipped with a relative humidity sensor, 0 13 009 in the sequence shall be reported as mandatory and dewpoint temperature may be included as a derived value. If the radiosonde is equipped with a dewpoint temperature sensor, 0 12 103 in the sequence shall be reported and 0 13 009 shall be set to a missing value.

Category 10 – Vertical sounding sequences (satellite data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Satellite – brightness temperature)	
3 10 001	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 032	Cloud	
	1 01 026	Replicate 1 descriptor 26 times	
	3 03 025	Satellite channel and brightness temperature	
		(Satellite – low level)	
3 10 002	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 032	Cloud	
	1 01 009	Replicate 1 descriptor 9 times	
	3 03 023	Layer mean temperature	
		(Satellite – high level)	
3 10 003	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 032	Cloud	
	1 01 006	Replicate 1 descriptor 6 times	
	3 03 023	Layer mean temperature	
		(Satellite – precipitable water)	
3 10 004	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 032	Cloud	
	1 01 003	Replicate 1 descriptor 3 times	
	3 03 024	Precipitable water	
3 10 005	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 033	Cloud	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 025	Satellite channel and brightness temperature	
3 10 006	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 033	Cloud	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 023	Layer mean temperature	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 007	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 03 031	Significance data, land/sea, skin temperature	
	3 03 033	Cloud	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 024	Precipitable water	
		(ATOVS HIRS report)	
3 10 008	3 10 011	ATOVS field of view variables	
	1 01 019	Replicate 1 descriptor 19 times	
	3 10 012	ATOVS channel variables	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 25 079	Albedo-radiance solar filtered irradiance for ATOVS	
	0 25 080	Albedo-radiance equivalent filter width for ATOVS	
	0 33 032	Channel quality flags for ATOVS	
	0 14 045	Channel radiance	
		(ATOVS AMSU-A report)	
3 10 009	3 10 011	ATOVS field of view variables	
	1 01 015	Replicate 1 descriptor 15 times	
	3 10 012	ATOVS channel variables	
		(ATOVS AMSU-B/MHS report)	
3 10 010	3 10 011	ATOVS field of view variables	
	1 01 005	Replicate 1 descriptor 5 times	
	3 10 012	ATOVS channel variables	
		(ATOVS field of view variables)	
3 10 011	0 08 070	TOVS/ATOVS product qualifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 08 070	TOVS/ATOVS product qualifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 01 007	Satellite identifier	
	0 02 048	Satellite sensor indicator	
	0 05 040	Orbit number	
	0 25 075	Satellite antenna corrections version number	
	2 01 133	Change data width	
	0 05 041	Scan line number	
	2 01 000	Change data width	
	0 05 043	Field of view number	
	0 25 070	Major frame count	
	0 33 030	Scan line status flags for ATOVS	
	0 33 031	Scan line quality flags for ATOVS	
	0 04 001	Year	
	0 04 002	Month	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 011 *(continued)*	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	2 02 131	Change scale	
	2 01 138	Change data width	
	0 04 006	Second	
	2 01 000	Change data width	
	2 02 000	Change scale	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	2 02 126	Change scale	
	0 07 001	Height of station	
	2 02 000	Change scale	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	Satellite azimuth
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 33 033	Field of view quality flags for ATOVS	
	0 02 151	Radiometer identifier	
	0 12 064	Instrument temperature	
	0 02 151	Radiometer identifier	
	0 12 064	Instrument temperature	
	0 02 151	Radiometer identifier	
	0 12 064	Instrument temperature	
	0 02 151	Radiometer identifier	
	0 12 064	Instrument temperature	
		(ATOVS channel variables)	
3 10 012	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 25 076	Log_{10} of (temperature-radiance central wave number) for ATOVS	
	0 25 077	Bandwidth correction coefficient 1 for ATOVS	
	0 25 078	Bandwidth correction coefficient 2 for ATOVS	
	0 33 032	Channel quality flags for ATOVS	
	2 01 132	Change data width	
	2 02 129	Change scale	
	0 12 063	Brightness temperature	
	2 02 000	Change scale	
	2 01 000	Change data width	
		(AVHRR (GAC) report)	
3 10 013	0 01 007	Satellite identifier	
	0 05 040	Orbit number	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 013 *(continued)*	0 04 006	Second	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 07 025	Solar zenith angle	
	0 05 043	Field of view number	
	0 25 085	Fraction of clear pixels in HIRS FOV	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	0 08 072	Pixel(s) type	
	0 14 027	Albedo	
	2 02 000	Change scale	
	2 01 000	Change data width	
	2 01 132	Change data width	
	2 02 129	Change scale	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 013	0 08 072	Pixel(s) type	
(continued)	0 12 063	Brightness temperature	
	0 02 150	TOVS/ATOVS/AVHRR instrumentation channel number	
	0 08 023	First-order statistics	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	0 08 072	Pixel(s) type	
	0 12 063	Brightness temperature	
	2 02 000	Change scale	
	2 01 000	Change data width	
		(Satellite – geostationary wind data)	
3 10 014	3 01 072	Satellite identification	Satellite identification, date/time, latitude/longitude
	3 03 041	Wind sequence	
	3 04 011	GOES-I/M info	
		(Meteosat radiance data)	
3 10 015	3 01 072	Satellite identification	
	0 07 024	Satellite zenith angle	
	0 10 002	Height	
	3 03 041	Wind sequence	
	1 01 003	Replicate 1 descriptor 3 times	
	3 04 032	Cloud fraction	
	0 02 152	Satellite instrument used in data processing	
	0 02 024	Integrated mean humidity computational method	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 13 003	Relative humidity	
	1 01 003	Replicate 1 descriptor 3 times	
	3 04 033	Clear sky radiance	
		(Meteosat Second Generation (MSG) radiance data)	
3 10 016	3 01 072	Satellite identification	
	0 07 024	Satellite zenith angle	
	0 10 002	Height	
	3 03 041	Wind sequence	
	1 01 012	Replicate 1 descriptor 12 times	
	3 04 032	Cloud fraction	
	0 02 152	Satellite instrument used in data processing	
	0 02 024	Integrated mean humidity computational method	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 13 003	Relative humidity	
	1 01 012	Replicate 1 descriptor 12 times	
	3 04 033	Clear sky radiance	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Ozone data)	
3 10 018	0 01 007	Satellite identifier	
	0 05 040	Orbit number	
	0 04 001	Year	
	0 04 043	Day of the year	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	2 07 002	Increase scale, reference value and data width	
	0 26 030	Measurement integration time	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 33 072	Ozone error	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	= 0 Surface
	2 07 001	Increase scale, reference value and data width	
	0 10 004	Pressure	Terrain
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	0 08 003	Vertical significance (satellite observations)	= 2 Cloud top
	0 33 042	Type of limit represented by following value	= 0 Exclusive lower limit
	2 07 001	Increase scale, reference value and data width	
	0 07 004	Pressure	
	2 07 000	Increase scale, reference value and data width	Cancel
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	Below cloud top pressure
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	2 07 002	Increase scale, reference value and data width	
	0 20 081	Cloud amount in segment	Cloud fraction
	2 07 000	Increase scale, reference value and data width	Cancel
	0 20 065	Snow cover	
	0 08 029	Surface type	
	2 07 004	Increase scale, reference value and data width	
	0 15 030	Aerosol contamination index	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 075	Ascending/descending orbit qualifier	
		(Ozone data)	
3 10 019	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	= 624 SBUV/2
	3 01 011	Year, month, day	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 019 *(continued)*	3 01 013	Hour, minute, second	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 07 025	Solar zenith angle	
	0 08 021	Time significance	= 28 Start of scan
	0 07 025	Solar zenith angle	
	0 08 021	Time significance	= 29 End of scan
	0 07 025	Solar zenith angle	
	0 08 021	Time significance	Set to missing (cancel)
	0 08 029	Surface type	
	0 05 040	Orbit number	
	0 08 075	Ascending/descending orbit qualifier	
	0 08 003	Vertical significance (satellite observations)	= 0 Surface
	0 10 004	Pressure	= Terrain
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 33 070	Total ozone quality	
	0 15 030	Aerosol contamination index	
	2 07 002	Increase scale, reference value and data width	
	0 20 081	Cloud amount in segment	Cloud fraction
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	= 2 Cloud top
	0 33 042	Type of limit represented by following value	= 0 Exclusive lower limit
	0 07 004	Pressure	
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	Below cloud top pressure
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	1 13 021	Replicate 13 descriptors 21 times	
	0 07 004	Pressure	Bottom of layer
	0 07 004	Pressure	Top of layer
	2 07 002	Increase scale, reference value and data width	
	0 08 021	Time significance	= 27 First guess
	0 15 005	Ozone p	
	0 08 021	Time significance	Set to missing (cancel)
	0 15 005	Ozone p	
	0 33 007	Per cent confidence	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 026	Matrix significance	= 0 Row of averaging kernel matrix
	1 01 020	Replicate 1 descriptor 20 times	
	0 25 143	Linear coefficient	
	0 08 026	Matrix significance	Set to missing (cancel)
	0 08 043	Atmospheric chemical or physical constituent type	= 0 Ozone
	1 09 015	Replicate 9 descriptors 15 times	
	0 07 004	Pressure	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 019 *(continued)*	0 08 090	Decimal scale of following significands	
	2 07 006	Increase scale, reference value and data width	
	0 15 008	Significand of volumetric mixing ratio	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 090	Decimal scale of following significands	Set to missing (cancel)
	2 07 002	Increase scale, reference value and data width	
	0 33 007	Per cent confidence	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 043	Atmospheric chemical or physical constituent type	Set to missing (cancel)
	0 33 071	Profile ozone quality	
	1 08 008	Replicate 8 descriptors 8 times	
	2 02 124	Change scale	
	2 01 107	Change data width	
	0 02 071	Spectrographic wavelength	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	2 07 002	Increase scale, reference value and data width	
	0 20 081	Cloud amount in segment	Cloud fraction
	2 07 000	Increase scale, reference value and data width	Cancel
		(Retrieved ozone data)	
3 10 020	3 10 022	Satellite identifier, instrument and product type	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	3 04 034	Latitude/longitude, solar elevation, number of layers	
	3 10 021	Integrated ozone density, height of defined layer	
		(Integrated ozone density, height of defined layer)	
3 10 021	1 08 000	Delayed replication of 8 descriptors	
	0 31 001	Delayed descriptor replication factor	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 07 004	Pressure	
	0 07 004	Pressure	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 15 020	Integrated ozone density	
	0 10 002	Height	
		(Satellite identifier, instrument and product type)	
3 10 022	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 033	Identification of originating/generating centre	
	0 02 172	Product type for retrieved atmospheric gases	
		(Geostationary multi-channel satellite radiance data)	
3 10 023	3 01 072	Satellite identification	
	0 30 021	Number of pixels per row	
	0 30 022	Number of pixels per column	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 023 *(continued)*	0 08 012	Land/sea qualifier	
	0 07 024	Satellite zenith angle	
	0 07 025	Solar zenith angle	
	0 10 002	Height	
	1 01 012	Replicate 1 descriptor 12 times	
	3 04 032	Cloud fraction	
	1 05 002	Replicate 5 descriptors 2 times	
	0 02 152	Satellite instrument used in data processing	
	0 02 024	Integrated mean humidity computational method	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 13 003	Relative humidity	
	1 01 012	Replicate 1 descriptor 12 times	
	3 04 033	Clear sky radiance	
		(Geostationary three-channel satellite radiance data)	
3 10 024	3 01 072	Satellite identification	
	0 30 021	Number of pixels per row	
	0 30 022	Number of pixels per column	
	0 08 012	Land/sea qualifier	
	0 07 024	Satellite zenith angle	
	0 07 025	Solar zenith angle	
	0 10 002	Height	
	1 01 003	Replicate 1 descriptor 3 times	
	3 04 032	Cloud fraction	
	1 05 002	Replicate 5 descriptors 2 times	
	0 02 152	Satellite instrument used in data processing	
	0 02 024	Integrated mean humidity computational method	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 13 003	Relative humidity	
	1 01 003	Replicate 1 descriptor 3 times	
	3 04 033	Clear sky radiance	
		(SSMIS temperature data record)	
3 10 025	0 01 007	Satellite identifier	
	0 08 021	Time significance	Scan start
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	2 01 138	Change data width	
	2 02 131	Change scale	
	0 04 006	Second	Milliseconds
	2 02 000	Change scale	
	2 01 000	Change data width	
	2 01 132	Change data width	
	0 05 041	Scan line number	Scan number

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 025 *(continued)*	2 01 000	Change data width	
	2 01 129	Change data width	
	0 05 043	Field of view number	Scene number
	2 01 000	Change data width	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 13 040	Surface flag	
	0 20 029	Rain flag	
	1 04 024	Replicate 4 descriptors 24 times	
	0 05 042	Channel number	
	0 12 163	Brightness temperature	
	0 21 083	Warm target calibration	
	0 21 084	Cold target calibration	
	1 15 003	Replicate 15 descriptors 3 times	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	2 01 142	Change data width	
	2 02 131	Change scale	
	0 04 026	Time period or displacement	Ephemeris milliseconds
	2 02 000	Change scale	
	2 01 000	Change data width	
	0 05 001	Latitude (high accuracy)	Ephemeris
	0 06 001	Longitude (high accuracy)	Ephemeris
	2 01 138	Change data width	
	2 02 129	Change scale	
	0 07 001	Height of station	Ephemeris
	2 02 000	Change scale	
	2 01 000	Change data width	
	0 08 021	Time significance	Orbit start
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 05 040	Orbit number	
	1 01 003	Replicate 1 descriptor 3 times	
	0 12 070	Warm load temperature	
	0 25 054	SSMIS subframe ID number	
	1 01 004	Replicate 1 descriptor 4 times	
	0 25 055	Multiplexer housekeeping	
	0 08 007	Dimensional significance	Line
	1 04 028	Replicate 4 descriptors 28 times	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 02 111	Radar incidence angle	Earth angle
	0 05 021	Bearing or azimuth	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Satellite radio occultation data)	
3 10 026	3 10 022	Satellite identifier, instrument and product type	
	0 25 060	Software identification	
	0 08 021	Time significance	= 17 Start of phenomenon
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 01 138	Change data width	16 bits long
	2 02 131	Change scale	Scale: 3
	0 04 006	Second	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 33 039	Quality flags for radio occultation data	
	0 33 007	Per cent confidence	Whole message
	3 04 030	Location of platform	
	3 04 031	Speed of platform	
	0 02 020	Satellite classification	
	0 01 050	Platform transmitter ID number	
	2 02 127	Change scale	Scale: 1
	3 04 030	Location of platform	
	2 02 000	Change scale	Cancel
	3 04 031	Speed of platform	
	2 01 133	Change data width	18 bits long
	2 02 131	Change scale	Scale: 3
	0 04 016	Time increment	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	3 01 021	Latitude/longitude (high accuracy)	
	3 04 030	Location of platform	
	0 10 035	Earth's local radius of curvature	
	0 05 021	Bearing or azimuth	
	0 10 036	Geoid undulation	
	1 13 000	Delayed replication of 13 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	3 01 021	Latitude/longitude (high accuracy)	
	0 05 021	Bearing or azimuth	
	1 08 000	Delayed replication of 8 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 02 121	Mean frequency	
	0 07 040	Impact parameter	
	0 15 037	Bending angle	
	0 08 023	First-order statistics	= 13 Root-mean-square
	2 01 125	Change data width	20 bits long
	0 15 037	Bending angle	
	2 01 000	Change data width	Cancel
	0 08 023	First-order statistics	Set to missing
	0 33 007	Per cent confidence	All data for current replication

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 026 *(continued)*	1 08 000	Delayed replication of 8 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 07 007	Height	
	0 15 036	Atmospheric refractivity	
	0 08 023	First-order statistics	= 13 Root-mean-square
	2 01 123	Change data width	14 bits long
	0 15 036	Atmospheric refractivity	
	2 01 000	Change data width	Cancel
	0 08 023	First-order statistics	Set to missing
	0 33 007	Per cent confidence	All data for current height
	1 16 000	Delayed replication of 16 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 07 009	Geopotential height	
	0 10 004	Pressure	
	0 12 001	Temperature/air temperature	
	0 13 001	Specific humidity	
	0 08 023	First-order statistics	= 13 Root-mean-square
	2 01 120	Change data width	6 bits long
	0 10 004	Pressure	
	2 01 000	Change data width	Cancel
	2 01 122	Change data width	6 bits long
	0 12 001	Temperature/air temperature	
	2 01 000	Change data width	Cancel
	2 01 123	Change data width	9 bits long
	0 13 001	Specific humidity	
	2 01 000	Change data width	Cancel
	0 08 023	First-order statistics	Set to missing
	0 33 007	Per cent confidence	All data for current height
	0 08 003	Vertical significance (satellite observations)	= 0 Surface
	0 07 009	Geopotential height	
	0 10 004	Pressure	
	0 08 023	First-order statistics	= 13 Root-mean-square
	2 01 120	Change data width	6 bits long
	0 10 004	Pressure	
	2 01 000	Change data width	Cancel
	0 08 023	First-order statistics	Set to missing
	0 33 007	Per cent confidence	Surface data
		(All sky radiance product main sequence)	
3 10 027	3 01 071	Satellite identifier/Generating resolution	Product information
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 30 021	Number of pixels per row	
	0 30 022	Number of pixels per column	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 027 *(continued)*	0 10 002	Height	Orbit height
	3 04 036	Cloud coverage	
	0 02 152	Satellite instrument used in data processing	
	0 02 167	Radiance computational method	
	1 01 011	Replicate 1 descriptor 11 times	
	3 04 035	All sky radiance data	
		(All sky radiance product main sequence)	
3 10 028	3 01 071	Satellite identifier/Generating resolution	Product information
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 30 021	Number of pixels per row	
	0 30 022	Number of pixels per column	
	0 10 002	Height	Orbit height
	3 04 036	Cloud coverage	
	0 02 152	Satellite instrument used in data processing	
	0 02 167	Radiance computational method	
	1 01 011	Replicate 1 descriptor 11 times	
	3 04 037	All sky radiance data	
		(Layer, ozone, height, temperature and water vapour)	
3 10 029	1 10 000	Delayed replication of 10 descriptors	
	0 31 001	Delayed descriptor replication factor	
	2 01 138	Change data width	
	2 02 130	Change scale	
	0 07 004	Pressure	
	0 07 004	Pressure	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 15 020	Integrated ozone density	
	0 10 002	Height	
	0 12 101	Temperature/air temperature	
	0 13 098	Integrated water vapour density	
		(MIPAS or GOMOS instruments reporting)	
3 10 030	3 10 022	Satellite identifier, instrument and product type	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	3 04 034	Latitude/longitude, solar elevation, number of layers	
	3 10 029	Layer, ozone, height, temperature and water vapour	
		(Satellite collocated 1C reports with 3 instruments)	
3 10 050	3 10 051	Satellite position and instrument temperatures	
	3 10 052	Satellite instrument type and position	AIRS
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 050 *(continued)*	3 10 053	Satellite channels and brightness temperatures with expanded channel set	AIRS
	1 01 004	Replicate 1 descriptor 4 times	
	3 10 054	Satellite visible channels and albedos with expanded channel set	
	0 20 010	Cloud cover (total)	
	3 10 052	Satellite instrument type and position	AMSU-A
	1 01 015	Replicate 1 descriptor 15 times	
	3 10 053	Satellite channels and brightness temperatures with expanded channel set	AMSU-A
	3 10 052	Satellite instrument type and position	HSB
	1 01 005	Replicate 1 descriptor 5 times	
	3 10 053	Satellite channels and brightness temperatures with expanded channel set	HSB
		(Satellite position and instrument temperatures)	
3 10 051	0 01 007	Satellite identifier	
	0 05 040	Orbit number	
	2 01 133	Change data width	
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel
	2 01 132	Change data width	
	0 25 070	Major frame count	
	2 01 000	Change data width	Cancel
	2 02 126	Change scale	
	0 07 001	Height of station	
	2 02 000	Change scale	Cancel
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	1 02 009	Replicate 2 descriptors 9 times	
	0 02 151	Radiometer identifier	
	0 12 064	Instrument temperature	
		(Satellite instrument type and position)	
3 10 052	0 02 019	Satellite instruments	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 02 131	Change scale	
	2 01 138	Change data width	
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 05 043	Field of view number	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Satellite channels and brightness temperatures with expanded channel set)	
3 10 053	2 01 134	Change data width	
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel
	0 25 076	Log_{10} of (temperature-radiance central wave number) for ATOVS	
	0 33 032	Channel quality flags for ATOVS	
	0 12 163	Brightness temperature	Scale: 2
		(Satellite visible channels and albedos with expanded channel set)	
3 10 054	2 01 134	Change data width	
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel
	0 25 076	Log_{10} of (temperature-radiance central wave number) for ATOVS	
	0 33 032	Channel quality flags for ATOVS	
	2 01 131	Change data width	
	2 02 129	Change scale	
	1 02 002	Replicate 2 descriptors 2 times	
	0 08 023	First-order statistics	
	0 14 027	Albedo	
	0 08 023	First-order statistics	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
		(Satellite radiance/channel principal components)	
3 10 055	3 10 051	Satellite position and instrument temperatures	
	3 10 052	Satellite instrument type and position	AIRS
	1 02 020	Replicate 2 descriptors 20 times	
	0 25 076	Log_{10} of (temperature-radiance central wave number) for ATOVS	
	0 25 052	Log_{10} of principal components normalized fit to data	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	0 25 050	Principal component score	Satellite radiance
		(CrIS (Cross-Track Infrared Sounder) radiance data)	
3 10 060	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	3 04 030	Location of platform	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 060 *(continued)*	3 01 021	Latitude/longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 075	Ascending/descending orbit qualifier	
	2 01 133	Change data width	Increase bit width
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel increase bit width
	0 05 045	Field of regard number	
	0 05 043	Field of view number	
	0 05 040	Orbit number	
	0 10 001	Height of land surface	
	2 01 129	Change data width	Increase bit width
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel increase bit width
	2 02 127	Change scale	Increase scale
	2 01 125	Change data width	Increase bit width
	0 21 166	Land fraction	
	2 01 000	Change data width	Cancel increase bit width
	2 02 000	Change scale	Cancel increase scale
	0 08 012	Land/sea qualifier	
	0 20 010	Cloud cover (total)	
	0 20 014	Height of top of cloud	
	0 02 165	Radiance type flags	
	0 33 075	Scan-level quality flags	
	1 07 003	Replicate 7 descriptors 3 times	
	0 08 076	Type of band	
	0 06 029	Wave number	Start of range
	0 06 029	Wave number	End of range
	0 25 140	Start channel	
	0 25 141	End channel	
	0 33 076	Calibration quality flags	
	0 33 077	Field-of-view quality flags	
	0 08 076	Type of band	Set to missing (cancel)
	0 33 078	Geolocation quality	
	0 33 003	Quality information	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	2 01 133	Change data width	Increase bit width
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel increase bit width
	0 14 044	Channel radiance	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(ATMS (Advanced Technology Microwave Sounder) data)	
3 10 061	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	0 05 041	Scan line number	
	0 05 043	Field of view number	
	0 33 079	Granule level quality flags	
	0 33 080	Scan level quality flags	
	0 33 078	Geolocation quality	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	Increase bit width
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel increase bit width
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 25 075	Satellite antenna corrections version number	
	1 11 000	Delayed replication of 11 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 05 042	Channel number	
	2 02 131	Change scale	Increase scale by 3
	0 02 153	Satellite channel centre frequency	
	0 02 154	Satellite channel band width	
	2 02 000	Change scale	Cancel increase scale
	0 02 104	Antenna polarization	
	0 12 066	Antenna temperature	
	0 12 163	Brightness temperature	
	0 12 158	Noise-equivalent delta temperature while viewing cold target	
	0 12 159	Noise-equivalent delta temperature while viewing warm target	
	0 33 081	Channel data quality flags	
		(VIIRS (Visible/Infrared Imager Radiometer Suite) data)	
3 10 062	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 062 *(continued)*	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	2 01 133	Change data width	Increase bit width
	0 05 041	Scan line number	
	0 05 043	Field of view number	
	2 01 000	Change data width	Cancel increase bit width
	0 08 076	Type of band	
	0 33 082	Geolocation quality flags	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	Increase bit width
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel increase bit width
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 072	Pixel(s) type	
	0 08 029	Surface type	
	1 05 000	Delayed replication of 5 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 05 042	Channel number	
	0 02 155	Satellite channel wavelength	
	0 33 083	Radiance data quality flags	
	0 14 043	Channel radiance	
	0 15 042	Reflectance	
		(SST (Sea-surface temperature) data)	
3 10 063	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	2 01 133	Change data width	Increase bit width
	0 05 041	Scan line number	
	0 05 043	Field of view number	
	2 01 000	Change data width	Cancel increase bit width

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 063 *(continued)*	0 33 082	Geolocation quality flags	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	Increase bit width
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel increase bit width
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 075	Ascending/descending orbit qualifier	
	0 08 013	Day/night qualifier	
	0 08 072	Pixel(s) type	
	0 33 084	Pixel level quality flags	
	0 07 062	Depth below sea/water surface	
	0 33 086	Quality of pixel level retrieval	
	0 22 043	Sea/water temperature	
	0 07 062	Depth below sea/water surface	Top of layer
	0 07 062	Depth below sea/water surface	Bottom of layer
	0 33 086	Quality of pixel level retrieval	
	0 22 043	Sea/water temperature	
		(AOT (Aerosol optical thickness) data)	
3 10 064	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	2 01 133	Change data width	
	0 05 041	Scan line number	
	0 05 043	Field of view number	
	2 01 000	Change data width	Cancel
	0 33 082	Geolocation quality flags	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 075	Ascending/descending orbit qualifier	
	0 08 029	Surface type	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 064 *(continued)*	0 08 046	Atmospheric chemical or physical constituent type	
	0 33 085	Aerosol optical thickness quality flags	
	0 33 086	Quality of pixel level retrieval	
	0 15 049	Aerosol Angstrom wavelength exponent	
	0 33 086	Quality of pixel level retrieval	
	1 02 011	Replicate 2 descriptors 11 times	
	0 02 155	Satellite channel wavelength	
	0 15 062	Aerosol optical thickness	
		(OMPS (Ozone mapping and profiler suite) nadir profile data)	
3 10 065	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	0 33 082	Geolocation quality flags	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 075	Ascending/descending orbit qualifier	
	0 33 071	Profile ozone quality	
	0 33 070	Total ozone quality	
	0 20 021	Type of precipitation	
	0 15 045	Sulphur dioxide	
	0 15 046	Volcano contamination index	
	0 08 065	Sun-glint indicator	
	0 33 087	Extent of satellite within South Atlantic anomaly	
	0 08 003	Vertical significance (satellite observations)	
	0 10 004	Pressure	
	0 08 003	Vertical significance (satellite observations)	
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	
	2 07 000	Increase scale, reference value and data width	Cancel
	1 05 012	Replicate 5 descriptors 12 times	
	0 10 040	Number of retrieved layers	
	0 10 004	Pressure	
	2 07 003	Increase scale, reference value and data width	

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 065	0 15 005	Ozone p	
(continued)	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 046	Atmospheric chemical or physical constituent type	
	1 07 019	Replicate 7 descriptors 19 times	
	0 10 040	Number of retrieved layers	
	0 10 004	Pressure	
	0 08 090	Decimal scale of following signficands	
	2 07 006	Increase scale, reference value and data width	
	0 15 008	Significand of volumetric mixing ratio	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 090	Decimal scale of following significands	Set to missing (cancel)
		(OMPS (Ozone mapping and profiler suite) total column data)	
3 10 066	0 01 007	Satellite identifier	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 07 003	Increase scale, reference value and data width	
	0 04 006	Second	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 040	Orbit number	
	0 33 082	Geolocation quality flags	
	3 01 021	Latitude/longitude (high accuracy)	
	2 01 129	Change data width	
	0 07 002	Height or altitude	
	2 01 000	Change data width	Cancel
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 08 075	Ascending/descending orbit qualifier	
	0 20 081	Cloud amount in segment	Cloud fraction
	2 07 004	Increase scale, reference value and data width	
	0 15 030	Aerosol contamination index	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 20 065	Snow cover	
	0 15 041	Sulphur dioxide index	
	0 33 086	Quality of pixel level retrieval	
	0 33 087	Extent of satellite within South Atlantic anomaly	
	0 33 088	Ozone total column quality flag	
	0 08 003	Vertical significance (satellite observations)	= 0 Surface
	2 07 001	Increase scale, reference value and data width	
	0 07 004	Pressure	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)

(continued)

(Category 10 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 10 066 *(continued)*	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	= 2 Cloud top
	0 33 042	Type of limit represented by following value	= 0 Exclusive lower limit (>)
	2 07 001	Increase scale, reference value and data width	
	0 07 004	Pressure	Cloud top pressure
	2 07 000	Increase scale, reference value and data width	Cancel
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	Below cloud
	2 07 000	Increase scale, reference value and data width	Cancel
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	0 01 032	Generating application	= 0 First guess | Defined by local generating centre
	2 07 002	Increase scale, reference value and data width	
	0 15 001	Total ozone	First guess total column ozone
	2 07 000	Increase scale, reference value and data width	Cancel

Note: 3 10 027 is deprecated

Category 11 – Single level report sequences (conventional data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Aircraft reports)	
3 11 001	3 01 051	Flight number, navigational system, date/time, location, phase of flight	ASDAR
	0 07 002	Height or altitude	
	0 12 001	Temperature/air temperature	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 11 031	Degree of turbulence	
	0 11 032	Height of base of turbulence	
	0 11 033	Height of top of turbulence	
	0 20 041	Airframe icing	
		(ACARS reports)	
3 11 002	3 01 065	ACARS identification	
	3 01 066	ACARS location	
	3 11 003	ACARS standard reported variables	
	3 11 004	ACARS supplementary reported variables	
		(ACARS standard reported variables)	
3 11 003	0 10 070	Indicated aircraft altitude	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 12 001	Temperature/air temperature	
	0 13 002	Mixing ratio	
		(ACARS supplementary reported variables)	
3 11 004	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 11 034	Vertical gust velocity	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 11 035	Vertical gust acceleration	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 11 075	Mean turbulence intensity (eddy dissipation rate)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 11 076	Peak turbulence intensity (eddy dissipation rate)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 33 025	ACARS interpolated values indicator	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 33 026	Moisture quality	
		(Standard AMDAR reports)	
3 11 005	0 01 008	Aircraft registration number or other identification	
	0 01 023	Observation sequence number	
	3 01 021	Latitude/longitude (high accuracy)	

(continued)

(Category 11 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 11 005 *(continued)*	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	0 07 010	Flight level	
	0 08 009	Detailed phase of flight	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 11 031	Degree of turbulence	
	0 11 036	Maximum derived equivalent vertical gust speed	
	0 12 101	Temperature/air temperature	
	0 33 025	ACARS interpolated values indicator	
		(AMDAR data or aircraft data for one level without latitude/longitude)	
3 11 006	0 07 010	Flight level	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 02 064	Aircraft roll angle quality	
	0 12 101	Temperature/air temperature	
	0 12 103	Dewpoint temperature	
		(Aircraft data for one level with latitude/longitude indicated)	
3 11 007	0 07 010	Flight level	
	3 01 021	Latitude/longitude (high accuracy)	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 02 064	Aircraft roll angle quality	
	0 12 101	Temperature/air temperature	
	0 12 103	Dewpoint temperature	
		(Aircraft ascent/descent profile without latitude/longitude indicated at each level)	
3 11 008	0 01 008	Aircraft registration number or other identification	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 08 004	Phase of aircraft flight	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 11 006	AMDAR data or aircraft data for one level without latitude/longitude	
		(Aircraft ascent/descent profile with latitude/longitude given for each level)	
3 11 009	0 01 008	Aircraft registration number or other identification	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 08 004	Phase of aircraft flight	
	1 01 000	Delayed replication of 1 descriptor	

(continued)

(Category 11 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 11 009	0 31 001	Delayed descriptor replication factor	
(continued)	3 11 007	Aircraft data for one level with latitude/longitude indicated	
		(BUFR template for AMDAR, version 7)	
3 11 010	0 01 008	Aircraft registration number or other identification	
	0 01 023	Observation sequence number	
	0 01 006	Aircraft flight number	
	0 01 110	Aircraft tail number	
	0 01 111	Origination airport	
	0 01 112	Destination airport	
	2 04 002	Add associated field	2 bits long
	0 31 021	Associated field significance	= 8 Two bits quality information
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 010	Flight level	Pressure altitude
	0 10 053	Global navigation satellite system altitude	
	0 08 009	Detailed phase of flight	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 02 064	Aircraft roll angle quality	
	0 11 100	Aircraft true airspeed	
	0 11 101	Aircraft ground speed u-component	
	0 11 102	Aircraft ground speed v-component	
	0 11 103	Aircraft ground speed w-component	
	0 11 104	Aircraft true heading	
	0 12 101	Temperature/air temperature	
	0 02 170	Aircraft humidity sensors	
	2 01 144	Change data width	
	2 02 133	Change scale	
	0 13 002	Mixing ratio	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	2 01 135	Change data width	
	2 02 130	Change scale	
	0 13 003	Relative humidity	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 12 103	Dewpoint temperature	
	0 33 026	Moisture quality	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 20 042	Airframe icing present	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	

(continued)

(Category 11 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 11 010 *(continued)*	0 20 043	Peak liquid water content	
	0 20 044	Average liquid water content	
	0 20 045	Supercooled large droplet (SLD) conditions	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	0 33 025	ACARS interpolated values indicator	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 11 075	Mean turbulence intensity (eddy dissipation rate)	
	0 11 076	Peak turbulence intensity (eddy dissipation rate)	
	0 11 039	Extended time of occurrence of peak eddy dissipation rate	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 11 037	Turbulence index	EDR
	0 11 077	Reporting interval or averaging time for eddy dissipation rate	
	1 03 000	Delayed replication of 3 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 11 034	Vertical gust velocity	
	0 11 035	Vertical gust acceleration	
	0 11 036	Maximum derived equivalent vertical gust speed	
	2 04 000	Add associated field	Cancel
	1 19 000	Delayed replication of 19 descriptors	
	0 31 001	Delayed descriptor replication factor	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 007	Height	
	0 11 105	EDR algorithm version	
	2 04 007	Add associated field	7 bits long
	0 31 021	Associated field significance	= 7 Percentage confidence
	0 11 076	Peak turbulence intensity (eddy dissipation rate)	
	0 11 075	Mean turbulence intensity (eddy dissipation rate)	
	2 04 000	Add associated field	Cancel
	0 11 106	Running minimum confidence	
	0 11 107	Maximum number bad inputs	
	0 11 108	Peak location	
	0 11 109	Number of good EDR	
	0 12 101	Temperature/air temperature	
	0 11 001	Wind direction	
	2 01 130	Change data width	
	0 11 084	Wind speed	
	2 01 000	Change data width	Cancel

(continued)

(Category 11 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(IAGOS template for a single observation), version 2	
3 11 011	0 01 023	Observation sequence number	
	0 08 004	Phase of aircraft flight	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 07 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 12 101	Temperature/air temperature	
	1 06 000	Delayed replication of 6 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 046	Atmospheric chemical or physical constituent type	
	2 01 139	Change data width	20 bits long
	2 02 126	Change scale	Scale: 7
	0 15 026	Concentration of pollutant (mol mol^{-1})	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	1 06 000	Delayed replication of 6 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 046	Atmospheric chemical or physical constituent type	
	2 01 138	Change data width	19 bits long
	2 02 130	Change scale	Scale: 11
	0 15 026	Concentration of pollutant (mol mol^{-1})	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 15 052	Log_{10} of number density of aerosol particles with diameter greater than 5 nm	
	0 15 053	Log_{10} of number density of aerosol particles with diameter greater than 14 nm	
	0 15 054	Log_{10} of number density of aerosol particles with diameter between 0.25 and 2.5 µm	
	0 15 055	Non volatile aerosol ratio	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 13 099	Log_{10} of integrated cloud particle density	
	0 13 100	Log_{10} of integrated cloud particle area	
	0 13 101	Log_{10} of integrated cloud particle volume	

Category 12 – Single level report sequences (satellite data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 001	3 01 043	Satellite identifier, wind computation method, date/time, location	
	3 04 001	Cloud top pressure, temperature, wind	
3 12 002	3 01 043	Satellite identifier, wind computation method, date/time, location	
	3 04 002	Cloud top pressure, wind	
3 12 003	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 04 003	Surface temperature	
3 12 004	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 04 004	Cloud top pressure, cloud cover, temperature	
3 12 005	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	0 20 014	Height of top of cloud	
3 12 006	3 01 044	Satellite identifier, humidity computation method, date/time, location	
	3 04 005	Layer mean relative humidity	
3 12 007	3 01 042	Satellite identifier, instrument, data-processing technique, date/time, location	
	3 04 006	Radiation	
		(Orbital information, Part I)	
3 12 010	0 01 007	Satellite identifier	
	0 05 040	Orbit number	
	0 02 021	Satellite instrument data used in processing	
	0 05 041	Scan line number	
	0 04 001	Year	
	0 04 043	Day of the year	
		(Orbital information, Part II)	
3 12 011	2 02 131	Change scale	
	2 01 149	Change data width	
	0 04 006	Second	
	2 01 000	Change data width	
	2 02 126	Change scale	
	0 10 002	Height	
	2 02 000	Change scale	
	0 05 043	Field of view number	
	0 05 053	Field of view number increment	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(HIRS brightness temperatures – channels 1-19)	
3 12 012	2 02 129	Change scale	
	2 01 132	Change data width	
	1 01 019	Replicate 1 descriptor 19 times	
	0 12 063	Brightness temperature	
	2 01 000	Change data width	
	2 02 000	Change scale	
		(HIRS brightness temperatures – channel 20)	
3 12 013	0 05 042	Channel number	
	2 02 129	Change scale	
	2 01 135	Change data width	
	0 12 063	Brightness temperature	
	2 01 000	Change data width	
	2 02 000	Change scale	
		(HIRS satellite data)	
3 12 014	3 12 010	Orbital information, Part I	
	3 12 011	Orbital information, Part II	
	1 05 056	Replicate 5 descriptors 56 times	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 05 042	Channel number	
	0 05 052	Channel number increment	
	3 12 012	HIRS brightness temperatures – channels 1–19	
	3 12 013	HIRS brightness temperatures – channel 20	
		(MSU brightness temperatures – channels 1–4)	
3 12 015	1 09 011	Replicate 9 descriptors 11 times	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 05 042	Channel number	
	0 05 052	Channel number increment	
	2 02 129	Change scale	
	2 01 132	Change data width	
	1 01 004	Replicate 1 descriptor 4 times	
	0 12 063	Brightness temperature	
	2 02 000	Change scale	
	2 01 000	Change data width	
		(MSU satellite data)	
3 12 016	3 12 010	Orbital information, Part I	
	3 12 011	Orbital information, Part II	
	3 12 015	MSU brightness temperatures – channels 1–4	
		(SSU brightness temperatures – channels 1–3)	
3 12 017	1 09 008	Replicate 9 descriptors 8 times	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 05 042	Channel number	
	0 05 052	Channel number increment	
	2 02 129	Change scale	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 017 *(continued)*	2 01 132	Change data width	
	1 01 003	Replicate 1 descriptor 3 times	
	0 12 063	Brightness temperature	
	2 02 000	Change scale	
	2 01 000	Change data width	
		(SSU satellite data)	
3 12 018	3 12 010	Orbital information, Part I	
	3 12 011	Orbital information, Part II	
	3 12 017	SSU brightness temperatures – channels 1-3	
		(Wave scatterometer product with width change for wave number (spectral))	
3 12 019	3 01 047	ERS product header	
	3 01 048	Radar parameters	
	0 15 015	Maximum image spectral component before normalization	
	0 29 002	Coordinate grid type	
	0 21 076	Representation of intensities	
	1 06 012	Replicate 6 descriptors 12 times	
	2 01 129	Change data width	14 bits long
	0 06 030	Wave number (spectral)	
	2 01 000	Change data width	Cancel
	1 02 012	Replicate 2 descriptors 12 times	
	0 05 030	Direction (spectral)	
	0 21 075	Image spectrum intensity	
	0 21 066	Wave scatterometer product confidence data	
		(Wave scatterometer product)	
3 12 020	3 01 047	ERS product header	
	3 01 048	Radar parameters	
	0 15 015	Maximum image spectral component before normalization	
	0 29 002	Coordinate grid type	
	0 21 076	Representation of intensities	
	1 04 012	Replicate 4 descriptors 12 times	
	0 06 030	Wave number (spectral)	
	1 02 012	Replicate 2 descriptors 12 times	
	0 05 030	Direction (spectral)	
	0 21 075	Image spectrum intensity	
	0 21 066	Wave scatterometer product confidence data	
		(Wind scatterometer product)	
3 12 021	3 01 047	ERS product header	
	1 01 003	Replicate 1 descriptor 3 times	
	3 01 049	Radar beam data	
	0 11 012	Wind speed at 10 m	
	0 11 011	Wind direction at 10 m	
	0 21 067	Wind product confidence data	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Radar altimeter product)	
3 12 022	3 01 047	ERS product header	
	0 08 022	Total number (with respect to accumulation or average)	Number in average
	0 11 012	Wind speed at 10 m	
	0 11 050	Standard deviation of horizontal wind speed	
	0 22 070	Significant wave height	
	0 22 026	Standard deviation of significant wave height	
	3 12 041	Altitude	
	0 10 050	Standard deviation altitude	
	0 21 068	Radar altimeter product confidence data	
	0 21 071	Peakiness	
	0 21 072	Satellite altimeter calibration status	
	0 21 073	Satellite altimeter instrument mode	
	3 12 042	Altitude corrections	
	0 21 062	Backscatter	
	0 15 011	Log_{10} of integrated electron density	
		(ATSR sea-surface temperature product)	
3 12 023	3 01 047	ERS product header	
	1 03 003	Replicate 3 descriptors 3 times	
	0 08 022	Total number (with respect to accumulation or average)	Number in average
	0 12 061	Skin temperature	
	0 22 050	Standard deviation sea-surface temperature	
	0 21 069	SST product confidence data	
	0 21 085	ATSR sea-surface temperature across-track band number	
		(Wave scatterometer product enhanced)	
3 12 024	3 12 020	Wave scatterometer product	
	0 08 060	Sample scanning mode significance	Range
	0 08 022	Total number (with respect to accumulation or average)	Number in sample
	0 08 060	Sample scanning mode significance	Horizontal
	0 08 022	Total number (with respect to accumulation or average)	Number in sample
	0 25 014	Azimuth clutter cut-off	
	0 22 101	Total energy (wavelength > 731m) at low wave numbers	
	0 22 097	Mean wavelength > 731 m of image spectrum at low wave numbers	
	0 22 098	Wavelength spread (wavelength > 731 m) at low wave numbers	
	0 22 099	Mean direction at low wave numbers (wavelength > 731 m)	
	0 22 100	Direction spread at low wave numbers (wavelength > 731 m)	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Wave scatterometer enhanced product (with change of width for wave number (spectral))	
3 12 025	3 12 019	Wave scatterometer product with width change for wave number (spectral)	
	0 08 060	Sample scanning mode significance	Range
	0 08 022	Total number (with respect to accumulation or average)	Number in sample
	0 08 060	Sample scanning mode significance	Horizontal
	0 08 022	Total number (with respect to accumulation or average)	Number in sample
	0 25 014	Azimuth clutter cut-off	
	0 22 101	Total energy (wavelength > 731m) at low wave numbers	
	0 22 097	Mean wavelength > 731 m of image spectrum at low wave numbers	
	0 22 098	Wavelength spread (wavelength > 731 m) at low wave numbers	
	0 22 099	Mean direction at low wave numbers (wavelength > 731 m)	
	0 22 100	Direction spread at low wave numbers (wavelength > 731 m)	
		(QUIKSCAT data)	
3 12 026	3 01 046	Satellite identifier, direction of motion, sensor, model function, software, resolution	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 12 031	SEAWINDS wind	
	1 01 004	Replicate 1 descriptor 4 times	
	3 12 030	Wind, formal uncertainty, likelihood	
	0 21 110	Number of inner-beam sigma-0 (forward of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 027	Radar specification, normalized radar cross-section, Kp variance coefficient	
	0 21 111	Number of outer-beam sigma-0 (forward of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 027	Radar specification, normalized radar cross-section, Kp variance coefficient	
	0 21 112	Number of inner-beam sigma-0 (aft of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 027	Radar specification, normalized radar cross-section, Kp variance coefficient	
	0 21 113	Number of outer-beam sigma-0 (aft of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 027	Radar specification, normalized radar cross-section, Kp variance coefficient	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(ATSR SST product (SADIST-2))	
3 12 027	3 01 047	ERS product header	
	1 05 009	Replicate 5 descriptors 9 times	
	3 01 023	Latitude/longitude (coarse accuracy)	10-arcmin cell
	0 07 021	Elevation	Incidence angle nadir view **|** Set to zero
	0 12 061	Skin temperature	SST (nadir-only view)
	0 07 021	Elevation	Incidence angle dual view **|** Set to missing
	0 12 061	Skin temperature	SST (dual view)
	0 21 085	ATSR sea-surface temperature across-track band number	0–9
	0 21 070	SST product confidence data (SADIST-2)	23-bit flag
		(SEAWINDS QUIKSCAT data)	
3 12 028	3 01 046	Satellite identifier, direction of motion, sensor, model function, software, resolution	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 08 025	Time difference qualifier	
	2 01 136	Change data width	
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	3 12 031	SEAWINDS wind	
	3 12 032	SEAWINDS precipitation	
	1 01 004	Replicate 1 descriptor 4 times	
	3 12 030	Wind, formal uncertainty, likelihood	
	1 01 002	Replicate 1 descriptor 2 times	
	3 12 033	Antenna polarization, brightness temperature	
	0 21 110	Number of inner-beam sigma-0 (forward of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 028	Radar specification, SEAWINDS normalized radar cross-section, Kp variance coefficient	
	0 21 111	Number of outer-beam sigma-0 (forward of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 028	Radar specification, SEAWINDS normalized radar cross-section, Kp variance coefficient	
	0 21 112	Number of inner-beam sigma-0 (aft of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 028	Radar specification, SEAWINDS normalized radar cross-section, Kp variance coefficient	
	0 21 113	Number of outer-beam sigma-0 (aft of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 028	Radar specification, SEAWINDS normalized radar cross-section, Kp variance coefficient	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Wind, formal uncertainty, likelihood)	
3 12 030	2 01 130	Change data width	
	2 02 129	Change scale	
	0 11 012	Wind speed at 10 m	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 11 052	Formal uncertainty in wind speed	
	2 01 135	Change data width	
	2 02 130	Change scale	
	0 11 011	Wind direction at 10 m	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 11 053	Formal uncertainty in wind direction	
	0 21 104	Likelihood computed for solution	
		(SEAWINDS wind)	
3 12 031	0 05 034	Along-track row number	
	0 06 034	Cross-track cell number	
	0 21 109	SEAWINDS wind vector cell quality	
	0 11 081	Model wind direction at 10 m	
	0 11 082	Model wind speed at 10 m	
	0 21 101	Number of vector ambiguities	
	0 21 102	Index of selected wind vector	
	0 21 103	Total number of sigma-0 measurements	
		(SEAWINDS precipitation)	
3 12 032	0 21 120	Probability of rain	
	0 21 121	SEAWINDS NOF rain index	
	0 13 055	Intensity of precipitation	
	0 21 122	Attenuation correction on sigma-0 (from tB)	
		(Antenna polarization, brightness temperature)	
3 12 033	0 02 104	Antenna polarization	
	0 08 022	Total number (with respect to accumulation or average)	
	0 12 063	Brightness temperature	
	0 12 065	Standard deviation brightness temperature	
		(Altitude)	
3 12 041	2 01 141	Change data width	28 bits long
	2 02 130	Change scale	Scale: 2
	0 07 001	Height of station	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
		(Altitude corrections)	
3 12 042	0 21 077	Altitude correction (ionosphere)	
	0 21 078	Altitude correction (dry troposphere)	
	0 21 079	Altitude correction (wet troposphere)	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 042 *(continued)*	0 21 080	Altitude correction (calibration constant)	
	0 21 081	Open loop correction (height-time loop)	
	0 21 082	Open loop correction (auto gain control)	
		(AATSR sea-surface temperatures)	
3 12 045	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 002	Height or altitude	
	0 12 180	Averaged 12 micron BT for all clear pixels at nadir	
	0 12 181	Averaged 11 micron BT for all clear pixels at nadir	
	0 12 182	Averaged 3.7 micron BT for all clear pixels at nadir	
	0 12 183	Averaged 12 micron BT for all clear pixels, forward view	
	0 12 184	Averaged 11 micron BT for all clear pixels, forward view	
	0 12 185	Averaged 3.7 micron BT for all clear pixels, forward view	
	0 02 174	Mean across-track pixel number	
	0 21 086	Number of pixels in nadir only, average	
	0 12 186	Mean nadir sea-surface temperature	
	0 21 087	Number of pixels in dual view, average	
	0 12 187	Mean dual view sea-surface temperature	
	0 33 043	AST confidence	
		(MERIS instrument reporting)	
3 12 050	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 10 080	Viewing zenith angle	
	0 27 080	Viewing azimuth angle	
	0 08 003	Vertical significance (satellite observations)	
	0 07 004	Pressure	
	0 13 093	Cloud optical thickness	
	0 08 003	Vertical significance (satellite observations)	
	2 01 131	Change data width	
	2 02 129	Change scale	
	0 07 004	Pressure	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 050 *(continued)*	0 07 004	Pressure	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 13 095	Total column water vapour	
		(Ocean cross spectra – WVS)	
3 12 051	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	0 08 075	Ascending/descending orbit qualifier	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 01 012	Direction of motion of moving observing platform	
	2 01 131	Change data width	
	0 01 013	Speed of motion of moving observing platform	
	2 01 000	Change data width	Cancel
	0 10 032	Satellite distance to Earth's centre	
	0 10 033	Altitude (platform to ellipsoid)	
	0 10 034	Earth's radius	
	0 07 002	Height or altitude	
	0 08 012	Land/sea qualifier	
	0 25 110	Image processing summary	
	0 25 111	Number of input data gaps	
	0 25 102	Number of missing lines excluding data gaps	
	0 02 104	Antenna polarization	
	0 25 103	Number of directional bins	
	0 25 104	Number of wavelength bins	
	0 25 105	First directional bin	
	0 25 106	Directional bin step	
	0 25 107	First wavelength bin	
	0 25 108	Last wavelength bin	
	0 02 111	Radar incidence angle	
	0 02 121	Mean frequency	
	0 02 026	Cross-track resolution	
	0 02 027	Along-track resolution	
	0 21 130	Spectrum total energy	
	0 21 131	Spectrum max energy	
	0 21 132	Direction of spectrum max on higher resolution grid	
	0 21 133	Wavelength of spectrum max on higher resolution grid	
	0 21 064	Clutter noise estimate	
	0 25 014	Azimuth clutter cut-off	
	0 21 134	Range resolution of cress covariance spectrum	
	1 07 018	Replicate 7 descriptors 18 times	
	0 05 030	Direction (spectral)	
	1 05 024	Replicate 5 descriptors 24 times	
	2 01 130	Change data width	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 051	0 06 030	Wave number (spectral)	
(continued)	2 01 000	Change data width	Cancel
	0 21 135	Real part of cross spectra polar grid number of bins	
	0 21 136	Imaginary part of cross spectra polar grid number of bins	
	0 33 044	ASAR quality information	
		(RA2 – radar altimeter-2)	
3 12 052	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	0 25 120	RA2-L2-processing flag	
	0 25 121	RA2-L2-processing quality	
	0 25 124	MWR-L2-processing flag	
	0 25 125	MWR-L2-processing quality	
	0 25 122	Hardware configuration for RF	
	0 25 123	Hardware configuration for HPA	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 002	Height or altitude	
	0 02 119	RA-2 instrument operations	
	0 33 047	Measurement confidence data	
	0 10 081	Altitude of COG above reference ellipsoid	
	0 10 082	Instantaneous altitude rate	
	0 10 083	Squared off nadir angle of the satellite from platform data	
	0 10 084	Squared off nadir angle of the satellite from waveform data	
	0 02 116	Percentage of 320 MHz band processed	
	0 02 117	Percentage of 80 MHz band processed	
	0 02 118	Percentage of 20 MHz band processed	
	0 02 156	Percentage of valid Ku ocean retracker measurements	
	0 02 157	Percentage of valid S ocean retracker measurements	
	0 14 055	Solar activity index	
	0 22 150	Number of 18 Hz valid points for Ku band	
	0 22 151	Ku band ocean range	
	0 22 152	STD of 18 Hz Ku band ocean range	
	0 22 153	Number of 18 Hz valid points for S band	
	0 22 154	S band ocean range	
	0 22 155	STD of 18 Hz S band ocean range	
	0 22 156	Ku band significant wave height	
	0 22 157	STD of 18 Hz Ku band ocean range	Significant wave height
	0 22 158	S band significant wave height	
	0 22 159	STD of 18 Hz S band significant wave height	
	0 21 137	Ku band corrected ocean backscatter coefficient	
	0 21 138	STD Ku band corrected ocean backscatter coefficient	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 052	0 21 139	Ku band net instrumental correction for AGC	
(continued)	0 21 140	S band corrected ocean backscatter coefficient	
	0 21 141	STD S band corrected ocean backscatter coefficient	
	0 21 142	S band net instrumental correction for AGC	
	0 10 085	Mean sea-surface height	
	0 10 086	Geoid's height	
	0 10 087	Ocean depth/land elevation	
	0 10 088	Total geocentric ocean tide height (solution 1)	
	0 10 089	Total geocentric ocean tide height (solution 2)	
	0 10 090	Long period tide height	
	0 10 091	Tidal loading height	
	0 10 092	Solid Earth tide height	
	0 10 093	Geocentric pole tide height	
	0 11 002	Wind speed	
	0 25 126	Model dry tropospheric correction	
	0 25 127	Inverted barometer correction	
	0 25 128	Model wet tropospheric correction	
	0 25 129	MWR derived wet tropospheric correction	
	0 25 130	RA2 ionospheric correction on Ku band	
	0 25 131	Ionospheric correction from Doris on Ku band	
	0 25 132	Ionospheric correction from model on Ku band	
	0 25 133	Sea state bias correction on Ku band	
	0 25 134	RA2 ionospheric correction on S band	
	0 25 135	Ionospheric correction from Doris on S band	
	0 25 136	Ionospheric correction from model on S band	
	0 25 137	Sea state bias correction on S band	
	0 13 096	MWR water vapour content	
	0 13 097	MWR liquid water content	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
	0 12 188	Interpolated 23.8 GHz brightness T from MWR	
	0 12 189	Interpolated 36.5 GHz brightness T from MWR	
	0 02 158	RA-2 instrument	
	0 02 159	MWR instrument	
	0 33 052	S band ocean retracking quality	
	0 33 053	Ku band ocean retracking quality	
	0 21 143	Ku band rain attenuation	
	0 21 144	Altimeter rain flag	
		(Ocean wave spectra)	
3 12 053	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	0 08 075	Ascending/descending orbit qualifier	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 053 *(continued)*	0 01 012	Direction of motion of moving observing platform	
	2 01 131	Change data width	
	0 01 013	Speed of motion of moving observing platform	
	2 01 000	Change data width	Cancel
	0 10 032	Satellite distance to Earth's centre	
	0 10 033	Altitude (platform to ellipsoid)	
	0 10 034	Earth's radius	
	0 07 002	Height or altitude	
	0 08 012	Land/sea qualifier	
	0 25 110	Image processing summary	
	0 25 111	Number of input data gaps	
	0 25 102	Number of missing lines excluding data gaps	
	0 02 104	Antenna polarization	
	0 25 103	Number of directional bins	
	0 25 104	Number of wavelength bins	
	0 25 105	First directional bin	
	0 25 106	Directional bin step	
	0 25 107	First wavelength bin	
	0 25 108	Last wavelength bin	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 22 160	Normalized inverse wave age	
	0 25 138	Average signal-to-noise ratio	
	2 01 130	Change data width	
	2 02 129	Change scale	
	0 22 021	Height of waves	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 33 048	Confidence measure of SAR inversion	
	0 33 049	Confidence measure of wind retrieval	
	0 02 026	Cross-track resolution	
	0 02 027	Along-track resolution	
	0 21 130	Spectrum total energy	
	0 21 131	Spectrum max energy	
	0 21 132	Direction of spectrum max on higher resolution grid	
	0 21 133	Wavelength of spectrum max on higher resolution grid	
	0 25 014	Azimuth clutter cut-off	
	1 06 036	Replicate 6 descriptors 36 times	
	0 05 030	Direction (spectral)	
	1 04 024	Replicate 4 descriptors 24 times	
	2 01 130	Change data width	
	0 06 030	Wave number (spectral)	
	2 01 000	Change data width	Cancel
	0 22 161	Wave spectra	
	0 33 044	ASAR quality information	
		(ASCAT level 1b cell information)	
3 12 055	0 05 033	Pixel size on horizontal – 1	
	0 05 040	Orbit number	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 055 *(continued)*	0 06 034	Cross-track cell number	
	0 10 095	Height of atmosphere used	
	0 21 157	Loss per unit length of atmosphere used	
		(Scatterometer wind cell information)	
3 12 056	0 25 060	Software identification	
	0 01 032	Generating application	
	0 11 082	Model wind speed at 10 m	
	0 11 081	Model wind direction at 10 m	
	0 20 095	Ice probability	
	0 20 096	Ice age ("A" parameter)	
	0 21 155	Wind vector cell quality	
	2 01 133	Change data width	Increase data width by 5 bits
	0 21 101	Number of vector ambiguities	
	0 21 102	Index of selected wind vector	
	2 01 000	Change data width	Cancel
		(Ambiguous wind data)	
3 12 057	2 01 130	Change data width	Increase data width by 2 bits
	2 02 129	Change scale	Increase scaling by 10^1
	0 11 012	Wind speed at 10 m	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	2 01 131	Change data width	Increase data width by 3 bits
	2 02 129	Change scale	Increase scaling by 10^1
	0 11 011	Wind direction at 10 m	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 21 156	Backscatter distance	
	0 21 104	Likelihood computed for solution	
		(ASCAT level 1b data)	
3 12 058	3 01 125	ASCAT header information	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	3 12 055	ASCAT level 1b cell information	
	0 21 150	Beam co-location	
	1 01 003	Replicate 1 descriptor 3 times	
	3 21 030	ASCAT sigma-0 information	
		(Scatterometer wind data)	
3 12 059	3 12 056	Scatterometer wind cell information	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 12 057	Ambiguous wind data	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Scatterometer soil moisture data)	
3 12 060	0 25 060	Software identification	
	0 25 062	Database identification	
	0 40 001	Surface soil moisture (ms)	
	0 40 002	Estimated error in surface soil moisture	
	0 21 062	Backscatter	Extrapolated backscatter at 40 deg incidence angle (sigma0_40)
	0 21 151	Estimated error in sigma-0 at 40 degrees incidence angle	
	0 21 152	Slope at 40 degrees incidence angle	
	0 21 153	Estimated error in slope at 40 degrees incidence angle	
	0 21 154	Soil moisture sensitivity	
	0 21 062	Backscatter	Dry backscatter
	0 21 088	Wet backscatter	
	0 40 003	Mean surface soil moisture	
	0 40 004	Rain fall detection	
	0 40 005	Soil moisture correction flag	
	0 40 006	Soil moisture processing flag	
	0 40 007	Soil moisture quality	
	0 20 065	Snow cover	
	0 40 008	Frozen land surface fraction	
	0 40 009	Inundation and wetland fraction	
	0 40 010	Topographic complexity	
		(ASCAT level 1b and level 2 data)	
3 12 061	3 12 058	ASCAT level 1b data	
	3 12 060	Scatterometer soil moisture data	
	3 12 059	Scatterometer wind data	
		(SMOS data)	
3 12 070	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 144	Snapshot identifier	
	0 01 124	Grid point identifier	
	0 30 010	Number of grid points	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 012	Grid point altitude	
	0 15 012	Total electron count per square metre	
	0 12 165	Direct sun brightness temperature	
	0 12 166	Snapshot accuracy	
	0 12 167	Radiometric accuracy (pure polarization)	
	0 12 168	Radiometric accuracy (cross polarization)	
	0 27 010	Footprint axis 1	
	0 28 010	Footprint axis 2	
	0 02 099	Polarization	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 070 *(continued)*	0 13 048	Water fraction	
	0 25 081	Incidence angle	
	0 25 082	Azimuth angle	
	0 25 083	Faraday rotational angle	
	0 25 084	Geometric rotational angle	
	0 12 080	Brightness temperature real part	
	0 12 081	Brightness temperature imaginary part	
	0 12 082	Pixel radiometric accuracy	
	0 25 174	SMOS information flag	
	0 33 028	Snapshot overall quality	
		(CryoSat-2 SIRAL altimeter)	
3 12 071	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 02 139	SIRAL instrument configuration	
	0 01 096	Station acquisition	Acquisition station name
	0 01 040	Processing centre ID code	
	0 25 061	Software identification and version number	
	0 05 040	Orbit number	
	0 05 044	Satellite cycle number	
	0 08 075	Ascending/descending orbit qualifier	
	0 08 077	Radiometer sensed surface type	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 10 081	Altitude of COG above reference ellipsoid	
	0 22 156	Ku band significant wave height	
	0 22 142	Square of significant wave height	
	1 01 020	Replicate 1 descriptor 20 times	
	0 22 149	20 Hz significant wave height squared	
	0 22 143	STD of 20 Hz SWH squared	
	0 22 144	Number of 20 Hz valid points for SWH squared	
	0 21 137	Ku band corrected ocean backscatter coefficient	
	1 01 020	Replicate 1 descriptor 20 times	
	0 21 181	20 Hz ocean backscatter coefficient	
	0 21 138	STD Ku band corrected ocean backscatter coefficient	
	0 21 180	Number of 20 Hz valid points for ocean backscatter coefficient	
	0 21 177	Corrected OCOG backscatter coefficient	
	0 21 178	STD of 20 Hz OCOG backscatter coefficient	
	0 21 179	Number of 20 Hz valid points for OCOG backscatter coefficient	

(continued)

(Category 12 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 071 *(continued)*	0 10 079	Off nadir angle of the satellite from platform data	
	0 10 085	Mean sea-surface height	
	0 10 086	Geoid's height	
	0 10 087	Ocean depth/land elevation	
	0 10 089	Total geocentric ocean tide height (solution 2)	
	0 10 090	Long period tide height	
	0 10 091	Tidal loading height	
	0 10 092	Solid Earth tide height	
	0 10 093	Geocentric pole tide height	
	0 11 097	Wind speed from altimeter	
	0 21 093	Ku band peakiness	Average of 20 Hz values
	1 01 020	Replicate 1 descriptor 20 times	
	0 21 182	20 Hz Ku band peakiness	20 values
	0 33 053	Ku band ocean retracking quality	
	0 22 151	Ku band ocean range	
	0 22 145	STD of 20 Hz ocean range	
	0 22 148	Number of 20 Hz valid points for ocean range	
	0 22 146	OCOG range	
	0 22 147	STD of 20 Hz OCOG range	
	0 25 126	Model dry tropospheric correction	
	0 25 128	Model wet tropospheric correction	
	0 25 127	Inverted barometer correction	
	0 21 176	High frequency variability correction	
	0 25 132	Ionospheric correction from model on Ku band	
	0 25 133	Sea state bias correction on Ku band	
	0 25 182	L1 processing flag	
	0 25 183	L1 processing quality	
	0 25 180	LRM mode per cent	
	0 25 184	L2 product status	
	0 25 181	L2 processing flag	
	0 33 080	Scan level quality flags	L2 processing quality

Notes:

(1) Separation of single level satellite data into sets of BUFR messages helps compression and results in efficient data transmission and storage.

(2) Each BUFR message may contain data for a number of locations; the BUFR compression technique involves negligible overheads for data items that are invariant.

(3) Compound BUFR messages may be described within the data description section, if required (e.g. 3 01 041, 3 04 001, 3 04 002, 3 04 003, 3 04 004, 3 04 005, 3 04 006).

Category 13 – Sequences common to image data

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Radar reflectivity values)	
3 13 009	0 21 001	Horizontal reflectivity	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 21 001	Horizontal reflectivity	
		(Radar rainfall intensities)	
3 13 010	0 21 036	Radar rainfall intensity	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 21 036	Radar rainfall intensity	
		(Non run-length encoded row for Pixel value (4 bits))	
3 13 031	0 06 002	Longitude (coarse accuracy)	First longitude location minus one increment
	0 06 012	Longitude increment (coarse accuracy)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	0 30 001	Pixel value (4 bits)	
		(Non run-length encoded picture data for Pixel value (4 bits))	
3 13 032	0 05 002	Latitude (coarse accuracy)	First latitude location minus one increment
	0 05 012	Latitude increment (coarse accuracy)	Signed value so cannot cross pole
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 13 031	Non run-length encoded row for Pixel value (4 bits)	
		(Run-length encoded row for Pixel value (4 bits))	
3 13 041	0 06 002	Longitude (coarse accuracy)	First longitude location minus one increment
	1 10 000	Delayed replication of 10 descriptors	
	0 31 001	Delayed descriptor replication factor	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 06 012	Longitude increment (coarse accuracy)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 012	Extended delayed descriptor and data repetition factor	
	0 30 001	Pixel value (4 bits)	
	0 06 012	Longitude increment (coarse accuracy)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 30 001	Pixel value (4 bits)	

(continued)

(Category 13 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Run-length encoded picture data for Pixel value (4 bits))	
3 13 042	0 05 002	Latitude (coarse accuracy)	First latitude location minus one increment
	0 05 012	Latitude increment (coarse accuracy)	Signed value so cannot cross pole
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 13 041	Run-length encoded row for pixel value (4 bits)	
		(Run-length encoded picture data for pixel value (4 bits), regular grid)	
3 13 043	0 06 002	Longitude (coarse accuracy)	First longitude location minus one increment
	0 05 002	Latitude (coarse accuracy)	First latitude location minus one increment
	0 05 012	Latitude increment (coarse accuracy)	
	1 12 000	Delayed replication of 12 descriptors	
	0 31 001	Delayed descriptor replication factor	
	1 10 000	Delayed replication of 10 descriptors	
	0 31 001	Delayed descriptor replication factor	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 06 012	Longitude increment (coarse accuracy)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 011	Delayed descriptor and data repetition factor	
	0 30 001	Pixel value (4 bits)	
	0 06 012	Longitude increment (coarse accuracy)	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 30 001	Pixel value (4 bits)	

Category 15 – Oceanographic report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Typically reported underwater sounding without optional fields)	
3 15 001	0 01 011	Ship or mobile land station identifier	Ship's call sign
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 06 001	Depth, temperature	
		(Typically reported underwater sounding without optional fields)	
3 15 002	0 01 011	Ship or mobile land station identifier	Ship's call sign
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 06 004	Depth, temperature, salinity	
		(Temperature and salinity profile observed by profile floats)	
3 15 003	0 01 087	WMO marine observing platform extended identifier	
	0 01 085	Observing platform manufacturer's model	
	0 01 086	Observing platform manufacturer's serial number	
	0 02 036	Buoy type	
	0 02 148	Data collection and/or location system	
	0 02 149	Type of data buoy	
	0 22 055	Float cycle number	
	0 22 056	Direction of profile	
	0 22 067	Instrument type for water temperature profile measurement	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 08 080	Qualifier for GTSPP quality flag	
	0 33 050	Global GTSPP quality flag	
	1 09 000	Delayed replication of 9 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 07 065	Water pressure	
	0 08 080	Qualifier for GTSPP quality flag	
	0 33 050	Global GTSPP quality flag	
	0 22 045	Sea/water temperature	
	0 08 080	Qualifier for GTSPP quality flag	
	0 33 050	Global GTSPP quality flag	
	0 22 064	Salinity	
	0 08 080	Qualifier for GTSPP quality flag	
	0 33 050	Global GTSPP quality flag	
		(XBT temperature profile data sequence)	
3 15 004	0 01 079	Unique identifier for the profile	Hexadecimal string
	0 01 011	Ship or mobile land station identifier	Ship's call sign
	0 01 103	IMO Number. Unique Lloyd's register	= 0 to 9999999

(continued)

(Category 15 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 15 004 *(continued)*	0 01 087	WMO marine observing platform extended identifier (see Note 1)	
	0 01 019	Long station or site name	Ship name
	0 01 080	Ship line number according to SOOP	
	0 05 036	Ship transect number according to SOOP (see Note 2)	
	0 01 036	Agency in charge of operating the observing platform	
	0 01 013	Speed of motion of moving observing platform	
	0 01 012	Direction of motion of moving observing platform	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 02 002	Type of instrumentation for wind measurement	
	0 11 002	Wind speed	
	0 11 001	Wind direction	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	
	0 07 033	Height of sensor above water surface	
	0 12 101	Temperature/air temperature	
	0 12 103	Dewpoint temperature	
	0 07 032	Height of sensor above local ground (or deck of marine platform)	Set to missing (cancel)
	0 07 033	Height of sensor above water surface	Set to missing (cancel)
	3 02 021	Waves	
	0 02 031	Duration and time of current measurement	
	0 02 030	Method of current measurement	
	0 22 005	Direction of sea-surface current	
	0 22 032	Speed of sea-surface current	
	0 22 063	Total water depth	
	0 08 080	Qualifier for GTSPP quality flag	
	0 33 050	Global GTSPP quality flag	
	0 22 178	XBT/XCTD launcher type	
	0 22 177	Height of XBT/XCTD launcher	Above sea level | 0 to 50 m in units of whole m
	0 22 067	Instrument type for water temperature profile measurement	
	0 08 041	Data significance	
	0 26 021	Year	
	0 26 022	Month	
	0 26 023	Day	
	0 22 068	Water temperature profile recorder types	
	0 25 061	Software identification and version number	
	0 08 041	Data significance	Set to missing (cancel)
	0 08 080	Qualifier for GTSPP quality flag	Set to missing (cancel)
	0 02 171	Instrument serial number for water temperature profile measurement	

(continued)

(Category 15 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 15 004 *(continued)*	3 02 090	Sea/water temperature high precision	
	0 02 171	Instrument serial number for water temperature profile measurement	
	0 02 032	Indicator for digitization (see Note 3)	
	3 15 005	Water temperature profile (Temperature profile observed by XBT or buoy)	
		(Water temperature profile (Temperature profile observed by XBT or buoy)	
3 15 005	1 06 000	Delayed replication of 6 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	0 07 063	Depth below sea/water surface (cm)	
	0 08 080	Qualifier for GTSPP quality flag	= 13 Water depth at a level
	0 33 050	Global GTSPP quality flag	
	0 22 043	Sea/water temperature	
	0 08 080	Qualifier for GTSPP quality flag	= 11 Water temperature at a level
	0 33 050	Global GTSPP quality flag	

Notes:

(1) If field 0 01 011 is used, this field will be left missing and vice versa.

(2) Integer, assigned by the operator, incremented for each new transect (i.e. all drops have the same transect number while the ship is moving from one end point of the line to the other end point; as soon as the ship arrived to port and goes back to start a new transect then transect number is incremented). The initial value and subsequent values for transect numbers do not matter provided that each new transect by a ship on a line has a transect number higher than previous transect numbers for the same line and the same ship. In case a single cruise follows more than one SOOP line in a row, then the transect number should be incremented each time the cruise changes line.

(3) This descriptor applies to the method used to select depths for the temperature profile encoded through 3 15 005. If temperatures are reported at significant depths, the values shall:

(a) Be sufficient to reproduce basic features of the profile; and

(b) Define the top and the bottom of isothermal layers.

Category 16 – Synoptic feature sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 001	3 01 011	Year, month, day	
	0 04 004	Hour	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 01 021	Synoptic feature identifier	
	0 02 041	Method for estimating reports related to synoptic features	
	0 19 001	Type of synoptic feature	
	0 10 051	Pressure reduced to mean sea level	
	0 19 002	Effective radius of feature	
	0 19 003	Wind speed threshold	15 m s^{-1} typically
	0 19 004	Effective radius with respect to wind speeds above threshold	
		(Header)	
3 16 002	0 08 021	Time significance	Data time (analysis)
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 01 033	Identification of originating/generating centre	
	0 08 021	Time significance	Validity time (forecast)
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 07 002	Height or altitude	Flight level (base of chart layer)
	0 07 002	Height or altitude	Flight level (top of chart layer)
		(Jet stream)	
3 16 003	1 10 000	Delayed replication of 10 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	Jet stream value
	0 08 007	Dimensional significance	Value for line
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 10 002	Height	Flight level
	0 11 002	Wind speed	
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel **|** End of object

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Turbulence)	
3 16 004	1 11 000	Delayed replication of 11 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	Value for turbulence
	0 08 007	Dimensional significance	Value for area
	0 07 002	Height or altitude	Flight level (base of layer)
	0 07 002	Height or altitude	Flight level (top of layer)
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 11 031	Degree of turbulence (see Note 1)	
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel **|** End of object
		(Storm)	
3 16 005	1 08 000	Delayed replication of 8 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 005	Meteorological attribute significance	Storm centre
	0 08 007	Dimensional significance	Value for point
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 01 026	WMO storm name	Use “UNKNOWN” for a sandstorm
	0 19 001	Type of synoptic feature	Value for type of storm
	0 08 007	Dimensional significance	Cancel
	0 08 005	Meteorological attribute significance	Cancel **|** End of object
		(Cloud)	
3 16 006	1 12 000	Delayed replication of 12 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	Value for cloud
	0 08 007	Dimensional significance	Value for area
	0 07 002	Height or altitude	Flight level (base of layer)
	0 07 002	Height or altitude	Flight level (top of layer)
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 20 011	Cloud amount (see Note 2)	
	0 20 012	Cloud type	
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel **|** End of object

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Front)	
3 16 007	1 10 000	Delayed replication of 10 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature (see Note 3)	Value for type of front
	0 08 007	Dimensional significance	Value for line
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel **|** End of object
		(Tropopause)	
3 16 008	1 11 000	Delayed replication of 11 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 001	Vertical sounding significance	Bit 3 set for tropopause
	0 08 007	Dimensional significance	Value for point
	0 08 023	First-order statistics (see Note 4)	Type of tropopause value
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 10 002	Height	
	0 08 023	First-order statistics	Cancel
	0 08 007	Dimensional significance	Cancel
	0 08 001	Vertical sounding significance	Cancel **|** End of object
		(Airframe icing area)	
3 16 009	1 11 000	Delayed replication of 11 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	Value for airframe icing
	0 08 007	Dimensional significance	Value for area
	0 07 002	Height or altitude	Flight level (base of layer)
	0 07 002	Height or altitude	Flight level (top of layer)
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 20 041	Airframe icing	Type of airframe icing
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel **|** End of object

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Name of feature)	
3 16 010	1 07 000	Delayed replication of 7 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	
	0 08 007	Dimensional significance	Value for point
	0 01 022	Name of feature	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel | End of object
		(Volcano erupting)	
3 16 011	1 17 000	Delayed replication of 17 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 011	Meteorological feature	Value for special clouds
	0 01 022	Name of feature	Volcano name
	0 08 007	Dimensional significance	Value for point
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 08 021	Time significance	Eruption starting time
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 20 090	Special clouds	Clouds from volcanic eruptions
	0 08 021	Time significance	Cancel
	0 08 007	Dimensional significance	Cancel
	0 08 011	Meteorological feature	Cancel | End of object
		(Tropical storm identification)	
3 16 020	0 01 033	Identification of originating/generating centre	
	0 01 025	Storm identifier	
	0 01 027	WMO long storm name	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
		(Analysis data)	
3 16 021	3 01 023	Latitude/longitude (coarse accuracy)	
	0 02 041	Method for estimating reports related to synoptic features	
	0 19 001	Type of synoptic feature	
	0 19 007	Effective radius of feature	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 021	0 19 008	Vertical extent of circulation	
(continued)	0 08 005	Meteorological attribute significance	= 1 Storm centre
	0 10 004	Pressure	Storm centre by virtue of preceding significance qualifier
	0 08 005	Meteorological attribute significance	= 2 Outer limit or edge of feature
	0 10 004	Pressure	Outer limit
	0 19 007	Effective radius of feature	Outer limit
	0 08 005	Meteorological attribute significance	= 3 Location of maximum wind
	0 08 021	Time significance	Time averaged
	0 04 075	Short time period or displacement	Minutes
	0 11 040	Maximum wind speed (mean wind)	
	0 19 007	Effective radius of feature	Maximum wind
	1 05 004	Replicate 5 descriptors 4 times	
	0 05 021	Bearing or azimuth	Starting
	0 05 021	Bearing or azimuth	Ending
	1 02 002	Replicate 2 descriptors 2 times	
	0 19 003	Wind speed threshold	
	0 19 004	Effective radius with respect to wind speeds above threshold	
		(Forecast data)	
3 16 022	0 01 032	Generating application	NWP model name, etc. code table defined by originating/ generating centre
	0 02 041	Method for estimating reports related to synoptic features	
	0 19 001	Type of synoptic feature	
	0 19 010	Method for tracking the centre of synoptic feature	
	1 18 000	Delayed replication of 18 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 021	Time significance	Forecast
	0 04 014	Time increment	Hours
	0 08 005	Meteorological attribute significance	Surface synoptic feature
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
	0 10 004	Pressure	
	0 11 041	Maximum wind gust speed	For example, used in the United States
	0 08 021	Time significance	Forecast time averaged
	0 04 075	Short time period or displacement	Minutes
	0 11 040	Maximum wind speed (mean wind)	
	0 19 008	Vertical extent of circulation	
	1 05 004	Replicate 5 descriptors 4 times	

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 022 *(continued)*	0 05 021	Bearing or azimuth	Starting
	0 05 021	Bearing or azimuth	Ending
	1 02 002	Replicate 2 descriptors 2 times	
	0 19 003	Wind speed threshold	
	0 19 004	Effective radius with respect to wind speeds above threshold	
		(Tropical storm analysis information)	
3 16 026	3 16 020	Tropical storm identification	
	3 16 021	Analysis data	
		(Tropical storm forecast information)	
3 16 027	3 16 020	Tropical storm identification	
	3 16 022	Forecast data	
		(SIGMET header)	
3 16 030	3 01 014	Time period	For which SIGMET is valid
	0 01 037	SIGMET sequence identifier	
	0 10 064	SIGMET cruising level	
	0 08 019	Qualifier for following centre identifier	= 1 ATS unit serving FIR
	0 01 062	Short ICAO location indicator	
	0 08 019	Qualifier for following centre identifier	= 2 FIR, = 3 UIR, = 4 CTA
	0 01 065	ICAO region identifier	
	0 08 019	Qualifier for following centre identifier	= 6 MWO
	0 01 062	Short ICAO location indicator	
	0 08 019	Qualifier for following centre identifier	Set to missing (cancel)
		(SIGMET, Observed or forecast location and motion)	
3 16 031	0 08 021	Time significance	= 16 Analysis, = 4 Forecast
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 027	Description of a feature in 3-D or 2-D	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
	0 20 028	Expected change in intensity	
	0 08 021	Time significance	Set to missing (cancel)
		(SIGMET, Forecast position)	
3 16 032	0 08 021	Time significance	= 4 Forecast
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	3 01 027	Description of a feature in 3-D or 2-D	
	0 08 021	Time significance	Set to missing (cancel)

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(SIGMET, Outlook)	
3 16 033	0 08 021	Time significance	= 4 Forecast
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 01 027	Description of a feature in 3-D or 2-D	
	0 08 021	Time significance	Set to missing (cancel)
		(Volcanic Ash SIGMET)	
3 16 034	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 17 Volcano
	0 01 022	Name of feature	
	0 08 007	Dimensional significance	= 0 Point
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 08 007	Dimensional significance	Set to missing (cancel)
	0 20 090	Special clouds	= 5 Clouds from volcanic eruptions
	3 16 031	SIGMET, Observed or forecast location and motion	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 16 032	SIGMET, Forecast position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 16 033	SIGMET, Outlook	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(Thunderstorm SIGMET)	
3 16 035	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 21 Thunderstorm
	0 20 023	Other weather phenomena	Bit 2 = Squalls or all 18 bits = Missing
	0 20 021	Type of precipitation	Bit 14 = Hail or all 30 bits = Missing
	0 20 008	Cloud distribution for aviation	= 15 OBSC, = 16 EMBD, = 12 FRQ, = 31 Missing
	3 16 031	SIGMET, Observed or forecast location and motion	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Tropical cyclone SIGMET)	
3 16 036	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 22 Tropical cyclone
	0 01 027	WMO long storm name	
	3 16 031	SIGMET, Observed or forecast location and motion	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 16 032	SIGMET, Forecast position	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 16 033	SIGMET, Outlook	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(Turbulence SIGMET)	
3 16 037	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 13 Turbulence
	0 11 031	Degree of turbulence	= 10 Moderate, = 11 Severe
	3 16 031	SIGMET, Observed or forecast location and motion	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(Icing SIGMET)	
3 16 038	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 15 Airframe icing
	0 20 041	Airframe icing	= 7 Severe
	0 20 021	Type of precipitation	Bit 3 = Liquid freezing or all 30 bits = Missing
	3 16 031	SIGMET, Observed or forecast location and motion	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(Mountain wave, duststorm or sandstorm SIGMET)	
3 16 039	0 08 079	Product status	= 0 Normal issue, = 1 Correction
	3 16 030	SIGMET header	
	0 08 011	Meteorological feature	= 23 Mountain wave, = 24 Duststorm, = 25 Sandstorm
	0 20 024	Intensity of phenomena	= 3 Heavy, = 5 Severe
	3 16 031	SIGMET, Observed or forecast location and motion	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Cancellation of SIGMET)	
3 16 040	3 16 030	SIGMET header	
	0 08 079	Product status	= 4 Cancellation
	3 01 014	Time period	Of the SIGMET to be cancelled
	0 01 037	SIGMET sequence identifier	Of the SIGMET to be cancelled
	0 10 064	SIGMET cruising level	Of the SIGMET to be cancelled
	0 08 079	Product status	Set to missing (cancel)
		(RADOB template – Part A: Information on tropical cyclone)	
3 16 050	3 01 001	WMO block and station numbers	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 02 160	Wave length of the radar	
	0 08 005	Meteorological attribute significance	= 1
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 08 005	Meteorological attribute significance	Cancel
	0 19 100	Time interval to calculate the movement of the tropical cyclone	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
	0 19 101	Accuracy of the position of the centre of the tropical cyclone	
	0 19 102	Shape and definition of the eye of the tropical cyclone	
	0 19 103	Diameter of major axis of the eye of the tropical cyclone	
	0 19 104	Change in character of the eye during the 30 minutes	
	0 19 105	Distance between the end of spiral band and the centre	
		(SAREP template – Part A: Information on tropical cyclone)	
3 16 052	3 01 005	Originating centre/sub-centre	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 01 007	Satellite identifier	
	0 25 150	Method of tropical cyclone intensity analysis using satellite data	
	1 22 000	Delayed replication of 22 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 01 027	WMO long storm name	
	0 19 150	Typhoon International Common Number (Typhoon Committee)	
	0 19 106	Identification number of tropical cyclone	
	0 08 005	Meteorological attribute significance	= 1
	0 05 002	Latitude (coarse accuracy)	

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 052	0 06 002	Longitude (coarse accuracy)	
(continued)	0 08 005	Meteorological attribute significance	Cancel
	0 19 107	Time interval over which the movement of the tropical cyclone has been calculated	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
	0 19 108	Accuracy of geographical position of the tropical cyclone	
	0 19 109	Mean diameter of the overcast cloud of the tropical cyclone	
	0 19 110	Apparent 24-hour change in intensity of the tropical cyclone	
	0 19 111	Current Intensity (CI) number of the tropical cyclone	
	0 19 112	Data Tropical (DT) number of the tropical cyclone	
	0 19 113	Cloud pattern type of the DT-number	
	0 19 114	Model Expected Tropical (MET) number of the tropical cyclone	
	0 19 115	Trend of the past 24-hour change (+: Developed, –: Weakened)	
	0 19 116	Pattern Tropical (PT) number of the tropical cyclone	
	0 19 117	Cloud picture type of the PT-number	
	0 19 118	Final Tropical (T) number of the tropical cyclone	
	0 19 119	Type of the final T-number	
		(Definition of squall line (by 3 points: Centre, North, South) and forecasted trajectory and evolution)	
3 16 060	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
		Position of squall line centre	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
		Amplitude of feature from most external points to centre point – North point	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
		Amplitude of feature from most external points to centre point – South point	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
		Amplitude of feature from most external points to centre point – Evolution	
	0 04 074	Short time period or displacement	Period of validity
	0 20 048	Evolution of feature	
	0 11 041	Maximum wind gust speed	Maximum burst expected
	0 13 055	Intensity of precipitation	Intensity of rain expected

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Definition of squall line (by centre and several points: North points and South points) and forecasted trajectory and evolution)	
3 16 061	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
		Position of squall line centre	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
	0 19 005	Direction of motion of feature	
	0 19 006	Speed of motion of feature	
		Amplitude of feature from most external points to centre point – North points	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
		Amplitude of feature from most external points to centre point – South points	
	1 02 000	Delayed replication of 2 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 05 002	Latitude (coarse accuracy)	
	0 06 002	Longitude (coarse accuracy)	
		Amplitude of feature from most external points to centre point – Evolution	
	0 04 074	Short time period or displacement	Period of validity
	0 20 048	Evolution of feature	
	0 11 041	Maximum wind gust speed	Maximum burst expected
	0 13 055	Intensity of precipitation	Intensity of rain expected
		(Graphical AIRMET Sierra)	
3 16 071	3 01 014	Time period	For which AIRMET is valid
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 075	GFA IFR ceiling and visibility	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 076	GFA mountain obscuration	
		(Graphical AIRMET Tango)	
3 16 072	3 01 014	Time period	For which AIRMET is valid
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 077	GFA turbulence	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 078	GFA strong surface wind	

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 072 *(continued)*	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 079	GFA low-level wind shear	
		(Graphical AIRMET Zulu)	
3 16 073	3 01 014	Time period	For which AIRMET is valid
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 080	GFA icing	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 16 081	GFA freezing level	
		(GFA identifier and observed/forecast location)	
3 16 074	0 01 039	Graphical Area Forecast (GFA) sequence identifier	
	0 08 021	Time significance	= 4 Forecast, = 16 Analysis
	3 01 014	Time period	For which hazard is being observed/ forecast
	3 01 027	Description of a feature in 3-D or 2-D	
	0 08 021	Time significance	Set to missing (cancel)
		(GFA IFR ceiling and visibility)	
3 16 075	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 041	Data significance	= 8 IFR ceiling and visibility
	3 16 074	GFA identifier and observed/forecast location	
	0 20 006	Flight rules	= 1 IFR
	0 33 042	Type of limit represented by following value	= 2 Exclusive upper limit, = 7 Missing
	0 20 013	Height of base of cloud	
	0 33 042	Type of limit represented by following value	= 2 Exclusive upper limit, = 7 Missing
	0 20 001	Horizontal visibility	
	0 20 025	Obscuration	
	0 20 026	Character of obscuration	= 6 Blowing, = 15 Missing
	0 08 041	Data significance	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(GFA mountain obscuration)	
3 16 076	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 041	Data significance	= 9 Mountain obscuration

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 16 076 *(continued)*	3 16 074	GFA identifier and observed/forecast location	
	0 20 006	Flight rules	= 1 IFR
	0 20 025	Obscuration	
	0 20 026	Character of obscuration	= 6 Blowing, = 15 Missing
	0 08 041	Data significance	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(GFA turbulence)	
3 16 077	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 011	Meteorological feature	= 13 Turbulence
	3 16 074	GFA identifier and observed/forecast location	
	0 11 031	Degree of turbulence	= 6 Moderate
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(GFA strong surface wind)	
3 16 078	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 041	Data significance	= 10 Strong surface wind
	3 16 074	GFA identifier and observed/forecast location	
	0 33 042	Type of limit represented by following value	= 0 Exclusive lower limit
	0 11 012	Wind speed at 10 m	
	0 08 041	Data significance	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(GFA low-level wind shear)	
3 16 079	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 011	Meteorological feature	= 16 Phenomenon
	3 16 074	GFA identifier and observed/forecast location	
	0 20 023	Other weather phenomena	Bit 12 = Wind shear
	0 20 024	Intensity of phenomena	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)
		(GFA icing)	
3 16 080	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 011	Meteorological feature	= 15 Airframe icing
	3 16 074	GFA identifier and observed/forecast location	
	0 20 041	Airframe icing	= 4 Moderate icing
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)

(continued)

(Category 16 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(GFA freezing level)	
3 16 081	0 08 079	Product status	= 0 Normal, = 1 COR, = 2 AMD, = 3 COR AMD, = 4 CNL
	0 08 041	Data significance	= 11 Freezing level, = 12 Multiple freezing level
	3 16 074	GFA identifier and observed/forecast location	
	0 08 041	Data significance	Set to missing (cancel)
	0 08 079	Product status	Set to missing (cancel)

Notes:

(1) For MOD OCNL SEV code as 12 (extreme in clear air) or 13 (extreme in cloud).

(2) Code table values:

FRQ = code figure 8 (8 oktas)

OCNL EMBD = code figure 6 (6 oktas)

ISOL = code figure 2 (2 oktas) when the cloud = Cb.

(3) Front direction (towards which the front is moving) must always be given as it is needed for plotting purposes. A front direction with a front speed of zero would indicate a slow front. A value in the code table exists to represent a quasi-stationary front.

(4) The statistic is to determine whether the following tropopause levels are minimum, maximum or spot values (missing code value).

(5) Decibel (dB) is a logarithmic measure of the relative power, or of the relative values of two flux densities, especially of sound intensities and radio and radar power densities. In radar meteorology, the logarithmic scale (dBZ) is used for measuring radar reflectivity factor (obtained from the American Meteorological Society *Glossary of Meteorology*).

Category 18 – Radiological report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 18 001	3 01 025	Latitude/longitude (coarse accuracy), day/time	
	0 24 011	Dose	
3 18 003	3 01 026	Latitude/longitude (high accuracy), time period (day, hour, minute)	
	0 24 005	Isotope mass	
	0 24 004	Element name	
	0 24 021	Air concentration (of named isotope type including gross beta)	
3 18 004	3 01 025	Latitude/longitude (coarse accuracy), day/time	
	0 04 023	Time period or displacement	
	0 13 011	Total precipitation/total water equivalent	
	0 24 005	Isotope mass	
	0 24 004	Element name	
	0 24 022	Concentration in precipitation (of named isotope type)	

Category 21 – Radar report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Wind profiler – antenna characteristics)	
3 21 001	0 02 101	Type of antenna	
	0 02 114	Antenna effective surface area	
	0 02 105	Maximum antenna gain	
	0 02 106	3-dB beamwidth	
	0 02 107	Sidelobe suppression	
	0 02 121	Mean frequency	
		(Wind profiler – moment data)	
3 21 003	0 21 051	Signal power above 1 mW	
	0 21 014	Doppler mean velocity (radial)	
	0 21 017	Doppler velocity spectral width	
	0 21 030	Signal to noise ratio	
		(Wind profiler – moment data sounding)	
3 21 004	3 01 031	Identification and type of station, date/time, location (high accuracy), height of station	
	0 02 003	Type of measuring equipment used	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 21 003	Wind profiler – moment data	
		(Transmitter-receiver characteristics)	
3 21 005	0 25 004	Echo processing	
	0 02 121	Mean frequency	
	0 02 122	Frequency agility range	
	0 02 123	Peak power	
	0 02 124	Average power	
	0 02 125	Pulse repetition frequency	
	0 02 126	Pulse width	
	0 02 127	Receiver intermediate frequency	
	0 02 128	Intermediate frequency bandwidth	
	0 02 129	Minimum detectable signal	
	0 02 130	Dynamic range	
	0 02 131	Sensitivity time control (STC)	
		(Integration characteristics)	
3 21 006	0 25 001	Range-gate length	
	0 25 002	Number of gates averaged	
	0 25 003	Number of integrated pulses	
	0 25 005	Echo integration	
		(Corrections)	
3 21 007	0 25 009	Calibration method	
	0 25 010	Clutter treatment	
	0 25 011	Ground occultation correction (screening)	
	0 25 012	Range attenuation correction	
	0 25 013	Bright-band correction	
	0 25 015	Radome attenuation correction	
	0 25 016	Clear-air attenuation correction	
	0 25 017	Precipitation attenuation correction	

(continued)

(Category 21 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Z to R conversion)	
3 21 008	0 25 006	Z to R conversion	
	0 25 007	Z to R conversion factor	
	0 25 008	Z to R conversion exponent	
		(A to Z law)	
3 21 009	0 25 018	A to Z law for attenuation factor	
	0 25 019	A to Z law for attenuation exponent	
		(Antenna characteristics)	
3 21 010	0 02 101	Type of antenna	
	0 07 002	Height or altitude	Altitude of the tower base
	0 02 102	Antenna height above tower base	
	0 02 103	Radome	
	0 02 104	Antenna polarization	
	0 02 105	Maximum antenna gain	
	0 02 106	3-dB beamwidth	
	0 02 107	Sidelobe suppression	
	0 02 108	Crosspol discrimination (on axis)	
	0 02 109	Antenna speed (azimuth)	
	0 02 110	Antenna speed (elevation)	
	0 02 132	Azimuth pointing accuracy	
	0 02 133	Elevation pointing accuracy	
		(General characteristics)	
3 21 011	0 30 031	Picture type	
	0 30 032	Combination with other data	
	0 29 002	Coordinate grid type	
		(Antenna elevations)	
3 21 012	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	0 02 135	Antenna elevation	
		(Basic information (system/site header) on wind profiler/RASS)	
3 21 021	0 02 003	Type of measuring equipment used	
	0 02 101	Type of antenna	
	2 01 130	Change data width	8 bits long
	0 02 106	3-dB beamwidth	
	2 01 000	Change data width	Cancel
	2 01 132	Change data width	11 bits long
	2 02 130	Change scale	Scale: –6
	0 02 121	Mean frequency	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	2 01 133	Change data width	11 bits long
	2 02 129	Change scale	Scale: 0
	0 25 001	Range-gate length	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel

(continued)

(Category 21 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Wind profiler: processed-data winds)	
3 21 022	0 07 007	Height	
	2 04 001	Add associated field	1 bit long
	0 31 021	Associated field significance	
	0 11 001	Wind direction	
	2 04 000	Add associated field	Cancel
	0 11 002	Wind speed	
	2 04 001	Add associated field	1 bit long
	0 31 021	Associated field significance	
	0 11 006	w-component	
	2 04 000	Add associated field	Cancel
	0 21 030	Signal to noise ratio	
		(Wind profiler: raw-data winds)	
3 21 023	0 07 007	Height	
	0 21 091	Radar signal Doppler spectrum 0th moment	
	0 21 030	Signal to noise ratio	
	2 02 129	Change scale	Scale: 2
	0 21 014	Doppler mean velocity (radial)	
	2 01 129	Change data width	9 bits long
	0 21 017	Doppler velocity spectral width	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
		(RASS-mode: processed-data RASS)	
3 21 024	0 07 007	Height	
	2 04 001	Add associated field	1 bit long
	0 31 021	Associated field significance	
	0 12 007	Virtual temperature	
	0 11 006	w-component	
	2 04 000	Add associated field	Cancel
	0 21 030	Signal to noise ratio	
		(RASS-mode: raw-data RASS)	
3 21 025	0 07 007	Height	
	0 21 091	Radar signal Doppler spectrum 0th moment	
	0 21 030	Signal to noise ratio	
	2 02 129	Change scale	Scale: 2
	0 21 014	Doppler mean velocity (radial)	
	2 01 129	Change data width	9 bits long
	0 21 017	Doppler velocity spectral width	
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel
	0 21 092	RASS signal Doppler spectrum 0th moment, referring to RASS signal	
	0 21 030	Signal to noise ratio	Referring to RASS signal
	0 25 092	Acoustic propagation velocity	
	2 01 129	Change data width	9 bits long
	2 02 129	Change scale	Scale: 2
	0 21 017	Doppler velocity spectral width	Referring to RASS signal
	2 02 000	Change scale	Cancel
	2 01 000	Change data width	Cancel

(continued)

(Category 21 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(RASS data – fluxes)	
3 21 026	0 07 007	Height	
	2 04 001	Add associated field	1 bit long
	0 31 021	Associated field significance	
	0 12 007	Virtual temperature	
	0 25 091	Structure constant of the refraction index (C_n^2)	
	0 11 071	Turbulent vertical momentum flux	
	0 11 072	Turbulent vertical buoyancy flux	
	0 11 073	Turbulent kinetic energy	
	0 11 074	Dissipation energy	
	2 04 000	Add associated field	Cancel
		(Radar specification, normalized radar cross-section, Kp variance coefficient)	
3 21 027	0 21 118	Attenuation correction on sigma-0	
	2 02 129	Change scale	
	2 01 132	Change data width	
	0 02 112	Radar look angle	
	2 01 000	Change data width	Cancel
	2 01 131	Change data width	
	0 02 111	Radar incidence angle	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	0 02 104	Antenna polarization	
	0 21 105	Normalized radar cross-section	
	0 21 106	Kp variance coefficient (alpha)	
	0 21 107	Kp variance coefficient (beta)	
	0 21 114	Kp variance coefficient (gamma)	
	0 21 115	SEAWINDS sigma-0 quality	
	0 21 116	SEAWINDS sigma-0 mode	
	0 08 018	SEAWINDS land/ice surface type	
	0 21 117	Sigma-0 variance quality control	
		(Radar specification, SEAWINDS normalized radar cross-section, Kp variance coefficient)	
3 21 028	0 21 118	Attenuation correction on sigma-0	
	2 02 129	Change scale	
	2 01 132	Change data width	
	0 02 112	Radar look angle	
	2 01 000	Change data width	Cancel
	2 01 131	Change data width	
	0 02 111	Radar incidence angle	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	0 02 104	Antenna polarization	
	0 21 123	SEAWINDS normalized radar cross-section	
	0 21 106	Kp variance coefficient (alpha)	
	0 21 107	Kp variance coefficient (beta)	
	0 21 114	Kp variance coefficient (gamma)	
	0 21 115	SEAWINDS sigma-0 quality	
	0 21 116	SEAWINDS sigma-0 mode	
	0 08 018	SEAWINDS land/ice surface type	
	0 21 117	Sigma-0 variance quality control	

(continued)

(Category 21 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(ASCAT sigma-0 information)	
3 21 030	0 08 085	Beam identifier	
	2 02 129	Change scale	Increase scale by 10^1
	2 01 131	Change data width	Increase width by 3 bits
	0 02 111	Radar incidence angle	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	0 02 134	Antenna beam azimuth	
	0 21 062	Backscatter	
	0 21 063	Radiometric resolution (noise value)	
	0 21 158	ASCAT Kp estimate quality	
	0 21 159	ASCAT sigma-0 usability	
	0 21 160	ASCAT use of synthetic data	
	0 21 161	ASCAT synthetic data quantity	
	0 21 162	ASCAT satellite orbit and attitude quality	
	0 21 163	ASCAT solar array reflection contamination	
	0 21 164	ASCAT telemetry presence and quality	
	0 21 165	ASCAT extrapolated reference function presence	
	0 21 166	Land fraction	

Category 22 – Chemical and aerosol sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(METOP GOME-2)	
3 22 028	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 27 001	Latitude (high accuracy)	
	0 28 001	Longitude (high accuracy)	
	0 27 001	Latitude (high accuracy)	
	0 28 001	Longitude (high accuracy)	
	0 27 001	Latitude (high accuracy)	
	0 28 001	Longitude (high accuracy)	
	0 27 001	Latitude (high accuracy)	
	0 28 001	Longitude (high accuracy)	
	0 10 001	Height of land surface	
	0 14 019	Surface albedo	
	0 07 025	Solar zenith angle	
	0 10 080	Viewing zenith angle	
	0 05 023	Sun to satellite azimuth difference	
	0 20 010	Cloud cover (total)	
	0 08 003	Vertical significance (satellite observations)	
	0 07 004	Pressure	
	0 14 026	Albedo at the top of clouds	
	0 20 014	Height of top of cloud	
	0 13 093	Cloud optical thickness	
	1 05 000	Delayed replication of 5 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 004	Pressure	
	0 07 004	Pressure	
	0 08 043	Atmospheric chemical or physical constituent type	
	0 08 044	CAS registry number	
	0 15 021	Integrated mass density	

Category 40 – Additional satellite report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(IASI Level 1c data)	
3 40 001	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	2 02 131	Change scale	Add 3 to scale
	2 01 138	Change data width	Add 10 to width
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 05 043	Field of view number	
	0 05 040	Orbit number	
	2 01 133	Change data width	Add 5 to width
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel
	2 01 132	Change data width	Add 4 to width
	0 25 070	Major frame count	
	2 01 000	Change data width	Cancel
	2 02 126	Change scale	Subtract 2 from scale
	0 07 001	Height of station	
	2 02 000	Change scale	Cancel
	0 33 060	GqisFlagQual – individual IASI-System quality flag	
	0 33 061	GqisQualIndex – indicator for instrument noise performance (contributions from spectral and radiometric calibration)	
	0 33 062	GqisQualIndexLoc – indicator for geometric quality index	
	0 33 063	GqisQualIndexRad – indicator for instrument noise performance (contributions from radiometric calibration)	
	0 33 064	GqisQualIndexSpect – indicator for instrument noise performance (contributions from spectral calibration)	
	0 33 065	GqisSysTecSondQual – output of system TEC (Technical Expertise Centre) quality function	
	1 01 010	Replicate 1 descriptor 10 times	
	3 40 002	IASI Level 1c band description	
	1 01 087	Replicate 1 descriptor 87 times	
	3 40 003	IASI Level 1c 100 channels	
	0 02 019	Satellite instruments	
	0 25 051	AVHRR channel combination	
	1 01 007	Replicate 1 descriptor 7 times	
	3 40 004	IASI Level 1c AVHRR single scene	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(IASI Level 1c band description)	
3 40 002	0 25 140	Start channel	
	0 25 141	End channel	
	0 25 142	Channel scale factor	
		(IASI Level 1c 100 channels)	
3 40 003	1 04 100	Replicate 4 descriptors 100 times	
	2 01 136	Change data width	Add 8 to width
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel
	0 14 046	Scaled IASI radiance	
		(IASI Level 1c AVHRR single scene)	
3 40 004	0 05 060	Y angular position from centre of gravity	
	0 05 061	Z angular position from centre of gravity	
	0 25 085	Fraction of clear pixels in HIRS FOV	
	1 05 006	Replicate 5 descriptors 6 times	
	0 05 042	Channel number	
	0 25 142	Channel scale factor	
	0 14 047	Scaled mean AVHRR radiance	
	0 25 142	Channel scale factor	
	0 14 048	Scaled standard deviation AVHRR radiance	
		(JASON2 OGDR data)	
3 40 005	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 044	Satellite cycle number	
	0 05 040	Orbit number	
	0 01 030	Numerical model identifier	
		Datation	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 007	Seconds within a minute (microsecond accuracy)	
		Location and surface type	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 08 029	Surface type	
	0 08 074	Altimeter echo type	
	0 08 077	Radiometer sensed surface type	
		Flags	
	0 40 011	Interpolation flag	
	0 25 097	Three-dimensional error estimate of the navigator orbit	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 005 *(continued)*	0 25 095	Altimeter state flag	
	0 25 098	Altimeter data quality flag	
	0 25 099	Altimeter correction quality flag	
	0 21 144	Altimeter rain flag	
	0 25 096	Radiometer state flag	
	0 40 012	Radiometer data quality flag	
	0 40 013	Radiometer brightness temperature interpretation flag	
	0 21 169	Ice presence indicator	
		Altimeter: Ku band	
	0 22 151	Ku band ocean range	
	0 22 162	RMS of 20 Hz Ku band ocean range	
	0 22 163	Number of 20 Hz valid points for Ku band	
	0 25 160	Ku band net instrumental correction	
	0 25 133	Sea state bias correction on Ku band	
	0 22 156	Ku band significant wave height	
	0 22 164	RMS 20 Hz Ku band significant wave height	
	0 22 165	Number of 20 Hz valid points for Ku band significant wave height	
	0 22 166	Ku band net instrumental correction for significant wave height	
	0 21 137	Ku band corrected ocean backscatter coefficient	
	0 21 138	STD Ku band corrected ocean backscatter coefficient	
	0 22 167	Number of valid points for Ku band backscatter	
	0 21 139	Ku band net instrumental correction for AGC	
	0 21 118	Attenuation correction on sigma-0	
	0 21 145	Ku band automatic gain control	
	0 21 146	RMS Ku band automatic gain control	
	0 21 147	Number of valid points for Ku band automatic gain control	
		Altimeter: C band	
	0 22 168	C band ocean range	
	0 22 169	RMS of C band ocean range	
	0 22 170	Number of 20 Hz valid points for C band	
	0 25 161	C band net instrumental correction	
	0 25 162	Sea state bias correction on C band	
	0 22 171	C band significant wave height	
	0 22 172	RMS 20 Hz C band significant wave height	
	0 22 173	Number of 20 Hz valid points for C band significant wave height	
	0 22 174	C band net instrumental correction for significant wave height	
	0 21 170	C band corrected ocean backscatter coefficient	
	0 21 171	RMS C band corrected ocean backscatter coefficient	
	0 22 175	Number of valid points for C band backscatter	
	0 21 172	C band net instrumental correction for AGC	
	0 21 118	Attenuation correction on sigma-0	
	0 21 173	C band automatic gain control	
	0 21 174	RMS C band automatic gain control	
	0 21 175	Number of valid points for C band automatic gain control	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 005 *(continued)*		*Radiometer*	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 13 090	Radiometer water vapour content	
	0 13 091	Radiometer liquid content	
		Wind	
	0 07 002	Height or altitude	
	0 11 097	Wind speed from altimeter	
	0 11 098	Wind speed from radiometer	
	0 07 002	Height or altitude	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
		Dynamic topography	
	0 10 096	Mean dynamic topography	
	0 10 081	Altitude of COG above reference ellipsoid	
	0 10 082	Instantaneous altitude rate	
	0 10 083	Squared off nadir angle of the satellite from platform data	
	0 10 101	Squared off nadir angle of the satellite from waveform data	
	0 25 132	Ionospheric correction from model on Ku band	
	0 25 163	Altimeter ionospheric correction on Ku band	
	0 25 126	Model dry tropospheric correction	
	0 25 128	Model wet tropospheric correction	
	0 25 164	Radiometer wet tropospheric correction	
	0 10 085	Mean sea-surface height	
	0 10 097	Mean sea-surface height from altimeter only	
	0 10 086	Geoid's height	
	0 10 087	Ocean depth/land elevation	
	0 10 092	Solid Earth tide height	
	0 10 088	Total geocentric ocean tide height (solution 1)	
	0 10 089	Total geocentric ocean tide height (solution 2)	
	0 10 098	Loading tide height geocentric ocean tide solution 1	
	0 10 099	Loading tide height geocentric ocean tide solution 2	
	0 10 090	Long period tide height	
	0 10 100	Non-equilibrium long period tide height	
	0 10 093	Geocentric pole tide height	
	0 25 127	Inverted barometer correction	Sea-surface height correction due to pressure loading
	0 40 014	High-frequency fluctuations of the sea-surface topography correction	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(IASI Level 1c data (all channels))	
3 40 007	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	2 02 131	Change scale	Add 3 to scale
	2 01 138	Change data width	Add 10 to width
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 05 043	Field of view number	
	0 05 040	Orbit number	
	2 01 133	Change data width	Add 5 to width
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel
	2 01 132	Change data width	Add 4 to width
	0 25 070	Major frame count	
	2 01 000	Change data width	Cancel
	2 02 126	Change scale	Subtract 2 from scale
	0 07 001	Height of station	
	2 02 000	Change scale	Cancel
	1 03 003	Replicate 3 descriptors 3 times	
	0 25 140	Start channel	
	0 25 141	End channel	
	0 33 060	GqisFlagQual – individual IASI-System quality flag	
	0 33 061	GqisQualIndex – indicator for instrument noise performance (contributions from spectral and radiometric calibration)	
	0 33 062	GqisQualIndexLoc – indicator for geometric quality index	
	0 33 063	GqisQualIndexRad – indicator for instrument noise performance (contributions from radiometric calibration)	
	0 33 064	GqisQualIndexSpect – indicator for instrument noise performance (contributions from spectral calibration)	
	0 33 065	GqisSysTecSondQual – output of system TEC (Technical Expertise Centre) quality function	
	0 40 020	GqisFlagQualDetailed – quality flag for the system	
	1 01 010	Replicate 1 descriptor 10 times	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 007	3 40 002	IASI Level 1c band description	
(continued)	1 01 087	Replicate 1 descriptor 87 times	
	3 40 003	IASI Level 1c 100 channels	
	0 02 019	Satellite instruments	
	0 25 051	AVHRR channel combination	
	1 01 007	Replicate 1 descriptor 7 times	
	3 40 004	IASI Level 1c AVHRR single scene	
	0 20 081	Cloud amount in segment	
	0 08 029	Surface type	
	0 20 083	Amount of segment covered by scene	
	0 08 029	Surface type	
	0 40 018	GIacAvgImagIIS – average of imager measurements	
	0 40 019	GIacVarImagIIS – variance of imager measurements	
	0 40 021	Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice	
	0 40 022	Number of missing, bad or failed AVHRR pixels	
		(IASI sequence combining PC scores, channel selection and enhanced data)	
		Satellite processing information	
3 40 008	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
		Date and time	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	2 02 131	Change scale	Add 3 to scale
	2 01 138	Change data width	Add 10 to width
	0 04 006	Second	
	2 01 000	Change data width	Cancel
	2 02 000	Change scale	Cancel
		Location information	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
	0 05 043	Field of view number	
	0 05 040	Orbit number	
	2 01 133	Change data width	Add 5 to width
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel
	2 01 132	Change data width	Add 4 to width
	0 25 070	Major frame count	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 008 *(continued)*	2 01 000	Change data width	Cancel
	2 02 126	Change scale	Subtract 2 from scale
	0 07 001	Height of station	
	2 02 000	Change scale	Cancel
		Quality information	
	1 03 003	Replicate 3 descriptors 3 times	
	0 25 140	Start channel	
	0 25 141	End channel	
	0 33 060	GqisFlagQual – individual IASI-System quality flag	
	0 33 061	GqisQualIndex – indicator for instrument noise performance (contributions from spectral and radiometric calibration)	
	0 33 062	GqisQualIndexLoc – indicator for geometric quality index	
	0 33 063	GqisQualIndexRad – indicator for instrument noise performance (contributions from radiometric calibration)	
	0 33 064	GqisQualIndexSpect – indicator for instrument noise performance (contributions from spectral calibration)	
	0 33 065	GqisSysTecSondQual – output of system TEC (Technical Expertise Centre) quality function	
	0 40 020	GqisFlagQualDetailed – quality flag for the system	
		IASI subset of channels	
	1 01 010	Replicate 1 descriptor 10 times	
	3 40 002	IASI Level 1c band description	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 002	Extended delayed descriptor replication factor	
	2 01 136	Change data width	Add 8 to width
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel
	0 14 046	Scaled IASI radiance	
		Instrument band definition	
	1 08 003	Replicate 8 descriptors 3 times	
	0 25 140	Start channel	
	0 25 141	End channel	
	0 40 026	Score quantization factor	
	0 40 016	Residual RMS in band	
	0 25 062	Database identification	
		Principal component scores for band	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	0 40 017	Non-normalized principal component score	
		AVHRR scene analysis	
	0 02 019	Satellite instruments	
	0 25 051	AVHRR channel combination	
	1 01 007	Replicate 1 descriptor 7 times	
	3 40 004	IASI Level 1c AVHRR single scene	
	0 20 081	Cloud amount in segment	
	0 08 029	Surface type	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 008	0 20 083	Amount of segment covered by scene	
(continued)	0 08 029	Surface type	
	0 40 018	GlacAvgImagIIS – average of imager measurements	
	0 40 019	GlacVarImagIIS – variance of imager measurements	
	0 40 021	Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice	
	0 40 022	Number of missing, bad or failed AVHRR pixels	
		(Normalized differential vegetation index (NDVI))	
3 40 009	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
	3 01 011	Year, month, day	
	3 01 013	Hour, minute, second	
	0 05 040	Orbit number	
	2 01 136	Change data width	Add 8 to width
	0 05 041	Scan line number	
	2 01 000	Change data width	Cancel
	0 25 071	Frame count	
	0 05 001	Latitude (high accuracy)	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	1 07 064	Replicate 7 descriptors 64 times	
	1 06 032	Replicate 6 descriptors 32 times	
	0 08 012	Land/sea qualifier	
	0 08 013	Day/night qualifier	
	0 08 065	Sun-glint indicator	
	0 08 072	Pixel(s) type	
	0 13 039	Terrain type (ice/snow)	
	0 40 015	Normalized differential vegetation index (NDVI)	
		(JASON-2 OGDR data)	
		Satellite	
3 40 010	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 096	Station acquisition	
	0 25 061	Software identification and version number	
	0 05 044	Satellite cycle number	
	0 05 040	Orbit number	
	0 01 030	Numerical model identifier	
		Datation	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	
	0 04 004	Hour	
	0 04 005	Minute	
	0 04 007	Seconds within a minute (microsecond accuracy)	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 010		*Location and surface type*	
(continued)	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 08 029	Surface type	
	0 08 074	Altimeter echo type	
	0 08 077	Radiometer sensed surface type	
		Flags	
	0 40 011	Interpolation flag	
	0 25 097	Three-dimensional error estimate of the navigator orbit	
	0 25 095	Altimeter state flag	
	0 25 098	Altimeter data quality flag	
	0 25 099	Altimeter correction quality flag	
	0 21 144	Altimeter rain flag	
	0 25 096	Radiometer state flag	
	0 40 012	Radiometer data quality flag	
	0 40 013	Radiometer brightness temperature interpretation flag	
	0 21 169	Ice presence indicator	
	0 40 023	Auxiliary altimeter state flags	
	0 40 024	Meteorological map availability	
	0 40 025	Interpolation flag for mean diurnal tide	
		Altimeter: Ku band	
	0 22 151	Ku band ocean range	
	0 22 162	RMS of 20 Hz Ku band ocean range	
	0 22 163	Number of 20 Hz valid points for Ku band	
	0 25 160	Ku band net instrumental correction	
	0 25 133	Sea state bias correction on Ku band	
	0 22 156	Ku band significant wave height	
	0 22 164	RMS 20 Hz Ku band significant wave height	
	0 22 165	Number of 20 Hz valid points for Ku band significant wave height	
	0 22 166	Ku band net instrumental correction for significant wave height	
	0 21 137	Ku band corrected ocean backscatter coefficient	
	0 21 138	STD Ku band corrected ocean backscatter coefficient	
	0 22 167	Number of valid points for Ku band backscatter	
	0 21 139	Ku band net instrumental correction for AGC	
	0 21 118	Attenuation correction on sigma-0	
	0 21 145	Ku band automatic gain control	
	0 21 146	RMS Ku band automatic gain control	
	0 21 147	Number of valid points for Ku band automatic gain control	
		Altimeter: C band	
	0 22 168	C band ocean range	
	0 22 169	RMS of C band ocean range	
	0 22 170	Number of 20 Hz valid points for C band	
	0 25 161	C band net instrumental correction	
	0 25 162	Sea state bias correction on C band	
	0 22 171	C band significant wave height	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 010 *(continued)*	0 22 172	RMS 20 Hz C band significant wave height	
	0 22 173	Number of 20 Hz valid points for C band significant wave height	
	0 22 174	C band net instrumental correction for significant wave height	
	0 21 170	C band corrected ocean backscatter coefficient	
	0 21 171	RMS C band corrected ocean backscatter coefficient	
	0 22 175	Number of valid points for C band backscatter	
	0 21 172	C band net instrumental correction for AGC	
	0 21 118	Attenuation correction on sigma-0	
	0 21 173	C band automatic gain control	
	0 21 174	RMS C band automatic gain control	
	0 21 175	Number of valid points for C band automatic gain control	
		Radiometer	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 02 153	Satellite channel centre frequency	
	0 12 063	Brightness temperature	
	0 13 090	Radiometer water vapour content	
	0 13 091	Radiometer liquid content	
		Wind	
	0 07 002	Height or altitude	
	0 11 097	Wind speed from altimeter	
	0 11 098	Wind speed from radiometer	
	0 07 002	Height or altitude	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
		Dynamic topography	
	0 10 096	Mean dynamic topography	
	0 10 081	Altitude of COG above reference ellipsoid	
	0 10 082	Instantaneous altitude rate	
	0 10 083	Squared off nadir angle of the satellite from platform data	
	0 10 101	Squared off nadir angle of the satellite from waveform data	
	0 25 132	Ionospheric correction from model on Ku band	
	0 25 163	Altimeter ionospheric correction on Ku band	
	0 25 126	Model dry tropospheric correction	
	0 25 128	Model wet tropospheric correction	
	0 25 164	Radiometer wet tropospheric correction	
	0 10 085	Mean sea-surface height	
	0 10 097	Mean sea-surface height from altimeter only	
	0 10 086	Geoid’s height	
	0 10 087	Ocean depth/land elevation	
	0 10 092	Solid Earth tide height	
	0 10 088	Total geocentric ocean tide height (solution 1)	

(continued)

(Category 40 – continued)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 010 *(continued)*	0 10 089	Total geocentric ocean tide height (solution 2)	
	0 10 098	Loading tide height geocentric ocean tide solution 1	
	0 10 099	Loading tide height geocentric ocean tide solution 2	
	0 10 090	Long period tide height	
	0 10 100	Non-equilibrium long period tide height	
	0 10 093	Geocentric pole tide height	
	0 25 127	Inverted barometer correction	Sea-surface height correction due to pressure loading
	0 40 014	High-frequency fluctuations of the sea-surface topography correction	
	0 10 102	Sea-surface height anomaly	

Notes: Descriptor 3 40 010 should be used in preference to 3 40 005.

CODE TABLES AND FLAG TABLES ASSOCIATED WITH BUFR/CREX TABLE B

Note: In developing code tables associated with BUFR/CREX Table B to specify units of elements, the following principles should be applied:

(a) Code tables specifying the units for an element which is defined, in the *Manual on Codes*, by a single symbolic letter shall be compatible with the relevant existing WMO code tables;

(b) Code tables combining two or more existing WMO code tables to specify the units for an element which is defined, in the *Manual on Codes*, by a group of symbolic letters shall be compatible with the combined code figures of the relevant group of symbolic letters;

(c) Code tables combining two or more existing WMO code tables to specify the units for an element which is defined, in the *Manual on Codes*, by different symbolic letters shall be compatible with the code figures of the relevant symbolic letters, with successive tens or hundreds values added, as appropriate;

(d) Code tables and flag tables should only be used for reporting qualitative information. Quantitative information should be reported as observed using entries in Table B. “Data description operators” from Table C should be applied when a “scale change” or “data width change” is required;

(e) Reference to existing specification(s) and code table(s) in the *Manual on Codes*, with explanation of possible deviations, shall be given in an additional table annexed to the code tables associated with BUFR/CREX Table B.

0 01 003

WMO Region number/geographical area

Code figure	
0	Antarctica
1	Region I
2	Region II
3	Region III
4	Region IV
5	Region V
6	Region VI
7	Missing value

0 01 007

Satellite identifier

(See common Code table C–5 Part C/c.)

0 01 024

Wind speed source

Code figure	
0	No wind speed data available
1	AMSR-E data
2	TMI data
3	NWP: ECMWF
4	NWP: UK Met Office
5	NWP: NCEP
6	Reference climatology
7	ERS_Scatterometer
8–30	Reserved for future use
31	Missing value

0 01 028

Aerosol optical depth (AOD) source

Code figure	
0	No AOD data available
1	NESDIS
2	NAVOCEANO
3	NAAPS
4	MERIS
5	AATSR
6–30	Reserved for future use
31	Missing value

0 01 029

SSI* source

Code figure	
0	No SSI data available
1	MSG_SEVIRI
2	GOES East
3	GOES West
4	ECMWF
5	NCEP
6	UK Met Office
7–30	Reserved for future use
31	Missing value

* Surface solar irradiance

0 01 031

Identification of originating/generating centre

(See common Code table C–1 in Part C/c.)

0 01 033

Identification of originating/generating centre

(See common Code table C–1 in Part C/c.)

0 01 034

Identification of originating/generating sub-centre

*(To be defined by centres themselves –
See common Code table C–12 in Part C/c.)*

0 01 036

Agency in charge of operating the observing platform

(The first three digits represent the ISO country code)

Code figure	
0–36000	Reserved
36001	Australia, Bureau of Meteorology (BoM)
36002	Australia, Joint Australian Facility for Ocean Observing Systems (JAFOOS)
36003	Australia, the Commonwealth Scientific and Industrial Research Organization (CSIRO)
36004–124000	Reserved
124001	Canada, Marine Environmental Data Service (MEDS)
124002	Canada, Institute of Ocean Sciences (IOS)
124003–156000	Reserved

(continued)

(Code table 0 01 036 – continued)

Code figure	
156001	China, The State Oceanic Administration
156002	China, Second Institute of Oceanography, State Oceanic Administration
156003	China, Institute of Ocean Technology
156004–250000	Reserved
250001	France, Institut de Recherche pour le Développement (IRD)
250002	France, Institut Français de Recherche pour l'Exploitation de la mer (IFREMER)
250003–276000	Reserved
276001	Germany, Bundesamt fuer Seeschiffahrt und Hydrographie (BSH)
276002	Germany, Institut fuer Meereskunde, Kiel
276003–356000	Reserved
356001	India, National Institute of Oceanography (NIO)
356002	India, National Institute for Ocean Technology (NIOT)
356003	India, National Centre for Ocean Information Service
356004–392000	Reserved
392001	Japan, Japan Meteorological Agency (JMA)
392002	Japan, Frontier Observational Research System for Global Change
392003	Japan, Japan Marine Science and Technology Centre (JAMSTEC)
392004–410000	Reserved
410001	Republic of Korea, Seoul National University
410002	Republic of Korea, Korea Ocean Research and Development Institute (KORDI)
410003	Republic of Korea, Meteorological Research Institute
410004–540000	Reserved
540001	New Caledonia, Institut de Recherche pour le Développement (IRD)
540002–554000	Reserved
554001	New Zealand, National Institute of Water and Atmospheric Research (NIWA)
554002–643000	Reserved
643001	Russian Federation, State Oceanographic Institute of Roshydromet
643002	Russian Federation, Federal Service for Hydrometeorology and Environmental Monitoring
643003–724000	Reserved
724001	Spain, Instituto Español de Oceanografia
724002–826000	Reserved
826001	United Kingdom, Hydrographic Office
826002	United Kingdom, Southampton Oceanography Centre (SOC)
826003–840000	Reserved
840001	USA, NOAA Atlantic Oceanographic and Meteorological Laboratories (AOML)
840002	USA, NOAA Pacific Marine Environmental Laboratories (PMEL)
840003	USA, Scripps Institution of Oceanography (SIO)
840004	USA, Woods Hole Oceanographic Institution (WHOI)
840005	USA, University of Washington
840006	USA, Naval Oceanographic Office
840007–1048574	Reserved
1048575	Missing value

0 01 038

Source of sea ice fraction

Code figure	
0	No sea ice set
1	NSIDC SSM/I Cavalieri et al (1992)
2	AMSR-E
3	ECMWF
4	CMS (France) cloud mask used by Medspiration
5	EUMETSAT OSI-SAF
6–30	Reserved for future use
31	Missing value

0 01 052

Platform transmitter ID

Code figure	
0	Primary
1	Secondary
2	Reserved
3	Missing value

0 01 090

Technique for making up initial perturbations

Code figure	
0	Lagged-average forecasting (LAF)
1	Breeding
2	Singular vectors
3	Multiple analysis cycles
4–191	Reserved
192–254	Reserved for local use
255	Missing value

0 01 092

Type of ensemble forecast

Code figure	
0	Unperturbed high-resolution control forecast
1	Unperturbed low-resolution control forecast
2	Negatively perturbed forecast
3	Positively perturbed forecast
4–191	Reserved
192–254	Reserved for local use
255	Missing value

0 01 101

State identifier

Code figure	
0–99	Reserved
100	Algeria
101	Angola
102	Benin
103	Botswana
104	Burkina Faso
105	Burundi
106	Cameroon
107	Cabo Verde
108	Central African Republic
109	Chad
110	Comoros
111	Congo
112	Côte d'Ivoire
113	Democratic Republic of the Congo
114	Djibouti
115	Egypt
116	Eritrea
117	Ethiopia
118	France (RA I)
119	Gabon
120	Gambia
121	Ghana
122	Guinea
123	Guinea-Bissau
124	Kenya
125	Lesotho
126	Liberia
127	Libya
128	Madagascar
129	Malawi
130	Mali
131	Mauritania
132	Mauritius
133	Morocco
134	Mozambique
135	Namibia
136	Niger
137	Nigeria
138	Portugal (RA I)
139	Rwanda
140	Sao Tome and Principe

(continued)

(Code table 0 01 101 – continued)

Code figure	
141	Senegal
142	Seychelles
143	Sierra Leone
144	Somalia
145	South Africa
146	Spain (RA I)
147	Sudan
148	Swaziland
149	Togo
150	Tunisia
151	Uganda
152	United Kingdom of Great Britain and Northern Ireland (RA I)
153	United Republic of Tanzania
154	Zambia
155	Zimbabwe
156–199	Reserved for Region I (Africa)
200	Afghanistan
201	Bahrain
202	Bangladesh
203	Bhutan
204	Cambodia
205	China
206	Democratic People's Republic of Korea
207	Hong Kong, China
208	India
209	Iran, Islamic Republic of
210	Iraq
211	Japan
212	Kazakhstan
213	Kuwait
214	Kyrgyzstan
215	Lao People's Democratic Republic
216	Macao, China
217	Maldives
218	Mongolia
219	Myanmar
220	Nepal
221	Oman
222	Pakistan
223	Qatar
224	Republic of Korea
225	Yemen
226	Russian Federation (RA II)
227	Saudi Arabia
228	Sri Lanka

(continued)

(Code table 0 01 101 – continued)

Code figure	
229	Tajikistan
230	Thailand
231	Turkmenistan
232	United Arab Emirates
233	Uzbekistan
234	Viet Nam
235–299	Reserved for Region II (Asia)
300	Argentina
301	Bolivia (Plurinational State of)
302	Brazil
303	Chile
304	Colombia
305	Ecuador
306	France (RA III)
307	Guyana
308	Paraguay
309	Peru
310	Suriname
311	Uruguay
312	Venezuela (Bolivarian Republic of)
313–399	Reserved for Region III (South America)
400	Antigua and Barbuda
401	Bahamas
402	Barbados
403	Belize
404	British Caribbean Territories
405	Canada
406	Colombia
407	Costa Rica
408	Cuba
409	Dominica
410	Dominican Republic
411	El Salvador
412	France (RA IV)
413	Guatemala
414	Haiti
415	Honduras
416	Jamaica
417	Mexico
418	Curaçao and Sint Maarten
419	Nicaragua
420	Panama
421	Saint Lucia
422	Trinidad and Tobago

(continued)

(Code table 0 01 101 – continued)

Code figure	
423	United Kingdom of Great Britain and Northern Ireland (RA IV)
424	United States of America (RA IV)
425	Venezuela (Bolivarian Republic of)
426–499	Reserved for Region IV (North America, Central America and the Caribbean)
500	Australia
501	Brunei Darussalam
502	Cook Islands
503	Fiji
504	French Polynesia
505	Indonesia
506	Kiribati
507	Malaysia
508	Micronesia, Federated States of
509	New Caledonia
510	New Zealand
511	Niue
512	Papua New Guinea
513	Philippines
514	Samoa
515	Singapore
516	Solomon Islands
517	Tonga
518	United Kingdom of Great Britain and Northern Ireland (RA V)
519	United States of America (RA V)
520	Vanuatu
521–599	Reserved for Region V (South-West Pacific)
600	Albania
601	Armenia
602	Austria
603	Azerbaijan
604	Belarus
605	Belgium
606	Bosnia and Herzegovina
607	Bulgaria
608	Croatia
609	Cyprus
610	Czech Republic
611	Denmark
612	Estonia
613	Finland
614	France (RA VI)
615	Georgia
616	Germany
617	Greece

(continued)

(Code table 0 01 101 – continued)

Code figure	
618	Hungary
619	Iceland
620	Ireland
621	Israel
622	Italy
623	Jordan
624	Kazakhstan
625	Latvia
626	Lebanon
627	Lithuania
628	Luxembourg
629	Malta
630	Monaco
631	Montenegro
632	Netherlands
633	Norway
634	Poland
635	Portugal (RA VI)
636	Republic of Moldova
637	Romania
638	Russian Federation (RA VI)
639	Serbia
640	Slovakia
641	Slovenia
642	Spain (RA VI)
643	Sweden
644	Switzerland
645	Syrian Arab Republic
646	The former Yugoslav Republic of Macedonia
647	Turkey
648	Ukraine
649	United Kingdom of Great Britain and Northern Ireland (RA VI)
650–699	Reserved for Region VI (Europe)
700–999	Reserved
1000–1022	Not used
1023	Missing value

0 02 001

Type of station

Code figure	
0	Automatic
1	Manned
2	Hybrid: both manned and automatic
3	Missing value

0 02 002

Type of instrumentation for wind measurement

Bit No.	Type of Instrumentation and original units for wind measurement (measured in m s^{-1} unless otherwise indicated)
1	Certified instruments
2	Originally measured in knots
3	Originally measured in km h^{-1}
All 4	Missing value

0 02 003

Type of measuring equipment used

Code figure	
0	Pressure instrument associated with wind measuring equipment
1	Optical theodolite
2	Radio theodolite
3	Radar
4	VLF-Omega
5	Loran C
6	Wind profiler
7	Satellite navigation
8	Radio-acoustic Sounding System (RASS)
9	Sodar
10–13	Reserved
14	Pressure instrument associated with wind measuring equipment but pressure element failed during ascent
15	Missing value

0 02 004

Type of instrumentation for evaporation measurement or type of crop for which evapotranspiration is reported

Code figure	Instrumentation or crop type	Type of data
0	USA open pan evaporimeter (without cover)	Evaporation
1	USA open pan evaporimeter (mesh covered)	
2	GGI-3000 evaporimeter (sunken)	
3	20 m^2 tank	
4	Others	
5	Rice	Evapotranspiration
6	Wheat	
7	Maize	
8	Sorghum	
9	Other crops	
10–14	Reserved	
15	Missing value	

0 02 011

Radiosonde type

(See common Code table C–2 in Part C/c.)

0 02 012

Radiosonde computational method

(To be developed)

0 02 013

Solar and infrared radiation correction

Code figure	
0	No correction
1	CIMO solar corrected and CIMO infrared corrected
2	CIMO solar corrected and infrared corrected
3	CIMO solar corrected only
4	Solar and infrared corrected automatically by radiosonde system
5	Solar corrected automatically by radiosonde system
6	Solar and infrared corrected as specified by country
7	Solar corrected as specified by country
8–14	Reserved
15	Missing value

0 02 014

Tracking technique/status of system used

(See common Code table C–7 in Part C/c.)

0 02 015

Radiosonde completeness

Code figure	
0	Reserved
1	Pressure only radiosonde
2	Pressure only radiosonde plus transponder
3	Pressure only radiosonde plus radar reflector
4	No-pressure radiosonde plus transponder
5	No-pressure radiosonde plus radar reflector
6–14	Reserved
15	Missing value

0 02 016

Radiosonde configuration

Bit No.	
1	Train regulator
2	Light unit
3	Parachute
4	Rooftop release
All 5	Missing value

0 02 017

Correction algorithms for humidity measurements

Code figure	
0	No corrections
1	Time lag correction provided by the manufacturer
2	Solar radiation correction provided by the manufacturer
3	Solar radiation and time lag correction provided by the manufacturer
4–30	Reserved
31	Missing value

0 02 019

Satellite instruments

(See common Code table C–8 in Part C/c.)

0 02 020

Satellite classification

Code figure	
0	Nimbus
1	VTPR
2	Tiros 1 (Tiros, NOAA-6 to NOAA-13)
3	Tiros 2 (NOAA-14 onwards)
10	EOS
31	DMSP
61	EUMETSAT Polar System (EPS)
91	ERS
121	ADEOS
122	GCOM
241	GOES
261	JASON
271	GMS
272	MTSAT
273	Himawari
281	COMS
301	INSAT
331	METEOSAT Operational Programme (MOP)
332	METEOSAT Transitional Programme (MTP)
333	METEOSAT Second Generation Programme (MSG)
351	GOMS
380	FY-1
381	FY-2
382–400	Reserved
401	GPS
402	GLONASS
403	GALILEO
404–510	Reserved
511	Missing value

0 02 021

Satellite instrument data used in processing

Bit No.	
1	High-resolution infrared sounder (HIRS)
2	Microwave sounding unit (MSU)
3	Stratospheric sounding unit (SSU)
4	AMI (advanced microwave instrument) wind mode
5	AMI (advanced microwave instrument) wave mode
6	AMI (advanced microwave instrument) image mode
7	Radar altimeter
8	ATSR (along-track scanning radiometer)
All 9	Missing value

0 02 022

Satellite data-processing technique used

Bit flags denoting the elements included in processing sounding data.

Bit No.	
1	Processing technique not defined
2	Automated statistical regression
3	Clear path
4	Partly cloudy path
5	Cloudy path
6–7	Reserved
All 8	Missing value

Notes:

(1) Clear path means the sounding has been generated from clear radiances derived from actual clear spot measurements. Tropospheric and stratospheric HIRS data, as well as MSU and SSU data, have been used.

(2) Partly cloudy path means the sounding has been generated from clear radiances which have been calculated from partly cloudy spots. Tropospheric and stratospheric HIRS data, as well as MSU and SSU data, have been used.

(3) Cloudy path means the sounding has been generated only from stratospheric HIRS data, MSU data and SSU data. Tropospheric HIRS data have not been used because of cloudy conditions.

0 02 023

Satellite-derived wind computation method

Code figure	
0	Reserved
1	Wind derived from cloud motion observed in the infrared channel
2	Wind derived from cloud motion observed in the visible channel
3	Wind derived from cloud motion observed in the water vapour channel
4	Wind derived from motion observed in a combination of spectral channels
5	Wind derived from motion observed in the water vapour channel in clear air
6	Wind derived from motion observed in the ozone channel
7	Wind derived from motion observed in water vapour channel (cloud or clear air not specified)
8–12	Reserved
13	Root-mean-square
14	Reserved
15	Missing value

0 02 024

Integrated mean humidity computational method

Code figure	
0	Reserved
1	Table with full range of humidity variation in layer
2	Regression technique on 2 humidity values in layer
3–14	Reserved
15	Missing value

0 02 025

Satellite channel(s) used in computation

Bit flags denoting the instrument and/or channels used in obtaining various physical parameters. If, in any grouping of parameters, all bits = 0, then no retrieval was made for that parameter or set of parameters.

Bit No.	Instrument (channels)
1	Reserved
	Group 1 – Layer precipitable water for the layers: surface to 700 hPa, 700 to 500 hPa, and 500 to 300 hPa
2	HIRS
3	MSU
4–5	Reserved
	Group 2 – Tropopause temperature and pressure
6	HIRS
7	MSU
8–9	Reserved
	Group 3 – Total ozone
10	HIRS (1, 2, 3, 8, 9, 16, 17)
11	HIRS (1, 2, 3, 9, 17)
12	MSU
13–14	Reserved
	Group 4 – Mean temperature for the layers: surface to 850 hPa, 850 to 700 hPa, 700 to 500 hPa, 500 to 400 hPa, 400 to 300 hPa, 300 to 200 hPa, and 200 to 100 hPa
15	HIRS
16	HIRS*
17	MSU
18	SKINTK (ocean only)
19–20	Reserved

(continued)

(Flag table 0 02 025 – continued)

Bit No.	Instrument (channels)
	Group 5 – Channel combinations used to obtain mean temperatures for the layers 100 to 70 hPa, 70 to 50 hPa, 50 to 30 hPa, 30 to 10 hPa, 10 to 5 hPa, 5 to 2 hPa, 2 to 1 hPa, 1 to 0.4 hPa
21	HIRS*
22	SSU
23	MSU (3, 4)
24	Reserved
All 25	Missing value

Note: HIRS* is equivalent to: HIRS channels 1 (669 cm^{-1})
2 (679 cm^{-1})
3 (690 cm^{-1})
4 (2358 cm^{-1})

0 02 030

Method of current measurement

Code figure	
0	Reserved
1*	ADCP (Acoustic Doppler Current Profiler)
2	GEK (Geomagnetic ElectroKinetograph)
3	Ship's set and drift determined by fixes 3–6 hours apart
4	Ship's set and drift determined by fixes more than 6 hours but less than 12 hours apart
5	Drift of buoy
6	ADCP (Acoustic Doppler Current Profiler)
7	Missing value

* Value deprecated. Code figure 6 should be used instead.

0 02 031

Duration and time of current measurement

Code figure		
0	Reserved	
1	Instantaneous	between H – 1 and H
2	Averaged over 3 minutes or less	between H – 1 and H
3	Averaged over more than 3 minutes, but 6 at the most	between H – 1 and H
4	Averaged over more than 6 minutes, but 12 at the most	between H – 1 and H
5	Instantaneous	between H – 2 and H – 1
6	Averaged over 3 minutes or less	between H – 2 and H – 1
7	Averaged over more than 3 minutes, but 6 at the most	between H – 2 and H – 1
8	Averaged over more than 6 minutes, but 12 at the most	between H – 2 and H – 1
9	Vector or Doppler current profiling method not used	
10	Reserved	

(continued)

(Code table 0 02 031 – continued)

Code figure	
11	1 hour or less
12	More than 1 hour but 2 at the most
13	More than 2 hours but 4 at the most
14	More than 4 hours but 8 at the most
15	More than 8 hours but 12 at the most
16	More than 12 hours but 18 at the most
17	More than 18 hours but 24 at the most
18	Reserved
19	Drift method not used
20–30	Reserved
31	Missing value

Notes:

(1) Code figures 1–9: Duration and time of current measurement (vector or Doppler current profiling method).

(2) Code figures 11–19: Period of current measurement (drift method).

(3) H = Time of observation.

0 02 032

Indicator for digitization

Code figure	
0	Values at selected depths (data points fixed by the instrument or selected by any other method)
1	Values at selected depths (data points taken from traces at significant depths)
2	Reserved
3	Missing value

0 02 033

Method of salinity/depth measurement

Code figure	
0	No salinity measured
1	In situ sensor, accuracy better than 0.02 ‰
2	In situ sensor, accuracy less than 0.02 ‰
3	Sample analysis
4–6	Reserved
7	Missing value

0 02 034

Drogue type

Code figure	
0	Unspecified drogue
1	Holey sock
2	TRISTAR
3	Window shade
4	Parachute
5	Non-Lagrangian sea anchor
6–30	Reserved (to be developed)
31	Missing value

0 02 036

Buoy type

Code figure	
0	Drifting buoy
1	Fixed buoy
2	Sub-surface float (moving)
3	Missing value

0 02 037

Method of tidal observation

Code figure	
0	Reserved
1	Manual reading from vertical tide staff
2	Manual reading from single automatic recorder at station
3	Manual reading from multiple automatic recorders at station
4	Automatic reading from single automatic recorder at station without level reference check
5	Automatic reading from single automatic recorder at station with level reference check, or from multiple automatic recorders
6	Reserved
7	Missing value

0 02 038

Method of water temperature and/or salinity measurement

Code figure	
0	Ship intake
1	Bucket
2	Hull contact sensor
3	Reversing thermometer
4	STD/CTD sensor
5	Mechanical BT
6	Expendable BT
7	Digital BT
8	Thermistor chain
9	Infrared scanner
10	Microwave scanner
11	Infrared radiometer
12	In-line thermosalinograph
13	Towed body
14	Other
15	Missing value

0 02 039

Method of wet-bulb temperature measurement

Code figure	
0	Measured wet-bulb temperature
1	Iced bulb measured wet-bulb temperature
2	Computed wet-bulb temperature
3	Iced bulb computed wet-bulb temperature
4–6	Reserved
7	Missing value

0 02 040

Method of removing velocity and motion of platform from current

Code figure		
0	Ship's motion removed by averaging	Ship's velocity removed by bottom tracking
1	Ship's motion removed by motion compensation	
2	Ship's motion not removed	
3	Ship's motion removed by averaging	Ship's velocity removed by navigation
4	Ship's motion removed by motion compensation	
5	Ship's motion not removed	
6	Doppler current profiling method not used	
7–14	Reserved	
15	Missing value	

0 02 041

Method for estimating reports related to synoptic features

Code figure	
0	Information based on manual analysis
1	Information based on computer analysis
2	Information based on data assimilation
3	Information based on computer analysis or data assimilation manually modified
4–9	Reserved
10	Information based on the numerical weather prediction
11–62	Reserved for future use
63	Missing value

0 02 042

Indicator for sea-surface current speed

Code figure	
0	Value originally reported in m/s
1	Value originally reported in knots
2	No sea current data available
3	Missing value

0 02 044

Indicator for method of calculating spectral wave data

Code figure	
0	Reserved for future use
1	Longuet-Higgins (1964)
2	Longuet-Higgins (F3 method)
3	Maximum likelihood method
4	Maximum entropy method
5–14	Reserved
15	Missing value

0 02 045

Indicator for type of platform

Code figure	
0	Sea station
1	Automatic data buoy
2	Aircraft
3	Satellite
4–14	Reserved
15	Missing value

0 02 046

Wave measurement instrumentation

Code figure	
0	Reserved for future use
1	Heave sensor
2	Slope sensor
3–14	Reserved
15	Missing value

0 02 047

Deep-ocean tsunameter type

Code figure	
0	Reserved
1	DART II (PMEL)
2	DART ETD
3	SAIC Tsunami Buoy (STB)
4	GFZ – Potsdam
5	INCOIS (India)
6	InaBuoy (Indonesia)
7	Envirtech
8–99	Reserved
100–126	Not used
127	Missing value

0 02 048

Satellite sensor indicator

Code figure	
0	HIRS
1	MSU
2	SSU
3	AMSU-A
4	AMSU-B
5	AVHRR
6	SSMI
7	NSCAT
8	SEAWINDS
9	POSEIDON altimeter
10	JMR (JASON Microwave Radiometer)
11	MHS
12	ASCAT
13–14	Reserved
15	Missing value

0 02 049

Geostationary satellite data-processing technique used

Bit No.	
1	Processing technique not defined
2	Simultaneous physical retrieval
3	Clear sounding
4	Cloudy sounding
5–7	Reserved for future use
All 8	Missing value

Notes:

(1) Clear sounding indicates the sounding has been generated from a set of clear radiances using all available sounder radiances.

(2) Cloudy sounding indicates that sufficient clear radiances could not be identified in the sounding area. The sounding is calculated from the cloud top (cloud pressure greater than or equal to 780 hPa) upwards.

0 02 050

Geostationary sounder satellite channels used

Bit No.	Channel	Central wavelength (micrometers)
1	1	14.71
2	2	14.37
3	3	14.06
4	4	13.64
5	5	13.37
6	6	12.66
7	7	12.02
8	8	11.03
9	9	9.71
10	10	7.43
11	11	7.02
12	12	6.51
13	13	4.57
14	14	4.52
15	15	4.45
16	16	4.13
17	17	3.98
18	18	3.74
19	19	0.969
All 20	Missing value	

Note: Beginning with the first bit position (high order bit), if the bit position is set to one, then the channel is used. If the bit position is set to zero, then the channel is not used.

0 02 051

Indicator to specify observing method for extreme temperatures

Code figure	
0	Reserved
1	Maximum/minimum thermometers
2	Automated instruments
3	Thermograph
4–14	Reserved
15	Missing value

0 02 052

Geostationary imager satellite channels used

Bit No.	Channel	Central wavelength (micrometers)
1	1	0.55 – 0.75
2	2	3.9
3	3	6.7
4	4	10.7
5	5	12.0
All 6	Missing value	

Note: Beginning with the first bit position (high order bit), if the bit position is set to one, then the channel is used. If the bit position is set to zero, then the channel is not used.

0 02 053

GOES-I/M brightness temperature characteristics

Code figure	
0	Observed brightness temperature
1	Brightness temperature with bias correction applied
2	Brightness temperature calculated from first guess
3	Brightness temperature calculated from sounding
4–14	Reserved
15	Missing value

0 02 054

GOES-I/M soundings parameter characteristics

Code figure	
0	Parameter derived using observed sounder brightness temperatures
1	Parameter derived using observed imager brightness temperatures
2	Parameter derived using first guess information
3	Parameter derived using NMC analysis information
4	Parameter derived using radiosonde information
5–14	Reserved
15	Missing value

0 02 055

Geostationary soundings statistical parameters

Code figure	
0	Statistics generated comparing retrieval versus radiosonde
1	Statistics generated comparing retrieval versus first guess
2	Statistics generated comparing radiosonde versus first guess
3	Statistics generated comparing observed versus retrieval
4	Statistics generated comparing observed versus first guess
5	Statistics generated comparing radiosonde versus imager
6	Statistics generated comparing radiosonde versus sounder
7	Statistics generated for radiosonde
8	Statistics generated for first guess
9–14	Reserved
15	Missing value

0 02 056

Geostationary soundings accuracy statistics

Code figure	
0	Sums of differences
1	Sums of squared differences
2	Sample size
3	Minimum difference
4	Maximum difference
5–14	Reserved
15	Missing value

0 02 057

Origin of first-guess information for GOES-I/M soundings

Code figure	
0	Nested Grid Model (NGM)
1	Aviation Model (AVN)
2	Medium Range Forecast (MRF) Model
3	Global Data Assimilation System (GDAS) Forecast Model
4	Prior soundings (within 3 hours of current time)
5	Climatology
6–14	Reserved
15	Missing value

0 02 058

Valid times of first-guess information for GOES-I/M soundings

Code figure	
0	12 hour and 18 hour
1	18 hour and 24 hour
2	6 hour and 12 hour
3	Greater than 24 hours
4–14	Reserved
15	Missing value

0 02 059

Origin of analysis information for GOES-I/M soundings

Code figure	
0	NCEP Nested Grid Model (NGM) Analysis
1	NCEP Aviation Model (AVN) Analysis
2	NCEP Medium Range Forecast (MRF) Model Analysis
3	NCEP Global Data Assimilation System (GDAS) Forecast Model Analysis
4–14	Reserved
15	Missing value

0 02 060

Origin of surface information for GOES-I/M soundings

Code figure	
0	Current surface hourly reports
1	Current ship reports
2	Current buoy reports
3	One hour old surface hourly reports
4	One hour old ship reports
5	One hour old buoy reports
6–14	Reserved
15	Missing value

0 02 061

Aircraft navigational system

Code figure	
0	Inertial navigation system
1	OMEGA
2–6	Reserved
7	Missing value

0 02 062

Type of aircraft data relay system

Code figure	
0	ASDAR
1	ASDAR (ACARS also available but not operative)
2	ASDAR (ACARS also available and operative)
3	ACARS
4	ACARS (ASDAR also available but not operative)
5	ACARS (ASDAR also available and operative)
6–14	Reserved
15	Missing value

0 02 064

Aircraft roll angle quality

Code figure	Meaning
0	Good
1	Bad
2	Reserved
3	Missing value

Note: Bad is currently defined as a roll angle > 5 degrees from vertical.

0 02 066

Radiosonde ground receiving system

Code figure	
0	InterMet IMS 2000
1	InterMet IMS 1500C
2–61	Reserved
62	Other
63	Missing value

0 02 070

Original specification of latitude/longitude

Code figure	
0	Actual location in seconds
1	Actual location in minutes
2	Actual location in degrees
3	Actual location in decidegrees
4	Actual location in centidegrees
5	Referenced to checkpoint in seconds
6	Referenced to checkpoint in minutes
7	Referenced to checkpoint in degrees
8	Referenced to checkpoint in decidegrees
9	Referenced to checkpoint in centidegrees
10	Actual location in tenths of a minute
11	Referenced to checkpoint in tenths of a minute
12–14	Reserved
15	Missing value

0 02 080

Balloon manufacturer

Code figure	
0	Kaysam
1	Totex
2	KKS
3–61	Reserved
62	Other
63	Missing value

0 02 081

Type of balloon

Code figure	
0	GP26
1	GP28
2	GP30
3	HM26
4	HM28
5	HM30
6	SV16
7–29	Reserved
30	Other
31	Missing value

0 02 083

Type of balloon shelter

Code figure	
0	High bay
1	Low bay
2	Balloon-inflated launch system (BILS)
3	Roof-top BILS
4–13	Reserved
14	Other
15	Missing value

0 02 084

Type of gas used in balloon

Code figure	
0	Hydrogen
1	Helium
2	Natural gas
3–13	Reserved
14	Other
15	Missing value

0 02 095

Type of pressure sensor

Code figure	
0	Capacitance aneroid
1	Derived from GPS
2	Resistive strain gauge
3	Silicon capacitor
4	Derived from radar height
5–29	Reserved
30	Other
31	Missing value

0 02 096

Type of temperature sensor

Code figure	
0	Rod thermistor
1	Bead thermistor
2	Capacitance bead
3	Capacitance wire
4	Resistive sensor
5	Chip thermistor
6–29	Reserved
30	Other
31	Missing value

0 02 097

Type of humidity sensor

Code figure	
0	VIZ Mark II carbon hygristor
1	VIZ B2 hygristor
2	Vaisala A-Humicap
3	Vaisala H-Humicap
4	Capacitance sensor
5	Vaisala RS90
6	Sippican Mark IIA carbon hygristor
7	Twin alternatively heated Humicap capacitance sensor
8	Humicap capacitance sensor with active de-icing method
9–29	Reserved
30	Other
31	Missing value

0 02 099

Polarization

Code figure	
0	HH polarization
1	VV polarization
2	HV polarization real valued component
3	HV polarization imaginary valued component
4–6	Reserved
7	Missing value

0 02 101

Type of antenna

Code figure	
0	Centre front-fed paraboloid
1	Offset front-fed paraboloid
2	Centre Cassegrain paraboloid
3	Offset Cassegrain paraboloid
4	Planar array
5	Coaxial-collinear array
6	Yagi elements array
7	Microstrip
8–13	Reserved
14	Other
15	Missing value

0 02 103

Radome

Bit No.	
1	Radar antenna is protected by a radome
All 2	Missing value

0 02 104

Antenna polarization

Code figure	
0	Horizontal polarization
1	Vertical polarization
2	Right circular polarization
3	Left circular polarization
4	Horizontal and vertical polarization
5	Right and left circular polarization
6	Quasi-horizontal polarization
7	Quasi-vertical polarization
8–14	Reserved
15	Missing value

0 02 115

Type of surface observing equipment

Code figure	
0	PDB
1	RSOIS
2	ASOS
3	Psychrometer
4	F420
5–29	Reserved
30	Other
31	Missing value

0 02 119

RA-2 instrument operations

Code figure	
0	Intermediate frequency calibration mode (IF CAL)
1	Built-in test equipment digital (BITE DGT)
2	Built-in test equipment radio frequency (BITE RF)
3	Preset tracking (PSET TRK)
4	Preset LOOP OUT
5	ACQUISITION
6	TRACKING
7	Missing value

0 02 131

Sensitivity time control (STC)

Bit No.	
1	STC operational
All 2	Missing values

0 02 137

Radar dual PRF ratio

Code figure	
1	3:2
2	4:3
3	5:4
4–14	Reserved
15	Missing value

0 02 138

Antenna rotation direction

Code figure	
1	Clockwise rotation
2	Counterclockwise rotation
3	Missing value

0 02 139

SIRAL instrument configuration

Code figure	Meaning
0	SIRAL nominal
1	SIRAL redundant
2	Missing value

0 02 143

Ozone instrument type

Code figure	
0	Reserved
1	Brewer spectrophotometer
2	Caver Teichert
3	Dobson
4	Dobson (Japan)
5	Ehmet
6	Fecker telescope
7	Hoelper
8	Jodmeter
9	Filter Ozonometer M-83
10	Mast
11	Oxford
12	Paetzold
13	Regener
14	Reserved for future use
15	Vassy filter ozonometer
16	Carbon iodide
17	Surface ozone bubbler
18	Filter ozonometer M-124
19	ECC sonde
20–126	Reserved
127	Missing value

0 02 144

Light source type for Brewer spectrophotometer

Code figure	
0	Direct sun
1	Direct sun, attenuator #1
2	Direct sun, attenuator #2
3	Focused moon
4	Focused sun
5	Focused sun corrected with adjacent sky measurements
6	Zenith sky
7–14	Reserved
15	Missing value

Note: Entries 1 and 2 should not be used.

0 02 145

Wavelength setting for Dobson instruments

Code figure	
0	Wavelengths AD ordinary setting
1	Wavelengths BD ordinary setting
2	Wavelengths CD ordinary setting
3	Wavelengths CC' ordinary setting
4	Wavelengths AD focused image
5	Wavelengths BD focused image
6	Wavelengths CD focused image
7	Wavelengths CC' focused image
8–14	Reserved
15	Missing value

0 02 146

Source conditions for Dobson instruments

Code figure	
0	On direct sun
1	On direct moon
2	On blue zenith sky
3	On zenith cloud (uniform stratified layer of small opacity)
4	On zenith cloud (uniform or moderately variable layer of medium opacity)
5	On zenith cloud (uniform or moderately variable layer of large opacity)
6	On zenith cloud (highly variable opacity, with or without precipitation)
7	On zenith cloud (fog)
8	On zenith haze
9	On direct sun through thin cloud, fog or haze
10–14	Reserved
15	Missing value

0 02 148

Data collection and/or location system

Code figure	
0	Reserved
1	Argos
2	GPS
3	GOES DCP
4	METEOSAT DCP
5	ORBCOMM
6	INMARSAT
7	Iridium
8	Iridium and GPS
9	Argos-3
10	Argos-4
11–30	Reserved
31	Missing value

0 02 149

Type of data buoy

Code figure	
0	Unspecified drifting buoy
1	Standard Lagrangian drifter (Global Drifter Programme)
2	Standard FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy)
3	Wind measuring FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy)
4	Ice float
5	SVPG Standard Lagrangian drifter with GPS
6	SVP-HR drifter with high-resolution temperature or thermistor string
7	Reserved
8	Unspecified sub-surface float
9	SOFAR
10	ALACE
11	MARVOR
12	RAFOS
13	PROVOR
14	SOLO
15	APEX
16	Unspecified moored buoy
17	Nomad
18	3-metre discus
19	10-12-metre discus
20	ODAS 30 series
21	ATLAS (e.g. TAO area)

(continued)

(Code table 0 02 149 – continued)

Code figure	
22	TRITON buoy
23	FLEX mooring (e.g. TIP area)
24	Omnidirectional waverider
25	Directional waverider
26	Sub-surface ARGO float
27	PALACE
28	NEMO
29	NINJA
30	Ice buoy/float (POPS or ITP)
31–33	Reserved
34	Mooring oceanographic
35	Mooring meteorological
36	Mooring multidisciplinary (OceanSITES)
37	Mooring tide gauge or tsunami buoy
38–62	Reserved
63	Missing value

0 02 150

TOVS/ATOVS/AVHRR instrumentation channel number

Code figure	
0	Reserved
1	HIRS 1
2	HIRS 2
3	HIRS 3
4	HIRS 4
5	HIRS 5
6	HIRS 6
7	HIRS 7
8	HIRS 8
9	HIRS 9
10	HIRS 10
11	HIRS 11
12	HIRS 12
13	HIRS 13
14	HIRS 14
15	HIRS 15
16	HIRS 16
17	HIRS 17
18	HIRS 18
19	HIRS 19
20	HIRS 20
21	MSU 1
22	MSU 2
23	MSU 3
24	MSU 4
25	SSU 1
26	SSU 2
27	SSU 3
28	AMSU-A 1
29	AMSU-A 2
30	AMSU-A 3
31	AMSU-A 4
32	AMSU-A 5
33	AMSU-A 6
34	AMSU-A 7
35	AMSU-A 8
36	AMSU-A 9
37	AMSU-A 10
38	AMSU-A 11
39	AMSU-A 12
40	AMSU-A 13
41	AMSU-A 14

(continued)

(Code table 0 02 150 – continued)

Code figure	
42	AMSU-A 15
43	AMSU-B 1 / MHS 1
44	AMSU-B 2 / MHS 2
45	AMSU-B 3 / MHS 3
46	AMSU-B 4 / MHS 4
47	AMSU-B 5 / MHS 5
48	AVHRR 1
49	AVHRR 2
50	AVHRR 3a
51	AVHRR 3b
52	AVHRR 4
53	AVHRR 5
54–62	Reserved
63	Missing value

0 02 151

Radiometer identifier

Code figure	
0	HIRS
1	MSU
2	SSU
3	AMSU-A1-1
4	AMSU-A1-2
5	AMSU-A2
6	AMSU-B
7	AVHRR
8	Reserved
9	MHS
10–2046	Reserved
2047	Missing value

0 02 152

Satellite instrument used in data processing

Bit No.	
1	High-resolution infrared sounder (HIRS)
2	Microwave sounding unit (MSU)
3	Stratospheric sounding unit (SSU)
4	AMI wind mode
5	AMI wave mode
6	AMI image mode
7	RADAR altimeter
8	ATSR
9	Geostationary imager
10	Geostationary sounder
11	Geostationary Earth radiation (GERB)
12	Multi-channel scanning radiometer
13	Polar-orbiting imager
14–30	Reserved
All 31	Missing value

0 02 158

RA-2 instrument

Bit No.	
1	Mismatch in RED VEC HPA
2	Mismatch in RED VEC RFSS
3	PTR calibration band 320 MHz (Ku)
4	PTR calibration band 80 MHz (Ku)
5	PTR calibration band 20 MHz (Ku)
6	PTR calibration band 160 MHz (S)
7	Ku flight calibration parameters available
8	S flight calibration parameters available
All 9	Missing value

Note: PTR = Pulse target response
HPA = High power amplifier
RFSS = Radio frequency subsystem
RED = Redundancy

0 02 159

MWR instrument

Bit No.	
1	Temperature inconsistency
2	Data is missing
3	Redundancy channel
4	Power bus protection
5	Overvoltage/Overload protection
6	Reserved
7	Reserved
All 8	Missing value

Note: MWR = Microwave radiometer

0 02 160

Wave length of the radar

Code figure	
0	Reserved
1	10 to less than 20 mm
2	Reserved
3	20 to less than 40 mm
4	Reserved
5	40 to less than 60 mm
6	Reserved
7	60 to less than 90 mm
8	90 to less than 110 mm
9	110 mm and greater
10–14	Not used
15	Missing value

0 02 163

Height assignment method

Code figure	
0	Auto editor
1	IRW height assignment
2	WV height assignment
3	H_2O intercept height assignment
4	CO_2 slicing height assignment
5	Low pixel max gradient
6	Higher pixel max gradient
7	Primary height assignment
8	Layer thickness assignment
9	Cumulative contribution function – 10 per cent height
10	Cumulative contribution function – 50 per cent height
11	Cumulative contribution function – 90 per cent height
12	Cumulative contribution function – height of maximum gradient
13	IR / two WV channel ratioing method
14	Composite height assignment
15	Missing value

0 02 164

Tracer correlation method

Code figure	
0	LP – Norms least square minimum
1	EN – Euclidean norm with radiance correlation
2	CC – Cross correlation
3–6	Reserved
7	Missing value

0 02 165

Radiance type flags

Bit No.	
1	Clear path
2	Partly cloudy path
3	Cloudy path
4	Apodized
5	Unapodized
6	Reconstructed
7	Cloud cleared
8–14	Reserved
All 15	Missing value

0 02 166

Radiance type

Code figure	
0	Type not defined
1	Automated statistical regression
2	Clear path
3	Partly cloudy path
4	Cloudy path
5–14	Reserved
15	Missing value

0 02 167

Radiance computational method

Code figure	
0	Method not defined
1	1b raw radiance
2	Processed radiance
3–14	Reserved
15	Missing value

0 02 169

Anemometer type

Code figure	
0	Cup rotor
1	Propeller rotor
2	Wind Observation Through Ambient Noise (WOTAN)
3	Sonic
4–14	Reserved
15	Missing value

0 02 170

Aircraft humidity sensors

Code figure	Sensor type
0	SpectraSensors WVSS-II, Version 1
1	SpectraSensors WVSS-II, Version 2
2	SpectraSensors WVSS-II, Version 3
3–61	Reserved
62	Other
63	Missing value

0 02 172

Product type for retrieved atmospheric gases

Code figure	
0	Reserved
1	Retrieval from a nadir sounding
2	Retrieval from a limb sounding
3–254	Reserved
255	Missing value

0 02 175

Method of precipitation measurement

Code figure	
0	Manual measurement
1	Tipping bucket method
2	Weighing method
3	Optical method
4	Pressure method
5	Float method
6	Drop counter method
7–13	Reserved
14	Others
15	Missing value

0 02 176

Method of state of ground measurement

Code figure	
0	Manual observation
1	Video camera method
2	Infrared method
3	Laser method
4–13	Reserved
14	Others
15	Missing value

0 02 177

Method of snow depth measurement

Code figure	
0	Manual observation
1	Ultrasonic method
2	Video camera method
3	Laser method
4–13	Reserved
14	Others
15	Missing value

0 02 178

Method of liquid content measurement of precipitation

Code figure	
0	Manual observation
1	Optical method
2	Capacitive method
3–13	Reserved
14	Others
15	Missing value

0 02 179

Type of sky condition algorithm

Code figure	
0	Manual observation
1	VAISALA algorithm
2	ASOS (FAA) algorithm
3	AWOS (Canada) algorithm
4–13	Reserved
14	Others
15	Missing value

0 02 180

Main present weather detecting system

Code figure	
0	Manual observation
1	Optical scatter system combined with precipitation occurrence sensing system
2	Forward and/or backscatter system of visible light
3	Forward and/or backscatter system of infrared light
4	Infrared light emitting diode (IRED) system
5	Doppler radar system
6–13	Reserved
14	Others
15	Missing value

0 02 181

Supplementary present weather sensor

Bit No.	
1	Rain detector
2	Freezing rain sensor
3	Ice detection sensor
4	Hail and ice pellet sensor
5–19	Reserved
20	Others
All 21	Missing value

0 02 182

Visibility measurement system

Code figure	
0	Manual measurement
1	Transmissometer system (base > 25 m)
2	Transmissometer system (base < 25 m)
3	Forward scatter system
4	Backscatter system
5–13	Reserved
14	Others
15	Missing value

0 02 183

Cloud detection system

Code figure	
0	Manual observation
1	Ceilometer system
2	Infrared camera system
3	Microwave visual camera system
4	Sky imager system
5	Video time-lapsed camera system
6	Micropulse lidar (MPL) system
7–13	Reserved
14	Others
15	Missing value

0 02 184

Type of lightning detection sensor

Code figure	
0	Manual observation
1	Lightning imaging sensor
2	Electrical storm identification sensor
3	Magnetic finder sensor
4	Lightning strike sensor
5	Flash counter
6	ATDnet VLF waveform correlated sensor
7–13	Reserved
14	Others
15	Missing value

0 02 185

Method of evaporation measurement

Code figure	
0	Manual measurement
1	Balanced floating method
2	Pressure method
3	Ultrasonic method
4	Hydraulic method
5–13	Reserved
14	Others
15	Missing value

0 02 186

Capability to detect precipitation phenomena

Bit No.	
1	Precipitation-unknown type
2	Liquid precipitation not freezing
3	Liquid freezing precipitation
4	Drizzle
5	Rain
6	Solid precipitation
7	Snow
8	Snow grains
9	Snow pellets
10	Ice pellets
11	Ice crystals
12	Diamond dust
13	Small hail
14	Hail

(continued)

(Flag table 0 02 186 – continued)

Bit No.	
15	Glaze
16	Rime
17	Soft rime
18	Hard rime
19	Clear ice
20	Wet snow
21	Hoar frost
22	Dew
23	White dew
24–29	Reserved
All 30	Missing value

0 02 187

Capability to detect other weather phenomena

Bit No.	
1	Dust/sand whirl
2	Squalls
3	Sand storm
4	Dust storm
5	Lightning – cloud to surface
6	Lightning – cloud to cloud
7	Lightning – distant
8	Thunderstorm
9	Funnel cloud not touching surface
10	Funnel cloud touching surface
11	Spray
12–17	Reserved
All 18	Missing value

0 02 188

Capability to detect obscuration

Bit No.	
1	Fog
2	Ice fog
3	Steam fog
4–6	Reserved
7	Mist
8	Haze
9	Smoke
10	Volcanic ash
11	Dust
12	Sand
13	Snow
14–20	Reserved
All 21	Missing value

0 02 189

Capability to discriminate lightning strikes

Bit No.	
1	Manual observation
2	All lightning strikes without discrimination
3	Lightning strikes cloud to ground only
4	All lightning strikes with discrimination between cloud to ground and cloud to cloud
5–11	Reserved
All 12	Missing value

0 02 191

Geopotential height calculation

Code figure	
0	Geopotential height calculated from pressure
1	Geopotential height calculated from GPS height
2	Geopotential height calculated from radar height
3–14	Reserved
15	Missing value

0 04 059

Times of observation used to compute the reported mean values

Bit No.	
1	0000 UTC
2	0600 UTC
3	1200 UTC
4	1800 UTC
5	Other hours
All 6	Missing value

0 04 080

Averaging period for following value

Code figure	
0	Spot values
1	Less than 15 minutes
2	From 15 to 45 minutes
3	More than 45 minutes
4–8	Reserved
9	Data not available
10–14	Not used
15	Missing value

0 08 001

Vertical sounding significance

Bit No.	
1	Surface
2	Standard level
3	Tropopause level
4	Maximum wind level
5	Significant level, temperature and/or relative humidity
6	Significant level, wind
All 7	Missing value

0 08 002

Vertical significance (surface observations)

Code figure	
0	Observing rules for base of lowest cloud and cloud types of FM 12 SYNOP and FM 13 SHIP apply
1	First non-Cumulonimbus significant layer
2	Second non-Cumulonimbus significant layer
3	Third non-Cumulonimbus significant layer
4	Cumulonimbus layer
5	Ceiling
6	Clouds not detected below the following height(s)
7	Low cloud
8	Middle cloud
9	High cloud
10	Cloud layer with base below and top above the station
11	Cloud layer with base and top below the station level
12–19	Reserved
20	No clouds detected by the cloud detection system
21	First instrument detected cloud layer
22	Second instrument detected cloud layer
23	Third instrument detected cloud layer
24	Fourth instrument detected cloud layer
25–61	Reserved
62	Value not applicable
63	Missing value

0 08 003

Vertical significance (satellite observations)

Code figure	
0	Surface
1	Base of satellite sounding
2	Cloud top
3	Tropopause
4	Precipitable water
5	Sounding radiances
6	Mean temperatures
7	Ozone
8	Low cloud
9	Med cloud
10	High cloud
11–62	Reserved
63	Missing value

0 08 004

Phase of aircraft flight

Code figure	
0–1	Reserved
2	Unsteady (UNS)
3	Level flight, routine observation (LVR)
4	Level flight, highest wind encountered (LVW)
5	Ascending (ASC)
6	Descending (DES)
7	Missing value

0 08 005

Meteorological attribute significance

Code figure	
0	Reserved
1	Storm centre
2	Outer limit or edge of storm
3	Location of maximum wind
4	Location of the storm in the perturbed analysis
5	Location of the storm in the analysis
6–14	Reserved
15	Missing value

0 08 006

Ozone vertical sounding significance

Bit No.	
1	Surface
2	Standard level
3	Tropopause level
4	Prominent maximum level
5	Prominent minimum level
6	Minimum pressure level
7	Reserved
8	Level of undetermined significance
All 9	Missing value

0 08 007

Dimensional significance

Code figure	
0	Point
1	Line
2	Area
3	Volume
4–14	Reserved
15	Missing value

Note: A consecutive sequence of 2 or more of location coordinates, such as latitude and longitude pairs, defines a line or polygon. Points shall be joined in the order given in the message. Any area described will fall left of the drawn boundary in the direction established by the order of the points given in the message. This definition is for simple non-intersecting polygons without holes.

0 08 008

Radiation vertical sounding significance

Bit No.	
1	Surface
2	Standard level
3	Tropopause level
4	Level of beta radiation maximum
5	Level of gamma radiation maximum
6	Minimum pressure level
7	Reserved
8	Level of undetermined significance
All 9	Missing value

0 08 009

Detailed phase of flight

Code figure	
0	Level flight, routine observation, unsteady
1	Level flight, highest wind encountered, unsteady
2	Unsteady (UNS)
3	Level flight, routine observation (LVR)
4	Level flight, highest wind encountered (LVW)
5	Ascending (ASC)
6	Descending (DES)
7	Ascending, observation intervals selected by time increments
8	Ascending, observation intervals selected by time increments, unsteady
9	Ascending, observation intervals selected by pressure increments
10	Ascending, observation intervals selected by pressure increments, unsteady
11	Descending, observation intervals selected by time increments
12	Descending, observation intervals selected by time increments, unsteady
13	Descending, observation intervals selected by pressure increments
14	Descending, observation intervals selected by pressure increments, unsteady
15	Missing value

0 08 010

Surface qualifier (for temperature data)

Code figure	
0	Reserved
1	Bare soil
2	Bare rock
3	Land grass cover
4	Water (lake, sea)
5	Flood water underneath
6	Snow
7	Ice
8	Runway or road
9	Ship or platform deck in steel
10	Ship or platform deck in wood
11	Ship or platform deck partly covered with rubber mat
12–30	Reserved
31	Missing value

0 08 011

Meteorological feature

Code figure	
0	Quasi-stationary front at the surface
1	Quasi-stationary front above the surface
2	Warm front at the surface
3	Warm front above the surface
4	Cold front at the surface
5	Cold front above the surface
6	Occlusion
7	Instability line
8	Intertropical front
9	Convergence line
10	Jet stream
11	Cloud clear
12	Cloud
13	Turbulence
14	Storm
15	Airframe icing
16	Phenomenon
17	Volcano
18	Atmospherics
19	Reserved
20	Special clouds
21	Thunderstorm
22	Tropical cyclone
23	Mountain wave
24	Duststorm
25	Sandstorm
26–62	Reserved
63	Missing value

0 08 012

Land/sea qualifier

Code figure	
0	Land
1	Sea
2	Coast
3	Missing value

0 08 013

Day/night qualifier

Code figure	
0	Night
1	Day
2	Twilight
3	Missing value

0 08 014

Qualifier for runway visual range

Code figure		
0	10-minute mean value	– normal value
1	10-minute mean value	– above the upper limit for assessments of RVR (P)
2	10-minute mean value	– below the lower limit for assessments of RVR (M)
3	one-minute minimum value	– normal value
4	one-minute minimum value	– above the upper limit for assessments of RVR (P)
5	one-minute minimum value	– below the lower limit for assessments of RVR (M)
6	one-minute maximum value	– normal value
7	one-minute maximum value	– above the upper limit for assessments of RVR (P)
8	one-minute maximum value	– below the lower limit for assessments of RVR (M)
9–14	Reserved	
15	Missing value	

0 08 016

Change qualifier of a trend-type forecast or an aerodrome forecast

Code figure	
0	NOSIG
1	BECMG
2	TEMPO
3	FM
4–6	Reserved
7	Missing value

0 08 017

Qualifier of the time when the forecast change is expected

Code figure	
0	FM
1	TL
2	AT
3	Missing value

0 08 018

SEAWINDS land/ice surface type

Bit No.	
1	Land is present
2	Surface ice map indicates ice is present
3–10	Reserved
11	Ice map data not available
12	Attenuation map data not available
13–16	Reserved
All 17	Missing value

0 08 019

Qualifier for following centre identifier

Code figure	
0	Reserved
1	ATS (Air Traffic Service) unit serving FIR (Flight Information Region)
2	FIR (Flight Information Region)
3	UIR (Upper Flight Information Region)
4	CTA (Control Area)
5	VAAC (Volcanic Ash Advisory Centre)
6	MWO (Meteorological Watch Office) issuing SIGMET
7–14	Reserved
15	Missing value

0 08 021

Time significance

Code figure	
0	Reserved
1	Time series
2	Time averaged (see Note 1)
3	Accumulated
4	Forecast
5	Forecast time series
6	Forecast time averaged
7	Forecast accumulated
8	Ensemble mean (see Note 2)
9	Ensemble mean time series
10	Ensemble mean time averaged
11	Ensemble mean accumulated
12	Ensemble mean forecast
13	Ensemble mean forecast time series
14	Ensemble mean forecast time averaged
15	Ensemble mean forecast accumulated
16	Analysis
17	Start of phenomenon
18	Radiosonde launch time
19	Start of orbit
20	End of orbit
21	Time of ascending node
22	Time of occurrence of wind shift
23	Monitoring period
24	Agreed time limit for report reception
25	Nominal reporting time
26	Time of last known position
27	First guess
28	Start of scan
29	End of scan or time of ending
30	Time of occurrence
31	Missing value

Notes:

(1) "Time averaged" indicates that values are continuously averaged over a period of time.

(2) "Ensemble mean" indicates that a number of distinct values corresponding to a set of time locations are averaged.

(3) Time significance must be qualified by appropriate time periods being specified.

0 08 023

*First-order statistics**

Code figure	
0–1	Reserved
2	Maximum value
3	Minimum value
4	Mean value
5	Median value
6	Modal value
7	Mean absolute error
8	Reserved
9	Best estimate of standard deviation (N–1)
10	Standard deviation (N)
11	Harmonic mean
12	Root-mean-square vector error
13	Root-mean-square
14–31	Reserved
32	Vector mean
33–62	Reserved for local use
63	Missing value

* All first-order statistics are in the units defined by the original data descriptors.

0 08 024

*Difference statistics**

Code figure	
0–1	Reserved
2	Observed minus maximum
3	Observed minus minimum
4	Observed minus mean
5	Observed minus median
6	Observed minus mode
7–10	Reserved
11	Observed minus climatology (anomaly)
12	Observed minus analysed value
13	Observed minus initialized analysed value
14	Observed minus forecast value **
15–20	Reserved
21	Observed minus interpolated value
22	Observed minus hydrostatically calculated value
23–31	Reserved
32–62	Reserved for local use
63	Missing value

* Difference statistics are difference values; they have dimensions the same as the corresponding reported values with respect to units, but assume a range centred on zero (e.g., the difference between reported and analysed values, the difference between reported and forecast values).

** Where observed minus forecast values are represented, the period of the forecast shall be indicated by an appropriate descriptor from Class 04.

0 08 025

Time difference qualifier

Code figure	
0	Universal Time Coordinated (UTC) minus Local Standard Time (LST)
1	Local Standard Time
2	Universal Time Coordinated (UTC) minus Satellite clock
3–4	Reserved
5	Time difference from edge of processing segment
6–14	Reserved
15	Missing value

0 08 026

Matrix significance

Code figure	
0	Averaging kernel matrix
1	Correlation matrix (C)
2	Lower triangular correlation matrix square root (L from $C=LL^T$)
3	Inverse of lower triangular correlation matrix square root (L^{-1})
4–42	Reserved
43–62	Reserved for local use
63	Missing or undefined significance

0 08 029

Surface type

Code figure	
0	Open ocean or semi-enclosed sea
1	Enclosed sea or lake
2	Continental ice
3	Land
4	Low inland (below sea level)
5	Mix of land and water
6	Mix of land and low inland
7–10	Reserved
11	River
12	Lake
13	Sea
14	Glacier
15	Urban land
16	Rural land
17	Suburban land
18–254	Reserved
255	Missing value

0 08 033

Method of derivation of percentage confidence

Code figure	
0	Reserved
1	Percentage confidence calculated using cloud fraction
2	Percentage confidence calculated using standard deviation of temperature
3	Percentage confidence calculated using probability of cloud contamination
4	Percentage confidence calculated using normality of distribution
5–126	Reserved
127	Missing value

0 08 035

Type of monitoring exercise

Code figure	
0	Global
1	Regional
2	National
3	Special
4	Bilateral
5	Reserved
6	Reserved
7	Missing value

0 08 036

Type of centre or station performing monitoring

Code figure	
0	WMO Secretariat
1	WMO
2	RSMC
3	NMC
4	RTH
5	Observing site
6	Other
7	Missing value

0 08 039

Time significance (Aviation forecast)

Code figure	
0	Issue time of forecast
1	Time of commencement of period of the forecast
2	Time of ending of period of the forecast
3	Forecast time of maximum temperature
4	Forecast time of minimum temperature
5	Time of beginning of the forecast change
6	Time of ending of the forecast change
7–62	Reserved
63	Missing value

0 08 040

Flight level significance

Code figure	
0	High-resolution data sample
1	Within 20 hPa of surface
2	Pressure less than 10 hPa (i.e., 9, 8, 7, etc.) when no other reason applies
3	Base pressure level for stability index
4	Begin doubtful temperature, height data
5	Begin missing data (all elements)
6	Begin missing relative humidity data
7	Begin missing temperature data
8	Highest level reached before balloon descent because of icing or turbulence
9	End doubtful temperature, height data
10	End missing data (all elements)
11	End missing relative humidity data
12	End missing temperature data
13	Zero degrees Celsius crossing(s) for RADAT
14	Standard pressure level
15	Operator-added level
16	Operator-deleted level
17	Balloon re-ascended beyond previous highest ascent level
18	Significant relative humidity level
19	Relative humidity level selection terminated
20	Surface level
21	Significant temperature level
22	Mandatory temperature level
23	Flight termination level
24	Tropopause(s)
25	Aircraft report
26	Interpolated (generated) level
27	Mandatory wind level
28	Significant wind level
29	Maximum wind level
30	Incremental wind level (fixed regional)
31	Incremental height level (generated)
32	Wind termination level
33	Pressure 100 to 110 hPa, when no other reason applies
34	Freezing level base
35	Freezing level top
36	Flight level base
37	Flight level top
38–39	Reserved
40	Significant thermodynamic level (inversion)
41	Significant relative humidity level (according to NCDC criteria)
42	Significant temperature level (according to NCDC)
43	Begin missing wind data
44	End missing wind data
45–59	Reserved
60	Level of 80-knot isotach above jet
61	Level of 80-knot isotach below jet
62	Other
63	Missing value

0 08 041

Data significance

Code figure	
0	Parent site
1	Observation site
2	Balloon manufacture date
3	Balloon launch point
4	Surface observation
5	Surface observation displacement from launch point
6	Flight level observation
7	Flight level termination point
8	IFR ceiling and visibility
9	Mountain obscuration
10	Strong surface wind
11	Freezing level
12	Multiple freezing level
13	Instrument manufacture date
14–30	Reserved
31	Missing value

0 08 042

Extended vertical sounding significance

Bit No.	
1	Surface
2	Standard level
3	Tropopause level
4	Maximum wind level
5	Significant temperature level
6	Significant humidity level
7	Significant wind level
8	Beginning of missing temperature data
9	End of missing temperature data
10	Beginning of missing humidity data
11	End of missing humidity data
12	Beginning of missing wind data
13	End of missing wind data
14	Top of wind sounding
15	Level determined by regional decision
16	Reserved
17	Pressure level originally indicated by height as the vertical coordinate
All 18	Missing value

0 08 043

Atmospheric chemical or physical constituent type

Note: The last column in the table contains the associated registry number from the Chemical Abstracts Service (CAS) of the American Chemical Society.

Code figure	Name	Formula	CAS number (if applicable)
0	Ozone	O_3	10028-15-6
1	Water vapour	H_2O	7732-18-5
2	Methane	CH_4	74-82-8
3	Carbon dioxide	CO_2	124-38-9
4	Carbon monoxide	CO	630-08-0
5	Nitrogen dioxide	NO_2	10102-44-0
6	Nitrous oxide	N_2O	10024-97-2
7	Formaldehyde	HCHO	50-00-0
8	Sulphur dioxide	SO_2	7446-09-5
9–24	Reserved		
25	Particulate matter < 1.0 microns		
26	Particulate matter < 2.5 microns		
27	Particulate matter < 10 microns		
28	Aerosols (generic)		
29	Smoke (generic)		
30	Crustal material (generic dust)		
31	Volcanic ash		
32–200	Reserved		
201–254	Reserved for local use		
255	Missing value		

0 08 050

Qualifier for number of missing values in calculation of statistic

Code figure	
0	Reserved
1	Pressure
2	Temperature
3	Extreme temperature
4	Vapour pressure
5	Precipitation
6	Sunshine duration
7	Maximum temperature
8	Minimum temperature
9	Wind
10–14	Reserved
15	Missing value

0 08 051

Qualifier for number of missing values in calculation of statistic

Code figure	
1	Pressure
2	Temperature
3	Extreme temperature
4	Vapour pressure
5	Precipitation
6	Sunshine duration
7	Missing value

0 08 052

Condition for which number of days of occurrence follows

Code figure	
0	Mean wind speed over a 10-minute period observed or recorded equal to or more than 10 m s^{-1} or 20 knots
1	Mean wind speed over a 10-minute period observed or recorded equal to or more than 20 m s^{-1} or 40 knots
2	Mean wind speed over a 10-minute period observed or recorded equal to or more than 30 m s^{-1} or 60 knots
3	Maximum temperature less than 273.15 K
4	Maximum temperature equal to or more than 298.15 K
5	Maximum temperature equal to or more than 303.15 K
6	Maximum temperature equal to or more than 308.15 K
7	Maximum temperature equal to or more than 313.15 K
8	Minimum temperature less than 273.15 K
9	Maximum temperature equal to or more than 273.15 K
10	Precipitation equal to or more than 1.0 kg m^{-2}
11	Precipitation equal to or more than 5.0 kg m^{-2}
12	Precipitation equal to or more than 10.0 kg m^{-2}
13	Precipitation equal to or more than 50.0 kg m^{-2}
14	Precipitation equal to or more than 100.0 kg m^{-2}
15	Precipitation equal to or more than 150.0 kg m^{-2}
16	Snow depth more than 0.00 m
17	Snow depth more than 0.01 m
18	Snow depth more than 0.10 m
19	Snow depth more than 0.50 m
20	Horizontal visibility less than 50 m
21	Horizontal visibility less than 100 m
22	Horizontal visibility less than 1000 m
23	Hail
24	Thunderstorm
25–30	Reserved
31	Missing value

0 08 053

Day of occurrence qualifier

Code figure	
0	Value occurred on only one day in the month
1	Value occurred on more than one day in the month
2	Reserved
3	Missing value

0 08 054

Qualifier for wind speed or wind gusts

Code figure	
0	Wind speed or gust is as reported
1	Wind speed is greater than that reported (P in METAR/TAF/SPECI)
2–6	Reserved
7	Missing value

0 08 060

Sample scanning mode significance

Code figure	
0	Reserved
1	Range
2	Azimuth
3	Horizontal
4	Vertical
5	North/South
6	East/West
7–14	Reserved
15	Missing value

0 08 065

Sun-glint indicator

Code figure	
0	No sun-glint
1	Sun-glint
2	Reserved
3	Missing value

0 08 066

Semi-transparency indicator

Code figure	
0	Opaque
1	Semi-transparent
2	Reserved
3	Missing value

0 08 070

TOVS/ATOVS product qualifier

Code figure	
0	Reserved
1	Reserved
2	Earth located instrument counts, calibration coefficients and housekeeping (level 1b)
3	Earth located calibrated radiances (level 1c)
4	Mapped to a common footprint, Earth located calibrated radiances (level 1d)
5–14	Reserved
15	Missing value

0 08 072

Pixel(s) type

Code figure	
0	Mixed
1	Clear
2	Cloudy
3	Probably clear
4	Probably cloudy
5–6	Reserved
7	Missing value

0 08 074

Altimeter echo type

Code figure	
0	Open ocean or semi-enclosed sea
1	Non-ocean like
2	Reserved
3	Missing value

0 08 075

Ascending/descending orbit qualifier

Code figure	
0	Ascending orbit
1	Descending orbit
2	Reserved
3	Missing value

0 08 076

Type of band

Code figure	
0	Ku
1	C
2	Long-wave infrared
3	Medium-wave infrared
4	Short-wave infrared
5	M
6	I
7	Day/night
8–62	Reserved
63	Missing value

0 08 077

Radiometer sensed surface type

Code figure	
0	Land
1	Sea
2	Coastal
3	Open ocean or semi-enclosed sea
4	Enclosed sea or lake
5	Continental ice
6–126	Reserved
127	Missing value

0 08 079

Product status

Code figure	
0	Normal issue
1	Correction to a previously issued product (COR)
2	Amendment to a previously issued product (AMD)
3	Correction to a previously issued amended product (COR AMD)
4	Cancellation of a previously issued product (CNL)
5	No product available (NIL)
6	Special report (SPECI)
7	Corrected special report (SPECI COR)
8–14	Reserved
15	Missing or not applicable

0 08 080

Qualifier for GTSPP quality flag*

Code figure	
0	Total water pressure profile
1	Total water temperature profile
2	Total water salinity profile
3	Total water conductivity profile
4	Total water depth
5–9	Reserved
10	Water pressure at a level
11	Water temperature at a level
12	Salinity at a level
13	Water depth at a level
14–19	Reserved
20	Position
21–62	Reserved
63	Missing value

* GTSPP = Global Temperature Salinity Profile Programme

0 08 081

Type of equipment

Code figure	
0	Sensor
1	Transmitter
2	Receiver
3	Observing platform
4–62	Reserved
63	Missing value

0 08 082

Modification of sensor height to another value

Code figure	
0	Sensor height is not modified
1	Sensor height is modified to standard level*
2–6	Reserved
7	Missing value

* If 0 08 082 = 1, the standard level is indicated by the Class 07 descriptor, which immediately follows. It is possible to indicate the real height of the sensor by preceding the descriptor by the relevant Class 07 descriptor.

0 08 083

Nominal value indicator

Bit No.	
1	Adjusted to or with respect to representative height of sensor above local ground (or deck of marine platform)
2	Adjusted to or with respect to representative height of sensor above water surface
3	Adjusted with respect to standard surface roughness
4	Adjusted with respect to wind speed
5	Adjusted with respect to temperature
6	Adjusted with respect to pressure
7	Adjusted with respect to humidity
8	Adjusted with respect to evaporation
9	Adjusted with respect to wetting losses
10–14	Reserved
All 15	Missing value

0 08 085

Beam identifier

Code figure	
0	Fore beam
1	Mid beam
2	Aft beam
3–6	Reserved
7	Missing value

0 08 086

Vertical significance for NWP

Bit No.	
1	Model “ground” surface
2	Standard level
3	Tropopause level
4	Maximum wind level
5	Significant temperature level
6	Significant humidity level
7	Significant wind level
8	Vertically interpolated level (This should be set to 1 for points on the vertical profile that fall between the model’s native vertical levels.)
9	Virtual station height
10–11	Reserved
All 12	Missing value

0 10 063

Characteristic of pressure tendency

Code figure		
0	Increasing, then decreasing; atmospheric pressure the same or higher than three hours ago	
1	Increasing, then steady; or increasing, then increasing more slowly	Atmospheric pressure now higher than three hours ago
2	Increasing (steadily or unsteadily)	
3	Decreasing or steady, then increasing; or increasing, then increasing more rapidly	
4	Steady; atmospheric pressure the same as three hours ago	
5	Decreasing, then increasing; atmospheric pressure the same or lower than three hours ago	
6	Decreasing, then steady; or decreasing, then decreasing more slowly	Atmospheric pressure now lower than three hours ago
7	Decreasing (steadily or unsteadily)	
8	Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly	
9–14	Reserved	
15	Missing value	

Notes:

(1) In reports from automatic stations, code figure 2 shall be used when tendency is positive, 7 when negative, and 4 when pressure is the same as three hours before.

(2) In reports from tropical stations reporting 24-hour pressure changes, code figure 2 shall be used when tendency is positive, 7 when negative, and 4 when pressure is the same as 24 hours before.

0 10 064

SIGMET cruising level

Code figure	
0	Subsonic
1	Transonic
2	Supersonic
3–6	Reserved
7	Missing value

0 11 030

Extended degree of turbulence

Code figure		
0	Nil	in cloud
1	Light	in cloud
2	Moderate	in cloud
3	Severe	in cloud
4	Nil	in clear air
5	Light	in clear air
6	Moderate	in clear air
7	Severe	in clear air
8	Nil	cloud/clear air not specified
9	Light	cloud/clear air not specified
10	Moderate	cloud/clear air not specified
11	Severe	cloud/clear air not specified
12	Extreme, in clear air	
13	Extreme, in cloud	
14	Extreme, cloud/clear air not specified	
15	Light, isolated moderate	
16	Light, occasional moderate	
17	Light, frequently moderate	
18	Moderate, isolated severe	
19	Moderate, occasional severe	
20	Moderate, frequently severe	
21	Severe, isolated extreme	
22	Severe, occasional extreme	
23	Severe, frequently extreme	
24–62	Reserved	
63	Missing value	

0 11 031

Degree of turbulence

Code figure		
0	Nil	in cloud
1	Light	in cloud
2	Moderate	in cloud
3	Severe	in cloud
4	Nil	in clear air
5	Light	in clear air
6	Moderate	in clear air
7	Severe	in clear air
8	Nil	cloud/clear air not specified
9	Light	cloud/clear air not specified
10	Moderate	cloud/clear air not specified
11	Severe	cloud/clear air not specified

(continued)

(Code table 0 11 031 – continued)

Code figure	
12	Extreme, in clear air
13	Extreme, in cloud
14	Extreme, cloud/clear air not specified
15	Missing value

0 11 037

Turbulence index

Code figure	Average value of eddy dissipation rate (ave) ($m^{2/3}$ s^{-1})	Peak value of eddy dissipation rate (peak) ($m^{2/3}$ s^{-1})
0	ave < 0.1	peak < 0.1
1	ave < 0.1	0.1 <= peak < 0.2
2	0.1 <= ave < 0.2	0.1 <= peak < 0.2
3	ave < 0.1	0.2 <= peak < 0.3
4	0.1 <= ave < 0.2	0.2 <= peak < 0.3
5	0.2 <= ave < 0.3	0.2 <= peak < 0.3
6	ave < 0.1	0.3 <= peak < 0.4
7	0.1 <= ave < 0.2	0.3 <= peak < 0.4
8	0.2 <= ave < 0.3	0.3 <= peak < 0.4
9	0.3 <= ave < 0.4	0.3 <= peak < 0.4
10	ave < 0.1	0.4 <= peak < 0.5
11	0.1 <= ave < 0.2	0.4 <= peak < 0.5
12	0.2 <= ave < 0.3	0.4 <= peak < 0.5
13	0.3 <= ave < 0.4	0.4 <= peak < 0.5
14	0.4 <= ave < 0.5	0.4 <= peak < 0.5
15	ave < 0.1	0.5 <= peak < 0.8
16	0.1 <= ave < 0.2	0.5 <= peak < 0.8
17	0.2 <= ave < 0.3	0.5 <= peak < 0.8
18	0.3 <= ave < 0.4	0.5 <= peak < 0.8
19	0.4 <= ave < 0.5	0.5 <= peak < 0.8
20	0.5 <= ave < 0.8	0.5 <= peak < 0.8
21	ave < 0.1	0.8 <= peak
22	0.1 <= ave < 0.2	0.8 <= peak
23	0.2 <= ave < 0.3	0.8 <= peak
24	0.3 <= ave < 0.4	0.8 <= peak
25	0.4 <= ave < 0.5	0.8 <= peak
26	0.5 <= ave < 0.8	0.8 <= peak
27	0.8 <= ave	0.8 <= peak
28	Nil	Nil
29–62	Reserved	Reserved
63	Missing value	Missing value

0 11 038

Time of occurrence of peak eddy dissipation rate

Code figure	Minutes prior to observation time (min)
0	min < 1
1	1 <= min < 2
2	2 <= min < 3
3	3 <= min < 4
4	4 <= min < 5
5	5 <= min < 6
6	6 <= min < 7
7	7 <= min < 8
8	8 <= min < 9
9	9 <= min < 10
10	10 <= min < 11
11	11 <= min < 12
12	12 <= min < 13
13	13 <= min < 14
14	14 <= min < 15
15	No timing information available
16–30	Reserved
31	Missing value

0 11 039

Extended time of occurrence of peak eddy dissipation rate

Code figure	Minutes prior to observation time (min)
0	min < 1
1	1 <= min < 2
2	2 <= min < 3
3	3 <= min < 4
4	4 <= min < 5
5	5 <= min < 6
6	6 <= min < 7
7	7 <= min < 8
8	8 <= min < 9
9	9 <= min < 10
10	10 <= min < 11
11	11 <= min < 12
12	12 <= min < 13
13	13 <= min < 14
14	14 <= min < 15
15–59	As above to 59 <=min < 60
60	No timing information available
61–62	Reserved
63	Missing value

0 13 038

Superadiabatic indicator

Code figure	
0	Not superadiabatic
1	Superadiabatic
2	Reserved
3	Missing value

0 13 039

Terrain type (ice/snow)

Code figure	
0	Sea ice
1	Snow on land
2–6	Reserved
7	Missing value

0 13 040

Surface flag

Code figure	
0	Land
1	Reserved
2	Near coast
3	Ice
4	Possible ice
5	Ocean
6	Coast
7–14	Reserved
15	Missing value

0 13 041

Pasquill-Gifford stability category

Code figure	
1	A
2	A – B
3	B
4	B – C
5	C
6	D
7	E
8	F
9	G
10–14	Reserved
15	Missing value

0 13 051

Frequency group, precipitation

Code figure	
0	Smaller than any value in the 30-year period
1	In the first quintile
2	In the second quintile
3	In the third quintile
4	In the fourth quintile
5	In the fifth quintile
6	Greater than any value in the 30-year period
7–14	Reserved
15	Missing value

0 13 056

Character and intensity of precipitation

Code figure	
0	No precipitation
1	Light intermittent
2	Moderate intermittent
3	Heavy intermittent
4	Very heavy intermittent
5	Light continuous
6	Moderate continuous
7	Heavy continuous
8	Very heavy continuous
9	Variable – alternatively light and heavy
10–14	Reserved
15	Missing value

0 13 057

Time of beginning or end of precipitation

Code figure	
0	No precipitation
1	Within the last hour
2	1 to 2 hours ago
3	2 to 3 hours ago
4	3 to 4 hours ago
5	4 to 5 hours ago
6	5 to 6 hours ago
7	6 to 8 hours ago
8	8 to 10 hours ago
9	More than 10 hours ago
10–14	Reserved
15	Missing value

0 15 025

Type of pollutant

Code figure	
0	Ozone
1–10	Reserved
11	Fine particulate matter (diameter < 2.5 microns)
12	Fine particulate matter (diameter < 10 microns)
13–14	Reserved
15	Missing value

0 19 001

Type of synoptic feature

Code figure	
0	Depression or low (extratroplcal)
1	Tropical depression
2	Tropical storm
3	Severe tropical storm
4	Typhoon
5–9	Reserved
10	Dust/sandstorm
11–62	Reserved
63	Missing value

Note: New local names for storm of various strengths shall be added as necessary.

0 19 008

Vertical extent of circulation

Code figure	
0	Reserved
1	Shallow (top of circulation below 700-hPa level)
2	Medium (top between 700-hPa and 400-hPa level)
3	Deep (top above 400-hPa level)
4–6	Reserved
7	Missing value

0 19 010

Method for tracking the centre of synoptic feature

Code figure	
1	Minimum value of sea level pressure
2	Maximum value of 850 hPa relative vorticity
3–14	Reserved
15	Missing value

0 19 100

Time interval to calculate the movement of the tropical cyclone

Code figure	
0–2	Not used
3	During the preceding 15 minutes
4	During the preceding 30 minutes
5	During the preceding 1 hour
6	During the preceding 2 hours
7	During the preceding 3 hours
8	During the preceding 6 hours
9	During a period of more than 6 hours
10	Undetermined
11–14	Not used
15	Missing value

0 19 101

Accuracy of the position of the centre of the tropical cyclone

Code figure	
0	Reserved
1	Eye visible on radar scope, accuracy good (within 10 km)
2	Eye visible on radar scope, accuracy fair (within 30 km)
3	Eye visible on radar scope, accuracy poor (within 50 km)
4	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy good (within 10 km)
5	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy fair (within 30 km)
6	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy poor (within 50 km)
7	Position of the centre outside the area covered by the radar scope, extrapolation by means of the spiral-band overlay
8–9	Reserved
10	Accuracy undetermined
11–14	Not used
15	Missing value

0 19 102

Shape and definition of the eye of the tropical cyclone

Code figure		
0	Circular	
1	Elliptical – the minor axis is at least 3/4 the length of the major axis	well defined
2	Elliptical – the minor axis is less than 3/4 the length of the major axis	well defined
3	Apparent double eye	well defined
4	Other shape	well defined
5	Ill defined	
6	Undetermined	
7	Missing value	

0 19 103

Diameter of major axis of the eye of the tropical cyclone

Code figure	
0	Less than 5 km
1	5 to less than 10 km
2	10 to less than 15 km
3	15 to less than 20 km
4	20 to less than 25 km
5	25 to less than 30 km
6	30 to less than 35 km
7	35 to less than 40 km
8	40 to less than 50 km
9	50 km and greater
10	Undetermined
11–14	Not used
15	Missing value

0 19 104

Change in character of the eye during the 30 minutes

Code figure	
0	Eye has first become visible during the past 30 minutes
1	No significant change in the characteristics or size of the eye
2	Eye has become smaller with no other significant change in characteristics
3	Eye has become larger with no other significant change in characteristics
4	Eye has become less distinct with no significant change in size
5	Eye has become less distinct and decreased in size
6	Eye has become less distinct and increased in size
7	Eye has become more distinct with no significant change in size
8	Eye has become more distinct and decreased in size
9	Eye has become more distinct and increased in size
10	Change in character and size of eye cannot be determined
11–14	Not used
15	Missing value

0 19 105

Distance between the end of spiral band and the centre

Code figure	
0	0 to less than 100 km
1	100 to less than 200 km
2	200 to less than 300 km
3	300 to less than 400 km
4	400 to less than 500 km
5	500 to less than 600 km
6	600 to less than 800 km
7	800 km or more
8–9	Reserved
10	Doubtful or undetermined
11–14	Not used
15	Missing value

0 19 107

Time interval over which the movement of the tropical cyclone has been calculated

Code figure	
0	Less than 1 hour
1	1 to less than 2 hours
2	2 to less than 3 hours
3	3 to less than 6 hours
4	6 to less than 9 hours
5	9 to less than 12 hours
6	12 to less than 15 hours
7	15 to less than 18 hours
8	18 to less than 21 hours
9	21 to less than 30 hours
10–14	Not used
15	Missing value

0 19 108

Accuracy of geographical position of the tropical cyclone

Code figure	
0	Cyclone centre within 10 km of the transmitted position
1	Cyclone centre within 20 km of the transmitted position
2	Cyclone centre within 50 km of the transmitted position
3	Cyclone centre within 100 km of the transmitted position
4	Cyclone centre within 200 km of the transmitted position
5	Cyclone centre within 300 km of the transmitted position
6	Cyclone centre undetermined
7	Missing value

0 19 109

Mean diameter of the overcast cloud of the tropical cyclone

Code figure	
0	Less than 1° of latitude
1	1° to less than 2° of latitude
2	2° to less than 3° of latitude
3	3° to less than 4° of latitude
4	4° to less than 5° of latitude
5	5° to less than 6° of latitude
6	6° to less than 7° of latitude
7	7° to less than 8° of latitude
8	8° to less than 9° of latitude
9	9° of latitude or more
10	Undetermined
11–14	Not used
15	Missing value

0 19 110

Apparent 24-hour change in intensity of the tropical cyclone

Code figure	
0	Much weakening
1	Weakening
2	No change
3	Intensification
4	Strong Intensification
5–8	Reserved
9	Not observed previously
10	Undetermined
11–14	Not used
15	Missing value

0 19 113

Cloud pattern type of the DT-number

Code figure	Type
1	Curved Band
2	Shear
3	Eye
4	Banding Eye
5	Central Dense Overcast (CDO)
6	Embedded Centre
7	Centre Cold Cover (CCC)
8–14	Reserved
15	Missing value

0 19 117

Cloud picture type of the PT-number

Code figure	Type
1	A (Curved Band)
2	B (CDO)
3	C (Shear)
4–6	Reserved
7	Missing value

0 19 119

Type of the final T-number

Code figure	Type
1	DT-number
2	PT-number
3	MET-number
4–6	Reserved
7	Missing value

0 20 003

Present weather

Code figure	
00–49	*No precipitation at the station at the time of observation*
00–19	No precipitation, fog, ice fog (except for 11 and 12), duststorm, sandstorm, drifting or blowing snow at the station* at the time of observation or, except for 09 and 17, during the preceding hour
00–03	No meteors except photometeors
00	Cloud development not observed or not observable } Characteristic change of the state of sky during the past hour
01	Clouds generally dissolving or becoming less developed } Characteristic change of the state of sky during the past hour
02	State of sky on the whole unchanged } Characteristic change of the state of sky during the past hour
03	Clouds generally forming or developing } Characteristic change of the state of sky during the past hour
04–09	Haze, dust, sand or smoke
04	Visibility reduced by smoke, e.g. veldt or forest fires, industrial smoke or volcanic ashes
05	Haze
06	Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation
07	Dust or sand raised by wind at or near the station at the time of observation, but no well-developed dust whirl(s) or sand whirl(s), and no duststorm or sandstorm seen; or, in the case of sea stations and coastal stations, blowing spray at the station
08	Well-developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the same time of observation, but no duststorm or sandstorm
09	Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour
10	Mist
11	Patches } shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 metres on land or 10 metres at sea
12	More or less continuous } shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 metres on land or 10 metres at sea
13	Lightning visible, no thunder heard
14	Precipitation within sight, not reaching the ground or the surface of the sea
15	Precipitation within sight, reaching the ground or the surface of the sea, but distant, i.e. estimated to be more than 5 km from the station
16	Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station
17	Thunderstorm, but no precipitation at the time of observation
18	Squalls } at or within sight of the station during the preceding hour or at the time of observation
19	Funnel cloud(s)** } at or within sight of the station during the preceding hour or at the time of observation
20–29	Precipitation, fog, ice fog or thunderstorm at the station during the preceding hour but not at the time of observation
20	Drizzle (not freezing) or snow grains } not falling as shower(s)
21	Rain (not freezing) } not falling as shower(s)
22	Snow } not falling as shower(s)
23	Rain and snow or ice pellets } not falling as shower(s)
24	Freezing drizzle or freezing rain } not falling as shower(s)
25	Shower(s) of rain

* The expression "at the station" refers to a land station or a ship.

** Tornado cloud or waterspout.

(continued)

(Code table 0 20 003 – continued)

Code figure		
26	Shower(s) of snow, or of rain and snow	
27	Shower(s) of hail*, or of rain and hail*	
28	Fog or ice fog	
29	Thunderstorm (with or without precipitation)	
30–39	Duststorm, sandstorm, drifting or blowing snow	
30	Slight or moderate duststorm or sandstorm	– has decreased during the preceding hour
31	Slight or moderate duststorm or sandstorm	– no appreciable change during the preceding hour
32	Slight or moderate duststorm or sandstorm	– has begun or has increased during the preceding hour
33	Severe duststorm or sandstorm	– has decreased during the preceding hour
34	Severe duststorm or sandstorm	– no appreciable change during the preceding hour
35	Severe duststorm or sandstorm	– has begun or has increased during the preceding hour
36	Slight or moderate drifting snow	generally low (below eye level)
37	Heavy drifting snow	generally low (below eye level)
38	Slight or moderate blowing snow	generally high (above eye level)
39	Heavy blowing snow	generally high (above eye level)
40–49	Fog or ice fog at the time of observation	
40	Fog or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer	
41	Fog or ice fog in patches	
42	Fog or ice fog, sky visible	has become thinner during the preceding hour
43	Fog or ice fog, sky invisible	has become thinner during the preceding hour
44	Fog or ice fog, sky visible	no appreciable change during the preceding hour
45	Fog or ice fog, sky invisible	no appreciable change during the preceding hour
46	Fog or ice fog, sky visible	has begun or has become thicker during the preceding hour
47	Fog or ice fog, sky invisible	has begun or has become thicker during the preceding hour
48	Fog, depositing rime, sky visible	
49	Fog, depositing rime, sky invisible	
50–99	*Precipitation at the station at the time of observation*	
50–59	Drizzle	
50	Drizzle, not freezing, intermittent	slight at time of observation
51	Drizzle, not freezing, continuous	slight at time of observation
52	Drizzle, not freezing, intermittent	moderate at time of observation
53	Drizzle, not freezing, continuous	moderate at time of observation
54	Drizzle, not freezing, intermittent	heavy (dense) at time of observation
55	Drizzle, not freezing, continuous	heavy (dense) at time of observation
56	Drizzle, freezing, slight	

* Hail, small hail, snow pellets.

(continued)

(Code table 0 20 003 – continued)

Code figure			
57	Drizzle, freezing, moderate or heavy (dense)		
58	Drizzle and rain, slight		
59	Drizzle and rain, moderate or heavy		
60–69	Rain		
60	Rain, not freezing, intermittent	slight at time of observation	
61	Rain, not freezing, continuous		
62	Rain, not freezing, intermittent	moderate at time of observation	
63	Rain, not freezing, continuous		
64	Rain, not freezing, intermittent	heavy at time of observation	
65	Rain, not freezing, continuous		
66	Rain, freezing, slight		
67	Rain, freezing, moderate or heavy		
68	Rain or drizzle and snow, slight		
69	Rain or drizzle and snow, moderate or heavy		
70–79	Solid precipitation not in showers		
70	Intermittent fall of snowflakes	slight at time of observation	
71	Continuous fall of snowflakes		
72	Intermittent fall of snowflakes	moderate at time of observation	
73	Continuous fall of snowflakes		
74	Intermittent fall of snowflakes	heavy at time of observation	
75	Continuous fall of snowflakes		
76	Diamond dust (with or without fog)		
77	Snow grains (with or without fog)		
78	Isolated star-like snow crystals (with or without fog)		
79	Ice pellets		
80–99	Showery precipitation, or precipitation with current or recent thunderstorm		
80	Rain shower(s), slight		
81	Rain shower(s), moderate or heavy		
82	Rain shower(s), violent		
83	Shower(s) of rain and snow mixed, slight		
84	Shower(s) of rain and snow mixed, moderate or heavy		
85	Snow shower(s), slight		
86	Snow shower(s), moderate or heavy		
87	Shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed	– slight	
88	Shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed	– moderate or heavy	
89	Shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder	– slight	
90	Shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder	– moderate or heavy	
91	Slight rain at time of observation		Thunderstorm during the preceding hour but not at time of observation
92	Moderate or heavy rain at time of observation		
93	Slight snow, or rain and snow mixed or hail* at time of observation		
94	Moderate or heavy snow, or rain and snow mixed or hail* at time of observation		

* Hail, small hail, snow pellets.

(continued)

(Code table 0 20 003 – continued)

Code figure		
95	Thunderstorm, slight or moderate, without hail*, but with rain and/or snow at time of observation	Thunderstorm at time of observation
96	Thunderstorm, slight or moderate, with hail* at time of observation	
97	Thunderstorm, heavy, without hail*, but with rain and/or snow at time of observation	
98	Thunderstorm combined with duststorm or sandstorm at time of observation	
99	Thunderstorm, heavy, with hail* at time of observation	
	Present weather reported from an automatic weather station	
100	No significant weather observed	
101	Clouds generally dissolving or becoming less developed during the past hour	
102	State of sky on the whole unchanged during the past hour	
103	Clouds generally forming or developing during the past hour	
104	Haze or smoke, or dust in suspension in the air, visibility equal to, or greater than, 1 km	
105	Haze or smoke, or dust in suspension in the air, visibility less than 1 km	
106–109	Reserved	
110	Mist	
111	Diamond dust	
112	Distant lightning	
113–117	Reserved	
118	Squalls	
119	Reserved	
	Code figures 120–126 are used to report precipitation, fog (or ice fog) or thunderstorm at the station during the preceding hour but not at the time of observation	
120	Fog	
121	PRECIPITATION	
122	Drizzle (not freezing) or snow grains	
123	Rain (not freezing)	
124	Snow	
125	Freezing drizzle or freezing rain	
126	Thunderstorm (with or without precipitation)	
127	BLOWING OR DRIFTING SNOW OR SAND	
128	Blowing or drifting snow or sand, visibility equal to, or greater than, 1 km	
129	Blowing or drifting snow or sand, visibility less than 1 km	
130	FOG	
131	Fog or ice fog in patches	
132	Fog or ice fog, has become thinner during the past hour	
133	Fog or ice fog, no appreciable change during the past hour	
134	Fog or ice fog, has begun or become thicker during the past hour	
135	Fog, depositing rime	
136–139	Reserved	

*Hail, small hail, snow pellets.

(continued)

(Code table 0 20 003 – continued)

Code figure	
140	PRECIPITATION
141	Precipitation, slight or moderate
142	Precipitation, heavy
143	Liquid precipitation, slight or moderate
144	Liquid precipitation, heavy
145	Solid precipitation, slight or moderate
146	Solid precipitation, heavy
147	Freezing precipitation, slight or moderate
148	Freezing precipitation, heavy
149	Reserved
150	DRIZZLE
151	Drizzle, not freezing, slight
152	Drizzle, not freezing, moderate
153	Drizzle, not freezing, heavy
154	Drizzle, freezing, slight
155	Drizzle, freezing, moderate
156	Drizzle, freezing, heavy
157	Drizzle and rain, slight
158	Drizzle and rain, moderate or heavy
159	Reserved
160	RAIN
161	Rain, not freezing, slight
162	Rain, not freezing, moderate
163	Rain, not freezing, heavy
164	Rain, freezing, slight
165	Rain, freezing, moderate
166	Rain, freezing, heavy
167	Rain (or drizzle) and snow, slight
168	Rain (or drizzle) and snow, moderate or heavy
169	Reserved
170	SNOW
171	Snow, slight
172	Snow, moderate
173	Snow, heavy
174	Ice pellets, slight
175	Ice pellets, moderate
176	Ice pellets, heavy
177	Snow grains
178	Ice crystals
179	Reserved
180	SHOWER(S) OR INTERMITTENT PRECIPITATION
181	Rain shower(s) or intermittent rain, slight
182	Rain shower(s) or intermittent rain, moderate
183	Rain shower(s) or intermittent rain, heavy

(continued)

(Code table 0 20 003 – continued)

Code figure	
184	Rain shower(s) or intermittent rain, violent
185	Snow shower(s) or intermittent snow, slight
186	Snow shower(s) or intermittent snow, moderate
187	Snow shower(s) or intermittent snow, heavy
188	Reserved
189	Hail
190	THUNDERSTORM
191	Thunderstorm, slight or moderate, with no precipitation
192	Thunderstorm, slight or moderate, with rain showers and/or snow showers
193	Thunderstorm, slight or moderate, with hail
194	Thunderstorm, heavy, with no precipitation
195	Thunderstorm, heavy, with rain showers and/or snow showers
196	Thunderstorm, heavy, with hail
197–198	Reserved
199	Tornado
	Present weather (in addition to present weather report from either a manned or an automatic station)
Decile 200–209	
200–203	Not used
204	Volcanic ash suspended in the air aloft
205	Not used
206	Thick dust haze, visibility less than 1 km
207	Blowing spray at the station
208	Drifting dust (sand)
209	Wall of dust or sand in distance (like haboob)
Decile 210–219	
210	Snow haze
211	Whiteout
212	Not used
213	Lightning, cloud to surface
214–216	Not used
217	Dry thunderstorm
218	Not used
219	Tornado cloud (destructive) at or within sight of the station during preceding hour or at the time of observation
Decile 220–229	
220	Deposition of volcanic ash
221	Deposition of dust or sand
222	Deposition of dew
223	Deposition of wet snow
224	Deposition of soft rime
225	Deposition of hard rime

(continued)

(Code table 0 20 003 – continued)

Code figure		
226	Deposition of hoar frost	
227	Deposition of glaze	
228	Deposition of ice crust (ice slick)	
229	Not used	
Decile 230–239		
230	Duststorm or sandstorm with temperature below 0 °C	
231–238	Not used	
239	Blowing snow, impossible to determine whether snow is falling or not	
Decile 240–249		
240	Not used	
241	Fog on sea	
242	Fog in valleys	
243	Arctic or Antarctic sea smoke	
244	Steam fog (sea, lake or river)	
245	Steam log (land)	
246	Fog over ice or snow cover	
247	Dense fog, visibility 60–90 m	
248	Dense fog, visibility 30–60 m	
249	Dense fog, visibility less than 30 m	
Decile 250–259		
250	Drizzle, rate of fall	less than 0.10 mm h^{-1}
251	Drizzle, rate of fall	0.10–0.19 mm h^{-1}
252	Drizzle, rate of fall	0.20–0.39 mm h^{-1}
253	Drizzle, rate of fall	0.40–0.79 mm h^{-1}
254	Drizzle, rate of fall	0.80–1.59 mm h^{-1}
255	Drizzle, rate of fall	1.60–3.19 mm h^{-1}
256	Drizzle, rate of fall	3.20–6.39 mm h^{-1}
257	Drizzle, rate of fall	6.4 mm h^{-1} or more
258	Not used	
259	Drizzle and snow	
Decile 260–269		
260	Rain, rate of fall	less than 1.0 mm h^{-1}
261	Rain, rate of fall	1.0–1.9 mm h^{-1}
262	Rain, rate of fall	2.0– 3.9 mm h^{-1}
263	Rain, rate of fall	4.0– 7.9 mm h^{-1}
264	Rain, rate of fall	8.0–15.9 mm h^{-1}
265	Rain, rate of fall	16.0–31.9 mm h^{-1}
266	Rain, rate of fall	32.0–63.9 mm h^{-1}
267	Rain, rate of fall	64.0 mm h^{-1} or more
268–269	Not used	

(continued)

(Code table 0 20 003 – continued)

Code figure

Decile 270–279

270		less than 1.0 cm h^{-1}
271		1.0–1.9 cm h^{-1}
272		2.0–3.9 cm h^{-1}
273		4.0–7.9 cm h^{-1}
274	Snow, rate of fall	8.0–15.9 cm h^{-1}
275		16.0–31.9 cm h^{-1}
276		32.0–63.9 cm h^{-1}
277		64.0 cm h^{-1} or more
278	Snow or ice crystal precipitation from a clear sky	
279	Wet snow, freezing on contact	

Decile 280–289

280	Precipitation of rain
281	Precipitation of rain, freezing
282	Precipitation of rain and snow mixed
283	Precipitation of snow
284	Precipitation of snow pellets or small hall
285	Precipitation of snow pellets or small hail, with rain
286	Precipitation of snow pellets or small hail, with rain and snow mixed
287	Precipitation of snow pellets or small hail, with snow
288	Precipitation of hail
289	Precipitation of hail, with rain
290	Precipitation of hall, with rain and snow mixed
291	Precipitation of hail, with snow
292	Shower(s) or thunderstorm over sea
293	Shower(s) or thunderstorm over mountains
294–299	Not used
300–507	Reserved
508	No significant phenomenon to report, present and past weather omitted
509	No observation, data not available, present and past weather omitted
510	Present and past weather missing, but expected
511	Missing value

Notes:

(1) The middle portion of this code table (code figures 100–199) includes terms on several levels to cover simple and increasingly complex automatic stations.

(2) Generic terms for weather (e.g. fog, drizzle) are intended for use at automatic stations capable of determining types of weather but no other information. Generic terms are included in the code table using all capital letters.

(3) Code figures for generic precipitation (code figures 140–148) are arranged in order of increasing complexity. For example, a very simple station that can sense only the presence or absence of precipitation would use code figure 140 (precipitation). At the next level, an automatic station capable of sensing amount but not type would use code figure 141 or 142. An automatic station capable of sensing gross type (liquid, solid, freezing) and amount would use code figures 143–148. An automatic station capable of reporting actual types of precipitation (e.g. drizzle rain), but not the amount, would use the appropriate whole decile number (e.g. 150 for generic drizzle, 160 for generic rain).

0 20 004/0 20 005

Past weather (1) and (2)

Code figure	
0	Cloud covering 1/2 or less of the sky throughout the appropriate period
1	Cloud covering more than 1/2 of the sky during part of the appropriate period and covering 1/2 or less during part of the period
2	Cloud covering more than 1/2 of the sky throughout the appropriate period
3	Sandstorm, duststorm or blowing snow
4	Fog or ice fog or thick haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed
8	Shower(s)
9	Thunderstorm(s) with or without precipitation
10	No significant weather observed
11	VISIBILITY REDUCED (see Note)
12	Blowing phenomena, visibility reduced
13	FOG (see Note)
14	PRECIPITATION (see Note)
15	Drizzle
16	Rain
17	Snow or ice pellets
18	Showers or intermittent precipitation
19	Thunderstorm
20–30	Reserved
31	Missing value

Note: The weather descriptions in code figures 10 to 19 are progressively complex, to accommodate the different levels of weather discrimination capability of various automatic stations. Stations having only basic sensing capability may use the lower code figures and basic generic descriptions (shown in capital letters). Stations with progressively higher discrimination capability shall use the more detailed descriptions (higher codes).

0 20 006

Flight rules

Code figure	
0	Low instrument flight rules – Ceiling < 500 feet and/or visibility < 1 mile
1	Instrument flight rules – Ceiling < 1000 feet and/or visibility < 3 miles
2	Marginal visual flight rules – 1000 feet <= Ceiling < 3000 feet and/or 3 miles <= visibility < 5 miles
3	Visual flight rules – Ceiling => 3000 feet and/or visibility => 5 miles
4–6	Reserved
7	Missing value

0 20 008

Cloud distribution for aviation

Code figure		
0	Sky clear	
1	Few	
2	Scattered	
3	Broken	
4	Overcast	
5	Reserved	
6	Scattered/broken	(Many forecasts use scattered/broken or broken/overcast
7	Broken/overcast	followed by cloud type(s))
8	Isolated	(Used on aviation charts to describe the cloud type Cb)
9	Isolated embedded	(Used on aviation charts to describe the cloud type Cb)
10	Occasional	(Used on aviation charts to describe the cloud type Cb)
11	Occasional embedded	(Used on aviation charts to describe the cloud type Cb)
12	Frequent	(Used on aviation charts to describe the cloud type Cb)
13	Dense	(Used on aviation charts to describe cloud that would cause sudden changes in visibility (less than 1 000 m))
14	Layers	
15	Obscured (OBSC)	
16	Embedded (EMBD)	
17	Frequent embedded	
18–30	Reserved	
31	Missing value	

0 20 009

General weather indicator (TAF/METAR)

Code figure	
0	Reserved
1	NSC Nil Significant Cloud
2	CAVOK
3	SKC Sky Clear
4	NSW Nil Significant Weather
5–14	Reserved
15	Missing value

0 20 011

Cloud amount

Code figure		
0	0	0
1	1 okta or less, but not zero	1/10 or less, but not zero
2	2 oktas	2/10 – 3/10
3	3 oktas	4/10
4	4 oktas	5/10

(continued)

(Code table 0 20 011 – continued)

Code figure		
5	5 oktas	6/10
6	6 oktas	7/10 – 8/10
7	7 oktas or more, but not 8 oktas	9/10 or more, but not 10/10
8	8 oktas	10/10
9	Sky obscured by fog and/or other meteorological phenomena	
10	Sky partially obscured by fog and/or other meteorological phenomena	
11	Scattered	
12	Broken	
13	Few	
14	Reserved	
15	Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made	

Notes:

(1) For use of code figure 15, see Regulation 12.1.4.

(2) “Clear” and “overcast” are coded by 0 and 8, respectively.

0 20 012

Cloud type

Code figure	
0	Cirrus (Ci)
1	Cirrocumulus (Cc)
2	Cirrostratus (Cs)
3	Altocumulus (Ac)
4	Altostratus (As)
5	Nimbostratus (Ns)
6	Stratocumulus (Sc)
7	Stratus (St)
8	Cumulus (Cu)
9	Cumulonimbus (Cb)
10	No C_H clouds
11	Cirrus fibratus, sometimes uncinus, not progressively invading the sky
12	Cirrus spissatus, in patches or entangled sheaves, which usually do not increase and sometimes seem to be the remains of the upper part of a Cumulonimbus; or Cirrus castellanus or floccus
13	Cirrus spissatus cumulonimbogenitus
14	Cirrus uncinus or fibratus, or both, progressively invading the sky; they generally thicken as a whole
15	Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively invading the sky; they generally thicken as a whole, but the continuous veil does not reach 45 degrees above the horizon
16	Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively Invading the sky; they generally thicken as a whole; the continuous veil extends more than 45 degrees above the horizon, without the sky being totally covered
17	Cirrostratus covering the whole sky

(continued)

(Code table 0 20 012 – continued)

Code figure	
18	Cirrostratus not progressively invading the sky and not entirely covering it
19	Cirrocumulus alone, or Cirrocumulus predominant among the C_H clouds
20	No C_M clouds
21	Altostratus translucidus
22	Altostratus opacus or Nimbostratus
23	Altocumulus translucidus at a single level
24	Patches (often lenticular) of Altocumulus translucidus, continually changing and occurring at one or more levels
25	Altocumulus translucidus in bands, or one or more layers of Altocumulus translucidus or opacus, progressively invading the sky; these Altocumulus clouds generally thicken as a whole
26	Altocumulus cumulogenitus (or cumulonimbogenitus)
27	Altocumulus translucidus or opacus in two or more layers, or Altocumulus opacus in a single layer, not progressively invading the sky, or Altocumulus with Altostratus or Nimbostratus
28	Altocumulus castellanus or floccus
29	Altocumulus of a chaotic sky, generally at several levels
30	No C_L clouds
31	Cumulus humilis or Cumulus fractus other than of bad weather,* or both
32	Cumulus mediocris or congestus, Towering cumulus (TCU), with or without Cumulus of species fractus or humilis or Stratocumulus, all having their bases at the same level
33	Cumulonimbus calvus, with or without Cumulus, Stratocumulus or Stratus
34	Stratocumulus cumulogenitus
35	Stratocumulus other than Stratocumulus cumulogenitus
36	Stratus nebulosus or Stratus fractus other than of bad weather,* or both
37	Stratus fractus or Cumulus fractus of bad weather,* or both (pannus), usually below Altostratus or Nimbostratus
38	Cumulus and Stratocumulus other than Stratocumulus cumulogenitus, with bases at different levels
39	Cumulonimbus capillatus (often with an anvil), with or without Cumulonimbus calvus, Cumulus, Stratocumulus, Stratus or pannus
40	C_H
41	C_M
42	C_L
43–58	Reserved
59	Cloud not visible owing to darkness, fog, duststorm, sandstorm, or other analogous phenomena
60	C_H clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena, or because of a continuous layer of lower clouds
61	C_M clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena, or because of continuous layer of lower clouds
62	C_L clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena
63	Missing value

* "Bad weather" denotes the conditions which generally exist during precipitation and a short time before and after.

0 20 017

Cloud top description

Code figure		
0	Isolated cloud fragments of clouds	
1	Continuous cloud	flat tops
2	Broken cloud – small breaks	flat tops
3	Broken cloud – large breaks	flat tops
4	Continuous cloud	undulating tops
5	Broken cloud – small breaks	undulating tops
6	Broken cloud – large breaks	undulating tops
7	Continuous or almost continuous waves with towering clouds above the top of the layer	
8	Groups of waves with towering clouds above the top of the layer	
9	Two or more layers at different levels	
10–14	Reserved	
15	Missing value	

0 20 018

Tendency of runway visual range

Code figure	
0	Increasing (U)
1	Decreasing (D)
2	No distinct change (N)
3	Missing value

0 20 021

Type of precipitation

Bit No.	
1	Precipitation – unknown type
2	Liquid precipitation not freezing
3	Liquid freezing precipitation
4	Drizzle
5	Rain
6	Solid precipitation
7	Snow
8	Snow grains
9	Snow pellets
10	Ice pellets
11	Ice crystals
12	Diamond dust
13	Small hail

(continued)

(Flag table 0 20 021 – continued)

Bit No.	
14	Hail
15	Glaze
16	Rime
17	Soft rime
18	Hard rime
19	Clear ice
20	Wet snow
21	Hoar frost
22	Dew
23	White dew
24–29	Reserved
All 30	Missing value

Note: Mixed precipitation is indicated by setting to one the bits of all the observed single types of precipitation.

0 20 022

Character of precipitation

Code figure	
0	No precipitation
1	Continuous
2	Intermittent
3	Shower
4	Not reaching ground
5	Deposition
6–14	Reserved
15	Missing value

0 20 023

Other weather phenomena

Bit No.	
1	Dust/sand whirl
2	Squalls
3	Sandstorm
4	Duststorm
5	Lightning – cloud to surface
6	Lightning – cloud to cloud
7	Lightning – distant
8	Thunderstorm

(continued)

(Flag table 0 20 023 – continued)

Bit No.	
9	Funnel cloud not touching surface
10	Funnel cloud touching surface
11	Spray
12	Waterspout
13	Wind shear
14	Dust devils
15–17	Reserved
All 18	Missing value

0 20 024

Intensity of phenomena

Code figure	
0	No phenomena
1	Light
2	Moderate
3	Heavy
4	Violent
5	Severe
6	Very severe
7	Missing value

0 20 025

Obscuration

Bit No.	
1	Fog
2	Ice fog
3	Steam fog
4–6	Reserved
7	Mist
8	Haze
9	Smoke
10	Volcanic ash
11	Dust
12	Sand
13	Snow
14	Cloud
15	Precipitation
16	Impossible to determine whether snow is falling or not
17–20	Reserved
All 21	Missing value

0 20 026

Character of obscuration

Code figure	
0	No change
1	Shallow
2	Patches
3	Partial
4	Freezing
5	Low drifting
6	Blowing
7	Increasing
8	Decreasing
9	In suspension in the air
10	Wall
11	Dense
12	Whiteout
13	Drifting and blowing
14	Reserved
15	Missing value

0 20 027

Phenomena occurrence*

Bit No.	
1	At time of observation
2	In past hour
3	In time period for past weather W_1W_2
4	In time period specified
5	Reserved
6	Below station level
7	At the station (see Note 1)
8	In the vicinity (see Note 2)
All 9	Missing value

* Phenomenon in this flag table means any phenomenon, including precipitation and obscuration.

Notes:

(1) In conjunction with the observation of waterspouts or funnel clouds, i.e., within 3 km of the station.

(2) In conjunction with the observation of waterspouts or funnel clouds, i.e., more than 3 km from the station.

0 20 028

Expected change in intensity

Code figure	
0	No change (NC)
1	Forecast to weaken (WKN)
2	Forecast to intensify (INTSF)
3–6	Reserved
7	Missing value

0 20 029

Rain flag

Code figure	
0	No rain
1	Rain
2	Reserved
3	Missing value

0 20 032

Rate of ice accretion (estimated)

Code figure	
0	Ice not building up
1	Ice building up slowly
2	Ice building up rapidly
3	Ice melting or breaking up slowly
4	Ice melting or breaking up rapidly
5–6	Reserved
7	Missing value

0 20 033

Cause of ice accretion

Bit No.	
1	Icing from ocean spray
2	Icing from fog
3	Icing from rain
All 4	Missing value

0 20 034

Sea ice concentration

Code figure			
0	No sea ice in sight		
1	Ship in open lead more than 1.0 nautical mile wide, or ship in fast ice with boundary beyond limit of visibility		
2	Sea ice present in concentrations less than 3/10 (3/8), open water or very open pack ice	Sea ice concentration is uniform in the observation area	Ship in ice or within 0.5 nautical mile of ice edge
3	4/10 to 6/10 (3/8 to less than 6/8), open pack ice		
4	7/10 to 8/10 (6/8 to less than 7/8), close pack ice		
5	9/10 or more, but not 10/10 (7/8 to less than 8/8), very close pack ice		
6	Strips and patches of pack ice with open water between	Sea ice concentration is not uniform in the observation area	
7	Strips and patches of close or very close pack ice with areas of lesser concentration between		
8	Fast ice with open water, very open or open pack ice to seaward of the ice boundary		
9	Fast ice with close or very close pack ice to seaward of the boundary		
10–13	Reserved		
14	Unable to report, because of darkness, lack of visibility, or because ship is more than 0.5 nautical mile away from ice edge		
15–30	Reserved		
31	Missing value		

0 20 035

Amount and type of ice

Code figure	
0	No ice of land origin
1	1–5 icebergs, no growlers or bergy bits
2	6–10 icebergs, no growlers or bergy bits
3	11–20 icebergs, no growlers or bergy bits
4	Up to and including 10 growlers and bergy bits – no icebergs
5	More than 10 growlers and bergy bits – no icebergs
6	1–5 icebergs, with growlers and bergy bits
7	6–10 icebergs, with growlers and bergy bits
8	11–20 icebergs, with growlers and bergy bits
9	More than 20 icebergs, with growlers and bergy bits – a major hazard to navigation
10–13	Reserved
14	Unable to report, because of darkness, lack of visibility or because only sea ice is visible
15	Missing value

0 20 036

Ice situation

Code figure	
0	Ship in open water with floating ice in sight
1	Ship in easily penetrable ice; conditions improving
2	Ship in easily penetrable ice; conditions not changing
3	Ship in easily penetrable ice; conditions worsening
4	Ship in ice difficult to penetrate; conditions improving
5	Ship in ice difficult to penetrate; conditions not changing
6	Ship in ice difficult to penetrate and conditions worsening. Ice forming and floes freezing together
7	Ship in ice difficult to penetrate and conditions worsening. Ice under slight pressure
8	Ship in ice difficult to penetrate and conditions worsening. Ice under moderate or severe pressure
9	Ship in ice difficult to penetrate and conditions worsening. Ship beset
10–29	Reserved
30	Unable to report, because of darkness or lack of visibility
31	Missing value

0 20 037

Ice development

Code figure	
0	New ice only (frazil ice, grease ice, slush, shuga)
1	Nilas or ice rind, less than 10 cm thick
2	Young ice (grey ice, grey-white ice), 10–30 cm thick
3	Predominantly new and/or young ice with some first-year ice
4	Predominantly thin first-year ice with some new and/or young ice
5	All thin first-year ice (30–70 cm thick)
6	Predominantly medium first-year ice (70–120 cm thick) and thick first-year ice (>120 cm thick) with some thinner (younger) first-year ice
7	All medium and thick first-year ice
8	Predominantly medium and thick first-year ice with some old ice (usually more than 2 metres thick)
9	Predominantly old ice
10–29	Reserved
30	Unable to report, because of darkness, lack of visibility or because only ice of land origin is visible or because ship is more than 0.5 nautical mile away from ice edge
31	Missing value

0 20 040

Evolution of drift snow

Code figure	
0	Drift snow ended before the hour of observation
1	Intensity diminishing
2	No change
3	Intensity increasing
4	Continues, apart from interruption lasting less than 30 minutes
5	General drift snow has become drift snow near the ground
6	Drift snow near the ground has become general drift snow
7	Drift snow has started again after an interruption of more than 30 minutes
8–14	Reserved
15	Missing value

0 20 041

Airframe icing

Code figure	
0	No icing
1	Light icing
2	Light icing in cloud
3	Light icing in precipitation
4	Moderate icing
5	Moderate icing in cloud
6	Moderate icing in precipitation
7	Severe icing
8	Severe icing in cloud
9	Severe icing in precipitation
10	Trace of icing
11	Trace of icing in cloud
12	Trace of icing in precipitation
13–14	Reserved
15	Missing value

0 20 042

Airframe icing present

Code figure	
0	No icing
1	Icing present
2	Reserved
3	Missing value

0 20 045

Supercooled large droplet (SLD) conditions

Code figure	
0	No SLD conditions present
1	SLD conditions present
2	Reserved
3	Missing value

0 20 048

Evolution of feature

Code figure	
0	Stability
1	Diminution
2	Intensification
3	Unknown
4–14	Reserved
15	Missing value

0 20 050

Cloud index

Code figure	
0	Reserved
1	1st low cloud
2	2nd low cloud
3	3rd low cloud
4	1st medium cloud
5	2nd medium cloud
6	3rd medium cloud
7	1st high cloud
8	2nd high cloud
9–254	Reserved
255	Missing value

0 20 055

State of sky in the tropics

Code figure	
0	Cumulus, if any, are quite small; generally less than 2/8 coverage, except on windward slopes of elevated terrain; average width of cloud is at least as great as its vertical thickness
1	Cumulus of intermediate size with cloud cover less than 5/8; average cloud width is more than its vertical thickness; towers are vertical with little or no evidence of precipitation, except along slopes of elevated terrain; a general absence of middle and upper clouds
2	Swelling Cumulus with rapidly growing tall turrets which decrease in size with height and whose tops tend to separate from the longer cloud body and evaporate within minutes of the separation
3	Swelling Cumulus with towers having a pronounced tilt in a downwind direction; vertical cloud thickness is more than one and a half times that of its average width
4	Swelling Cumulus with towers having a pronounced tilt in an upwind direction; vertical cloud thickness is more than one and a half times that of its average width
5	Tall Cumulus congestus with vertical thickness more than twice the average width; not organized in clusters or lines; one or more layers of clouds extend out from the cloud towers, although no continuous cloud layers exist (see Note)
6	Isolated Cumulonimbus or large clusters of Cumulus turrets separated by wide areas in which clouds are absent; cloud bases are generally dark with showers observed in most cells; some scattered middle and upper clouds may be present; individual Cumulus cells are one to two times higher than they are wide
7	Numerous Cumulus extending through the middle troposphere with broken to overcast sheets of middle clouds and/or Cirrostratus; Cumulus towers do not decrease generally in size with height; ragged dark cloud bases with some showers present
8	Continuous dense middle clouds and/or Cirrostratus cloud sheets with some large isolated Cumulonimbus or Cumulus congestus clouds penetrating these sheets; light rain occasionally observed from the Altostratus; Cumulonimbus bases ragged and dark with showers visible (see Note)
9	Continuous sheets of middle clouds and/or Cirrostratus with Cumulonimbus and Cumulus congestus in organized lines or cloud bands; rain is generally observed from Altostratus sheets and heavy showers from Cumulonimbus; wind has a squally character
10	State of sky unknown or not described by any of the above
11–14	Reserved
15	Missing value

Note: In the event of obscuration of clouds due to heavy rain, the observer should use code 5 or 8. Code 5 should be used if the rain is localized or is brief in duration; Code 8 should be used if the rain is widespread or lasts for longer periods of time.

0 20 056

Cloud phase

Code figure	
0	Unknown
1	Water
2	Ice
3	Mixed
4	Clear
5–6	Reserved
7	Missing value

0 20 062

State of the ground (with or without snow)

Code figure		
0	Surface of ground dry (without cracks and no appreciable amount of dust or loose sand)	
1	Surface of ground moist	
2	Surface of ground wet (standing water in small or large pools on surface)	
3	Flooded	
4	Surface of ground frozen	without snow or measurable ice cover
5	Glaze on ground	
6	Loose dry dust or sand not covering ground completely	
7	Thin cover of loose dry dust or sand covering ground completely	
8	Moderate or thick cover of loose dry dust or sand covering ground completely	
9	Extremely dry with cracks	
10	Ground predominantly covered by ice	
11	Compact or wet snow (with or without ice) covering less than one half of the ground	
12	Compact or wet snow (with or without ice) covering at least one half of the ground but ground not completely covered	
13	Even layer of compact or wet snow covering ground completely	
14	Uneven layer of compact or wet snow covering ground completely	with snow or measurable ice cover
15	Loose dry snow covering less than one half of the ground	
16	Loose dry snow covering at least one half of the ground but ground not completely covered	
17	Even layer of loose dry snow covering ground completely	
18	Uneven layer of loose dry snow covering ground completely	
19	Snow covering ground completely; deep drifts	
20–30	Reserved	
31	Missing value	

Notes:

(1) The definitions in code numbers 0 to 2 and 4 apply to representative bare ground and numbers 3, 5 to 9 and 10 to 19 to an open representative area.

(2) In all instances the highest code figures applicable are to be reported.

(3) In the above code table, whenever reference is made to ice, it also includes solid precipitation other than snow.

0 20 063

Special phenomena

Code figure	
0	Reserved
1	Highest wind speed gusts greater than 11.5 m/s
2	Highest mean wind speed greater than 17.5 m/s
3–6	Reserved
7	Visibility greater than 100 000 m
8–9	Reserved
	10–19 Mirage
10	Mirage – No specification
11	Mirage – Image of distant object raised (looming)
12	Mirage – Image of distant object raised clear above the horizon
13	Mirage – Inverted image of distant object
14	Mirage – Complex, multiple images of distant object (images not inverted)
15	Mirage – Complex, multiple images of distant object (some images being inverted)
16	Mirage – Sun or moon seen appreciably distorted
17	Mirage – Sun visible, although astronomically below the horizon
18	Mirage – Moon visible, although astronomically below the horizon
19	Reserved
	20–22 Day darkness, worst in direction specified
20	Day darkness, bad, worst in direction specified
21	Day darkness, very bad, worst in direction specified
22	Day darkness, black, worst in direction specified
23–30	Reserved
	31–39 Coloration and/or convergence of clouds associated with a tropical disturbance
31	Slight coloration of clouds at sunrise associated with a tropical disturbance
32	Deep-red coloration of clouds at sunrise associated with a tropical disturbance
33	Slight coloration of clouds at sunset associated with a tropical disturbance
34	Deep-red coloration of clouds at sunset associated with a tropical disturbance
35	Convergence of C_H clouds at a point below 45° forming or increasing and associated with a tropical disturbance
36	Convergence of C_H clouds at a point above 45° associated with a tropical disturbance
37	Convergence of C_H clouds at a point below 45° dissolving or diminishing and associated with a tropical disturbance
38	Convergence of C_H clouds at a point above 45° associated with a tropical disturbance
39	Reserved
	40–43 Hoar frost or coloured precipitation
40	Hoar frost on horizontal surfaces
41	Hoar frost on horizontal and vertical surfaces
42	Precipitation containing sand or desert dust
43	Precipitation containing volcanic ash
44–49	Reserved

(continued)

(Code table 0 20 063 – continued)

Code figure	
	50–59 Nature and/or type of squall
50	Calm or light wind followed by a squall
51	Calm or light wind followed by a succession of squalls
52	Gusty weather followed by a squall
53	Gusty weather followed by a succession of squalls
54	Squall followed by gusty weather
55	General gusty weather with squall at intervals
56	Squall approaching station
57	Line squall
58	Squall with drifting or blowing dust or sand
59	Line squall with drifting or blowing dust or sand
	60–69 Variation of temperature during the period specified, associated with glaze or rime
60	Temperature steady
61	Temperature falling, without going below 0°C
62	Temperature rising, without going above 0°C
63	Temperature falling to a value below 0°C
64	Temperature rising to a value above 0°C
65	Irregular variation, oscillations of temperature passing through 0°C
66	Irregular variation, oscillations of temperature not passing through 0°C
67	Variation of temperature not observed
68	Not allocated
69	Variation of temperature unknown owing to lack of thermograph
	70–79 Variation of visibility during the period specified
70	Visibility has not varied (sun* visible) towards direction specified
71	Visibility has not varied (sun* invisible) towards direction specified
72	Visibility has increased (sun* visible) towards direction specified
73	Visibility has increased (sun* invisible) towards direction specified
74	Visibility has decreased (sun* visible) towards direction specified
75	Visibility has decreased (sun* invisible) towards direction specified
76	Fog coming from direction specified
77	Fog has lifted, without dissipating
78	Fog has dispersed without regard to direction
79	Moving patches or banks of fog
	80–89 Optical phenomena
80	Brocken spectre
81	Rainbow
82	Solar or lunar halo
83	Parhelia or anthelia
84	Sun pillar
85	Corona
86	Twilight glow
87	Twilight glow on the mountains (Alpenglühen)
88	Mirage
89	Zodiacal light
90	St Elmo’s fire
91–1022	Reserved
1023	Missing value

* Or sky (if sun is low), or moon or stars at night.

0 20 071

Accuracy of fix and rate of atmospherics

Code figure	Accuracy of fix (estimated error)	Repetition rate
0	No assessment	No assessment
1	Less than 50 km	Less than 1 per second
2	Between 50 and 200 km	Less than 1 per second
3	More than 200 km	Less than 1 per second
4	Less than 50 km	1 or more per second
5	Between 50 and 200 km	1 or more per second
6	More than 200 km	1 or more per second
7	Less thank 50 km	Rate so rapid number cannot be counted
8	Between 50 and 200 km	Rate so rapid number cannot be counted
9	More than 200 km	Rate so rapid number cannot be counted
10–14	Reserved	
15	Missing value	

0 20 085

General condition of runway

Code figure	
0	Cleared (CLRD//)
1	All runways closed (SNOCLO)
2–14	Reserved
15	Missing value

0 20 086

Runway deposits

Code figure	
0	Clear and dry
1	Damp
2	Wet with water patches
3	Rime and frost covered (depth normally less than 1 mm)
4	Dry snow
5	Wet snow
6	Slush
7	Ice
8	Compacted or rolled snow
9	Frozen ruts or ridges
10–14	Reserved
15	Missing or not reported (e.g. due to runway clearance in progress)

0 20 087

Runway contamination

Code figure	
0	Reserved
1	Less than 10% of runway covered
2	11% to 25% of runway covered
3–4	Reserved
5	25% to 50% of runway covered
6–8	Reserved
9	51% to 100% of runway covered
10–14	Reserved
15	Missing or not reported (e.g. due to runway clearance in progress)

0 20 089

Runway friction coefficient

Code figure	
0	0.00
1	0.01
2–88	0.02…0.88
89	0.89
90	0.90
91	Braking action poor
92	Braking action medium to poor
93	Braking action medium
94	Braking action medium to good
95	Braking action good
96–98	Reserved
99	Unreliable
100–126	Reserved
127	Missing, not reported and/or runway not operational

0 20 090

Special clouds

Code figure	
0	Reserved
1	Nacreous clouds
2	Noctilucent clouds
3	Clouds from waterfalls
4	Clouds from fires
5	Clouds from volcanic eruptions
6–14	Reserved
15	Missing value

0 20 101

Locust (acridian) name

Code figure	
0	Reserved
1	Schistocerca gregaria
2	Locusta migratoria
3	Nomadacris septemfasciata
4	Oedaleus senegalensis
5	Anracridium spp
6	Other locusts
7	Other grasshoppers
8	Other crickets
9	Spodoptera exempta
10–14	Reserved
15	Missing value

0 20 102

Locust (maturity) colour

Code figure	
0	Green
1	Green or black
2	Black
3	Yellow and black
4	Straw/grey
5	Pink
6	Dark red/brown
7	Mixed red and yellow
8	Yellow
9	Other
10–14	Reserved
15	Missing value

0 20 103

Stage of development of locusts

Code figure	
0	Hoppers (nymphs, larvae), stage 1
1	Hoppers (nymphs, larvae), stage 2 or mixed 1, 2 instars (stages)
2	Hoppers (nymphs, larvae), stage 3 or mixed 2, 3 instars
3	Hoppers (nymphs, larvae), stage 4 or mixed 3, 4 instars
4	Hoppers (nymphs, larvae), stage 5 or mixed 4, 5 instars
5	Hoppers (nymphs, larvae), stage mixed, all or many instars
6	Fledglings (wings too soft for sustained flight)
7	Immature adults
8	Mixed maturity adults
9	Mature adults
10–14	Reserved
15	Missing value

0 20 104

Organization state of swarm or band of locusts

Code figure	
0	Hoppers only, mainly in bands or clusters
1	Winged adults in the vicinity more than 10 kilometres from point of observation
2	Locusts in flight, a few seen at the station
3	Locusts at the station, most of them on the ground
4	Locusts, some on ground and others in flight at a height less than 10 metres
5	Locusts, some on ground and others in flight at a height greater than 10 metres
6	Locusts, most in flight at a height less than 10 metres
7	Locusts, most in flight at a height greater than 10 metres
8	Locusts, all over inflicting severe damage to vegetation, no extermination operation
9	Locusts, all over inflicting severe damage to vegetation, extermination operation in progress
10–14	Reserved
15	Missing value

0 20 105

Size of swarm or band of locusts and duration of passage of swarm

Code figure	
When 0 20 104 (Organization state of swarm or band of locusts) = 0	
0	Reserved
1	Area covered by isolated bands < 10 m^2
2	Area covered by isolated bands 10 – 100 m^2
3	Area covered by isolated bands 100 – 1000 m^2
4	Area covered by isolated bands 1 000 – 10000 m^2
5	Area covered by isolated bands 1 – 10 ha
6	Area covered by isolated bands > 10 ha
7	Area covered by dispersed bands < 100 km^2
8	Area covered by dispersed bands 100 – 1000 km^2
9	Area covered by dispersed bands > 1000 km^2
10–14	Reserved
15	Missing value
When 0 20 104 (Organization state of swarm or band of locusts) = 1 to 9	
0	Small swarm less than 1 km^2 or adults in ground, tens or hundreds of individuals visible simultaneously, duration of passage less than 1 hour ago
1	Small swarm less than 1 km^2 or adults in ground, tens or hundreds of individuals visible simultaneously, duration of passage 1 to 6 hours ago
2	Small swarm less than 1 km^2 or adults in ground, tens or hundreds of individuals visible simultaneously, duration of passage over 6 hours ago
3	Medium swarm or scattered adults, several visible simultaneously, duration of passage less than 1 hour ago
4	Medium swarm or scattered adults, several visible simultaneously, duration of passage 1 to 6 hours ago

(continued)

(Code table 0 20 105 – continued)

Code figure	
5	Medium swarm or scattered adults, several visible simultaneously, duration of passage over 6 hours ago
6	Large swarm or isolated adults, seen singly, duration of passage less than 1 hour ago
7	Large swarm or isolated adults, seen singly, duration of passage 1 to 6 hours ago
8	Large swarm or isolated adults, seen singly, duration of passage over 6 hours ago
9	More than one swarm of locusts
10	Size of swarm and/or duration of passage not determined owing to darkness or similar phenomena
11–14	Reserved
15	Missing value

0 20 106

Locust population density

Code figure	
0	Reserved
1	Thin density swarm (swarm visible only when near enough for individual locusts to be discerned)
2	Medium density swarm
3	Dense swarm (obscuring nearby features, e.g. trees)
4	Isolated hoppers seen singly
5	Scattered hoppers, several visible simultaneously
6–14	Reserved
15	Missing value

0 20 107

Direction of movements of locust swarm

Code figure	
0	Reserved
1	Generally in the direction NE
2	Generally in the direction E
3	Generally in the direction SE
4	Generally in the direction S
5	Generally in the direction SW
6	Generally in the direction W
7	Generally in the direction NW
8	Generally in the direction N
9	Specific direction indeterminable
10–14	Reserved
15	Missing value

0 20 108

Extent of vegetation

Code figure	
0	Bare ground
1	Dry, presence of few and isolated shrubs
2	Sparse vegetation (sprouting)
3	Dense vegetation (sprouting)
4	Sparse vegetation (growing)
5	Dense vegetation (growing)
6	Sparse vegetation in flower
7	Dense vegetation in flower
8–14	Reserved
15	Missing value

0 20 119

Lightning discharge polarity

Code figure	
0	Not defined
1	Positive
2	Negative
3	Missing value

0 20 124

Lightning stroke or flash

Code figure	
0	Not defined
1	Lightning stroke
2	Lightning flash, by manual observation, or if equipment insensitive to stroke resolution
3	Missing value

0 20 136

Supplementary cloud type

Code figure		
	0–7 Nature of clouds of vertical development (C$_a$ *– Code table 0531)*	
0	Isolated cumulus humilis and/or cumulus mediocris	of vertical development
1	Numerous cumulus humilis and/or cumulus mediocris	
2	Isolated cumulus congestus	
3	Numerous cumulus congestus	
4	Isolated cumulonimbus	
5	Numerous cumulonimbus	
6	Isolated cumulus and cumulonimbus	
7	Numerous cumulus and cumulonimbus	

(continued)

(Code table 0 20 136 – continued)

Code figure	
8–9	Reserved
	10–19 Orographic clouds (C_0 – Code table 0561)
10	Reserved
11	Isolated orographic clouds, pileus, incus, forming
12	Isolated orographic clouds, pileus, incus, not changing
13	Isolated orographic clouds, pileus, incus, dissolving
14	Irregular banks of orographic cloud, föhn bank, etc., forming
15	Irregular banks of orographic cloud, föhn bank, etc., not changing
16	Irregular banks of orographic cloud, föhn bank, etc., dissolving
17	Compact layer of orographic cloud, föhn bank, etc., forming
18	Compact layer of orographic cloud, föhn bank, etc., not changing
19	Compact layer of orographic cloud, föhn bank, etc., dissolving
	20–29 Cloud conditions over mountains and passes (N_m – Code table 2745)
20	All mountains open, only small amounts of cloud present
21	Mountains partly covered with detached clouds (not more than half the peaks can be seen)
22	All mountain slopes covered, peaks and passes free
23	Mountains open on observer's side (only small amounts of cloud present), but a continuous wall of cloud on the other side
24	Clouds low above the mountains, but all slopes and mountains open (only small amounts of cloud on the slopes)
25	Clouds low above the mountains, peaks partly covered by precipitation trails or clouds
26	All peaks covered but passes open, slopes either open or covered
27	Mountains generally covered but some peaks free, slopes wholly or partially covered
28	All peaks, passes and slopes covered
29	Mountains cannot be seen owing to darkness, fog, snowstorm, precipitation, etc.
30–34	Reserved
	35–39 Condensation trails (N_t – Code table 2752)
35	Non-persistent condensation trails
36	Persistent condensation trails covering less than 1/8 of the sky
37	Persistent condensation trails covering 1/8 of the sky
38	Persistent condensation trails covering 2/8 of the sky
39	Persistent condensation trails covering 3/8 or more of the sky
	40–49 Cloud conditions observed from a higher level (N_v – Code table 2754)
40	No cloud or mist – observed from a higher level
41	Mist, clear above – observed from a higher level
42	Fog patches – observed from a higher level
43	Layer of slight fog – observed from a higher level
44	Layer of thick fog – observed from a higher level
45	Some isolated clouds – observed from a higher level
46	Isolated clouds and fog below – observed from a higher level
47	Many isolated clouds – observed from a higher level
48	Sea of clouds – observed from a higher level
49	Bad visibility obscuring the downward view – observed from a higher level
50–510	Reserved
511	Missing value

0 20 137

Evolution of clouds

Code figure	
0	No change
1	Cumulification
2	Slow elevation
3	Rapid elevation
4	Elevation and stratification
5	Slow lowering
6	Rapid lowering
7	Stratification
8	Stratification and lowering
9	Rapid change
10–14	Reserved
15	Missing value

0 21 066

Wave scatterometer product confidence data

Bit No.	
1	Processing equipment not working
2	Equipment failed
3	PRF code changed during image generation
4	Sampling window changed during image generation
5	Gain changed during image generation
6	Chirp replica exceeds specified value
7	Input data mean and standard deviation of in-phase and quadrature out of range
8	Doppler centroid confidence > MMCC value
9	Doppler centroid absolute value > PRF/2
10	Doppler ambiguity confidence < MMCC value
11	Output data mean and standard deviation =< MMCC value
All 12	Missing value

Notes:
(1) MMCC is Mission Management Control Centre.

(2) PRF is Pulse Repetition Frequency.

0 21 067

Wind product confidence data

Bit No.	
1	No forebeam calculation
2	No midbeam calculation
3	No aftbeam calculation
4	Forebeam arcing detected
5	Midbeam arcing detected
6	Aftbeam arcing detected
7	Any beam noise content above or equal to threshold
8	Land (any land in cell footprint)
9	Autonomous ambiguity removal not used
10	Meteorological background not used
11	Minimum residual exceeded threshold
12	Frame checksum error detected
All 13	Missing value

0 21 068

Radar altimeter product confidence data

Bit No.	
1	Standard deviation of wind speed outside MMCC limit
2	Standard deviation of significant wave height outside MMCC limit
3	Standard deviation of altitude outside MMCC limit
4	Mean peakiness outside MMCC limit
5	Frame checksum error detected
6	Height-time loop time constant correction not performed
7	Not enough measurements (N < 10)
All 8	Missing value

Note: MMCC is Mission Management Control Centre.

0 21 069

SST product confidence data

Bit No.	
1	12.0 μm channel present in source data
2	11.0 μm channel present in source data
3	3.7 μm channel present in source data
4	1.6 μm channel present in source data
5	Cloud identification used 1.6 μm histogram reflectance cloud test
6	1.6 μm histogram reflectance cloud test used dynamic threshold
7	Sun glint detected by 1.6 μm reflectance cloud test
8	3.7 μm channel used in sea-surface temperature retrieval
9	Sea-surface temperature derivation used daytime data (night-time if zero)
All 10	Missing value

0 21 070

SST product confidence data (SADIST-2)

Bit No.	
	1–9 Nadir-only view SST retrieval used 3.7 micron channel (one bit per 10-arcmin cell)
1	Cell 1: nadir-only view SST used 3.7 micron channel
2	Cell 2: nadir-only view SST used 3.7 micron channel
3	Cell 3: nadir-only view SST used 3.7 micron channel
4	Cell 4: nadir-only view SST used 3.7 micron channel
5	Cell 5: nadir-only view SST used 3.7 micron channel
6	Cell 6: nadir-only view SST used 3.7 micron channel
7	Cell 7: nadir-only view SST used 3.7 micron channel
8	Cell 8: nadir-only view SST used 3.7 micron channel
9	Cell 9: nadir-only view SST used 3.7 micron channel

Cell Numbering:

NW				NE
	7	8	9	
	4	5	6	
	1	2	3	
SW				SE

(continued)

(Flag table 0 21 070 – continued)

Bit No.	
	10–18 Dual view SST retrieval used 3.7 micron channel (one bit per 10-arcmin cell)
10	Cell 1: dual view SST used 3.7 micron channel
11	Cell 2: dual view SST used 3.7 micron channel
12	Cell 3: dual view SST used 3.7 micron channel
13	Cell 4: dual view SST used 3.7 micron channel
14	Cell 5: dual view SST used 3.7 micron channel
15	Cell 6: dual view SST used 3.7 micron channel
16	Cell 7: dual view SST used 3.7 micron channel
17	Cell 8: dual view SST used 3.7 micron channel
18	Cell 9: dual view SST used 3.7 micron channel
19	Nadir view contains day-time data (night if zero)
20	Forward view contains day-time data (night if zero)
21	Record contains contributions from instrument scans acquired when ERS platform not in yaw-steering mode
22	Record contains contributions from instrument scans for which product confidence data show quality is poor or unknown
All 23	Missing value

Cell Numbering:

NW				NE
	7	8	9	
	4	5	6	
	1	2	3	
SW				SE

0 21 072

Satellite altimeter calibration status

Bit No.	
1	Height error correction applied instead of open loop calibration
2	Microwave sounder used for troposphere correction
3	AGC output correction applied instead of open loop calibration
All 4	Missing value

0 21 073

Satellite altimeter instrument mode

Bit No.	
1	Blank data record
2	Test
3	Calibration (closed loop)
4	BITE
5	Acquisition on ice
6	Acquisition on ocean
7	Tracking on ice
8	Tracking on ocean
All 9	Missing value

0 21 076

Representation of intensities

Code figure	
0	Linear
1	Logarithmic (base e)
2	Logarithmic (base 10)
3–6	Reserved
7	Missing value

0 21 109

SEAWINDS wind vector cell quality

Bit No.	
1	Not enough good sigma-0 available for wind retrieval
2	Poor azimuth diversity among sigma-0 for wind retrieval
3–7	Reserved
8	Some portion of wind vector cell is over land
9	Some portion of wind vector cell is over ice
10	Wind retrieval not performed for wind vector cell
11	Reported wind speed is greater than 30 m s^{-1}
12	Reported wind speed is less than or equal to 3 m s^{-1}
13–16	Reserved
All 17	Missing value

0 21 115

SEAWINDS sigma-0 quality

Bit No.	
1	Sigma-0 measurement is not usable
2	Signal to noise ratio is low
3	Sigma-0 is negative
4	Sigma-0 is outside of acceptable range
5	Scatterometer pulse quality is not acceptable
6	Sigma-0 cell location algorithm does not converge
7	Frequency shift lies beyond the range of the x factor table
8	Spacecraft temperature is beyond calibration coefficient range
9	No applicable altitude records were found for this sigma-0
10	Interpolated ephemeris data are not acceptable for this sigma-0
11–16	Reserved
All 17	Missing value

0 21 116

SEAWINDS sigma-0 mode

Bit No.	
1	Calibration/measurement pulse flag (1)
2	Calibration/measurement pulse flag (2)
3	Outer antenna beam
4	Sigma-0 cell is aft of spacecraft
5	Current mode (1)
6	Current mode (2)
7	Effective gate width – slice resolution (1)
8	Effective gate width – slice resolution (2)
9	Effective gate width – slice resolution (3)
10	Low resolution mode – whole pulse data
11	Scatterometer electronic subsystem B
12	Alternate spin rate – 19.8 rpm
13	Receiver protection on
14	Slices per composite flag (1)
15	Slices per composite flag (2)
16	Slices per composite flag (3)
All 17	Missing value

0 21 119

Wind scatterometer geophysical model function

Code figure	
0	Reserved
1	SASS
2	SASS2
3	NSCAT0
4	NSCAT1
5	NSCAT2
6	QSCAT0
7	QSCAT1
8–30	Reserved
31	CMOD1
32	CMOD2
33	CMOD3
34	CMOD4
35	CMOD5
36–62	Reserved
63	Missing value

0 21 144

Altimeter rain flag

Bit No.	
1	Rain
All 2	Missing value

0 21 150

Beam co-location

Code figure	
0	Data from single ground station (no co-location)
1	Data from multiple ground station (co-located data)
2	Reserved
3	Missing value

0 21 155

Wind vector cell quality

Bit No.	
1	Not enough good sigma-0 available for wind retrieval
2	Poor azimuth diversity among sigma-0 for wind retrieval
3	Any beam noise content above threshold
4	Product monitoring not used
5	Product monitoring flag
6	KNMI quality control fails
7	Variational quality control fails
8	Some portion of wind vector cell is over land
9	Some portion of wind vector cell is over ice
10	Wind retrieval not performed for wind vector cell
11	Reported wind speed is greater than 30 m/s
12	Reported wind speed is less than or equal to 3 m/s
13	Rain flag for the wind vector cell is not usable
14	Rain flag algorithm detects rain
15	No meteorological background used
16	Data are redundant
17–23	Reserved
All 24	Missing value

0 21 158

ASCAT Kp quality estimate

Code figure	
0	Acceptable
1	Not acceptable
2	Reserved
3	Missing value

0 21 159

ASCAT sigma-0 usability

Code figure	
0	Good
1	Usable
2	Bad
3	Missing value

0 21 169

Ice presence indicator

Code figure	
0	No ice present
1	Ice present
2	Reserved
3	Missing value

0 22 056

Direction of profile

Code figure	
0	Upwards profile
1	Downwards profile
2	Horizontal
3	Missing value

0 22 060

Lagrangian drifter drogue status

Code figure	
0	Drogue is detached
1	Drogue is attached
2	Drogue status unknown
3–6	Reserved
7	Missing value

0 22 061

State of the sea

Code figure		Height in metres
0	Calm (glassy)	0
1	Calm (rippled)	0 – 0.1
2	Smooth (wavelets)	0.1 – 0.5
3	Slight	0.5 – 1.25
4	Moderate	1.25 – 2.5
5	Rough	2.5 – 4
6	Very rough	4 – 6
7	High	6 – 9
8	Very high	9 – 14
9	Phenomenal	Over 14
10–14	Reserved	
15	Missing value	

Notes:

(1) These values refer to well-developed wind waves of the open sea. While priority shall be given to the descriptive terms, these height values may be used for guidance by the observer when reporting the total state of agitation of the sea resulting from various factors such as wind, swell, currents, angle between swell and wind, etc.

(2) The exact bounding height shall be assigned for the lower code figure; e.g., a height of 4 m is coded as 5.

0 22 067

Instrument type for water temperature profile measurement

(See common Code table C–3)

0 22 068

Water temperature profile recorder types

(See common Code table C–4)

0 22 120

Tide station automated water level check

Code figure	
0	Good data
1	Maximum (high) water level limit exceeded
2	Minimum (low) water level limit exceeded
3	Rate of change limit for water level exceeded
4	Flat limit for water level exceeded
5	Observed minus predicted water level value limit exceeded
6	Observed value from primary water level sensor minus backup water level sensor
7	Value exceeded specified tolerance from expected value
8	Water level QA parameter (sigmas and/or outliers) limits exceeded
9	Sea temperature outside of expected range
10	Multiple QC checks (above) failed
11	No automated water level checks performed
12–30	Reserved
31	Missing value

0 22 121

Tide station manual water level check

Code figure	
0	Operational
1	Possible clogging problem or otherwise degraded water level data
2	Possible datum shift
3	Unknown status of water level sensor
4	Suspected or known sea temperature sensor problem
5	Multiple possible problems (above)
6	Bad data – DO NOT DISSEMINATE!
7	No manual water level checks performed
8–30	Reserved
31	Missing value

0 22 122

Tide station automated meteorological data check

Code figure	
0	Good data from all sensors
1	Wind direction outside of allowable range
2	Wind speed outside of expected range
3	Barometric pressure outside of expected range
4	Air temperature outside of expected range
5	Multiple sensors failed QC checks
6	No automated meteorological data checks performed
7–30	Reserved
31	Missing value

0 22 123

Tide station manual meteorological data check

Code figure	
0	Operational
1	Suspected or known problem with wind sensor
2	Suspected or known problem with barometric pressure sensor
3	Suspected or known problem with air temperature sensor
4	Unknown status of all sensors
5	Suspected or known problems with multiple sensors
6	Bad data – DO NOT DISSEMINATE!
7	No manual meteorological data checks performed
8–30	Reserved
31	Missing value

0 22 178

XBT/XCTD launcher type

Code figure	
0	Unknown
1	LM-2A Deck-mounted
2	LM-3A Hand-Held
3	LM-4A Thru-Hull
4–9	Reserved
10	AL-12 TSK Autolauncher (up to 12 probes)
11–19	Reserved
20	SIO XBT Autolauncher (up to 6 probes)
21–29	Reserved
30	AOML XBT V6 Autolauncher (up to 6 Deep Blue probes)
31	AOML XBT V8.0 Autolauncher (up to 8 Deep Blue probes)
32	AOML XBT V8.1 Autolauncher (up to 8 Deep Blue and Fast Deep probes)
33–89	Reserved
90	CSIRO Devil Autolauncher
91–99	Reserved
100	MFSTEP Autolauncher (Mediterranean)
101–254	Reserved
255	Missing value

0 23 001

Accident early notification – article applicable

Code figure	
0	Reserved
1	Articles 1 and 2
2	Article 3
3	Article 5.2
4–6	Reserved
7	Missing value

0 23 002

Activity or facility involved in incident

Code figure	
0	Reserved
1	Nuclear reactor on ground
2	Nuclear reactor at sea
3	Nuclear reactor in space
4	Nuclear fuel facility
5	Radioactive waste management facility
6	Transport of nuclear fuel or radioactive waste
7	Storage of nuclear fuel or radioactive waste
8	Manufacture of radio-isotopes
9	Use of radio-isotopes
10	Storage of radio-isotopes
11	Disposal of radio-isotopes
12	Transport of radio-isotopes
13	Use of radio-isotopes for power generation
14–29	Reserved
30	Other
31	Missing value

0 23 003

Type of release

Code figure	
0	No release
1	Release to atmosphere
2	Release to water
3	Release to both atmosphere and water
4	Expected release to atmosphere
5	Expected release to water
6	Expected release to both atmosphere and water
7	Missing value

0 23 004

Countermeasures taken near border

Code figure	
0	No countermeasures
1	Evacuation
2	Sheltering
3	Prophylaxis
4	Water
5–6	Reserved
7	Missing value

0 23 005

Cause of incident

Code figure	
0	Incident State does not understand what happened
1	Incident State knows the cause of the incident
2	Reserved
3	Missing value

0 23 006

Incident situation

Code figure	
0	No improvement
1	Unstable
2	No deterioration
3	Improving
4	Stable
5	Deteriorating
6	Reserved
7	Missing value

0 23 007

Characteristics of release

Code figure	
0	No release
1	Release has stopped
2	Release
3	Release is continuing
4–6	Reserved
7	Missing value

0 23 008/0 23 009

State of current or expected release

Code figure	
0	Gaseous
1	Particulate
2	Mixture of gaseous and particulate
3	Missing value

0 23 016

Possibility of significant chemical toxic health effect

Code figure	
0	No significant chemical toxic health effect
1	Significant chemical toxic health effect possible
2	Reserved
3	Missing value

0 23 018

Release behaviour over time

Code figure	
0	Release no longer occurring
1	Release still occurring
2	Release expected to increase in next six hours
3	Release expected to remain constant in next six hours
4	Release expected to decrease in next six hours
5–6	Reserved
7	Missing value

0 23 031

Possibility that plume will encounter precipitation in State in which incident occurred

Code figure	
0	Plume will not encounter rain in incident State
1	Plume will encounter rain in incident State
2	Reserved
3	Missing value

0 23 032

Plume will encounter change in wind direction and/or speed flag

Code figure	
0	No significant change expected within the next six hours
1	Anticipated significant change expected within the next six hours
2	Reserved
3	Missing value

0 24 003

Composition of release

Code figure	
0	Noble gases
1	Iodines
2	Caesiums
3	Transuranics
4–30	Reserved
31	Missing value

0 25 004

Echo processing

Code figure	
0	Incoherent
1	Coherent (Doppler)
2	Reserved
3	Missing value

0 25 005

Echo integration

Code figure	
0	Logarithm – 2.5 dB
1	Linear
2	Special
3	Missing value

0 25 006

Z to R conversion

Code figure	
0	ZH to R conversion
1	(ZH, ZDR) to (NO, DO) to R
2	(Z (F1), Z (F2)) to attenuation to R
3–5	Reserved
6	Other
7	Missing value

0 25 009

Calibration method

Bit No.	
1	None
2	Calibration target or signal
3	Against raingauges
4	Against other Instruments (disdrometer – attenuation)
All 4	Missing value

0 25 010

Clutter treatment

Code figure	
0	None
1	Map
2	Insertion of higher elevation data and map
3	Analysis of the fluctuating logarithm signal (clutter detection)
4	Extraction of the fluctuating part of linear signal (clutter suppression)
5	Clutter suppression – Doppler
6	Multiparameter analysis
7–14	Reserved
15	Missing value

0 25 011

Ground occultation correction (screening)

Code figure	
0	None
1	Map of correction factors
2	Interpolation (azimuth or elevation)
3	Missing value

0 25 012

Range attenuation correction

Code figure	
0	Hardware
1	Software
2	Hardware and software
3	Missing value

0 25 013

Bright-band correction

Bit No.	
1	Bright-band correction
All 2	Missing value

0 25 015

Radome attenuation correction

Bit No.	
1	Radome attenuation correction
All 2	Missing value

0 25 017

Precipitation attenuation correction

Bit No.	
1	Precipitation attenuation correction
All 2	Missing value

0 25 020

Mean speed estimation

Code figure	
0	FFT (fast Fourier transform)
1	PPP (pulse-pair processing)
2	VPC (vector-phase change)
3	Missing value

0 25 021

Wind computation enhancement

Bit No.	
1	Simple average
2	Consensus average
3	Median check
4	Vertical consistency check
5	Other
6–7	Reserved
All 8	Missing value

0 25 022

GHRSST rejection flag*

Bit No.	
1	Unprocessed
2	Land suspected
3	Wind speed too large
4	Ice detected
5	Rain detected (Microwave retrievals only)
6	Cloudy detected (Infra-red retrievals only)
7	Cosmetic value
8	SST out of range
All 9	Missing value

* GHRSST = GODAE high-resolution sea-surface temperature

0 25 023

GHRSST confidence flag

Bit No.	
1	Default confidence value has been used
2	Default bias and standard deviation have been used
3	Sun glint suspected
4	Sea ice retrieval for microwave data
5	High wind speed retrieval
6	Inaccurate SST due to low SST (< 285K) (Only applies to the TMI instrument)
7	Relaxed rain contamination suspected
8	Potential side lobe contamination
All 9	Missing value

0 25 024

GHRSST data quality

Code figure	
0	Unprocessed infrared retrieval
1	Cloudy retrievals
2	Bad: Data that are probably contaminated by cloud
3	Suspect data
4	Acceptable data
5	Excellent data
6	Cool skin suspected
7–9	Reserved
10	Unprocessed microwave retrieval
11	Questionable microwave retrieval that may be contaminated
12	Acceptable microwave retrieval
13	High probability of diurnal variability
14	Reserved
15	Missing value

0 25 029

Calibration method

Bit No.	
1	Reserved
2	Calibration target or signal
3	Against raingauges
4	Against other instruments (disdrometer – attenuation)
5	Reserved
All 6	Missing value

0 25 030

Running mean sea-surface temperature usage

Code figure	
0	Running mean sea-surface temperature not used because usage criteria not met
1	Running mean sea-surface temperature not used because data not available
2	Running mean sea-surface temperature used as predictor
3	Missing value

0 25 031

NWP-generated vertical profile thinning method

Code figure	Meaning
0	Reserved
1	No thinning applied (all native model levels are included from base to top of pseudo-sounding)
2	Native model levels are present only if they are significant levels as per regulations B/C 25 for conventional TEMP soundings
3	A predefined subset of native model levels is present
4	No native model levels are present. All profile levels are interpolated to a predefined set of pressure coordinate levels
5–6	Reserved
7	Missing value

Note: None of the code figures exclude the addition of interpolated levels at the discretion of the generating centre.

0 25 032

Wind profiler mode information

Code figure	
0	Reserved
1	Data from low mode
2	Data from high mode
3	Missing value

0 25 033

Wind profiler submode information

Code figure	
0	Wind profiler operating in submode A
1	Wind profiler operating in submode B
2	Reserved
3	Missing value

0 25 034

Wind profiler quality control test results

Bit No.	Meaning (1 = true, 0 = false)
1	Test A performed and failed
2	Test B performed and failed
3	Test results inconclusive
All 4	Missing value

0 25 035

Decision method for polarity

Code figure	
0	Not defined
1	Individual voltage deflection
2	Current based, above a threshold
3	Voltage based, above a threshold
4	Consensus of sensors, current above a threshold
5	Consensus of sensors, voltage above a threshold
6	Reserved
7	Missing value

0 25 036

Atmospherics location method

Code figure	
0	Network of several direction-finders operating on the same individual atmospherics
1	Network of several arrival-time stations operating on the same individual atmospherics
2–5	Reserved
6	Single station range bearing technique
7–14	Reserved
15	Missing value

0 25 040

CO_2 wind product derivation

Code figure	
0	Non-specific mode
1	First guess data
2	Cloud data
3	Average vector data
4	Primary data
5	Guess data
6	Vector data
7	Tracer data; this image
8	Tracer data to next image
9–14	Reserved
15	Missing value

0 25 041

Moving platform direction reporting method

Code figure	
0	Direction originally reported in true degrees
1	Direction originally reported using Code table 0700, FM 13
2	Reserved
3	Missing value

Note: Where the original reporting method is as indicated by code figure 1, the following conversion is recommended to obtain a suitable data value corresponding to descriptor 0 01 012:

Reported value	Data value
0	0
1	45
2	90
3	135
4	180
5	225
6	270
7	315
8	360
9	511

0 25 042

Moving platform speed reporting method

Code figure	
0	Speed originally reported in metres per second
1	Speed originally reported using Code table 4451, FM 13
2	Reserved
3	Missing value

Note: Where the original reporting method is as indicated by code figure 1, the following conversion is recommended to obtain a suitable data value corresponding to descriptor 0 01 013:

Reported value	Data value
0	0
1	1
2	4
3	7
4	9
5	12
6	14
7	17
8	19
9	21
/	1023

0 25 045

HIRS channel combination

Bit No.	
1–20	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present, if bit position is set to 0, then channel is not present
All 21	Missing value

0 25 046

MSU channel combination

Bit No.	
1–4	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present, if bit position is set to 0, then channel is not present
All 5	Missing value

0 25 047

SSU channel combination

Bit No.	
1–3	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present; if bit position is set to 0, then channel is not present
All 4	Missing value

0 25 048

AMSU-A channel combination

Bit No.	
1–15	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present, if bit position is set to 0, then channel is not present
All 16	Missing value

0 25 049

AMSU-B channel combination

Bit No.	
1–5	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present, if bit position is set to 0, then channel is not present
All 6	Missing value

0 25 051

AVHRR channel combination

Bit No.	
1–6	Beginning with first bit position (high order bit), if bit position is set to 1, then channel is present, if bit position is set to 0, then channel is not present
All 7	Missing value

0 25 053

Observation quality

Bit No.	
1	Good
2	Redundant
3	Questionable
4	Bad
5	Experimental
6	Precipitating
7–11	Reserved
All 12	Missing value

0 25 063

Central processor or system identifier

Code figure	
0	Not defined
1	Main processor
2	Backup processor
3–254	Reserved
255	Missing value

0 25 069

Flight level pressure corrections

Bit No.	
1	Smoothed
2	Baseline adjusted
3	Normalized time interval
4	Outlier checked
5	Plausibility checked
6	Consistency checked
7	Interpolated
All 8	Missing value

0 25 086

Depth correction indicator

Code figure	
0	Depths are not corrected
1	Depths are corrected
2	Reserved
3	Missing value

0 25 090

Orbit state flag

Code figure	
0	Orbit computed during a manoeuvre
1	Adjusted mission operations orbit
2	Extrapolated mission operations orbit
3	Adjusted (preliminary/precise) orbit
4	(Preliminary/precise) orbit is estimated during a manoeuvre period
5	(Preliminary/precise) orbit is interpolated over a tracking data gap
6	(Preliminary/precise) orbit is extrapolated for a duration less than 1 day
7	(Preliminary/precise) orbit is extrapolated for a duration that ranges from 1 day to 2 days
8	(Preliminary/precise) orbit is extrapolated for a duration larger than 2 days, or that the orbit is extrapolated just after a manoeuvre
9	DORIS* DIODE** navigator orbit
10–14	Reserved
15	Missing value

* DORIS stands for “Doppler Orbitography and Radio-positioning Integrated by Satellite”.

** DIODE means “Détermination Immédiate d’Orbite par Doris Embarqué” or immediate onboard orbit determination by DORIS. It is part of the DORIS instrument, which calculates the satellite’s position and velocity.

0 25 093

RASS computation correction

Bit No.	
1	No correction
2	Vertical velocity correction
3–6	Reserved
7	All corrections
All 8	Missing value

0 25 095

Altimeter state flag

Bit No.	
1	Altimeter operating (0 if nominal, 1 if backup)
All 2	Missing value

0 25 096

Radiometer state flag

Bit No.	
1	Mode indicator (0 if mode 2, 1 if mode 1)
2	Mode 1 calibration sequence indicator (0 if normal data taking either mode 1 or 2, 1 if mode 1 calibration sequence)
	Bits 3 and 4 indicate active 23.8 GHz channel(s):
3	Channel 2 (0 if on, 1 if off)
4	Channel 3 (0 if on, 1 if off)
All 5	Missing value

0 25 097

Three-dimensional error estimate of the navigator orbit

Code figure	
0	Ranges between 0 and 30 cm
1	Ranges between 30 and 60 cm
2	Ranges between 60 and 90 cm
3	Ranges between 90 and 120 cm
4	Ranges between 120 and 150 cm
5	Ranges between 150 and 180 cm
6	Ranges between 180 and 210 cm
7	Ranges between 210 and 240 cm
8	Ranges between 240 and 270 cm
9	Ranges larger than 270 cm
10–14	Reserved
15	Missing value

0 25 098

Altimeter data quality flag

Bit No.	(0 is good, 1 is bad)
1	Ku band range
2	C band range
3	Ku band SWH*
4	C band SWH*
5	Ku band backscatter coefficient
6	C band backscatter coefficient
7	Off nadir angle from Ku band waveform parameters
8	Off nadir angle from platform
All 9	Missing value

* SWH = Significant wave height

0 25 099

Altimeter correction quality flag

Bit No.	(0 is good, 1 is bad)
1	Ku band range instrumental correction
2	C band range instrumental correction
3	Ku band SWH* instrumental correction
4	C band SWH* instrumental correction
5	Ku band backscatter coefficient instrumental correction
6	C band backscatter coefficient instrumental correction
7–8	Reserved
All 9	Missing value

* SWH = Significant wave height

0 25 110

Image processing summary

Bit No.	
1	Raw data analysis used for raw data correction. Correction done using default parameters
2	Raw data analysis used for raw data correction. Correction done using raw data analysis results
3	Antenna elevation pattern correction applied
4	Nominal chirp replica used
5	Reconstructed chirp used
6	Slant range to ground range conversion applied
7–9	Reserved
All 10	Missing value

0 25 120

RA2-L2-processing flag

Code figure	
0	Percentage of DSRs* free of processing errors during Level 2 processing is greater than the acceptable threshold
1	Percentage of DSRs free of processing errors during Level 2 processing is less than the acceptable threshold
2	Reserved
3	Missing value

* DSR = Data set record

0 25 122

*Hardware configuration for RF**

Code figure	
0	Hardware configuration for RF is A
1	Hardware configuration for RF is B
2	Reserved
3	Missing value

* RF = Radio frequency

0 25 123

*Hardware configuration for HPA**

Code figure	
0	Hardware configuration for HPA is A
1	Hardware configuration for HPA is B
2	Reserved
3	Missing value

* HPA = High power amplifier

0 25 124

MWR-L2-processing flag*

Code figure	
0	Percentage of DSRs** free of processing errors during Level 2 processing is greater than the acceptable threshold
1	Percentage of DSRs** free of processing errors during Level 2 processing is less than the acceptable threshold
2	Reserved
3	Missing value

* MWR = Microwave radiometer

** DSR = Data set record

0 25 150

Method of tropical cyclone intensity analysis using satellite data

Code figure	
1	The Dvorak’s VIS (VISual imagery) intensity analysis
2	The Dvorak’s EIR (Enhanced InfraRed imagery) intensity analysis
3–14	Reserved
15	Missing value

0 25 174

SMOS information flag

Bit No.	Meaning
1	Pixel is affected by RFI effects
2	Pixel is located in the hexagonal Alias direction centred on Sun alias
3	Pixel is close to the border delimiting the extended Alias free zone
4	Pixel is inside the extended Alias free zone
5	Pixel is inside the exclusive of Alias free zone
6	Pixel is located in a zone where a Moon Alias was reconstructed
7	Pixel is located in a zone where Sun reflection has been detected
8	Pixel is located in a zone where Sun Alias was reconstructed
9	Flat target transformation has been performed during image reconstruction of this pixel
10	Scene has been combined with an adjustment scene in opposite polarization during image reconstruction to account for cross-polarization leakage
11	Direct Moon correction has been performed during image reconstruction of this pixel
12	Reflected Sun correction has been performed during image reconstruction of this pixel
13	Direct Sun correction has been performed during image reconstruction of this image
All 14	Missing value

0 25 181

L2 processing flag

Code figure	Meaning
0	OK
1	Percentage of L2b records free of processing errors is less than acceptable threshold
2	Missing value

0 25 182

L1 processing flag

Code figure	Meaning
0	OK
1	Percentage of L1b records free of processing errors is less than acceptable threshold
2	Missing value

0 25 184

L2 product status

Code figure	Meaning
0	OK
1	Product as a duration shorter than the input product
2	Missing value

0 26 010

Hours included

Bit No.	
1	0100 included
2	0200 included
3	0300 included
4	0400 included
5	0500 included
6	0600 included
7	0700 included
8	0800 included
9	0900 included
10	1000 included
11	1100 included
12	1200 included
13	1300 included
14	1400 included
15	1500 included
16	1600 included
17	1700 included
18	1800 included
19	1900 included
20	2000 included
21	2100 included
22	2200 included
23	2300 included
24	2400 included
25	Unknown mixture of hours
All 26	Missing value

0 29 001

Projection type

Code figure	
0	Gnomonic projection
1	Polar stereographic projection
2	Lambert’s conformal conic projection
3	Mercator’s projection
4	Scanning Cone (radar)*
5	Reserved
6	No projection
7	Missing value

* Projection type 4 indicates a Cartesian grid placed directly on the scanning cone defined by the azimuthal sweep of the radar.

0 29 002

Coordinate grid type

Code figure	
0	Cartesian
1	Polar
2	Other
3–6	Reserved
7	Missing value

0 30 031

Picture type

Code figure	
0	PPI
1	Composite
2	CAPPI
3	Vertical section
4	Alphanumeric data
5	Map of subject clutter
6	Map
7	Test picture
8	Comments
9	Map of ground occultation
10	Map of radar beam height
11–13	Reserved
14	Other
15	Missing value

0 30 032

Combination with other data

Bit No.	
1	Map
2	Satellite IR
3	Satellite VIS
4	Satellite WV
5	Satellite multispectral
6	Synoptic observations
7	Forecast parameters
8	Lightning data
9–14	Reserved
15	Other data
All 16	Missing value

0 31 021

Associated field significance

Code figure		
0	Reserved	
1	1-bit indicator of quality	0 = good 1 = suspect or bad
2	2-bit indicator of quality	0 = good 1 = slightly suspect 2 = highly suspect 3 = bad
3–5	Reserved	
6	4-bit indicator of quality control class according to GTSPP	0 = Unqualified 1 = Correct value (all checks passed) 2 = Probably good but value inconsistent with statistics (differ from climatology) 3 = Probably bad (spike, gradient, ... if other tests passed) 4 = Bad value, impossible value (out of scale, vertical instability, constant profile) 5 = Value modified during quality control 6–7 = Not used (reserved) 8 = Interpolated value 9 = Missing value
7	Percentage confidence	
8		0 = Not suspected 1 = Suspected 2 = Reserved 3 = Information not required
9–20	Reserved	
21	1-bit indicator of correction (see Note 2)	0 = original value 1 = substituted/corrected value
22–62	Reserved for local use	
63	Missing value	

Notes:

(1) Associated field significance shall be used initially in conjunction with the quality of observed data.

(2) The code figure 21 may be used within corrected messages with the substituted/corrected values identified.

(3) Further applications may be developed.

0 31 031

Data present indicator

Bit No.	Value	
1	0	Data present
	1	Data not present

0 33 002

Quality information

Code figure	
0	Data not suspect
1	Data suspect
2	Reserved
3	Quality information not given

0 33 003

Quality information

Code figure	
0	Data not suspect
1	Data slightly suspect
2	Data highly suspect
3	Data considered unfit for use
4–6	Reserved
7	Quality information not given

0 33 005

Quality information (AWS data)

Bit No.	
1	No automated meteorological data checks performed
2	Pressure data suspect
3	Wind data suspect
4	Air temperature data suspect
5	Wet-bulb temperature data suspect
6	Humidity data suspect
7	Ground temperature data suspect
8	Soil temperature (depth 1) data suspect
9	Soil temperature (depth 2) data suspect
10	Soil temperature (depth 3) data suspect
11	Soil temperature (depth 4) data suspect
12	Soil temperature (depth 5) data suspect
13	Cloud data suspect
14	Visibility data suspect
15	Present weather data suspect
16	Lightning data suspect
17	Ice deposit data suspect
18	Precipitation data suspect
19	State of ground data suspect
20	Snow data suspect
21	Water content data suspect
22	Evaporation/evapotranspiration data suspect
23	Sunshine data suspect
24–29	Reserved
All 30	Missing value

0 33 006

Internal measurement status information (AWS)

Code figure	
0	Self-check OK
1	At least one warning active, no alarms
2	At least one alarm active
3	Sensor failure
4–6	Reserved
7	Missing value

0 33 015

Data quality-check indicator

Code figure	
0	Passed all checks
1	Missing data check
2	Descending/reascending balloon check
3	Data plausibility check (above limits)
4	Data plausibility check (below limits)
5	Superadiabatic lapse rate check
6	Limiting angles check
7	Ascension rate check
8	Excessive change from previous flight
9	Balloon overhead check
10	Wind speed check
11	Wind direction check
12	Dependency check
13	Data valid but modified
14	Data outlier check
15–62	Reserved
63	Missing value

0 33 020

Quality control indication of following value

Code figure	
0	Good
1	Inconsistent
2	Doubtful
3	Wrong
4	Not checked
5	Has been changed
6	Estimated
7	Missing value

0 33 021

Quality of following value

Code figure	
0	Within limits
1	Outside limits
2	Reserved
3	Missing value

0 33 022

Quality of buoy satellite transmission

Code figure	
0	Good (several identical reports have been received)
1	Dubious (no identical reports have been received)
2	Reserved
3	Missing value

0 33 023

Quality of buoy location

Code figure	
0	Reliable (location was made over two satellite passes)
1	Latest known (no location over the corresponding pass)
2	Dubious (location made over one pass only; a second solution is possible in 5 per cent of the cases)
3	Missing value

0 33 024

Station elevation quality mark (for mobile stations)

Code figure	
0	Reserved
1	Excellent – within 3 metres
2	Good – within 10 metres
3	Fair – within 20 metres
4	Poor – more than 20 metres
5	Excellent – within 10 feet
6	Good – within 30 feet
7	Fair – within 60 feet
8	Poor – more than 60 feet
9–14	Reserved
15	Missing value

0 33 025

ACARS interpolated values indicator

Code figure	
0	Time interpolated, latitude and longitude reported
1	Time reported, latitude and longitude interpolated
2	Time, latitude, and longitude interpolated
3	Time, latitude, and longitude reported
4–6	Reserved
7	Missing value

0 33 026

Moisture quality

Code figure	
0	Normal operations – measurement mode
1	Normal operations – non-measurement mode
2	Small RH
3	Humidity element is wet
4	Humidity element contaminated
5	Heater fail
6	Heater fail and wet/contaminated humidity element
7	At least one of the input parameters used in the calculation of mixing ratio is invalid
8	Numeric error
9	Sensor not installed
10	Calculated RH > 100%
11	Input laser power too low
12	Probe WV temperature out of range
13	Probe WV pressure out of range
14	Spectral line out of range
15	No laser output
16–62	Reserved
63	Missing value

0 33 027

Location quality class (range of radius of 66% confidence)

Code figure	
0	Radius >= 1500 m
1	500 m =< Radius <1500 m
2	250 m =< Radius < 500 m
3	Radius < 250 m
4–6	Reserved
7	Missing value

0 33 028

Snapshot overall quality

Code figure	
1	Nominal
2	Degraded by SW error; any error reported by the algorithms
3	Degraded by instrument error
4	Degraded by corrupted /missing ADF
5–6	Reserved
7	Missing value

0 33 030

Scan line status flags for ATOVS

Bit No.	
1	Do not use scan for product generation
2	Time sequence error detected with this scan
3	Data gap precedes this scan
4	No calibration
5	No Earth location
6	First good time following a clock update
7	Instrument status changed with this scan
8–23	Reserved
All 24	Missing value

Note: If bit is set to 1 then statement is true.

0 33 031

Scan line quality flags for ATOVS

Bit No.	
1	Time field is bad but can probably be inferred from the previous good time
2	Time field is bad and cannot be inferred from the previous good time
3	This record starts a sequence that is inconsistent with previous times (i.e. there is a time discontinuity). This may or may not be associated with a spacecraft clock update (see scan line status flags for ATOVS)
4	Start of a sequence that apparently repeats scan times that have been previously accepted
5	Scan line was not calibrated because of bad time
6	Scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data or to a data gap
7	Scan line was not calibrated because of bad or insufficient PRT data
8	Scan line was calibrated but with marginal PRT data
9	Some uncalibrated channels on this scan
10	Uncalibrated due to instrument mode

(continued)

(Flag table 0 33 031 – continued)

Bit No.	
11	Questionable calibration because of antenna position error of space view
12	Questionable calibration because of antenna position error of black body
13	Not Earth located because of bad time
14	Earth location questionable because of questionable time code (see time problem code bits)
15	Earth location questionable – only marginal agreement with reasonableness check
16	Earth location questionable – fails reasonableness check
17	Earth location questionable because of antenna position check
18	Scan line calibration cold black body
19	Scan line calibration warm black body
20	Scan line calibration space view
21	Earth view
22–23	Reserved
All 24	Missing value

Notes:

(1) If bit is set to 1 then statement is true.

(2) Bits 1–4 represent time problem code. All bits off implies the scan time is as expected.

(3) Bits 5–10 represent calibration problem code. All bits set to zero indicated normal calibration. Where any of bits 5, 7, 10 are set, secondary calibration coefficients have been used.

(4) Bits 11–17 represent Earth location problem code. All bits set to zero implies the Earth location was normal.

0 33 032

Channel quality flags for ATOVS

Bit No.	
1	No good blackbody counts for scan line
2	No good space view counts for this line
3	No good PRTs for this line
4	Some bad blackbody view counts for this line
5	Some bad space view counts for this line
6	Some bad PRT temps on this line
7–23	Reserved (bits set to zero)
All 24	Missing value

Note: All bits off implies a good calibration.

0 33 033

Field of view quality flags for ATOVS

Bit No.	
1	Set if secondary calibration used
2–21	Bit n set to 1 if brightness temperature in channel n–1 is physically unreasonable or has not been calculated due to calibration problems
22	Set if all the channels are missing
23	Suspect
All 24	Missing value

Notes:

(1) All bits off implies a good calibration.

(2) Bits 2–21 used for HIRS, but only bits 2–16 used for AMSU-A and only bits 2–6 used for AMSU-B.

0 33 035

Manual/automatic quality control

Code figure	
0	Automatic quality control passed and not manually checked
1	Automatic quality control passed and manually checked and passed
2	Automatic quality control passed and manually checked and deleted
3	Automatic quality control failed and manually not checked
4	Automatic quality control failed and manually checked and failed
5	Automatic quality control failed and manually checked and re-inserted
6	Automatic quality control flagged data as questionable and not manually checked
7	Automatic quality control flagged data as questionable and manually checked and failed
8	Manually checked and failed
9–14	Reserved
15	Missing value

0 33 037

Wind correlation error

Bit No.	
1	u departure from guess
2	v departure from guess
3	u and v departure from guess
4	u acceleration
5	v acceleration
6	u and v acceleration
7	Possible land feature
8	u acceleration and possible land feature
9	v acceleration and possible land feature
10	u and v acceleration and possible land feature

(continued)

(Flag table 0 33 037 – continued)

Bit No.	
11	Bad wind guess
12	Correlation failure
13	Search box off edge of area
14	Target box off edge of area
15	Pixel brightness out of bounds (noisy line)
16	Target outside of latitude/longitude box
17	Target outside of pressure minimum/maximum
18	Autoeditor flagged slow vector
19	Autoeditor flagged vectors
All 20	Missing value

0 33 038

Quality flags for ground-based GNSS data*

Bit No.	
1	Total zenith delay quality is considered poor
2	GALILEO satellites used
3	GLONASS satellites used
4	GPS satellites used
5	Meteorological data applied
6	Atmospheric loading correction applied
7	Ocean tide loading applied
8	Climate quality data processing
9	Near-real time data processing
All 10	Missing value

* GNSS = Global Navigation Satellite Systems

0 33 039

Quality flags for radio occultation data

Bit No.	
1	Non-nominal quality
2	Offline product
3	Ascending occultation flag
4	Excess phase processing non-nominal
5	Bending angle processing non-nominal
6	Refractivity processing non-nominal
7	Meteorological processing non-nominal
8–13	Reserved
14	Background profile non-nominal
15	Background (i.e. not retrieved) profile present
All 16	Missing value

0 33 041

Attribute of following value

Code figure	
0	The following value is the true value
1	The following value is higher than the true value (the measurement hit the lower limit of the instrument)
2	The following value is lower than the true value (the measurement hit the higher limit of the instrument)
3	Missing value

Note: This descriptor will be associated with visibility data or height of clouds data to specify if the value is bounded. If the reported data is the true value, the code figure is 0. However, the measurement can hit the limit of the instrument measurement capability. If the reported value is higher than the true value, the code figure is 1; if the reported value is lower than the true value, the code figure is 2.

0 33 042

Type of limit represented by following value

Code figure	
0	Exclusive lower limit (>)
1	Inclusive lower limit (>=)
2	Exclusive upper limit (<)
3	Inclusive upper limit (=<)
4–6	Reserved
7	Missing value

0 33 043

AST confidence

Bit No.	
1	Sea MDS. Nadir only SST retrieval used 3.7 micron channel. Land MDS reserved
2	Sea MDS. Dual view SST retrieval used 3.7 micron channel. Land MDS reserved
3	Nadir view contains day time data
4	Forward view contains day time data
5–7	Reserved
All 8	Missing value

0 33 044

ASAR quality information

Bit No.	
1	Input data mean outside nominal range flag
2	Input data standard deviation outside nominal range flag
3	Number of input data gaps > threshold value

(continued)

(Flag table 0 33 044 – continued)

Bit No.	
4	Percentage of missing lines > threshold value
5	Doppler centroid uncertain. Confidence measure < specific value
6	Doppler ambiguity estimate uncertain. Confidence measure < specific value
7	Output data mean outside nominal range flag
8	Output data standard deviation outside nominal range flag
9	Chirp reconstruction failed or is of low quality flag
10	Data set missing
11	Invalid downlink parameters
12	Azimuth cut-off iteration count. The azimuth cut-off fit did not converge within a minimum number of iterations
13	Azimuth cut-off fit did not converge within a minimum number of iterations
14	Phase information confidence measure. The imaginary spectral peak is less than a minimum threshold, or the zero lag shift is greater than a minimum threshold
All 15	Missing value

0 33 047

Measurement confidence data

Bit No.	
1	Error detected and attempts to recover made
2	Anomaly in on-board data handling (OBDH) value detected
3	Anomaly in ultra stable oscillator processing (USOP) value detected
4	Errors detected by on-board computer
5	Automatic gain control (AGC) out of range
6	Reception (Rx) delay fault. Rx distance out of range
7	Wave form samples fault identifier. Error
8	S band anomaly/error detected
9–11	Reserved
12	Brightness temperature (channel 1) out of range
13	Brightness temperature (channel 2) out of range
14	Reserved
15	Ku band ocean retracking error
16	S band ocean retracking error
17	Ku band ice 1 retracking error
18	S band ice 1 retracking error
19	Ku band ice 2 retracking error
20	S band ice 2 retracking error
21	Ku band sea ice retracking error
22	Arithmetic fault error
23	Meteo data state. No map
24	Meteo data state. 1 map
25	Meteo data state. 2 maps degraded
26	Meteo data state. 2 maps nominal
27	Orbit propagator status for propagation mode, several errors
28	Orbit propagator status for propagation mode, warning detected
29	Orbit propagator status for initialization mode, several errors
30	Orbit propagator status for initialization mode, warning detected
All 31	Missing value

0 33 048

Confidence measure of SAR inversion*

Code figure	
0	Inversion successful
1	Inversion not successful
2	Reserved
3	Missing value

* SAR = Synthetic aperture radar

0 33 049

Confidence measure of wind retrieval

Code figure	
0	External wind direction used during inversion
1	External wind direction not used during inversion
2	Reserved
3	Missing value

0 33 050

Global GTSPP quality flag

Code figure	
0	Unqualified
1	Correct value (all checks passed)
2	Probably good but value inconsistent with statistics (differ from climatology)
3	Probably bad (spike, gradient, etc., if other tests passed)
4	Bad value, impossible value (out of scale, vertical instability, constant profile)
5	Value modified during quality control
6–7	Reserved
8	Interpolated value
9	Good for operational use; Caution; check literature for other uses
10–14	Reserved
15	Missing value

0 33 052

S band ocean retracking quality

Bit No.	
1–20	First 20 least significant bits correspond to the 20 values (one per data block containing: 0 = valid measurement, 1 = invalid). Bit 1 applies to the 20th data block
All 21	Missing value

0 33 053

Ku band ocean retracking quality

Bit No.	
1–20	First 20 least significant bits correspond to the 20 values (one per data block containing: 0 = valid measurement, 1 = invalid). Bit 1 applies to the 20th data block
All 21	Missing value

0 33 060

GqisFlagQual – individual IASI-System quality flag

Code figure	
0	Good
1	Bad
2	Reserved
3	Missing value

0 33 070

Total ozone quality

Code figure	
0	Good retrieval
1	Bad aerosol information flag or NOAA-16 radiance anomaly
2	Solar zenith angle greater than 84 degrees
3	380 nm residue greater than limit
4	Ozone inconsistency
5	Difference between profile ozone and step 3 total ozone exceeds threshold (set to 25 DU)
6	Step 1 ozone iteration did not converge
7	Any channel residue greater than 16 or bad radiance
8	Insufficient pixels – not processed
9	First guess good – ozone forecast data used
10	High cloud in pixel – not processed
11	Successful ozone retrieval
12	Unsuccessful ozone retrieval
13–14	Reserved
15	Missing value

0 33 071

Profile ozone quality

Code figure	
0	Good retrieval
1	Solar zenith angle greater than 84 degrees
2	Difference between step 3 and profile total ozone greater than limit (25 DU)
3	Average final residue for wavelengths used in retrieval greater than threshold
4	Final residue greater than 3 times a priori error
5	Difference between retrieved and a priori greater than 3 times a priori error
6	Non-convergent solution
7	Upper level profile anomaly or stray light anomaly
8	Initial residue greater than 18.0 N-value units
9–14	Reserved
15	Missing value

0 33 072

Ozone error

Code figure	
0	Good retrieval
1	Reflectivity out of range
2	Larger pixels (Number of cross-track pixels less than 32) or backward scans error
3	Solar zenith angle greater than 88 degrees
4	Latitude/longitude out of range
5	Viewing zenith angle or solar zenith angle out of range
6	Step-one process failed in general
7	First guess ozone out of range
8	Too many iterations (exceed 8)
9	Step-one residue calculation failed
10	Step-two process failed in general
11	First guess ozone profile out of range
12	Step-two ozone value out of range
13	Step-two residue calculation failed
14	Step-three process failed in general
15	Polarization correction accuracy alert
16	Radiance or irradiance less or equal to zero
17–30	Reserved
31	Missing value

0 33 075

Scan-level quality flags

Bit No.	
1	Gap in Raw Data Record (RDR) data detected (i.e., missing scan(s) preceding the current scan)
2	Recorded time is not in sequence (i.e., the scan start time is out of sequence)
3	Lambda monitored calculation cannot be updated (see Note 1)
4	The measured temperatures of any instrument components (e.g., beam-splitter, scan mirror, scan baffle) are outside the allowable ranges (see Note 2)
5	At least one of the monitored instrument temperatures has drifted more than a specified tolerance value
6–12	Reserved
All 13	Missing value

Notes:

(1) Set to 1 if laser wavelength calculation is invalid due to laser diode bias current and/or laser diode temperature measurements being outside the predetermined allowable ranges. These ranges are tunable. In this case Lambda monitored calculation shall have 1 bit per scan.

(2) These temperatures are used to compute the "environmental" contribution to the Internal Calibration Target (ICT) radiances. When this bit is set to 1, the invalid temperatures shall be replaced with the validated temperature values of the ICT.

0 33 076

Calibration quality flags

Bit No.	
1	Lunar intrusion on first deep space view (see Note)
2	Lunar intrusion on second deep space view (see Note)
3–8	Reserved
All 9	Missing value

Note: Set to 1 if at least one spectrum in the deep space moving average was invalidated due to a lunar intrusion.

0 33 077

Field-of-view quality flags

Bit No.	
1	Degraded SDR* quality
2	Invalid SDR* quality (see Note 1)
3	Invalid SDR* geolocation information
4	Degraded radiometric calibration
5	Invalid radiometric calibration (see Note 2)
6	Degraded spectral calibration
7	Invalid spectral calibration (see Note 3)
8	Fringe count error detected and corrected (see Note 4)
9	Day/night indicator (see Note 5)
10	Invalid RDR** data (see Note 6)
11	Significant fringe count error detected (see Note 7)
12	Bit trim failed
13–18	Reserved
All 19	Missing value

* SDR = Sensor data record
** RDR = Raw data record

Notes:

(1) SDR quality is invalid if bit trim failed (see bit 12), or fringe count error detected (see bit 11), or invalid raw data record (RDR) data (see bit 10), or invalid radiometric calibration (see bit 5), or invalid spectral calibration (see bit 7).

(2) Radiometric calibration is invalid if radiometric calibration is not performed, or if it is performed with invalid calibration data (e.g., deep space window size = 0).

(3) Spectral calibration is invalid if fringe count error detected and corrected (see bit 8), or if neon calibration is suspect and Lambda monitored calculation cannot be updated (see “Scan-level quality flags” (0 33 075) – bit 3).

(4) Set to 0 if no fringe count error was detected (see bit 11), or a fringe count error was detected but it was not corrected.

(5) Set to 0 if day (solar zenith angle < 90°). Set to 1 if night (solar zenith angle >= 90°).

(6) This flag indicates the instrument exhibited operational errors and the associated interferogram(s) is/are excluded from SDR processing.

(7) This flag indicates that a significant number of fringes have been missed, shifting the interferogram ZPD outside of a window monitored by the instrument, and the interferogram is excluded from SDR processing.

0 33 078

Geolocation quality

Code figure	
0	Nominal – altitude and ephemeris data available
1	Missing at most a small gap of altitude and ephemeris data
2	Missing more than a small gap of altitude and ephemeris data, but no more than a granule boundary
3	Missing more than a granule boundary of altitude and ephemeris data
4–14	Reserved
15	Missing value

0 33 079

Granule level quality flags

Bit No.	
1–5	Reserved
6	The No. 1–No.7 health checks failed
7	The No. 8–No.15 health checks failed
8	The No. 16–No.23 health checks failed
9	The No. 24–No.31 health checks failed
10	The No. 32–No.39 health checks failed
11	The No. 40–No.47 health checks failed
12	The No. 48–No.55 health checks failed
13	The No. 56–No.63 health checks failed
14	The No. 64–No.70 health checks failed
15	Quadratic correction applied to the radiometric transfer function for non-linearity correction
All 16	Missing value

0 33 080

Scan level quality flags

Bit No.	
1–6	Reserved
7	Divide-by-zero condition or computation loop failed to converge in the K/Ka and V (KAV) band PRT *
8	Divide-by-zero condition or computation loop failed to converge in the WG band PRT
9	Divide-by-zero condition or computation loop failed to converge in the K/Ka, V, W, G band receiver shelf PRT K temperature computation
10	Out of range condition for the K/Ka and V band PRT
11	Out of range condition for the WG band PRT
12	KAV PRT temperature inconsistency
13	WG PRT temperature inconsistency
14	Time sequence error
15	Data gap – missing scan(s) preceding the current scan
16	KAV PRT sufficiency – insufficient KAV PRT data are available
17	WG PRT sufficiency – insufficient WG PRT data are available
18	Space view antenna position error
19	Blackbody antenna position error
All 20	Missing value

* PRT = Platinum Resistance Temperature

0 33 081

Channel data quality flags

Bit No.	
1–2	Reserved
3	Moon in space view
4	Gain error – the lowest blackbody count is smaller than or equal to the highest space view count in a scan
5	Calibration with fewer than preferred samples
6	Space view data sufficiency check – insufficient space view samples are available
7	Blackbody view data sufficiency check – insufficient blackbody view samples are available
8	Out of range condition for the space view
9	Out of range condition for the blackbody view
10	Space view inconsistency
11	Blackbody view inconsistency
All 12	Missing value

0 33 082

Geolocation quality flags

Bit No.	
1–5	Reserved
6	Within south Atlantic anomaly
7	Invalid input data (indicates that any of the spacecraft ephemeris or attitude data are invalid)
8	Bad pointing (indicates that the sensor LOS does not intersect the geoid, is near the limb, has invalid sensor angles or other similar condition)
9	Bad terrain (indicates that the algorithm could not obtain a valid terrain value)
10	Invalid solar angles
11	Missing at most a small gap of altitude and ephemeris data
12	Missing more than a small gap of altitude and ephemeris data, but no more than a granule boundary
13	Missing more than a granule boundary of altitude and ephemeris data
14	The number of encoder pulse values per delta time is not as expected
15	Solar eclipse during Earth view scan
All 16	Missing value

0 33 083

Radiance data quality flags

Bit No.	
1–6	Reserved
7	Poor calibration quality due to bad space view offsets, OBC * view offsets, etc. or use of a previous calibration view
8	Saturated pixel
9	Missing data –data required for calibration processing are not available for processing
10	Calibrated pixel radiance out of range
11	Calibrated pixel reflectance or EBBT out of range
12	The moon has corrupted the space view
13	Scan data is not present (no valid data)
14	Quality for this scan-line is reduced. The value is determined by the combined number of steps required to find a replacement for thermistor or calibration source data
15	Bad detector
All 16	Missing value

* OBC = on-board calibration

0 33 084

Pixel level quality flags

Bit No.	
1–5	Reserved
6	Bulk SST outside of validation range
7	Skin SST outside of validation range
8	Sensor zenith angle > 40 degrees (pixel is not within 40 degrees of nadir and therefore is not of high quality)
9	Degradation – horizontal cell size (HCS) > 1.3 km (HCS > 1.3 km, swath width > 1 700 km, sensor zenith angle > 50.3 degrees)
10	Exclusion: no ocean in pixel
11	Degradation: aerosol optical thickness (AOT) > 0.6 (AOT in horizontal cell > 0.6 on the slant path (AOT @550 nm))
12	Exclusion: AOT > 1.0 (AOT in horizontal cell > 1.0 on the slant path (AOT @550 nm))
13	Sun glint present in pixel
14	Ice concentration threshold exceeded (SST not retrieved due to ice concentration exceeding threshold in system spec)
15	Thin cirrus detected in pixel
All 16	Missing value

0 33 085

Aerosol optical thickness quality flags

Bit No.	
1–3	Reserved
4	Angstrom exponent is outside of the system specification range
5	Excluded, Angstrom exponent for AOT* at 550 nm < 0.15
6	Bright surface in cell (if over land), or shallow or turbid water in cell (if over ocean)
7	Low sun, excluded, Solar Zenith Angle > 80 degrees
8	Low sun, degraded, 65 degrees < Solar Zenith Angle <= 80 degrees
9	Fire detected in cell
10	Snow/Ice in cell
11	Cloud shadow in cell
12	Sun glint in cell
13	Bad SDR** data present in horizontal cell (quality of AOT/APSP*** degraded or AOT/APSP not retrieved due to bad SDR data in horizontal cell)
14	Cirrus contamination in cell
15	Cloud adjacent to cell
16	Cloud contamination in cell
17	AOT is outside of the system specification range
All 18	Missing value

* AOT = Aerosol optical thickness
** SDR = Sensor data record
*** APSP = Aerosol particle size parameter

0 33 086

Quality of pixel level retrieval

Code figure	
0	Not retrieved
1	Excluded
2	Degraded
3	High quality
4–6	Reserved
7	Missing value

0 33 087

Extent of satellite within South Atlantic anomaly (based on climatological data)

Code figure	
0	Less than or equal to 10%
1	Greater than 10% but less than or equal to 20%
2	Greater than 20% but less than or equal to 30%
3	Greater than 30% but less than or equal to 40%
4	Greater than 40% but less than or equal to 50%
5	Greater than 50% but less than or equal to 60%
6	Greater than 60% but less than or equal to 70%
7	Greater than 70% but less than or equal to 80%
8	Greater than 80%
9–14	Reserved
15	Missing value

0 33 088

Ozone total column quality flag

Bit No.	
1–5	Reserved
6	Surface reflectivity out of range
7	Residual too large
8	Aerosol index limit exceeded
9	Solar eclipse present (all or part of the IFOV* is affected by a solar eclipse, umbra or penumbra viewing)
10	Sun glint present within IFOV
11	Snow or ice surface is within the IFOV
12	Solar zenith angle in excluded (night) condition (solar zenith angle >= 88 degrees)
13	Solar zenith angle in degraded condition (80 degrees <= solar zenith angle < 88 degrees)
14	SO_2 index > 6 DU (degraded condition)
15	Residues are not consistent (indicates whether the residues from the 22 wavelengths are consistent)
16	O_3 triplet selection is not consistent within retrieval (ozone triplet consistency)
17	Input data quality is not good
All 18	Missing value

* IFOV = Instantaneous field of view

0 35 000

FM and Regional Code number

Code figure	
000–099	International FM Codes
100–199	RA I Codes
200–299	RA II Codes
300–399	RA III Codes
400–499	RA IV Codes
500–599	RA V Codes
600–699	RA VI Codes
700–799	Antarctic Codes
800–999	Reserved
1000–1022	Not used
1023	Missing value

0 35 001

Time frame for monitoring

Code figure	
0	Real time
1	Near-real time
2	Non-real time
3–6	Reserved
7	Missing value

0 35 030

Discrepancies in the availability of expected data

Code figure	
0	No discrepancies
1	Non-compliance with standard and recommended practices and procedures including those of monitoring
2	Catalogues of meteorological bulletins not updated in a timely manner
3	Incorrect routing directories
4	Lack of flexibility in the routing arrangements
5	Deficiencies in the operation of GTS centres and circuits
6	Loss of data or delays in relaying data on the GTS
7	Routing of data different from the routing provided in the plan
8	Various malpractices
9–14	Reserved
15	Missing value

0 35 031

Qualifier on monitoring results

Code figure	
1	Sufficient and all of acceptable quality
2	Sufficient but partly of acceptable quality
3	Insufficient but all of acceptable quality
4	Insufficient and of unacceptable quality
5	Some messages not complete
6	Suspect or wrongly coded groups could not be interpreted confidently
7	Gross coding errors
8	Transmission sequential order not observed
9	Report completely garbled and thus discarded
10	Deficiencies identified and rectified
11	Deficiencies identified but not rectified
12	Deficiencies not identified
13	Measuring errors
14	Mutual inconsistency
15	Temporal inconsistency
16	Forecast error
17	Bias
18	Improve system of quality control
19	Expand training programmes
20–98	Reserved
99–126	Not used
127	Missing value

0 35 032

Cause of missing data

Code figure	
1	Data groups missing due to radio fading
2	Data groups missing due to outage of centre
3	Data groups missing due to outage of circuit
4	Non-implementation or maintenance of required RBSN density
5	Shortage of qualified staff to man stations
6	Lack of consumables
7	Instrument failure
8	Non-adherence to telecommunication procedures
9	Some observing programmes ceased
10–14	Not used
15	Missing value

0 35 033

Observation and collection deficiencies

Code figure	
1	No deficiency
2	Observations not made regularly
3	Observations not made at right time
4	Observations made but not disseminated
5	Observations made and sent to incorrect users
6	Collection not received
7	Collection transmitted late
8	Collection not transmitted
9	Difficulties in HF propagation and selection of suitable frequency
10	Difficulties in maintenance of communication equipment at remote stations
11	No alternative arrangement for routing meteorological observation
12–99	Reserved
100–122	Not used
123	Missing value

0 35 034

Statistical trends for availability of data (during the survey period(s))

Code figure	
1	Slight improvement
2	Significant improvement
3	Most significant improvement
4	Steady
5	Decreasing
6	Efforts required to improve night-time observations
7	Missing value

0 35 035

Reason for termination

Code figure	
0	Reserved
1	Balloon burst
2	Balloon forced down by icing
3	Leaking or floating balloon

(continued)

(Code table 0 35 035 – continued)

Code figure	
4	Weak or fading signal
5	Battery failure
6	Ground equipment failure
7	Signal interference
8	Radiosonde failure
9	Excessive missing data frames
10	Reserved
11	Excessive missing temperature
12	Excessive missing pressure
13	User terminated
14–29	Reserved
30	Other
31	Missing value

0 40 005

Soil moisture correction flag

Bit No.	
1	Soil moisture between –20% and 0%
2	Soil moisture between 100% and 120%
3	Correction of wet backscatter reference
4	Correction of dry backscatter reference
5	Correction of volume scattering in sand
6–7	Reserved
All 8	Missing value

Note: The nominal range for the surface soil moisture is 0% – 100%. In extreme cases, the extrapolated backscatter at 40 degrees incidence angle may exceed the dry or the wet backscatter reference. In these cases, the value provided by the measurement process of surface soil moisture is, respectively, less than 0% or more than 100%.

0 40 006

Soil moisture processing flag

Bit No.	
1	Not soil
2	Sensitivity to soil moisture below limit
3	Azimuthal noise above limit
4	Backscatter Fore-Aft beam out of range
5	Slope Mid-Fore beam out of range
6	Slope Mid-Aft beam out of range
7	Soil moisture below –20%
8	Soil moisture above 120%
9–15	Reserved
All 16	Missing value

Note: See Note under Flag table 0 40 005.

0 40 011

Interpolation flag

Bit No.	
1	Mean sea-surface (MSS) interpolation flag
2	Ocean tide solution 1 interpolation flag (0 = 4 points over ocean, 1 = less than 4 points)
3	Ocean tide solution 2 interpolation flag (0 = 4 points over ocean, 1 = less than 4 points)
4	Meteorological data interpolation flag (0 = 4 points over ocean, 1 = less than 4 points)
5–7	Reserved
All 8	Missing value

0 40 012

Radiometer data quality flag

Bit No.	(0 is good, 1 is bad)
1	18.7 GHz brightness temperature
2	23.8 GHz brightness temperature
3	34 GHz brightness temperature
4–7	Reserved
All 8	Missing value

0 40 013

Radiometer brightness temperature interpretation flag

Code figure	
0	Interpolation with no gap between JMR* data
1	Interpolation with gaps between JMR* data
2	Extrapolation of JMR* data
3	Failure of extrapolation and interpolation
4–6	Reserved
7	Missing value

* JMR = JASON-1 Microwave Radiometer

0 40 020

GqisFlagQualDetailed – quality flag for the system

Bit No.	
1	NZPD and complex calibration error
2	Band 3 affected by spike
3	Band 3 affected by saturation
4	Band 2 affected by spike
5	Band 1 affected by spike
6	Overflow/under flow
7	On-board processing error
8	Spectral calibration error
9	Radiometric calibration error
10	Missing AVHRR data
11	Missing IIS data
12	Missing sounder data
13	GqisFlagQual summary flag for all bands
14	On-ground processing error
15	Inter-calibration error IASI/AVHRR
16	Spare
All 17	Missing value

0 40 023

Auxiliary altimeter state flags

Bit No.	
1	Band sequence (0 = 3Ku_1C_3Ku, 1 = 2Ku_1C_2Ku)
2	C band frequency (0 = 320 MHz, 1 = 100 MHz)
3	C band status (0 = On, 1 = Off)
4	Ku band status (0 = On, 1 = Off)
All 5	Missing value

0 40 024

Meteorological map availability

Code figure	
0	2 maps available (6 hours apart)
1	2 maps available (> 6 hours apart)
2	1 map available; data extrapolated
3	No maps used
4–6	Reserved
7	Missing value

0 40 025

Interpolation flag for mean diurnal tide

Code figure	
0	Good
1	Bad
2	Reserved
3	Missing value

ATTACHMENT

DEFINITION OF FM 94 BUFR USING BACKUS-NAUR FORM

1. INTRODUCTION

The *Backus-Naur Form* (BNF) is a powerful and unambiguous means of defining a representation form. The notation used is as follows:

⟨lower case letters⟩	an entity defined to be comprised of other entities
⟨UPPER CASE LETTERS⟩	an “atomic” or “terminal” entity, *not* defined in terms of other entities
: : =	is comprised of
⟨entity⟩	specific occurrence of an entity
⟨entity 1⟩⟨entity 2⟩	entity 1 followed by entity 2
⟨- - -⟩|⟨- - -⟩	alternative entities
⟨- - -⟩(n)	exactly n occurrences
⟨- - -⟩o	optional entity (zero or one)
⟨- - -⟩*	zero or more occurrences
⟨- - -⟩+	one or more occurrences

2. DEFINITION OF FM 94 BUFR

In the following, BNF is used to define BUFR from a “top down” approach.

2.1 BUFR message

⟨BUFR message⟩	: : =	⟨indicator section⟩ ⟨identification section⟩ ⟨optional section⟩o ⟨data description section⟩ ⟨data section⟩ ⟨END OF BUFR MESSAGE⟩
⟨END OF BUFR MESSAGE⟩	: : =	string “7777”

2.2 Indicator section

⟨indicator section⟩	: : =	⟨START OF BUFR MESSAGE⟩ ⟨total length of BUFR message⟩ ⟨BUFR edition number⟩
⟨START OF BUFR MESSAGE⟩	: : =	string “BUFR”
⟨total length of BUFR message⟩	: : =	24-bit unsigned integer giving the total length of the message, including the Indicator section, in octets
⟨BUFR edition number⟩	: : =	8-bit unsigned integer

2.3 Identification section

⟨identification section⟩	: : =	⟨LENGTH OF SECTION⟩ ⟨BUFR MASTER TABLE⟩ ⟨originating centre number⟩ ⟨UPDATE SEQUENCE NUMBER⟩ ⟨OPTIONAL SECTION FLAG⟩ ⟨RESERVED FLAG⟩ (7) ⟨BUFR DATA CATEGORY⟩ ⟨BUFR DATA SUB-CATEGORY⟩ ⟨version number of master table used⟩ ⟨version number of local tables used⟩ ⟨YEAR OF CENTURY⟩ ⟨MONTH⟩ ⟨DAY⟩ ⟨HOUR⟩ ⟨MINUTE⟩ ⟨optional part⟩ ⟨PADDING⟩*	
⟨LENGTH OF SECTION⟩	: : =	24-bit unsigned integer giving the length of the section in octets	
⟨BUFR MASTER TABLE⟩	: : =	8-bit unsigned integer giving the BUFR master table	
⟨originating centre number⟩	: : =	16-bit code table	
⟨UPDATE SEQUENCE NUMBER⟩	: : =	8-bit unsigned integer assigned by the originating centre as zero when a BUFR message is first created, and incremented each time it is updated	
⟨OPTIONAL SECTION FLAG⟩	: : =	1-bit flag – 1 indicates Optional section; 0 that it is not present	
⟨RESERVED FLAG⟩	: : =	7-bit flag – reserved for future use (set to 0)	
⟨BUFR DATA CATEGORY⟩	: : =	8-bit unsigned integer indicating the general BUFR data category according to Table A	
⟨BUFR DATA SUB-CATEGORY⟩	: : =	8-bit unsigned integer indicating the BUFR data sub-category according to local convention	
⟨version number of master table used⟩	: : =	8-bit unsigned integer	
⟨version number of local tables used⟩	: : =	8-bit unsigned integer	
⟨YEAR OF CENTURY⟩	: : =	8-bit unsigned integer – year	most typical for the BUFR message contents
⟨MONTH⟩	: : =	8-bit unsigned integer – month	
⟨DAY⟩	: : =	8-bit unsigned integer – day	
⟨HOUR⟩	: : =	8-bit unsigned integer – hour	
⟨MINUTE⟩	: : =	8-bit unsigned integer – minute	
⟨optional part⟩	: : =	as defined by local convention	
⟨PADDING⟩	: : =	sufficient binary zeros, if required, to ensure the section length is a multiple of 2 octets	

2.4 Optional section

⟨optional section⟩	: : =	⟨LENGTH OF SECTION⟩ ⟨RESERVED OCTET⟩ ⟨entity for local use by ADP centres⟩ ⟨PADDING⟩*

⟨RESERVED OCTET⟩	: : =	8-bit unsigned integer set to 0
⟨entity for local use by ADP centres⟩	: : =	defined by ADP centre concerned

2.5 Data description section

⟨data description section⟩	: : =	⟨LENGTH OF SECTION⟩ ⟨RESERVED OCTET⟩ ⟨NUMBER OF DATA SUBSETS⟩ ⟨description section flags⟩ ⟨subset data description⟩
⟨NUMBER OF DATA SUBSETS⟩	: : =	16-bit unsigned integer indicating the number of subsets of data contained in the BUFR message
⟨description section flags⟩	: : =	⟨OBSERVED DATA FLAG⟩ ⟨COMPRESSED DATA FLAG⟩ ⟨RESERVED FLAG⟩ (6)
⟨OBSERVED DATA FLAG⟩	: : =	1-bit flag – 1 indicates observed data; 0 indicates other data
⟨COMPRESSED DATA FLAG⟩	: : =	1-bit flag – 1 indicates compressed data; 0 indicates non-compressed data
⟨RESERVED FLAG⟩	: : =	6-bit flag – reserved for future use (set to 0)
⟨subset data description⟩	: : =	⟨descriptor⟩+
⟨descriptor⟩	: : =	⟨element descriptor⟩| ⟨replication descriptor⟩| ⟨operator descriptor⟩| ⟨sequence descriptor⟩
⟨element descriptor⟩	: : =	⟨table b reference⟩
⟨replication descriptor⟩	: : =	⟨DESCRIPTOR CODE⟩ ⟨REPLICATION SCOPE⟩ ⟨NUMBER OF REPLICATIONS⟩ ⟨table b reference⟩ o
⟨DESCRIPTOR CODE⟩	: : =	2-bit unsigned integer defining the descriptor type – value 1
⟨REPLICATION SCOPE⟩	: : =	6-bit unsigned integer defining the number of subsequent descriptors to be replicated
⟨NUMBER OF REPLICATIONS⟩	: : =	8-bit unsigned integer defining the number of times the descriptors within the scope are to be replicated – if 0, the next element descriptor relates to a data item containing the number of replications
⟨operator descriptor⟩	: : =	⟨table c reference⟩
⟨data description operator⟩	: : =	⟨replication descriptor⟩| ⟨replication descriptor⟩ ⟨element descriptor⟩| ⟨operator descriptor⟩| ⟨operator descriptor⟩ ⟨element descriptor⟩
⟨sequence descriptor⟩	: : =	⟨table d reference⟩

2.6 BUFR Table B

⟨table b⟩	: : =	⟨table b entry⟩+
⟨table b entry⟩	: : =	⟨table b reference⟩ ⟨ELEMENT NAME⟩ ⟨UNITS NAME⟩ ⟨UNITS SCALE SIGN⟩ ⟨UNITS SCALE⟩ ⟨UNITS REFERENCE SIGN⟩ ⟨UNITS REFERENCE VALUE⟩ ⟨ELEMENT DATA WIDTH⟩
⟨table b reference⟩	: : =	⟨DESCRIPTOR CODE⟩ ⟨CLASS NUMBER⟩ ⟨ELEMENT NUMBER⟩
⟨DESCRIPTOR CODE⟩	: : =	2-bit unsigned integer – value 0
⟨CLASS NUMBER⟩	: : =	6-bit unsigned integer – indicating table b class
⟨ELEMENT NUMBER⟩	: : =	8-bit unsigned integer – indicating table b element
⟨ELEMENT NAME⟩	: : =	⟨first line of element name⟩ ⟨second line of element name⟩
⟨first line of element name⟩	: : =	first 32 characters of element name
⟨second line of element name⟩	: : =	next 32 characters of element name
⟨UNITS NAME⟩	: : =	24-character name of SI units used: entered as “CODE TABLE” if data values reference to a code; as “FLAG TABLE” if values reference to a flag; as “NUMERIC” if values are non-dimensional; as “CCITT IA5” if values are characters
⟨UNITS SCALE SIGN⟩	: : =	1-bit sign of units scale value (0 = positive)
⟨UNITS SCALE⟩	: : =	7-bit unsigned integer giving the power of 10 by which the original data element in the units given by ⟨UNITS NAME⟩ is to be multiplied to give the value found in the BUFR message
⟨UNITS REFERENCE SIGN⟩	: : =	1-bit sign of units reference value (0 = positive)
⟨UNITS REFERENCE VALUE⟩	: : =	31-bit unsigned integer containing the data element reference value, scaled according to the units scale
⟨ELEMENT DATA WIDTH⟩	: : =	8-bit unsigned integer indicating data width in bits

2.7 BUFR Table C

⟨table c⟩	: : =	⟨table c entry⟩+
⟨table c entry⟩	: : =	⟨table c reference⟩ ⟨OPERAND⟩ ⟨OPERATOR NAME⟩ ⟨OPERATION DEFINITION⟩
⟨table c reference⟩	: : =	⟨DESCRIPTOR CODE⟩ ⟨OPERATION CODE⟩
⟨DESCRIPTOR CODE⟩	: : =	2-bit unsigned integer – value 2

⟨OPERATION CODE⟩	: : =	6-bit unsigned integer indicating the intended operation
⟨OPERAND⟩	: : =	8-bit unsigned integer value, to be used as an operand as indicated by the operation definition
⟨OPERATOR NAME⟩	: : =	40-character operator name
⟨OPERATION DEFINITION⟩	: : =	rules defining the operation to be performed

2.8 BUFR Table D

⟨table d⟩	: : =	⟨table d entry⟩+
⟨table d entry⟩	: : =	⟨table d reference⟩ ⟨descriptor⟩ ⟨descriptor⟩+
⟨table d reference⟩	: : =	⟨DESCRIPTOR CODE⟩ ⟨CATEGORY NUMBER⟩ ⟨SEQUENCE NUMBER⟩
⟨DESCRIPTOR CODE⟩	: : =	2-bit unsigned integer – value 3
⟨CATEGORY NUMBER⟩	: : =	6-bit unsigned integer indicating table d category
⟨SEQUENCE NUMBER⟩	: : =	8-bit unsigned integer indicating table d sequence list

2.9 Data section

⟨data section⟩	: : =	⟨LENGTH OF SECTION⟩ ⟨RESERVED OCTET⟩ ⟨binary data as defined by sequence descriptors⟩ ⟨PADDING⟩*

3. DEFINITION OF EXCHANGE FORMS FOR BUFR TABLES

3.1 Format for international exchange of Table B

⟨table b⟩	: : =	⟨table b entry⟩+
⟨table b entry⟩	: : =	⟨DESCRIPTOR FLAG⟩ ⟨CLASS NUMBER⟩ ⟨ELEMENT NUMBER⟩ ⟨ELEMENT NAME LINE 1⟩ ⟨ELEMENT NAME LINE 2⟩ ⟨UNITS NAME⟩ ⟨UNITS SCALE SIGN⟩ ⟨UNITS SCALE⟩ ⟨UNITS REFERENCE SIGN⟩ ⟨UNITS REFERENCE VALUE⟩ ⟨ELEMENT DATA WIDTH⟩
⟨DESCRIPTOR FLAG⟩	: : =	1-digit integer as 1 character
⟨CLASS NUMBER⟩	: : =	2-digit integer as 2 characters

⟨ELEMENT NUMBER⟩	: : =	3-digit integer as 3 characters
⟨ELEMENT NAME LINE 1⟩	: : =	Line 1 of name as 32 characters
⟨ELEMENT NAME LINE 2⟩	: : =	Line 2 of name as 32 characters
⟨UNITS NAME⟩	: : =	units in 24 characters, or “CODE TABLE”, “FLAG TABLE”, “NUMERIC” or “CCITT IA5”
⟨UNITS SCALE SIGN⟩	: : =	sign of units scale as 1 character
⟨UNITS SCALE⟩	: : =	3-digit unsigned integer as 3 characters giving the power of 10 by which the original data element in the units given by ⟨UNITS NAME⟩ is to be multiplied to give the value found in the BUFR message
⟨UNITS REFERENCE SIGN⟩	: : =	sign of units reference value as 1 character
⟨UNITS REFERENCE VALUE⟩	: : =	10-digit unsigned integer as 10 characters
⟨ELEMENT DATA WIDTH⟩	: : =	3-digit unsigned integer as 3 characters

Notes:

(1) All characters shall be represented as upper case characters using CCITT IA5 (International Alphabet No. 5).

(2) FORTRAN notation shall be used to represent units; thus m^2 s^{-2} will be represented as M**2/S**2, etc.

(3) Each table b entry shall be represented using 95 characters.

3.2 Format for international exchange of Table D

⟨Table d⟩	: : =	⟨Table d entry⟩+
⟨Table d entry⟩	: : =	⟨F DESCRIPTOR⟩ ⟨X DESCRIPTOR⟩ ⟨Y DESCRIPTOR⟩ ⟨SEQUENCE DESCRIPTOR⟩*
⟨F DESCRIPTOR⟩	: : =	1-digit integer F descriptor as 1 character
⟨X DESCRIPTOR⟩	: : =	2-digit integer X descriptor as 2 characters
⟨Y DESCRIPTOR⟩	: : =	3-digit integer Y descriptor as 3 characters
⟨SEQUENCE DESCRIPTOR⟩	: : =	6-digit integer table reference as 6 characters

PART C

COMMON FEATURES TO BINARY AND ALPHANUMERIC CODES

a. **FM system of numbering table-driven alphanumeric codes**

b. **List of table-driven alphanumeric codes with their specifications and associated code tables**

   Attachment: CREX template examples

c. **Common code tables to binary and alphanumeric codes**

d. **Regulations for reporting traditional observation data in Table-Driven Code Forms (TDCF): BUFR or CREX**

   Attachment I: Examples of templates for the transmission in BUFR or CREX of other data types

   Attachment II: List of alphanumeric code tables related to BUFR and CREX code tables and flag tables

a. FM SYSTEM OF NUMBERING TABLE-DRIVEN ALPHANUMERIC CODES

Each table-driven code bears a number, preceded by the letters FM. This number is followed by a Roman numeral to identify the session of CBS which either approved the code as a new one or made the latest amendment to its previous version. A code approved or amended by correspondence after a session of CBS receives the number of that session.

Furthermore, an indicator term is used to designate the code colloquially and is therefore called a “code name”.

Note on nomenclature:

> Changes and augmentations to the structure of the CREX data representation shall be identified as different “CREX edition numbers”. The previous edition number was 1. The new edition number is 2.
>
> Changes to the content of the parameter Tables A, B, C and D shall be identified as different “table versions”. The previous tables were Version 20; the changes described in this edition will become “Tables A, B, C and D, Version 21”.
>
> Further CREX editions and table versions may be generated independently of one another in the future as requirements dictate.

The FM system of numbering the codes, together with the corresponding code names and their reference list of CBS approved decision, is the following:

FM SYSTEM OF TABLE-DRIVEN ALPHANUMERIC CODES

FM 95–XIV CREX **Character form for the representation and exchange of data**

Res. 8 (EC-LI), Rec. 8 (CBS-99), Rec. 9 (CBS-00), approved by the President of WMO, Res. 4 (EC-LIII), Rec. 9 (CBS-01), approved by the President of WMO, Res. 2 (EC-LVII), Res. 10 (EC-LIX) and Res. 7 (EC-LXI), and adoption between CBS sessions (2010, 2012 and 2013)

b. LIST OF TABLE-DRIVEN ALPHANUMERIC CODES WITH THEIR SPECIFICATIONS AND ASSOCIATED CODE TABLES

FM 95–XIV CREX Character form for the representation and exchange of data

C O D E F O R M

SECTION 0	**Indicator section**
SECTION 1	**Data description**
SECTION 2	**Data section**
SECTION 3	(**Optional section**)
SECTION 4	**End section**

Notes:

(1) CREX is the name of a character code for the representation and exchange of meteorological and other data.

(2) CREX uses many of the principles of FM 94 BUFR.

(3) CREX may be used for the exchange of data for which there is no suitable existing WMO code form.

(4) A CREX message shall consist of one or more subsets of related meteorological data defined, described, and represented by a single CREX entity. For observational data, each subset shall correspond to one report.

(5) A CREX message consists of sections:

Section number	*Name*	*Contents*
0	Indicator section	"CREX"
1	Data description section	CREX master table number, edition number, table version number, BUFR master table number, version number of local table, data category and sub-category, originating centre and sub-centre, sequence number of message, number of subsets, date and time, then a collection of descriptors which define the form and content of data subsets making the data section, and an optional check digit indicator "E"
2	Data section	A set of data items defined by Section 1
3	Optional section	"SUPP" followed by additional items for local use
4	End section	"7777"

(6) It will be noted that CREX representation is suitable for the manual encoding and visual display of meteorological and other data.

R E G U L A T I O N S

95.1 **General**

95.1.1 The beginning and ending of the data representation form shall be identified by the characters "CREX" and "7777", respectively.

95.1.2 Information within CREX shall be character coded.

95.1.3 A group is a sequence of one or more contiguous characters corresponding to a single data descriptor or data value. Groups shall be separated from each other by one or more space characters. Multiple space characters shall be used when needed to improve human readability.

95.1.4 The subset terminator shall be represented by the character string "+". The subset terminator shall not be used when the subset is the last subset.

95.1.5 The section terminator shall be represented by the character string "++". The section terminator shall additionally function as a subset terminator for the last subset.

95.2 **Section 0 – Indicator section**

95.2.1 Section 0 shall be four characters long consisting of the character sequence “CREX”.

95.3 **Section 1 – Data description section**

95.3.1 Table indicators

95.3.1.1 The data description section shall begin with the CREX table descriptor starting with the letter T and followed by a 10-digit number (tteevvbbww) without a separator character. The first two digits (tt) shall define the CREX master table used (tt = 00 if the standard WMO FM 95 CREX tables are used). The next two digits (ee) shall indicate the CREX edition number used, the next two (vv) the CREX table version number used, the next two (bb) the BUFR master table version number used and the last two (ww) the version number of local table (*however for use of local table see Notes 6 and 7 of CREX Table B*).

95.3.1.2 Immediately following the CREX table descriptor and a space character as separator, Section 1 shall contain a six-digit number (nnnmmm) preceded by the letter A. The first three digits (nnn) define the data category referenced to CREX Table A. The next three digits (mmm) shall indicate the sub-category from Common Code table C-13.

95.3.2 Other indicators

95.3.2.1 Immediately following the CREX table descriptors and a space character as separator, Section 1 shall contain an eight-digit number (oooooppp) preceded by the letter P. The first five digits (ooooo) define the originating centre from Common Code table C-11. The next three digits (ppp) shall indicate the originating sub-centre from Common Code table C-12.

95.3.2.2 Immediately following the CREX indicator for originating centre and a space character as separator, Section 1 shall contain a two-digit number (uu) preceded by the letter U. The two digits (uu) define the sequence number of the message (00 for original message, uu for updated version).

95.3.2.3 Immediately following the CREX indicator for the sequence number and a space character as separator, Section 1 shall contain a three-digit number (sss) preceded by the letter S. The three digits (sss) define the number of subsets in the report.

95.3.2.4 Immediately following the CREX indicator for the number of subsets and a space character as separator, Section 1 shall contain an eight-digit number (yyyymmdd) preceded by the letter Y. The first four digits (yyyy) define the year of the most typical time for the CREX message content. The next two digits (mm) define the month and the last two digits (dd) define the day.

95.3.2.5 Immediately following the CREX indicator for the date and a space character as separator, Section 1 shall contain a four-digit number (hhnn) preceded by the letter H. The first two digits (hh) define the hour of the most typical time for the CREX message content and the next two digits (nn) define the minutes.

95.3.3 Data description syntax for CREX

95.3.3.1 After the CREX indicators defining the most typical time for the CREX message content, Section 1 shall have one or more data descriptor(s). Data descriptors shall be preceded by a space character as separator. Data descriptors shall occupy 6 characters. Each descriptor shall have three parts: F (one letter), xx (two digits), yyy (three digits or – (minus sign) followed by two digits for C02yyy data description operator for negative scales – see CREX Table C).

95.3.3.2 The first part (F) of a data descriptor shall be: B, C, D or R.

95.3.3.3 If F = B, the descriptor shall function as “element descriptor”, and it shall define a single data item by reference to CREX Table B named: Bxxyyy.

95.3.3.4 If F = C, the descriptor shall function as “operator descriptor”, and it shall define an operation by reference to CREX Table C named: Cxxyyy.

95.3.3.5 If F = R, the descriptor shall function as "replication descriptor". The two digits “xx” shall define the number of following descriptors to be repeated the number of times defined by the three digits “yyy”. If “yyy” equal “000”, the descriptor defines a delayed replication. Delayed replication is the replication of data values of which the number of replication is known only in the observed report and will therefore be part of the data section (for example: number of levels in a sounding). A corresponding number of four digits in the data section shall then define the number of replications of the data values corresponding to the following xx descriptors in the data description section.

95.3.3.6 If F = D, the descriptor shall function as “sequence descriptor”, and it shall define a list of element descriptors, replication descriptors, operator descriptors and/or sequence descriptors by reference to CREX Table D and named: Dxxyyy.

95.3.4 CREX Table B shall define the element descriptors. If one entry in CREX Table B and one entry in BUFR Table B have the same table reference, the element name shall be the same in both tables. CREX Table B entries shall contain:

(a) The table reference (B xx yyy);

(b) The element name (64 characters maximum);

(c) The units to be used for data representation in CREX, or instead, a reference to a code table or flag table which will then define the possible data value for the element;

(d) The scale factor to be applied to the data value for CREX purposes; the scale defines the precision of the value. No decimal points shall be used in the data section, so a positive scale means that so many figures after the decimal point are included (e.g. scale = 2 means values coded in hundredths, e.g. height coded in centimetre). A negative scale means that so many figures before the decimal point are not included (e.g. heights in hundreds of metres would have scale = –2);

(e) The number of characters to be used in CREX to represent the corresponding data value (without counting the sign);

(f) Reference values for CREX elements are always zero and there shall be no column for this attribute in CREX tables.

Note: Each entry in CREX Table B defining element descriptor should correspond with entries in BUFR Table B and listed in the same table, in Part B, Binary codes, BUFR/CREX Table B.

95.3.4.1 Units should be based on standard international units of the SI system. Alternatively, in exceptional cases, consideration may be given to other standard common units used by the data producer and the users, where a convincing case can be made that those units are more appropriate. In such a case, priority shall be given to units contained in WMO Common Table C-6 or, in the case of descriptors for aviation products, ICAO Annex 5.

95.3.4.2 An operator descriptor shall be used to define change of unit, scale, or data width. The change shall apply only to the data value of the element referenced in the following element descriptor. The “yyy” digits of the operator descriptor shall define the new unit (yyy being equal to the code figure of the new unit defined in Common Code table C-6 listing all the possible units), the new scale or the new data width. The original Table B unit, scale or data width shall be back in force again for that element when subsequently referenced in the data description section until a new change occurs.

Note: Change of unit, scale or data width should be avoided; it should be only a last resort solution. These changes are not recommended in a common CREX Table D sequence. The change operators should not be used when the end user of the message would be a human reader.

95.3.4.3 CREX code tables shall have the same code figures as BUFR code tables. As CREX code tables are generally longer than corresponding BUFR code tables (for example: 99 entries rather than 63), the value corresponding to "Missing" and the values over within the BUFR code table shall be declared “Not used” within the corresponding CREX table ("63" to "99" Not used, in the example).

95.3.4.4 CREX flag tables shall be the same as BUFR flag tables. However, in CREX, flag tables shall be expressed using the octal representation in the following way: a set of three bits being represented by a figure from 0 to 7 (the leftmost bit being the first bit in the table rank), zeros being added on the left when the number of flags is not a multiple of 3:

000 = 0 (no bit set)

001 = 1 (bit 3 set)

010 = 2 (bit 2 set)

011 = 3 (bits 2 and 3 set)

100 = 4 (bit 1 set)

101 = 5 (bits 1 and 3 set)

110 = 6 (bits 1 and 2 set)

111 = 7 (all bits set).

For example, the seven flag table sequence “1100110” transformed with the addition on the left of two zeros to “001100110” would be translated to “146” in octal.

Missing value for a flag table shall be indicated by a set of solidi “/” covering the data width.

95.3.5 Element descriptors corresponding to the following classes in CREX Table B shall remain in effect until superseded by redefinition:

Class

00 Reserved

01 Identification

02 Instrumentation

03 Reserved

04 Location (time)

05 Location (horizontal-1)

06 Location (horizontal-2)

07 Location (vertical)

08 Significance qualifiers

09 Reserved

Note: Redefinition is effected by the occurrence of element descriptors which contradict the preceding element descriptors from these classes. If two or more elements from the same class do not contradict one another, they all apply.

95.3.5.1 The consecutive occurrence of two identical element descriptors or identical sets of element descriptors from Classes 04 to 07, inclusive, shall denote a range of values bounded by the corresponding element values. This enables the definition of layers and simple time periods.

95.3.5.2 The definition of line, areas, volumes and more complex time attributes shall be accomplished using descriptors from Classes 04 to 07 in association with suitable descriptors from Class 08.

95.3.5.3 The consecutive occurrence of two or more non-identical element descriptors from Classes 04 to 07, inclusive, shall infer that all such elements remain in effect until redefined, unless such elements define an increment.

95.3.5.4 Data items defined by element descriptors in Class 10 or above shall not behave as coordinates with respect to subsequent data.

95.3.5.5 Increments:

Any occurrence of an element descriptor from Classes 04 to 07 which defines an increment shall indicate that the location corresponding to that class shall be incremented by the corresponding data value. In the case of successive increments from the same class, this means that each increment shall apply in a cumulative manner, with all preceding increments remaining in effect.

Displacements:

In contrast, any displacement descriptor from Classes 04 to 07 does not redefine the location corresponding to that class, but shall define only a transient displaced location from the location corresponding to that class. In the case of successive displacements from the same class, this means that each displacement shall apply independently and in a non-cumulative manner to the location corresponding to that class.

95.3.5.6 Time or location increment descriptors, from Classes 04 to 07 inclusive, may be associated with replication descriptors in the following way: when an increment descriptor immediately precedes a replication descriptor, or is separated from it by one or more operator descriptors from Table C, this shall signify that such increments shall be applied for each replication; the application of the increments shall take effect from the beginning of each defined replication, including the first.

95.3.5.7 If a CREX message is made up of more than one subset, each subset shall be treated as though it was the first subset encountered.

95.3.6 A check digit indicator is optional at the end of section 1. If present, it shall take the form of the single character “E”.

95.4 Section 2 – Data section

95.4.1 The data section shall be comprised of one or more subsets of groups. Each group shall represent one data value. The sequence of data values shall correspond in order to the list of descriptors defined by Section 1 and shall be terminated by subset terminator, or, in the case of the last subset, by the section terminator.

95.4.2 Each data value shall be coded using the number of characters defined in the CREX Table B entry of the corresponding direct element descriptor in Section 1 or of the corresponding element descriptor within a sequence of descriptors defined by a sequence descriptor in Section 1. However, values of the CREX Table B entry, which are equal to or beyond the missing value of the corresponding BUFR Table B entry, shall not be used. If the data value is a number defining a delayed replication (descriptor “Rxx000” in Section 1), it shall comprise four digits.

95.4.3 Each numerical data value shall include leading zeroes when the number of digits required to represent the value is smaller than the number of characters defined in the corresponding CREX Table B entry or for the delayed repetition number, to keep the number of characters representing the data value always equal to the original data width defined in CREX tables or Regulations, in order to facilitate the presentation alignment and the decoding process.

95.4.4 Positive numerical data values shall be unsigned. Negative numerical data values only shall be signed and represented with the negative sign immediately preceding the data value.

95.4.5 Each data value having a unit defined as character shall include trailing blanks when the number of characters required to represent the data value is smaller than the number of characters defined in the corresponding CREX Table B entry, to keep the number of characters representing the data value always equal to the original data width defined in CREX tables, in order to facilitate the presentation alignment and the decoding process.

95.4.6 A missing value shall be represented as a group of solidi “/” characters equal in number to the number of characters normally required to represent the value concerned.

95.4.7 If the check digit indicator “E” is present at the end of Section 1, a check digit shall be added in front of each data value, immediately preceding the first character of each data value. The check digit shall take the value of the unit digit of the ordered number of the data value, counting along the data subset in which it is contained, starting from 0 (the digit increases from 0 to 9 cyclically). The check digit shall precede immediately the negative sign if the data value is negative.

95.5 Section 3 – Optional section

95.5.1 Section 3 is optional and if present, shall contain additional items as may be defined within each centre for specific use.

95.5.2 Section 3, if present, shall start with the four-character sequence "SUPP" and shall end with a section terminator.

95.6 Section 4 – End section

95.6.1 Section 4 shall be four characters long coded as "7777". Section 4 shall not have a section terminator.

SPECIFICATIONS OF SECTIONS

Notes:

(1) Each section contains one or more groups of characters separated by one separator character.

(2) In the following, each group is numbered as group 1, group 2 and so on, from the beginning of the section.

(3) For Master Table 0, the master table version numbers are as follows:

0	Experimental
1	Version implemented on 3 May 2000
2	Version implemented on 7 November 2001
3	Version implemented on 4 November 2003
4	Version implemented on 2 November 2005
5	Version implemented on 7 November 2007
6	Version implemented on 4 November 2009
7	Version implemented on 15 September 2010
8–15	Not used
16	Version implemented on 4 May 2011
17	Version implemented on 2 November 2011
18	Version implemented on 2 May 2012
19	Version implemented on 7 November 2012
20	Pre-operational to be implemented by next amendment

Section 0 – Indicator section

Group No.	Contents	Meaning	
1	CREX	CREX:	Beginning of the CREX message

Section 1 – Data description section

Group No.	Contents	Meaning	
1	Ttteevvbbww	T:	Indicator for CREX tables
		tt:	CREX Master Table used (00 for WMO standard FM 95 CREX tables)
		ee:	CREX edition number (02)
		vv:	CREX Master Table version number (see Note 3 above)
		bb:	BUFR Master Table version number used (see Note 5 under section 1 of the BUFR regulations)
		ww:	Version number of local table
2	Annnmmm	A:	Indicator for CREX Table A entry
		nnn:	Data category from CREX Table A
		mmm:	International data sub-category from Common Code table C-13
3	Poooooppp	P:	Indicator for originating centre
		ooooo:	Originating centre from Common Code table C-11
		ppp:	Originating sub-centre from Common Code table C-12
4	Uuu	U:	Indicator for sequence number of message
		uu:	Update sequence number (00 for original messages and for messages containing only delayed reports; incremented for the other updates)
5	Ssss	S:	Indicator for number of subsets
		sss:	Number of subsets included in the report
6	Yyyyymmdd	Y:	Indicator for date
		yyyy:	Year
		mm:	Month
		dd:	Day
7	Hhhnn	H:	Indicator for time
		hh:	Hour
		nn:	Minute
8 to n	Bxxyyy, Cxxyyy, Dxxyyy, and/or Rxxyyy	B,C,D:	Indicators for CREX Tables B, C, D entries
		xxyyy:	5 digits each which indicate references from CREX Tables B, C, and/or D
		R:	Indicator for replication
		xx:	Number of replicated descriptors
		yyy:	Number of replications (delayed replication if yyy = 0)
(n + 1)	(E)	E:	Optional check digit indicator

Groups 6 and 7 (Y, yyyy, mm, dd, H, hh, nn): Most typical time for the CREX message content (see Note below)

Note: When accuracy of the time does not define a time unit, then the value for this unit is set to zero (e.g. SYNOP observation at 09 UTC, then minute = 0).

Section 2 – Data section

Group No.	Contents	Meaning	
1 to m	(d) Data values	d:	Optional check digit
		Data: values	Data values corresponding to section 1 descriptors

Section 3 – Optional section

Group No.	Contents	Meaning
1	SUPP	SUPP: The four letters SUPP indicate the presence of a supplementary optional section
2 to p	Items for local use	Additional items for local use developed by the generating centre

Section 4 – End section

Group No.	Contents	Meaning
1	7777	7777: End of CREX

VISUALIZATION OF CREX CODE FORM

(Bold characters are fixed alphanumeric characters; features in brackets are optional)

CREX++

Ttteevvbbww **A**nnnmmm **P**ooooooppp **U**uu **S**sss **Y**yyyymmdd **H**hhnn

Rxxyyy …..….. ………. ……….. ………… ……….. ……….. ………… ……… (E)++

or **B**xxyyy

or **C**xxyyy

or **D**xxyyy

((d)Data values ………… ………. ……….. ………… ……….. ……….. ………… ……….. …………+)

………… …………

………… …………

((d)Data values ………… ………. ……….. ………… ……….. ……….. ………… ……….. …………+)

(d)Data values ………… ………. ……….. ………… ……….. ……….. ………… ……….. …………++

(**SUPP** Items for local use …………….. …………………. ……………………. ………++)

7777

Note: If there is more than one subset, there shall be one "+" padded at the end of each subset, except for the last one (see Regulations 95.1.4, 95.1.5 and 95.4.1).

CREX TABLES, CODE TABLES, FLAG TABLES AND TEMPLATE EXAMPLES

FM 95 CREX refers to three types of tables: CREX tables, code tables and flag tables.

CREX tables

Tables containing information used to describe, classify and define the contents of a CREX message are called CREX tables. Four CREX tables are defined: Tables A, B, C and D. Entry numbering shall be the same in CREX tables and BUFR tables for the same entity represented. Table B entries shall be listed in the common BUFR/CREX Table B in Part B, Binary codes. Table D common sequences shall not be defined in both CREX Table D and BUFR Table D unless otherwise a conversion between both Tables D is not simple, that is, the conversion is not completed by simple replacement of part “F” of each descriptor. If a CREX Table D sequence is not defined in BUFR Table D, it shall be assigned a number not used by any BUFR sequence. Similarly, new BUFR Table D sequences shall be assigned a number not used by any CREX Table D sequence.

Code tables and flag tables

CREX Table B defines some elements by means of code tables or flag tables. Within this general description are included code tables referenced by code figures and flag tables, where each bit is set to 0 or 1 to indicate a false or true value with respect to a specific criterion. Within CREX all code tables and flag tables refer to elements defined within CREX Table B; they are numbered according to the xx and yyy values of the corresponding Table B reference.

Code tables in CREX

CREX code tables have the same code figure as BUFR code tables and are not reproduced. Values of the CREX code, which are equal to or beyond the missing value of BUFR code figure, shall not be used. A missing value in CREX for a code table shall be indicated by a set of solidi “/” covering the data width.

Flag tables in CREX

CREX flag tables shall be the same as BUFR flag tables. However flag tables in CREX shall be expressed using octal representation in the following way: a set of three bits being represented by a figure from 0 to 7 (the leftmost bit being the first bit in the table rank), zeros being added on the left when the number of flags is not a multiple of 3:

000 = 0 (not bit set)
001 = 1 (bit 3 set)
010 = 2 (bit 2 set)
011 = 3 (bits 2 and 3 set)
100 = 4 (bit 1 set)
101 = 5 (bits 1 and 3 set)
110 = 6 (bits 1 and 2 set)
111 = 7 (all bits set).

For example, the seven flag table sequence “1100110” transformed with the addition on the left of two zeros to “001100110” would be translated to “146” in octal.

CREX flag tables are the same as BUFR flag tables and are not reproduced here.

In CREX, a missing value for a flag table shall be indicated by a set of solidi “/” covering the data width.

CREX template examples

Examples of templates of some CREX messages are listed as models in the following Attachment (I.2-Att.CREX-1 to 14) to help users understand the CREX code.

CREX TABLE RELATIVE TO SECTION 1

CREX Table A – *Data category*

Code figure	Data type
000	Surface data – land
001	Surface data – sea
002	Vertical soundings (other than satellite)
003	Vertical soundings (satellite)
004	Single level upper-air data (other than satellite)
005	Single level upper-air data (satellite)
006	Radar data
007	Synoptic features
008	Physical/chemical constituents
009	Dispersal and transport
010	Radiological data
011	CREX tables, complete replacement or update
012	Surface data (satellite)
013–019	Reserved
020	Status information
021	Radiances (satellite measured)
022	Radar (satellite) but not altimeter and scatterometer
023	Lidar (satellite)
024	Scatterometry (satellite)
025	Altimetry (satellite)
026	Spectrometry (satellite)
027	Gravity measurement (satellite)
028	Precision orbit (satellite)
029	Space environment (satellite)
030	Calibration datasets (satellite)
031	Oceanographic data
032–100	Reserved
101	Image data (satellite)
102–239	Reserved
240–254	For experimental use
255	Other category

CREX TABLES RELATIVE TO SECTION 2

CREX Table B – *Classification of elements*

F	X	Class	Comments
B	00	CREX table entries	
B	01	Identification	Identifies origin and type of data
B	02	Instrumentation	Defines instrument types used
B	03	Reserved	
B	04	Location (time)	Defines time and time derivatives
B	05	Location (horizontal – 1)	Defines geographical position, including horizontal derivatives, in association with Class 06 (first dimension of horizontal space)
B	06	Location (horizontal – 2)	Defines geographical position, including horizontal derivatives, in association with Class 05 (second dimension of horizontal space)
B	07	Location (vertical)	Defines height, altitude, pressure level, including vertical derivatives of position
B	08	Significance qualifiers	Defines special character of data
B	09	Reserved	
B	10	Non-coordinate location (vertical)	Height, altitude, pressure and derivatives observed or measured, *not* defined as a vertical location
B	11	Wind and turbulence	Wind speed, direction, etc.
B	12	Temperature	
B	13	Hydrographic and hydrological elements	Humidity, rainfall, snowfall, etc.
B	14	Radiation and radiance	
B	15	Physical/chemical constituents	
B	19	Synoptic features	
B	20	Observed phenomena	Defines present/past weather, special phenomena, etc.
B	21	Radar data	
B	22	Oceanographic elements	
B	23	Dispersal and transport	
B	24	Radiological elements	
B	25	Processing information	
B	26	Non-coordinate location (time)	Defines time and time derivatives that are not coordinates
B	27	Non-coordinate location (horizontal – 1)	Defines geographical positions, in conjunction with Class 28, that are not coordinates
B	28	Non-coordinate location (horizontal – 2)	Defines geographical positions, in conjunction with Class 27, that are not coordinates
B	29	Map data	
B	30	Image	
B	33	Quality information	
B	35	Data monitoring information	
B	40	Satellite data	

(continued)

(CREX Table B – continued)

Notes:

(1) Where a code table or flag table is appropriate, “code table” or “flag table”, respectively is entered in the UNIT column.

(2) The code tables and flag tables associated with Table B are numbered to correspond with the xx and yyy part of the table reference.

(3) To encode values into CREX, the data (with units as specified in the UNIT column) must be multiplied by 10 to the power SCALE.

(4) Where a UNIT is given as Character, data shall be coded as character data left justified within the field width.

(5) Classes 48 to 63 are reserved for local use; all other classes are reserved for future development.

(6) Entries 192 to 255 within all classes are reserved for local use.

(7) The use of local descriptors, as defined in Notes 5 and 6, in messages intended for non-local or international exchange is strongly discouraged.

(8) First-order statistics are included in Table B only when they are produced, as such, by the observing system.

CREX Table B entries from Classes 00 to 40 are defined in BUFR/CREX Table B in Part B, Binary codes, of the Manual.

Note: Class 31 does not exist in CREX.

CREX Table C – *Data description operators*

REFERENCE	OPERAND	OPERATOR NAME	OPERATION DEFINITION
C 01	YYY	Data width replacement	YYY characters (from 000 to 999) replace specified Table B data width
C 02	YYY	Scale factor replacement	YYY (from –99 to 999) replaces the specified Table B scale factor
C 05	YYY	Character insertion	YYY characters (from 001 to 999), including spaces, are inserted as a data field
C 07	YYY	Units replacement	Change unit to unit defined in Common Code table C–6 by code figure equal to YYY, for example: YYY = 040 changes unit to Celsius YYY = 741 changes unit to km h^{-1} YYY = 201 changes unit to knot YYY = 740 changes unit to km
C 41	000	Define event	This operator denotes the beginning of the definition of an event (see Note 2)
C 41	999	Cancel define event	This operator denotes the conclusion of the event definition that was begun via the previous C 41 000 operator
C 42	000	Define conditioning event	This operator denotes the beginning of the definition of a conditioning event (see Note 2)
C 42	999	Cancel define conditioning event	This operator denotes the conclusion of the conditioning event definition that was begun via the previous C 42 000 operator
C 43	000	Categorical forecast values follow	The values which follow are categorical forecast values (see Note 3)
C 43	999	Cancel categorical forecast values follow	This operator denotes the conclusion of the definition of categorical forecast values that was begun via the previous C 43 000 operator
C 60	YYY	National letters insertion (see Note 4)	YYY national letters including spaces are inserted as a data field

Notes:

(1) The operations specified by operator descriptors C 41 000, C 42 000 and C 43 000 remain defined until cancelled or until the end of the data subset. Regulation 95.3.4.2 shall not apply here.

(2) An event, as defined for use with operators C 41 000 and C 42 000, is a set of one or more circumstances described using appropriate Table B descriptors along with their corresponding data values. The grouping of such descriptors together as a single "event" allows them to be collectively assigned as the target of a separate descriptor such as B 33 045 or B 33 046. When defining a circumstance within an event, descriptor B 33 042 may be employed preceding the appropriate Table B descriptor in order to indicate that the corresponding value is actually a bound for a range of values.

(continued)

(CREX Table C – continued)

(3) A categorical forecast value represents a "best guess" from among a set of related, and often mutually exclusive, data values or categories. Operator C 43 000 may be used to designate one or more values as being categorical forecast values, and descriptor B 33 042 may be employed preceding any such value in order to indicate that that value is actually a bound for a range of values.

(4) Only the characters from the International Telegraphic Alphabet No. 2 (ITA2) are likely to be transmitted accurately to all recipients.

CREX Table D – *List of common sequences*

F	X	CATEGORY OF SEQUENCES
D	00	CREX table entries sequences
D	01	Location and identification sequences
D	02	Meteorological sequences common to surface data
D	03	Meteorological sequences common to vertical soundings data
D	04	For satellite observations (*not to be used in CREX for transmission*)
D	05	Meteorological or hydrological sequences common to hydrological observations
D	06	Meteorological or oceanographic sequences common to oceanographic observations
D	07	Surface report sequences (land)
D	08	Surface report sequences (sea)
D	09	Vertical sounding sequences (conventional data)
D	10	Vertical sounding sequences (satellite data) (*not to be used in CREX for transmission*)
D	11	Single-level report sequences (conventional data)
D	12	Single-level report sequences (satellite data) (*not to be used in CREX for transmission*)
D	13	Sequences common to image data (*not to be used in CREX for transmission*)
D	14	Reserved
D	15	Oceanographic report sequences
D	16	Synoptic feature sequences
D	18	Radiological report sequences
D	21	Radar report sequences (*not to be used in CREX for transmission*)
D	22	Chemical and aerosol sequences
D	35	Monitoring information

Notes:

(1) From a conceptual point of view, Table D is not necessary:

- (a) The Data description section can fully and completely describe the data using only element descriptors, operator descriptors and the rules of description;
- (b) Such a means of defining the data would involve considerable overheads in terms of the length of the Data description section. Table D is a device to reduce these overheads;
- (c) Each entry within Table D contains a list of descriptors. Each sequence descriptor that references to Table D may be “expanded” by replacing it with the list corresponding to that entry. The process of “expansion” is well defined, provided it results in a set of element descriptors and operator descriptors;
- (d) Descriptors listed in entries to Table D may themselves refer to Table D, provided no circularity results on repeated expansion;
- (e) The initial Table D has been limited to lists of descriptors likely to be frequently used. Every attempt has been made not to produce initial tables that are too comprehensive. Minor differences of reporting practice can be accommodated by not endeavouring to reduce each observation type to a single descriptor. Indeed, much more flexibility is retained if the Data description section is envisaged as containing three or four descriptors.

(2) It should be noted that, initially, effort has been concentrated on the requirements for observational data. Extensions forecast data, time-series data, products, etc., follow logically and can be added at an appropriate future date.

(3) Underwater soundings are included, with some minor omissions, to illustrate the facility to describe data of slightly different contents.

(4) Categories 48 to 63 are reserved for local use; all other categories are reserved for future development.

(5) Entries 192 to 255 within all categories are reserved for local use.

Category 00 – *CREX table entries sequences*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 00 010	D 00 003 R 01 000 B 00 030	Table D descriptor to be defined Delayed replication of 1 descriptor Descriptor defining sequence

Category 01 – *Location and identification sequences*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Identification)
D 01 029	B 01 018	Short station identifier
	B 02 001	Type of station
	D 01 011	Date
		(Identification – with physical location)
D 01 030	B 01 018	Short station identifier
	B 02 001	Type of station
	D 01 011	Date
	D 01 024	Latitude and longitude, height
		(Ozone instrumentation – Brewer spectrophotometer)
D 01 070	B 02 143	Ozone instrument type
	B 02 142	Ozone instrument serial number or identifier
	B 02 144	Light source type for Brewer
		(Ozone instrumentation – Dobson spectrophotometer)
D 01 074	B 02 143	Ozone instrument type
	B 02 142	Ozone instrument serial number/identification
	B 02 145	Wavelength setting for Dobson instrument
	B 02 146	Source conditions for Dobson instrument
		(Sounding identification)
D 01 075	D 01 001	WMO block number, WMO station number
	B 01 015	Station or site name
	D 01 024	Latitude, longitude, height of station
	B 08 021	18 = launch time
	D 01 011	Year, month, day
	D 01 012	Hour, minute
		(Ozone sounding instrumentation)
D 01 076	B 02 011	Radiosonde type
	B 02 143	Ozone instrument type
	B 02 142	Ozone instrument serial number or identifier

Category 02 – *Meteorological sequences common to surface data*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 02 013	D 02 006	Pressure and pressure change
	D 02 003	Wind, temperature, humidity, visibility, weather
	R 01 000	Delayed replication of 1 descriptor
	D 02 005	Cloud layer information

Category 05 – *Meteorological or hydrological sequences common to hydrological observations*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(SADC-HYCOS single measurement)
D 05 001	B 11 001	Wind direction
	B 11 002	Wind speed
	B 13 060	Total accumulated precipitation
	B 13 071	Upstream water level
		(SADC-HYCOS environmental measurement)
D 05 002	D 01 012	Hour, minute of environmental measurement
	B 12 001	Air temperature
	B 13 003	Relative humidity
	B 14 051	Direct solar radiation integrated over last hour
	B 13 060	Total accumulated precipitation
	B 13 072	Downstream water level
	B 13 080	pH
	B 13 081	Conductivity
	B 13 082	Water temperature
	B 13 083	Dissolved oxygen
	B 13 084	Turbidity
		(SADC-HYCOS measurement array definition)
D 05 003	D 01 012	Hour, minute of first single measurement minus increment
	B 04 065	Short time increment – time interval between measurements
	R 01 000	Delayed replication n times of next descriptor
	D 05 001	Single measurement
		(SADC-HYCOS report)
D 05 004	D 01 030	Identification
	D 05 002	Environmental measurement
	D 05 003	Measurement array
		(MEDHYCOS measurement)
D 05 006	B 13 072	Downstream water level
	B 13 082	Water temperature
	B 13 019	Precipitation last hour
	C 07 005	Next datum in kelvin
	C 01 004	Next datum over four characters
	B 12 001	Air temperature
	B 13 073	Maximum water height observed
	B 13 060	Total accumulated precipitation
		(MEDHYCOS report)
D 05 007	D 01 029	Identification
	D 01 012	Hour, minute (time of first measurement)
	B 04 065	Short time increment – time interval between measurements
	R 01 000	Delayed replication n times of next descriptor
	D 05 006	Single measurement

(continued)

(Category 05 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(AOCHYCOS-Chad measurement)
D 05 008	D 05 006	Same as MEDHYCOS type measurement
	C 07 005	Next datum in kelvin
	C 01 004	Next datum over four characters
	B 12 030	Soil temperature at –50 cm
		(AOCHYCOS-Chad report)
D 05 009	D 01 029	Identification
	D 01 012	Hour, minute (time of first measurement)
	B 04 065	Short time increment – time interval between measurements
	R 01 000	Delayed replication n times of next descriptor
	D 05 008	Single measurement
		(MEDHYCOS-Measurement type 2)
D 05 010	D 05 008	Same as AOCHYCOS type measurement
	B 02 091	Sensor entry 4/20 mA (no. 1)
	B 02 091	Sensor entry 4/20 mA (no. 2)
		(MEDHYCOS report type 2)
D 05 011	D 01 029	Identification
	D 01 012	Hour, minute (time of first measurement)
	B 04 065	Short time increment – time interval between measurements
	R 01 000	Delayed replication n times of next descriptor
	D 05 010	Single measurement
		(Meteorological parameters associated with hydrological data)
D 05 016	B 14 021	Global radiation over period
	B 07 004	Atmospheric pressure
	B 13 003	Relative humidity
	B 11 002	Wind speed
	B 11 001	Wind direction
	B 11 041	Maximum wind speed (gusts)
	B 11 043	Maximum wind gust direction
		(Water quality measurement)
D 05 017	B 13 080	pH
	B 13 081	Conductivity
	B 13 083	Dissolved oxygen
	B 13 085	Oxidation reduction potential (ORP)
	B 13 084	Turbidity
		(MEDHYCOS report with meteorology and water quality data)
D 05 018	D 01 029	Identification
	D 01 012	Hour, minute (time) of first measurement
	B 04 065	Hour increment
	R 03 000	Number of replications of next 3 descriptors
	D 05 008	Same as AOCHYCOS type measurement
	D 05 016	Meteorological parameters associated to hydrological data
	D 05 017	Water quality measurement

Category 06 – *Meteorological or oceanographic sequences common to oceanographic observations*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 06 001	B 02 032	Indicator for digitization
	R 02 000	Delayed replication of 2 descriptors
	B 07 062	Depth below sea surface
	B 22 042	Subsurface sea temperature
D 06 004	B 02 032	Indicator for digitization
	B 02 033	Method of salinity/depth measurement
	R 03 000	Delayed replication of 3 descriptors
	B 07 062	Depth below sea surface
	B 22 043	Subsurface sea temperature
	B 22 062	Salinity
D 06 005	B 02 031	Method of current measurement
	R 03 000	Delayed replication of 3 descriptors
	B 07 062	Depth below sea surface
	B 22 004	Direction of current
	B 22 031	Speed of current
		(Tide report identification, water level checks, time increments)
D 06 019	B 01 075	Tide station alphanumeric identification
	D 01 011	Year, month, day
	D 01 012	Hour, minute
	B 22 042	Sea/water temperature
	B 22 120	Tide station automated water level check
	B 22 121	Tide station manual water level check
	C 01 002	Change data width to 2 characters
	B 04 015	Time increment
	B 04 065	Short time increment
		(Tide report identification, water level checks, time period or displacement, time increment) (see Note 1)
D 06 020	B 01 075	Tide station alphanumeric identification
	D 01 011	Year, month, day
	D 01 012	Hour, minute
	B 22 042	Sea/water temperature
	B 22 120	Tide station automated water level check
	B 22 121	Tide station manual water level check
	B 04 075	Short time period or displacement
	B 04 065	Short time increment

(continued)

(Category 06 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Meteorological parameters in tide station)
D 06 021	B 01 075	Tide station alphanumeric identification
	D 01 011	Year, month, day
	D 01 012	Hour, minute
	B 22 122	Tide station automated meteorological data check
	B 22 123	Tide station manual meteorological data check
	B 12 001	Air temperature
	D 03 002	Pressure, wind direction, wind speed
		(Tidal elevation)
D 06 022	B 01 075	Tide station identification
	D 01 011	Year, month, day
	D 01 012	Hour, minute
	B 22 038	Tidal elevation with respect to local chart datum
	B 22 039	Meteorological residual tidal elevation (surge or offset)
		(Tide elevation series) (see Note 2)
D 06 024	D 06 020	Tide report identification, water level checks, time period or displacement, time increment
	R 02 006	Replicate 2 descriptors 6 times
	B 22 038	Tidal elevation with respect to local chart datum
	B 22 039	Meteorological residual tidal elevation (surge or offset)
		(Tide elevation series)
D 06 025	D 06 019	Tide report identification, water level checks, time increments
	R 02 006	Replicate 2 descriptors 6 times
	B 22 038	Tidal elevation with respect to local chart datum
	B 22 039	Meteorological residual tidal elevation (surge or offset)

Notes:

(1) This sequence is deprecated because of incorrect usage of descriptor B 04 075; sequence D 06 019 should be used instead.

(2) This sequence is deprecated because of incorrect usage of descriptor B 04 075 in sequence D 06 020; sequence D 06 025 should be used instead.

Category 07 – *Surface report sequences (land)*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME	
		(Low altitude station)	
D 07 003	D 07 001	Location (high accuracy) and basic report	
	R 01 000	Delayed replication of 1 descriptor	
	D 02 005	Cloud layer information	
		(Low altitude station)	
D 07 004	D 07 002	Location (coarse accuracy) and basic report	
	R 01 000	Delayed replication of 1 descriptor	
	D 02 005	Cloud layer information	
		(D_vVVVV)	
D 07 012	R 03 000	Delayed replication of 3 descriptors (up to 3)	
	B 08 023	First-order statistics	
	B 05 021	Direction of visibility observed	D_v
	B 20 001	Horizontal visibility	VVVV
		($D_RD_RV_RV_RV_RV_R$)	
D 07 013	R 06 000	Delayed replication of 6 descriptors (up to 4)	
	B 01 064	Runway designator	D_RD_R
	B 08 014	Qualification for runway visual range	
	B 20 061	Runway visual range	$V_RV_RV_RV_R$
	B 08 014	Qualification for runway visual range	
	B 20 061	Runway visual range	$V_RV_RV_RV_R$
	B 20 018	Tendency of runway visual range	i
		(w´w´)	
D 07 014	R 01 000	Delayed replication of 1 descriptor (up to 3)	
	B 20 019	Significant present weather	w´w´
		(Clouds group(s))	
D 07 015	R 01 000	Delayed replication of 1 descriptor	
	D 02 005	($N_sN_sN_s$, CC, $h_sh_sh_s$)	
	B 20 002	Vertical visibility	$VVh_sh_sh_s$
		(REw´w´)	
D 07 016	R 01 000	Delayed replication of 1 descriptor (up to 3)	
	B 20 020	Significant recent weather phenomena	REw´w´
		(Wind shear on runway(s))	
D 07 017	R 01 000	Delayed replication of 1 descriptor	
	B 11 070	Runway designator of the runway affected by wind shear (including ALL)	WS RWYD_RD_R
		(Trend-type landing forecast)	
D 07 018	B 08 016	Change qualifier of a trend-type forecast or an aerodrome forecast	TTTTT
	R 02 000	Delayed replication of 2 descriptors (up to 2)	
	B 08 017	Qualifier of the time when the forecast change is expected (FM, TL, AT)	TT
	D 01 012	GG, gg	

(continued)

(Category 07 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME	
D 07 018	R 04 000	Delayed replication of 4 descriptors (up to 1)	
(continued)	B 07 006	Height above station	
	B 11 001	Wind direction	ddd
	B 11 002	Wind speed	ff
	B 11 041	Maximum wind speed (gusts)	f_mf_m
	B 20 009	General weather indicator	
	R 01 000	Delayed replication of 1 descriptor (up to 1)	
	B 20 001	Horizontal visibility	VVVV
	D 07 014	w´w´	
		(Ozone data – single observation)	
D 07 030	B 15 001	Value of ozone measurement	
	B 15 002	Value of the air-mass	
		(Ozone data – averaged observations)	
D 07 031	B 08 022	Number of measurements	
	B 08 023	First-order statistics = 4: mean value	
	B 15 001	Value (average) of ozone measurement	
	B 08 023	First-order statistics = 9: best estimate of standard deviation	
	B 15 001	Best estimate of standard deviation of the ozone measurement	
	B 08 023	First-order statistics = 11: harmonic mean	
	B 15 002	Value (harmonic mean) of the air-mass	
		(Total ozone measurement from a Brewer ground-based spectrophotometer obtained from a single observation)	
D 07 041	D 01 001	Identification	
	B 01 015	Station or site name	
	D 01 024	Latitude, longitude, height of station	
	D 01 011	Year, month, day (of ozone measurement)	
	D 01 012	Hour, minute (of ozone measurement)	
	D 01 070	Ozone instrumentation	
	D 07 030	Data (single observation)	
		(Total ozone measurement from a Brewer ground-based spectrophotometer obtained from averaged observations)	
D 07 042	D 01 001	Identification	
	B 01 015	Station or site name	
	D 01 024	Latitude, longitude, height of station	
	D 01 011	Year, month, day (of ozone measurement)	
	D 01 012	Hour, minute (of ozone measurement)	
	B 08 021	Time significance = 8: ensemble mean	
	B 04 025	Time period (minutes) for the computation of the average	
	D 01 070	Ozone instrumentation	
	D 07 031	Data (averaged observation)	

(continued)

(Category 07 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		Total ozone measurement from a Dobson ground-based spectrophotometer obtained from a single observation)
D 07 043	D 01 001	Identification
	B 01 015	Station or site name
	D 01 024	Latitude, longitude, height of station
	D 01 011	Year, month, day (of ozone measurement)
	D 01 012	Hour, minute (of ozone measurement)
	D 01 074	Ozone instrumentation
	D 07 030	Data (single observation)
		(Total ozone measurement from a Dobson ground-based spectrophotometer obtained from averaged observations)
D 07 044	D 01 001	Identification
	B 01 015	Station or site name
	D 01 024	Latitude, longitude, height of station
	D 01 011	Year, month, day (of ozone measurement)
	D 01 012	Hour, minute (of ozone measurement)
	B 08 021	Time significance = 8: ensemble mean
	B 04 025	Time period (minutes) for the computation of the average
	D 01 074	Ozone instrumentation
	D 07 031	Data (averaged observation)
		(Soil temperature below land surface)
D 07 060	B 07 061	Depth below land surface
	B 12 030	Soil temperature
		(Soil temperature data at number of depths not exceeding five – high accuracy position)
D 07 061	D 01 031	Identification, type, date/time, position (high accuracy), height
	R 01 005	Replicate 1 descriptor 5 times
	D 07 060	Depth below land surface, soil temperature
		(Soil temperature data at number of depths not exceeding five – coarse accuracy position)
D 07 062	D 01 032	Identification, type, date/time, position (coarse accuracy), height
	R 01 005	Replicate 1 descriptor 5 times
	D 07 060	Depth below land surface, soil temperature
		(Soil temperature with scale of 2 below land surface)
D 07 063	B 07 061	Depth below land surface
	B 12 130	Soil temperature (with scale of 2)

(continued)

(Category 07 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME	
		("Instantaneous" parameters of sequence D 07 089)	
		Surface station identification, time, horizontal and vertical coordinates	
D 07 087	D 01 001	WMO block number, WMO station number	IIiii
	B 02 001	Type of station	i_x
	D 01 011	Year, month, day	YY
	D 01 012	Hour, minute	GG, gg
	D 01 023	Latitude, longitude (course accuracy)	
	B 07 030	Height of station ground above msl	
	B 07 031	Height of barometer above msl	
		Pressure data	
	D 02 001	Pressure	$P_oP_oP_oP_o$
		Pressure reduced to mean sea level	PPPP
		3-hour pressure change	ppp
		Characteristic of pressure tendency	a
	B 10 062	24-hour pressure change	$p_{24}p_{24}p_{24}$
	B 07 004	Pressure (standard level) = 925, 850, 700, .. hPa = missing for lowland stations	a_3
	B 10 009	Geopotential height of the standard level = missing for lowland stations	hhh
		Temperature and humidity	
	B 07 032	Height of sensor above local ground (for temperature measurement)	
	B 12 101	Temperature/air temperature (sc. 2)	s_nTTT
	B 12 103	Dewpoint temperature (sc. 2)	$s_nT_dT_dT_d$
	B 13 003	Relative humidity	
	B 07 032	Height of sensor above local ground (set to missing to cancel the previous value)	
		Visibility	
	B 20 001	Horizontal visibility	VV
		Cloud data	
	D 02 004	Cloud cover (total) If N = 9, then B 20 010 = 113%, if N = /, then B 20 010 = missing.	N
		Vertical significance If C_L are observed, then B 08 002 = 7 (low cloud), if C_L are not observed and C_M are observed, then B 08 002 = 8 (middle cloud), if only C_H are observed, B 08 002 = 0, if N = 9, then B 08 002 = 5, if N = 0, then B 08 002 = 62, if N = /, then B 08 002 = missing.	
		Cloud amount (of low or middle clouds) If N = 0, then B 20 011 = 0, if N = 9, then B 20 011 = 9, if N = /, then B 20 011 = missing.	N_h

(continued)

(Category 07 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME	
D 07 087 *(continued)*		Height of base of cloud	h
		If N = 0 or /, then B 20 013 = missing.	
		Cloud type (low clouds)	C_L
		B 20 012 = C_L + 30,	
		if N = 0, then B 20 012 = 30,	
		if N = 9 or /, then B 20 012 = 62.	
		Cloud type (middle clouds)	C_M
		B 20 012 = C_M + 20,	
		if N = 0, then B 20 012 = 20,	
		if N = 9 or / or C_M = /, then B 20 012 = 61.	
		Cloud type (high clouds)	C_H
		B 20 012 = C_H + 10,	
		if N = 0, then B 20 012 = 10,	
		if N = 9 or / or C_H = /, then B 20 012 = 60.	
	R 01 000	Delayed replication of the next 1 descriptor	
	D 02 005	Vertical significance	
		In any Cb layer, B 08 002 = 4, else:	
		in the first replication:	
		if N = 9, then B 08 002 = 5,	
		if N = /, then B 08 002 = missing,	
		else B 08 002 = 1;	
		in the other replications B 08 002 = 2, 3, 4.	
		Cloud amount	N_s
		in the first replication:	
		if N = /, then B 20 011 = missing,	
		else B 20 011 = N_s;	
		in the other replications B 20 011 = N_s.	
		Cloud type	C
		if N = 9 or /, then B 20 012 = missing,	
		else B 20 012 = C.	
		Height of base of cloud	h_sh_s
		(“Period” parameters of sequence D 07 089)	
		Present and past weather	
D 07 088	B 20 003	Present weather	ww
	B 04 024	Time period	
		At 00, 06, 12, 18 UTC = –6.	
		At 03, 09, 15, 21 UTC = –3.	
	B 20 004	Past weather (1)	W_1
	B 20 005	Past weather (2)	W_2
		Evaporation	
	B 04 024	Time period in hours = –24	
	B 02 004	Type of instrument for evaporation or crop type for evapotranspiration	i_E
	B 13 033	Evaporation /evapotranspiration	EEE

(continued)

(Category 07 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME	
D 07 088		*Sunshine*	
(continued)	R 02 002	Replicate next 2 descriptors 2 times	
	B 04 024	Time period in hours in the first replication = –24, in the second replication = –1.	
	B 14 031	Total sunshine in minutes in the first replication in the second replication	 SSS SS
		Precipitation	
	R 02 002	Replicate next 2 descriptors 2 times	
	B 04 024	Time period in hours	t_R
	B 13 011	Total precipitation no precipitation = 0 trace = –0.1	RRR
		Extreme temperature	
	B 07 032	Height of sensor above local ground (for temperature measurement)	
	B 04 024	Time period in hours = –12	
	B 12 111	Maximum temperature at height and over period specified	$s_nT_xT_xT_x$
	B 04 024	Time period in hours = –12	
	B 12 112	Minimum temperature at height and over period specified	$s_nT_nT_nT_n$
		Wind data	
	B 07 032	Height of sensor above local ground (for wind measurement)	
	B 02 002	Type for instrumentation for wind measurement	i_w
	B 08 021	Time significance = 2 (time averaged)	
	B 04 025	Time period = –10 (or number of minutes after a significant change of wind, if any)	
	B 11 001	Wind direction If dd = 00 (calm) or dd = 99 (variable), B 11 001 = 0.	dd
	B 11 002	Wind speed	ff
	B 08 021	Time significance (set to missing to cancel the previous value)	
		(Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data manually encoded in CREX)	
D 07 089	D 07 087	“Instantaneous” parameters of sequence D 07 089	
	D 07 088	“Period” parameters of sequence D 07 089	

Category 08 – *Surface report sequences (sea)*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(TRACKOB template)
D 08 010	B 01 011	Ship or mobile land station identifier
	R 13 000	Delayed replication of 13 descriptors
	D 01 011	Date
	D 01 012	Time
	D 01 021	Latitude/longitude (high accuracy)
	B 04 080	Averaging period for following value
	B 22 049	Sea-surface temperature
	B 04 080	Averaging period for following value
	B 22 059	Sea-surface salinity
	B 04 080	Averaging period for following value
	B 22 005	Direction of sea-surface current
	B 02 042	Indicator for sea-surface current speed
	B 22 032	Speed of sea-surface current
	B 02 042	Indicator for sea-surface current speed (cancel)
	B 04 080	Averaging period for following value (cancel)

Category 09 – *Vertical sounding sequences (conventional data)*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Vertical wind profile)
D 09 001	D 01 037	Identification, etc. (land station, high accuracy position)
	R 01 000	Delayed replication of 1 descriptor
	D 03 011	Winds at heights
		(Vertical wind profile)
D 09 002	D 01 038	Identification, etc. (land station, coarse accuracy position)
	R 01 000	Delayed replication of 1 descriptor
	D 03 011	Winds at heights
		(Vertical wind profile)
D 09 003	D 01 037	Identification, etc. (land station, high accuracy position)
	R 01 000	Delayed replication of 1 descriptor
	D 03 012	Winds at pressure levels
		(Vertical wind profile)
D 09 004	D 01 038	Identification, etc. (land station, coarse accuracy position)
	R 01 000	Delayed replication of 1 descriptor
	D 03 012	Winds at pressure levels
		(Vertical sounding with relative humidity)
D 09 005	D 01 037	Identification, etc. (land station, high accuracy position)
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 013	Pressure, geopotential, temperature and wind data
		(Vertical sounding with relative humidity)
D 09 006	D 01 038	Identification, etc. (land station, coarse accuracy position)
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 013	Pressure, geopotential, temperature and wind data
		(Vertical sounding with dewpoint data)
D 09 007	D 01 037	Identification, etc. (land station, high accuracy position)
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 014	Pressure, geopotential, temperature and wind data
		(Vertical sounding with dewpoint data)
D 09 008	D 01 038	Identification, etc. (land station, coarse accuracy position)
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 014	Pressure, geopotential, temperature and wind data
		(Vertical wind profile)
D 09 011	D 01 039	Ship's identification, etc.
	R 01 000	Delayed replication of 1 descriptor
	D 03 011	Winds at heights

(continued)

(Category 09 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Vertical wind profile)
D 09 012	D 01 039	Ship's identification, etc.
	R 01 000	Delayed replication of 1 descriptor
	D 03 012	Winds at pressure levels
		(Vertical sounding with relative humidity)
D 09 013	D 01 039	Ship's identification, etc.
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 013	Pressure, geopotential, temperature and wind data
		(Vertical sounding with dewpoint data)
D 09 014	D 01 039	Ship's identification, etc.
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 014	Pressure, geopotential, temperature and wind data
		(Vertical wind profile)
D 09 015	D 01 040	Ship's identification, etc.
	R 01 000	Delayed replication of 1 descriptor
	D 03 011	Winds at heights
		(Vertical wind profile)
D 09 016	D 01 040	Ship's identification, etc.
	R 01 000	Delayed replication of 1 descriptor
	D 03 012	Winds at pressure levels
		(Vertical sounding with relative humidity)
D 09 017	D 01 040	Ship's identification, etc.
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 013	Pressure, geopotential, temperature and wind data
		(Vertical sounding with dewpoint data)
D 09 018	D 01 040	Ship's identification, etc.
	D 02 004	Significant cloud information
	R 01 000	Delayed replication of 1 descriptor
	D 03 014	Pressure, geopotential, temperature and wind data
		(Wind profiler – wind data sounding)
D 09 019	D 01 031	Identification, etc.
	B 02 003	Type of measuring equipment used
	R 01 000	Delayed replication of 1 descriptor
	D 03 011	Winds at heights
		(Wind profiler – Cartesian coordinates)
D 09 020	D 01 031	Identification, etc.
	B 02 003	Type of measuring equipment used
	R 04 000	Delayed replication of 4 descriptors
	B 07 003	Geopotential
	B 11 003	u-component
	B 11 004	v-component
	B 11 005	w-component

(continued)

(Category 09 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Ozone sonde flight data) (see Note 1)
D 09 030	B 15 004	Ozone sounding correction factor
	B 15 005	Ozone p
	R 04 000	Delayed replication
	B 04 015	Time increment since launch time, if needed; in minutes
	B 08 006	Ozone vertical sounding significance
	B 07 004	Pressure
	B 15 003	Measured ozone partial pressure
		(Ozone sonde flight data)
D 09 031	B 15 004	Ozone sounding correction factor
	B 15 005	Ozone p
	R 04 000	Delayed replication
	B 04 025	Time displacement (since launch time) in minutes
	B 08 006	Ozone vertical sounding significance
	B 07 004	Pressure
	B 15 003	Measured ozone partial pressure
		(Ozone sounding not coupled to a ground-based spectrophotometer) (see Note 2)
D 09 040	D 01 075	Identification
	D 01 076	Instrumentation
	D 09 030	Ozone flight data
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is a single value) (see Note 2)
D 09 041	D 07 041	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 030	Ozone flight data
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is an averaged value) (see Note 2)
D 09 042	D 07 042	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 030	Ozone flight data
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is a single value) (see Note 2)
D 09 043	D 07 043	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 030	Ozone flight data

(continued)

(Category 09 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is an averaged value) (see Note 2)
D 09 044	D 07 044	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 030	Ozone flight data
		(Ozone sounding not coupled to a ground-based spectrophotometer)
D 09 045	D 01 075	Identification
	D 01 076	Instrumentation
	D 09 031	Ozone flight data
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is a single value)
D 09 046	D 07 041	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 031	Ozone flight data
		(Ozone sounding coupled to measurements from a Brewer ground-based spectrophotometer; the total ozone obtained from the Brewer is an averaged value)
D 09 047	D 07 042	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 031	Ozone flight data
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is a single value)
D 09 048	D 07 043	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 031	Ozone flight data
		(Ozone sounding coupled to measurements from a Dobson ground-based spectrophotometer; the total ozone obtained from the Dobson is an averaged value)
D 09 049	D 07 044	Description of the ground-based part
	D 01 075	Identification of the ozone sounding part
	D 01 076	Instrumentation of sounding
	D 09 031	Ozone flight data

(continued)

(Category 09 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Sequence for representation of PILOT in the area of ASECNA)
D 09 071	D 01 001	WMO block and station numbers
	B 02 014	Tracking technique/status of system used
	B 02 003	Type of measuring equipment used
	D 01 113	Date/time of launch
	D 01 114	Horizontal and vertical coordinates of launch site
	D 01 023	Latitude/longitude (coarse accuracy)
	B 07 030	Height of station ground above mean sea level
	B 07 007	Height (release of balloon)
	R 03 000	Delayed replication of 3 descriptors
	B 07 009	Geopotential height
	B 11 001	Wind direction
	B 11 002	Wind speed

Notes:

(1) Sequence D 09 030 is deprecated because of incorrect usage of descriptor B 04 015; sequence D 09 031 should be used instead.

(2) This sequence is deprecated because it includes deprecated sequence D 09 030; sequence D 09 045, D 09 046, D 09 047, D 09 048 and D 09 049 should be used instead of respectively D 09 040, D 09 041, D 09 042, D 09 043 and D 09 044.

Category 11 – *Single-level report sequences (conventional data)*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(ACARS supplementary reported variables)
D 11 004	R 01 000	Delayed replication of 1 descriptor
	B 11 034	Vertical gust velocity
	R 01 000	Delayed replication of 1 descriptor
	B 11 035	Vertical gust acceleration
	R 01 000	Delayed replication of 1 descriptor
	B 11 075	Mean turbulence intensity (eddy dissipation rate)
	R 01 000	Delayed replication of 1 descriptor
	B 11 076	Peak turbulence intensity (eddy dissipation rate)
	R 01 000	Delayed replication of 1 descriptor
	B 33 025	ACARS interpolated values indicator
	R 01 000	Delayed replication of 1 descriptor
	B 33 026	**Moisture quality**
		(Standard AMDAR reports)
D 11 005	B 01 008	Aircraft identification
	B 01 023	Sequence number
	D 01 021	Latitude and longitude
	D 01 011	Year, month, day
	D 01 013	Hour, minute, second
	B 07 010	Flight level
	B 08 009	Detailed phase of flight
	B 11 001	Wind direction
	B 11 002	Wind speed
	B 11 031	Degree of turbulence
	B 11 036	Derived equivalent vertical gust speed
	B 12 101	Temperature/air temperature
	B 33 025	ACARS interpolated values indicator
		(AMDAR data or aircraft data for one level without latitude/longitude)
D 11 006	B 07 010	Flight level
	B 11 001	Wind direction
	B 11 002	Wind speed
	B 02 064	Aircraft roll angle quality
	B 12 101	Temperature/air temperature
	B 12 103	Dewpoint temperature
		(Aircraft data for one level with latitude/longitude indicated)
D 11 007	B 07 010	Flight level
	D 01 021	Latitude, longitude
	B 11 001	Wind direction
	B 11 002	Wind speed
	B 02 064	Aircraft roll angle quality
	B 12 101	Temperature/air temperature
	B 12 103	Dewpoint temperature

(continued)

(Category 11 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Aircraft ascent/descent profile without latitude/longitude indicated at each level)
D 11 008	B 01 008	Aircraft identification
	D 01 011	Year, month, day
	D 01 013	Hour, minute, second
	D 01 021	Latitude, longitude
	B 08 004	Phase of flight
	R 01 000	Delayed replication of 1 descriptor
	D 11 006	Aircraft data for one level without latitude/longitude
		(Aircraft ascent/descent profile with latitude/longitude given for each level)
D 11 009	B 01 008	Aircraft identification
	D 01 011	Year, month, day
	D 01 013	Hour, minute, second
	D 01 021	Latitude, longitude
	B 08 004	Phase of flight
	R 01 000	Delayed replication of 1 descriptor
	D 11 007	Aircraft data for one level with latitude/longitude indicated

Category 16 – *Synoptic feature sequences*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Jet stream)
D 16 003	R 09 000	Delayed replication of 9 descriptors
	B 08 011	Meteorological feature (jet stream value)
	B 08 007	Dimensional significance (value for line)
	R 04 000	Delayed replication of 4 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 10 002	Flight level (altitude)
	B 11 002	Wind speed
	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Turbulence)
D 16 004	R 10 000	Delayed replication of 10 descriptors
	B 08 011	Meteorological feature (value for turbulence)
	B 08 007	Dimensional significance (value for area)
	B 07 002	Flight level (altitude) (base of layer)
	B 07 002	Flight level (altitude) (top of layer)
	R 02 000	Delayed replication of 2 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 11 031	Degree of turbulence
	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Storm)
D 16 005	R 08 000	Delayed replication of 8 descriptors
	B 08 005	Meteorological attribute significance (storm centre)
	B 08 007	Dimensional significance (value for point)
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 01 026	WMO storm name (use “UNKNOWN” for a sandstorm)
	B 19 001	Synoptic features (value for type of storm)
	B 08 007	Dimensional significance (cancel)
	B 08 005	Meteorological attribute significance (cancel/end of object)
		(Cloud)
D 16 006	R 11 000	Delayed replication of 11 descriptors
	B 08 011	Meteorological feature (value for cloud)
	B 08 007	Dimensional significance (value for area)
	B 07 002	Flight level (altitude) (base of layer)
	B 07 002	Flight level (altitude) (top of layer)
	R 02 000	Delayed replication of 2 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 20 011	Cloud amount

(continued)

(Category 16 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 16 006	B 20 012	Cloud type
(*continued*)	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Front)
D 16 007	R 09 000	Delayed replication of 9 descriptors
	B 08 011	Meteorological feature (value for type of front)
	B 08 007	Dimensional significance (value for line)
	R 04 000	Delayed replication of 4 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 19 005	Direction of feature
	B 19 006	Speed of feature
	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Tropopause)
D 16 008	R 10 000	Delayed replication of 10 descriptors
	B 08 001	Vertical significance (bit 3 set for tropopause)
	B 08 007	Dimensional significance (value for point)
	B 08 023	Statistic (type of tropopause value)
	R 03 000	Delayed replication of 3 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 10 002	Height/altitude
	B 08 023	Statistic (cancel)
	B 08 007	Dimensional significance (cancel)
	B 08 001	Vertical significance (cancel/end of object)
		(Airframe icing area)
D 16 009	R 10 000	Delayed replication of 10 descriptors
	B 08 011	Meteorological feature (value for airframe icing)
	B 08 007	Dimensional significance (value for area)
	B 07 002	Flight level (altitude) (base of layer)
	B 07 002	Flight level (altitude) (top of layer)
	R 02 000	Delayed replication of 2 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 20 041	Airframe icing (type of airframe icing)
	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Name of feature)
D 16 010	R 07 000	Delayed replication of 7 descriptors
	B 08 011	Meteorological feature
	B 08 007	Dimensional significance (value for point)
	B 01 022	Name of feature
	B 05 002	Latitude (coarse)

(continued)

(Category 16 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 16 010	B 06 002	Longitude (coarse)
(*continued*)	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Volcano erupting)
D 16 011	R 16 000	Delayed replication of 16 descriptors
	B 08 011	Meteorological feature (value for special clouds)
	B 01 022	Name of feature (volcano name)
	B 08 007	Dimensional significance (value for point)
	R 02 000	Delayed replication of 2 descriptors
	B 05 002	Latitude (coarse)
	B 06 002	Longitude (coarse)
	B 08 021	Time significance (eruption starting time)
	B 04 001	Year
	B 04 002	Month
	B 04 003	Day
	B 04 004	Hour
	B 04 005	Minute
	B 20 090	Special clouds (clouds from volcanic eruptions)
	B 08 021	Time significance (cancel)
	B 08 007	Dimensional significance (cancel)
	B 08 011	Meteorological feature (cancel/end of object)
		(Tropical storm identification)
D 16 020	B 01 033	Identification of originating/generating centre
	B 01 025	Storm identifier
	B 01 027	WMO storm name
	D 01 011	Year, month, day
	D 01 012	Hour, minute
		(Analysis data)
D 16 021	D 01 023	Latitude (coarse accuracy), longitude (coarse accuracy)
	B 02 041	Method for estimating reports related to synoptic features
	B 19 001	Type of synoptic feature
	B 19 007	Effective radius of feature
	B 19 005	Direction of motion of feature
	B 19 006	Speed of motion of feature
	B 19 008	Vertical extent of feature
	B 08 005	Surface synoptic feature significance (value=1 for storm centre)
	B 10 004	Pressure (of storm centre by virtue of preceding significance qualifier)
	B 08 005	Value = 2 for outer limit or edge of feature
	B 10 004	Pressure (at outer limit)
	B 19 007	Radius (of outer limit)
	B 08 005	Value = 3 for location of maximum wind
	B 08 021	Time significance (time averaged)
	B 04 075	Time period (minutes)

(continued)

(Category 16 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 16 021 (*continued*)	B 11 040	Maximum wind speed (mean wind)
	B 19 007	Radius of feature (maximum wind)
	R 05 004	(4 times replication of following 5 descriptors)
	B 05 021	Starting bearing or azimuth
	B 05 021	Ending bearing or azimuth
	R 02 002	(2 times replication of following 2 descriptors)
	B 19 003	Wind speed threshold
	B 19 004	Effective radius with respect to wind speed above threshold
		(Forecast data)
D 16 022	B 01 032	Generating application (NWP model name, etc. code table defined by originating/generating centre)
	B 02 041	Method for estimating reports related to synoptic features
	B 19 001	Type of synoptic feature
	B 19 010	Method for tracing of the centre of synoptic feature
	R 18 000	(NN times replication of following 18 descriptors – delayed replication)
	B 08 021	Time significance (forecast)
	B 04 014	Time increment (hour)
	B 08 005	Surface synoptic feature significance
	D 01 023	Latitude (coarse accuracy), longitude (coarse accuracy)
	B 19 005	Direction of motion of feature
	B 19 006	Speed of motion of feature
	B 10 004	Pressure
	B 11 041	Maximum wind speed (gusts: e.g. used in US)
	B 08 021	Time significance (forecast time averaged)
	B 04 075	Time period (minutes)
	B 11 040	Maximum wind speed (mean wind)
	B 19 008	Vertical extent of feature
	R 05 004	(4 times replication of following 5 descriptors)
	B 05 021	Starting bearing or azimuth
	B 05 021	Ending bearing or azimuth
	R 02 002	(2 times replication of following 2 descriptors)
	B 19 003	Wind speed threshold
	B 19 004	Effective radius with respect to wind speed above threshold
		(Tropical storm analysis information)
D 16 026	D 16 020	Tropical storm identification
	D 16 021	Analysis data
		(Tropical storm forecast information)
D 16 027	D 16 020	Tropical storm identification
	D 16 022	Forecast data
		(SAREP template – Part A: Information on tropical cyclone)
D 16 052	D 01 005	Originating centre/sub-centre
	D 01 011	Date
	D 01 012	Time

(continued)

(Category 16 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
D 16 052	B 01 007	Satellite identifier
(*continued*)	B 25 150	Method of tropical cyclone intensity analysis using satellite data
	R 22 000	Delayed replication of 22 descriptors
	B 01 027	WMO long storm name
	B 19 150	Typhoon International Common Number (Typhoon Committee)
	B 19 106	Identification number of tropical cyclone
	B 08 005	Meteorological attribute significance (=1)
	B 05 002	Latitude (coarse accuracy)
	B 06 002	Longitude (coarse accuracy)
	B 08 005	Cancel Meteorological attribute significance
	B 19 107	Time interval of the tropical cyclone analysis
	B 19 005	Direction of motion of feature
	B 19 006	Speed of motion of feature
	B 19 108	Accuracy of geographical position of the tropical cyclone
	B 19 109	Mean diameter of the overcast cloud of the tropical cyclone
	B 19 110	Apparent 24-hour change in intensity of the tropical cyclone
	B 19 111	Current Intensity (CI) number of the tropical cyclone
	B 19 112	Data Tropical (DT) number of the tropical cyclone
	B 19 113	Cloud pattern type of the DT-number
	B 19 114	Model Expected Tropical (MET) number of the tropical cyclone
	B 19 115	Trend of the past 24-hour change (+: Developed, –: Weakened)
	B 19 116	Pattern Tropical (PT) number of the tropical cyclone
	B 19 117	Cloud picture type of the PT-number
	B 19 118	Final Tropical (T) number of the tropical cyclone
	B 19 119	Type of the final T-number
		(Definition of squall line (by 3 points: Centre, North, South) and forecasted trajectory and evolution)
D 16 060	D 01 011	Date
	D 01 012	Time
		Position of squall line centre
	B 05 002	Latitude
	B 06 002	Longitude
	B 19 005	Direction of moving feature
	B 19 006	Speed of moving feature
		Amplitude of feature from most external points to centre point
		North point
	B 05 002	Latitude
	B 06 002	Longitude
		South point
	B 05 002	Latitude
	B 06 002	Longitude
		Evolution
	B 04 074	Period of validity
	B 20 048	Evolution of feature
	B 11 041	Maximum burst expected
	B 13 055	Intensity of rain expected

(continued)

(Category 16 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Definition of squall line (by centre and several points: North points and South points) and forecasted trajectory and evolution)
D 16 061	D 01 011	Date
	D 01 012	Time
		Position of squall line centre
	B 05 002	Latitude
	B 06 002	Longitude
	B 19 005	Direction of moving feature
	B 19 006	Speed of moving feature
		Amplitude of feature from most external points to centre point
		North points
	R 02 000	Define delayed replication of next 2 descriptors
	B 05 002	Latitude
	B 06 002	Longitude
		South points
	R 02 000	Define delayed replication of next 2 descriptors
	B 05 002	Latitude
	B 06 002	Longitude
		Evolution
	B 04 074	Period of validity
	B 20 048	Evolution of feature
	B 11 041	Maximum burst expected
	B 13 055	Intensity of rain expected

Category 35 – *Monitoring information*

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Specify monitoring station)
D 35 001	B 08 035	Type of monitoring exercise
	B 35 001	Time frame for monitoring
	B 08 036	Type of centre or station performing monitoring
	D 01 001	WMO block and station number
		(Specify monitoring centre)
D 35 002	B 08 035	Type of monitoring exercise
	B 35 001	Time frame for monitoring
	B 08 036	Type of centre or station performing monitoring
	B 01 033	Identification of originating/generating centre
		(Specify monitoring period)
D 35 003	B 08 021	(23) Monitoring period
	B 04 001	Year
	B 04 002	Month
	B 04 003	Day
	B 04 004	Hour
	B 04 073	Short period or displacement
		(Specify report type and single station being monitored)
D 35 004	B 08 021	(24) Agreed time limit for report reception
	B 04 004	Hour
	B 08 021	(25) Nominal reporting time
	B 04 004	Hour
	B 35 000	FM and Regional code number
	D 01 001	(WMO station identifier)
	B 35 011	Number of reports actually received
		(Specify report type and WMO block being monitored)
D 35 005	B 08 021	(24) Agreed time limit for report reception
	B 04 004	Hour
	B 08 021	(25) Nominal reporting time
	B 04 004	Hour
	B 35 000	FM and Regional code number
	B 01 001	WMO block number
	B 35 011	Number of reports actually received
		(Specify report type and WMO Region being monitored)
D 35 006	B 08 021	(24) Agreed time limit for report reception
	B 04 004	Hour
	B 08 021	(25) Nominal reporting time
	B 04 004	Hour
	B 35 000	FM and Regional code number
	B 01 003	WMO Region/geographical area
	B 35 011	Number of reports actually received

(continued)

(Category 35 – continued)

SEQUENCE	TABLE REFERENCES F X Y	ELEMENT NAME
		(Report type and multiple stations from one block being monitored)
D 35 007	B 08 021	(24) Agreed time limit for report reception
	B 04 004	Hour
	B 08 021	(25) Nominal reporting time
	B 04 004	Hour
	B 35 000	FM and Regional code number
	B 01 001	WMO block number
	R 02 000	Delayed replication (2 descriptors) – count of stations
	B 01 002	WMO station number
	B 35 011	Number of reports actually received
		(Monitoring a report type from multiple stations)
D 35 010	D 35 002	(Specify monitoring centre)
	D 35 003	(Specify monitoring period)
	D 35 007	(Specify report type and multiple stations being monitored)

ATTACHMENT

CREX TEMPLATE EXAMPLES

PROPOSED BLOEMHOF FLOOD MONITORING CREX CODE (HYDROLOGY)

Indicator section and data description section

CREX++

T000101 A000 D05004++

Station identification

Sequence: D 01 030 consisting of

B 01 018	WMO station identifier
B 02 001	Type of station
D 01 011	Date
D 01 024	Latitude and longitude and height

Hourly environmental data

Sequence: D 05 002 consisting of

D 01 012	Time (hour, minute)
B 12 001	Air temperature
B 13 003	Relative humidity
B 14 051	Direct solar radiation during the last hour
B 13 060	Total accumulated precipitation (modulo 10 000 kg m^{-2})
B 13 072	Downstream water level
B 13 080	pH
B 13 081	Conductivity
B 13 082	Water temperature
B 13 083	Dissolved oxygen
B 13 084	Turbidity

Multiple measurement array definition

Sequence: D 05 003 consisting of

D 01 012	Time of first measurement (hour, minute) minus increment
B 04 065	Short time increment – time interval between measurements in the array (12 minutes)
R 01 000	Delayed replication of one next descriptor (D 05 001) – Number of measurements in the array (5)
D 05 001	Single measurement

Single measurement

Sequence: D 05 001 consisting of

B 11 001	Wind direction
B 11 002	Wind speed
B 13 060	Total accumulated precipitation (modulo 10 000 kg m^{-2})
B 13 071	Upstream water level

End of message

...++

7777

Thus the format of the message D 05 004 for the BLOEMHOF Flood Monitoring System will be:

Indicator section and data description section then:

D 01 030	Identification
D 05 002	Hourly instantaneous values
D 05 003	Array definition
n x D 05 001	Multiple measurements
++ 7777	End of message

Example

A CREX message transmitted at 1046 UTC would be the following:

CREX++
T000101 A000 D05004++
12345 2 1998 02 03 –2600 02800 01570
10 00 285 065 0326 03842 0683 075 2600 2805 ///// 0156
09 00 12 0005
290 0102 00012 1226
250 0250 00025 1230
245 0175 00028 1235
230 0105 00004 1241
220 0025 00001 1249++
7777

Note that the + at end of lines are not needed, only at the end of the whole report (in that case after 1249 – last line) and only if a whole message was to be repeated one or more times. The whole message from 12345 to 1249 is called a “subset” (See Regulation 95.4.1). The space before –2 600 is required for transmission purposes, but optional for display (to keep alignment). Fifth line, last group = delayed replication – 4 digits only = 0005.

Line 1: Message identification

Line 3:

Station number: 12345
Station type: 2
Date of main measurement: 3 February 1998
Position of station: 26 degrees South, 28 degrees East, 1 570 m high

Line 4:

Time of hourly measurement: 1000 UTC

Air temperature at 1000 UTC: 28.5°C

Relative humidity at 1000 UTC: 65%

Direct solar radiation integrated over the period 0900 to 1000 UTC: 326 000 J m^{-2}

Total accumulated precipitation at 1000 UTC: 0 384.2 kg m^{-2}

Downstream water level at 1000 UTC: 6.83 m

Water pH: 7.5

Conductivity at 1000 UTC: 2.6 Siemens m^{-1} = 26 mS cm^{-1}

Water temperature at 1000 UTC: 280.5 K

Dissolved oxygen at 1000 UTC: Not available

Turbidity at 1000 UTC: 156 Lumen

Line 5: Measurement array definition

First measurement minus 12 minutes at 0900 UTC

Interval between measurements is 12 minutes

Number of measurements is 5

Line 6: First set of measurements at 0912 UTC

Instantaneous wind direction at 0912 UTC: 290

Instantaneous wind speed at 0912 UTC: 10.2 m s^{-1}

Total precipitation between 0900 and 0912 UTC: 1.2 kg m^{-2}

Upstream water level at 0912 UTC: 12.26 m

Line 7: Second set of measurements at 0924 UTC

Instantaneous wind direction at 0924 UTC: 250

Instantaneous wind speed at 0924 UTC: 25.0 m s^{-1}

Total precipitation between 0912 and 0924 UTC: 2.5 kg m^{-2}

Upstream water level at 0924 UTC: 12.30 m

Line 8: Third set of measurements at 0936 UTC

Instantaneous wind direction at 0936 UTC: 245

Instantaneous wind speed at 0936 UTC: 17.5 m s^{-1}

Total precipitation between 0912 and 0936 UTC: 2.8 kg m^{-2}

Upstream water level at 0936 UTC: 12.35 m

Line 9: Fourth set of measurements at 0948 UTC

Instantaneous wind direction at 0948 UTC: 230

Instantaneous wind speed at 0948 UTC: 10.5 m s^{-1}

Total precipitation between 0912 and 0948 UTC: 0.4 kg m^{-2}

Upstream water level at 0948 UTC: 12.41 m

Line 10: Fifth set of measurements at 1000 UTC

Instantaneous wind direction at 1000 UTC: 220

Instantaneous wind speed at 1000 UTC: 2.5 m s^{-1}

Total precipitation between 0912 and 1000 UTC: 0.1 kg m^{-2}

Upstream water level at 1000 UTC: 12.49 m

Line 11: End of message identifier

TIDE GAUGE DATA EXAMPLE

CREX++
T000101 A001 D06025++
RI010 1998 01 23 15 00 2761 00 00 30 –30
01407 1225 01384 1217 01382 1221 01395 1220 01473 1262 01502 1227+
CT010 1998 01 23 15 00 2781 01 00 30 –30
02024 1757 02043 1717 02124 1728 02177 1716 ///// //// 02259 1670++
7777

Interpretation of the example:

Line	*Group*	*Meaning*
1	CREX	Indicator of a CREX message
2	T000101	CREX Master Table Number 00, Edition 01, Version 01
	A0001	Data type 001: Surface data – sea
	D 06 025	Tide elevation series
3	RI010	Tide station RI010
	1998	Year: 1998
	01	Month: January
	23	Day: 23
	15	Hour: 1500 UTC
	00	Minute: 00
	2761	Sea/water temperature: 276.1 K
	00	Tide station automated water level check: Good data
	00	Tide station manual water level check: Operational
	30	Time increment: Time is now hour 1500, minute 30
	–30	Short time increment: Increment is applied prior to each replication of two descriptors indicated by the group R 02 006, thus the time is now hour 1 500, minute 00
4	01407	Tide elevation of 1 407 mm at hour 1500, minute 00
	1225	Meteorological residual tidal elevation of 1 225 mm at hour 1500, minute 00
	01384	Tide elevation of 1 384 mm at hour 1400, minute 30

	1217	Meteorological residual tidal elevation of 1 217 mm at hour 1400, minute 30
	01382	Tide elevation of 1 382 mm at hour 1400, minute 00
	1221	Meteorological residual tidal elevation of 1 221 mm at hour 1400, minute 00
	01395	Tide elevation of 1 395 mm at hour 1300, minute 30
	1220	Meteorological residual tidal elevation of 1 220 mm at hour 1300, minute 30
	01473	Tide elevation of 1 473 mm at hour 1300, minute 30
	1262	Meteorological residual tidal elevation of 1 262 mm at hour 1300, minute 00
	01502	Tide elevation of 1 502 mm at hour 1200, minute 30
	1227	Meteorological residual tidal elevation of 1 227 mm at hour 1200, minute 30
	+	End of report for station RI010
5	CT010	Tide station CT010
	1998	Year: 1998
	01	Month: January
	23	Day: 23
	15	Hour: 1500 UTC
	00	Minute: 00
	2761	Sea/water temperature: 276.1 K
	00	Tide station automated water level check: Good data
	00	Tide station manual water level check: Operational
	30	Time increment: Time is now hour 1500, minute 30
	–30	Short time increment: Increment is applied prior to each replication of two descriptors indicated by the group R 02 006, thus the time is now hour 1500, minute 00
6	02024	Tide elevation of 2 024 mm at hour 1500, minute 00
	1715	Meteorological residual tidal elevation of 1 715 mm at hour 1500, minute 00
	02043	Tide elevation of 2 043 mm at hour 1400, minute 30
	1717	Meteorological residual tidal elevation of 1 717 mm at hour 1400, minute 30
	02124	Tide elevation of 2 124 mm at hour 1400, minute 00
	1728	Meteorological residual tidal elevation of 1 728 mm at hour 1400, minute 00
	02177	Tide elevation of 2 177 mm at hour 1300, minute 30
	1716	Meteorological residual tidal elevation of 1 716 mm at hour 1300, minute 30
	/////	Tide elevation missing at hour 1300, minute 30
	////	Meteorological residual tidal elevation missing at hour 1300, minute 00
	02259	Tide elevation of 2 259 mm at hour 1200, minute 30
	1670	Meteorological residual tidal elevation of 1 670 mm at hour 1200, minute 30
	++	End of report for station CT010; also, end of Data section
7	7777	End of CREX message

TOTAL OZONE MEASUREMENT FROM A BREWER GROUND-BASED SPECTROPHOTOMETER OBTAINED FROM AVERAGED OBSERVATIONS

KULD40 OKOH 041643
CREX++
T0002071500 A008002 P00089001 U00 S001 Y20110504 H0748 D07042++
11 649 Hradec Kralove   5018 01583 00285 2011 05 04 07
48 08 0526 001 98   00 00022 04 0383 09 0012 11 157++
7777

CREX

T0002071500		CREX master table		00
		CREX edition number		02
		CREX table version number		07
		BUFR Master table version number used		15
		Version number of local table		00
A008002		Data category		008
		International data subcategory		002
P00089001		Originating centre (Common Code table C–11)		00089
		Originating sub-centre (Common Code table C–12)		001
U00		Update sequence number (00 for original and delayed messages; incremented for corrected messages)		00
S001		Number of subsets included in the report		001
Y20110504		Year		2011
		Month		05
		Day		04
H0748		Hour		07
		Minute		48
D07042	D01001			
	B01001	WMO block number		11
	B01002	WMO station number		649
	B01015	Station or site name (1)		Hradec Kralove^^^^^^
	D01024			
	B05002	Latitude (2) (3)	50.18 deg N	5018
	B06002	Longitude (2) (3)	15.83 deg E	01583
	B07001	Height of station		00285
	D01011			
	B04001	Year (of ozone measurement)		2011
	B04002	Month (of ozone measurement)		05
	B04003	Day (of ozone measurement)		04
	D01012			
	B04004	Hour (of ozone measurement) (4)		07
	B04005	Minute (of ozone measurement) (4)		48
	B08021	Time significance = 8 = ensemble mean(5)		08

	B04025	Time period (in minutes)	0526
D01070			
	B02143	Ozone instrument type	001
	B02142	Ozone instrument serial number [(1)]	98^^
	B02144	Light source type for Brewer spectrophotometer [(6)]	00
D07031			
	B08022	Number of measurements	00022
	B08023	First order statistic = 4 = mean value	04
	B15001	Value (average) of ozone measurement	0383
	B08023	First order statistic = 9 = best estimate of std deviation	09
	B15001	Best estimate of std deviation of the ozone measurement	0012
	B08023	First order statistic = 11 = harmonic mean	11
	B15002	Harmonic mean of the air mass	157

7777

Notes:
(1) Characters “^^^^^^” are used for visualization of the corresponding number of space characters.
(2) Latitude and longitude shall be reported in degrees with precision in hundredths of a degree.
(3) South latitude and west longitude shall be assigned negative values.
(4) Hour and minute specify the time of the first measurement of the series.
(5) “Ensemble mean” indicates that a number of distinct values corresponding to a set of time locations are averaged.
(6) Ozone measurements of only one light source shall be selected, i.e. the best light source of the day.

ATTACHMENT

EXAMPLE OF AN OZONE SOUNDING COUPLED TO A BREWER SPECTROPHOTOMETER

Note: ^ means space in the definitions below

CREX++

T000101

A008

D 01 001	WMO block number	71
	WMO station	913
B 01 015	Station or site name	Churchill^^^^^^^^^^^
D 01 024	Latitude	5875
	Longitude	–09400
	Elevation	00029
D 01 011	Year	1998
	Month	04
	Day	29
D 01 012	Hours	13
	Minutes	46
B 08 021	Time significance = 8 = ensemble mean	08
B 04 025	Time period (minutes)	0550
D 01 070	Ozone instrument type	001
	Ozone instrument serial number (Brewer)	26^^
	Light source type for Brewer (direct sun)	00
B 08 022	Number of measurements	00010
B 08 023	First order statistics = 4 = mean value	04
B 15 001	Value of ozone measurement	0399
B 08 023	First order statistics = 9 = best estimate of standard deviation	09
B 15 001	Best estimate of standard deviation	0010
B 08 023	First order statistics = harmonic mean	11
B 15 002	Harmonic mean of the air mass	202
D 01 001	WMO block and station number	71
		913
B 01 015	Station or site name	Churchill^^^^^^^^^^^
D 01 024	Latitude	5875
	Longitude	–09400
	Elevation	00029
B 08 021	18 = launch time follows	18
D 01 011	Year	1998
	Month	04
	Day	29
D 01 012	Hours	11
	Minutes	22
B 02 011	Radiosonde type	061
B 02 143	Ozone instrument type	019
B 02 142	Ozone sonde serial number	////
D 15 004	Ozone sounding correction factor	0893
D 15 005	Ozone p	373

R 04 000	Delayed replication factor = number of levels	0093
	The next four descriptors are repeated 93 times	
B 04 025	Time displacement since launch time (minutes)	See below
B 08 006	Ozone VSS	See below
B 07 004	Pressure	See below
B 15 003	Measured ozone partial pressure	See below
++		
7777	End of message	

```
KULA01 CWAO 051800
CREX++
T000101 A008 D09047++
71 913 CHURCHILL       5875 –09400 00029 1998 04 29 13 46
   08 0550 001 26 00 00010 04 0399 09 0010 11 202
   71 913 CHURCHILL   5875 –09400 00029 18 1998 04 29 11 22
   061 019 //// 0893 373 0093
   0000 400 10041 029 0000 200 10000 029 0000 002 09915 031
   0001 002 09735 036 0001 002 09678 038 0002 002 09273 038
   0003 002 09111 039 0004 200 08500 039 0009 200 07000 037
   0011 002 06450 037 0012 002 06279 036 0012 002 06159 031
   0014 002 05847 034 0016 002 05347 030 0016 002 05269 029
   0017 002 05100 040 0018 200 05000 034 0019 002 04821 030
   0023 200 04000 030 0027 002 03400 026 0029 002 03000 028
   0031 002 02857 029 0031 002 02818 024 0032 002 02743 017
   0034 200 02500 015 0036 002 02225 014 0038 002 02078 029
   0038 002 02049 036 0039 200 02000 066 0039 002 01992 066
   0039 002 01952 093 0040 002 01909 105 0040 002 01866 105
   0041 002 01800 115 0042 002 01765 103 0042 002 01741 100
   0043 002 01693 112 0043 002 01656 112 0044 002 01612 109
   0044 002 01590 092 0044 002 01580 066 0045 002 01559 052
   0045 002 01517 049 0046 002 01500 059 0046 002 01488 070
   0046 002 01469 098 0047 002 01440 107 0047 002 01391 107
   0048 002 01335 117 0049 002 01291 162 0050 002 01257 153
   0051 002 01206 155 0051 002 01190 141 0051 002 01182 141
   0052 002 01142 156 0053 002 01103 154 0054 002 01059 177
   0055 002 01005 170 0056 200 01000 178 0056 002 00978 197
   0057 002 00951 187 0058 002 00914 183 0058 002 00889 171
   0059 002 00866 182 0059 002 00855 195 0060 002 00837 198
   0061 002 00808 175 0061 002 00797 172 0064 200 00700 160
   0065 002 00671 157 0067 002 00630 142 0068 002 00592 153
```

0068 002 00583 162 0070 002 00531 157 0072 002 00501 164
0072 200 00500 161 0073 002 00479 162 0073 002 00462 151
0075 002 00435 156 0076 002 00418 153 0078 002 00378 161
0081 002 00319 132 0082 002 00311 136 0083 200 00300 130
0086 002 00258 111 0091 200 00200 095 0097 002 00143 079
0099 002 00126 078 0103 200 00100 071 0110 200 00070 058
0115 002 00054 044 0116 200 00050 039 0120 002 00043 032++
7777

EXAMPLE OF AN OZONE SOUNDING NOT COUPLED TO A BREWER SPECTROPHOTOMETER

CREX++		
T000101		
A008		
D 01 001	WMO station and block number	71
		917
B 01 015	Station or site name	Eureka^^^^^^^^^^^^^^
D 01 024	Latitude	7598
	Longitude	–08593
	Elevation	00010
B 08 021	18 = launch time follows	18
D 01 011	Year	1998
	Month	04
	Day	29
D 01 012	Hours	23
	Minutes	18
B 02 011	Radiosonde type	061
B 02 143	Ozone instrument type	019
B 02 142	Ozone sonde serial number	////
D 15 004	Ozone sounding correction factor	////
D 15 005	Ozone p	375
R 04 000	Delayed replication factor = number of levels	0082
	The next four descriptors are repeated 82 times	
B 04 025	Time displacement since launch time (minutes)	See below
B 08 006	Ozone VSS	See below
B 07 004	Pressure	See below
B 15 003	Measured ozone partial pressure	See below
++		
7777	End of message	

```
KULA01 CWAO 051800
CREX++
T000101 A008 D09045++
71 917 EUREKA            7598 –08593 00010 18 1998 04 29 23 18
    061 019 //// //// 375 0082
    0000 400 10137 030 0000 200 10000 030 0001 002 09687 037
    0002 002 09366 033 0004 002 08831 037 0005 200 08500 036
    0007 002 08013 043 0007 002 07881 047 0008 002 07646 037
    0009 002 07442 042 0011 200 07000 031 0012 002 06849 027
    0013 002 06710 036 0015 002 06291 029 0022 200 05000 028
    0025 002 04557 027 0029 002 04065 024 0029 200 04000 020
    0032 002 03626 025 0038 002 03000 020 0040 002 02890 021
    0040 002 02829 065 0041 002 02726 105 0043 002 02576 118
    0044 200 02500 135 0048 002 02218 165 0049 002 02147 161
    0050 002 02104 171 0051 002 02031 153 0051 002 02010 159
    0051 200 02000 171 0052 002 01941 188 0054 002 01854 198
    0056 002 01744 187 0056 002 01717 194 0057 002 01683 191
    0058 002 01640 161 0058 002 01623 159 0059 002 01585 168
    0059 002 01576 185 0060 002 01545 197 0061 002 01500 202
    0063 002 01414 221 0064 002 01370 220 0065 002 01335 230
    0066 002 01269 219 0067 002 01232 227 0067 002 01226 235
    0068 002 01208 241 0072 002 01055 242 0074 200 01000 236
    0075 002 00960 228 0076 002 00936 192 0077 002 00912 180
    0078 002 00897 187 0078 002 00883 210 0079 002 00868 221
    0079 002 00850 202 0080 002 00841 199 0081 002 00815 208
    0081 002 00807 189 0081 002 00803 171 0082 002 00790 152
    0082 002 00777 157 0083 002 00764 172 0084 002 00741 156
    0084 002 00722 156 0085 002 00715 162 0085 200 00700 188
    0085 200 00700 193 0086 002 00682 203 0088 002 00639 212
    0090 002 00608 206 0091 002 00588 190 0091 002 00582 192
    0092 002 00570 209 0092 002 00557 215 0096 200 00500 197
    0099 002 00437 171 0108 002 00316 139 0110 200 00300 128
    0115 002 00242 108++
7777
```

SAMPLE DATA WITH CREX SEQUENCE FOR EXCHANGE OF FORECAST RESULT ON TROPICAL CYCLONES

Descriptor	Order No.	Sample data	Corresponding meaning	Unit	Scale	Data width
B 01 033	1	034	Originating Centre = RSMC Tokyo	Code table	0	3
B 01 025	2	21W	Storm identifier	Character	0	3
B 01 027	3	ZANE	WMO storm name	Character	0	10
D 01 011			(sequence descriptor)			
B 04 001	4	1996	Year	Year	0	4
B 04 002	5	10	October	Month	0	2
B 04 003	6	01	1st	Day	0	2
D 01 012			(sequence descriptor)			
B 04 004	7	06	6 o'clock (UTC)	Hour	0	2
B 04 005	8	00	0 minute (UTC)	Minute	0	2
B 01 032	9	XXX	(to be defined)			
			Identification of NWP model	Code table	0	3
B 02 041	0	01	Based on computer analysis	Code table	0	2
B 19 001	1	02	Tropical storm	Code table	0	2
B 19 010	2	01	Minimum value of sea level pressure	Code table	0	2
R 18 000	3	0003	(***delayed replication descriptor**) Data for 3 forecast times of 18 descriptors follow	Numeric	0	4
B 08 021	4	04	Forecast data follow	Code table	0	2
B 04 014	5	0012	12 hour forecast data follow	Hour	0	4
B 08 005	6	01	Data of storm centre follow	Code table	0	2
D 01 023			(sequence descriptor)			
B 05 002	7	3010	Latitude of the storm centre is 30.1N	Degree	2	4
B 06 002	8	14200	Longitude of the storm centre is 142.0E	Degree	2	5
B 19 005	9	270	Direction of motion of storm is 270	Degree true	0	3
B 19 006	0	00500	Speed of motion of storm is 5 m s^{-1}	m s^{-1}	2	5
B 10 004	1	09750	Pressure of storm centre is 975 hPa	Pa	–1	5
B 11 041	2	0576	Gust wind speed is 57.6 m s^{-1}	m s^{-1}	1	4
B 08 021	3	06	Forecast time averaged follow	Code table	0	2
B 04 075	4	10	10 minutes mean value follow	Minute	0	2
B 11 040	5	0360	Maximum wind speed is 36.0 m s^{-1}	m s^{-1}	1	4
B 19 008	6	2	Storm depth is medium	Code table	0	1
R 05 004			***(replication descriptor) 4 times replication of following 5 descriptors			
B 05 021	7	31500	Sector 1 (from 315 degrees	Degree true	2	5
B 05 021	8	04500	to 45 degrees)	Degree true	2	5
R 02 002			***(replication descriptor) 2 times replication of following 2 descriptors			
B 19 003	9	025	Wind speed threshold is 25 m s^{-1}	m s^{-1}	0	3
B 19 004	0	1950	Effective radius is 195 km	m	–2	4

Descriptor	Order No.	Sample data	Corresponding meaning
	1	015	Wind speed threshold is 15 m s^{-1}
	2	4000	Effective radius is 400 km
	3	04500	Sector 2 (from 45 degrees to 135 degrees)
	4	13500	
	5	025	Wind speed threshold is 25 m s^{-1}
	6	1950	Effective radius is 195 km
	7	015	Wind speed threshold is 15 m s^{-1}
	8	4300	Effective radius is 430 km
	9	13500	Sector 3 (from 135 degrees to 225 degrees)
	0	22500	
	1	025	Wind speed threshold is 25 m s^{-1}
	2	1950	Effective radius is 195 km
	3	015	Wind speed threshold is 15 m s^{-1}
	4	6090	Effective radius is 609 km
	5	22500	Sector 4 (from 225 degrees to 315 degrees)
	6	31500	
	7	025	Wind speed threshold is 25 m s^{-1}
	8	1950	Effective radius is 195 km
	9	015	Wind speed threshold is 15 m s^{-1}
	0	4700	Effective radius is 470 km
	1	04	(24- and 36-hour forecast data follow as same as
	....		the second fourth order above) ....

CREX MESSAGE COMPOSED OF ABOVE DATA ELEMENTS:

CREX++
T000101 A007 B01033 B01025 B01027 D01011 D01012 B01032 B02041 B19001 B19010 R18000 B08021 B04014 B08005 D01023 B19005 B19006 B10004 B11041 B08021 B04075 B11040 B19008 R05004 B05021 B05021 R02002 B19003 B19004 E++
0034 121W 2ZANE 31996 410 501 606 700 8XXX 901 002 101 20003 304 40012 501 63010 714200 8270 900500 009750 10576 206 310 40360 52 631500 704500 8025 91950 0015 14000 204500 313500 4025 51950 6015 74300 813500 922500 0025 11950 2015 36090 422500 531500 6025 71950 8015 94700 004 ....++
7777
or (with big common sequence definition)
CREX++
T000101 A007 D16027E++
0034 121W 2ZANE 31996 410 501 606 700 8XXX 901 002 101 20003 304 40012 501 63010 714200 8270 900500 009750 10576 206 310 40360 52 631500 704500 8025 91950 0015 14000 204500 313500 4025 51950 6015 74300 813500 922500 0025 11950 2015 36090 422500 531500 6025 71950 8015 94700 004 ....++
7777
or without check digit:
CREX++
T000101 A007 D16027++
034 21W ZANE 1996 10 01 06 00 XXX 01 02 01 0003 04 0012 01 3010 14200 270 00500 09750 0576 06 10 0360 2 31500 04500 025 1950 015 4000 04500 13500 025 1950 015 4300 13500 22500 025 1950 015 6090 22500 31500 025 1950 015 4700 04 ....++
7777

MONITORING INFORMATION SAMPLE MESSAGE

CREX++	(indicator section)
T000101 A020 D35010++	(description section
1 2 4 014 23 1996 10 01 00 15 24 06 25 00 012 63 0003 740 0360 894 0353	
792 0125++	(data section)
7777	(end section)

1	Regional exercise
2	Non-real time
4	RTH
014	Nairobi
23	Monitoring period follows
1996	YYYY
10	MM
01	DD
00	HH
15	Days duration
24	Data cut-off follows
06	Hours
25	Report time follows
00	Hours
012	SYNOP
63	Block number
0003	Stations
740	Nairobi
0360	Well done
894	Dar es Salaam
0353	Very good
792	A station
0125	Must do better!
++	
7777	

c. COMMON CODE TABLES TO BINARY AND ALPHANUMERIC CODES

COMMON CODE TABLE C–1: ***Identification of originating/generating centre***

F_1F_2 for alphanumeric codes

$F_3F_3F_3$ for alphanumeric codes

Code table 0 in GRIB Edition 1/Code table 0 01 033 for BUFR Edition 3

Octet 5 in Section 1 of GRIB Edition 1/Octet 6 in Section 1 of BUFR Edition 3

COMMON CODE TABLE C–2: **Radiosonde/sounding system used**

Code table 3685 – r_ar_a (Radiosonde/sounding system used) – for alphanumeric codes

Code table 0 02 011 (Radiosonde type) in BUFR

COMMON CODE TABLE C–3: ***Instrument make and type for water temperature profile measurement with fall rate equation coefficients***

Code table 1770 – $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) – for alphanumeric codes

Code table 0 22 067 (Instrument type for water temperature profile measurement) in BUFR

COMMON CODE TABLE C–4: ***Water temperature profile recorder types***

Code table 4770 – X_RX_R (Recorder type) – for alphanumeric codes

Code table 0 22 068 (Water temperature profile recorder types) in BUFR

COMMON CODE TABLE C–5: ***Satellite identifier***

$I_6I_6I_6$ for alphanumeric codes

Code table 0 01 007 in BUFR

Code used in GRIB Edition 2

COMMON CODE TABLE C–6: ***List of units for TDCFs***

(Used only in Volume I.2, Parts B and C)

COMMON CODE TABLE C–7: ***Tracking technique/status of system used***

Code table 3872 – s_as_a for alphanumeric code

Code table 0 02 014 in BUFR

COMMON CODE TABLE C–8: ***Satellite Instruments***

Code table 0 02 019 in BUFR

COMMON CODE TABLE C–11: ***Originating/generating centres***

BUFR 0 01 035

CREX Edition 2, ooooo in Group Poooooppp in Section 1

GRIB Edition 2, Octets 6–7 in Section 1

BUFR Edition 4, Octets 5–6 in Section 1

COMMON CODE TABLE C–12: ***Sub-centres of originating centres defined by entries in Common Code tables C–1 or C–11***

BUFR 0 01 034

BUFR Edition 3, Octet 5 in Section 1

BUFR Edition 4, Octets 7–8 in Section 1

GRIB Edition 1, Octet 26 in Section 1

GRIB Edition 2, Octets 8–9 in Section 1

CREX Edition 2, ppp in Group Poooooppp in Section 1

COMMON CODE TABLE C–13: ***Data sub-categories of categories defined by entries in BUFR Table A***

BUFR Edition 4, Octet 12 in Section 1 (if = 255, it means other sub-category or undefined)

CREX Edition 2, mmm in Group Annnmmm of Section 1

COMMON CODE TABLE C–14: ***Atmospheric chemical or physical constituent type***

Code Table 4.230 in GRIB 2

COMMON CODE TABLE C–1: *Identification of originating/generating centre*

Common Code table:
- F_1F_2 for alphanumeric codes
- $F_3F_3F_3$ for alphanumeric codes
- Code table 0 in GRIB Edition 1/Code table 0 01 033 in BUFR Edition 3
- Octet 5 in Section 1 of GRIB Edition 1/Octet 6 in Section 1 of BUFR Edition 3

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
00	000	0	WMO Secretariat
			01–09: WMCs
01	001	1	Melbourne
02	002	2	Melbourne
03	003	3	)
04	004	4	Moscow
05	005	5	Moscow
06	006	6	)
07	007	7	US National Weather Service – National Centres for Environmental Prediction (NCEP)
08	008	8	US National Weather Service Telecommunications Gateway (NWSTG)
09	009	9	US National Weather Service – Other
			10–25: Centres in Region I
10	010	10	Cairo (RSMC)
11	011	11	)
12	012	12	Dakar (RSMC)
13	013	13	)
14	014	14	Nairobi (RSMC)
15	015	15	)
16	016	16	Casablanca (RSMC)
17	017	17	Tunis (RSMC)
18	018	18	Tunis – Casablanca (RSMC)
19	019	19	)
20	020	20	Las Palmas
21	021	21	Algiers (RSMC)
22	022	22	ACMAD
23	023	23	Mozambique (NMC)
24	024	24	Pretoria (RSMC)
25	025	25	La Réunion (RSMC)
			26–40: Centres in Region II
26	026	26	Khabarovsk (RSMC)
27	027	27	)
28	028	28	New Delhi (RSMC)
29	029	29	)
30	030	30	Novosibirsk (RSMC)
31	031	31	)
32	032	32	Tashkent (RSMC)
33	033	33	Jeddah (RSMC)
34	034	34	Tokyo (RSMC), Japan Meteorological Agency

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
35	035	35	)
36	036	36	Bangkok
37	037	37	Ulaanbaatar
38	038	38	Beijing (RSMC)
39	039	39	)
40	040	40	Seoul
			41–50: Centres in Region III
41	041	41	Buenos Aires (RSMC)
42	042	42	)
43	043	43	Brasilia (RSMC)
44	044	44	)
45	045	45	Santiago
46	046	46	Brazilian Space Agency - INPE
47	047	47	Colombia (NMC)
48	048	48	Ecuador (NMC)
49	049	49	Peru (NMC)
50	050	50	Venezuela (Bolivarian Republic of) (NMC)
			51–63: Centres in Region IV
51	051	51	Miami (RSMC)
52	052	52	Miami (RSMC), National Hurricane Centre
53	053	53	Montreal (RSMC)
54	054	54	)
55	055	55	San Francisco
56	056	56	ARINC Centre
57	057	57	US Air Force – Air Force Global Weather Central
58	058	58	Fleet Numerical Meteorology and Oceanography Center, Monterey, CA, United States
59	059	59	The NOAA Forecast Systems Laboratory, Boulder, CO, United States
60	060	60	United States National Center for Atmospheric Research (NCAR)
61	061	61	Service ARGOS – Landover
62	062	62	US Naval Oceanographic Office
63	063	63	International Research Institute for Climate and Society (IRI)
			64–73: Centres in Region V
64	064	64	Honolulu (RSMC)
65	065	65	Darwin (RSMC)
66	066	66	)
67	067	67	Melbourne (RSMC)
68	068	68	Reserved
69	069	69	Wellington (RSMC)
70	070	70	)
71	071	71	Nadi (RSMC)
72	072	72	Singapore
73	073	73	Malaysia (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
			74–99: Centres in Region VI
74	074	74	UK Meteorological Office - Exeter (RSMC)
75	075	75	)
76	076	76	Moscow (RSMC)
77	077	77	Reserved
78	078	78	Offenbach (RSMC)
79	079	79	)
80	080	80	Rome (RSMC)
81	081	81	)
82	082	82	Norrköping
83	083	83	)
84	084	84	Toulouse (RSMC)
85	085	85	Toulouse (RSMC)
86	086	86	Helsinki
87	087	87	Belgrade
88	088	88	Oslo
89	089	89	Prague
90	090	90	Episkopi
91	091	91	Ankara
92	092	92	Frankfurt/Main
93	093	93	London (WAFC)
94	094	94	Copenhagen
95	095	95	Rota
96	096	96	Athens
97	097	97	European Space Agency (ESA)
98	098	98	European Centre for Medium-Range Weather Forecasts (ECMWF) (RSMC)
99	099	99	De Bilt
			Additional Centres
Not applicable	100	100	Brazzaville
Not applicable	101	101	Abidjan
Not applicable	102	102	Libya (NMC)
Not applicable	103	103	Madagascar (NMC)
Not applicable	104	104	Mauritius (NMC)
Not applicable	105	105	Niger (NMC)
Not applicable	106	106	Seychelles (NMC)
Not applicable	107	107	Uganda (NMC)
Not applicable	108	108	United Republic of Tanzania (NMC)
Not applicable	109	109	Zimbabwe (NMC)
Not applicable	110	110	Hong-Kong, China
Not applicable	111	111	Afghanistan (NMC)
Not applicable	112	112	Bahrain (NMC)
Not applicable	113	113	Bangladesh (NMC)
Not applicable	114	114	Bhutan (NMC)
Not applicable	115	115	Cambodia (NMC)
Not applicable	116	116	Democratic People's Republic of Korea (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	117	117	Islamic Republic of Iran (NMC)
Not applicable	118	118	Iraq (NMC)
Not applicable	119	119	Kazakhstan (NMC)
Not applicable	120	120	Kuwait (NMC)
Not applicable	121	121	Kyrgyzstan (NMC)
Not applicable	122	122	Lao People's Democratic Republic (NMC)
Not applicable	123	123	Macao, China
Not applicable	124	124	Maldives (NMC)
Not applicable	125	125	Myanmar (NMC)
Not applicable	126	126	Nepal (NMC)
Not applicable	127	127	Oman (NMC)
Not applicable	128	128	Pakistan (NMC)
Not applicable	129	129	Qatar (NMC)
Not applicable	130	130	Yemen (NMC)
Not applicable	131	131	Sri Lanka (NMC)
Not applicable	132	132	Tajikistan (NMC)
Not applicable	133	133	Turkmenistan (NMC)
Not applicable	134	134	United Arab Emirates (NMC)
Not applicable	135	135	Uzbekistan (NMC)
Not applicable	136	136	Viet Nam (NMC)
Not applicable	137–139	137–139	Reserved for other centres
Not applicable	140	140	Bolivia (Plurinational State of) (NMC)
Not applicable	141	141	Guyana (NMC)
Not applicable	142	142	Paraguay (NMC)
Not applicable	143	143	Suriname (NMC)
Not applicable	144	144	Uruguay (NMC)
Not applicable	145	145	French Guiana
Not applicable	146	146	Brazilian Navy Hydrographic Centre
Not applicable	147	147	National Commission on Space Activities (CONAE) – Argentina
Not applicable	148–149	148–149	Reserved for other centres
Not applicable	150	150	Antigua and Barbuda (NMC)
Not applicable	151	151	Bahamas (NMC)
Not applicable	152	152	Barbados (NMC)
Not applicable	153	153	Belize (NMC)
Not applicable	154	154	British Caribbean Territories Centre
Not applicable	155	155	San **José**
Not applicable	156	156	Cuba (NMC)
Not applicable	157	157	Dominica (NMC)
Not applicable	158	158	Dominican Republic (NMC)
Not applicable	159	159	El Salvador (NMC)
Not applicable	160	160	US NOAA/NESDIS
Not applicable	161	161	US NOAA Office of Oceanic and Atmospheric Research
Not applicable	162	162	Guatemala (NMC)
Not applicable	163	163	Haiti (NMC)
Not applicable	164	164	Honduras (NMC)
Not applicable	165	165	Jamaica (NMC)
Not applicable	166	166	Mexico City

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	167	167	Curaçao and Sint Maarten (NMC)
Not applicable	168	168	Nicaragua (NMC)
Not applicable	169	169	Panama (NMC)
Not applicable	170	170	Saint Lucia (NMC)
Not applicable	171	171	Trinidad and Tobago (NMC)
Not applicable	172	172	French Departments in RA IV
Not applicable	173	173	US National Aeronautics and Space Administration (NASA)
Not applicable	174	174	Integrated Science Data Management/Marine Environmental Data Service (ISDM/MEDS) – Canada
Not applicable	175	175	University Corporation for Atmospheric Research (UCAR) – United States
Not applicable	176	176	Cooperative Institute for Meteorological Satellite Studies (CIMSS) – United States
Not applicable	177	177	NOAA National Ocean Service – United States
Not applicable	178–189	178–189	Reserved for other centres
Not applicable	190	190	Cook Islands (NMC)
Not applicable	191	191	French Polynesia (NMC)
Not applicable	192	192	Tonga (NMC)
Not applicable	193	193	Vanuatu (NMC)
Not applicable	194	194	Brunei Darussalam (NMC)
Not applicable	195	195	Indonesia (NMC)
Not applicable	196	196	Kiribati (NMC)
Not applicable	197	197	Federated States of Micronesia (NMC)
Not applicable	198	198	New Caledonia (NMC)
Not applicable	199	199	Niue
Not applicable	200	200	Papua New Guinea (NMC)
Not applicable	201	201	Philippines (NMC)
Not applicable	202	202	Samoa (NMC)
Not applicable	203	203	Solomon Islands (NMC)
Not applicable	204	204	National Institute of Water and Atmospheric Research (NIWA – New Zealand)
Not applicable	205–209	205–209	Reserved
Not applicable	210	210	Frascati (ESA/ESRIN)
Not applicable	211	211	Lannion
Not applicable	212	212	Lisbon
Not applicable	213	213	Reykjavik
Not applicable	214	214	Madrid
Not applicable	215	215	Zurich
Not applicable	216	216	Service ARGOS – Toulouse
Not applicable	217	217	Bratislava
Not applicable	218	218	Budapest
Not applicable	219	219	Ljubljana
Not applicable	220	220	Warsaw
Not applicable	221	221	Zagreb
Not applicable	222	222	Albania (NMC)
Not applicable	223	223	Armenia (NMC)
Not applicable	224	224	Austria (NMC)
Not applicable	225	225	Azerbaijan (NMC)
Not applicable	226	226	Belarus (NMC)
Not applicable	227	227	Belgium (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	228	228	Bosnia and Herzegovina (NMC)
Not applicable	229	229	Bulgaria (NMC)
Not applicable	230	230	Cyprus (NMC)
Not applicable	231	231	Estonia (NMC)
Not applicable	232	232	Georgia (NMC)
Not applicable	233	233	Dublin
Not applicable	234	234	Israel (NMC)
Not applicable	235	235	Jordan (NMC)
Not applicable	236	236	Latvia (NMC)
Not applicable	237	237	Lebanon (NMC)
Not applicable	238	238	Lithuania (NMC)
Not applicable	239	239	Luxembourg
Not applicable	240	240	Malta (NMC)
Not applicable	241	241	Monaco
Not applicable	242	242	Romania (NMC)
Not applicable	243	243	Syrian Arab Republic (NMC)
Not applicable	244	244	The former Yugoslav Republic of Macedonia (NMC)
Not applicable	245	245	Ukraine (NMC)
Not applicable	246	246	Republic of Moldova (NMC)
Not applicable	247	247	Operational Programme for the Exchange of weather RAdar information (OPERA) – EUMETNET
Not applicable	248	248	Montenegro (NMC)
Not applicable	249	249	Reserved for other centres
Not applicable	250	250	COnsortium for Small scale MOdelling (COSMO)
Not applicable	251	251	Meteorological Cooperation on Operational NWP (MetCoOp)
Not applicable	252	252	Max Planck Institute for Meteorology (MPI-M)
Not applicable	253	253	Reserved for other centres
Not applicable	254	254	EUMETSAT Operation Centre
Not applicable	255	255	Missing value
Not applicable	256–999	Not applicable	Not used

Notes:

(1) The closed bracket sign) indicates that the corresponding code figure is reserved for the previously named centre.

(2) With GRIB or BUFR, to indicate whether the originating/generating centre is a sub-centre or not, the following procedure should be applied:

In GRIB edition 1, use octet 26 of section 1, or in BUFR edition 3, use octet 5 of section 1, with the following meaning:

Code figure	
0	Not a sub-centre, the originating/generating centre is the centre defined by Octet 5 in section 1 of GRIB Edition 1, or by octet 6 in section 1 of BUFR edition 3.
1 to 254	Identifier of the sub-centre which is the originating/generating centre. The identifier of the sub-centre is allocated by the associated centre which is defined by octet 5 in section 1 of GRIB edition 1, or octet 6 in section 1 of BUFR edition 3. The sub-centre identifiers should be supplied to the WMO Secretariat by the associated centre(s) for publication.

(3) For the definitions of sub-centres provided to the WMO Secretariat, see Common Code table C–12.

COMMON CODE TABLE C–2: *Radiosonde/sounding system used*

Common Code table { Code table 3685 – r_ar_a (Radiosonde/sounding system used) – for alphanumeric codes
Code table 0 02 011 (Radiosonde type) in BUFR

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Not applicable	00	0	Reserved
Before	01	1	iMet-1-BB (United States)
Not applicable	02	2	No radiosonde – passive target (e.g. reflector)
Not applicable	03	3	No radiosonde – active target (e.g. transponder)
Not applicable	04	4	No radiosonde – passive temperature-humidity profiler
Not applicable	05	5	No radiosonde – active temperature-humidity profiler
Not applicable	06	6	No radiosonde – radio-acoustic sounder
Before	07	7	iMet-1-AB (United States)
Not applicable	08	8	No radiosonde –... (reserved)
Not applicable	09	9	No radiosonde – system unknown or not specified
Before	10	10	VIZ type A pressure-commutated (United States)
Before	11	11	VIZ type B time-commutated (United States)
Before	12	12	RS SDC (Space Data Corporation – United States)
Before	13	13	Astor (no longer made – Australia)
Before	14	14	VIZ MARK I MICROSONDE (United States)
Before	15	15	EEC Company type 23 (United States)
Before	16	16	Elin (Austria)
Before	17	17	Graw G. (Germany)
Before	18	18	Graw DFM-06 (Germany)
Before	19	19	Graw M60 (Germany)
Before	20	20	Indian Meteorological Service MK3 (India)
Before	21	21	VIZ/Jin Yang MARK I MICROSONDE (Republic of Korea)
Before	22	22	Meisei RS2-80 (Japan)
Before	23	23	Mesural FMO 1950A (France)
Before	24	24	Mesural FMO 1945A (France)
Before	25	25	Mesural MH73A (France)
Before	26	26	Meteolabor Basora (Switzerland)
Before	27	27	AVK-MRZ (Russian Federation)
Before	28	28	Meteorit MARZ2-1 (Russian Federation)
Before	29	29	Meteorit MARZ2-2 (Russian Federation)
Before	30	30	Oki RS2-80 (Japan)
Before	31	31	VIZ/Valcom type A pressure-commutated (Canada)
Before	32	32	Shanghai Radio (China)
Before	33	33	UK Met Office MK3 (UK)
Before	34	34	Vinohrady (Czech Republic)
Before	35	35	Vaisala RS18 (Finland)
Before	36	36	Vaisala RS21 (Finland)

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Before	37	37	Vaisala RS80 (Finland)
Before	38	38	VIZ LOCATE Loran-C (United States)
Before	39	39	Sprenger E076 (Germany)
Before	40	40	Sprenger E084 (Germany)
Before	41	41	Sprenger E085 (Germany)
Before	42	42	Sprenger E086 (Germany)
Before	43	43	AIR IS - 4A - 1680 (United States)
Before	44	44	AIR IS - 4A - 1680 X (United States)
Before	45	45	RS MSS (United States)
Before	46	46	AIR IS - 4A - 403 (United States)
Before	47	47	Meisei RS2-91 (Japan)
Before	48	48	VALCOM (Canada)
Before	49	49	VIZ MARK II (United States)
Before	50	50	Graw DFM-90 (Germany)
Before	51	51	VIZ-B2 (United States)
Before	52	52	Vaisala RS80-57H
Before	53	53	AVK-RF95 (Russian Federation)
Before	54	54	Graw DFM-97 (Germany)
Before	55	55	Meisei RS-01G (Japan)
Before	56	56	M2K2 (France)
Before	57	57	Modem M2K2-DC (France)
Before	58	58	AVK-BAR (Russian Federation)
Before	59	59	Modem M2K2-R 1680 MHz RDF radiosonde with pressure sensor chip (France)
Before	60	60	Vaisala RS80/MicroCora (Finland)
Before	61	61	Vaisala RS80/Loran/Digicora I, II or Marwin (Finland)
Before	62	62	Vaisala RS80/PCCora (Finland)
Before	63	63	Vaisala RS80/Star (Finland)
Before	64	64	Orbital Sciences Corporation, Space Data Division, transponder radiosonde, type 909-11-XX, where XX corresponds to the model of the instrument (United States)
Before	65	65	VIZ transponder radiosonde, model number 1499–520 (United States)
Before	66	66	Vaisala RS80 /Autosonde (Finland)
Before	67	67	Vaisala RS80/Digicora III (Finland)
Before	68	68	AVK-RZM-2 (Russian Federation)
Before	69	69	MARL-A or Vektor-M-RZM-2 (Russian Federation)
Before	70	70	Vaisala RS92/Star (Finland)
Before	71	71	Vaisala RS90/Loran/Digicora I, II or Marwin (Finland)
Before	72	72	Vaisala RS90/PC-Cora (Finland)
Before	73	73	Vaisala RS90/Autosonde (Finland)
Before	74	74	Vaisala RS90/Star (Finland)

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Before	75	75	AVK-MRZ-ARMA (Russian Federation)
Before	76	76	AVK-RF95-ARMA (Russian Federation)
Before	77	77	GEOLINK GPSonde GL98 (France)
Before	78	78	Vaisala RS90/Digicora III (Finland)
Before	79	79	Vaisala RS92/Digicora I, II or Marwin (Finland)
Before	80	80	Vaisala RS92/Digicora III (Finland)
Before	81	81	Vaisala RS92/Autosonde (Finland)
Before	82	82	Sippican MK2 GPS/STAR (United States) with rod thermistor, carbon element and derived pressure
Before	83	83	Sippican MK2 GPS/W9000 (United States) with rod thermistor, carbon element and derived pressure
Needed	84	84	Vacant
Before	85	85	Sippican MARK IIA with chip thermistor, carbon element and derived pressure from GPS height
Before	86	86	Sippican MARK II with chip thermistor, pressure and carbon element
Before	87	87	Sippican MARK IIA with chip thermistor, pressure and carbon element
Before	88	88	MARL-A or Vektor-M-MRZ (Russian Federation)
Before	89	89	MARL-A or Vektor-M-BAR (Russian Federation)
Not applicable	90	90	Radiosonde not specified or unknown
Not applicable	91	91	Pressure only radiosonde
Not applicable	92	92	Pressure only radiosonde plus transponder
Not applicable	93	93	Pressure only radiosonde plus radar reflector
Not applicable	94	94	No pressure radiosonde plus transponder
Not applicable	95	95	No pressure radiosonde plus radar reflector
Not applicable	96	96	Descending radiosonde
Before	97	97	BAT-16P (South Africa)
Before	98	98	BAT-16G (South Africa)
Before	99	99	BAT-4G (South Africa)
	Not available	100	Reserved for BUFR only
	01	101	Not vacant
	Not available	102–106	Reserved for BUFR only
	07	107	Not vacant
	Not available	108–109	Reserved for BUFR only
01/01/2008	10	110	Sippican LMS5 w/Chip Thermistor, duct mounted capacitance relative humidity sensor and derived pressure from GPS
		height	
01/01/2008	11	111	Sippican LMS6 w/Chip Thermistor, external boom mounted capacitance relative humidity sensor, and derived pressure from GPS height
Needed	12	112	Vacant
15/09/2010	13	113	Vaisala RS92/MARWIN MW32 (Finland)
03/11/2011	14	114	Vaisala RS92/DigiCORA MW41 (Finland)
01/12/2011	15	115	PAZA-12M/Radiotheodolite-UL (Ukraine)

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
01/12/2011	16	116	PAZA-22/AVK-1 (Ukraine)
02/05/2012	17	117	Graw DFM-09 (Germany)
	18	118	Not vacant
Needed	19	119	Vacant
	20–21	120–121	Not vacant
02/05/2012	22	122	Meisei RS-11G GPS radiosonde w/thermistor, capacitance relative humidity sensor, and derived pressure from GPS height (Japan)
03/11/2011	23	123	Vaisala RS41/DigiCORA MW41 (Finland)
03/11/2011	24	124	Vaisala RS41/AUTOSONDE (Finland)
03/11/2011	25	125	Vaisala RS41/MARWIN MW32 (Finland)
	26–27	126–127	Not vacant
15/09/2011	28	128	AVK - AK2-02 (Russian Federation)
15/09/2011	29	129	MARL-A or Vektor-M - AK2-02 (Russian Federation)
01/01/2010	30	130	Meisei RS-06G (Japan)
03/11/2011	31	131	Taiyuan GTS1-1/GFE(L) (China)
03/11/2011	32	132	Shanghai GTS1/GFE(L) (China)
03/11/2011	33	133	Nanjing GTS1-2/GFE(L) (China)
Needed	34–36	134–136	Vacant
	37	137	Not vacant
Needed	38–40	138–140	Vacant
03/11/2011	41	141	Vaisala RS41 with pressure derived from GPS height/ DigiCORA MW41 (Finland)
03/11/2011	42	142	Vaisala RS41 with pressure derived from GPS height/ AUTOSONDE (Finland)
Needed	43–46	143–146	Vacant
	47	147	Not vacant
02/05/2012	48	148	PAZA-22M/MARL-A
	49	149	Not vacant
Needed	50	150	Vacant
	51	151	Not vacant
03/11/2011	52	152	Vaisala RS92-NGP/Intermet IMS-2000 (United States)
	53–59	153–159	Not vacant
Needed	60	160	Vacant
	61	161	Not vacant
Needed	62–66	162–166	Vacant
	67–72	167–172	Not vacant
Needed	73	173	Vacant
	74–76	174–176	Not vacant
15/03/2010	77	177	Modem GPSonde M10 (France)
	78–81	178–181	Not vacant

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
07/11/2012	82	182	Lockheed Martin LMS-6 w/chip thermistor; external boom mounted polymer capacitive relative humidity sensor; capacitive pressure sensor and GPS wind
07/11/2012	83	183	Vaisala RS92-D/Intermet IMS 1500 w/silicon capacitive pressure sensor, capacitive wire temperature sensor, twin thin-film heated polymer capacitive relative humidity sensor and RDF wind
	84–89	184–189	Not vacant
	Not available	190–196	Reserved for BUFR only
	97–99	197–199	Not vacant
	Not available	200–254	Reserved for BUFR only
		255	Missing value

Notes:

(1) References to countries in brackets indicate the manufacturing location rather than the country using the instrument.

(2) Some of the radiosondes listed are no longer in use but are retained for archiving purposes.

(3) The alphanumeric code format reports only 2 digits, and the first digit for BUFR is identified from the date: the first digit is 0 if the introduction of the radiosonde for observation was before 30 June 2007, or 1 otherwise. Entries in the second part of the table (after 99), which are declared “Vacant” can be used for new radiosondes because the 2-digit number was originally attributed to sondes, which are no longer used. *This system has been adopted to accommodate reporting in TEMP traditional alphanumeric code format up to the time BUFR is fully used for radiosonding reports.*

COMMON CODE TABLE C–3: *Instrument make and type for water temperature profile measurement with fall rate equation coefficients*

Common Code table
- Code table 1770 – $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) – for alphanumeric codes
- Code table 0 22 067 (Instrument type for water temperature profile measurement) in BUFR

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 0 22 067)	Meaning: Instrument make and type	Equation Coefficients *a*	*b*
001	1	Sippican T-4	6.472	–2.16
002	2	Sippican T-4	6.691	–2.25
011	11	Sippican T-5	6.828	–1.82
021	21	Sippican Fast Deep	6.346	–1.82
031	31	Sippican T-6	6.472	–2.16
032	32	Sippican T-6	6.691	–2.25
041	41	Sippican T-7	6.472	–2.16
042	42	Sippican T-7	6.691	–2.25
051	51	Sippican Deep Blue	6.472	–2.16
052	52	Sippican Deep Blue	6.691	–2.25
061	61	Sippican T-10	6.301	–2.16
071	71	Sippican T-11	1.779	–0.255
081	81	Sippican AXBT (300 m probes)	1.52	0.0
201	201	TSK T-4	6.472	–2.16
202	202	TSK T-4	6.691	–2.25
211	211	TSK T-6	6.472	–2.16
212	212	TSK T-6	6.691	–2.25
221	221	TSK T-7	6.472	–2.16
222	222	TSK T-7	6.691	–2.25
231	231	TSK T-5	6.828	–1.82
241	241	TSK T-10	6.301	–2.16
251	251	TSK Deep Blue	6.472	–2.16
252	252	TSK Deep Blue	6.691	–2.25
261	261	TSK AXBT		
401	401	Sparton XBT-1	6.301	–2.16
411	411	Sparton XBT-3	5.861	–0.0904
421	421	Sparton XBT-4	6.472	–2.16
431	431	Sparton XBT-5	6.828	–1.82
441	441	Sparton XBT-5DB	6.828	–1.82
451	451	Sparton XBT-6	6.472	–2.16
461	461	Sparton XBT-7	6.472	–2.16
462	462	Sparton XBT-7	6.705	–2.28
471	471	Sparton XBT-7DB	6.472	–2.16
481	481	Sparton XBT-10	6.301	–2.16
491	491	Sparton XBT-20	6.472	–2.16
501	501	Sparton XBT-20DB	6.472	–2.16
510	510	Sparton 536 AXBT	1.524	0
700	700	Sippican XCTD Standard		
710	710	Sippican XCTD Deep		
720	720	Sippican AXCTD		
730	730	Sippican SXCTD		

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 0 22 067)	Meaning: Instrument make and type	Equation Coefficients *a*	*b*
741	741	TSK XCTD/XCTD-1	3.42543	–0.47
742	742	TSK XCTD-2	3.43898	–0.31
743	743	TSK XCTD-2F	3.43898	–0.31
744	744	TSK XCTD-3	5.07598	–0.72
745	745	TSK XCTD-4	3.68081	–0.47
751	751	TSK AXCTD		
780	780	Sea-Bird SBE21 SEACAT Thermosalinograph	Not applicable	
781	781	Sea-Bird SBE45 MicroTSG Thermosalinograph	Not applicable	
800	800	Mechanical BT	Not applicable	
810	810	Hydrocast	Not applicable	
820	820	Thermistor chain	Not applicable	
825	825	Temperature (sonic) and pressure probes	Not applicable	
830	830	CTD	Not applicable	
831	831	CTD-P-ALACE float	Not applicable	
837	837	ARVOR_C, SBE conductivity sensor		
838	838	ARVOR_D, SBE conductivity sensor		
839	839	PROVOR–II, SBE conductivity sensor		
840	840	PROVOR, no conductivity sensor	Not applicable	
841	841	PROVOR, Sea-Bird conductivity sensor	Not applicable	
842	842	PROVOR, FSI conductivity sensor	Not applicable	
843	843	Polar Ocean Profiling System (POPS), PROVOR, SBE CTD		
844	844	Profiling float, ARVOR, Sea-Bird conductivity sensor		
845	845	Webb Research, no conductivity sensor	Not applicable	
846	846	Webb Research, Sea-Bird conductivity sensor	Not applicable	
847	847	Webb Research, FSI conductivity sensor	Not applicable	
848	848	APEX–EM, SBE conductivity sensor		
849	849	APEX_D, SBE conductivity sensor		
850	850	SOLO, no conductivity sensor	Not applicable	
851	851	SOLO, Sea-Bird conductivity sensor	Not applicable	
852	852	SOLO, FSI conductivity sensor	Not applicable	
853	853	Profiling float, SOLO2 (SCRIPPS), Sea-Bird conductivity sensor		
854	854	S2A, SBE conductivity sensor		
855	855	Profiling float, NINJA, no conductivity sensor	Not applicable	
856	856	Profiling float, NINJA, SBE conductivity sensor	Not applicable	
857	857	Profiling float, NINJA, FSI conductivity sensor	Not applicable	
858	858	Profiling float, NINJA, TSK conductivity sensor	Not applicable	

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 0 22 067)	Meaning: Instrument make and type	Equation Coefficients *a*	*b*
859	859	Profiling float, NEMO, no conductivity sensor	Not applicable	
860	860	Profiling float, NEMO, SBE conductivity sensor	Not applicable	
861	861	Profiling float, NEMO, FSI conductivity sensor	Not applicable	
862	862	SOLO_D, SBE conductivity sensor		
863	863	NAVIS–A, SBE conductivity sensor		
864	864	NINJA_D, SBE conductivity sensor		
865	865	NOVA, SBE conductivity sensor		
866–899	866–899	Reserved		
900	900	Sippican LMP-5 XBT	9.727	–0.0000473
901	901	Ice-tethered Profiler (ITP), SBE CTD		
902–994	902–994	Reserved		
995	995	Instrument attached to marine mammals	Not applicable	
996	996	Instrument attached to animals other than marine mammals	Not applicable	
997–999	997–999	Reserved		
	1000–1022	Reserved		
	1023	Missing value		

Notes:

(1) The depth is calculated from coefficients *a* and *b* and the time *t* as follows: $z = at + 10^{-3}\, bt^2$

(2) All unassigned numbers are reserved for future use.

(3) The values of *a* and *b* are supplied for information only.

COMMON CODE TABLE C–4: *Water temperature profile recorder types*

Common Code table { Code table 4770 – X_RX_R (Recorder type) – for alphanumeric codes
Code table 0 22 068 (Water temperature profile recorder types) in BUFR

Code figure for X_RX_R	Code figure for BUFR (Code table 0 22 068)	Meaning
01	1	Sippican Strip Chart Recorder
02	2	Sippican MK2A/SSQ-61
03	3	Sippican MK-9
04	4	Sippican AN/BHQ-7/MK8
05	5	Sippican MK-12
06	6	Sippican MK-21
07	7	Sippican MK-8 Linear Recorder
08	8	Sippican MK-10
10	10	Sparton SOC BT/SV Processor Model 100
11	11	Lockheed-Sanders Model OL5005
20	20	ARGOS XBT-ST
21	21	CLS-ARGOS/Protecno XBT-ST Model-1
22	22	CLS-ARGOS/Protecno XBT-ST Model-2
30	30	BATHY Systems SA-810
31	31	Scripps Metrobyte Controller
32	32	Murayama Denki Z-60-16 III
33	33	Murayama Denki Z-60-16 II
34	34	Protecno ETSM2
35	35	Nautilus Marine Service NMS-XBT
40	40	TSK MK-2A
41	41	TSK MK-2S
42	42	TSK MK-30
43	43	TSK MK-30N
45	45	TSK MK-100
46	46	TSK MK-130 Compatible recorder for both XBT and XCTD
47	47	TSK MK-130A XCTD recorder
48	48	TSK AXBT RECEIVER MK-300
49	49	TSK MK-150/MK-150N Compatible recorder for both XBT and XCTD
50	50	JMA ASTOS
60	60	ARGOS communications, sampling on up transit
61	61	ARGOS communications, sampling on down transit
62	62	Orbcomm communications, sampling on up transit
63	63	Orbcomm communications, sampling on down transit
64	64	Iridium communications, sampling on up transit
65	65	Iridium communications, sampling on down transit
70	70	CSIRO Devil-1 XBT acquisition system
71	71	CSIRO Devil-2 XBT acquisition system
72	72	TURO/CSIRO Quoll XBT acquisition system
80	80	Applied Microsystems Ltd., MICRO-SVT&P
81	81	Sea Mammal Research Unit, Univ. St. Andrews, UK, uncorrected salinity from a sea mammal mounted instrument
82	82	Sea Mammal Research Unit, Univ. St. Andrews, UK, corrected salinity from a sea mammal mounted instrument
99	99	Unknown
	127	Missing value

Note: All unassigned numbers are reserved for future use.

COMMON CODE TABLE C–5: *Satellite identifier*

Common Code table { $I_6I_6I_6$ for alphanumeric codes
Code table 0 01 007 in BUFR
Code used in GRIB Edition 2 }

(EVEN DECILES INDICATE POLAR-ORBITING SATELLITES AND ODD DECILES INDICATE GEOSTATIONARY SATELLITES.)

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
000	0	0	Reserved
	001–099: Numbers allocated to Europe		
001	1	1	ERS 1
002	2	2	ERS 2
003	3	3	METOP-1 (Metop-B)
004	4	4	METOP-2 (Metop-A)
005	5	5	METOP-3 (Metop-C)
020	20	20	SPOT1
021	21	21	SPOT2
022	22	22	SPOT3
023	23	23	SPOT4
040	40	40	OERSTED
041	41	41	CHAMP
042	42	42	TerraSAR-X
043	43	43	TanDEM-X
044	44	44	PAZ
046	46	46	SMOS
047	47	47	CryoSat-2
048	48	48	AEOLUS
050	50	50	METEOSAT 3
051	51	51	METEOSAT 4
052	52	52	METEOSAT 5
053	53	53	METEOSAT 6
054	54	54	METEOSAT 7
055	55	55	METEOSAT 8
056	56	56	METEOSAT 9
057	57	57	METEOSAT 10
058	58	58	METEOSAT 1
059	59	59	METEOSAT 2
060	60	60	ENVISAT
070	70	70	METEOSAT 11
	100–199: Numbers allocated to Japan		
120	120	120	ADEOS
121	121	121	ADEOS II
122	122	122	GCOM-W1
140	140	140	GOSAT
150	150	150	GMS 3
151	151	151	GMS 4
152	152	152	GMS 5

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
171	171	171	MTSAT-1R
172	172	172	MTSAT-2
173	173	173	Himawari-8
174	174	174	Himawari-9
	200–299: Numbers allocated to the United States		
200	200	200	NOAA 8
201	201	201	NOAA 9
202	202	202	NOAA 10
203	203	203	NOAA 11
204	204	204	NOAA 12
205	205	205	NOAA 14
206	206	206	NOAA 15
207	207	207	NOAA 16
208	208	208	NOAA 17
209	209	209	NOAA 18
220	220	220	LANDSAT 5
221	221	221	LANDSAT 4
222	222	222	LANDSAT 7
223	223	223	NOAA 19
224	224	224	NPP
240	240	240	DMSP 7
241	241	241	DMSP 8
242	242	242	DMSP 9
243	243	243	DMSP 10
244	244	244	DMSP 11
245	245	245	DMSP 12
246	246	246	DMSP 13
247	247	247	DMSP 14
248	248	248	DMSP 15
249	249	249	DMSP 16
250	250	250	GOES 6
251	251	251	GOES 7
252	252	252	GOES 8
253	253	253	GOES 9
254	254	254	GOES 10
255	255	255	GOES 11
256	256	256	GOES 12
257	257	257	GOES 13
258	258	258	GOES 14
259	259	259	GOES 15
260	260	260	JASON 1
261	261	261	JASON 2
281	281	281	QUIKSCAT

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
282	282	282	TRMM
283	283	283	CORIOLIS
285	285	285	DMSP17
286	286	286	DMSP18

300–399: Numbers allocated to the Russian Federation

310	310	310	GOMS 1
311	311	311	GOMS 2
320	320	320	METEOR 2-21
321	321	321	METEOR 3-5
322	322	322	METEOR 3M-1
323	323	323	METEOR 3M-2
341	341	341	RESURS 01-4

400–499: Numbers allocated to India

410	410	410	KALPANA-1
421	421	421	Oceansat-2
430	430	430	INSAT 1B
431	431	431	INSAT 1C
432	432	432	INSAT 1D
440	440	440	Megha-Tropiques
441	441	441	SARAL
450	450	450	INSAT 2A
451	451	451	INSAT 2B
452	452	452	INSAT 2E
470	470	470	INSAT 3A
471	471	471	INSAT 3D
472	472	472	INSAT 3E

500–599: Numbers allocated to China

500	500	500	FY-1C
501	501	501	FY-1D
510	510	510	FY-2
512	512	512	FY-2B
513	513	513	FY-2C
514	514	514	FY-2D
515	515	515	FY-2E
520	520	520	FY-3A
521	521	521	FY-3B

600–699: Numbers allocated to Europe

700–799: Numbers allocated to the United States

700	700	700	TIROS M (ITOS 1)
701	701	701	NOAA 1
702	702	702	NOAA 2
703	703	703	NOAA 3
704	704	704	NOAA 4
705	705	705	NOAA 5

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
706	706	706	NOAA 6
707	707	707	NOAA 7
708	708	708	TIROS-N
710	710	710	GOES (SMS 1)
711	711	711	GOES (SMS 2)
720	720	720	TOPEX
721	721	721	GFO (GEOSAT follow on)
722	722	722	GRACE A
723	723	723	GRACE B
731	731	731	GOES 1
732	732	732	GOES 2
733	733	733	GOES 3
734	734	734	GOES 4
735	735	735	GOES 5
740	740	740	COSMIC-1
741	741	741	COSMIC-2
742	742	742	COSMIC-3
743	743	743	COSMIC-4
744	744	744	COSMIC-5
745	745	745	COSMIC-6
763	763	763	NIMBUS 3
764	764	764	NIMBUS 4
765	765	765	NIMBUS 5
766	766	766	NIMBUS 6
767	767	767	NIMBUS 7
780	780	780	ERBS
781	781	781	UARS
782	782	782	EARTH PROBE
783	783	783	TERRA
784	784	784	AQUA
785	785	785	AURA
786	786	786	C/NOFS
787	787	787	CALIPSO
788	788	788	CloudSat
800–849 Numbers allocated to other satellite operators			
800	800	800	SUNSAT
810	810	810	COMS-1
811	811	811	COMS-2
820	820	820	SAC-C
821	821	821	SAC-D
825	825	825	KOMPSAT-5
850	850	850	Combination of TERRA and AQUA
851	851	851	Combination of NOAA 16 to NOAA 19
852	852	852	Combination of Metop-1 to Metop-3
853	853	853	Combination of METEOSAT and DMSP

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
854	854	854	Non-specific mixture of geostationary and low Earth-orbiting satellites
870–998	870–998	870–998	Reserved
999 Missing value	999–1022	999–65534	Reserved
	1023	65535	Missing value

Note: Within the ranges 000 to 849 and 870 to 998, even deciles indicate polar orbiting satellites and odd deciles indicate geostationary satellites. The range from 850 to 869 shall be used to indicate combinations of satellites, so the aforementioned decile rule does not apply to values in this range.

COMMON CODE TABLE C–6: *List of units for TDCFs*

Code figure		Conventional abbreviation	Abbreviation in IA5/ASCII (5)	Abbreviation in ITA2 (5)	Definition in base units (2)
	Base SI units (1)				
001	metre	m	m	M	
002	kilogram	kg	kg	KG	
003	second	s	s	S	
004	ampere	A	A	A	
005	kelvin	K	K	K	
006	mole	mol	mol	MOL	
007	candela	cd	cd	CD	
	Supplementary SI Units (1)				
021	radian	rad	rad	RAD	
022	steradian	sr	sr	SR	
	Derived SI Units with special names (1)				
030	hertz	Hz	Hz	HZ	s^{-1}
031	newton	N	N	N	$kg\ m\ s^{-2}$
032	pascal	Pa	Pa	PAL	$kg\ m^{-1}\ s^{-2}$
033	joule	J	J	J	$kg\ m^{2}\ s^{-2}$
034	watt	W	W	W	$kg\ m^{2}\ s^{-3}$
035	coulomb	C	C	C	A s
036	volt	V	V	V	$kg\ m^{2}\ s^{-3}\ A^{-1}$
037	farad	F	F	F	$kg^{-1}\ m^{-2}\ s^{4}\ A^{2}$
038	ohm	Ω	Ohm	OHM	$kg\ m^{2}\ s^{-3}\ A^{-2}$
039	siemens	S	S	SIE	$kg^{-1}\ m^{-2}\ s^{3}\ A^{2}$
040	weber	Wb	Wb	WB	$kg\ m^{2}\ s^{-2}\ A^{-1}$
041	tesla	T	T	T	$kg\ s^{-2}\ A^{-1}$
042	henry	H	H	H	$kg\ m^{2}\ s^{-2}\ A^{-2}$
060	degree Celsius	°C	Cel	CEL	K+273.15
070	lumen	lm	lm	LM	cd sr
071	lux	lx	lx	LX	$cd\ sr\ m^{-2}$
080	becquerel	Bq	Bq	BQ	s^{-1}
081	gray	Gy	Gy	GY	$m^{2}\ s^{-2}$
082	sievert	Sv	Sv	SV	$m^{2}\ s^{-2}$
	SI Unit prefixes (1) (3) (4)				
no	(yotta)	(Y)	(Y)	(Y)	
no	(zetta)	(Z)	(Z)	(Z)	
no	exa	E	E	E	
no	peta	P	P	PE	
no	tera	T	T	T	
no	giga	G	G	G	
no	mega	M	M	MA	
no	kilo	k	k	K	
no	hecto	h	h	H	
no	deca	da	da	DA	
no	deci	d	d	D	
no	centi	c	c	C	
no	milli	m	m	M	
no	micro	µ	u	U	

Code figure		Conventional abbreviation	Abbreviation in IA5/ASCII (5)	Abbreviation in ITA2 (5)	Definition in base units (2)
no	nano	n	n	N	
no	pico	p	p	P	
no	femto	f	f	F	
no	atto	a	a	A	
no	(zepto)	(z)	(z)		
no	(yocto)	(y)	(y)		
	Other, non-SI, units recognized by CGPM (4)				
110	degree (angle)	°	deg	DEG	
111	minute (angle)	'	'	MNT	
112	second (angle)	"	"	SEC	
120	litre	l or L	l or L	L	
130	minute (time)	min	min	MIN	
131	hour	h	h	HR	
132	day	d	d	D	
150	tonne	t	t	TNE	
160	electron volt	eV	eV	EV	
161	atomic mass unit	u	u	U	
170	astronomic unit	AU	AU	ASU	
171	parsec	pc	pc	PRS	
	Non-SI Units tolerated because of widespread use				
200	nautical mile				
201	knot	kt	kt	KT	
210	decibel (6)	dB	dB	DB	
220	hectare	ha	ha	HAR	
230	week				
231	year	a	a	ANN	
	Other Units as used by WMO (7)				
300	per cent	%	%	PERCENT	
301	parts per thousand	‰	0/00	PERTHOU	
310	eighths of cloud	okta	okta	OKTA	
320	degrees true	°	deg	DEG	
321	degrees per second	degree/s	deg/s	DEG/S	
350	degrees Celsius (8)	°C	C	C	
351	degrees Celsius per metre	°C/m	C/m	C/M	
352	degrees Celsius per 100 metres	°C/100 m	C/100 m	C/100 M	
360	Dobson Unit (9)	DU	DU	DU	
430	month	mon	mon	MON	
441	per second (same as hertz)	s^{-1}	/s	/S	
442	per second squared	s^{-2}	s–2		
501	knots per 1000 metres	kt/1000 m	kt/km	KT/KM	
510	foot	ft	ft	FT	
511	inch	in	in	IN	
520	decipascals per second (microbar per second)	dPa s^{-1}	dPa/s	DPAL/S	
521	centibars per second	cb s^{-1}	cb/s	CB/S	
522	centibars per 12 hours	cb/12 h	cb/12 h	CB/12 HR	
523	dekapascal	daPa	daPa	DAPAL	

Code figure		Conventional abbreviation	Abbreviation in IA5/ASCII (5)	Abbreviation in ITA2 (5)	Definition in base units (2)
530	hectopascal	hPa	hPa	HPAL	
531	hectopascals per second	hPa s^{-1}	hPa/s	HPAL/S	
532	hectopascals per hour	hPa h^{-1}	hPa/h	HPAL/HR	
533	hectopascals per 3 hours	hPa/3 h	hPa/3 h	HPAL/3 HR	
535	nanobar = hPa 10^{-6}	nbar	nbar	NBAR	
620	grams per kilogram	g kg^{-1}	g/kg	G/KG	
621	grams per kilogram per second	g kg^{-1} s^{-1}	g kg–1 s–1		
622	kilograms per kilogram	kg kg^{-1}	kg/kg	KG/KG	
623	kilograms per kilogram per second	kg kg^{-1} s^{-1}	kg kg–1 s–1		
624	kilograms per square metre	kg m^{-2}	kg m–2		
630	acceleration due to gravity	g	g		
631	geopotential metre	gpm	gpm		
710	millimetre	mm	mm	MM	
711	millimetres per second	mm s^{-1}	mm/s	MM/S	
712	millimetres per hour	mm h^{-1}	mm/h	MM/HR	
713	millimetres to the sixth power per cubic metre	mm^6 m^{-3}	mm6 m–3		
715	centimetre	cm	cm	CM	
716	centimetres per second	cm s^{-1}	cm/s	CM/S	
717	centimetres per hour	cm h^{-1}	cm/h	CM/HR	
720	decimetre	dm	dm	DM	
731	metres per second	m s^{-1}	m/s	M/S	
732	metres per second per metre	m s^{-1}/m	m s–1/m		
733	metres per second per 1000 metres	m s^{-1}/1000 m	m s–1/km		
734	square metres	m^2	m2	M2	
735	square metres per second	m^2 s^{-1}	m2/s	M2/S	
740	kilometre	km	km	KM	
741	kilometres per hour	km h^{-1}	km/h	KM/HR	
742	kilometres per day	km/d	km/d	KM/D	
743	per metre	m^{-1}	m–1	/M	
750	becquerels per litre	Bq l^{-1}	Bq/l	BQ/L	
751	becquerels per square metre	Bq m^{-2}	Bq m–2	BQ/M2	
752	becquerels per cubic metre	Bq m^{-3}	Bq m–3	BQ/M3	
753	millisievert	mSv	mSv	MSV	
760	metres per second squared	m s^{-2}	m s–2		
761	square metres second	m^2 s	m2 s		
762	square metres per second squared	m^2 s^{-2}	m2 s–2		
763	square metres per radian second	m^2 rad^{-1} s	m2 rad–1 s		
764	square metres per hertz	m^2 Hz^{-1}	m2/Hz		
765	cubic metres	m^3	m3		
766	cubic metres per second	m^3 s^{-1}	m3/s		
767	cubic metres per cubic metre	m^3 m^{-3}	m3 m–3		
768	metres to the fourth power	m^4	m4		
769	metres to the two thirds power per second	$m^{2/3}$ s^{-1}	m2/3 s–1		
772	logarithm per metre	log (m^{-1})	log (m–1)		
773	logarithm per square metre	log (m^{-2})	log (m–2)		
775	kilograms per metre	kg m^{-1}	kg/m		

Code figure		Conventional abbreviation	Abbreviation in IA5/ASCII (5)	Abbreviation in ITA2 (5)	Definition in base units (2)
776	kilograms per square metre per second	$kg\ m^{-2}\ s^{-1}$	kg m–2 s–1		
777	kilograms per cubic metre	$kg\ m^{-3}$	kg m–3		
778	per square kilogram per second	$kg^{-2}\ s^{-1}$	kg–2 s–1		
779	seconds per metre	$s\ m^{-1}$	s/m		
785	kelvin metres per second	$K\ m\ s^{-1}$	K m s–1		
786	kelvins per metre	$K\ m^{-1}$	K/m		
787	kelvin square metres per kilogram per second	$K\ m^2\ kg^{-1}\ s^{-1}$	K m2 kg–1 s–1		
788	moles per mole	$mol\ mol^{-1}$	mol/mol		
790	radians per metre	$rad\ m^{-1}$	rad/m		
795	newtons per square metre	$N\ m^{-2}$	N m–2		
800	pascals per second	$Pa\ s^{-1}$	Pa/s		
801	kilopascal	kPa	kPa		
805	joules per square metre	$J\ m^{-2}$	J m–2		
806	joules per kilogram	$J\ kg^{-1}$	J/kg		
810	watts per metre per steradian	$W\ m^{-1}\ sr^{-1}$	W m–1 sr–1		
811	watts per square metre	$W\ m^{-2}$	W m–2		
812	watts per square metre per steradian	$W\ m^{-2}\ sr^{-1}$	W m–2 sr–1		
813	watts per square metre per steradian centimetre	$W\ m^{-2}\ sr^{-1}\ cm$	W m–2 sr–1 cm		
814	watts per square metre per steradian metre	$W\ m^{-2}\ sr^{-1}\ m$	W m–2 sr–1 m		
815	watts per cubic metre per steradian	$W\ m^{-3}\ sr^{-1}$	W m–3 sr–1		
820	siemens per metre	$S\ m^{-1}$	S/m		
825	square degrees	$degree^2$	deg2		
830	becquerel seconds per cubic metre	$Bq\ s\ m^{-3}$	Bq s m–3		
835	decibels per metre	$dB\ m^{-1}$	dB/m		
836	decibels per degree	$dB\ degree^{-1}$	dB/deg		
841	pH unit	pH unit	pH unit		
842	N units	N units	N units		

Notes:

(1) The international system of units, *Système International d'Unités* (SI), was established by the eleventh General Conference on Weights and Measures in 1960, and extended at the 1980 Conference. There are seven base units, two dimensionless supplementary units and a set of prefixes for decimal scaling. These may be combined to give compound units. Some compound units have special names, and are called derived Units.

(2) When documenting compound SI units, each symbol for each base unit has been separated from the others by a space. There is no space between the unit and any prefix or exponent. Any prefix establishes a new unit to which any exponent applies (e.g. $km^2 = (km)^2 = m^6$ not $k(m^2) = m^5$). Prefixes must be in the case specified. The full name of the unit must not start with an upper case letter. If the solidus (/) is used, there must be only one. There is no space before or after it.

(3) Prefixes beyond exa and atto have been proposed but not yet adopted. Use of the prefixes hecto, deca, deci and centi is discouraged.

(4) Prefixes generally should not be used with units having non-decimal multiples and sub-multiples, such as units of time and angle, or with knots and nautical miles.

(5) Non-WMO abbreviations with limited character sets taken from ISO 2955-1983. Other abbreviations try to be consistent with this.

(6) The decibel is one tenth of a bel, which is the decimal logarithm of a ratio of two powers. Frequently, suffixes are supplied to indicate information about one of the quantities in the ratio, such as dB(mW), dBm, dBZ, dBW, dBmW, dB(μV/m). It is recommended that only dB is used, with the full meaning of the ratio explained, including reference levels.

(7) This list consists of the units not mentioned previously that occur in existing WMO Manuals.

(8) The abbreviation for degrees Celsius proposed for WMO use, C, could be confused with Coulombs. In this case, Amperes second should be used instead.

(9) Dobson Unit = DU. One Dobson Unit corresponds to a layer of 0.01 mm of pure ozone, if the whole column of atmosphere were compressed at P = 1013 hPa and T = 0 °C.

COMMON CODE TABLE C–7: *Tracking technique/status of system used*

Common Code table { Code table 3872 – $s_a s_a$ for alphanumeric codes; Code table 0 02 014 in BUFR }

Code figure for $s_a s_a$	Code figure for BUFR (Code table 0 02 014)	
00	0	No wind finding
01	1	Automatic with auxiliary optical direction finding
02	2	Automatic with auxiliary radio direction finding
03	3	Automatic with auxiliary ranging
04	4	Not used
05	5	Automatic with multiple VLF-Omega signals
06	6	Automatic cross chain Loran-C
07	7	Automatic with auxiliary wind profiler
08	8	Automatic satellite navigation
09–18	9–18	Reserved
19	19	Tracking technique not specified
		TRACKING TECHNIQUES/STATUS OF ASAP SYSTEM
		STATUS OF SHIP SYSTEM
20	20	Vessel stopped
21	21	Vessel diverted from original destination
22	22	Vessel's arrival delayed
23	23	Container damaged
24	24	Power failure to container
25–28	25–28	Reserved for future use
29	29	Other problems
		SOUNDING SYSTEM
30	30	Major power problems
31	31	UPS inoperative
32	32	Receiver hardware problems
33	33	Receiver software problems
34	34	Processor hardware problems
35	35	Processor software problems
36	36	NAVAID system damaged
37	37	Shortage of lifting gas
38	38	Reserved
39	39	Other problems
		LAUNCH FACILITIES
40	40	Mechanical defect
41	41	Material defect (hand launcher)
42	42	Power failure
43	43	Control failure
44	44	Pneumatic/hydraulic failure

Code figure for $s_a s_a$	Code figure for BUFR (Code table 0 02 014)	
45	45	Other problems
46	46	Compressor problems
47	47	Balloon problems
48	48	Balloon release problems
49	49	Launcher damaged
		DATA ACQUISITION SYSTEM
50	50	R/S receiver antenna defect
51	51	NAVAID antenna defect
52	52	R/S receiver cabling (antenna) defect
53	53	NAVAID antenna cabling defect
54–58	54–58	Reserved
59	59	Other problems
		COMMUNICATIONS
60	60	ASAP communications defect
61	61	Communications facility rejected data
62	62	No power at transmitting antenna
63	63	Antenna cable broken
64	64	Antenna cable defect
65	65	Message transmitted power below normal
66–68	66–68	Reserved
69	69	Other problems
70	70	All systems in normal operation
71–98	71–98	Reserved
99	99	Status of system and its components not specified
Not available	100–126	Reserved
Not available	127	Missing value

COMMON CODE TABLE C–8: *Satellite instruments*

Common Code table Code table 0 02 019 in BUFR

Code	Agency	Type	Instrument short name	Instrument long name
10	BNSC	Radiometer	AATSR	Advanced along track scanning radiometer
11	BNSC	Radiometer	ATSR	Along track scanning radiometer
12	BNSC	Radiometer	ATSR-2	Along track scanning radiometer-2
13	BNSC	Radiometer	MWR	Microwave radiometer
30	CNES	Communications	ARGOS	
40	CNES	Lidar	Laser reflectors	
41	CNES	Lidar	DORIS	Doppler orbitography and radio-positioning integrated by satellite
42	CNES	Lidar	DORIS-NG	Doppler orbitography and radio-positioning integrated by satellite-NG
47	CNES	Radar altimeter	POSEIDON-1 (SSALT1)	Positioning ocean, solid Earth, ice dynamics orbiting navigator (single frequency solid state radar altimeter)
48	CNES	Radar altimeter	POSEIDON-2 (SSALT2)	Positioning ocean, solid Earth, ice dynamics orbiting navigator (double frequency solid state radar altimeter)
49	CNES	Radar altimeter	POSEIDON-3 (SSALT3)	Positioning ocean, solid Earth, ice dynamics orbiting navigator (double frequency solid state radar altimeter)
50	CNES	Imaging radiometer	ATSR/M	ATSR/M
51	CNES	High-resolution optical imager	HRG	
52	CNES	Radiometer	HRV	High-resolution visible
53	CNES	Radiometer	HRVIR	High-resolution visible and infrared
54	CNES	Radiometer	ScaRaB/MV2	Scanner for Earth's radiation budget
55	CNES	Radiometer	POLDER	POLDER
56	CNES	Imaging multi-spectral radiometer	IIR	Imaging Infrared Radiometer
60	CNES	Spectrometer	VEGETATION	VEGETATION
61	CNES	Spectrometer	WINDII	WINDII
62	CNES	Altimeter	AltiKa	Ka band Radar Altimeter
80	CSA	Communications	RADARSAT DTT	
81	CSA	Communications	RADARSAT TTC	
85	CSA	Radar	SAR (CSA)	Synthetic aperture radar (CSA)
90	CSA	Radiometer	MOPITT	Measurements of pollution in the troposphere
91	CSA	Atmospheric chemistry instrument	OSIRIS	Optical spectrograph and Infrared imaging system
97	CSIRO	Radiometer	Panchromatic imager	
98	CRCSS	Atmospheric temperature and humidity sounder	GPS receiver	
102	DLR	Radiometer	CHAMP GPS sounder	GPS turborogue space receiver (TRSR)
103	DLR	Radiometer	IGOR	Integrated GPS and Occultation Receiver
116	DLR	Magnetometer	CHAMP gravity package (Accelerometer+GPS)	STAR accelerometer

Code	Agency	Type	Instrument short name	Instrument long name
117	DLR	Magnetometer	CHAMP magnetometry package (1 scalar+ 2 vector magnetometer)	Overhauser magnetometer (OVM) and fluxgate magnetometer (FGM)
120	ESA	Communications	ENVISAT Comms	Communications package on ENVISAT
121	ESA	Communications	ERS Comms	Communication package for ERS
130	ESA	Lidar	ALADIN	Atmospheric laser Doppler instrument
131	ESA	Lidar	ATLID	Atmospheric lidar
140	ESA	Radar	AMI/SAR/image	Active microwave instrumentation image mode
141	ESA	Radar	AMI/SAR/wave	Active microwave instrumentation wave mode
142	ESA	Radar	AMI/scatterometer	Active microwave instrumentation wind mode
143	ESA	Radar	ASAR	ASAR
144	ESA	Imaging microwave	ASAR	Advanced synthetic aperture radar (image mode)
145	ESA	Imaging microwave	ASAR	Advanced synthetic aperture radar (wave mode)
146	ESA	Cloud profile and rain radar	CPR	Cloud radar
147	ESA	Radar	RA-2/MWR	Radar altimeter-2
148	ESA	Radar	RA/MWR	Radar altimeter
150	ESA	Scatterometer	SCATTEROMETER	Scatterometer
161	ESA	Radiometer	MIPAS	Michelson interferometric passive atmosphere sounder
162	ESA	Imaging multi-spectral radiometer (passive microwave)	MWR-2	Microwave radiometer-2
163	ESA	Atmospheric chemistry instrument	SOPRANO	Sub-milimetre observation of processes in the absorption noteworthy for ozone
170	ESA	Atmospheric chemistry instrument	GOME	Global ozone monitoring experiment
172	ESA	Spectrometer	GOMOS	Global ozone monitoring by occultation of stars
174	ESA	Spectrometer	MERIS	Medium resolution imaging spectrometer
175	ESA	Spectrometer	SCIAMACHY	Scanning imaging absorption spectrometer for atmospheric cartography
176	ESA	Radiometer	MIRAS	Microwave imaging radiometer using aperture synthesis
177	ESA	Radar Altimeter	SIRAL	SAR/Interferometric Radar Altimeter
181	EUMETSAT	Communications	METEOSAT Comms	Communications package for METEOSAT
182	EUMETSAT	Communications	MSG Comms	Communications package for MSG
190	ESA/ EUMETSAT	Scatterometer	ASCAT	Advanced scatterometer
200	EUMETSAT	Radiometer	GERB	Geostationary Earth radiation budget
202	ESA/ EUMETSAT	Radiometer	GRAS	GNSS receiver for atmospheric sounding
203	EUMETSAT	Radiometer	MHS	Microwave humidity sounder
205	EUMETSAT	Radiometer	MVIRI	METEOSAT visible and infrared imager
207	EUMETSAT	Radiometer	SEVIRI	Spinning enhanced visible and infrared imager

Code	Agency	Type	Instrument short name	Instrument long name
208	EUMETSAT	Imaging multi-spectral radiometer (vis/IR)	VIRI	VIRI
220	ESA/ EUMETSAT	Spectrometer	GOME-2	Global ozone monitoring experiment-2
221	CNES/ EUMETSAT	Atmospheric temperature and humidity sounder	IASI	Infrared atmospheric sounding interferometer
240	CAST	Communications	DCP	Data-collection platform transponder
245	CAST	Radiometer	CCD	High-resolution CCD camera
246	INPE	Atmospheric temperature and humidity sounder	HSB	Humidity sounder/Brazil
248	INPE	Imaging multi-spectral radiometer (vis/IR)	OBA	Observador Brasileiro da Amazonia
250	CAST	Radiometer	WFI	Wide field imager
255	CAST	Spectrometer	IRMSS	Infrared multispectral scanner
260	ISRO	Precision orbit	BSS & FSS transponders	
261	ISRO	Precision orbit	DRT-S&R	
262	ISRO	Communications	INSAT Comms	Communications package for INSAT
268	ISRO	High-resolution optical imager	HR-PAN	High-resolution panchromatic camera
269	ISRO	Imaging multi-spectral radiometer (passive microwave)	MSMR	Multifrequency scanning microwave radiometer
270	ISRO	Imaging multi-spectral radiometer (vis/IR)	VHRR	Very high-resolution radiometer
271	ISRO	Imaging multi-spectral radiometer (vis/IR)	WiFS	Wide field sensor
275	ISRO	High-resolution optical imager	AWiFS	Advanced wide field sensor
276	ISRO	High-resolution optical imager	LISS-I	Linear imaging self scanner-I
277	ISRO	High-resolution optical imager	LISS-II	Linear imaging self scanner-II
278	ISRO	High-resolution optical imager	LISS-III	Linear imaging self scanner-III
279	ISRO	High-resolution optical imager	LISS-IV	Linear imaging self scanner-IV
284	ISRO	High-resolution optical imager	PAN	Panchromatic sensor
285	ISRO	Imaging multi-spectral radiometer (vis/IR)	MOS	Modular opto-electronic scanner

Code	Agency	Type	Instrument short name	Instrument long name
286	ISRO	Ocean colour Instrument	OCM	Ocean colour monitor
287	ASI		ROSA	Radio Occultation Sounder of the Atmosphere
288	ISRO	Scatterometer	SCAT	Scatterometer
290	JMA	Communications	MTSAT Comms	Communications package for MTSAT
291	JMA	Communications	Himawari Comms	Communications package for Himawari
294	JMA	Imaging multi-spectral radiometer	JAMI	Japanese Advanced Meteorological Imager
295	JMA	Imaging multi-spectral radiometer	IMAGER/MTSAT-2	Imager/MTSAT-2
296	JMA	Imaging multi-spectral radiometer	VISSR	Visible and infrared spin scan radiometer
297	JMA	Imaging multi-spectral radiometer	AHI	Advanced Himawari Imager
300	NASA	Lidar	GLAS	Geoscience laser altimeter system
301	NASA	Precision orbit	LRA	Laser retroreflector array
302	NASA	Lidar	MBLA	Multi-beam laser altimeter
303	NASA	Lidar	CALIOP	Cloud-aerosol lidar with orthogonal polarization
309	NASA	Cloud profile and rain radar	CPR (Cloudsat)	Cloud profiling radar
312	NASA	Radar	NSCAT	NASA scatterometer
313	NASA	Radar	SeaWinds	ADEOS II – NASA scatterometer
330	NASA	Earth radiation budget radiometer	ACRIM	Active cavity radiometer irradiance monitor
334	NASA	Total and profile ozone	BUV	Backscatter ultraviolet instrument
336	NASA	High-resolution optical imager	ALI	Advanced land imager
347	NASA	High-resolution optical imager	ASTER	Advanced spaceborne thermal emission and reflection radiometer
348	NASA	Earth radiation budget radiometer	CERES-2	Cloud and the Earth's radiant energy system
351	NASA	Atmospheric temperature and humidity sounder	GPSDR	GPS demonstration receiver
353	NASA	Total and profile ozone	HiRDLS	High-resolution dynamics limb sounder
354	NASA	Total and profile ozone	HRDI	High-resolution Doppler imager
356	NASA	Radiometer	LIS	Lightning imaging sensor
358	NASA	Magnetic field, auroal imagery scintillation boundary	PEM	Particle environment monitor
359	NASA	Ocean colour instrument	SeaWiFS	Sea-viewing wide field-of-view sensor
360	NASA	Earth radiation budget radiometer	SUSIM (UARS)	Solar ultraviolet irradiance monitor
363	NASA	Total and profile ozone	SBUV/1	Solar backscatter ultraviolet 1 instrument

Code	Agency	Type	Instrument short name	Instrument long name
365	NASA	Imaging multi-spectral radiometer (passive microwave)	TMI	TRMM microwave imager
366	NASA	Imaging multi-spectral radiometer (passive microwave)	JMR	JASON-1 microwave radiometer
367	NASA	Imaging multi-spectral radiometer	AMR	Advanced microwave radiometer
369	NASA	Total and profile ozone	LIMS	Limb infrared monitor of the stratosphere
370	NASA	Total and profile ozone	LRIR	Limb radiance inversion radiometer instrument
371	NASA	Total and profile ozone	EPIC	Earth polychromatic imaging camera
372	NASA	Earth radiation budget radiometer	NISTAR	NIST advanced radiometer
373	NASA	Magnetic field, auroal imagery scintillation boundary	Plasma-Mag	
374	NASA	Other	XPS	XUV photometer system
375	NASA	Imaging multi-spectral radiometer (vis/IR)	VIRS	Visible infrared scanner
376	CNES	Multiple direction/ polarization radiometer	POLDER II	Polarization and directionality of the Earth's reflectance-II
377	NASA	Earth radiation budget radiometer	TIM	Total irradiance monitor
379	NASA	Imaging multi-spectral radiometer (vis/IR)	WFC	Wide field camera
382	NASA	Spectro-radiometer	CLAES	Cryogenic limb array etalon spectrometer
383	NASA	Spectro-radiometer	HALOE	Halogen occultation experiment
384	NASA	Spectro-radiometer	ISAMS	Improved stratospheric and mesospheric sounder
385	NASA	Spectro-radiometer	MISR	Multi-angle imaging spectroradiometer
386	NASA	Spectro-radiometer	MLS	Microwave limb sounder
387	NASA	Spectro-radiometer	MLS (EOS-Aura)	Microwave limb sounder (EOS-Aura)
389	NASA	Spectro-radiometer	MODIS	Moderate-resolution imaging spectroradiometer
393	NASA	Gravity	HAIRS	High accuracy inter-satellite ranging system
394	NASA	Total and profile ozone	OMI	Ozone measuring instrument
395	NASA	Radiometer	Atmospheric corrector	Atmospheric corrector
396	NASA	Radiometer	Hyperion	Hyperspectral imager
399	NASA	Spectro-radiometer	SAGE I	Stratospheric aerosol and gas experiment-I

Code	Agency	Type	Instrument short name	Instrument long name
400	NASA	Spectro-radiometer	SAGE II	Stratospheric aerosol and gas experiment-II
401	NASA	Spectro-radiometer	SAGE III	Stratospheric aerosol and gas experiment-III
402	NASA	Spectro-radiometer	SAMS	Stratospheric and mesospheric sounder
403	NASA	Spectro-radiometer	SAM-II	Stratospheric aerosol measurement-II
404	NASA	Spectro-radiometer	IRIS	Infrared interferometer spectrometer
405	NASA	Atmospheric temperature and Humidity sounder	GIFTS	Geosynchronous imaging Fourier transform spectrometer
420	NASA	Spectrometer	AIRS	Atmospheric Infrared sounder
426	NASA	Spectrometer	SOLSTICE	Solar stellar irradiance comparison experiment
430	NASA	Spectrometer	TES	Tropospheric emission spectrometer
431	NASA	Spectrometer	TOMS	Total ozone mapping spectrometer
450	JAXA	Communications	ADEOS Comms	Communications package for ADEOS
451	JAXA	Communications	DCS (JAXA)	Data-collection system (JAXA)
453	NASDA	Communications	GMS Comms	Communications package on GMS
454	NASDA	Communications	JERS-1 Comms	Communications package for JERS-1
460	NASDA	Lidar	RIS	Retroreflector in space
461	NASDA	Radar	PR	Precipitation radar
462	NASDA	Imaging microwave radar	SAR	Synthetic aperture radar
470	JAXA	Imaging microwave radar	PALSAR	Phased array type L-band synthetic aperture radar
478	JAXA	Imaging multi-spectral radiometer (passive microwave)	AMSR2	Advanced Microwave Scanning Radiometer 2
479	JAXA	Imaging multi-spectral radiometer (passive microwave)	AMSR-E	Advanced microwave scanning radiometer – EOS
480	JAXA	High-resolution optical imager	PRISM (ALOS)	Panchromatic remote-sensing instrument for stereo mapping
481	JAXA	Radiometer	AMSR	Advanced microwave scanning radiometer
482	NASDA	High-resolution optical imager	AVNIR	Advanced visible and near infrared radiometer
483	JAXA	High-resolution optical imager	AVNIR-2	Advanced visible and near infrared radiometer type 2
484	JAXA	Imager	GLI	Global imager
485	NASDA	Radiometer	MESSR	Multispectral electronic self scanning radiometer
486	NASDA	Radiometer	MSR	Microwave scanning radiometer
487	NASDA	Radiometer	OCTS	Ocean colour and temperature scanner
488	NASDA	Radiometer	OPS	Optical sensor
489	NASDA	Radiometer	VISSR (GMS-5)	Visible and infrared spin scan radiometer (GMS-5)
490	NASDA	Radiometer	VTIR	Visible and thermal infrared radiometer
510	NASDA	Spectrometer	ILAS-I	Improved limb atmospheric spectrometer
511	NASDA	Spectrometer	ILAS-II	Improved limb atmospheric spectrometer

Code	Agency	Type	Instrument short name	Instrument long name
512	NASDA	Spectrometer	IMG	Inferometric monitor of greenhouse gases
514	NASDA	Space environment	SEM	Space environment monitor (NASDA)
515	JAXA	Total and profile ozone	SOFIS	Solar occultation Fourier transform spectrometer for inclined orbit satellite
516	JAXA	Spectrometer	TANSO-FTS	Thermal and Near infrared Sensor for carbon Observations (TANSO) Fourier Transform Spectrometer (FTS)
517	JAXA	Imager	TANSO-CAI	Thermal and Near infrared Sensor for carbon Observations (TANSO) Cloud and Aerosol Imager (CAI)
540	NOAA	Communications	DCS (NOAA)	Data-collection system (NOAA)
541	NOAA	Communications	GOES Comms	Communications package on GOES
542	NOAA	Communications	LANDSAT Comms	Communications package for LANDSAT
543	NOAA	Communications	NOAA Comms	Communications package for NOAA
544	NOAA	Communications	S&R (GOES)	Search and rescue
545	NOAA	Communications	S&R (NOAA)	Search and rescue
546	NOAA	Communications	WEFAX	Weather facsimile
547	NOAA	Spectrometer	SEM (GOES)	Space environment monitor
550	NOAA	Magnetic field	SSM	Special sensor magnetometer
551	NOAA	Magnetic field	SSJ/4	Special sensor precipitating plasma monitor
552	NOAA	Space environment	SSIES-2	Special sensor ionospheric plasma drift/scintillation meter
553	NOAA	Space environment	SSB/X-2	Special sensor gamma ray particle detector
570	NOAA	Radiometer	AMSU-A	Advanced microwave sounding unit-A
574	NOAA	Radiometer	AMSU-B	Advanced microwave sounding unit-B
580	NOAA	Radiometer	ATOVS (HIRS/3 + AMSU + AVHRR/3)	Advanced TIROS operational vertical sounder
590	NOAA	Radiometer	AVHRR/2	Advanced very high-resolution radiometer/2
591	NOAA	Radiometer	AVHRR/3	Advanced very high-resolution radiometer/3
592	NOAA	Radiometer	AVHRR/4	Advanced very high-resolution radiometer/4
600	NOAA	Radiometer	ERBE	Earth's radiation budget experiment
601	NOAA	Radiometer	ETM+	Enhanced thematic mapper
605	NOAA	Radiometer	HIRS/2	High-resolution infrared sounder/2
606	NOAA	Radiometer	HIRS/3	High-resolution infrared sounder/3
607	NOAA	Radiometer	HIRS/4	High-resolution infrared sounder/4
615	NOAA	Radiometer	IMAGER	Imager
616	NOAA	Imaging multi-spectral radiometer (vis/IR)	VIIRS	Visible/infrared imager radiometer suite
620	NOAA	Atmospheric temperature and humidity sounder	CrIRS/NP	Cross-track infrared sounder/NPOESS
621	NOAA	Atmospheric temperature and humidity sounder	ATMS	Advanced technology microwave sounder
622	NOAA	Radiometer	MSS	Multispectral scanning system
623	NOAA	Radiometer	MSU	Microwave sounding unit
624	NOAA	Radiometer	SBUV/2	Solar backscatter ultraviolet instrument/2

Code	Agency	Type	Instrument short name	Instrument long name
625	NOAA	Radiometer	SBUV/3	Solar backscatter ultraviolet instrument/3
626	NOAA	Radiometer	SOUNDER	SOUNDER
627	NOAA	Radiometer	SSU	Stratospheric sounding unit
628	NOAA	Radiometer	TM	Thematic mapper
629	NOAA	Radiometer	TOVS (HIRS/2 +	TIROS operational vertical sounder MSU + SSU)
630	NOAA	Radiometer	VAS	VISSR atmospheric sounder
631	NOAA	Radiometer	SSZ	
645	NOAA	Spectrometer	SEM	Space environment monitor
650	NRSCC	Radiometer	MVIRSR (10 channel)	Multispectral visible and infrared scan radiometer
651	NRSCC	Radiometer	MVIRSR (3 channel)	Multispectral visible and infrared scan radiometer
652	NRSCC	Radiometer	MVIRSR (5 channel)	Multispectral visible and infrared scan radiometer
670	NSAU	Radar	RLSBO	Side looking microwave radar
680	NSAU	High-resolution optical imager	MSU-EU	Multispectral radiometer with high resolution
681	NSAU	Imaging multi-spectral radio-meter (vis/IR)	MSU-UM	Visible multispectral radiometer
682	NSAU	Radiometer	RM-08	Imaging microwave radiometer
683	NSAU	High-resolution optical imager	SU-UMS	Stereo radiometer with high resolution
684	NSAU	High-resolution optical imager	SU-VR	Visible radiometer with high resolution
685	NSAU	Radiometer	TRASSER	
700	ROSCOSMOS	Communications	KONDOR-2	Data-collection and transmission system
701	ROSCOSMOS	Communications	BRK	
710	ROSCOSMOS	Lidar	ALISSA	Backscatter lidar
712	ROSCOSMOS	Lidar	Balkan-2 lidar	
715	ROSCOSMOS	Lidar	MK-4	
716	ROSCOSMOS	Lidar	MK-4M	
730	ROSCOSMOS	Radar	Greben	Radar altimeter
731	ROSCOSMOS	Radar	SAR-10	Synthetic aperture radar
732	ROSCOSMOS	Radar	SAR-3	Synthetic aperture radar
733	ROSCOSMOS	Radar	SAR-70	Synthetic aperture radar
740	ROSCOSMOS	Radar	SLR-3	Side looking radar
745	ROSCOSMOS	Radar	Travers SAR	
750	ROSCOSMOS	Radiometer	174-K	Temperature and humidity profiler
751	ROSCOSMOS	Radiometer	BTVK	Scanning television radiometer
752	ROSCOSMOS	Radiometer	Chaika	Scanning infrared radiometer
753	ROSCOSMOS	Radiometer	DELTA-2	Multispectral microwave scanner
755	ROSCOSMOS	Radiometer	IKAR-D	Multispectral microwave scanner
756	ROSCOSMOS	Radiometer	IKAR-N	Multispectral microwave scanner
757	ROSCOSMOS	Radiometer	IKAR-P	Multispectral microwave scanner
760	ROSCOSMOS	Radiometer	ISP	
761	ROSCOSMOS	Radiometer	KFA-1000	Photographic camera
762	ROSCOSMOS	Radiometer	KFA-200	Photographic camera
763	ROSCOSMOS	Radiometer	KFA-3000	Photographic camera

Code	Agency	Type	Instrument short name	Instrument long name
770	ROSCOSMOS	Radiometer	Klimat	Scanning infrared radiometer
771	ROSCOSMOS	Radiometer	Klimat-2	Scanning infrared radiometer
775	ROSCOSMOS	Radiometer	MIRAS	
776	ROSCOSMOS	Radiometer	MIVZA	
777	ROSCOSMOS	Radiometer	MIVZA-M	Microwave scanning radiometer
780	ROSCOSMOS	Radiometer	MR-2000	
781	ROSCOSMOS	Radiometer	MR-2000M	
785	ROSCOSMOS	Radiometer	MR-900	Scanning telephotometer
786	ROSCOSMOS	Radiometer	MR-900B	Scanning visual band telephotometer
790	ROSCOSMOS	Radiometer	MSU-E	Multispectral high-resolution electronic scanner
791	ROSCOSMOS	Radiometer	MSU-E1	Multispectral high-resolution electronic scanner
792	ROSCOSMOS	Radiometer	MSU-E2	Multispectral high-resolution electronic scanner
793	ROSCOSMOS	Radiometer	MSU-M	
794	ROSCOSMOS	Radiometer	MSU-S	Multispectral medium-resolution scanner
795	ROSCOSMOS	Radiometer	MSU-SK	Multispectral medium-resolution conical scanner
796	ROSCOSMOS	Radiometer	MSU-V	Multispectral high-resolution conical scanner
810	ROSCOSMOS	Radiometer	MTZA	Scanning microwave radiometer
815	ROSCOSMOS	Imaging multi-spectral radiometer (passive microwave)	MZOAS	Scanning microwave radiometer
820	ROSCOSMOS	Imaging multi-spectral radiometer (passive microwave)	R-225	Single channel microwave radiometer
821	ROSCOSMOS	Radiometer	R-400	
822	ROSCOSMOS	Radiometer	R-600	Single channel microwave radiometer
830	ROSCOSMOS	Radiometer	RMS	Radiation measurement system
835	ROSCOSMOS	Radiometer	TV camera	
836	ROSCOSMOS	Radiometer	SILVA	
840	ROSCOSMOS	Spectro-radiometer	SROSMO	Spectroradiometer for ocean monitoring
850	ROSCOSMOS	Spectrometer	BUFS-2	Backscatter spectrometer/2
851	ROSCOSMOS	Spectrometer	BUFS-4	Backscatter spectrometer/4
855	ROSCOSMOS	Spectrometer	ISTOK-1	Infrared spectrometer
856	ROSCOSMOS	Spectrometer	SFM-2	Spectrometer to measure direct solar radiation
857	ROSCOSMOS	Spectrometer	DOPI	
858	ROSCOSMOS	Spectrometer	KGI-4	
859	ROSCOSMOS	Spectrometer	Ozon-M	
860	ROSCOSMOS	Spectrometer	RMK-2	
900	NOAA	Radiometer	MAXIE	Magnetospheric atmospheric X-ray imaging experiment
901	NOAA	Radiometer	OLS	Operational linescan system
905	NOAA	Radiometer	SSM/I	Mission sensor microwave imager
906	NOAA	Radiometer	SSM/T-1	Mission sensor microwave temperature sounder
907	NOAA	Radiometer	SSM/T-2	Mission sensor microwave water vapour sounder

Code	Agency	Type	Instrument short name	Instrument long name
908	NOAA	Radiometer	SSMIS	Special sensor microwave imager sounder
910	NOAA	Radiometer	SXI	Solar X-ray imager
930	NOAA	Spectrometer	EHIC	Energetic heavy ion composition experiment
931	NOAA	Spectrometer	X-ray astronomy payload	
932	NRSCC	Imaging multi-spectral radiometer (vis/IR)	IVISSR (FY-2)	Improved multispectral visible and Infrared scan radiometer (5 channels)
933	NRSCC	Atmospheric temperature and humidity sounder	IRAS	Infrared atmospheric sounder
934	NRSCC	Atmospheric temperature and humidity sounder	MWAS	Microwave atmospheric sounder
935	NRSCC	Atmospheric temperature and humidity sounder	IMWAS	Improved Microwave atmospheric sounder
936	NRSCC	Atmospheric temperature and humidity sounder	MWHS	Microwave humidity sounder
937	NRSCC	Imaging multi-spectral radiometer (vis/IR)	MVIRS	Moderate resolution visible and infrared imaging spectroradiometer
938	NRSCC	Imaging multi-spectral radiometer (passive microwave)	MWRI	Microwave radiation imager
940	ROSCOSMOS	Atmospheric temperature and humidity sounder	MTVZA-OK	Scanning microwave radiometer
941	CNES	Atmospheric temperature and humidity sounder	SAPHIR	
942	CNES	Microwave imager	MADRAS	Microwave Analysis and Detection of Rain and Atmospheric Structures
944	NOAA	Radar altimeter	ALT	Altimeter
945	NOAA	Earth radiation budget radiometer	TSIS	Total solar irradiance sensor
946	NOAA	Imaging multi-spectral radiometer (passive microwave)	CMIS	Conical-scanning microwave imager/sounder
947	NOAA	Total and profile ozone	OMPS	Ozone mapping and profiler suite
948	NOAA	Space environment atmospheric temperature and humidity sounder	GPSOS	Global positioning system occultation sensor
949	NOAA	Magnetic field, auroal imagery scintillation boundary	SESS	Space environmental sensor suite
950	NRSCC	Imaging multi-spectral radiometer (vis/IR)	VIRR	Multispectral visible and infrared scan radiometer (10 channels)

Code	Agency	Type	Instrument short name	Instrument long name
951	NRSCC	Total and profile ozone	TOM	Total ozone mapper
952	NRSCC	Total and profile ozone	OP	Ozone profiler
953–999		Reserved		
1000–2046		Reserved for long-term future use		
2047		Missing value		

COMMON CODE TABLE C–11: *Originating/generating centres*

Common Code table
- BUFR 0 01 035
- CREX Edition 2, ooooo in Group Poooooppp in Section 1
- GRIB Edition 2, Octets 6–7 in Section 1
- BUFR Edition 4, Octets 5–6 in Section 1

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00000	0	WMO Secretariat
		00001–00009: WMCs
00001	1	Melbourne
00002	2	Melbourne
00003	3	)
00004	4	Moscow
00005	5	Moscow
00006	6	)
00007	7	US National Weather Service, National Centres for Environmental Prediction (NCEP)
00008	8	US National Weather Service Telecommunications Gateway (NWSTG)
00009	9	US National Weather Service – Other
		00010–00025: Centres in Region I
00010	10	Cairo (RSMC)
00011	11	)
00012	12	Dakar (RSMC)
00013	13	)
00014	14	Nairobi (RSMC)
00015	15	)
00016	16	Casablanca (RSMC)
00017	17	Tunis (RSMC)
00018	18	Tunis–Casablanca (RSMC)
00019	19	)
00020	20	Las Palmas
00021	21	Algiers (RSMC)
00022	22	ACMAD
00023	23	Mozambique (NMC)
00024	24	Pretoria (RSMC)
00025	25	La Réunion (RSMC)
		00026–00040: Centres in Region II
00026	26	Khabarovsk (RSMC)
00027	27	)
00028	28	New Delhi (RSMC)
00029	29	)

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00030	30	Novosibirsk (RSMC)
00031	31	)
00032	32	Tashkent (RSMC)
00033	33	Jeddah (RSMC)
00034	34	Tokyo (RSMC), Japan Meteorological Agency
00035	35	)
00036	36	Bangkok
00037	37	Ulaanbaatar
00038	38	Beijing (RSMC)
00039	39	)
00040	40	Seoul
		00041–00050: Centres in Region III
00041	41	Buenos Aires (RSMC)
00042	42	)
00043	43	Brasilia (RSMC)
00044	44	)
00045	45	Santiago
00046	46	Brazilian Space Agency - INPE
00047	47	Colombia (NMC)
00048	48	Ecuador (NMC)
00049	49	Peru (NMC)
00050	50	Venezuela (Bolivarian Republic of) (NMC)
		00051–00063: Centres in Region IV
00051	51	Miami (RSMC)
00052	52	Miami RSMC, National Hurricane Centre
00053	53	Montreal (RSMC)
00054	54	)
00055	55	San Francisco
00056	56	ARINC Centre
00057	57	US Air Force – Air Force Global Weather Central
00058	58	Fleet Numerical Meteorology and Oceanography Center, Monterey, CA, United States
00059	59	The NOAA Forecast Systems Laboratory, Boulder, CO, United States
00060	60	United States National Center for Atmospheric Research (NCAR)
00061	61	Service ARGOS – Landover
00062	62	US Naval Oceanographic Office
00063	63	International Research Institute for Climate and Society (IRI)

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
		00064–00073: Centres in Region V
00064	64	Honolulu (RSMC)
00065	65	Darwin (RSMC)
00066	66	)
00067	67	Melbourne (RSMC)
00068	68	Reserved
00069	69	Wellington (RSMC)
00070	70	)
00071	71	Nadi (RSMC)
00072	72	Singapore
00073	73	Malaysia (NMC)
		00074–00099: Centres in Region VI
00074	74	UK Meteorological Office – Exeter (RSMC)
00075	75	)
00076	76	Moscow (RSMC)
00077	77	Reserved
00078	78	Offenbach (RSMC)
00079	79	)
00080	80	Rome (RSMC)
00081	81	)
00082	82	Norrköping
00083	83	)
00084	84	Toulouse (RSMC)
00085	85	Toulouse (RSMC)
00086	86	Helsinki
00087	87	Belgrade
00088	88	Oslo
00089	89	Prague
00090	90	Episkopi
00091	91	Ankara
00092	92	Frankfurt/Main
00093	93	London (WAFC)
00094	94	Copenhagen
00095	95	Rota
00096	96	Athens
00097	97	European Space Agency (ESA)
00098	98	European Centre for Medium Range Weather Forecasts (ECMWF) (RSMC)
00099	99	De Bilt

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
		Additional Centres
00100	100	Brazzaville
00101	101	Abidjan
00102	102	Libya (NMC)
00103	103	Madagascar (NMC)
00104	104	Mauritius (NMC)
00105	105	Niger (NMC)
00106	106	Seychelles (NMC)
00107	107	Uganda (NMC)
00108	108	United Republic of Tanzania (NMC)
00109	109	Zimbabwe (NMC)
00110	110	Hong Kong, China
00111	111	Afghanistan (NMC)
00112	112	Bahrain (NMC)
00113	113	Bangladesh (NMC)
00114	114	Bhutan (NMC)
00115	115	Cambodia (NMC)
00116	116	Democratic People's Republic of Korea (NMC)
00117	117	Islamic Republic of Iran (NMC)
00118	118	Iraq (NMC)
00119	119	Kazakhstan (NMC)
00120	120	Kuwait (NMC)
00121	121	Kyrgyzstan (NMC)
00122	122	Lao People's Democratic Republic (NMC)
00123	123	Macao, China
00124	124	Maldives (NMC)
00125	125	Myanmar (NMC)
00126	126	Nepal (NMC)
00127	127	Oman (NMC)
00128	128	Pakistan (NMC)
00129	129	Qatar (NMC)
00130	130	Yemen (NMC)
00131	131	Sri Lanka (NMC)
00132	132	Tajikistan (NMC)
00133	133	Turkmenistan (NMC)
00134	134	United Arab Emirates (NMC)
00135	135	Uzbekistan (NMC)
00136	136	Viet Nam (NMC)
00137–00139	137–139	Reserved for other centres
00140	140	Bolivia (Plurinational State of) (NMC)

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00141	141	Guyana (NMC)
00142	142	Paraguay (NMC)
00143	143	Suriname (NMC)
00144	144	Uruguay (NMC)
00145	145	French Guiana
00146	146	Brazilian Navy Hydrographic Centre
00147	147	National Commission on Space Activities (CONAE) – Argentina
00148–00149	148–149	Reserved for other centres
00150	150	Antigua and Barbuda (NMC)
00151	151	Bahamas (NMC)
00152	152	Barbados (NMC)
00153	153	Belize (NMC)
00154	154	British Caribbean Territories Centre
00155	155	San José
00156	156	Cuba (NMC)
00157	157	Dominica (NMC)
00158	158	Dominican Republic (NMC)
00159	159	El Salvador (NMC)
00160	160	US NOAA/NESDIS
00161	161	US NOAA Office of Oceanic and Atmospheric Research
00162	162	Guatemala (NMC)
00163	163	Haiti (NMC)
00164	164	Honduras (NMC)
00165	165	Jamaica (NMC)
00166	166	Mexico
00167	167	Curaçao and Sint Maarten (NMC)
00168	168	Nicaragua (NMC)
00169	169	Panama (NMC)
00170	170	Saint Lucia (NMC)
00171	171	Trinidad and Tobago (NMC)
00172	172	French Departments in RA IV
00173	173	US National Aeronautics and Space Administration (NASA)
00174	174	Integrated Science Data Management/Marine Environmental Data Service (ISDM/MEDS – Canada)
00175	175	University Corporation for Atmospheric Research (UCAR) – United States
00176	176	Cooperative Institute for Meteorological Satellite Studies (CIMSS) – United States
00177	177	NOAA National Ocean Service – United States
00178–00189	178–189	Reserved for other centres

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00190	190	Cook Islands (NMC)
00191	191	French Polynesia (NMC)
00192	192	Tonga (NMC)
00193	193	Vanuatu (NMC)
00194	194	Brunei Darussalam (NMC)
00195	195	Indonesia (NMC)
00196	196	Kiribati (NMC)
00197	197	Federated States of Micronesia (NMC)
00198	198	New Caledonia (NMC)
00199	199	Niue
00200	200	Papua New Guinea (NMC)
00201	201	Philippines (NMC)
00202	202	Samoa (NMC)
00203	203	Solomon Islands (NMC)
00204	204	National Institute of Water and Atmospheric Research (NIWA – New Zealand)
00205–00209	205–209	Reserved for other centres
00210	210	Frascati (ESA/ESRIN)
00211	211	Lannion
00212	212	Lisboa
00213	213	Reykjavik
00214	214	Madrid
00215	215	Zurich
00216	216	Service ARGOS Toulouse
00217	217	Bratislava
00218	218	Budapest
00219	219	Ljubljana
00220	220	Warsaw
00221	221	Zagreb
00222	222	Albania (NMC)
00223	223	Armenia (NMC)
00224	224	Austria (NMC)
00225	225	Azerbaijan (NMC)
00226	226	Belarus (NMC)
00227	227	Belgium (NMC)
00228	228	Bosnia and Herzegovina (NMC)
00229	229	Bulgaria (NMC)
00230	230	Cyprus (NMC)
00231	231	Estonia (NMC)
00232	232	Georgia (NMC)

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00233	233	Dublin
00234	234	Israel (NMC)
00235	235	Jordan (NMC)
00236	236	Latvia (NMC)
00237	237	Lebanon (NMC)
00238	238	Lithuania (NMC)
00239	239	Luxembourg
00240	240	Malta (NMC)
00241	241	Monaco
00242	242	Romania (NMC)
00243	243	Syrian Arab Republic (NMC)
00244	244	The former Yugoslav Republic of Macedonia (NMC)
00245	245	Ukraine (NMC)
00246	246	Republic of Moldova (NMC)
00247	247	Operational Programme for the Exchange of weather RAdar information (OPERA) – EUMETNET
00248	248	Montenegro (NMC)
00249	249	Reserved for other centres
00250	250	COnsortium for Small scale MOdelling (COSMO)
00251	251	Meteorological Cooperation on Operational NWP (MetCoOp)
00252	252	Max Planck Institute for Meteorology (MPI-M)
00253	253	Reserved for other centres
00254	254	EUMETSAT Operation Centre
00255	255	Not to be used
00256	256	Angola (NMC)
00257	257	Benin (NMC)
00258	258	Botswana (NMC)
00259	259	Burkina Faso (NMC)
00260	260	Burundi (NMC)
00261	261	Cameroon (NMC)
00262	262	Cabo Verde (NMC)
00263	263	Central African Republic (NMC)
00264	264	Chad (NMC)
00265	265	Comoros (NMC)
00266	266	Democratic Republic of the Congo (NMC)
00267	267	Djibouti (NMC)
00268	268	Eritrea (NMC)
00269	269	Ethiopia (NMC)

CREX Edition 2 B 01 035 (5 characters) and Group 3 in Section 1	GRIB Edition 2 Octets 6–7 in Section 1 BUFR Edition 4 0 01 035 (16 bits) and Octets 5–6 in Section 1	
00270	270	Gabon (NMC)
00271	271	Gambia (NMC)
00272	272	Ghana (NMC)
00273	273	Guinea (NMC)
00274	274	Guinea-Bissau (NMC)
00275	275	Lesotho (NMC)
00276	276	Liberia (NMC)
00277	277	Malawi (NMC)
00278	278	Mali (NMC)
00279	279	Mauritania (NMC)
00280	280	Namibia (NMC)
00281	281	Nigeria (NMC)
00282	282	Rwanda (NMC)
00283	283	Sao Tome and Principe (NMC)
00284	284	Sierra Leone (NMC)
00285	285	Somalia (NMC)
00286	286	Sudan (NMC)
00287	287	Swaziland (NMC)
00288	288	Togo (NMC)
00289	289	Zambia (NMC)
00290–65534	290–65534	Reserved for other centres
65535	65535	Missing value
65536–99999	Not applicable	Not used

Notes:

(1) The closed bracket sign ")" indicates that the corresponding code figure is reserved for the previously named centre.

(2) With GRIB or BUFR, to indicate whether the originating/generating centre is a sub-centre or not, the following procedure should be applied:

In GRIB edition 2, use octets 8–9 of section 1, or in BUFR edition 4, use octets 7–8 of section 1, with the following meaning:

Code figure

Code figure	
0	Not a sub-centre, the originating/generating centre is the centre defined by octets 6–7 in section 1 of GRIB edition 2, or by octets 5–6 in section 1 of BUFR edition 4.
1 to 254	Identifier of the sub-centre which is the originating/generating centre. The identifier of the sub-centre is allocated by the associated centre, which is defined by octets 6–7 in section 1 of GRIB edition 2 or by octets 5–6 in section 1 of BUFR edition 4. The sub-centre identifiers should be supplied to the WMO Secretariat by the associated centre(s) for publication.

(3) For the definitions of sub-centres provided to the WMO Secretariat, see Common Code table C–12.

COMMON CODE TABLE C–12: *Sub-centres of originating centres defined by entries in Common Code tables C–1 or C–11*

ORIGINATING CENTRES C–1, C–11 or C–12		SUB-CENTRES BUFR 0 01 034 BUFR Edition 3, Octet 5 in Section 1 BUFR Edition 4, Octets 7–8 in Section 1 GRIB Edition 1, Octet 26 in Section 1 GRIB Edition 2, Octets 8–9 in Section 1 CREX Edition 2, ppp in Group Poooooppp in Section 1	
Code figure	Name	Code figure	Name
		0	No sub-centre
REGION II			
34	Tokyo (RSMC), Japan Meteorological Agency	207	Syowa
		240	Kiyose
		241	Reanalysis project
39	Beijing (RSMC)	225	Beijing
		226	Guangzhou
		228	Urumuqi
40	Seoul	243	Seoul
		245	Jincheon
110	Hong-Kong, China	229	Hong-Kong
REGION III			
46	Brazilian Space Agency - INPE	10	Cachoeira Paulista (INPE)
		11	Cuiaba (INPE)
		12	Brasilia (INMET)
		13	Fortaleza (FUNCEME)
		14	Natal (Navy Hygrog. Centre)
		15	Manaus (SIVAM)
		16	Natal (INPE)
		17	Boa Vista
147	National Commission on Space Activities (CONAE) – Argentina	10	Córdoba
		15	Ushuaia
		20	Marambio
		30	Santiago de Chile
		40	Punta Arenas
		50	Base Presidente Frei
		60	Cotopaxi
REGION IV			
7	US National Weather Service, NCEP	1	NCEP Reanalysis Project
		2	NCEP Ensemble Products
		3	NCEP Central Operations
		4	Environmental Modeling Center
		5	Hydrometeorological Prediction Center
		6	Ocean Prediction Center
		7	Climate Prediction Center
		8	Aviation Weather Center
		9	Storm Prediction Center
		10	National Hurricane Center
		11	NWS Techniques Development Laboratory
		12	NESDIS Office of Research and Applications
		13	Federal Aviation Administration
		14	NWS Meteorological Development Laboratory
		15	North American Regional Reanalysis Project
		16	Space Weather Prediction Center
		17	ESRL Global Systems Division

ORIGINATING CENTRES C–1, C–11 or C–12		SUB-CENTRES BUFR 0 01 034; BUFR Edition 3, Octet 5 in Section 1; BUFR Edition 4, Octets 7–8 in Section 1; GRIB Edition 1, Octet 26 in Section 1; GRIB Edition 2, Octets 8–9 in Section 1; CREX Edition 2, ppp in Group Poooooppp in Section 1	
Code figure	Name	Code figure	Name
REGION IV (*continued*)			
160	United States NOAA/NESDIS	10	Tromso (Norway)
		11	McMurdo (Antarctica)
161	United States NOAA Office of Oceanic and Atmospheric Research (NOAA/OAR)	1	Great Lakes Environmental Research Laboratory
		2	Earth System Research Laboratory
		3	Atlantic Oceanographic and Meteorological Laboratory
		4	Pacific Marine Environmental Laboratory
		5	Air Resources Laboratory
		6	Geophysical Fluid Dynamics Laboratory
		7	National Severe Storms Laboratory
173	United States National Aeronautics and Space Administration (NASA)	1	Ames Research Center
		2	Dryden Flight Research Center
		3	Glenn Research Center
		4	Goddard Space Flight Center
		5	Jet Propulsion Laboratory
		6	Johnson Space Center
		7	Kennedy Space Center
		8	Langley Research Center
		9	Marshall Space Flight Center
		10	Stennis Space Center
		11	Goddard Institute for Space Studies
		12	Independent Verification and Validation Facility
		13	NASA Shared Service Center
		14	Wallops Flight Facility
176	Cooperative Institute for Meteorological Satellite Studies (CIMSS) – United States	10	Tromso (Norway)
		11	McMurdo (Antarctica)
		12	Sodankyla (Finland)
		13	Fairbanks (United States)
		14	Barrow (United States)
		15	Rothera (Antarctica)
177	NOAA National Ocean Service – United States	1	Centre for Operational Oceanographic Products and Services
		2	Coastal Survey Development Laboratory
REGION V			
2	Melbourne	201	Casey
		203	Davis
		211	Melbourne Crib Point 1
		214	Darwin
		217	Perth
		219	Townsville
		232	Fiji
		235	Noumea
		237	Papeete
		250	Vladivostock
		251	Guam
		252	Honolulu

ORIGINATING CENTRES C–1, C–11 or C–12		SUB-CENTRES BUFR 0 01 034 BUFR Edition 3, Octet 5 in Section 1 BUFR Edition 4, Octets 7–8 in Section 1 GRIB Edition 1, Octet 26 in Section 1 GRIB Edition 2, Octets 8–9 in Section 1 CREX Edition 2, ppp in Group Poooooppp in Section 1	
Code figure	Name	Code figure	Name
REGION V (*continued*)			
69	Wellington (RSMC)	243	Kelburn
72	Singapore	249	Singapore
204	National Institute of Water and Atmospheric Research (NIWA –New Zealand)	101	Maupia
		102	Lauder
REGION VI			
74	UK Met Office, Exeter (RSMC)	1	Shanwick Oceanic Area Control Centre
		2	Fucino
		3	Gatineau
		4	Maspalomas (Spain)
		5	ESA ERS Central Facility
		6	Prince Albert
		7	West Freugh
		13	Tromso
		21	Agenzia Spaziale Italiana (Italy)
		22	Centre National de la Recherche Scientifique (France)
		23	GeoForschungs Zentrum (Germany)
		24	Geodetic Observatory Pecny (Czech Republic)
		25	Institut d'Estudis Espacials de Catalunya (Spain)
		26	Federal Office of Topography (Switzerland)
		27	Nordic Commission of Geodesy (Norway)
		28	Nordic Commission of Geodesy (Sweden)
		29	Institute Géographique National (France) – Service de géodésie
		30	Bundesamt für Kartographie und Geodäsie (Germany)
		31	Institute of Engineering Satellite Surveying and Geodesy (United Kingdom)
		32	Joint Operational Meteorology and Oceanography Centre (JOMOC)
		33	Koninklijk Nederlands Meteorologisch Institut (Netherlands)
		34	Nordic GPS Atmospheric Analysis centre (Sweden)
		35	Instituto Geografico Nacional de España (Spain)
		36	Met Éireann (Ireland)
		37	Royal Observatory of Belgium (Belgium)
78	Offenbach (RSMC)	10	POLARA (Polarimetric Radar Algorithms instance)
		64	Bundeswehr Geoinformation Office (BGIO)
		110	NowCast mobile (Lightning data)
		221	Schleswig-Holstein, Traffic Operations Computing Centre (TOCC) Kiel/Neumünster

ORIGINATING CENTRES C–1, C–11 or C–12		SUB-CENTRES BUFR 0 01 034 BUFR Edition 3, Octet 5 in Section 1 BUFR Edition 4, Octets 7–8 in Section 1 GRIB Edition 1, Octet 26 in Section 1 GRIB Edition 2, Octets 8–9 in Section 1 CREX Edition 2, ppp in Group Poooooppp in Section 1	
Code figure	Name	Code figure	Name
REGION VI (*continued*)			
78	Offenbach (RSMC) (*continued*)	222	Hamburg, TOCC Hamburg
		223	Niedersachsen, TOCC Hannover
		224	Austria (NMC)
		225	Nordrhein-Westfalen, TOCC Kamen Leverkusen
		226	Hessen, TOCC Rüsselsheim
		227	Rheinland-Pfalz, TOCC Koblenz
		228	Baden-Württemberg, TOCC Ludwigsburg
		229	Bayern, TOCC Freimann
		230	Saarland, TOCC Rohrbach
		231	Bayern, Autobahn directorate Nordbayern
		232	Brandenburg, TOCC Stolpe
		233	Mecklenburg-Vorpommern, TOCC Malchow
		234	Sachsen, TOCC Dresden
		235	Sachsen-Anhalt, TOCC Halle
		236	Thüringen, TOCC Erfurt
		237	EasyWay – Meteotrans
		254	EUMETSAT
80	Rome (RSMC)	101	Albania (NMC)
89	Prague (RTH)	1	Solar and Ozone Observatory Hradec Kralove
96	Athens	1	Cyprus (NMC)
227	Belgium (NMC)	1	Luxembourg (NMC)
250	COSMO (COnsortium for Small scale MOdelling)	76	Roshydromet (Russian Federation)
		78	Deutscher Wetterdienst (Germany)
		80	Ufficio Generale Spazio Aereo e Meteorologia (Italy)
		96	Hellenic National Meteorological Service (Greece)
		215	MeteoSwiss (Switzerland)
		220	Institute of Meteorology and Water Management (Poland)
		242	National Meteorological Administration (Romania)
254	EUMETSAT Operation Centre	10	Tromso (Norway)
		20	Maspalomas (Spain)
		30	Kangerlussuaq (Greenland)
		40	Edmonton (Canada)
		50	Bedford (Canada)
		60	Gander (Canada)
		70	Monterey (United States)
		80	Wallops Island (United States)
		90	Gilmor Creek (United States)
		100	Athens (Greece)
		120	Ewa Beach, Hawaii
		130	Miami, Florida
		140	Lannion (France)
		150	Svalbard (Norway)
		170	St Denis (La Réunion)

ORIGINATING CENTRES C–1, C–11 or C–12		SUB-CENTRES BUFR 0 01 034 BUFR Edition 3, Octet 5 in Section 1 BUFR Edition 4, Octets 7–8 in Section 1 GRIB Edition 1, Octet 26 in Section 1 GRIB Edition 2, Octets 8–9 in Section 1 CREX Edition 2, ppp in Group Poooooppp in Section 1	
Code figure	Name	Code figure	Name
REGION VI (*continued*)			
254	EUMETSAT Operation Centre (*continued*)	180	Moscow
		190	Muscat
		200	Khabarovsk
		210	Novosibirsk

COMMON CODE TABLE C–13: *Data sub-categories of categories defined by entries in BUFR Table A*

DATA CATEGORIES		INTERNATIONAL DATA SUB-CATEGORIES	
BUFR Edition 4, Octet 11 in Section 1 CREX Edition 2, nnn in Group Annnmmm of Section 1		BUFR Edition 4, Octet 12 (if = 255, it means other sub-category or undefined) CREX Edition 2, mmm in Group Annnmmm of Section 1	
Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
0	Surface data – land	0	Hourly synoptic observations from fixed-land stations (SYNOP)
		1	Intermediate synoptic observations from fixed-land stations (SYNOP)
		2	Main synoptic observations from fixed-land stations (SYNOP)
		3	Hourly synoptic observations from mobile-land stations (SYNOP MOBIL)
		4	Intermediate synoptic observations from mobile-land stations (SYNOP MOBIL)
		5	Main synoptic observations from mobile-land stations (SYNOP MOBIL)
		6	One-hour observations from automated stations
		7	n-minute observations from AWS stations
		10	Routine aeronautical observations (METAR)
		11	Special aeronautical observations (SPECI)
		14	Ground-based GPS humidity observations (GPSIWV)
		20	Climatological observations (CLIMAT)
		30	Sferics locations
		40	Hydrologic reports
		50	Hourly synoptic observations with supplementary one-hour data
		51	Intermediate synoptic observations with supplementary one-hour data
		52	Main synoptic observations with supplementary one-hour data
1	Surface data – sea	0	Synoptic observations (SHIP)
		6	One-hour observations from automated stations
		7	n-minute observations from AWS stations
		20	Climatological observations (CLIMAT SHIP)
		25	Buoy observation (BUOY)
		30	Tide gauge
		31	Observed water level time series
2	Vertical soundings (other than satellite)	1	Upper-wind reports from fixed-land stations (PILOT)
		2	Upper-wind reports from ships (PILOT SHIP)
		3	Upper-wind reports from mobile land stations (PILOT MOBIL)
		4	Upper-level temperature/humidity/wind reports from fixed-land stations (TEMP)
		5	Upper-level temperature/humidity/wind reports from ships (TEMP SHIP)
		6	Upper-level temperature/humidity/wind report from mobile land stations (TEMP MOBIL)

DATA CATEGORIES BUFR Edition 4, Octet 11 in Section 1 CREX Edition 2, nnn in Group Annnmmm of Section 1		INTERNATIONAL DATA SUB-CATEGORIES BUFR Edition 4, Octet 12 (if = 255, it means other sub-category or undefined) CREX Edition 2, mmm in Group Annnmmm of Section 1	
Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
2	Vertical soundings (other than satellite) (*continued*)	7	Upper-level temperature/humidity/wind reports from dropwinsondes (TEMP DROP)
		10	Wind profiler reports
		11	RASS temperature profiles
		20	ASDAR/ACARS profiles (AMDAR)
		21	Profiles of atmospheric constituents concentrations
		25	Climatological observations from fixed-land stations (CLIMAT TEMP)
		26	Climatological observations from ships (CLIMAT TEMP SHIP)
3	Vertical soundings (satellite)	0	Temperature (SATEM)
		1	TIROS (TOVS)
		2	ATOVS
		3	AMSU-A
		4	AMSU-B
		5	HIRS
		6	MHS
		7	IASI
		20	IR temperature/humidity sounding
		30	Hyperspectral temperature/humidity sounding
		40	MW temperature/humidity sounding
		50	Radio occultation sounding
4	Single level upper-air data (other than satellite)	0	ASDAR/ACARS (AMDAR)
		1	Manual (AIREP, PIREP)
5	Single level upper-air data (satellite)	0	Cloud wind data (SATOB)
		1	Cloud properties
6	Radar data	0	Reflectivity data
		1	Doppler wind profiles
		2	Derived products
		3	Ground radar weather (RADOB)
7	Synoptic features	0	Forecast tropical cyclone tracks from EPS
		1	Squall line
8	Physical/chemical constituents	0	Surface ozone
		1	Ozone vertical sounding
		2	Total ozone
9	Dispersal and transport	0	Trajectories, analysis or forecast
10	Radiological data	1	Observation (RADREP)
		2	Forecast (RADOF)
12	Surface data (satellite)	0	ERS-uwa
		1	ERS-uwi
		2	ERS-ura

DATA CATEGORIES BUFR Edition 4, Octet 11 in Section 1 CREX Edition 2, nnn in Group Annnmmm of Section 1		INTERNATIONAL DATA SUB-CATEGORIES BUFR Edition 4, Octet 12 (if = 255, it means other sub-category or undefined) CREX Edition 2, mmm in Group Annnmmm of Section 1	
Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
12	Surface data (satellite) (*continued*)	3	ERS-uat
		4	SSM/I radiometer
		5	Quikscat
		6	Surface temp./radiation (SATOB)
		7	ASCAT data
		8	Soil moisture
		9	Normalized differential vegetation index (NDVI)
		10	Normalized radar backscatter
		11	Surface emissivity
		12	Sea-surface temperature
21	Radiances (satellite measured)	0	Earth radiation budget
		5	Cross-track infrared sounder
		6	Advanced technology microwave sounder
		7	Visible/infrared imager radiometer suite
22	Radar (satellite) but not altimeter and scatterometer	0	Cloud and precipitation radar
		1	Synthetic aperture radar
23	Lidar (satellite)	0	Lidar based missions (for wind, for cloud/aerosol, for water vapour, for altimetry)
24	Scatterometry (satellite)	0	Wind scatterometry
25	Altimetry (satellite)	0	Radar altimetry
26	Spectrometry (satellite)	0	Cross nadir shortwave spectrometry (for chemistry)
		1	Cross nadir IR spectrometry (for chemistry)
		2	Limb sounding shortwave spectrometry
		3	Limb sounding IR spectrometry
		4	Limb sounding sub-millimetre wave spectrometry
30	Calibration dataset (satellite)	0	Subsetted data
		1	Collocated data
		2	On-board calibration data
		3	Bias monitoring
		4	Near-real-time correction
		5	Re-analysis correction
31	Oceanographic data	0	Surface observation
		1	Surface observation along track (TRACKOB)
		2	Spectral wave observation (WAVEOB)
		3	Bathythermal observation (BATHY)
		4	Sub-surface floats (profile)
		5	XBT/XCTD profiles (TESAC)
		6	Waves reports
		7	Tsunameter data

DATA CATEGORIES		INTERNATIONAL DATA SUB-CATEGORIES	
BUFR Edition 4, Octet 11 in Section 1 CREX Edition 2, nnn in Group Annnmmm of Section 1		BUFR Edition 4, Octet 12 (if = 255, it means other sub-category or undefined) CREX Edition 2, mmm in Group Annnmmm of Section 1	
Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
101	Image data (satellite)	0	Multi-purpose VIS/IR imagery
		1	Conical scanning MW imagery (intermediate frequencies)
		2	Low frequency MW imagery
		3	Ocean colour imagery
		4	Imagery with special viewing geometry
		5	Lightning imagery
		6	High-resolution shortwave imagery for land observation
		7	SMOS data

COMMON CODE TABLE C–14: *Atmospheric chemical or physical constituent type*

Common Code table Code table 4.230 in GRIB Edition 2

Code figure	Meaning	Chemical formula
0	Ozone	O_3
1	Water vapour	H_2O
2	Methane	CH_4
3	Carbon dioxide	CO_2
4	Carbon monoxide	CO
5	Nitrogen dioxide	NO_2
6	Nitrous oxide	N_2O
7	Formaldehyde	$HCHO$
8	Sulphur dioxide	SO_2
9	Ammonia	NH_3
10	Ammonium	NH_4^+
11	Nitrogen monoxide	NO
12	Atomic oxygen	O
13	Nitrate radical	NO_3
14	Hydroperoxyl radical	HO_2
15	Dinitrogen pentoxide	N_2O_5
16	Nitrous acid	$HONO$
17	Nitric acid	HNO_3
18	Peroxynitric acid	HO_2NO_2
19	Hydrogen peroxide	H_2O_2
20	Molecular hydrogen	H
21	Atomic nitrogen	N
22	Sulphate	SO_4^{2-}
23	Radon	Rn
24	Elemental mercury	$Hg(0)$
25	Divalent mercury	Hg^{2+}
26	Atomic chlorine	Cl
27	Chlorine monoxide	ClO
28	Dichlorine peroxide	Cl_2O_2
29	Hypochlorous acid	$HClO$
30	Chlorine nitrate	$ClONO_2$
31	Chlorine dioxide	ClO_2
32	Atomic bromine	Br
33	Bromine monoxide	BrO
34	Bromine chloride	$BrCl$
35	Hydrogen bromide	HBr
36	Hypobromous acid	$HBrO$
37	Bromine nitrate	$BrONO_2$
38	Oxygen	O_2
39-9999	Reserved	
10000	Hydroxyl radical	OH
10001	Methyl peroxy radical	CH_3O_2
10002	Methyl hydroperoxide	CH_3O_2H
10004	Methanol	CH_3OH
10005	Formic acid	CH_3OOH
10006	Hydrogen cyanide	HCN
10007	Aceto nitrile	CH_3CN
10008	Ethane	C_2H_6
10009	Ethene (= Ethylene)	C_2H_4
10010	Ethyne (= Acetylene)	C_2H_2
10011	Ethanol	C_2H_5OH
10012	Acetic acid	C_2H_5OOH
10013	Peroxyacetyl nitrate	$CH_3C(O)OONO_2$
10014	Propane	C_3H_8
10015	Propene	C_3H_6

Code figure	Meaning	Chemical formula
10016	Butanes	C_4H_{10}
10017	Isoprene	C_5H_{10}
10018	Alpha pinene	$C_{10}H_{16}$
10019	Beta pinene	$C_{10}H_{16}$
10020	Limonene	$C_{10}H_{16}$
10021	Benzene	C_6H_6
10022	Toluene	C_7H_8
10023	Xylene	C_8H_{10}
10024–10499	Reserved for other simple organic molecules (e.g. higher aldehydes, alcohols, peroxides,…)	
10500	Dimethyl sulphide	CH_3SCH_3 (DMS)
10501–20000	Reserved	
20001	Hydrogen chloride	
20002	CFC-11	
20003	CFC-12	
20004	CFC-113	
20005	CFC-113a	
20006	CFC-114	
20007	CFC-115	
20008	HCFC-22	
20009	HCFC-141b	
20010	HCFC-142b	
20011	Halon-1202	
20012	Halon-1211	
20013	Halon-1301	
20014	Halon-2402	
20015	Methyl chloride (HCC-40)	
20016	Carbon tetrachloride (HCC-10)	
20017	HCC-140a	CH_3CCl_3
20018	Methyl bromide (HBC-40B1)	
20019	Hexachlorocyclohexane (HCH)	
20020	Alpha hexachlorocyclohexane	
20021	Hexachlorobiphenyl (PCB-153)	
20022–29999	Reserved	
30000	Radioactive pollutant (tracer, defined by originating centre)	
30001–30009	Reserved	
30010	Hydrogen	H-3
30011	Hydrogen organic bounded	H-3o
30012	Hydrogen inorganic	H-3a
30013	Beryllium 7	Be-7
30014	Beryllium 10	Be-10
30015	Carbon 14	C-14
30016	Carbon 14 CO_2	C-14CO_2
30017	Carbon 14 other gases	C-14og
30018	Nitrogen 13	N-13
30019	Nitrogen 16	N-16
30020	Fluorine 18	F-18
30021	Sodium 22	Na-22
30022	Phosphate 32	P-32
30023	Phosphate 33	P-33
30024	Sulphur 35	S-35
30025	Chlorine 36	Cl-36
30026	Potassium 40	K-40
30027	Argon 41	Ar-41
30028	Calcium 41	Ca-41
30029	Calcium 45	Ca-45
30030	Titanium 44	Ti-44

Code figure	Meaning	Chemical formula
30031	Scandium 46	Sc-46
30032	Vanadium 48	V-48
30033	Vanadium 49	V-49
30034	Chrome 51	Cr-51
30035	Manganese 52	Mn-52
30036	Manganese 54	Mn-54
30037	Iron 55	Fe-55
30038	Iron 59	Fe-59
30039	Cobalt 56	Co-56
30040	Cobalt 57	Co-57
30041	Cobalt 58	Co-58
30042	Cobalt 60	Co-60
30043	Nickel 59	Ni-59
30044	Nickel 63	Ni-63
30045	Zinc 65	Zn-65
30046	Gallium 67	Ga-67
30047	Gallium 68	Ga-68
30048	Germanium 68	Ge-68
30049	Germanium 69	Ge-69
30050	Arsenic 73	As-73
30051	Selenium 75	Se-75
30052	Selenium 79	Se-79
30053	Rubidium 81	Rb-81
30054	Rubidium 83	Rb-83
30055	Rubidium 84	Rb-84
30056	Rubidium 86	Rb-86
30057	Rubidium 87	Rb-87
30058	Rubidium 88	Rb-88
30059	Krypton 85	Kr-85
30060	Krypton 85 metastable	Kr-85m
30061	Krypton 87	Kr-87
30062	Krypton 88	Kr-88
30063	Krypton 89	Kr-89
30064	Strontium 85	Sr-85
30065	Strontium 89	Sr-89
30066	Strontium 89/90	Sr-8990
30067	Strontium 90	Sr-90
30068	Strontium 91	Sr-91
30069	Strontium 92	Sr-92
30070	Yttrium 87	Y-87
30071	Yttrium 88	Y-88
30072	Yttrium 90	Y-90
30073	Yttrium 91	Y-91
30074	Yttrium 91 metastable	Y-91m
30075	Yttrium 92	Y-92
30076	Yttrium 93	Y-93
30077	Zirconium 89	Zr-89
30078	Zirconium 93	Zr-93
30079	Zirconium 95	Zr-95
30080	Zirconium 97	Zr-97
30081	Niobium 93 metastable	Nb-93m
30082	Niobium 94	Nb-94
30083	Niobium 95	Nb-95
30084	Niobium 95 metastable	Nb-95m
30085	Niobium 97	Nb-97
30086	Niobium 97 metastable	Nb-97m
30087	Molybdenum 93	Mo-93
30088	Molybdenum 99	Mo-99

Code figure	Meaning	Chemical formula
30089	Technetium 95 metastable	Tc-95m
30090	Technetium 96	Tc-96
30091	Technetium 99	Tc-99
30092	Technetium 99 metastable	Tc-99m
30093	Rhodium 99	Rh-99
30094	Rhodium 101	Rh-101
30095	Rhodium 102 metastable	Rh-102m
30096	Rhodium 103 metastable	Rh-103m
30097	Rhodium 105	Rh-105
30098	Rhodium 106	Rh-106
30099	Palladium 100	Pd-100
30100	Palladium 103	Pd-103
30101	Palladium 107	Pd-107
30102	Ruthenium 103	Ru-103
30103	Ruthenium 105	Ru-105
30104	Ruthenium 106	Ru-106
30105	Silver 108 metastable	Ag-108m
30106	Silver 110 metastable	Ag-110m
30107	Cadmium 109	Cd-109
30108	Cadmium 113 metastable	Cd-113m
30109	Cadmium 115 metastable	Cd-115m
30110	Indium 114 metastable	In-114m
30111	Tin 113	Sn-113
30112	Tin 119 metastable	Sn-119m
30113	Tin 121 metastable	Sn-121m
30114	Tin 122	Sn-122
30115	Tin 123	Sn-123
30116	Tin 126	Sn-126
30117	Antimony 124	Sb-124
30118	Antimony 125	Sb-125
30119	Antimony 126	Sb-126
30120	Antimony 127	Sb-127
30121	Antimony 129	Sb-129
30122	Tellurium 123 metastable	Te-123m
30123	Tellurium 125 metastable	Te-125m
30124	Tellurium 127	Te-127
30125	Tellurium 127 metastable	Te-127m
30126	Tellurium 129	Te-129
30127	Tellurium 129 metastable	Te-129m
30128	Tellurium 131 metastable	Te-131m
30129	Tellurium 132	Te-132
30130	Iodine 123	I-123
30131	Iodine 124	I-124
30132	Iodine 125	I-125
30133	Iodine 126	I-126
30134	Iodine 129	I-129
30135	Iodine 129 elementary gaseous	I-129g
30136	Iodine 129 organic bounded	I-129o
30137	Iodine 131	I-131
30138	Iodine 131 elementary gaseous	I-131g
30139	Iodine 131 organic bounded	I-131o
30140	Iodine 131 gaseous elementary and organic bounded	I-131go
30141	Iodine 131 aerosol	I-131a
30142	Iodine 132	I-132
30143	Iodine 132 elementary gaseous	I-132g
30144	Iodine 132 organic bounded	I-132o
30145	Iodine 132 gaseous elementary and organic bounded	I-132go

Code figure	Meaning	Chemical formula
30146	Iodine 132 aerosol	I-132a
30147	Iodine 133	I-133
30148	Iodine 133 elementary gaseous	I-133g
30149	Iodine 133 organic bounded	I-133o
30150	Iodine 133 gaseous elementary and organic bounded	I-133go
30151	Iodine 133 aerosol	I-133a
30152	Iodine 134	I-134
30153	Iodine 134 elementary gaseous	I-134g
30154	Iodine 134 organic bounded	I-134o
30155	Iodine 135	I-135
30156	Iodine 135 elementary gaseous	I-135g
30157	Iodine 135 organic bounded	I-135o
30158	Iodine 135 gaseous elementary and organic bounded	I-135go
30159	Iodine 135 aerosol	I-135a
30160	Xenon 131 metastable	Xe-131m
30161	Xenon 133	Xe-133
30162	Xenon 133 metastable	Xe-133m
30163	Xenon 135	Xe-135
30164	Xenon 135 metastable	Xe-135m
30165	Xenon 137	Xe-137
30166	Xenon 138	Xe-138
30167	Xenon sum of all Xenon isotopes	Xe-sum
30168	Caesium 131	Cs-131
30169	Caesium 134	Cs-134
30170	Caesium 135	Cs-135
30171	Caesium 136	Cs-136
30172	Caesium 137	Cs-137
30173	Barium 133	Ba-133
30174	Barium 137 metastable	Ba-137m
30175	Barium 140	Ba-140
30176	Cerium 139	Ce-139
30177	Cerium 141	Ce-141
30178	Cerium 143	Ce-143
30179	Cerium 144	Ce-144
30180	Lanthanum 140	La-140
30181	Lanthanum 141	La-141
30182	Praseodymium 143	Pr-143
30183	Praseodymium 144	Pr-144
30184	Praseodymium 144 metastable	Pr-144m
30185	Samarium 145	Sm-145
30186	Samarium 147	Sm-147
30187	Samarium 151	Sm-151
30188	Neodymium 147	Nd-147
30189	Promethium 146	Pm-146
30190	Promethium 147	Pm-147
30191	Promethium 151	Pm-151
30192	Europium 152	Eu-152
30193	Europium 154	Eu-154
30194	Europium 155	Eu-155
30195	Gadolinium 153	Gd-153
30196	Terbium 160	Tb-160
30197	Holmium 166 metastable	Ho-166m
30198	Thulium 170	Tm-170
30199	Ytterbium 169	Yb-169
30200	Hafnium 175	Hf-175
30201	Hafnium 181	Hf-181
30202	Tantalum 179	Ta-179

Code figure	Meaning	Chemical formula
30203	Tantalum 182	Ta-182
30204	Rhenium 184	Re-184
30205	Iridium 192	Ir-192
30206	Mercury 203	Hg-203
30207	Thallium 204	Tl-204
30208	Thallium 207	Tl-207
30209	Thallium 208	Tl-208
30210	Thallium 209	Tl-209
30211	Bismuth 205	Bi-205
30212	Bismuth 207	Bi-207
30213	Bismuth 210	Bi-210
30214	Bismuth 211	Bi-211
30215	Bismuth 212	Bi-212
30216	Bismuth 213	Bi-213
30217	Bismuth 214	Bi-214
30218	Polonium 208	Po-208
30219	Polonium 210	Po-210
30220	Polonium 212	Po-212
30221	Polonium 213	Po-213
30222	Polonium 214	Po-214
30223	Polonium 215	Po-215
30224	Polonium 216	Po-216
30225	Polonium 218	Po-218
30226	Lead 209	Pb-209
30227	Lead 210	Pb-210
30228	Lead 211	Pb-211
30229	Lead 212	Pb-212
30230	Lead 214	Pb-214
30231	Astatine 217	At-217
30232	Radon 219	Rn-219
30233	Radon 220	Rn-220
30234	Radon 222	Rn-222
30235	Francium 221	Fr-221
30236	Francium 223	Fr-223
30237	Radium 223	Ra-223
30238	Radium 224	Ra-224
30239	Radium 225	Ra-225
30240	Radium 226	Ra-226
30241	Radium 228	Ra-228
30242	Actinium 225	Ac-225
30243	Actinium 227	Ac-227
30244	Actinium 228	Ac-228
30245	Thorium 227	Th-227
30246	Thorium 228	Th-228
30247	Thorium 229	Th-229
30248	Thorium 230	Th-230
30249	Thorium 231	Th-231
30250	Thorium 232	Th-232
30251	Thorium 234	Th-234
30252	Protactinium 231	Pa-231
30253	Protactinium 233	Pa-233
30254	Protactinium 234 metastable	Pa-234m
30255	Uranium 232	U-232
30256	Uranium 233	U-233
30257	Uranium 234	U-234
30258	Uranium 235	U-235
30259	Uranium 236	U-236

Code figure	Meaning	Chemical formula
30260	Uranium 237	U-237
30261	Uranium 238	U-238
30262	Plutonium 236	Pu-236
30263	Plutonium 238	Pu-238
30264	Plutonium 239	Pu-239
30265	Plutonium 240	Pu-240
30266	Plutonium 241	Pu-241
30267	Plutonium 242	Pu-242
30268	Plutonium 244	Pu-244
30269	Neptunium 237	Np-237
30270	Neptunium 238	Np-238
30271	Neptunium 239	Np-239
30272	Americium 241	Am-241
30273	Americium 242	Am-242
30274	Americium 242 metastable	Am-242m
30275	Americium 243	Am-243
30276	Curium 242	Cm-242
30277	Curium 243	Cm-243
30278	Curium 244	Cm-244
30279	Curium 245	Cm-245
30280	Curium 246	Cm-246
30281	Curium 247	Cm-247
30282	Curium 248	Cm-248
30283	Curium 243/244	Cm-243244
30284	Plutonium 238/Americium 241	Pu-238Am-241
30285	Plutonium 239/240	Pu-239240
30286	Berkelium 249	Bk-249
30287	Californium 249	Cf-249
30288	Californium 250	Cf-250
30289	Californium 252	Cf-252
30290	Sum aerosol particulates	SumAer
30291	Sum Iodine	SumIod
30292	Sum noble gas	SumNG
30293	Activation gas	ActGas
30294	Cs-137 Equivalent	EquCs137
30295–59999	Reserved	
60000	HO_x radical ($OH+HO_2$)	
60001	Total inorganic and organic peroxy radicals (HO_2 + RO_2)	RO_2
60002	Passive Ozone	
60003	NO_x expressed as nitrogen	NO_x
60004	All nitrogen oxides (NO_y) expressed as nitrogen	NO_y
60005	Total inorganic chlorine	Cl_x
60006	Total inorganic bromine	Br_x
60007	Total inorganic chlorine except HCl, $ClONO_2$: ClO_x	
60008	Total inorganic bromine except HBr, $BrONO_2$: BrO_x	
60009	Lumped alkanes	
60010	Lumped alkenes	
60011	Lumped aromatic compounds	
60012	Lumped terpenes	
60013	Non-methane volatile organic compounds expressed as carbon	NMVOC
60014	Anthropogenic non-methane volatile organic compounds expressed as carbon	aNMVOC
60015	Biogenic non-methane volatile organic compounds expressed as carbon	bNMVOC
60016	Lumped oxygenated hydrocarbons	OVOC
60017	NOx expressed as nitrogen dioxide (NO_2)	NOx
60018–61999	Reserved	

Code figure	Meaning	Chemical formula
62000	Total aerosol	
62001	Dust dry	
62002	Water in ambient	
62003	Ammonium dry	
62004	Nitrate dry	
62005	Nitric acid trihydrate	
62006	Sulphate dry	
62007	Mercury dry	
62008	Sea salt dry	
62009	Black carbon dry	
62010	Particulate organic matter dry	
62011	Primary particulate organic matter dry	
62012	Secondary particulate organic matter dry	
62013	Black carbon hydrophilic dry	
62014	Black carbon hydrophobic dry	
62015	Particulate organic matter hydrophilic dry	
62016	Particulate organic matter hydrophobic dry	
62017	Nitrate hydrophilic dry	
62018	Nitrate hydrophobic dry	
62019	Reserved	
62020	Smoke – high absorption	
62021	Smoke – low absorption	
62022	Aerosol – high absorption	
62023	Aerosol – low absorption	
62024–65534	Reserved	
65535	Missing	

d. REGULATIONS FOR REPORTING TRADITIONAL OBSERVATION DATA IN TABLE-DRIVEN CODE FORMS (TDCF): BUFR OR CREX

The following specific regulations and their associated templates can be found on the WMO Web server at http://www.wmo.int/pages/prog/www/WMOCodes/TemplateExamples.html.

B/C1 – Regulations for reporting SYNOP data in TDCF

Annex: Regional regulations for reporting SYNOP data in BUFR/CREX for RA I, RA II, RA III, RA IV and RA VI

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

B/C10 – Regulations for reporting SHIP data in TDCF

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

Annex I: RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

Annex II: List of parameters for representation of additional information on sounding instrumentation

B/C26 – Regulations for reporting TEMP DROP data in TDCF

B/C30 – Regulations for reporting CLIMAT data in TDCF

B/C32 – Regulations for reporting CLIMAT SHIP data in TDCF

General features

(i) The regulations for reporting data of traditional observations in BUFR or CREX are intended to provide a link between the Manual on Codes, Volume I.1 and Volume II, containing traditional alphanumeric codes (TAC) regulations with detailed description of reporting practices and the Volume I.2, where the code forms FM 94 BUFR and FM 95 CREX are defined.

(ii) A BUFR/CREX template has been developed for each traditional observation that is considered suitable for migration to table-driven code forms (TDCF). Templates presented prior to the regulations are BUFR templates; if used for CREX, relevant modifications have to be introduced.

(iii) The regulations for reporting data of each traditional observation in TDCF are numbered in the increasing order in compliance with a standard BUFR/CREX template recommended for the data type. For reference, the number of the corresponding TAC regulation is included at the end of the regulation, written in square brackets.

(iv) BUFR/CREX templates defined for traditional observation data contain not only the elements reported in the corresponding TAC, but also other important information. The regulations for reporting traditional observations data in BUFR/CREX address also these additional entries (e.g. horizontal and vertical coordinates of the observation site, position of sensors, significance qualifiers).

(v) With each element introduced within the regulations, the unit and the required precision are specified. If different units are used in BUFR and CREX, the unit in which the element value is reported in CREX is also mentioned. Scaling is expected to be executed by the encoding BUFR or CREX software; in case of manual encoding of a CREX message, however, the scaling shall be included in the reporting procedure.

(vi) If the unit of the element is defined as a flag table, the element values shall be reported in octal representation in CREX.

(vii) Reporting practices primarily refer to the procedures relevant for producing of the data in BUFR or CREX at the observing site. When data are collected in TAC and converted into BUFR or CREX in the centre, the differences in the reporting procedures, if any, are mentioned.

(viii) If regional or national reporting practices require inclusion of additional parameters, the regulations provide guidance for addition of the relevant descriptors.

(ix) A NIL report shall be represented by setting all values to “missing value” except for the identification of the station or observing site and delayed replication factors.

Note: Texts in italic within the regulations indicate that special attention should be given to this aspect of the regulation.

Attachment I

EXAMPLES OF TEMPLATES FOR THE TRANSMISSION IN BUFR OR CREX OF OTHER DATA TYPES

These templates, some of which have not yet been validated, can be found on the WMO Web server at http://www.wmo.int/pages/prog/www/WMOCodes/TemplateExamples.html#Attachment.

Attachment II

LIST OF ALPHANUMERIC CODE TABLES RELATED TO BUFR AND CREX CODE TABLES AND FLAG TABLES

BUFR/CREX code or flag table	Related code table, regulation or code form in alphanumeric codes	Remarks
0 01 003	A_1 – Code table 0161	—
0 01 007	$I_6I_6I_6$	Common Code table C–5
0 01 031	F_1F_2, $F_3F_3F_3$	Common Code table C–1
0 01 032	—	Defined by originating/generating centre
0 01 033	F_1F_2, $F_3F_3F_3$	Common Code table C–1
0 01 034	F_1F_2, $F_3F_3F_3$	See Common Code table C–12
0 02 001*	i_x – Code table 1860	—
0 02 002	i_u – Code table 1853	—
0 02 003	a_4 – Code table 0265	—
0 02 004	i_E – Code table 1806	—
0 02 011	r_ar_a – Code table 3685 (0–89)	Defined in common Code table C–2
0 02 012	—	To be developed
0 02 013	s_r – Code table 3849	—
0 02 014	s_as_a – Code table 3872	—
0 02 015	r_ar_a – Code table 3685 (91–95)	Defined in common Code table C–2
0 02 016	—	—
0 02 019	—	Common Code table C–8
0 02 021	I_3	—
0 02 022	I_4 – Code table 1765	—
0 02 023	w_i – Code table 4639	—
0 02 030	k_5 – Code table 2266	—
0 02 031	k_3 – Code table 2264	—
	k_4 – Code table 2265	
0 02 032	k_1 – Code table 2262	Numerical variation in each table
0 02 033	k_2 – Code table 2263	—
0 02 034	X_tX_t – Code table 4780	—
0 02 038	s_s – Code table 3850	—
0 02 039	s_w – Code table 3855	—
0 02 040	k_6 – Code table 2267	—
0 02 042	i_c – Code table 1833	—
0 02 044	I_m – Code table 1744	—
0 02 045	I_p – Code table 1747	—
0 02 051	i_y – Code table 1857	—
0 02 061	s_1 – Code table 3866	—
0 02 062	s_2 – Code table 3867	—
0 02 149	B_tB_t – Code table 0370	Additional entries in Code table 0 02 149
0 02 160	R_w – Code table 3555	—

* See note at the end of this attachment.

BUFR/CREX code or flag table	Related code table, regulation or code form in alphanumeric codes	Remarks
0 04 059	g – Code table 1400	More flexible than Code table 1400
0 04 080	m_S, m_T, m_c – Code table 2604	—
0 08 001	TEMP/TEMP SHIP – Sections 2 to 6	—
0 08 002	SYNOP/SHIP – Regulation 12.4.10.1	—
0 08 004	AMDAR – Regulation 42.2	—
0 08 009	$i_pi_pi_p$ – AMDAR	—
0 08 011	F_t – Code table 1152	—
0 08 014	METAR/SPECI – Regulation 15.7.6	—
0 08 016	METAR/SPECI – Regulation 15.14	—
0 08 017	METAR/SPECI – Regulation 15.14.3	—
0 08 050	CLIMAT – Qualifier for number of missing values	—
0 08 052	CLIMAT – Condition for which number of days of occurrence	—
0 08 053	CLIMAT – Day of occurrence	—
0 08 054	METAR/SPECI – Regulation 15.5.6	—
0 08 079	METAR/SPECI/TAF – Product status	—
0 10 063	a – Code table 0200	—
0 11 031	i – Code table 1800	—
	B_A – Code table 0302	
0 13 041	s_p – Code table 3847	—
0 13 051	R_d – Code table 3534	—
0 19 100	t_e – Code table 4035	—
0 19 101	A_C – Code table 0104	—
0 19 102	S_C – Code table 3704	—
0 19 103	W_C – Code table 4504	—
0 19 104	a_C – Code table 0204	—
0 19 105	r_t – Code table 3652	—
0 19 107	t_m – Code table 4044	—
0 19 108	A_t – Code table 0152	—
0 19 109	W_f – Code table 4536	—
0 19 110	a_t – Code table 0252	—
0 20 003*	ww – Code table 4677	—
	w_aw_a – Code table 4680	
	w_1w_1 – Code table 4687	
0 20 004	W_1 – Code table 4561	—
	W_{a1} – Code table 4531	
0 20 005	W_2 – Code table 4561	—
	W_{a2} – Code table 4531	
0 20 009	METAR/SPECI	—
0 20 011	N – Code table 2700	—
0 20 012	C – Code table 0500	—
	C_H – Code table 0509	
	C_M – Code table 0515	
	C_L – Code table 0513	
0 20 017	C_t – Code table 0552	—
0 20 018	METAR/SPECI – Regulation 15.7.4.3	—
0 20 032	R_s – Code table 3551	—
0 20 033	I_s – Code table 1751	—
0 20 034	c_i – Code table 0639	—

* See note at the end of this attachment.

BUFR/CREX code or flag table	Related code table, regulation or code form in alphanumeric codes	Remarks
0 20 035	b_i – Code table 0439	—
0 20 036	z_i – Code table 5239	—
0 20 037	S_i – Code table 3739	—
0 20 040	S'_8 – Code table 3776	—
0 20 041	I_c – Code table 1733	Additional entries in Code table 0 20 041
0 20 055	C_s – Code table 430 (Vol. II)	—
0 20 062	E – Code table 0901 E´ – Code table 0975	—
0 20 063	$S_PS_Ps_ps_p$ – Code table 3778	—
	A – Code table 0101	—
	A_3 – Code table 0163	—
	C_c – Code table 0533	—
	S_0 – Code table 3761	—
	S_q – Code table 3848	—
	T_w – Code table 3955	—
	Z_0 – Code table 5161	—
0 20 071	A_i – Code table 0139	—
0 20 085	METAR/SPECI – Regulation 15.13.6.1	—
0 20 086	E_R – Code table 0919	—
0 20 087	C_R – Code table 0519	—
0 20 089	B_RB_R – Code table 0366	—
0 20 090	C_s – Code table 0521	—
0 20 101	L_n – Code table 162 (Vol. II)	—
0 20 102	L_c – Code table 159 (Vol. II)	—
0 20 103	L_d – Code table 160 (Vol. II)	—
0 20 104	L_g – Code table 161 (Vol. II)	—
0 20 105	s_L – Code table 173 (Vol. II)	—
0 20 106	d_L – Code table 139 (Vol. II)	—
0 20 107	D_L – Code table 140 (Vol. II)	—
0 20 108	v_e – Code table 182 (Vol. II)	—
0 20 136	C_a – Code table 0531	—
	C_0 – Code table 0561	—
	N_m – Code table 2745	—
	N_t – Code table 2752	—
	N_v – Code table 2754	—
0 20 137	n_3 – Code table 2863	—
0 22 061	S – Code table 3700	—
0 22 067	$I_xI_xI_x$ – Code table 1770	Common Code table C–3
0 22 068	X_RX_R – Code table 4770	Common Code table C–4
0 23 001	A_a – Code table 0131	—
0 23 002	AA – Code table 0177	—
0 23 003	B_T – Code table 0324	—
0 23 004	P_a – Code table 3131	—
0 23 005	A_c – Code table 0133	—
0 23 006	A_e – Code table 0135	—
0 23 007	E_c – Code table 0933	—
0 23 008 0 23 009	E_s – Code table 0943	—
0 23 016	R_e – Code table 3535	—
0 23 018	E_e – Code table 0935	—
0 23 031	R_p – Code table 3548	—

BUFR/CREX code or flag table	Related code table, regulation or code form in alphanumeric codes	Remarks
0 23 032	I_n – Code table 1743	—
0 24 003	R_c – Code table 3533	—
0 25 041	D_s – Code table 0700	—
0 25 042	v_s – Code table 4451	—
0 25 086	Q_z – Code table 3318	—
0 29 001	g_rg_r – Code table 1487	—
0 33 020	Q_d, Q_{d1}, Q_{d2}, Q_l, Q_t – Code table 3334	—
0 33 021	Q_P, Q_{TW} – Code tables 3315 - 3319	—
0 33 022	Q_N – Code table 3313	—
0 33 023	Q_L – Code table 3311	—
0 33 024	i_m – Code table 1845	—
0 33 027	Q_A – Code table 3302	—

Note: Encoding/decoding of SYNOP/SHIP i_x – Code table 1860 to/from BUFR code tables

Code figure	Type of station operation	0 02 001 Type of station	0 20 003 Present weather
1	Manned station (group $7wwW_1W_2$ included) (but actually missing)	1 (1)	00–99 (200–299) (510)
2	Manned station (group 7ww W_1W_2 omitted, no significant phenomenon to report)	1	508
3	Manned station (group 7ww W_1W_2 omitted, no observation, data not available)	1	509
4	Automatic station (group 7ww W_1W_2 included, using Code tables 4677 and 4561) (but actually missing)	0 (0)	00–99 (200–299) (510)
5	Automatic station (group $7w_aw_aW_{a1}W_{a2}$ omitted, no significant phenomenon to report)	0	508
6	Automatic station (group 7 $w_aw_aW_{a1}W_{a2}$ omitted, no observation, data not available)	0	509
7	Automatic station (group 7 $w_aw_aW_{a1}W_{a2}$ included, using Code tables 4680 and 4531) (but actually missing)	0 (0)	100–199 (200–299) (510)

JN 131204

www.wmo.int