DRAFT AMENDMENTS TO THE MANUAL ON CODES, VOLUME I.2 (WMO-NO. 306) BY FAST-TRACK PROCEDURE

28 July 2020

INTRODUCTION

In accordance with the "Procedures for Maintaining Manuals and Guides Managed by the Commission for Basic Systems" (Resolution 21 (Cg-17)), *the draft amendments to the Manual on Codes, Volume I.2* by the fast-track procedure have been approved by the chairpersons of the Expert Team on Data Standards (ET-Data) and the Standing Committee on Information Management and Technology (SC-IMT).

The focal points for codes and data representation matters are invited to review and comment, if any, the draft amendments, noting the following points.

1) The proposed implementation date of the amendments is ***16 November 2020***.

2) The deadline for comments by focal points is ***29 September 2020***, i.e. within the two months following the date of dispatch of this draft.

3) Send comments to wis-consultation@wmo.int with the subject: FT2020-2 Vol. I.2.

4) Focal points, having not replied by the deadline above, are implicitly considered as having agreed with the draft amendments.

5) These amendments will be notified through the Operational Newsletter on the World Weather Watch available from the WMO website with your concurrence and after the adoption by the President of WMO on behalf of Executive Council (EC).

AMENDMENTS

Each draft amendment below is listed individually based on the request. Additions are formatted in green with a dashed underline (e.g. new text) and deletions are formatted in red with a strikethrough and a dashed underline (e.g. ~~old text~~).

Part B – Binary Codes: FM 92 GRIB

1. GRIB2 code/flag tables in v25.0.0

Add "with source or sink" to the titles of templates 4.76 to 4.83 and in Code Table 4.0. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/13.

Code table 4.0 – *Product definition template number*

Code figure	Meaning
76	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents with source or sink
77	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents with source or sink
78	a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents with source or sink
79	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 with source or sink
80	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol with source or sink
81	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol with source or sink
82	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 with source or sink
83	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 with source or sink

Product definition template 4.76 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents with source or sink

Product definition template 4.77 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents with source or sink

Product definition template 4.78 – 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 with source or sink

Product definition template 4.79 – 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 with source or sink

Product definition template 4.80 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol with source or sink

Product definition template 4.81 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol with source or sink

Product definition template 4.82 – 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 with source or sink

Product definition template 4.83 – 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 with source or sink

2. GRIB2 template 4.83 in v25.0.0

Add two templates. Template 4.84 is an improvement of Template 4.83 and Template 4.85 is an improvement of template 4.47. The differences between the new table and previous table are highlighted in red and green. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/14.

Code table 4.0 – *Product definition template number*

Code figure	Meaning
83	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 with source or sink
84	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 with source or sink
85	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
86–90	Reserved

Product definition template 4.84 – 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 with source or sink

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 4.2)
14	Source or sink (see Code table 4.238)
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 _ _ _ _ _ _ _ _	Type of generating process (see Code table 4.3)
~~26~~ 27	Background generating process identifier (defined by originating centre)
~~27~~ 28	Forecast generating process identifier (defined by originating centre)
~~28-29~~ 29-30	Hours after reference time of data cut-off (see Note 1)
~~30~~ 31	Minutes after reference time of data cut-off
~~31~~ 32	Indicator of unit of time range (see Code table 4.4)
~~32-35~~ 33-36	Forecast time in units defined by octet 32 (see Note 2)
~~36~~ 37	Type of first fixed surface (see Code table 4.5)
~~37~~ 38	Scale factor of first fixed surface
~~38-41~~ 39-42	Scaled value of first fixed surface
~~42~~ 43	Type of second fixed surface (see Code table 4.5)
~~43~~ 44	Scale factor of second fixed surface
~~44-47~~ 45-48	Scaled value of second fixed surface
~~48~~ 49	Type of ensemble forecast (see Code table 4.6)
~~49~~ 50	Perturbation number
~~50~~ 51	Number of forecasts in ensemble
~~51-52~~ 52-53	Year of end of overall time interval
~~53~~ 54	Month of end of overall time interval
~~54~~ 55	Day of end of overall time interval
~~55~~ 56	Hour of end of overall time interval
~~56~~ 57	Minute of end of overall time interval
~~57~~ 58	Second of end of overall time interval
~~58~~ 59	n - number of time range specifications describing the time intervals used to calculate the statistically processed field
~~59-62~~ 60-63	Total number of data values missing in statistical process
	~~63-74~~ 64-75 Specification of the outermost (or only) time range over which statistical processing is done
~~63~~ 64	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~~ 65	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
~~65~~ 66	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
~~66-69~~ 67-70	Length of the time range over which statistical processing is done, in units defined by the previous octet
~~70~~ 71	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
~~71-74~~ 72-75	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	~~75~~ 76-nn These octets are included only if n > 1, where nn = 63 + 12 x n
~~75-86~~ 76-87	As octets ~~63~~ 64 to ~~74~~ 75, next innermost step of processing
~~87~~ 88-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets ~~63~~ 64 to ~~74~~ 75, 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 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 4.85 – 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~~ 12-13	Aerosol type (see Code table 4.233)
~~15~~ 14	Type of interval for first and second sizes (see Code table 4.91)
~~16~~ 15	Scale factor of first size
~~17-20~~ 16-19	Scaled value of first size in metres
~~21~~ 20	Scale factor of second size
~~22-25~~ 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 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 Notes 3 and 4)
	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.

(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 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.

3. Incorrect units of "Potential evaporation rate" in Code Table 4.2

Add entry with correct units to Code Table 4.2. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/15.

Product discipline 0 – Meteorological products, parameter category 1: moisture

Number	Parameter	Units
41	Potential evaporation rate	W m^{-2} (1)
…		
143	Potential evaporation rate	kg m^{-2} s^{-1}
~~143~~ 144-191	Reserved	

(1) The listed units for this parameter appear not to be appropriate for potential evaporation rate. Instead, it is recommended to use parameter 143.

4. New type of level: departure level of most unstable parcel of air

Add entries to Code Table 4.5. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/16.

Code table 4.5 – *Fixed surface types and units*

Code figure	Meaning	Unit
14	Convective condensation level (CCL)	–
16	Level of neutral buoyancy or equilibrium level (LNB)	–
17	Departure level of the most unstable parcel of air (MUDL)	–
18	Departure level of a mixed layer parcel of air with specified layer depth	Pa
~~17~~-19	Reserved	
20	Isothermal level	K

5. New Table 4.2 entries proposed by Canada

Add entries to Code Table 4.2, add Code Tables 4.246 and 4.247. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/17.

Product discipline 0 – Meteorological products, parameter category 1: moisture

Number	Parameter	Units

120	Unbalanced component of specific cloud ice water content	kg kg^{-1}
121	Fraction of snow cover	Proportion
122	Precipitation intensity index	(Code table 4.247)
123	Dominant precipitation type	(Code table 4.201)
124	Presence of showers	(Code table 4.222)
125	Presence of blowing snow	(Code table 4.222)
126	Presence of blizzard	(Code table 4.222)
127	Ice pellets (non water equivalent) precipitation rate	m/s

Product discipline 0 – Meteorological products, parameter category 7: thermodynamic stability indices

Number	Parameter	Units
18	Flux Richardson number	Numeric
19	Convective available potential energy – shear	m^2 s^{-2}
20	Thunderstorm intensity index	(Code table 4.246)
~~20~~ 21-191	Reserved	

Product discipline 0 –Meteorological products, parameter category 19: physical atmospheric properties

Number	Parameter	Units
40	Snow level	m

Code table 4.246 – *Thunderstorm Intensity*

Code figure	Meaning
0	No thunderstorm occurence
1	Weak thunderstorm
2	Moderate thunderstorm
3	Severe thunderstorm
4-254	Reserved
255	Missing

Code table 4.247 – *Precipitation Intensity*

Code figure	Meaning
0	No precipitation occurrence
1	Light precipitation
2	Moderate precipitation
3	Heavy precipitation
4-245	Reserved
255	Missing

6. New GRIB2 code Table 4.2 entries requested by Norway

Add entries to Code Table 4.2. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/20.

Product discipline 0 – Meteorological products, parameter category 0: temperature

Number	Parameter	Units
28	Unbalanced component of temperature	K
29	Temperature advection	K s^{-1}
30	Latent heat net flux due to evaporation	W m^{-2}
31	Latent heat net flux due to sublimation	W m^{-2}
~~30~~ 32-191	Reserved	
192–254	Reserved for local use	

Product discipline 0 – Meteorological products, parameter category 1: moisture

Number	Parameter	Units
128	Total solid precipitation rate	kg m^{-2} s^{-1} (see Note 1)
129	Effective radius of cloud water	m

Notes:

(1) Total solid precipitation includes the sum of all types of solid water, e.g. graupel, snow and hail.

Product discipline 0 – Meteorological products, parameter category 4: short-wave radiation

Number	Parameter	Units
53	Upward short-wave radiation flux, clear sky	W m^{-2}
54	Direct normal short-wave radiation flux	W m^{-2} (see Note 1)
~~54~~ 55-191	Reserved	

Notes:

(1) Normal flux is on a surface lifted to be normal to sun rays.

Product discipline 0 – Meteorological products, parameter category 6: cloud

Number	Parameter	Units
49	Volume fraction of cloud (ice and/or water)**	Numeric
50	Fog	% (see Note 1)
~~50~~ 51–191	Reserved	

Notes:

(1) Fog is defined as cloud cover in the lowest model level.

7. Clarify 4.2 direction of combined wind waves and swell

Modify entry in Code Table 4.2. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/22.

Product discipline 10 – Oceanographic products, parameter category 0: waves

Number	Parameter	Units
13	Secondary wave mean period	s
14	Mean direction of combined wind waves and swell	degree true

15	Mean period of combined wind waves and swell	s

8. Convective rain and snow specific water content in Code Table 4.2

Add entries to Code Table 4.2. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/24.

Product discipline 0 – Meteorological products, parameter category 1: moisture

Number	Parameter	Units
142	Effective aspect ratio of subgrid ice clouds	–
144	specific rain water content (convective)	kg kg^{-1}
145	specific snow water content (convective)	kg kg^{-1}
~~143~~ 146-191	Reserved	
192–254	Reserved for local use	

9. New GRIB2 Code Table 4.2 entries for the physical atmospheric properties of seeing and sky transparency

Add entries to Code Tables 4.2 and add Code Table 4.214. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/25.

Product discipline 0 – Meteorological products, parameter category 19: physical atmospheric properties

Number	Parameter	Units
36	Presence of snow squalls	Code table 4.222
37	Icing severity	Code table 4.228
38	Sky transparency index	(Code Table 4.214)
39	Seeing Index	(Code Table 4.214)
…		
~~38~~ 41–191	Reserved	
192–254	Reserved for local use	

Code table 4.214 – *Envrionmental Factor Qualifier*

Code figure	Meaning
0	Worst
1	Very poor
2	Poor
3	Average
4	Good
5	Excellent
6-190	Reserved
191	Unknown
192-254	Reserved for local use
255	Missing

10. New GRIB table entry for describing probability

Add entry to Code Table 4.16. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/26.

Code table 4.16 – *Quality value associated with parameter*

Code figure	Meaning
4	Random error (see Note 5)
5	Probability
~~5~~ 6-191	Reserved

11. New parameters in Code Table 4.2 for fire weather forecasting

Add entries to Code Table 4.2. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/27.

Product discipline 2 – Land surface products, parameter category 4: fire weather products

Number	Parameter	Units
11	Fire Daily Severity Rating (as defined by the Canadian Forest Service)	Numeric
12	Keetch-Byram drought index	Numeric
13	Drought factor (as defined by the Australian Forest Service)	Numeric
14	Rate of spread (as defined by the Australian Forest Service)	m/s
15	Fire danger index (as defined by the Australian Forest Service)	Numeric
16	Spread component (as defined by the U.S Forest Service National Fire-Danger Rating System)	Numeric
17	Burning index (as defined by the U.S Forest Service National Fire-Danger Rating System)	Numeric
18	Ignition component (as defined by the U.S Forest Service National Fire-Danger Rating System)	%
19	Energy release component (as defined by the U.S Forest Service National Fire-Danger Rating System)	Joule/m^2
~~12~~ 20-191	Reserved	

12. New entries in Code Table 4.238

Add entries to Code Table 4.238 and modify the meaning of one entry. See GitHub issue for more details: https://github.com/wmo-im/GRIB2/issues/28.

Code table 4.238 – *Source or sink*

Code figure	Meaning
0	~~Reserved~~ Other
1	Aviation

…

11	Oceans
12	Elevated anthropogenic sources
13	Surface anthropogenic sources
14	Agriculture livestock
15	Agriculture soils
16	Agriculture waste burning
17	Agriculture (all)
18	Residential, commercial and other combustion
19	Power generation
20	Super power stations
21	Fugitives
22	Industrial process
23	Solvents
24	Ships
25	Wastes (solid and water)
26	Road transportation
27	Off-road transportation
~~12~~ 28-191	Reserved

Part B – Binary Codes: FM 94 BUFR

13. Add perturbed forecast in table 0-01-092

Add entry to Code Table 0-01-092. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/3.

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	Perturbed forecast
~~4~~ 5–191	Reserved
192–254	Reserved for local use
255	Missing value

14. New BUFR sequence for tropical cyclone tracks

Add entries to Table D Category 16. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/4.

Category 16 – Synoptic feature sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Tropical cyclone track and wind radii)	
3 16 082	0 01 033	Identification of Originating/generating Centre	
	0 01 034	Identification of Originating/generating Centre Sub-Centre	
	0 01 032	Generating application	
	0 01 025	Storm identifier	
	0 01 027	WMO long storm name	
	0 01 090	Technique for making up initial perturbations	
	0 01 091	Ensemble member number	
	0 01 092	Type of ensemble forecast	
	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	0 08 005	Meteorological attribute significance	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 08 005	Meteorological attribute significance	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 10 051	Pressure reduced to mean sea level	
	0 08 005	Meteorological attribute significance	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 11 012	Wind speed at 10 m	
	1 07 003	Delayed replication of 7 descriptors	
	0 19 003	Wind speed threshold	
	1 05 004	Delayed replication of 5 descriptors	
	0 05 021	Bearing or azimuth	
	0 05 021	Bearing or azimuth	
	2 01 131	Change data width	
	0 19 004	Effective radius with respect to wind speeds above threshold	
	2 01 000	Change data width (Cancel - set to missing)	
	1 16 000	Delayed replication of 16 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 021	Time significance	
	0 04 024	Time period or displacement	
	0 08 005	Meteorological attribute significance	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 10 051	Pressure reduced to mean sea level	
	0 08 005	Meteorological attribute significance	
	3 01 023	Latitude/longitude (coarse accuracy)	
	0 11 012	Wind speed at 10 m	
	1 07 003	Delayed replication of 7 descriptors	
	0 19 003	Wind speed threshold	
	1 05 004	Delayed replication of 5 descriptors	
	0 05 021	Bearing or azimuth	
	0 05 021	Bearing or azimuth	
	2 01 131	Change data width	
	0 19 004	Effective radius with respect to wind speeds above threshold	
	2 01 000	Change data width (Cancel - set to missing)	

15. New entries in BUFR flag table 0-33-066

Add entries to Flag Table 0-33-066. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/7.

0 33 066

AMV* quality flag

Bit No.	
~~21~~ 1-19	Reserved
20	Good wind, but an alternative channel used for feature tracking
21	Good wind, but an alternative set of channels used for the determination of cloud-top height/AMV height assignment
22	Correlation surface constraint fails
23	Reserved
All 24	Missing Value

16. Table D sequence for reporting marine observations from unmanned surface vehicles

Add entries to Table D Category 15. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/8.

Category 15 – Oceanographic report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Met-ocean observations from autonomous surface vehicles)	
3 15 011	3 01 150	(WIGOS identifier)	
	0 01 087	WMO marine observing platform extended identifier	
	0 01 036	Agency in charge of operating the observing platform	
	0 01 085	Observing platform manufacturer's model	
	0 01 086	Observing platform manufacturer's serial number	
	0 03 001	Surface station type	
	2 08 032	Change width of CCITT IA5 field	
	0 01 079	Unique ID for profile	UUID for report, 32 character hex string
	2 08 000	Change width of CCITT IA5 field	
	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)		
		0 11 104	True heading of aircraft, ship or other mobile platform[DB2]		
		1 03 000	Delayed replication of 3 descriptor		
		0 31 000	Short delayed descriptor replication factor		
		0 07 031	Height of barometer above mean sea level		
		3 06 038	Sequence for representation of standard surface marine meteorological observations from moored buoys		
		0 12 161	Skin temperature		
		1 01 000	Delayed replication of 1 descriptors		
		0 31 000	Short delayed descriptor replication factor		
		3 06 034	(Surface current)		
		1 01 000	Delayed replication of 1 descriptor		
		0 31 000	Short delayed descriptor replication factor		
		3 06 039	(Sequence for representation of basic wave measurements)		
		1 01 000	Delayed replication of 1 descriptors		
		0 31 000	Short delayed descriptor replication factor		
		3 06 033	(Surface salinity)		
		1 01 000	Delayed replication of 1 descriptor		
		0 31 000	Short delayed descriptor replication factor		
		3 06 041	(Depth and temperature profile (high accuracy/precision))		
		1 01 000	Delayed replication of 1 descriptors		
		0 31 000	Short delayed descriptor replication factor		
		3 06 004	(Depth, temperature, salinity)		
		1 01 000	Delayed replication of 1 descriptor		
		0 31 000	Short delayed descriptor replication factor		
		3 06 005	Sub-surface current measurements		
		1 05 000	Delayed replication of 5 descriptors		
		0 31 000	Short delayed descriptor replication factor		
		0 41 001	pCO2		
		0 08 043	Atmospheric chemical or physical constituent type		
		0 15 028	Mole fraction of atmospheric constituent / pollutant in dry air		
		0 08 043	Atmospheric chemical or physical constituent type		
		0 13 080	Water pH		
		1 04 000	Delayed replication of 4 descriptors		
		0 31 000	Short delayed descriptor replication factor		
		0 41 005	Turbidity		
		0 41 003	Dissolved nitrates		

	0 22 188	Dissolved oxygen	
	0 41 002	Fluorescence	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 000	Short delayed descriptor replication factor	
	3 06 040	Sequence for representation of detailed spectral wave measurements	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 08 021	Time significance	
	0 04 025	Time period or displacement	
	0 14 017	Instantaneous long-wave radiation	
	0 14 018	Instantaneous short-wave radiation	

17. Correct clerical error in BUFR Table B entry 0-40-063

Modify entry in Table B Class 40. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/9.

Class 40 – BUFR/CREX Satellite data

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 40 063	Scaling vector multiplying the a priori ~~CO~~ vector in order to define the retrieved ~~CO~~ vector	Numeric	5	0	26	Numeric	5	8

18. New BUFR sequences for encoding IKFS2 products

Add entry to Table B Class 40, add Flag Table 0 40 074, and add entry to Table B Class 07, add entry to Table D Category 40. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/10.

Class 40 – BUFR/CREX Satellite data

TABLE		BUFR				CREX		
					DATA			DATA

REFERENCE F X Y	ELEMENT NAME	UNIT	SCALE	REFERENCE VALUE	WIDTH (Bits)	UNIT	SCALE	WIDTH (Characters)
0 40 073	PWLR estimated retrieval error of surface skin temperature	K	1	0	8	K	1	3
0 40 074	General interferometry quality flags	Flag table	0	0	16			

0 40 074

General interferometry quality flags

Code figure	Meaning
1	Incompatibility of a scan angle for electroencephalogram
2	Calibration failure (limit of black body temperature reached, not enough sources for interferometry, etc.)
3	Geolocation executed taking into account the orientation of the spacecraft and using the star catalogue
4	High level of cryogenic sediment reached, requiring outgassing of the radiation cooler. Set when NESR level of the ice cover threshold crossed
5	Interferometry package flag
6	General accuracy flag
7	Noise present during the interferometry
8	Outgassing of the radiation cooler
9	Flag preceding the first 24 hours/day mark (on as a rule)
10	Telemetry package flag
11-15	Reserved
All 16	Missing value

Class 07 – BUFR/CREX Location (vertical)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 07 071	Height (high resolution)	m	-3	-10000000	26	m	3	8
0 07 072	Scan angle	deg	2	-9000	15	deg	2	6

Category 40 – Additional satellite report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 40 018	3 01 129	Observing satellite and instruments	

	3 01 130	High precision timestamp	
	3 01 131	Pixel geolocation	
	0 07 072	Scan angle	
	0 40 074	General interferometry quality flags	
	1 04 000	Delayed repetition of 1 descriptor	Repeat for all channels
	0 31 002	Delayed descriptor replication factor	
	2 01 136	Change data width	
	0 05 042	Channel number	
	2 01 000	Change data width	
	0 14 044	Change radiance	

19. Table D sequence for reporting scatterometer data from CFOSAT

Add entries to Table D Category 12. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/12.

Category 12 – Single level report sequences (satellite data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
3 12 034		(CFOSAT scatterometer data)	
	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	
	3 12 031	Scatterometer wind	
	3 12 032	Scatterometer 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	
	1 03 018	Replicate 3 descriptor 18 times	
	0 21 110	Number of inner-beam sigma-0 (forward of satellite)	
	3 01 023	Latitude/longitude (coarse accuracy)	
	3 21 028	Radar specification, normalized radar cross-section, Kp variance coefficient	

20.

20. Proposal for new BUFR table entries for Sentinel-6 Michael Freilich

Add entries to Table B Class 21, Table B Class 22 and add entries to Table D Category 40. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/15.

Class 21 – BUFR/CREX Radar data

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 188	Number of valid points for specific band automatic gain control	Numeric	0	0	7	Numeric	0	3
0 21 189	Corrected OCOG* backscatter coefficient (negative reference)	dB	2	-32768	16	dB	2	6

Class 22 – BUFR/CREX Oceanographic elements

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 22 178	XBT/XCTD launcher	Code table	0	0	8	Code table	0	3
0 22 179	Specific band significant wave height (negative reference)	m	3	-500	16	m	3	6
0 22 182	Water column height (see Note 9)	m	3	0	23	m	3	7

Category 40 – Additional satellite report sequences

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Altimeter product)	
3 40 019	3 40 020	Satellite general values	
	3 40 021	General radiometer values	
	3 40 022	Altimeter model values	
	3 40 023	Altimeter main values	
		(Satellite general values)	
3 40 020	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 05 044	Satellite cycle number	
	0 01 096	Station acquisition	
	0 05 040	Orbit number	
	0 01 040	Processing centre id code	
	0 25 061	Software identification and version number	

		0 25 182	L1 processing flag		
		0 25 183	L1 processing quality		
		0 25 181	L2 processing flag		
		0 25 184	L2 product status		
		0 08 075	Ascending/descending orbit qualifier		
		0 25 090	Orbit state flag		
		3 01 011	Date		
		3 01 013	Time		
		0 04 007	Seconds within a minute (microsecond accuracy)		
		3 01 021	Latitude and longitude (high resolution)		
		0 05 063	Spacecraft roll		
		0 05 064	Spacecraft pitch		
		0 05 066	Spacecraft yaw		
		0 10 081	Altitude of cog above reference ellipsoid		
		0 10 082	Instantaneous altitude rate		
			(General radiometer values)		
	3 40 021	0 40 012	Radiometer data quality flag		
		0 08 077	Radiometer sensed surface type		
		1 04 000	Delayed replication		
		0 31 001	Delayed descriptor replication factor		
		0 02 153	Satellite channel centre frequency		
		0 12 063	Brightness temperature		
		0 12 065	Standard deviation brightness temperature		
		0 40 013	Radiometer brightness temperature interpretation flag		
		0 07 002	Height or altitude		
		0 11 098	Wind speed from radiometer		
			(Altimeter model values)		
	3 40 022	0 08 029	Surface type		
		2 01 137	Change data width		
		2 02 129	Change data scale		
		0 06 021	Distance		
		2 02 000	Reset scale		
		2 0 1000	Reset width		
		0 10 087	Ocean depth/land elevation		
		0 40 024	Meteorological map availability		
		0 07 002	Height or altitude		
		0 25 126	Model dry tropospheric correction		
		0 25 128	Model wet tropospheric correction		
		0 40 011	Interpolation flag		
		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		
		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 10 092	Solid earth tide height		
		0 10 093	Geocentric pole tide height		
		0 10 098	Loading tide height geocentric ocean tide solution 1		
		0 10 099	Loading tide height geocentric ocean tide solution 2		
		010 100	Non-equilibrium long period tide height		
		0 25 127	Inverted barometer correction		
		0 40 014	High-frequency fluctuations of the sea-surface topography correction		
		0 01 030	Numerical model identifier		
		0 10 085	Mean sea-surface height		

		0 01 030	Numerical model identifier		
		0 10 085	Mean sea-surface height		
		0 10 086	Geoid's height		
		0 10 096	Mean dynamic topography		
		0 10 103	Mean dynamic topography accuracy		
		0 21 169	Ice presence indicator		
		0 13 055	Intensity of precipitation		
		0 25 165	Ionospheric correction from model on specific band		
			(Altimeter main values)		
	3 40 023	0 25 095	Altimeter state flag		
		0 40 023	Auxiliary altimeter state flags		
		0 08 074	Altimeter echo type		
		3 40 024	1 Hz C and Ku band values		
		3 40 024	1 Hz C and Ku band values		
		3 40 024	1 Hz C and Ku band values		
		3 40 025	20 Hz C and Ku band values		
			(1 Hz C and Ku band values)		
	3 40 024	0 22 080	Waveband central frequency		
		0 08 076	Type of band		
		0 25 190	Altimeter echo processing mode		
		0 10 102	Sea-surface height anomaly		
		0 22 189	Specific band ocean range		
		0 22 191	Rms of specific band ocean range		
		0 22 130	Number of valid points for specific band		
		0 25 167	Specific band net instrumental correction		
		0 25 163	Altimeter ionospheric correction on ku band		
		0 15 012	Total electron count per square metre		
		0 25 164	Radiometer wet tropospheric correction		
		0 13 090	Radiometer water vapour content		
		0 13 091	Radiometer liquid content		
		0 25 166	Sea state bias correction on specific band		
		0 07 002	Height or altitude		
		0 11 097	Wind speed from altimeter		
		0 21 183	Specific band corrected ocean backscatter coefficient		
		0 21 184	Std specific band corrected ocean backscatter coefficient		
		0 22 134	Number of valid points for specific band backscatter		
		0 21 122	Attenuation correction on sigma-0 (from tb)		
		0 21 186	Specific band automatic gain control		
		0 21 187	Rms specific band automatic gain control		
		0 21 188	Number of valid points for specific band automatic gain control		
		2 01 131	Change data width		
		0 21 185	Specific band net instrumental correction for agc		
		2 01 000	Reset width		
		0 22 179	Specific band significant wave height		
		0 22 131	Rms specific band significant wave height		
		0 22 132	Number of valid points for specific band significant wave height		
		0 22 133	Specific band net instrument correction for significant wave height		
		0 21 144	Altimeter rain flag		
		0 25 191	Altimeter tracking mode		
		0 21 143	Ku band rain attenuation		
		0 10 101	Squared off-nadir angle of the satellite from waveform		

			data		
		0 25 112	Band specific altimeter data quality flag		
		0 25 113	Band specific altimeter correction quality flag		
		0 33 092	Band specific ocean quality flag		
			(20 Hz C and Ku band values)		
	3 40 025	0 08 049	Number of observations		
		0 22 080	Waveband central frequency		
		0 08 076	Type of band		
		0 25 190	Altimeter echo processing mode		
		1 46 021	Replication		
		3 01 011	Date		
		3 01 013	Time		
		0 04 007	Seconds within a minute (microsecond accuracy)		
		3 01 021	Latitude and longitude (high resolution)		
		0 10 081	Altitude of cog above reference ellipsoid		
		0 10 082	Instantaneous altitude rate		
		0 08 029	Surface type		
		2 01 137	Change data width		
		2 02 129	Change data scale		
		0 06 021	Distance		
		2 02 000	Reset scale		
		2 01 000	Reset width		
		0 25 191	Altimeter tracking mode		
		0 21 071	Peakiness		
		0 01 030	Numerical model identifier		
		0 10 085	Mean sea-surface height		
		0 01 030	Numerical model identifier		
		0 10 085	Mean sea-surface height		
		0 40 011	Interpolation flag		
		0 10 088	Total geocentric ocean tide height (solution 1)		
		0 10 089	Total geocentric ocean tide height (solution 2)		
		0 25 164	Radiometer wet tropospheric correction		
		0 07 002	Height or altitude		
		0 25 126	Model dry tropospheric correction		
		0 25 128	Model wet tropospheric correction		
		0 10 102	Sea-surface height anomaly		
		0 22 189	Specific band ocean range		
		0 25 167	Specific band net instrumental correction		
		0 25 163	Altimeter ionospheric correction on ku band		
		0 21 183	Specific band corrected ocean backscatter coefficient		
		2 01 131	Change data width		
		0 21 185	Specific band net instrumental correction for agc		
		2 01 000	Reset width		
		0 22 179	Specific band significant wave height		
		0 22 133	Specific band net instrument correction for significant wave height		
		0 22 146	Ocog range		
		0 21 189	Corrected OCOG* backscatter coefficient		
		0 13 163	Snow water equivalent		
		2 02 126	Change data scale		
		0 22 046	Sea ice fraction		
		2 02 000	Reset scale		
		0 13 117	Snow density (liquid water content)		
		0 13 013	Total snow depth		
		0 25 112	Band specific altimeter data quality flag		
		0 25 113	Band specific altimeter correction quality flag		

	0 33 092	Band specific ocean quality flag		

21. New table B descriptor for a sensor identifier

Add entry to Table B Class 01. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/19.

Class 01 –BUFR/CREX Identification

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 01 153	Tsunameter report sequence number triggered by a tsunami event	Numeric	0	0	7	Numeric	0	2
0 01 154	Sensor identifier	Numeric	0	0	12	Numeric	0	4
0 01 160	Aircraft reporting point (Beacon identifier)	CCITT IA5	0	0	64	Character	0	8

22. New BUFR Table B and D descriptors for scatterometer data

Add entries to Table B Class 21, Table B Class 33 and Table D Category 12, add tables to Code/Flag Table 33 and add entry to Code/Flag Table 0 02 048. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/20.

Class 21 – BUFR/CREX Radar data

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 21 094	S band peakiness	Numeric	3	0	15	Numeric	3	5
0 21 095	Kp coefficient A	Numeric	6	0	20	Numeric	6	7
0 21 096	Kp coefficient B	Numeric	6	0	20	Numeric	6	7
0 21 097	Kp coefficient C	Numeric	6	0	20	Numeric	6	7
0 21 101	Number of vector ambiguities	Numeric	0	0	3	Numeric	0	1

Class 33 – BUFR/CREX Quality information

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0 33 053	Ku band ocean retracking quality	Flag table	0	0	21	Flag table	0	7
0 33 055	Wind vector quality flag	Flag table	0	0	24	Flag table	0	8
0 33 056	Sigma-0 quality flag	Flag table	0	0	24	Flag table	0	8
0 33 060	GqisFlagQual – individual IASISystem quality flag	Code table	0	0	2	Code table	0	1

0 02 048

Satellite sensor indicator

Code figure

12	ASCAT
13	OSCAT2
~~13~~ 14	Reserved
15	Missing value

0 33 055

Wind vector quality flag

Code figure

1-10	Reserved
11	Ocean sigma0 is not available for wind retrievals
12	Background wind is not available
13	Background model detect land
14	Background model detect ice
15	Sigma0 is not land/ice free
16	Sigma0 land contamination
17	Sigma0 ice contamination
18	Not enough azimuthal diversity
19	Inversion is not done
20	Overall WVC flag
21	Inversion is attempted (flag is set)
22	Rainflag is attempted (flag is set)
23	Rain is detected
All 24	Missing value

0 33 056

Sigma-0 quality flag

Code figure

1-7	Reserved
8	Ascending
9	VV polarisation
10	Fore of spacecraft
11	Land
12	Poor sigma0 (summary)
13	Invalid sigma-0 (summary)
14	Poor BT
15	Invalid BT
16	Land-sea boundary
17	Negative sigma-0
18-20	Reserved
21	Ice
22	Missing data at a given latitude-longitude for sea-ice flagging process for 2 or more number of days
23	Ice-ocean contamination
All 24	Missing value

Category 12 – Single level report sequences (satellite data)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		(Scatterometer level 2b data)	
3 12 029	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	Cancel change data width	
	0 05 034	Along track row number	
	2 01 129	Change data width	
	0 06 034	Cross-track cell number	

	2 01 000	Cancel change data width	
	0 33 055	Wind vector quality flag	
	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	
	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	

23. Revision of E-Profile sequences

Add Code Table 0 02 006, add entry to Table B Class 02 and add entries to Table B Class 15. See GitHub issue for more details: https://github.com/wmo-im/BUFR4/issues/21.

Class 02 – BUFR/CREX Instrumentation

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)

0 02 007	Type of sensor for water level measuring instrument	Code table	0	0	6	Code table	0	2
0 02 006	Upper air remote sensing instrument type	Code table	0	0	6	Code table	0	0
0 02 008	Type of offshore platform	Code table	0	0	4	Code table	0	2

0 02 006

Type of sensor for water level measuring instrument

Code figure	Description
0	reserved
1	Elastic backscatter Lidar
2	Raman backscatter Lidar
3	Radar wind profiler
4	Lidar wind profiler
5	Sodar wind profiler
6	Wind Profiler
7	Lidar
8 – 62	Reserved
63	Missing Value

Class 15 – BUFR/CREX Physical/chemical constituents

TABLE REFERENCE	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
F X Y								
0 15 072	Uncertainty in depolarization ratio	%	2	0	14	%	2	5
0 15 073	Attenuated Backscatter	$m^{-1}\ sr^{-1}$	8	-524288	20	$m^{-1}\ sr^{-1}$	8	7
0 15 074	Particle Backscatter Coefficient	$m^{-1}\ sr^{-1}$	8	-524288	20	$m^{-1}\ sr^{-1}$	8	7
0 15 075	Particle Extinction Coefficient	m^{-1}	8	-524288	20	m^{-1}	8	7
0 15 076	Particle LIDAR Ratio	sr	1	-2048	13	sr	1	5
0 15 077	Uncertainty in LIDAR Ratio	sr	1	0	12	sr	1	5
0 15 078	Particle Depolarization Ratio	%	2	-8192	15	%	2	5

Part C – Common Features to Binary and Alphanumeric Codes

24. New sub-category for TC tracks from deterministic

Add entry in Common Code Table C-13. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/4.

COMMON CODE TABLE C–13: ***Data sub-categories of categories defined by entries in BUFR Table A***

Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
7	Synoptic features	0	Forecast tropical cyclone tracks from EPS
		1	Squall line
		2	Forecast tropical cyclone from deterministic system

25. Amendment to Common Code table C-3 by Japan

Modify entries in Common Code Table C-3. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/6.

COMMON CODE TABLE C–3: ***Instrument make and type for water temperature profile measurement with fall rate equation coefficients***

Code figure for IxIxIx	Code figure for BUFR (Code table 0 22 067)	Meaning Instrument make and type	Equation Coefficients *a*	*b*
741	741	XCTD/XCTD-1/XCTD-1N	3.42543	–0.47
742	742	XCTD-2/XCTD-2N	3.43898	–0.31
743	743	TSK XCTD-2F	3.43898	–0.31
744	744	XCTD-3/XCTD-3N	5.07598	–0.72
745	745	XCTD-4/XCTD-4N	3.68081	–0.47

26. Add a new entry to Common Code Tables C-11 to identify IAP

Add entry to Common Code Table C-11. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/7.

COMMON CODE TABLE C–11: ***Originating/generating 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	
00290	290	EUMETNET E-Profile
00291	291	The Institute of Atmospheric Physics(IAP) of Chinese Academy of Sciences (CAS)
~~00291~~ 00292–65534	~~291~~ 292–65534	Reserved for other centres

27. Proposal for new entry in Common Code Tables C5

Add entry to Common Code Tables C-5. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/8.

COMMON CODE TABLE C–5: *Satellite identifier*

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
855	855	855	Combination of INSAT 3D and INSAT 3DR
856	856	856	Combination of Sentinel-3 satellites

28. New sub-category for Mode-S in C-13

Add entry to Common Code Table C-13. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/9.

COMMON CODE TABLE C–13: *Data sub-categories of categories defined by entries in BUFR Table A*

Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
4	Single level upper-air data (other than satellite)	0	ASDAR/ACARS (AMDAR)
		1	Manual (AIREP, PIREP)
		2	Mode-S

29. New CCT C-1/11, C-5 and C-8 entries for commercial providers of radio occultation data

Add entries to Common Code Tables C-1, C-5, C-8 and C-11. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/10.

COMMON CODE TABLE C–1: *Identification of originating/generating centre*

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	178	178	Spire Global, Inc.
Not applicable	179	179	GeoOptics, Inc.
Not applicable	180	180	PlanetiQ
Not applicable	~~179~~ 181–189	~~179~~ 181–189	Reserved for other centres

COMMON CODE TABLE C–5: *Satellite identifier*

Code figure for	Code figure for BUFR	Code figure for GRIB

$I_6I_6I_6$	(Code table 0 01 007)	Edition 2	
262	262	262	JASON 3
265	265	265	GeoOptics CICERO OP1
266	266	266	GeoOptics CICERO OP2
267	267	267	PlanetiQ GNOMES-A
268	268	268	PlanetiQ GNOMES-B
269	269	269	Spire Lemur 3U CubeSat

COMMON CODE TABLE C–8: ***Satellite instruments***

Code	Agency	Type	Instrument short name	Instrument long name
519	NASA	MW imaging/sound-	GMI	GPM microwave imager
526	GeoOptics	GNSS occultation sounder	Cion-A	GeoOptics Cion GNSS occultation receiver A
527	GeoOptics	GNSS occultation sounder	Cion-B	GeoOptics Cion GNSS occultation receiver B
528	GeoOptics	GNSS occultation sounder	Cion-C	GeoOptics Cion GNSS occultation receiver C
529	GeoOptics	GNSS occultation sounder	Cion-D	GeoOptics Cion GNSS occultation receiver D
530	Spire	GNSS occultation sounder	SGNOS-A	Spire global navigation satellite system A
531	Spire	GNSS occultation sounder	SGNOS-B	Spire global navigation satellite system B
532	Spire	GNSS occultation sounder	SGNOS-C	Spire global navigation satellite system C
533	Spire	GNSS occultation sounder	SGNOS-C	Spire global navigation satellite system D
534	PlanetiQ	GNSS occultation sounder	Pyxis-A	PlanetiQ Pyxis GNSS occultation receiver A
535	PlanetiQ	GNSS occultation sounder	Pyxis-B	PlanetiQ Pyxis GNSS occultation receiver B
540	NOAA	Communications	DCS (NOAA)	Data-collection system (NOAA)

COMMON CODE TABLE C–11: ***Originating/generating 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	
00178	178	Spire Global, Inc.
00179	179	GeoOptics, Inc.
00180	180	PlanetiQ
~~00179~~ 00181-00189	~~179~~ 181–189	Reserved for other centres

30. Add 3 new entries to C-2 for radiosondes of China

Add entries to Common Code Table C-2. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/11.

COMMON CODE TABLE C–2: ***Radiosonde/sounding system used***

Date of assignment of number (necessary after 30/06/2007)	Code figure for $r_a r_a$ (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
16/11/2020	Not available	200	Nanjing GTS11 (China)
16/11/2020	Not available	201	ShanghaiG TS12 (China)
16/11/2020	Not available	202	Taiyuan GTS13 (China)
	Not available	~~200~~ 203-254	Reserved for BUFR only

31. Add new chemical species, aerosols and pollen in Common Code Table 14

Add entries to Common Code Table C-14. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/12.

COMMON CODE TABLE C–14: ***Atmospheric chemical or physical constituent type***

Code figure	Meaning	Chemical formula
10054	3-hydroxypropyl hydroperoxide	$HOCH_2CH_2CH_2OOH$
10055	methyl-peroxy-nitrate (nitroperoxy-methane)	CH_3OONO_2
10056	2-lambda^1-Oxidanyloxy-2-methylbut-3-en-1-ol (4-Hydroxy-3-methyl-1-butene-3-ylperoxy radical)	$HOCH_2C(CH_3)(OO•)CHCH_2$
10057	2-lambda^1-Oxidanyloxy-3-methylbut-3-en-1-ol (2-Hydroxy-1-isopropenylethylperoxy radical)	$HOCH_2CH(OO•)C(CH_3)CH_2$
10058	(Z)-4-Hydroperoxy-2-methyl-2-butenal	$CH2(OOH)CHC(CH_3)CHO$
10059	(Z)-4-Hydroperoxy-3-methyl-2-butenal	$CH2(OOH)C(CH_3)CHCHO$
~~10055~~ 10060-10499	Reserved for other simple organic molecules (e.g. higher aldehydes, alcohols, peroxides, ...)	
60027	Oxides	O_x
60028	Peroxyacyl nitrates	$RC(O)OONO_2$
60029	Aromatic peroxide radical (Aryl dioxydanyl radicals)	ArOO•
60030	Biogenic Secondary Organic Compound	
60031	Anthropogenic Secondary Organic Compound	
60032	all hydroxy-peroxides products of the reaction of hydroxy-isoprene adducts with O_2	ISOPOOH
~~60028~~ 60033-61999	Reserved	
62029	Total aerosol hydrophobic	
62030	Primary particulate inorganic matter dry	
62031	Secondary particulate Inorganic matter dry	
62032	Biogenic Secondary Organic aerosol	
62033	Anthropogenic Secondary Organic aerosol	
~~62030~~ 62034-62099	Reserved	
62114	Ulmus (elm) pollen	
62115	Olea (olive) pollen	
~~62115~~ 62116-62199	Reserved	

32. Proposal for new entries in Common Code Tables C5 and C8

Add entries to Common Code Tables C-5 and C-8. See GitHub issue for more details: https://github.com/wmo-im/CCT/issues/13.

COMMON CODE TABLE C–5: *Satellite identifier*

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
	300–399: Numbers allocated to the Russian Federation		
323	323	323	METEOR 3M-2
324	324	324	METEOR-M N2
325	325	325	METEOR-M N2 2
341	341	341	RESURS 01-4

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
860	ROSCOSMOS	Spectrometer	RMK-2	
861	ROSCOSMOS	Atmospheric temperature and humidity sounder	MTVZA-GY	Module for temperature and humidity sounding in the atmosphere
862	ROSCOSMOS	Spectrometer	IKFS-2	Infrared Fourier spectrometer