

## Draft amendments to the Manual on Codes (WMO No. 306) by the fast-track procedure

In accordance with the "Procedures for Maintaining Manuals and Guides Managed by the Commission for Basic Systems" (Resolution 21 (Cg-17)) effective from 1 January 2016, *the draft amendments to the Manual on Codes, Volume I.2* by the fast-track procedure have been approved by the Chairs of CBS Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) and CBS Open Programme Area Group on Information Systems and Services (OPAG-ISS).

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

- (a) Proposed implementation date of the amendments is **4 May 2016**.
- (b) Deadline for comments by focal points is **4 April 2016**, i.e. within the two months following the date of dispatch of this draft.
- (c) Focal points having not replied by the deadline above are implicitly considered as having agreed with the draft amendments.
- (d) These amendments will be notified through the Operational Newsletter on the World Weather Watch available from the WMO web with your concurrence and after the approval by the president of CBS on behalf of Executive Council (EC).

The current edition of the WWW Operational News Letter is available from:

[http://www.wmo.int/pages/prog/www/ois/Operational\\_Information/Newsletters/current\\_news\\_en.html](http://www.wmo.int/pages/prog/www/ois/Operational_Information/Newsletters/current_news_en.html)

# LIST OF AMENDMENTS TO MANUAL ON CODES

FAST-TRACK 2016-1 (4 May 2016)

## CONTENTS

### Part B – Binary Codes

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

#### I. FM 92 GRIB – General regularly distributed information in binary form

1. [Fixed surface type for cloud base fields](#)
2. [GRIB2 parameters for NOAA/NWS forecast products](#)
3. [GRIB2 parameters and level type for the uncertainties in ensembles of regional reanalyses project](#)
4. [GRIB2 parameters for new forecast and post-processing products](#)

#### II. FM 94 BUFR – Binary universal form for the representation of meteorological data

5. [BUFR sequence and elements for Atmospheric Laser Doppler Instrument \(ALADIN\)](#)
6. [BUFR templates for WAVEOB data](#)
7. [BUFR elements and sequence for international exchange of road weather information](#)
8. [Synoptic reports from sea stations suitable for VOS observation data](#)

## I. FM 92 GRIB

### 1. Fixed surface type for cloud base fields

#### Add an entry:

In GRIB Code table 4.5,

Code figure	Meaning	Unit
13	Lowest level where vertically integrated cloud cover exceeds the specified percentage (cloud base for a given percentage cloud cover)	%

### 2. GRIB2 parameters for NCEP forecast products

#### Add entries:

In GRIB Code table 4.2,

#### **Discipline 0 (Meteorological products), Category 19 (Physical atmospheric properties)**

Number	Parameter	Unit
29	Clear air turbulence (CAT)	$\text{m}^{2/3} \text{s}^{-1}$

#### **Discipline 0 (Meteorological products), Category 20 (Atmospheric chemical constituents)**

Number	Parameter	Unit
111	Angstrom exponent	Numeric

### 3. GRIB2 parameters and level type for the uncertainties in ensembles of regional reanalyses project

#### Add entries:

In GRIB Code table 4.2,

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

Number	Parameter	Units	Description
52	Downward short-wave radiation flux, clear sky	$\text{W m}^{-2}$	Downward short-wave radiation flux computed under actual atmospheric conditions but assuming zero cloudiness.
53	Upward short-wave radiation flux, clear sky	$\text{W m}^{-2}$	Upward short-wave radiation flux computed under actual atmospheric conditions but assuming zero cloudiness.

#### **Product discipline 0 - Meteorological products, parameter category 5: long-wave radiation**

Number	Parameter	Units	Description
8	Downward long-wave radiation flux, clear sky	$\text{W m}^{-2}$	Downward long-wave radiation flux computed under actual atmospheric conditions but assuming zero cloudiness.

#### **Product discipline 1 - Hydrological products, parameter category 0: hydrology basic products**

Number	Parameter	Units	Description
16	Percolation rate	kg m <sup>-2</sup> s <sup>-1</sup>	<i>The percolation is the downward movement of water under hydrostatic pressure in the saturated zone. This water might still end up in rivers and lakes as discharge but it is a slower process than water runoff or drainage. Such defined percolation is an input for hydrological models together with e.g. water runoff.</i>

### Product discipline 2 - Land surface products, parameter category 3: soil products

Number	Parameter	Units	Description
26	Soil heat flux	W m <sup>-2</sup>	<i>The soil heat flux is the energy receive by the soil to heat it per unit of surface and time. The Soil heat flux is positive when the soil receives energy (warms) and negative when the soil loses energy (cools).</i>
27	Soil depth	m	<i>Soil depth, positive downward. It is meant to be used together with the type of level "soil level" to encode the depth of the level at each grid point.</i>

In GRIB Code table 4.5,

Code figure	Meaning	Units	Description
151	Soil level (see Note 5)	Numeric	<i>This level represents a soil model level. The aim of this type of the level is to encode a field referred to a soil level that has variable depth across the model domain. The non-constant depth is then encoded as a parameter "soil depth" discipline 2, category 3 and parameter number 27.</i>

### **Add a Note:**

In GRIB Code table 4.5,

Notes:

- (5) The soil level represents a model level for which the depth is not constant across the model domain. The depth in metres of the level is provided by another GRIB message with the parameter "soil depth" with discipline 2, category 3 and parameter number 27.

## 4. GRIB2 parameters for new forecast and post-processing products

### **Add entries:**

In GRIB Code table 4.2,

#### Product Discipline 0 – Meteorological products, Parameter category 1: moisture

Number	Parameter	Units
109	Mass density of liquid water coating on hail expressed as mass of liquid water per unit volume of air	kg m <sup>-3</sup>
110	Specific mass of liquid water coating on hail expressed as mass of liquid water per unit mass of moist air	kg kg <sup>-1</sup>
111	Mass mixing ratio of liquid water coating on hail	kg kg <sup>-1</sup>

	expressed as mass of liquid water per unit mass of dry air	
112	Mass density of liquid water coating on graupel	kg m <sup>-3</sup>
	expressed as mass of liquid water per unit volume of air	
113	Specific mass of liquid water coating on graupel	kg kg <sup>-1</sup>
	expressed as mass of liquid water per unit mass of moist air	
114	Mass mixing ratio of liquid water coating on graupel expressed as mass of liquid water per unit mass of dry air	kg kg <sup>-1</sup>
115	Mass density of liquid water coating on snow	kg m <sup>-3</sup>
	expressed as mass of liquid water per unit volume of air	
116	Specific mass of liquid water coating on snow	kg kg <sup>-1</sup>
	expressed as mass of liquid water per unit mass of moist air	
117	Mass mixing ratio of liquid water coating on snow	kg kg <sup>-1</sup>
	expressed as mass of liquid water per unit mass of dry air	

### Product Discipline 0 – Meteorological products, Parameter category 17: electrodynamics

Number	Parameter	Units
1	Lightning potential index (LPI) (see Note)	J kg <sup>-1</sup>

Note: Definition of LPI after Lynn et. al.:

Lynn, B., and Y. Yair, 2010: Prediction of lightning flash density with the WRF model, *Adv. Geosci.*, 23, 11-16  
 Yair, Y., B. Lynn, C. Price, V. Kotroni, K. Lagouvardos, E. Morin, A. Mugnai, and M. Llasat, 2010: Predicting the potential for lightning activity in Mediterranean storms based on the Weather Research and Forecasting (WRF) model dynamic and microphysical fields, *JGR*, 115, D04205, doi:10.1029/2008JD010868

### Add entries and a note to parameter 10:

In GRIB Code table 4.2,

### Product Discipline 0 – Meteorological products, Parameter category 18: nuclear/radiology

Number	Parameter	Units
10	Air concentration (see Note 3)	Bq m <sup>-3</sup>
14	Specific activity concentration (see Note 3)	Bq kg <sup>-1</sup>
15	Maximum of air concentration in layer	Bq m <sup>-3</sup>
16	Height of maximum air concentration	m

Notes:

(3) Conversion factor between “Specific activity concentration” (14) and “Air concentration” (10) is “mass density” [kg m<sup>-3</sup>].

### Product Discipline 0 – Meteorological products, Parameter category 19: physical atmospheric properties

Number	Parameter	Units
30	Eddy dissipation parameter (see Note 3)	m <sup>2/3</sup> s <sup>-1</sup>
31	Maximum of Eddy dissipation parameter in layer	m <sup>2/3</sup> s <sup>-1</sup>

Notes:

(3) Eddy dissipation parameter is third root of eddy dissipation rate [m<sup>2</sup> s<sup>-3</sup>].

### Add entries and a note to parameter 59:

In GRIB Code table 4.2,

**Product Discipline 0 – Meteorological products, Parameter category 20: atmospheric chemical constituents**

Number	Parameter	Units
59	Aerosol number concentration (see Note 2)	m <sup>-3</sup>
60	Aerosol specific number concentration (see Note 2)	kg <sup>-1</sup>
61	Maximum of mass density in layer (see Note 1)	kg m <sup>-3</sup>
62	Height of maximum mass density	m

Notes:

- (1) 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.
- (2) The term “number density” is used as well for “number concentration” (code number 59); conversion factor between “number density” (59) and “specific number concentration” (60) is “mass density” [kg m<sup>-3</sup>].

**Amend entries:**

In parameter numbers 1, 56 and 58 in Product Discipline 0 – Meteorological products, Parameter category 20: atmospheric chemical constituents of GRIB Code table 4.2,

"see Note" to "see Note 1"

**Add entries:**

In GRIB Code table 4.5,

Code figure	Meaning	Unit
13	Level of free convection (LFC)	-
14	Convective condensation level (CCL)	-
15	Level of neutral buoyancy or equilibrium level (LNB)	-

**II. FM 94 BUFR/FM 95 CREX**

**5. BUFR sequence and elements for Atmospheric Laser Doppler Instrument (ALADIN) [🔗](#)**

**Add entries:**

In BUFR/CREX Table B,

**Class 05 – BUFR/CREX Location (horizontal)**

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REF. VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Char.)
0 05 068	Profile number	Numeric	0	0	16	Numeric	0	5
0 05 069	Receiver channel	Code table	0	0	2	Code table	0	1
0 05 070	Observation identifier	Numeric	0	0	30	Numeric	0	10

### Class 07 – BUFR/CREX Location (vertical)

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REF. VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Char.)
0 07 071	Height (high resolution)	m	3	-10000000	26	m	3	8

### Class 25 – BUFR/CREX Processing information

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REF. VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Char.)
0 25 187	Confidence flag	Code table	0	0	4	Code table	0	2

### Class 40 – BUFR/CREX Satellite data

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REF. VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Char.)
0 40 029	Horizontal observation integration length	m	0	0	26	m	0	8
0 40 030	Horizontal line of sight wind	m s <sup>-1</sup>	2	-32767	16	m s <sup>-1</sup>	2	5
0 40 031	Error estimate of horizontal line of sight wind	m s <sup>-1</sup>	2	0	15	m s <sup>-1</sup>	2	5
0 40 032	Derivative wind to pressure	m s <sup>-1</sup> Pa <sup>-1</sup>	3	-100000	18	m s <sup>-1</sup> Pa <sup>-1</sup>	3	6
0 40 033	Derivative wind to temperature	m s <sup>-1</sup> K <sup>-1</sup>	3	-100000	18	m s <sup>-1</sup> K <sup>-1</sup>	3	6
0 40 034	Derivative wind to backscatter ratio	m s <sup>-1</sup>	3	-200000	19	m s <sup>-1</sup>	3	6
0 40 035	Satellite range	m	0	380000	18	m	0	6
0 40 036	Lidar I2b classification type	Code table	0	0	4	Code table	0	2
0 40 037	Backscatter ratio	Numeric	3	500	20	Numeric	3	7

### Add an entry:

In BUFR Table D,

TABLE REFERENCE	TABLE REFERENCES	Element name	
3 40 013	(Atmospheric Laser Doppler Instrument (ALADIN) L2B Data)		
	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	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)	
	0 05 068	Profile number	
	0 05 070	Observation identifier	
	0 05 069	Receiver channel	
	0 40 036	Lidar I2b classification type	
	0 08 091	Coordinates significance	= 2 Start of observation
0 05 001	Latitude (high accuracy)		

0 06 001	Longitude (high accuracy)	
0 04 016	Time increment	
0 08 091	Coordinates significance	= 3 End of observation
0 05 001	Latitude (high accuracy)	
0 06 001	Longitude (high accuracy)	
0 04 016	Time increment	
0 08 091	Coordinates significance	= 4 Horizontal centre of gravity of observation
0 05 001	Latitude (high accuracy)	
0 06 001	Longitude (high accuracy)	
0 04 016	Time increment	
0 08 091	Coordinates significance	= 6 Top of observation
0 07 071	Height (high resolution)	
0 05 021	Bearing or azimuth	
0 07 021	Elevation	
0 40 035	Satellite range	
0 08 091	Coordinates significance	= 7 Bottom of observation
0 07 071	Height (high resolution)	
0 05 021	Bearing or azimuth	
0 07 021	Elevation	
0 40 035	Satellite range	
0 08 091	Coordinates significance	= 5 Vertical centre of gravity of observation
0 07 071	Height (high resolution)	
0 05 021	Bearing or azimuth	
0 07 021	Elevation	
0 40 035	Satellite range	
0 40 029	Horizontal observation integration length	
0 40 030	Horizontal line of sight wind	
0 40 031	Error estimate of horizontal line of sight wind	
0 25 187	Confidence flag	
0 10 004	Pressure	
0 12 001	Temperature/air temperature	
0 40 037	Backscatter ratio	
0 40 032	Derivative wind to pressure	
0 40 033	Derivative wind to temperature	
0 40 034	Derivative wind to backscatter ratio	

**Add BUFR/CREX Code tables:**

**0 05 069**

**Receiver channel**

Code figure

- 0 Mie
- 1 Rayleigh
- 2 Reserved
- 3 Missing value

**0 25 187**

**Confidence flag**

Code figure

- 0 Valid
- 1 Invalid
- 2–14 Reserved
- 15 Missing value

**0 40 036**

**Lidar I2b classification type**

Code figure

- 0 Clear



1	Cloud
2–14	Reserved
15	Missing value

## 6. BUFR templates for WAVEOB data [🔗](#)

### Add entries:

In BUFR/CREX table B,

Table Reference F X Y	Element name	BUFR				CREX		
		Unit	Scale	Reference	Data width	Unit	Scale	Data width
0 22 102	Scaled maximum non-directional spectral wave density by frequency (Note 1)	m <sup>2</sup> s	0	0	14	m <sup>2</sup> s	0	5
0 22 103	Scaled maximum non-directional spectral wave density by wavenumber (Note 1)	m <sup>3</sup>	0	0	14	m <sup>3</sup>	0	5
0 22 104	Scaled non-directional spectral wave density by frequency (Note 1)	m <sup>2</sup> s	0	0	14	m <sup>2</sup> s	0	5
0 22 105	Scaled non-directional spectral wave density by wavenumber (Note 1)	m <sup>3</sup>	0	0	14	m <sup>3</sup>	0	5
0 22 106	Scaled directional spectral wave density by frequency (Note 1)	m <sup>2</sup> s rad <sup>-1</sup>	0	0	14	m <sup>2</sup> s rad <sup>-1</sup>	0	5
0 22 107	Scaled directional spectral wave density by wavenumber (Note 1)	m <sup>4</sup>	0	0	14	m <sup>4</sup>	0	5
0 22 108	Spectral wave density ratio	%	0	0	7	%	0	3
0 22 186	Direction from which waves are coming (Note 2)	degree true	0	0	9	degree true	0	3
0 22 187	Directional spread of wave (Note 3)	°	0	0	9	°	0	3

Notes:

- (1) Must be preceded by 0 08 090, possibly with intervening operators. The value is 10<sup>x</sup> multiplied by the encoded value, where x is the value associated with the preceding 0 08 090 descriptor. The encoded value is the actual value multiplied by 10<sup>-x</sup>.
- (2) 0 22 186 is introduced to express the direction of “any wave”, as opposed to the direction of “dominant wave” (0 22 076), “mean direction” (0 22 086), and “principal direction” (0 22 087).
- (3) 0 22 187 is introduced to express the directional spread of “any wave”, as opposed to the directional spread of “dominant wave” (0 22 077).

In BUFR Table D,

### TM 308015 – BUFR template for WAVEOB data expressed as frequency (I<sub>a</sub> = 0 in FM-65 WAVEOB)

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		<i>Identification (WAVEOB Section 0)</i>	
3 08 015	0 01 003	WMO Region number/geographical area	A <sub>1</sub> – First digit of WMO number (e.g. 62024 => 6)
	0 01 020	WMO Region sub-area	b <sub>w</sub> – Second digit of WMO number (e.g. 62024 => 2)
	0 01 005	Buoy/platform identifier	n <sub>b</sub> n <sub>b</sub> n <sub>b</sub> – Last 3 digits of WMO number (e.g. 62024 => 024)
	0 01 011	Ship or mobile land station identifier	D...D
	0 01 007	Satellite identifier	l <sub>6</sub> l <sub>6</sub> l <sub>6</sub>
	0 01 001	WMO block number	ll

	0 01 002	WMO station number	iii – IIIiii only apply to fixed sea stations
	0 02 044	Indicator for method of calculating spectral wave data	$I_m$ – Code table 1744 (WAVEOB), 0 02 044 (BUFR)
	0 02 045	Indicator for type of platform	$I_p$ – Code table 1747 (WAVEOB), 0 02 045 (BUFR)
	3 01 011	Year, month, day	YYMMJ – Date of observation
	3 01 012	Hour, minute	GGgg – Time of observation
	3 01 021	Latitude/longitude (high accuracy)	$Q_c L_a L_a L_a L_a L_o L_o L_o L_o$
		<i>Basic data (WAVEOB Section 0)</i>	
	0 22 063	Total water depth	1hhhh
	0 22 076	Direction from which dominant waves are coming	$9d_d d_d$ – Section 0
	0 22 077	Directional spread of dominant wave	$d_s d_s$ – section 0
	0 22 094	Total number of wave bands	111B <sub>T</sub> B <sub>T</sub> – Section 1
	0 25 043	Wave sampling interval (time)	SSSS – Section 1
	0 22 078	Duration of wave record	D'D'D'D' – Section 1
	1 05 002	Replicate 5 descriptors 2 times	Replicate over sensor type
	0 02 046	Wave measurement instrumentation	= 1 Heave sensor, = 2 Slope sensor
	0 22 070	Significant wave height	$2H_s H_s H_s H_s$ or $6H_{se} H_{se} H_{se} H_{se}$ – Section 0
	0 22 071	Spectral peak wave period	$3P_p P_p P_p P_p$ or $7P_{sp} P_{sp} P_{sp} P_{sp}$ – Section 0
	0 22 073	Maximum wave height	$4H_m H_m H_m H_m$
	0 22 074	Average wave period	$5P_a P_a P_a P_a$ or $8P_{sa} P_{sa} P_{sa} P_{sa}$ – Section 0
		<i>Spectral data (WAVEOB Section 1 – 5)</i>	
	1 27 000	Delayed replication of 27 descriptors	Replication over sensor type
	0 31 001	Delayed descriptor replication factor (see Note 1)	(0,1,2) normally 1
	0 02 046	Wave measurement instrumentation	= 1 Heave sensor, = 2 Slope sensor
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 102	Scaled maximum non-directional spectral wave density by frequency	$C_m C_m C_m$ – Section 2 or $C_{sm} C_{sm} C_{sm}$ – Section 3
	0 08 090	Decimal scale of following significands	Set to missing
	0 22 084	Band containing maximum non- directional spectral wave density	$n_m n_m$ – Section 2 or $n_{sm} n_{sm}$ – Section 3
	1 20 000	Delayed replication of 20 descriptors	Replication over bands
	0 31 001	Delayed descriptor replication factor	111B <sub>T</sub> B <sub>T</sub> – Section 1 (number of band)
	0 22 080	Waveband central frequency	$1f_1 f_1 f_1 f_1 x \dots$ – Section 1
	0 22 108	Spectral wave density ratio	$1c_1 c_1 c_2 c_2 \dots$ – Section 2 or $1c_{s1} c_{s1} c_{s2} c_{s2} \dots$ – Section 3
	0 22 086	Mean direction from which waves are coming	$1d_{a1} d_{a1}$ – Section 4
	0 22 087	Principal direction from which waves are coming	$d_{a2} d_{a2}$ – Section 4
	0 22 088	First normalized polar coordinate from Fourier coefficients	$r_1 r_1$ – Section 4
	0 22 089	Second normalized polar coordinate from Fourier coefficients	$r_2 r_2$ – Section 4
	1 05 000	Delayed replication of 5 descriptors (see Note 2)	
	0 31 001	Delayed descriptor replication factor	n – Section 5 (number of directions counted); = 0 if $I_b = 1$ (directional)
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 104	Scaled non-directional spectral wave density by frequency	$1A_1 A_1 A_1 x \dots$ – Section 5
	0 08 090	Decimal scale of following significands	Set to missing
	0 22 186	Direction from which waves are coming (see Note 3)	$1d_1 d_1$ – Section 5
	0 22 187	Directional spread of wave (see Note 3)	$d_s d_s$ – Section 5
	1 05 000	Delayed replication of 5 descriptors (see Note 4)	
	0 31 001	Delayed descriptor replication factor	n – Section 5 (Number of directions counted); = 0 if $I_b = 0$ (non-directional)
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 106	Scaled directional spectral wave density by frequency	$1A_1 A_1 A_1 x \dots$ – Section 5

	0 08 090	Decimal scale of following significands	Set to missing
	0 22 186	Direction from which waves are coming	1d <sub>1</sub> d <sub>1</sub> – Section 5
	0 22 187	Directional spread of wave	d <sub>s</sub> d <sub>s</sub> – Section 5

Notes:

- (1) Normally 1, may be 2 if both heave and slope sensors are in use, or 0 if no spectral data.
- (2) Non-directional spectra, ( $I_b = 0$  in WAVEOB) or partial directional spectra ( $I_b = 1$  in WAVEOB with one direction per wavenumber). Count = 0 (full directional spectra) or 1 (non-directional spectra or partial directional spectra). Partial directional spectra have only one direction per wavenumber band.
- (3) Missing for non-directional spectra.
- (4) Full directional spectra ( $I_b = 1$  in WAVEOB with more than one direction per wavenumber band). The replication count is the number of directions per wavenumber band which should normally cover the full circle.

**TM 308016 - BUFR template for WAVEOB data expressed as the wave number ( $I_a = 1$  in FM-65 WAVEOB).**

TABLE REFERENCE F X Y	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION
		<i>Identification (WAVEOB Section 0)</i>	
3 08 016	0 01 003	WMO Region number/geographical area	A <sub>1</sub> – First digit of WMO number (e.g. 62024 => 6)
	0 01 020	WMO Region sub-area	b <sub>w</sub> – Second digit of WMO number (e.g. 62024 => 2)
	0 01 005	Buoy/platform identifier	n <sub>b</sub> n <sub>b</sub> n <sub>b</sub> – Last 3 digits of WMO number (e.g. 62024 => 024)
	0 01 011	Ship or mobile land station identifier	D .... D
	0 01 007	Satellite identifier	l <sub>6</sub> l <sub>6</sub> l <sub>6</sub>
	0 01 001	WMO block number	ll
	0 01 002	WMO station number	iii – Iliii only apply to fixed sea stations
	0 02 044	Indicator for method of calculating spectral wave data	I <sub>m</sub> – Code table 1744 (WAVEOB), 0 02 044 (BUFR)
	0 02 045	Indicator for type of platform	I <sub>p</sub> – Code table 1747 (WAVEOB), 0 02 045 (BUFR)
	3 01 011	Year, month, day	YYMMJ – Date of observation
	3 01 012	Hour, minute	GGgg – Time of observation
	3 01 021	Latitude/longitude (high accuracy)	Q <sub>c</sub> L <sub>a</sub> L <sub>a</sub> L <sub>a</sub> L <sub>a</sub> , L <sub>o</sub> L <sub>o</sub> L <sub>o</sub> L <sub>o</sub> L <sub>o</sub>
		<i>Basic data (WAVEOB Section 0)</i>	
	0 22 063	Total water depth	1hhhh
	0 22 076	Direction from which dominant waves are coming	9d <sub>d</sub> d <sub>d</sub> – Section 0
	0 22 077	Directional spread of dominant wave	d <sub>s</sub> d <sub>s</sub> – Section 0
	0 22 094	Total number of wave bands	111B <sub>T</sub> B <sub>T</sub> – Section 1
	0 25 044	Wave sampling interval (space)	SSSS – Section 1
	0 22 079	Length of wave record	D'D'D'D' – Section 1
	1 05 002	Replicate 5 descriptors 2 times	Replication over sensor type
	0 02 046	Wave measurement instrumentation	= 1 Heave sensor, = 2 Slope sensor
	0 22 070	Significant wave height	2H <sub>s</sub> H <sub>s</sub> H <sub>s</sub> H <sub>s</sub> or 6H <sub>se</sub> H <sub>se</sub> H <sub>se</sub> H <sub>se</sub> H <sub>se</sub> H <sub>se</sub> – Section 0
	0 22 072	Spectral peak wave length	3P <sub>p</sub> P <sub>p</sub> P <sub>p</sub> P <sub>p</sub> – Section 0
	0 22 073	Maximum wave height	4H <sub>m</sub> H <sub>m</sub> H <sub>m</sub> H <sub>m</sub>
	0 22 075	Average wave length	5P <sub>a</sub> P <sub>a</sub> P <sub>a</sub> P <sub>a</sub> – Section 0
		<i>Spectral data (WAVEOB Section 1 – 5)</i>	
	1 27 000	Delayed replication of 27 descriptors	Replication over sensor type
	0 31 001	Delayed descriptor replication factor (see Note 1)	(0,1,2) normally 1
	0 02 046	Wave measurement instrumentation	= 1 Heave sensor, = 2 Slope sensor
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 103	Scaled maximum non-directional spectral wave density by wavenumber	C <sub>m</sub> C <sub>m</sub> C <sub>m</sub> – Section 2 or C <sub>sm</sub> C <sub>sm</sub> C <sub>sm</sub> – Section 3
	0 08 090	Decimal scale of following significands	Set to missing
	0 22 084	Band containing maximum non-directional spectral wave density	n <sub>m</sub> n <sub>m</sub> – Section 2 or n <sub>sm</sub> n <sub>sm</sub> – Section 3

	1 20 000	Delayed replication of 20 descriptors	Replication over band
	0 31 001	Delayed descriptor replication factor	111B <sub>T</sub> B <sub>T</sub> – Section 1 (number of band)
	0 22 081	Waveband central wave number	1f <sub>1</sub> f <sub>1</sub> f <sub>1</sub> f <sub>1</sub> x ... – Section 1
	0 22 108	Spectral wave density ratio	1c <sub>1</sub> c <sub>1</sub> c <sub>2</sub> c <sub>2</sub> ... – Section 2 or 1c <sub>s1</sub> c <sub>s1</sub> c <sub>s2</sub> c <sub>s2</sub> ... – Section 3
	0 22 086	Mean direction from which waves are coming	1d <sub>a1</sub> d <sub>a1</sub> – Section 4
	0 22 087	Principal direction from which waves are coming	d <sub>a2</sub> d <sub>a2</sub> – Section 4
	0 22 088	First normalized polar coordinate from Fourier coefficients	r <sub>1</sub> r <sub>1</sub> – Section 4
	0 22 089	Second normalized polar coordinate from Fourier coefficients	r <sub>2</sub> r <sub>2</sub> – Section 4
	1 05 000	Delayed replication of 5 descriptors (see Note 2)	
	0 31 001	Delayed descriptor replication factor	n – Section 5 (number of directions counted); = 0 if I <sub>b</sub> = 1 (directional)
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 105	Scaled non-directional spectral wave density by wavenumber	1A <sub>1</sub> A <sub>1</sub> A <sub>1</sub> x ... – Section 5
	0 08 090	Decimal scale of following significands	Set to missing
	0 22 186	Direction from which waves are coming (see Note 3)	1d <sub>1</sub> d <sub>1</sub> – Section 5
	0 22 187	Directional spread of wave (see Note 3)	d <sub>s</sub> d <sub>s</sub> – Section 5
	1 05 000	Delayed replication of 5 descriptors (see Note 4)	
	0 31 001	Delayed descriptor replication factor	n – Section 5 (number of directions counted); = 0 if I <sub>b</sub> = 0 (non-directional)
	0 08 090	Decimal scale of following significands	x – Scale to be applied to following element descriptors
	0 22 107	Scaled directional spectral wave density by wavenumber	1A <sub>1</sub> A <sub>1</sub> A <sub>1</sub> x ... – Section 5
	0 08 090	Decimal scale of following significands	Set to missing
	0 22 186	Direction from which waves are coming	1d <sub>1</sub> d <sub>1</sub> – Section 5
	0 22 187	Directional spread of wave	d <sub>s</sub> d <sub>s</sub> – Section 5

Notes:

- (1) Normally 1, may be 2 if both heave and slope sensors are in use, or 0 if no spectral data.
- (2) Non-directional spectra, (I<sub>b</sub> = 0 in WAVEOB) or partial directional spectra (I<sub>b</sub> = 1 in WAVEOB with one direction per wavenumber). Count = 0 (full directional spectra) or 1 (non-directional spectra or partial directional spectra). Partial directional spectra have only one direction per wavenumber band.
- (3) Missing for non-directional spectra.
- (4) Full directional spectra (I<sub>b</sub> = 1 in WAVEOB with more than one direction per wavenumber band). The replication count is the number of directions per wavenumber band which should normally cover the full circle.

## 7. BUFR elements and sequence for international exchange of road weather information

### Add entries:

In BUFR/CREX table B,

TABLE REFERENCE F X Y	ELEMENT NAME	BUFR				CREX		
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH
0 01 104	State/federal state identifier	CCITT IA5	0	0	32	Character	0	4
0 01 105	Highway designator	CCITT IA5	0	0	40	Character	0	5
0 01 106	Location along highway as	m	-2	0	14	m	-2	5

	indicated by position markers							
0 03 016	Position of road sensors	Code table	0	0	4	Code table	0	2
0 03 017	Extended type of station	Flag table	0	0	6	Flag table	0	2
0 03 018	Type of road	Code table	0	0	5	Code table	0	2
0 03 019	Type of construction	Code table	0	0	4	Code table	0	2
0 12 128	Road surface temperature	K	2	0	16	°C	2	5
0 12 129	Road sub-surface temperature	K	2	0	16	°C	2	5
0 13 116	Water film thickness	m	4	0	10	m	3	2
0 20 138	Road surface condition	Code table	0	0	4	Code table	0	2

In BUFR table D,

TABLE REFERENCE	TABLE REFERENCES	ELEMENT NAME	ELEMENT DESCRIPTION	
F X Y				
3 07 102	3 01 089	(Road weather information) <i>Station identification</i> National station identification	For identification of the road weather monitoring site	
	0 01 018	Short station or site name		
	0 01 015	Station or site name		
	0 01 104	State/federal state identifier		
	0 01 105	Highway designator		
	0 01 106	Location along highway as indicated by position markers		
	0 03 022	Extended type of station		
	0 03 023	Type of road		
	0 03 024	Type of construction		
	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 <i>Temperature, humidity and visibility data</i>		
	0 07 032	Height of sensor above local ground		
	0 12 101	Temperature/air temperature		
	0 12 103	Dewpoint temperature		
	0 13 003	Relative humidity		
	0 07 032	Height of sensor above local ground (or deck of marine platform)		Set to missing (cancel)
	0 20 001	Horizontal visibility <i>Road temperature and other data</i>		
	1 09 000	Delayed replication of 9 descriptors		
	0 31 001	Delayed descriptor replication factor		
	0 03 021	Position of road sensors		
	0 12 128	Road surface temperature		
1 02 000	Delayed replication of 2 descriptors			
0 31 001	Delayed descriptor replication factor			
0 07 061	Depth below land surface	= 0.30 m in the first replication, = e.g. 0.15 or 0.07 m in the second replication		
0 12 129	Road sub-surface temperature			
0 07 061	Depth below land surface	Set to missing (cancel)		
0 13 116	Water film thickness			

0 20 138	Road surface condition	
	<i>Precipitation data</i>	
0 04 025	Time period or displacement	= –15 minutes
0 20 024	Intensity of phenomena	Intensity (light, moderate, heavy) of precipitation
0 13 055	Intensity of precipitation	
0 20 021	Type of precipitation	
0 13 011	Total precipitation/total water equivalent of snow	
	<i>Wind data</i>	
0 07 032	Height of sensor above local ground (or deck of marine platform)	
0 08 021	Time significance	= 2 Time averaged
0 04 025	Time period or displacement	= –10 minutes
0 11 001	Wind direction	
0 11 002	Wind speed	
0 08 021	Time significance	Set to missing (cancel)
	<i>Maximum wind gust</i>	
0 04 025	Time period or displacement	In minutes
0 11 043	Maximum wind gust direction	
0 11 041	Maximum wind gust speed	
	<i>State of functionality</i>	
0 33 005	Quality information (AWS data)	

Notes:

- (1) To represent Intensity of precipitation, type of precipitation and state of functionality, 0 20 024 (Code table), 0 20 021 (Flag table) and 0 33 005 (Flag table) are used, respectively.
- (2) Some more descriptors are required to reduce the workload with respect to the station database, e.g. for identification of the federal state, identification of the highway, etc.
- (3) The majority of stations has only one position on the road and one sub-surface temperature sensor. Delayed replications have been introduced to increase flexibility and volume efficiency.
- (4) Each position of road sensors includes the measurements of
  - road surface temperature
  - road sub-surface temperatures
  - water film thickness
  - road surface condition
- (5) Some types of station do not have the ability to identify the surface condition accurately. They can only report conditions such as "not dry" or "glazed". The code table for road surface conditions has been adjusted accordingly.

**Add BUFR/CREX Code tables:**

**0 03 016**

**Position of road sensors**

Code figure

0	Fast lane between the wheel tracks
1	Fast lane between the wheel tracks in the opposite direction
2	Fast lane in the wheel tracks
3	Fast lane in the wheel tracks in the opposite direction
4	Slow lane between the wheel tracks
5	Slow lane between the wheel tracks in the opposite direction
6	Slow lane in the wheel tracks
7	Slow lane in the wheel tracks in the opposite direction
8–14	Reserved
15	Missing value

**0 03 017**

**Extended type of station**

Bit No.

1	Automatic
2	Manned
3	Event triggered
4	Longer time period than the standard
5	Reserved
All 6	Missing value

**0 03 018****Type of road**

Code figure

0	Free track without further information
1	Free track, embankment
2	Free track, flat relative to surroundings
3	Free track, water basin(s) in vicinity
4	Free track, forest
5	Free track, cleft
6	Free track, on hilltop
7	Free track, on hilltop, forest
8	Free track, in valley
9	Free track, in valley, forest
10	Free track, north inclination
11	Free track, north inclination, forest
12	Free track, south inclination
13	Free track, south inclination, forest
14–19	Reserved
20	Bridge without further information
21	Bridge across a valley in a urban area
22	Bridge across a valley with forest/meadows/fields
23	Bridge across street/track
24	Bridge across big river/canal
25	Bridge across river/canal of medium size
26	Bridge across a small stream/loading canal
27–30	Reserved
31	Missing value

**0 03 019****Type of construction**

Code figure

0	Asphalt
1	Concrete
2	Concrete construction
3	Steel-girder construction
4	Box girder bridge
5	Orthotropic slab
6	Drain asphalt
7–14	Reserved
15	Missing value



0 20 138

Road surface condition

Code figure

0	Dry
1	Moist
2	Wet
3	Rime
4	Snow
5	Ice
6	Glaze
7	Not dry
8–14	Reserved
15	Missing value

8. Synoptic reports from sea stations suitable for VOS observation data [f](#)

**Add entries:**

In BUFR/CREX Table B,

**Class 01 – BUFR/CREX Identification**

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	01	114	Encrypted ship or mobile land station identifier (base64 encoding)	CCITT IA5	0	0	352	Character	0	44

**Class 03 – BUFR/CREX Instrumentation**

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	03	001	Surface station type	Code table	0	0	5	Code table	0	2
0	03	003	Thermometer/hygrometer housing	Code table	0	0	4	Code table	0	2
0	03	004	Type of screen/shelter/radiation shield	Code table	0	0	4	Code table	0	2
0	03	005	Horizontal width of screen or shield (x)	m	3	0	16	m	3	5
0	03	006	Horizontal depth of screen or shield (y)	m	3	0	16	m	3	5
0	03	007	Vertical height of screen or shield (z)	m	3	0	16	m	3	5
0	03	008	Artificially ventilated screen or shield	Code table	0	0	3	Code table	0	1
0	03	009	Amount of forced ventilation at time of reading	m s <sup>-1</sup>	1	0	9	m s <sup>-1</sup>	1	3
0	03	020	Material for thermometer/hygrometer housing	Code table	0	0	3	Code table	0	1
0	03	021	Hygrometer heating	Code table	0	0	2	Code table	0	1
0	03	022	Instrument owner	Code table	0	0	3	Code table	0	1
0	03	023	Configuration of louvers for thermometer/hygrometer screen	Code table	0	0	3	Code table	0	1
0	03	024	Psychrometric coefficient	K <sup>-1</sup>	6	0	10	K <sup>-1</sup>	6	3

### Class 10 – BUFR/CREX Non coordinate location (vertical)

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	10	038	Maximum height of deck cargo above summer load line	m	0	0	6	m	0	2
0	10	039	Departure of reference level (summer maximum load line) from actual sea level	m	0	-32	6	m	0	3

### Class 11 – BUFR/CREX Wind and turbulence

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	11	007	Relative wind direction (in degrees off bow)	°	0	0	9	°	0	3
0	11	008	Relative wind speed	m s <sup>-1</sup>	1	0	12	m s <sup>-1</sup>	1	4

### Class 15 – BUFR/CREX Physical/chemical constituents

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	15	028	Mole fraction of atmospheric constituent/pollutant in dry air	‰	5	0	16	‰	5	5

### Class 25 – BUFR/CREX Processing information

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	25	185	Encryption method	Code table	0	0	8	Code table	0	3
0	25	186	Encryption key version	CCITT IA5	0	0	96	Character	0	12
0	25	188	Method for reducing pressure to sea level	Code table	0	0	5	Code table	0	2

### Class 41 – BUFR/CREX Oceanographic/bio-geochemical parameters

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	41	001	pCO <sub>2</sub>	Pa	3	0	18	Pa	3	6
0	41	002	Fluorescence	kg l <sup>-1</sup>	12	0	16	kg l <sup>-1</sup>	12	5
0	41	003	Dissolved nitrates	µmol kg <sup>-1</sup>	3	0	17	µmol kg <sup>-1</sup>	3	5
0	41	005	Turbidity	NTU	2	0	12	NTU	2	4

In BUFR Table D,

#### Category 01 – BUFR/CREX Location and identification sequences

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(Encrypted ship's call sign and encryption method)	
3	01	018	0	01	114	Encrypted ship or mobile land station identifier	
			0	25	185	Encryption method	
			0	25	186	Encryption key version	

#### Category 02 – BUFR/CREX Meteorological sequences common to surface data

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(Ship "instantaneous" data)	
3	02	062	0	25	188	Method for reducing pressure report to sea level	
			3	02	001	Pressure and 3-hour pressure change	
			3	02	093	Extended ship temperature and humidity data	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	053	Ship 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	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			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	
			0	08	002	Vertical significance (surface observations)	Set to missing (cancel)
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	055	Icing and ice	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	056	Sea/water temperature	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	021	Waves	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	024	Wind and swell waves	

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(Ship "period" data)	
3	02	063	3	02	038	Present and past weather	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	040	Precipitation measurement	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			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)
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	058	Ship extreme temperature data	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	064	Ship or other marine platform wind data	

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(VOSCLim data elements)	
3	02	092	0	11	104	True heading of aircraft, ship or other mobile platform	Ship's true heading
			0	01	012	Direction of motion of moving observing platform	Ship's course over ground
			0	01	013	Speed of motion of moving observing platform	Ship's speed over ground
			0	10	038	Maximum height of deck cargo above summer load line	
			0	10	039	Departure of reference level (summer maximum load line) from actual sea level	
			0	11	007	Relative wind direction (in degrees off bow)	
			0	11	008	Relative wind speed	

Table reference			Table references			Element name	Element description
F	XX	YYY	F	X	YYY		
						(Extended ship temperature and humidity data)	
3	02	093	0	07	032	Height of sensor above local ground (or deck of marine platform)	
			0	07	033	Height of sensor above water surface	
			3	03	099	Metadata common to temperature/humidity sensors	
			0	12	101	Temperature/air temperature	
			1	03	000	Delayed replication of 3 descriptors	
			0	31	000	Short delayed descriptor replication factor	Set to 0 if no change from previous values, 1 if changes
			0	07	032	Height of sensor above local ground (or deck of marine platform)	
			0	07	033	Height of sensor above water surface	
			3	03	099	Metadata common to temperature/humidity sensors	
			0	02	039	Method of wet-bulb temperature measurement	
			0	02	097	Type of humidity sensor	
			0	03	024	Psychrometric coefficient	Set to missing if type of humidity sensor is not psychrometer
			0	03	021	Hygrometer heating	
			0	12	102	Wet-bulb temperature	
			0	12	103	Dewpoint temperature	
			0	13	003	Relative humidity	
			0	07	032	Height of sensor above local ground (or deck of marine platform)	Cancel (set to missing)
			0	07	033	Height of sensor above water surface	Cancel (set to missing)
			3	03	099	Metadata common to temperature/humidity sensors	Cancel (set all elements in sequence to missing)
			0	02	039	Method of wet-bulb temperature measurement	Cancel (set to missing)
			0	02	097	Type of humidity sensor	Cancel (set to missing)
			0	03	021	Hygrometer heating	Cancel (set to missing)
			0	03	024	Psychrometric coefficient	Cancel (set to missing)

### Category 03 – BUFR/CREX Meteorological sequences common to vertical soundings data

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(Metadata common to temperature/humidity sensors)	
3	03	099	0	03	005	Horizontal width of screen or shield (x)	
			0	03	006	Horizontal depth of screen or shield (y)	
			0	03	007	Vertical height of screen or shield (z)	
			0	02	096	Type of thermometer	
			0	03	022	Instrument owner	
			0	03	003	Thermometer/hygrometer housing	
			0	03	020	Material for thermometer/hygrometer housing	
			0	03	004	Type of screen/shelter/radiation shield	
			0	03	023	Configuration of louvers for thermometer/hygrometer screen	
			0	03	008	Artificially ventilated screen or shield	
			0	03	009	Amount of forced ventilation at time of reading	

### Category 06 – BUFR/CREX Meteorological or oceanographic sequences common to oceanographic observations

Table reference			Table references			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(E-SURFMAR S-AWS Observations)	
3	06	043	0	41	001	pCO <sub>2</sub>	
			0	08	043	Atmospheric chemical or physical constituent type	Set to 3 (carbon dioxide)
			0	15	028	Mole fraction of atmospheric constituent/pollutant in dry air	
			0	08	043	Atmospheric chemical or physical constituent type	Cancel

			0	13	080	pH	
			0	41	005	Turbidity	
			0	41	003	Dissolved nitrates	
			0	22	188	Dissolved oxygen	
			0	41	002	Fluorescence	
			1	06	000	Delayed replication of 6 descriptors	
			0	31	000	Short delayed descriptor replication factor	
			0	04	024	Time period or displacement (hours)	Set to -1 (preceding hour)
			0	14	002	Long-wave radiation, integrated over period specified	Downwelling long-wave radiation
			0	14	002	Long-wave radiation, integrated over period specified	Upwelling long-wave radiation
			0	14	012	Net long-wave radiation, integrated over period specified	
			0	14	004	Short-wave radiation, integrated over period specified	
			0	04	024	Time period or displacement (hours)	Cancel

### Category 08 – BUFR/CREX Surface report sequences (sea)

Table reference			Table References			Element name	Element description
F	XX	YYY	F	XX	YYY		
						(Synoptic reports from sea stations suitable for VOS observation data)	
3	08	014	1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	01	018	Encrypted ship's call sign and encryption method	
			0	03	001	Surface station type	
			3	01	093	Ship identification, movement, date/time, horizontal and vertical coordinates	
			2	08	032	Change width of CCITT IA5 to 32 characters	
			0	01	079	Unique identifier for profile	Unique ID for report
			2	08	000	Change width of CCITT IA5	Cancel
			3	02	062	Ship "instantaneous" data	
			3	02	063	Ship "period" data	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	02	092	VOSClm data elements	
			1	01	000	Delayed replication of 1 descriptor	
			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	034	Surface current	
			1	01	000	Delayed replication of 1 descriptor	
			0	31	000	Short delayed descriptor replication factor	
			3	06	043	E-SURFMAR S-AWS Observations	

### Amend an element name:

In BUFR/CREX Table B,

### Class 11 – BUFR/CREX Wind and turbulence

Table Reference			Element name	BUFR				CREX		
F	XX	YYY		Unit	Scale	Ref. value	Data width (bits)	Unit	Scale	Data width (char)
0	11	104	True heading of aircraft, ship or other mobile platform	degree true	0	0	9	degree true	0	3

### Add and amend entries:

In BUFR/CREX Code tables,

**0 02 096**

**Type of temperature sensor**

Code figure	Meaning
0	Rod thermistor
1	Bead thermistor
2	Capacitance bead
3	Capacitance wire
4	Resistive sensor
5	Chip thermistor
6	Mercury
7	Alcohol/glycol
8–30	Reserved (for future use)
31	Missing value

**0 02 097**

**Type of humidity sensor**

Code figure	Meaning
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	Psychrometer
10	Capacitive (polymer)
11	Capacitive (ceramic, incl. metal oxide)
12	Resistive (generic)
13	Resistive (salt polymer)
14	Resistive (conductive polymer)
15	Thermal conductivity
16	Gravimetric
17	Paper-metal coil
18	Ordinary human hair
19	Rolled hair (torsion)
20	Goldbeater's skin
21	Chilled mirror hygrometer
22	Dew cell
23	Optical absorption sensor
24–30	Reserved for future use
31	Missing value

## **Add BUFR/CREX Code tables:**

### **0 03 001**

#### **Surface station type**

Code figure	Meaning
0	Land station (synoptic network)
1	Shallow water station (fixed to sea/lake floor)
2	Ship
3	Rig/platform
4	Moored buoy
5	Drifting buoy (or drifter)
6	Ice buoy
7	Land station (local network)
8	Land vehicle
9	Autonomous marine vehicle
10–30	Reserved (for future use)
31	Missing value

### **0 03 003**

#### **Thermometer/hygrometer housing**

Code figure	Meaning
0	Screen
1	Sling / Whirling
2	Unscreened
3	Radiation shield
4	Aspirated (e.g. Assmann)
5	Other Shelter
6	Handheld
7–14	Reserved for future use
15	Missing value

### **0 03 004**

#### **Type of screen/shelter/radiation shield**

Code figure	Meaning
0	Stevenson screen
1	Marine Stevenson screen
2	Cylindrical section plate shield
3	Concentric tube
4	Rectangular section shield
5	Square section shield
6	Triangular section shield
7	Open covered lean to
8	Open covered inverted V roof
9	Integrated (e.g. Chilled Mirror)
10–14	Reserved for future use
15	Missing value

### **0 03 008**

#### **Artificially ventilated screen or shield**

Code figure	Meaning
0	Natural ventilation in use
1	Artificial aspiration in use: constant flow at time of reading
2	Artificial aspiration in use: variable flow at time of reading
3–6	Reserved
7	Missing value

### **0 03 020**

#### **Material for thermometer/hygrometer housing**

Code figure	Meaning
0	Wood
1	Metal alloy
2	Plastic/GRP
3	Reed/grass/leaf
4–6	Reserved for future use
7	Missing value

### **0 03 021**

#### **Hygrometer heating**

Code figure	Meaning
0	Unheated
1	Heated
2	Not applicable
3	Missing value

### **0 03 022**

#### **Instrument owner**

Code figure	Meaning
0	National hydro meteorological/weather service
1	Other
2	Standards institute
3–6	Reserved for future use
7	Missing value

### **0 03 023**

#### **Configuration of louvers for thermometer/hygrometer screen**

Code figure	Meaning
0	Single v section louvers
1	Overlapping louvers
2	Double v section louvers
3	Non-overlapping louvers
4	Vented, non-louvered
5	Not applicable
6	Reserved for future use
7	Missing value

### **0 25 185**



### Encryption method

Code Figure	Meaning
0	AES 256
1–254	Reserved
255	Missing value

### 0 25 188

#### Method for reducing pressure report to sea level

Code Figure	Meaning
0	Pressure adjusted to mean sea level following WMO 8 for low level (< 50m) stations
1	Pressure adjusted to mean sea level following WMO 8 for stations below 750 m
2	Pressure adjusted to sea level following national practice
3	Pressure adjusted to local water level following national practice
4	Pressure not corrected for height
5–14	Reserved
15	Missing value

### Add an entry:

In Common Code table C-6,

Code figure		Conventional abbreviation	Abbreviation in IA5/ASCII	Abbreviation in IA2	Definition in base units
843	Nephelometric turbidity units	NTU	NTU		