

**ANNEX TO PARAGRAPH 2.1.1
OPERATIONAL**

EVENT PROBABILITIES

- Add the following entry to the Code Table 1.4:

8 Event Probability

- In Code Table 4.1, Product discipline 0, deprecate entries 9, 10,11, 12.

**ANNEX TO PARAGRAPH 2.1.3
OPERATIONAL**

NEW TABLE ENTRIES FOR QPF DATA

- Add new entry in Code Table 4.3 (Type of generating process):

Code figure	Meaning
10	Probability-weighted forecast

**ANNEX TO PARAGRAPH 2.1.4
OPERATIONAL**

NEW TABLE ENTRIES FOR WAFS DATA

New entries in Code Table 4.2:

Product discipline 0 – Meteorological products, parameter category 6: cloud		
Number	Parameter	Units
25	Horizontal extent of cumulonimbus (CB)	%

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

Number	Parameter	Units
20	Icing	%
21	In-cloud turbulence	%
22	Clear air turbulence (CAT)	%
23	Supercooled large droplet probability (see Note 4)	%

Add Note:

(4) Supercooled large droplets (SLD) are defined as those with a diameter greater than 50 microns.

New entry in Code Table 4.3 (Type of generating process):

Code figure	Meaning
9	Climatological

New entries in Code Table 4.5 (Fixed surface types and units):

Code figure	Meaning	Unit
10	Entire atmosphere	-
11	Cumulonimbus (CB) base	m
12	Cumulonimbus (CB) top	m

New entries in Code Table 4.207 (Icing):

Code figure	Meaning
4	Trace
5	Heavy

**ANNEX TO PARAGRAPH 2.1.5
PREOPERATIONAL**

NEW TEMPLATES FOR CHEMICALS

Addition of:

- a new category to Product Discipline 0 in In Code Table 4.1
- a set of new parameters in In Code **Table 4.2**
- a new Section 4 Code Table occupying 2 octets: Code Table 4.230, referring to a new **Common Code Table C-14: Atmospheric chemical or physical constituent type**
- new Product Definition Templates which include the new Code Table 4.230: **4.40 to 4.43**

In Code Table 4.1 proposed new entry:

Product Discipline 0:	Meteorological products
Category Description	
20	<i>Atmospheric chemical constituents</i>
21-189	Reserved

In Code Table 4.2 the following addition:

Product Discipline 0: Meteorological products, Parameter Category 20: Atmospheric chemical constituents

Number	Parameter	Units
0	Mass density (concentration)	kg m ⁻³
1	Column-integrated mass density (see Note 1)	kg m ⁻²
2	Mass mixing ratio (mass fraction in air)	kg kg ⁻¹
3	Atmosphere emission mass flux	kg m ⁻² s ⁻¹
4	Atmosphere net production mass flux	kg m ⁻² s ⁻¹
5	Atmosphere net production and emission mass flux	kg m ⁻² s ⁻¹
6	Surface dry deposition mass flux	kg m ⁻² s ⁻¹
7	Surface wet deposition mass flux	kg m ⁻² s ⁻¹
8	Atmosphere re-emission mass flux	kg m ⁻² s ⁻¹
9-49	Reserved	
50	Amount in atmosphere	mol
51	Concentration in air	mol m ⁻³
52	Volume mixing ratio (fraction in air)	mol mol ⁻¹
53	Chemical gross production rate of concentration	mol m ⁻³ s ⁻¹
54	Chemical gross destruction rate of concentration	mol m ⁻³ s ⁻¹

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.

55	Surface flux	$\text{mol m}^{-2} \text{s}^{-1}$
56	Changes of amount in atmosphere (see Note 1)	mol s^{-1}
57	Total yearly average burden of the atmosphere	mol
58	Total yearly averaged atmospheric loss (see Note 1)	mol s^{-1}
59-99	Reserved	
100	Surface area density (aerosol)	m^{-1}
101	Atmosphere optical thickness	m
102-191	Reserved	
192-254	Reserved for local use	
255	Missing	

Code Table 4.230: Atmospheric chemical constituent type
(see *Common Code Table C-14*)

Proposed new Product Definition Templates

The following proposed Product Definition Templates are based on existing templates with the inclusion of the new proposed Code Table 4.230.

Product Definition Template 4.40: Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17-18	Hours of observational data cutoff after reference time (see Note 1)
19	Minutes of observational data cutoff after reference time
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface

Note:

- Hours greater than 65534 will be coded as 65534.

Product Definition Template 4.41: Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code Table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble

Note:

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

Product Definition Template 4.42: Average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37-38	Year
39	Month
40	Day
41	Hour
42	Minute
43	Second
44	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
45-48	Total number of data values missing in statistical process
	<i>49-60 Specification of the outermost (or only) time range over which statistical processing is done</i>
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
52-55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
57-60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	<i>61-nn These octets are included only if $n > 1$, where $nn = 48 + 12 * n$</i>
61-72	As octets 49 to 60, next innermost step of processing
73- nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary.

Notes:

1. Hours greater than 65534 will be coded as 65534.
2. The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
3. An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge.
4. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 50, 62, 74 ...). For all but the innermost (last) time range, the next inner range is then processed using these references and forecast times as the initial reference and forecast time.

Product Definition Template 4.43: Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code Table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble
40-41	Year of end of overall time interval
42	Month of end of overall time interval
43	Day of end of overall time interval
44	Hour of end of overall time interval
45	Minute of end of overall time interval
46	Second of end of overall time interval
47	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
48-51	Total number of data values missing in statistical process
	<i>52-63 Specification of the outermost (or only) time range over which statistical processing is done</i>
52	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
53	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
54	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
55-58	Length of the time range over which statistical processing is done, in units defined by the previous octet
59	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
60-63	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	<i>64-nn These octets are included only if n>1, where nn = 51 + 12 * n</i>
64-75	As octets 52 to 63, next innermost step of processing

76-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 52 to 63, repeated as necessary.
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Notes:

1. Hours greater than 65534 will be coded as 65534.
2. The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
3. An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge.
4. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 53, 65, 77 ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast time.

**NEW COMMON CODE TABLE C-14:
FOR URGENT VALIDATION**

Atmospheric chemical or physical constituent type

Code figure	Meaning	Chemical formula
0	Ozone	O ₃
1	Water vapour	H ₂ O
2	Methane	CH ₄
3	Carbon dioxide	CO ₂
4	Carbon monoxide	CO
5	Nitrogen dioxide	NO ₂
6	Nitrous oxide	N ₂ O
7	Formaldehyde	HCHO
8	Sulphur dioxide	SO ₂
9	Ammonia	NH ₃
10	Ammonium	NH ₄ ⁺
11	Nitrogen monoxide	NO
12	Atomic oxygen	O
13	Nitrate radical	NO ₃
14	Hydroperoxyl radical	HO ₂
15	Dinitrogen pentoxide	N ₂ O ₅
16	Nitrous acid	HONO
17	Nitric acid	HNO ₃
18	Peroxynitric acid	HO ₂ NO ₂
19	Hydrogen peroxide	H ₂ O ₂
20	Molecular hydrogen	H
21	Atomic nitrogen	N
22	Sulphate	SO ₄ ²⁻
23	Radon	Rn
24	Elemental mercury	Hg(0)
25	Divalent mercury	Hg ²⁺
26	Atomic chlorine	Cl
27	Chlorine monoxide	ClO
28	Dichlorine peroxide	Cl ₂ O ₂
29	Hypochlorous acid	HClO

30	Chlorine nitrate	ClONO ₂
31	Chlorine dioxide	ClO ₂
32	Atomic bromine	Br
33	Bromine monoxide	BrO
34	Bromine chloride	BrCl
35	Hydrogen bromide	HBr
36	Hypobromous acid	HBrO
37	Bromine nitrate	BrONO ₂
38-9999	Reserved	
10000	Hydroxyl radical	OH
10001	Methyl peroxy radical	CH ₃ O ₂
10002	Methyl hydroperoxide	CH ₃ O ₂ H
10004	Methanol	CH ₃ OH
10005	Formic acid	CH ₃ OOH
10006	Hydrogen Cyanide	HCN
10007	Aceto nitrile	CH ₃ CN
10008	Ethane	C ₂ H ₆
10009	Ethene (= Ethylene)	C ₂ H ₄
10010	Ethyne (= Acetylene)	C ₂ H ₂
10011	Ethanol	C ₂ H ₅ OH
10012	Acetic acid	C ₂ H ₅ OOH
10013	Peroxyacetyl nitrate	CH ₃ C(O)OONO ₂
10014	Propane	C ₃ H ₈
10015	Propene	C ₃ H ₆
10016	Butanes	C ₄ H ₁₀
10017	Isoprene	C ₅ H ₁₀
10018	Alpha pinene	C ₁₀ H ₁₆
10019	Beta pinene	C ₁₀ H ₁₆
10020	Limonene	C ₁₀ H ₁₆
10021	Benzene	C ₆ H ₆
10022	Toluene	C ₇ H ₈
10023	Xylene	C ₈ H ₁₀
10024-10499	reserved for other simple organic molecules (e.g. higher aldehydes, alcohols, peroxides,...)	
10500	Dimethyl sulphide	CH ₃ SCH ₃ (DMS)
10501-20000	Reserved	
20001	Hydrogen chloride	
20002	CFC-11	
20003	CFC-12	
20004	CFC-113	
20005	CFC-113a	
20006	CFC-114	
20007	CFC-115	
20008	HCFC-22	
20009	HCFC-141b	
20010	HCFC-142b	
20011	Halon-1202	
20012	Halon-1211	
20013	Halon-1301	
20014	Halon-2402	
20015	Methyl chloride (HCC-40)	
20016	Carbon tetrachloride (HCC-10)	
20017	HCC-140a	CH ₃ CCl ₃
20018	Methyl bromide (HBC-40B1)	

20019	Hexachlorocyclohexane (HCH)	
20020	Alpha hexachlorocyclohexane	
20021	Hexachlorobiphenyl (PCB-153)	
20022-29999	Reserved	
30000-59999	Reserved	
60000	HOx radical (OH+HO ₂)	
60001	Total inorganic and organic peroxy radicals (HO ₂ + RO ₂)	RO ₂
60002	Passive Ozone	
60003	NO _x expressed as nitrogen	NO _x
60004	All nitrogen oxides (NO _y) expressed as nitrogen	NO _y
60005	Total inorganic chlorine	Cl _x
60006	Total inorganic bromine	Br _x
60007	Total inorganic chlorine except HCl, ClONO ₂ : ClO _x	
60008	Total inorganic bromine except HBr, BrONO ₂ : BrO _x	
60009	Lumped Alkanes	
60010	Lumped Alkenes	
60011	Lumped Aromatic Compounds	
60012	Lumped Terpenes	
60013	Non-methane volatile organic compounds expressed as carbon	NMVOC
60014	Anthropogenic non-methane volatile organic compounds expressed as carbon	aNMVOC
60015	Biogenic non-methane volatile organic compounds expressed as carbon	bNMVOC
60016	Lumped oxygenated hydrocarbons	OVOC
60017-61999	Reserved	
62000	Total aerosol	
62001	Dust dry	
62002	Water in ambient	
62003	Ammonium dry	
62004	Nitrate dry	
62005	Nitric acid trihydrate	
62006	Sulphate dry	
62007	Mercury dry	
62008	Sea salt dry	
62009	Black carbon dry	
62010	Particulate organic matter dry	
62011	Primary particulate organic matter dry	
62012	Secondary particulate organic matter dry	
62013-65534	Reserved	
65535	Missing	

Update Code Table 4.0:

Code Table 4.0: Number	Product Definition Template Number Description
0	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time
1	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
2	Derived forecast based on all ensemble members at a horizontal level or in a horizontal layer at a point in time
3	Derived forecasts based on a cluster of ensemble members over a rectangular area at a horizontal level or in a horizontal layer at a point in time
4	Derived forecasts based on a cluster of ensemble members over a circular area at a horizontal level or in a horizontal layer at a point in time
5	Probability forecasts at a horizontal level or in a horizontal layer at a point in time
6	Percentile forecasts at a horizontal level or in a horizontal layer at a point in time
7	Analysis or forecast error at a horizontal level or in a horizontal layer at a point in time
8	Average, accumulation, extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
9	Probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
10	Percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
11	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
12	Derived forecasts based in all ensemble members at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
13	Derived forecasts based on a cluster of ensemble members over a rectangular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
14	Derived forecasts based on a cluster of ensemble members over a circular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
15-19	Reserved
20	Radar product
21-29	Reserved
30	Satellite product (deprecated)
31	Satellite product
32-39	Reserved
40	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
41	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
42	Average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents
43	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents
44-253	Reserved
254	CCITT IA5 character string
255-999	Reserved
1000	Cross section of analysis and forecast at a point in time
1001	Cross section of averaged or otherwise statistically processed analysis or forecast over a range of time
1002	Cross-section of analysis and forecast, averaged or otherwise statistically processed
1003-1099	Reserved
1100	Hovmöller-type grid with no averaging or other statistical processing
1101	Hovmöller-type grid with averaging or other statistical processing
1102-32767	Reserved
32768-65534	Reserved for local use
65535	Missing

**ANNEX TO PARAGRAPH 2.1.6
FOR VALIDATION**

NEW GRID DEFINITION TEMPLATE FOR IRREGULAR LAT/LONG GRID

Grid Definition Template 3.130: Irregular Latitude/longitude grid

Octet Number(s)	Contents
15	Shape of the earth (see Code Table 3.2)
16	Scale factor of radius of spherical earth
17-20	Scaled value of radius of spherical earth
21	Scale factor of major axis of oblate spheroid earth
22-25	Scaled value of major axis of oblate spheroid earth
26	Scale factor of minor axis of oblate spheroid earth
27-30	Scaled value of minor axis of oblate spheroid earth
31-(N*4*2)	Ordered list of latitude/longitude pairs for each grid point. The list of numbers are integer values of the valid latitudes in microdegrees (scaled by 10 ⁶). Each integer value is represented in 4 octets and general regulations 92.1.7 and 92.1.8 apply. N is the number of data points defined in octets 7-10.

Add in:

Code Table 3.1: Grid Definition Template Number

Code figure	Meaning	Comments
121- 129	Reserved	
130	Irregular Latitude/longitude grid	
131- 999	Reserved	

**ANNEX TO PARAGRAPH 2.1.7
FOR VALIDATION**

NEW TEMPLATES FOR CATEGORICAL FORECAST DATA

Product Definition Template 4.51: Categorical forecasts at a horizontal level or in a horizontal layer at a point in time

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12	Type of generating process (see Code Table 4.3)
13	Background generating process identifier (defined by originating Centre)
14	Forecast generating process identifier (defined by originating Centre)
15-16	Hours after reference time of data cutoff (see Note 1)
17	Minutes after reference time of data cutoff
18	Indicator of unit of time range (see Code Table 4.4)
19-22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code Table 4.5)
24	Scale factor of first fixed surface
25-28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code Table 4.5)
30	Scale factor of second fixed surface
31-34	Scaled value of second fixed surface
35	NC - Number of categories

Repeat the following 12 octets for each category ($i = 1, NC$)

(36+12(i-1))	Code figure
(37+12(i-1))	Type of interval for first and second limit (see Code Table 4.91)
(38+12(i-1))	Scale factor of first limit
(39+12(i-1))- (42+12(i-1))	Scaled value of first limit
(43+12(i-1))	Scale factor of second limit
(44+12(i-1))- (47+12(i-1))	Scaled value of second limit

Note:

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

Product Definition Template 4.91: Categorical forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12	Type of generating process (see Code Table 4.3)
13	Background generating process identifier (defined by originating Centre)
14	Forecast generating process identifier (defined by originating Centre)
15-16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code Table 4.4)
19-22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code Table 4.5)
24	Scale factor of first fixed surface
25-28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code Table 4.5)
30	Scale factor of second fixed surface
31-34	Scaled value of second fixed surface
35	NC - Number of categories

Repeat the following 12 octets for each category ($i = 1, NC$)

(36+12(i-1))	Code figure
(37+12(i-1))	Type of interval for first and second limit (see Code Table 4.91)
(38+12(i-1))	Scale factor of first limit
(39+12(i-1))- (42+12(i-1))	Scaled value of first limit
(43+12(i-1))	Scale factor of second limit
(44+12(i-1))- (47+12(i-1))	Scaled value of second limit
(48+12(NC -1))- (49+12(NC -1))	Year of end of overall time interval
(50+12(NC -1))	Month of end of overall time interval
(51+12(NC -1))	Day of end of overall time interval
(52+12(NC -1))	Hour of end of overall time interval
(53+12(NC -1))	Minute of end of overall time interval
(54+12(NC -1))	Second of end of overall time interval
(55+12(NC -1))	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
(56+12(NC -1))- (59+12(NC -1))	Total number of data values missing in statistical process.
60-71	<i>Specification of the outermost (or only) time range over which statistical processing is done</i>
(60+12(NC -1))	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
(61+12(NC -1))	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
(62+12(NC -1))	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
(63+12(NC -1))- (66+12(NC -1))	Length of the time range over which statistical processing is done, in units defined by the previous octet
(67+12(NC -1))	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
(68+12(NC -1))- (71+12(NC -1))	Time increment between successive fields, in units defined by the previous octet (see Note 3)
72- nn	<i>These octets are included only if $n > 1$, where $nn = 72 + 12*(n-1) + 12*(NC-1)$</i>
(72+12(NC -1))- (83+12(NC -1))	As octets (60+12(NC -1)) to (71+12(NC -1)), next innermost step of processing
(84+12(NC -1))- nn	Additional time range specifications, included in accordance with the value of n . Contents as octets (60+12(NC -1)) to (71+12(NC -1)), repeated as necessary.

Notes:

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

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

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

New table entries in code table 4.0:

Code Table 4.0:

Product Definition Template Number

Number	Description
51	Categorical forecasts at a horizontal level or in a horizontal layer at a point in time
91	Categorical forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

New code table 4.91:

Code Table 4.91: Type of Interval

Code figure	Meaning
0	Smaller than first limit
1	Greater than second limit
2	Between first and second limit. The range includes the first limit but not the second limit.
3	Greater than first limit
4	Smaller than second limit
5	Smaller or equal first limit
6	Greater or equal second limit
7	Between first and second. The range includes the first limit and the second limit.
8	Greater or equal first limit
9	Smaller or equal second limit
10	Between first and second limit. The range includes the second limit but not the first limit.
11	Equal to first limit.
12-191	Reserved
192-254	Reserved for local use
255	Missing

Renamed code table 4.205:

Code Table 4.205: Presence of aerosol

Code figure	Meaning
0	Aerosol not present
1	Aerosol present
2-191	Reserved
192-254	Reserved for local use
255	Missing

**ANNEX TO PARAGRAPH 2.1.8
FOR URGENT VALIDATION**

NEW TEMPLATES FOR ATMOSPHERIC AEROSOLS

Product Definition Template 4.44: Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for Aerosol

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1).
11	Parameter number (see Code Table 4.2).
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
25	Type of generating process (see Code Table 4.3)
26	Background generating process identifier (defined by originating centre)
27	Analysis or forecast generating processes identifier (defined by originating centre)
28-29	Hours of observational data cutoff after reference time (see Note 1)
30	Minutes of observational data cutoff after reference time
31	Indicator of unit of time range (see Code Table 4.4)
32-33	Forecast time in units defined by octet 18
34	Type of first fixed surface (see Code Table 4.5)
35	Scale factor of first fixed surface
36-39	Scaled value of first fixed surface
40	Type of second fixed surface (see Code Table 4.5)
41	Scale factor of second fixed surface
42-45	Scaled value of second fixed surface

Note:

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

Product Definition Template 4.45: Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for Aerosol

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
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 cutoff (see Note 1)
30	Minutes after reference time of data cutoff
31	Indicator of unit of time range (see Code Table 4.4)
32-35	Forecast time in units defined by octet 18
36	Type of first fixed surface (see Code Table 4.5)
37	Scale factor of first fixed surface
38-41	Scaled value of first fixed surface
42	Type of second fixed surface (see Code Table 4.5)
43	Scale factor of second fixed surface
44-47	Scaled value of second fixed surface

- 48 Type of ensemble forecast (see Code Table 4.6)
- 49 Perturbation number
- 50 Number of forecasts in ensemble

Note:

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

Product Definition Template 4.46: Average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for Aerosol

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
25	Type of generating process (see Code Table 4.3)
26	Background generating process identifier (defined by originating Centre)
27	Analysis or Forecast generating process identifier (defined by originating Centre)
28-29	Hours after reference time of data cut-off (see Note 1)
30	Minutes after reference time of data cut-off
31	Indicator of unit of time range (see Code Table 4.4)
32-35	Forecast time in units defined by octet 18 (see Note 2)
36	Type of first fixed surface (see Code Table 4.5)
37	Scale factor of first fixed surface
38-41	Scaled value of first fixed surface
42	Type of second fixed surface (see Code Table 4.5)
43	Scale factor of second fixed surface
44-47	Scaled value of second fixed surface
48-49	Year
50	Month
51	Day Time of end of overall time interval
52	Hour
53	Minute
54	Second
55	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
56-59	Total number of data values missing in statistical process.
60-71	<i>Specification of the outermost (or only) time range over which statistical processing is done</i>
60	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
61	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
62	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
63-66	Length of the time range over which statistical processing is done, in units defined by the previous octet
67	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
68-71	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
71-nn	These octets are included only if n>1, where nn = 59 + 12 * n
71-74	As octets 47 to 58, next innermost step of processing

75-nn Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary.

Notes:

- (1) Hours greater than 65534 will be coded as 65534.
- (2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
- (3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge.
- (4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 61, 72 ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast time.

Product definition template 4.47: Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for Aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
25	Background generating process identifier (defined by originating centre)
26	Forecast generating process identifier (defined by originating centre)
27-28	Hours after reference time of data cut-off (see Note 1)
29	Minutes after reference time of data cut-off
30	Indicator of unit of time range (see Code table 4.4)
31-34	Forecast time in units defined by octet 18 (see Note 2)
35	Type of first fixed surface (see Code table 4.5)
36	Scale factor of first fixed surface
37-40	Scaled value of first fixed surface
41	Type of second fixed surface (see Code table 4.5)
42	Scale factor of second fixed surface
43-46	Scaled value of second fixed surface
47	Type of ensemble forecast (see Code table 4.6)
48	Perturbation number
49	Number of forecasts in ensemble
50-51	Year of end of overall time interval
52	Month of end of overall time interval
53	Day of end of overall time interval
54	Hour of end of overall time interval
55	Minute of end of overall time interval
56	Second of end of overall time interval
57	n — number of time range specifications describing the time intervals used to calculate the statistically-processed field
58-61	Total number of data values missing in statistical process
62-73	<i>Specification of the outermost (or only) time range over which statistical processing is done</i>
62	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
63	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)

64	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
65-68	Length of the time range over which statistical processing is done, in units defined by the previous octet
69	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
70-73	Time increment between successive fields, in units defined by the previous octet (see Note 3)
<i>74-nn These octets are included only if n>1, where nn = 61 + 12 x n</i>	
74-85	As octets 62 to 73, next innermost step of processing
74-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 62 to 73, repeated as necessary

Notes:

- (1) Hours greater than 65534 will be coded as 65534.
- (2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
- (3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a raingauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 63, 75 ...). For all but the innermost (last) time range, the next inner range is then processed using these references and forecast times as the initial reference and forecast time.

New entries in table 4.0:

Code Table 4.0:

Product Definition Template Number

Number	Description
44	Aerosol analysis or forecast at a horizontal level or in a horizontal layer at a point in time
45	Aerosol individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
46	Aerosol 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
47	Aerosol 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

New code table type of interval.

Code Table 4.91:

Type of Interval

Code figure	Meaning
0	Smaller than first limit
1	Greater than second limit
2	Between first and second limit. The range includes the first limit but not the second limit.
3	Greater than first limit
4	Smaller than second limit
5	Smaller or equal first limit
6	Greater or equal second limit
7	Between first and second. The range includes the first limit and the second limit.
8	Greater or equal first limit
9	Smaller or equal second limit
10	Between first and second limit. The range includes the second limit but not the first limit.

11	Equal to first limit.
12-191	Reserved
192-254	Reserved for local use
255	Missing

Code Table 4.233: Aerosol type
(See *Common Code Table C-14*)

ANNEX TO PARAGRAPH 2.1.9

OPERATIONAL

Add a preliminary Note in Code Table 4.2:

Code Table 4.2 Parameter number by product discipline and parameter category

Note: By convention, the flux sign is positive if downwards.

FOR URGENT VALIDATION

New entries in Code Table 4.2:

Meteorological products, temperature category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	0	18	Snow temperature (top of snow)	K
0	0	19	Turbulent transfer coefficient for heat	Numeric
0	0	20	Turbulent diffusion coefficient for heat	m ² s ⁻¹

Meteorological products, moisture category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	1	69	Total column integrated cloud water	kg m ⁻²
0	1	70	Total column integrated cloud ice	kg m ⁻²
0	1	71	Hail mixing ratio	kg kg ⁻¹
0	1	72	Total column integrated hail	kg m ⁻²
0	1	73	Hail precipitation rate	kg m ⁻² s ⁻¹
0	1	74	Total column integrated graupel	kg m ⁻²
0	1	75	Graupel (snow pellets) precipitation rate	kg m ⁻² s ⁻¹
0	1	76	Convective rain rate	kg m ⁻² s ⁻¹
0	1	77	Large scale rain rate	kg m ⁻² s ⁻¹
0	1	78	Total column integrated water (all components incl. precipitation)	kg m ⁻²
0	1	79	Evaporation rate	kg m ⁻² s ⁻¹
0	1	80	Total Condensate	kg kg ⁻¹
0	1	81	Total Column-Integrated Condensate	kg m ⁻²
0	1	82	Cloud Ice Mixing-Ratio	kg kg ⁻¹
<i>Parameters which should be deprecated (should be coded as rates):</i>				
0	1	47	Large scale water precipitation (non-convective)	kg m ⁻²
0	1	48	Convective water precipitation	kg m ⁻²
0	1	49	Total water precipitation	kg m ⁻²
0	1	50	Total snow precipitation	kg m ⁻²

Meteorological products, momentum category

DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	2	31	Turbulent diffusion coefficient for momentum	$\text{m}^2 \text{s}^{-1}$

Meteorological products, cloud category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	6	26	Height of convective cloud base	m
0	6	27	Height of convective cloud top	m
0	6	28	Number concentration of cloud droplets	kg^{-1}
0	6	29	Number concentration of cloud ice	kg^{-1}
0	6	30	Number density of cloud droplets	m^{-3}
0	6	31	Number density of cloud ice	m^{-3}
<i>Parameter to be deprecated (moved to moisture category):</i>				
0	6	17	Total Condensate	kg kg^{-1}
0	6	18	Total Column-Integrated Cloud Water	kg m^{-2}
0	6	19	Total Column-Integrated Cloud Ice	kg m^{-2}
0	6	20	Total Column-Integrated Condensate	kg m^{-2}
0	6	23	Cloud ice mixing ratio	kg kg^{-1}

Note: This category should be used to report cloud characteristics not involving moisture. Any moisture parameters pertaining to clouds should be reported using Discipline 0, Category 1 (Moisture)

Meteorological products, Thermodynamic Stability category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	7	13	Showalter index	K

Meteorological products, Radar category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	15	9	Reflectivity of cloud droplets	dB
0	15	10	Reflectivity of cloud ice	dB
0	15	11	Reflectivity of snow	dB
0	15	12	Reflectivity of rain	dB
0	15	13	Reflectivity of graupel	dB
0	15	14	Reflectivity of hail	dB

Meteorological products, Physical Atmospheric properties category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	19	24	Convective turbulent kinetic energy	J kg ⁻¹
0	19	25	Weather Interpretation ww (WMO)	-

Meteorological products, Miscellaneous category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	191	1	Geographical latitude	deg N
0	191	2	Geographical longitude	deg E

Land Surface products, Vegetation/Biomass category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
2	0	28	Leaf area index	Numeric
2	0	29	Evergreen forest	Numeric
2	0	30	Deciduous forest	Numeric
2	0	31	Normalized differential vegetation index (NDVI)	Numeric
2	0	32	Root depth of vegetation	M
<i>Parameters which should be set obsolete (moved to soil category):</i>				
2	0	2	Soil Temperature	K
2	0	22	Soil moisture	kg m ⁻³
2	0	23	Column-integrated soil water	kg m ⁻²

Land Surface products, Soil category				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
2	3	18	Soil Temperature	K
2	3	19	Soil moisture	kg m ⁻³
2	3	20	Column-integrated soil moisture	kg m ⁻²
2	3	21	Soil ice	kg m ⁻³
2	3	22	Column-integrated soil ice	kg m ⁻²

New entries in CODE TABLE 4.213: SOIL TYPE

Code figure	Meaning
12	Loam
13	Peat
14	Rock
15	Ice
16	Water

**ANNEX TO PARAGRAPH 2.1.10
FOR VALIDATION**

Product Definition Template 4.50: Analysis or forecast of a multi component parameter or matrix element at a point in time

(Additions to PDT 4.0 are marked in red)

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1).
11	Parameter number (see Code Table 4.2).
12	Type of generating process (see Code Table 4.3)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating processes identifier (defined by originating centre)
15-16	Hours of observational data cutoff after reference time (see Note 1)
17	Minutes of observational data cutoff after reference time
18	Indicator of unit of time range (see Code Table 4.4)
19-22	Forecast time in units defined by octet 18
23	Type of first fixed surface (see Code Table 4.5)
24	Scale factor of first fixed surface
25-28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code Table 4.5)
30	Scale factor of second fixed surface
31-34	Scaled value of second fixed surface
35	First dimension physical significance (Code Table 5.3) (see Note 2)
36	Second dimension physical significance (Code Table 5.3) (see Note 2)
37-40	First dimension coordinate value (IEEE 32-bit floating-point value)
41-44	Second dimension coordinate value (IEEE 32-bit floating-point value)
45-48	First dimension (rows) of the complete matrix (see Note 3)
49-52	Second dimension (columns) of the complete matrix (see Note 3)

Notes:

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

(2) In case of ocean wave spectra e.g., according to Code Table 5.3, the physical significance values are 1 (Direction Degrees true) and 2 (Frequency (s⁻¹)).

(3) The dimensions define the number of GRIBs needed for reconstruction of a complete matrix (e.g. wave spectrum) at one or more grid points. In case of vectors (1-dim-matrices), the second dimension must be set to 1 and the second dimension physical significance must be set to 255 (missing).

In case of multi component parameter (e.g. no matrix or vector element), first and second dimension are set to 1.

New entry in Table 4.0:

Code Table 4.0:

Product Definition Template Number

Number	Description
50	Analysis or forecast of a multi component parameter or matrix element at a point in time

**ANNEX TO PARAGRAPH 2.1.11
FOR VALIDATION**

New Grid Definition:

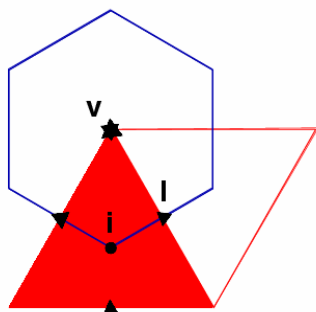
Grid definition template 3.101 General Unstructured Grid

Octet no.

- 15 Shape of the Earth (see Code Table 3.2)
- 16 – 18 Number of grid used (defined by originating centre)
- 19 Number of grid in reference (to allow annotating for Arakawa C-grid on arbitrary grid) (see Note 1)

Note:

(1) The Number is associated with an attribute of the respective grid description which consists of the centre longitude/latitude and the longitude/latitude of the boundary polygon vertices.



Variables can be defined on different positions in the triangle.

This leads to different sets of geo locations, e.g.:

1. triangles (i) (pressure, temperature,..)
2. quads (l) (wind velocity ..)
3. hexagons respectively pentagons (v) (vorticity)

Additional entry in Code Table 3.1: Grid template definition number

101 General Unstructured Grid

**ANNEX TO PARAGRAPH 2.1.12
FOR VALIDATION**

Data Representation Template 5.42: Grid point and spectral data - CCSDS szip

Preliminary note: For most templates, details of the packing process are described in regulation 92.9.4

Octet Number(s)	Contents
12-15	Reference value (R) (IEEE 32-bit floating-point value)
16-17	Binary scale factor (E)
18-19	Decimal scale factor (D)
20	Number of bits required to hold the resulting scaled and referenced data values.
21	Type of original field values (see Code Table 5.1)
22	szip options mask
23	szip bits per pixel
27-28	szip pixels per block
29-30	szip pixels per scan line

Notes:

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

(2) The Consultative Committee for Space Data Systems (CCSDS) szip is the standard used by space agencies for the compression of scientific data transmitted from satellites and other space instruments. CCSDS szip is a very fast predictive compression algorithm based on the extended-Rice algorithm, it uses Golomb-Rice codes for entropy coding. The sequence of prediction errors is divided into blocks. Each block is compressed using a two-pass algorithm. In the first pass the best coding method for the whole block is determined. In the second pass, output of the marker of the selected coding method as a side information is done along with prediction errors encoded.

The coding methods include:

- Golomb-Rice codes of a chosen rank
- Unary code for transformed pairs of prediction errors
- Fixed-length natural binary code if the block is found to be incompressible
- Signaling to the decoder empty block if all prediction errors are zeroes

A detailed description can be found in:

Consultative Committee for Space Data Systems: Lossless Data Compression.

CCSDS Recommendation for Space System Data Standards,
CCSDS 121.0-B-1, Blue Book, May 1997.



CCSDS121.0b1.pdf



CCSDS120.0g2.pdf

Note: CCSDS szip is often confused with a general-purpose compression utility by Schindler, which is also called szip.

Additional entry in Code Table 5.0: Data representation template number

42 Grid point and spectral data - CCSDS szip

**ANNEX TO PARAGRAPH 2.1.13
FOR VALIDATION
GRIB2 for Paleo Climate**

1.) Add in Section 1 - Identification Section:

Octet no.

22-24 Tens of thousands of years (for paleo climate (e.g. 83 billion years))

2.) Add as Note:

If applicable, year specification before Christ (B.C.) shall be indicated by setting the most significant bit of octet no. 13-14 and 22-24 to "1". According to regulation 92.1.5.

**ANNEX TO PARAGRAPH 2.1.14
PREOPERATIONAL
New entry to the Code Table 5.0**

200 Run length packing with level values

New Data Representation Template

5.200 Grid point data - Run length packing with level values

12 Number of bits used for each packed value in the run length packing with level values

13-14 MV - Maximum value within the levels that are used in the packing

15-16 MVL - Maximum value of level (Predefined)

17 Decimal scale factor of representative value of each level

18-19+2*(lv-1) List of MVL scaled representative values of each level from lv=1 to MVL

**ANNEX TO PARAGRAPH 3.1.1
PREOPERATIONAL**

MODIFIED DESCRIPTORS FOR REPRESENTATION OF RADIATION DATA

The modified descriptors for representation of radiation data and Notes (1) and (2) under Class 14 are proposed to be introduced in Version 14 of WMO FM 94 BUFR tables.

a) Insufficient range of values

It is proposed to modify data widths and reference values of descriptors for representation of radiation data to become:

Table reference	Element name	Unit	Scale	Refer. value	Data width	kJ m ⁻²		J cm ⁻²	
						max upward	max downward	max upward	max downward
0 14 001	Long-wave radiation, integrated over 24 hours	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 002	Long-wave radiation, integrated over period specified	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 003	Short-wave radiation, integrated over 24 hours	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 004	Short-wave radiation, integrated over period specified	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 011	Net long-wave radiation, integrated over 24 hours	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 012	Net long-wave radiation, integrated over period specified	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 013	Net short-wave radiation, integrated over 24 hours	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
0 14 014	Net short-wave radiation, integrated over period specified	J m ⁻²	-3	-65536	17	-65536	65534	-6553.6	6553.4
						min	max	min	max
0 14 028	Global solar radiation (high accuracy), integrated over period specified	J m ⁻²	-2	0	20	0	104857.4	0	10485.74
0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	J m ⁻²	-2	0	20	0	104857.4	0	10485.74
0 14 030	Direct solar radiation (high accuracy), integrated over period specified	J m ⁻²	-2	0	20	0	104857.4	0	10485.74

b) Sign of downward and upward radiation

It is proposed to modify the **Notes (1) and (2) under Class 14** to read:

- (1) Downward radiation shall be assigned **positive** values.
- (2) Upward radiation shall be assigned **negative** values.

c) Correction of 0 14 017 and 0 14 018

The existing descriptors 0 14 017 and 014 018 are proposed to be modified in Version 14 of WMO FM 94 BUFR tables to read:

<i>Table reference</i>	<i>Element name</i>	<i>Unit</i>	<i>Scale</i>	<i>Reference value</i>	<i>Data width</i>
0 14 017	Instantaneous long-wave radiation	W m ⁻²	0	-512	10
0 14 018	Instantaneous short-wave radiation	W m ⁻²	0	-2048	12

**ANNEX TO PARAGRAPH 3.1.2
FOR URGENT VALIDATION**

**BUFR TEMPLATE FOR SYNOPTIC REPORTS FROM SEA STATIONS SUITABLE FOR SHIP
OBSERVATION DATA FROM VOS STATIONS**

Sequence descriptor numbers 3 08 014, 3 02 062, 3 02 063 and 3 02 064 written in blue in this template, have not yet been included in Manual on Codes, WMO-No. 306, I.2.

3 08 014		Sequence for representation of synoptic reports from a sea station suitable for SHIP data from VOS stations
	3 01 093	Ship identification, movement, type, date/time, horizontal and vertical coordinates
	3 02 062	SHIP "instantaneous" data from VOS
	3 02 063	SHIP "period" data from VOS

3 01 093			Ship identification, movement, type, date/time, horizontal and vertical coordinates	Unit, scale
	3 01 036	0 01 011	Ship or mobile land station identifier D...D	CCITT IA5, 0
		0 01 012	Direction of motion of moving observing platform ⁽³⁾ D_s	Degree true, 0
		0 01 013	Speed of motion of moving observing platform ⁽⁴⁾ v_s	m s ⁻¹ , 0
		0 02 001	Type of station (i_x)	Code table, 0
		0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day YY	Day, 0
		0 04 004	Hour GG	Hour, 0
		0 04 005	Minute gg	Minute, 0
		0 05 002	Latitude (coarse accuracy) L_aL_aL_a	Degree, 2
		0 06 002	Longitude (coarse accuracy) L_oL_oL_o	Degree, 2
	0 07 030		Height of station platform above mean sea level	m, 1
	0 07 031		Height of barometer above mean sea level	m, 1
3 02 062			SHIP "instantaneous" data from VOS	
			Pressure data	
	3 02 001	0 10 004	Pressure P₀P₀P₀P₀	Pa, -1
		0 10 051	Pressure reduced to mean sea level PPPP	Pa, -1
		0 10 061	3-hour pressure change (sign included) ppp	Pa, -1
		0 10 063	Characteristic of pressure tendency a	Code table, 0
			Temperature and humidity data	
	3 02 052	0 07 032	Height of sensor above marine deck platform (for temperature measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature measurement)	m, 1
		0 12 101	Temperature/dry-bulb temperature(sc.2) s_nTTT	K, 2
		0 02 039	Method of wet-bulb temperature measurement	Code table, 0
		0 12 102	Wet-bulb temperature (scale 2) s_wT_bT_bT_b	K, 2
		0 12 103	Dew-point temperature (scale 2) s_nT_dT_dT_d	K, 2
		0 13 003	Relative humidity	%, 0
			Visibility data	

	3 02 053	0 07 032	Height of sensor above marine deck platform (for visibility measurement)	m, 2
		0 07 033	Height of sensor above water surface (for visibility measurement)	m, 1
		0 20 001	Horizontal visibility VV	m, -1
	0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
			Precipitation past 24 hours	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 034	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours R₂₄R₂₄R₂₄R₂₄	kg m ⁻² , 1
	0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value)	m, 2
			Cloud data	
	0 20 010		Cloud cover (total) N	%, 0
	0 08 002		Vertical significance	Code table, 0
	0 20 013		Height of base of cloud h	m, -1
	1 04 000		Delayed replication of 4 descriptors	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	0 20 011		Cloud amount (of low or middle clouds) N_h	Code table, 0
	0 20 012		Cloud type (low clouds) C_L	Code table, 0
	0 20 012		Cloud type (middle clouds) C_M	Code table, 0
	0 20 012		Cloud type (high clouds) C_H	Code table, 0
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount N_s	Code table, 0
		0 20 012	Cloud type C	Code table, 0
		0 20 013	Height of base of cloud h_sh_s	m, -1
	0 08 002		Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Icing and ice	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 055	0 20 031	Ice deposit (thickness) E_sE_s	m, 2
		0 20 032	Rate of ice accretion R_s	Code table, 0
		0 20 033	Cause of ice accretion I_s	Flag table, 0
		0 20 034	Sea ice concentration c_i	Code table, 0
		0 20 035	Amount and type of ice b_i	Code table, 0
		0 20 036	Ice situation z_i	Code table, 0
		0 20 037	Ice development S_i	Code table, 0
		0 20 038	Bearing of ice edge D_i	Degree true, 0
			Sea/water temperature	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 056		Sea Surface Temperature, method of measurement, and depth	
		0 02 038	Method of sea surface temperature measurement	Code table, 0
		0 07 063	Depth below sea water surface of sensor	m, 2

			(for sea surface temperature measurement)	
		0 22 043	Sea/water temperature $s_s T_w T_w T_w$	K, 2
		0 07 063	Depth below sea water surface of sensor (set to missing to cancel the previous value)	m, 2
			Waves	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 021	0 22 001	Direction of waves	Degree true, 0
		0 22 011	Period of waves $P_{wa} P_{wa}$	s, 0
		0 22 021	Height of waves $H_{wa} H_{wa}$	m, 1
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 024	0 22 002	Direction of wind waves	Degree true, 0
		0 22 012	Period of wind waves $P_w P_w$	s, 0
		0 22 022	Height of wind waves $H_w H_w$	m, 1
		1 01 002	Replicate 1 descriptor 2 times	
		3 02 023	Swell waves (2 systems of swell) $d_{w1} d_{w1}, P_{w1} P_{w1}, H_{w1} H_{w1}$ $d_{w2} d_{w2}, P_{w2} P_{w2}, H_{w2} H_{w2}$	
3 02 063			SHIP“period” data from VOS	
			Present and past weather	
	3 02 038	0 20 003	Present weather ww or $w_a w_a$	Code table, 0
		0 04 024	Time period	Hour, 0
		0 20 004	Past weather (1) W_1 or W_{a1}	Code table, 0
		0 20 005	Past weather (2) W_2 or W_{a2}	Code table, 0
			Precipitation measurement	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 040	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours t_R	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow RRR	kg m ⁻² , 1
			Extreme temperature data	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 000		Short delayed descriptor replication factor	Numeric, 0
	3 02 058	0 07 032	Height of sensor above marine deck platform (for temperature measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature measurement)	m, 1
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified $s_n T_x T_x T_x$	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified $s_n T_n T_n T_n$	K, 2
			Wind data	
	3 02 064	0 07 032	Height of sensor above marine deck platform (for wind measurement)	m, 2
		0 07 033	Height of sensor above water surface	m, 1

			(for wind measurement)	
		0 02 002	Type of instrumentation for wind measurement i_w	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction dd	Degree true, 0
		0 11 002	Wind speed ff	m s ⁻¹ , 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 000	Delayed replication of 3 descriptors	
		0 31 001	Delayed descriptor replication factor	Numeric, 0
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910f _m f _m , 911f _x f _x	m s ⁻¹ , 1

Notes:

- 1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- 2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- 3) 0 01 012: Means course made good (average course over the ground) during the three hours preceding the time of observation.
- 4) 0 01 013: Means speed made good (average speed over the ground) during the three hours preceding the time of observation.
- 5) If "plain language" text is reported within Section 2, this information can be conveyed in BUFR via the use of an appropriate 205YYY field as an extra descriptor following the above basic template.

ANNEX TO PARAGRAPH 3.1.3

For Air Chemistry:

PREOPERATIONAL

Descriptor Number	Descriptor Name	Unit	Scale	Reference Value	Bits	Test Dataset
0 15 021	Integrated mass density	kg/m**2	11	0	31	GOME-2

FOR URGENT VALIDATION

Element Descriptor	Element name	Unit	Scale	Reference Value	Data Width
0-08-046	Atmospheric chemical or physical constituent type	Common Code Table C-14	0	0	16

**ANNEX TO PARAGRAPH 3.1.4
FOR VALIDATION**

IEEE REPRESENTATION (FOR BUFR EDITION 5)

IEEE data description operator:

Table Reference	Operator name	Operation Description
F X Operand 2 09 YYY	IEEE floating point representation	“For elements in Table B other than CCITT IA5, Code Tables, Flag Tables and delayed descriptor replication factors, this operator shall indicate that values are represented in YYY bits IEEE floating point, where YYY can be set to 032 (single precision) or 064 (double precision). This operator shall override the scaling, reference value and data width from Table B. An operand of YYY=000 shall reinstate the Table B scaling, reference value and data width. (See note 21)

Note (21):

IEEE single or double precision floating point representation is specified in the standard ISO/IEC 559-1985 and ANSI/IEE 754-1985, which should be consulted for more details.

Additions to Regulations:

Insert a third sentence to regulation 94.1.5:

...deemed to be necessary. Missing values for IEEE data (when use of operator 209YYY) shall be the largest IEEE floating-point number for YYY bits taken from the 209YYY operator. This regulation....

In 94.6.3 change note (2) as:

(2) Where more than one data subset is included in a single BUFR message, data compression may be used as follows:

(i) Values for each data element are grouped into sets, and the sets shall be in the order defined by the data description; the first value in each set shall represent a minimum value for the set; for character data the first value in the set shall be set to all bits zero; however, if the character data values in all subsets are identical, the first value shall represent the character string; for IEEE floating point data the first value in the set shall be set all bits to zero; however, if all IEEE data values are identical the first value shall represent the IEEE value; this value is termed a "local reference value", R^0 , with respect to the subsequent set of data.

(ii) Local reference value shall be coded according to Regulation 94.6.2.

(iii) If all values of an element are missing, R^0 shall be coded with all bits set to 1s. In the case of IEEE data the local reference value shall be coded using YYY bits from the 209YYY operator and the value shall be the largest positive IEEE floating point number for YYY bits.

(iv) The local reference value shall be followed by 6-bit quantity specifying the number of bits for each increment or for character data, specifying the number of octets representing the character string. For IEEE data element it shall be the number of octets corresponding to

YYY bits from the 209YYY operator. However, if the character or IEEE data values in all subsets are identical, sub-note (vii) shall apply.

(v) Actual values, V, for non IEEE data and non-character string, will then be obtained as:
..... no change

(vi) Missing values will be denoted by setting all bits of the corresponding I to 1s. Missing values for IEEE data shall be the largest IEEE floating point number for YYY bits taken from the 209YYY operator.

(vii) no change

.....

In the:

Section 4 - Data section

(2) The binary data in compressed form may be described as follows:

.....

Add:

If operator 209YYY is used, R_1^0 local reference value shall be set to largest IEEE floating-point number for YYY bits (32 bits: hexadecimal: 7f7fffff) (64 bits: hexadecimal: 7fefffffffffff). The NBINC shall contain the number of octets corresponding to YYY bits and increments shall contain the IEEE values of YYY bits. If the IEEE values in all subsets are identical, NBINC=0 and R_1^0 shall contain the IEEE value. The IEEE values shall be represented as big endian IEEE floating point numbers.

**ANNEX TO PARAGRAPH 3.1.5
PREOPERATIONAL**

National and WMO station identification and the AWS BUFR templates

- a) It is proposed to pronounce the descriptors 0 01 101, 0 01 102 and 3 01 089 for National station identification pre-operational and submit them to the next CBS session for approval.

Table reference		BUFR				CREX		
F X Y	Element name	Unit	Scale	Reference value	Data width	Unit	Scale	Data width
0 01 101	State identifier	Code table	0	0	10	Code table	0	3
0 01 102	National station number	Numeric	0	0	30	Numeric	0	9

Table reference	Table reference	Element name
3 01 089		<i>National station identification</i>
	0 01 101	State identifier
	0 01 102	National station number

- b) It is proposed to pronounce the template 3 07 091 **pre-operational**. The sequences 3 07 092 and 3 07 093 are to be left in the stage of **validation**.

Table reference	Element name
3 07 091	<i>BUFR template for surface observations from one-hour period with national and WMO station identification</i>
3 07 092	<i>BUFR template for surface observations from n-minute period with national and WMO station identification</i>
3 07 093	<i>Nominal values</i>

PREOPERATIONAL**Code Table 0 01 101: State identifier**

Code figure	
0-99	Reserved
100	Algeria
101	Angola
102	Benin
103	Botswana
104	Burkina Faso
105	Burundi
106	Cameroon
107	Cape Verde
108	Central African Republic
109	Chad
110	Comoros
111	Congo
112	Cote d'Ivoire
113	Democratic Republic of the Congo
114	Djibouti
115	Egypt
116	Eritrea
117	Ethiopia
118	France (RA I)
119	Gabon
120	Gambia
121	Ghana
122	Guinea
123	Guinea-Bissau
124	Kenya
125	Lesotho
126	Liberia
127	Libyan Arab Jamahiriya
128	Madagascar
129	Malawi
130	Mali
131	Mauritania
132	Mauritius
133	Morocco
134	Mozambique
135	Namibia
136	Niger
137	Nigeria
138	Portugal (RA I)
139	Rwanda
140	Sao Tom and Prince
141	Senegal
142	Seychelles
143	Sierra Leone
144	Somalia
145	South Africa

146	Spain
147	Sudan
148	Swaziland
149	Togo
150	Tunisia
151	Uganda
152	United Kingdom of Great Britain and Northern Ireland (RA I)
153	United Republic of Tanzania
154	Zambia
155	Zimbabwe
156 -199	Reserved for Region I (Africa)
200	Afghanistan
201	Bahrain
202	Bangladesh
203	Bhutan
204	Cambodia
205	China
206	Democratic People's Republic of Korea
207	Hong Kong, China
208	India
209	Iran, Islamic Republic of
210	Iraq
211	Japan
212	Kazakhstan
213	Kuwait
214	Kyrgyz Republic
215	Lao People's Democratic Republic
216	Macao, China
217	Maldives
218	Mongolia
219	Myanmar
220	Nepal
221	Oman
222	Pakistan
223	Qatar
224	Republic of Korea
225	Republic of Yemen
226	Russian Federation (RA II)
227	Saudi Arabia
228	Sri Lanka
229	Tajikistan
230	Thailand
231	Turkmenistan
232	United Arab Emirates
233	Uzbekistan
234	Viet Nam, Socialist Republic of
235 -299	Reserved for Region II (Asia)
300	Argentina
301	Bolivia
302	Brazil
303	Chile
304	Colombia

305	Ecuador
306	France
307	Guyana
308	Paraguay
309	Peru
310	Suriname
311	Uruguay
312	Venezuela
313 -399	Reserved for Region III (South America)
400	Antigua and Barbuda
401	Bahamas
402	Barbados
403	Belize
404	British Caribbean Territories
405	Canada
406	Colombia
407	Costa Rica
408	Cuba
409	Dominica
410	Dominican Republic
411	El Salvador
412	France (RA IV)
413	Guatemala
414	Haiti
415	Honduras
416	Jamaica
417	Mexico
418	Netherlands Antilles and Aruba
419	Nicaragua
420	Panama
421	Saint Lucia
422	Trinidad and Tobago
423	United Kingdom of Great Britain and Northern Ireland (RA IV)
424	United States of America (RA IV)
425	Venezuela
426 - 499	Reserved for Region IV (North America, Central America and the Caribbean)
500	Australia
501	Brunei Darussalam
502	Cook Islands
503	Fiji
504	French Polynesia
505	Indonesia
506	Kiribati
507	Malaysia
508	Micronesia, Federated States of
509	New Caledonia
510	New Zealand
511	Niue
512	Papua New Guinea
513	Philippines
514	Samoa

515	Singapore
516	Solomon Islands
517	Tonga
518	United Kingdom of Great Britain and Northern Ireland (RA V)
519	United States of America (RA V)
520	Vanuatu
521 – 599	Reserved for Region V (South-West Pacific)
600	Albania
601	Armenia
602	Austria
603	Azerbaijan
604	Belarus
605	Belgium
606	Bosnia and Herzegovina
607	Bulgaria
608	Croatia
609	Cyprus
610	Czech Republic
611	Denmark
612	Estonia
613	Finland
614	France (RA VI)
615	Georgia
616	Germany
617	Greece
618	Hungary
619	Iceland
620	Ireland
621	Israel
622	Italy
623	Jordan
624	Kazakhstan
625	Latvia
626	Lebanon
627	Lithuania
628	Luxembourg
629	Malta
630	Monaco
631	Montenegro
632	Netherlands
633	Norway
634	Poland
635	Portugal (RA VI)
636	Republic of Moldova
637	Romania
638	Russian Federation (RA VI)
639	Serbia
640	Slovakia
641	Slovenia
642	Spain
643	Sweden
644	Switzerland
645	Syrian Arab Republic

646	The Former Yugoslav Republic of Macedonia
647	Turkey
648	Ukraine
649	United Kingdom of Great Britain and Northern Ireland (RA VI)
650 - 699	Reserved for Region VI (Europe)
700 – 999	Reserved
1000 – 1022	Not used
1023	Missing value

PREOPERATIONAL

BUFR template for surface observations from one-hour period

TM 307091

			Unit, scale
3 01 089		National station identification	
	0 01 101	State identifier ⁽¹⁾	Code table, 0
	0 01 102	National station number ⁽¹⁾	Numeric, 0
3 01 090		Fixed surface station identification; time, horizontal and vertical co-ordinates	
	3 01 004	Surface station identification	
		WMO block number ⁽¹⁾	Numeric, 0
		WMO station number ⁽¹⁾	Numeric, 0
		Station or site name	CCITT IA5, 0
		Type of station	Code table, 0
	3 01 011	Year ⁽²⁾	Year, 0
		Month ⁽²⁾	Month, 0
		Day ⁽²⁾	Day, 0
	3 01 012	Hour ⁽²⁾	Hour, 0
		Minute ⁽²⁾	Minute, 0
	3 01 021	Latitude (high accuracy)	Degree, 5
		Longitude (high accuracy)	Degree, 5
	0 07 030	Height of station ground above mean sea level	m, 1
	0 07 031	Height of barometer above mean sea level	m, 1
0 08 010		Surface qualifier (for temperature data)	Code table, 0
3 01 091		Surface station instrumentation	
	0 02 180	Main present weather detecting system	Code table, 0
	0 02 181	Supplementary present weather sensor	Flag table, 0
	0 02 182	Visibility measurement system	Code table, 0
	0 02 183	Cloud detection system	Code table, 0
	0 02 184	Type of lightning detection sensor	Code table, 0
	0 02 179	Type of sky condition algorithm	Code table, 0
	0 02 186	Capability to detect precipitation phenomena	Flag table, 0
	0 02 187	Capability to detect other weather phenomena	Flag table, 0
	0 02 188	Capability to detect obscuration	Flag table, 0
	0 02 189	Capability to discriminate lightning strikes	Flag table, 0
3 02 001	0 10 004	Pressure	Pa, -1
	0 10 051	Pressure reduced to mean sea level	Pa, -1

	0 10 061	3-hour pressure change ⁽³⁾	Pa, -1
	0 10 063	Characteristic of pressure tendency ⁽³⁾	Code table, 0
0 07 004		Pressure (standard level)	Pa, -1
0 10 009		Geopotential height of the standard level	gpm, 0
3 02 072		Temperature and humidity data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, 2
	0 12 103	Dew-point temperature (scale 2)	K, 2
	0 13 003	Relative humidity	%, 0
1 03 000		Delayed replication of 3 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
1 01 005		Replicate 1 descriptor five times	
3 07 063	0 07 061	Depth below land surface	m, 2
	0 12 130	Soil temperature (scale 2)	K, 2
0 07 061		Depth below land surface (set to missing to cancel the previous value)	m, 2
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 069		Visibility data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 33 041	Attribute of following value	Code table, 0
	0 20 001	Horizontal visibility	m, -1
0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
1 05 000		Delayed replication of 5 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
0 20 031		Ice deposit (thickness)	m, 2
0 20 032		Rate of ice accretion	Code table, 0
0 02 038		Method of sea surface temperature measurement	Code table, 0
0 22 043		Sea/water temperature (scale 2)	K, 2
3 02 021	0 22 001	Direction of waves	Degree true, 0
	0 22 011	Period of waves	s, 0
	0 22 021	Height of waves	m, 1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 078		State of ground and snow depth measurement	
	0 02 176	Method of state of ground measurement	Code table, 0
	0 20 062	State of ground (with or without snow)	Code table, 0
	0 02 177	Method of snow depth measurement	Code table, 0
	0 13 013	Total snow depth	m, 2
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 073		Cloud data	
	0 20 010	Cloud cover (total)	%, 0
	1 05 004	Replicate 5 descriptors four times	
	0 08 002	Vertical significance	Code table, 0
	0 20 011	Cloud amount	Code table, 0
	0 20 012	Cloud type	Code table, 0
	0 33 041	Attribute of following value	Code table, 0
	0 20 013	Height of base of cloud	m, -1

1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 074		Present and past weather	
	0 20 003	Present weather ⁽⁴⁾	Code table, 0
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 20 004	Past weather (1) ⁽⁴⁾	Code table, 0
	0 20 005	Past weather (2) ⁽⁴⁾	Code table, 0
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 075		Intensity of precipitation, size of precipitation element	
	0 08 021	Time significance (= 2 (time averaged))	Code table, 0
	0 04 025	Time period (= - 10 minutes)	Minute, 0
	0 13 055	Intensity of precipitation	Kg m ⁻² s ⁻¹ , 4
	0 13 058	Size of precipitation element	m, 4
	0 08 021	Time significance (= missing value)	Code table, 0
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
0 04 025		Time period (= - 10 minutes)	Minute, 0
3 02 076		Precipitation, obscuration and other phenomena	
	0 20 021	Type of precipitation	Flag table, 0
	0 20 022	Character of precipitation	Code table, 0
	0 26 020	Duration of precipitation ⁽⁵⁾	Minute, 0
	0 20 023	Other weather phenomena	Flag table, 0
	0 20 024	Intensity of phenomena	Code table, 0
	0 20 025	Obscuration	Flag table, 0
	0 20 026	Character of obscuration	Code table, 0
3 02 071		Wind data from one-hour period	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 08 021	Time significance (= 2 (time averaged))	Code table, 0
	0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind, if any)	Minute, 0
	0 11 001	Wind direction	Degree true, 0
	0 11 002	Wind speed	m s ⁻¹ , 1
	0 08 021	Time significance (= missing value)	Code table, 0
	1 03 002	Replicate next 3 descriptors 2 times	
	0 04 025	Time period (= - 10 minutes in the first replication, = - 60 minutes in the second replication)	Minute, 0
	0 11 043	Maximum wind gust direction	Degree true, 0
	0 11 041	Maximum wind gust speed	m s ⁻¹ , 1
	0 04 025	Time period (= - 10 minutes)	Minute, 0
	0 11 016	Extreme counterclockwise wind direction of a variable wind	Degree true, 0
	0 11 017	Extreme clockwise wind direction of a variable wind	Degree true, 0
3 02 077		Extreme temperature data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 12 111	Maximum temperature (scale 2) at height and over period specified	K, 2
	0 12 112	Minimum temperature (scale 2) at height and over period specified	K, 2

	0 07 032	Height of sensor above local ground (for ground temperature)	m, 2
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 12 112	Minimum temperature (scale 2) at height and over period specified (for ground temperature)	K, 2
0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 079		Precipitation measurement	
	0 07 032	Height of sensor above local ground	m, 2
	0 02 175	Method of precipitation measurement	Code table, 0
	0 02 178	Method of liquid water content measurement of precipitation	Code table, 0
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 13 011	Total precipitation / total water equivalent of snow	kg m ⁻² , 1
0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 080		Evaporation measurement	
	0 02 185	Method of evaporation measurement	Code table, 0
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 13 033	Evaporation /evapotranspiration	kg m ⁻² , 1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 081		Total sunshine data	
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 14 031	Total sunshine	Minute, 0
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 082		Radiation data	
	0 04 025	Time period (= - 60 minutes)	Minute, 0
	0 14 002	Long-wave radiation, integrated over period specified	J m ⁻² , -3
	0 14 004	Short-wave radiation, integrated over period specified	J m ⁻² , -3
	0 14 016	Net radiation, integrated over period specified	J m ⁻² , -4
	0 14 028	Global solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
	0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
	0 14 030	Direct solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
0 04 025		Time period (= - 10 minutes)	Minute, 0
0 13 059		Number of flashes	Numeric, 0
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 083		First order statistics of P, W, T, U data	
	0 04 025	Time period (= -10 minutes)	Minute, 0
	0 08 023	First order statistics (= 9 (best estimate of standard deviation)) ⁽⁶⁾	Code table, 0
	0 10 004	Pressure	Pa, -1
	0 11 001	Wind direction	Degree true, 0
	0 11 002	Wind speed	m s ⁻¹ , 1

	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, 2
	0 13 003	Relative humidity	%, 0
	0 08 023	First order statistics (= missing value)	Code table, 0
0 33 005		Quality information (AWS data)	Flag table, 0
0 33 006		Internal measurement status information (AWS)	Code table, 0

Notes:

- (1) 0 01 101 (WMO Member State identifier) and 0 01 102 (National AWS number) shall be used to identify a station within the national numbering system that is completely independent of the WMO international numbering system. The WMO international identification 0 01 001 (WMO block number) and 0 01 002 (WMO station number) shall be reported if available for the particular station.
- (2) The time identification refers to the end of the one-hour period.
- (3) 0 10 061 (3-hour pressure change) and 0 10 063 (Characteristic of pressure tendency) are included in this template, although they refer to 3-hour period preceding the time of observation.
- (4) Present weather may be represented only by 0 20 003, especially if reported from a manned non-automated station. When encoding present weather reported from an automatic weather station, the sequence of descriptors (proposed under 3 02 076) should be used, if applicable.
- (5) Duration of precipitation (in minutes) represents number of minutes in which any precipitation was registered.
- (6) Best estimate of standard deviation is counted out of a set of samples (signal measurements) recorded within the period specified; it should be reported as a missing value, if the measurements of the relevant element are not available from a part of the period specified by 0 04 025.
- (7) If reporting nominal values is required, the template shall be supplemented with 3 07 093.

FOR VALIDATION

BUFR template for surface observations from n-minute period

TM 307092

			Unit, scale
3 01 089		National station identification	
	0 01 101	State identifier ⁽¹⁾	Code table, 0
	0 01 102	National station number ⁽¹⁾	Numeric, 0
3 01 090		Fixed surface station identification; time, horizontal and vertical co-ordinates	
	3 01 004	Surface station identification	
		WMO block number	Numeric, 0
		WMO station number	Numeric, 0
		Station or site name	CCITT IA5, 0
		Type of station	Code table, 0
	3 01 011	Year ⁽²⁾	Year, 0
		Month ⁽²⁾	Month, 0
		Day ⁽²⁾	Day, 0
	3 01 012	Hour ⁽²⁾	Hour, 0
		Minute ⁽²⁾	Minute, 0
	3 01 021	Latitude (high accuracy)	Degree, 5
		Longitude (high accuracy)	Degree, 5
	0 07 030	Height of station ground above mean sea level	m, 1
	0 07 031	Height of barometer above mean sea level	m, 1
0 08 010		Surface qualifier (for temperature data)	Code table, 0
3 01 091		Surface station instrumentation	
	0 02 180	Main present weather detecting system	Code table, 0
	0 02 181	Supplementary present weather sensor	Flag table, 0
	0 02 182	Visibility measurement system	Code table, 0
	0 02 183	Cloud detection system	Code table, 0
	0 02 184	Type of lightning detection sensor	Code table, 0
	0 02 179	Type of sky condition algorithm	Code table, 0
	0 02 186	Capability to detect precipitation phenomena	Flag table, 0
	0 02 187	Capability to detect other weather phenomena	Flag table, 0
	0 02 188	Capability to detect obscuration	Flag table, 0
	0 02 189	Capability to discriminate lightning strikes	Flag table, 0
0 04 015		Time increment (= - n minutes)	Minute, 0
0 04 065		Short time increment (= 1 minute)	Minute, 0
1 25 000		Delayed replication of 25 descriptors	
0 31 001		Delayed descriptor replication factor (= n)	Numeric, 0
0 10 004		Pressure	Pa, -1
3 02 070		Wind data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 11 001	Wind direction	Degree true, 0
	0 11 002	Wind speed	m s ⁻¹ , 1
	0 11 043	Maximum wind gust direction	Degree true, 0
	0 11 041	Maximum wind gust speed	m s ⁻¹ , 1
	0 11 016	Extreme counterclockwise wind direction of a variable wind	Degree true, 0
	0 11 017	Extreme clockwise wind direction of a variable wind	Degree true, 0

3 02 072		Temperature and humidity data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, 2
	0 12 103	Dew-point temperature (scale 2)	K, 2
	0 13 003	Relative humidity	%, 0
0 07 032		Height of sensor above local ground (for ground temperature)	m, 2
0 12 101		Temperature/dry-bulb temperature (scale 2) (for ground temperature)	K, 2
1 03 000		Delayed replication of 3 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
1 01 005		Replicate 1 descriptor five times	
3 07 063	0 07 061	Depth below land surface	m, 2
	0 12 130	Soil temperature (scale 2)	K, 2
0 07 061		Depth below land surface (set to missing to cancel the previous value)	m, 2
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 069		Visibility data	
	0 07 032	Height of sensor above local ground	m, 2
	0 07 033	Height of sensor above water surface	m, 1
	0 33 041	Attribute of following value	Code table, 0
	0 20 001	Horizontal visibility	m, -1
0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 073		Cloud data	
	0 20 010	Cloud cover (total)	%, 0
	1 05 004	Replicate 5 descriptors four times	
	0 08 002	Vertical significance	Code table, 0
	0 20 011	Cloud amount	Code table, 0
	0 20 012	Cloud type	Code table, 0
	0 33 041	Attribute of following value	Code table, 0
	0 20 013	Height of base of cloud	m, -1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 076		Precipitation, obscuration and other phenomena	
	0 20 021	Type of precipitation	Flag table, 0
	0 20 022	Character of precipitation	Code table, 0
	0 26 020	Duration of precipitation ⁽³⁾	Minute, 0
	0 20 023	Other weather phenomena	Flag table, 0
	0 20 024	Intensity of phenomena	Code table, 0
	0 20 025	Obscuration	Flag table, 0
	0 20 026	Character of obscuration	Code table, 0
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
0 13 055		Intensity of precipitation	kgm ⁻² s ⁻¹ , 4
0 13 058		Size of precipitation element	m, 4
		(end of the replicated sequence)	
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0

0 20 031		Ice deposit (thickness)	m, 2
0 20 032		Rate of ice accretion	Code table, 0
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 078		State of ground and snow depth measurement	
	0 02 176	Method of state of ground measurement	Code table, 0
	0 20 062	State of ground (with or without snow)	Code table, 0
	0 02 177	Method of snow depth measurement	Code table, 0
	0 13 013	Total snow depth	m, 2
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 079		Precipitation measurement	
	0 07 032	Height of sensor above local ground	m, 2
	0 02 175	Method of precipitation measurement	Code table, 0
	0 02 178	Method of liquid water content measurement of precipitation	Code table, 0
	0 04 025	Time period (= - n minutes)	Minute, 0
	0 13 011	Total precipitation / total water equivalent of snow	kg m ⁻² , 1
0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 080		Evaporation measurement	
	0 02 185	Method of evaporation measurement	Code table, 0
	0 04 025	Time period or displacement (= - n minutes)	Minute, 0
	0 13 033	Evaporation /evapotranspiration	kg m ⁻² , 1
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 081		Total sunshine data	
	0 04 025	Time period (= - n minutes)	Minute, 0
	0 14 031	Total sunshine	Minute, 0
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 082		Radiation data	
	0 04 025	Time period (= - n minutes)	Minute, 0
	0 14 002	Long-wave radiation, integrated over period specified	J m ⁻² , -3
	0 14 004	Short-wave radiation, integrated over period specified	J m ⁻² , -3
	0 14 016	Net radiation, integrated over period specified	J m ⁻² , -4
	0 14 028	Global solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
	0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
	0 14 030	Direct solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
1 02 000		Delayed replication of 2 descriptors	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
0 04 025		Time period (= - n minutes)	Minute
0 13 059		Number of flashes	Numeric
1 01 000		Delayed replication of 1 descriptor	
0 31 000		Short delayed descriptor replication factor	Numeric, 0
3 02 083		First order statistics of P, W, T, U data	
	0 04 025	Time period (= - n minutes)	Minute, 0
	0 08 023	First order statistics	Code table, 0

		(= 9; best estimate of standard deviation) ⁽⁴⁾	
	0 10 004	Pressure	Pa, -1
	0 11 001	Wind direction	Degree true, 0
	0 11 002	Wind speed	m s ⁻¹ , 1
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, 2
	0 13 003	Relative humidity	%, 0
	0 08 023	First order statistics (= missing value)	Code table, 0
0 33 005		Quality information (AWS data)	Flag table, 0
0 33 006		Internal measurement status information (AWS)	Code table, 0

Notes:

- 1) 0 01 101 (WMO Member State identifier) and 0 01 102 (National AWS number) shall be used to identify a station within the national numbering system that is completely independent of the WMO international numbering system. The WMO international identification 0 01 001 (WMO block number) and 0 01 002 (WMO station number) shall be reported if available for the particular station.
- 2) The time identification refers to the end of the n-minute period.
- 3) Duration of precipitation (in minutes) represents number of minutes in which any precipitation was registered.
- 4) Best estimate of standard deviation is counted out of a set of samples (signal measurements) recorded within the period specified; it should be reported as a missing value, if the measurements of the relevant element are not available from a part of the period specified by 0 04 025.
- 5) If reporting nominal values is required, the template shall be supplemented with 3 07 093.

FOR VALIDATION

3 07 093 - Representation of nominal values

3 07 093		Nominal values	
	2 23 000	Substituted values operator	
	2 36 000	Backward reference bit map	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor = number of element descriptors	Numeric, 0
	0 31 031	Data present indicator	Numeric, 0
	0 01 033	Indication of originating/generating center	Code table, 0
	0 01 032	Generating application	Code table, 0
	0 08 083	Nominal value indicator	Flag table, 0
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Numeric, 0
	2 23 255	Substituted values	
	1 08 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Numeric, 0
	2 23 000	Substituted values operator	
	2 37 000	Use previously defined bit map	
	0 01 033	Indication of originating/generating center	Code table, 0
	0 01 032	Generating application	Code table, 0
	0 08 083	Nominal value indicator	Flag table, 0
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	Numeric, 0
	2 23 255	Substituted values	

ANNEX TO PARAGRAPH 3.1.6

OPERATIONAL

**Add in Common Table C-13 as International data sub-categories under:
000 Surface data — land**

- 50 Hourly synoptic observations with supplementary one-hour data
- 51 Intermediate synoptic observations with supplementary one-hour data
- 52 Main synoptic observations with supplementary one-hour data

FOR URGENT VALIDATION

BUFR template for representation of SYNOP data with supplementary information on one-hour observations

This template is proposed to be used for representation of surface observation data from both automatic stations and manned stations. This template is also suitable for SYNOP observation data, by including parameters covering periods longer than one hour.

Entries from the SYNOP BUFR template **TM 307080** are indicated by an asterisk * in the column **S**. Entries from the AWS BUFR template **TM 307091** are indicated by an asterisk * in the column **A**.

Entries used by both templates are not marked.

The very recent modifications and additions are written in blue and bold.

TM 307096 - BUFR template for representation of SYNOP data with supplementary information on one-hour observations

3 07 096		Sequence for representation of SYNOP data with supplementary information on one-hour observations
	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
	3 01 089	National station identification
	0 08 010	Surface qualifier (for temperature data)
	3 01 091	Surface station instrumentation
	3 02 084	“Instantaneous” data of sequence 307096
	3 02 085	“Period” data of sequence 307096
	0 33 005	Quality information (AWS data)
	0 33 006	Internal measurement status information (AWS)

This BUFR template further expands as follows:

				S	A		Unit, scale
3 01 090						Surface station identification; time, horizontal and vertical co-ordinates	
	3 01 004					Surface station identification	
		0 01 001				WMO block number	Numeric, 0
		0 01 002				WMO station number	Numeric, 0
		0 01 015				Station or site name	CCITT IA5, 0
		0 02 001				Type of station	Code table, 0
	3 01 011	0 04 001				Year	Year, 0
		0 04 002				Month	Month, 0
		0 04 003				Day	Day, 0
	3 01 012	0 04 004				Hour	Hour, 0
		0 04 005				Minute	Minute, 0
	3 01 021	0 05 001				Latitude (high accuracy)	Degree, 5
		0 06 001				Longitude (high accuracy)	Degree, 5
	0 07 030					Height of station ground above mean sea level	m, 1
	0 07 031					Height of barometer above mean sea level	m, 1
3 01 089					*	National station identification	
	0 01 101				*	State identifier (see Note 1)	Code table, 0
	0 01 102				*	National station number (see Note 1)	Numeric, 0
0 08 010					*	Surface qualifier (for temperature data)	Code table, 0
3 01 091					*	Surface station instrumentation	
	0 02 180				*	Main present weather detecting system	Code table, 0
	0 02 181				*	Supplementary present weather sensor	Flag table, 0
	0 02 182				*	Visibility measurement system	Code table, 0
	0 02 183				*	Cloud detection system	Code table, 0
	0 02 184				*	Type of lightning detection sensor	Code table, 0
	0 02 179				*	Type of sky condition algorithm	Code table, 0
	0 02 186				*	Capability to detect precipitation phenomena	Flag table, 0
	0 02 187				*	Capability to detect other weather phenomena	Flag table, 0

	0 02 188			*	Capability to detect obscuration	Flag table, 0
	0 02 189			*	Capability to discriminate lightning strikes	Flag table, 0
3 02 084					“Instantaneous” data of sequence 307096	
	3 02 031				Pressure data	
		3 02 001	0 10 004		Pressure	Pa, -1
			0 10 051		Pressure reduced to mean sea level	Pa, -1
			0 10 061		3-hour pressure change	Pa, -1
			0 10 063		Characteristic of pressure tendency	Code table, 0
		0 10 062		*	24-hour pressure change P₂₄P₂₄P₂₄	Pa, -1
		0 07 004			Pressure (standard level)	Pa, -1
		0 10 009			Geopotential height of the standard level	gpm, 0
	3 02 072				Temperature and humidity data	
		0 07 032			Height of sensor above local ground	m, 2
		0 07 033		*	Height of sensor above water surface	m, 1
		0 12 101			Temperature/dry-bulb temperature (scale 2)	K, 2
		0 12 103			Dew-point temperature (scale 2)	K, 2
		0 13 003			Relative humidity	%, 0
	1 03 000				Delayed replication of 3 descriptors	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0
	1 01 005			*	Replicate one descriptor five times	
	3 07 063	0 07 061		*	Depth below land surface	m, 2
		0 12 130		*	Soil temperature (scale 2)	K, 2
	0 07 061			*	Depth below land surface (set to missing to cancel the previous value)	m, 2
					Visibility data	
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0
	3 02 069	0 07 032			Height of sensor above local ground	m, 2
		0 07 033		*	Height of sensor above water surface	m, 1
		0 33 041		*	Attribute of following value	Code table, 0
		0 20 001			Horizontal visibility	m, -1
	0 07 032			*	Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
	0 07 033			*	Height of sensor above water surface (set to missing to cancel the previous value)	m, 1

					Marine data	
	1 05 000				Delayed replication of 5 descriptors	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0
	0 20 031			*	Ice deposit (thickness)	m, 2
	0 20 032			*	Rate of ice accretion	Code table, 0
	0 02 038			*	Method of sea surface temperature measurement	Code table, 0
	0 22 043			*	Sea/water temperature (scale 2)	K, 2
	3 02 021	0 22 001		*	Direction of waves	Degree true, 0
		0 22 011		*	Period of waves	s, 0
		0 22 021		*	Height of waves	m, 1
					State of ground and snow depth measurement	
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0
	3 02 078	0 02 176		*	Method of state of ground measurement	Code table, 0
		0 20 062			State of ground (with or without snow)	Code table, 0
		0 02 177		*	Method of snow depth measurement	Code table, 0
		0 13 013			Total snow depth	m, 2
	0 12 113			*	Ground minimum temperature (scale 2), past 12 hours $s_n T_g T_g$	K, 2
					Cloud data	
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0
	3 02 004	0 20 010			Cloud cover (total)	%, 0
		0 08 002		*	Vertical significance	Code table, 0
		0 20 011		*	Cloud amount (of low or middle clouds) N_h	Code table, 0
		0 20 013		*	Height of base of cloud h	m, -1
		0 20 012		*	Cloud type (low clouds C_L) C_L	Code table, 0
		0 20 012		*	Cloud type (middle clouds C_M) C_M	Code table, 0
		0 20 012		*	Cloud type (high clouds C_H) C_H	Code table, 0
	1 05 000				Delayed replication of 5 descriptors	
	0 31 001			*	Delayed descriptor replication factor	Numeric, 0
	0 08 002				Vertical significance	Code table, 0
	0 20 011				Cloud amount	Code table, 0

	0 20 012				Cloud type	Code table, 0
	0 33 041			*	Attribute of following value	Code table, 0
	0 20 013				Height of base of cloud	m, -1
					Clouds with bases below station level	
	3 02 036	1 05 000		*	Delayed replication of 5 descriptors	
		0 31 001		*	Delayed descriptor replication factor	Numeric, 0
		0 08 002		*	Vertical significance	Code table, 0
		0 20 011		*	Cloud amount N'	Code table, 0
		0 20 012		*	Cloud type C'	Code table, 0
		0 20 014		*	Height of top of cloud H'H'	m, -1
		0 20 017		*	Cloud top description C_t	Code table, 0
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000				Short delayed descriptor replication factor	Numeric, 0
				*	Direction of cloud drift 6D_LD_MD_H	
	3 02 047	1 02 003		*	Replicate 2 descriptors 3 times	
		0 08 002		*	Vertical significance (7= low cloud, 8= middle cloud, 9 = high cloud)	Code table, 0
		0 20 054		*	True direction from which clouds are moving D_LD_MD_H	Degree true, 0
	0 08 002			*	Vertical significance (set to missing to cancel the previous value)	Code table, 0
				*	Direction and elevation of cloud 57CD_ae_c	
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000				Short delayed descriptor replication factor	Numeric, 0
	3 02 048	0 05 021		*	Bearing or azimuth D_a	Degree true, 2
		0 07 021		*	Elevation angle e_c	Degree, 2
		0 20 012		*	Cloud type C	Code table, 0
		0 05 021		*	Bearing or azimuth (set to missing to cancel the previous value)	Degree true, 2
		0 07 021		*	Elevation angle (set to missing to cancel the previous value)	Degree, 2
	3 02 085				"Period" data of sequence 307096	
					Present and past weather data	
	1 05 000				Delayed replication of 5 descriptors	
	0 31 000			*	Short delayed descriptor replication factor	Numeric, 0

	0 20 003				Present weather (see Note 2)	Code table, 0
	1 03 002				Replicate 3 descriptors 2 times	
	0 04 024				Time period (= -1 hour in 1. replication, -x hours in 2. replication, x corresponding to the time period of W ₁ W ₂ in the SYNOP report)	Hour , 0
	0 20 004				Past weather (1)	Code table, 0
	0 20 005				Past weather (2)	Code table, 0
				*	Intensity of precipitation, size of precipitation element	
	1 01 000				Delayed replication of 1 descriptor	
	0 31 000			*	Short delayed descriptor replication factor	Numeric , 0
	3 02 075	0 08 021		*	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025		*	Time period (= - 10 minutes)	Minute, 0
		0 13 055		*	Intensity of precipitation	kg m ⁻² s ⁻¹ , 4
		0 13 058		*	Size of precipitation element	m, 4
		0 08 021		*	Time significance (= missing value)	Code table, 0
					Precipitation, obscuration and other phenomena	
	1 02 000				Delayed replication of 2 descriptors	
	0 31 000			*	Short delayed descriptor replication factor	Numeric , 0
	0 04 025			*	Time period (= - 10 minutes)	Minute, 0
	3 02 076			*	Precipitation, obscuration and other phenomena	
		0 20 021		*	Type of precipitation	Flag table, 0
		0 20 022		*	Character of precipitation	Code table, 0
		0 26 020		*	Duration of precipitation (see Note 3)	Minute, 0
		0 20 023		*	Other weather phenomena	Flag table, 0
		0 20 024		*	Intensity of phenomena	Code table, 0
		0 20 025		*	Obscuration	Flag table, 0
		0 20 026		*	Character of obscuration	Code table, 0
					Lightning data	
	1 02 000				Delayed replication of 2 descriptors	
	0 31 000			*	Short delayed descriptor replication factor	Numeric , 0
	0 04 025			*	Time period (= - 10 minutes)	Minute, 0
	0 13 059			*	Number of flashes	Numeric, 0
					Wind data	
	0 07 032				Height of sensor above local ground	m, 2

	0 07 033			*	Height of sensor above water surface	m, 1
	0 08 021				Time significance (= 2 (time averaged))	Code table, 0
	0 04 025				Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
	0 11 001				Wind direction	Degree true, 0
	0 11 002				Wind speed	m s ⁻¹ , 1
	0 08 021				Time significance (= missing value)	Code table, 0
	1 03 003				Replicate next 3 descriptors 3 times	
	0 04 025				Time period (= -10 minutes in 1. replication, = - 60 minutes in 2. replication, = - 60*3 or 60*6 minutes in 3. replication)	Minute, 0
	0 11 043				Maximum wind gust direction	Degree true, 0
	0 11 041				Maximum wind gust speed	m s ⁻¹ , 1
	0 04 025			*	Time period (= - 10 minutes)	Minute, 0
	0 11 016			*	Extreme counterclockwise wind direction of a variable wind	Degree true, 0
	0 11 017			*	Extreme clockwise wind direction of a variable wind	Degree true, 0
					Extreme temperature data	
	3 02 077	0 07 032		*	Height of sensor above local ground	m, 2
		0 07 033		*	Height of sensor above water surface	m, 1
		0 04 025		*	Time period (= - 60 minutes)	Minute, 0
		0 12 111		*	Maximum temperature (scale 2) at height and over period specified	K, 2
		0 12 112		*	Minimum temperature (scale 2) at height and over period specified	K, 2
		0 07 032		*	Height of sensor above local ground (for ground temperature)	m, 2
		0 04 025		*	Time period (= - 60 minutes)	Minute, 0
		0 12 112		*	Minimum temperature (scale 2) at height and over period specified (for ground temperature)	K, 2
	0 07 033			*	Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
	3 02 041	0 07 032		*	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024		*	Time period	Hour, 0
		0 04 024		*	Time period (see Notes 4 and 5)	Hour, 0

		0 12 111		*	Maximum temperature (scale 2) at height and over period specified $s_n T_x T_x T_x$	K, 2
		0 04 024		*	Time period	Hour, 0
		0 04 024		*	Time period (see Note 5)	Hour, 0
		0 12 112		*	Minimum temperature (scale 2) at height and over period specified $s_n T_n T_n T_n$	K, 2
					Precipitation measurement	
					Delayed replication of 6 descriptors	
		1 06 000				
		0 31 000		*	Short delayed descriptor replication factor	Numeric, 0
		0 07 032			Height of sensor above local ground	m, 2
		0 02 175		*	Method of precipitation measurement	Code table, 0
		0 02 178		*	Method of liquid water content measurement of precipitation	Code table, 0
		1 02 005			Replicate 2 descriptors 5 times	
		0 04 024			Time period in hours (= - 1 hour in the first replication, = - 3, -6, -12 and - 24 hours in the other replications) t_R	Hour, 0
		0 13 011			Total precipitation / total water equivalent of snow	kg m ⁻² , 1
		0 07 032		*	Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
					Evaporation data	
					Delayed replication of 3 descriptors	
		1 03 000				
		0 31 000		*	Short delayed descriptor replication factor	Numeric, 0
		0 02 185		*	Method of evaporation measurement	Code table, 0
		1 01 002			Replicate 1 descriptor 2 times	
		3 02 044	0 04 024	*	Time period in hours (= -1 hour in 1. replication, = -24 hours in 2. replication)	Hour, 0
		0 02 004		*	Type of instrument for evaporation measurement or type of crop	Code table, 0
		0 13 033			Evaporation /evapotranspiration	kg m ⁻² , 1
					Total sunshine data	
					Delayed replication of 2 descriptors	
		1 02 000				
		0 31 000		*	Short delayed descriptor replication factor	Numeric, 0
		1 01 002		*	Replicate 1 descriptor 2 times	

	3 02 039	0 04 024		*		Time period in hours (= -1 hour in 1. replication, = -24 hours in 2. replication)	Hour, 0
		0 14 031				Total sunshine	Minute, 0
						Radiation data	
	1 02 000					Delayed replication of 2 descriptors	
	0 31 000				*	Short delayed descriptor replication factor	Numeric, 0
	1 01 002			*		Replicate 1 descriptor 2 times	
		0 04 024		*		Time period in hours (= -1 hour in 1. replication, = -24 hours in 2. replication)	Hour, 0
		0 14 002				Long-wave radiation, integrated over period specified	J m ⁻² , -3
		0 14 004				Short-wave radiation, integrated over period specified	J m ⁻² , -3
		0 14 016				Net radiation, integrated over period specified	J m ⁻² , -4
		0 14 028				Global solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
		0 14 029				Diffuse solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
		0 14 030				Direct solar radiation (high accuracy), integrated over period specified	J m ⁻² , -2
				*		Temperature change gr. 54g ₀ s _n d _T	
	1 01 000					Delayed replication of 1 descriptor	
	0 31 000					Short delayed descriptor replication factor	Numeric, 0
	3 02 046	0 04 024		*		Time period or displacement	Hour, 0
		0 04 024		*		Time period or displacement (see Note 6)	Hour, 0
		0 12 049		*		Temperature change over period specified s _n d _T	K, 0
				*		First order statistics of P, W, T, U data	
	1 01 000					Delayed replication of 1 descriptor	
	0 31 000				*	Short delayed descriptor replication factor	Numeric, 0
	3 02 083	0 04 025		*		Time period (= -10 minutes)	Minute, 0
		0 08 023		*		First order statistics (see Note 7) (= 9 (best estimate of standard deviation))	Code table, 0
		0 10 004		*		Pressure	Pa, -1
		0 11 001		*		Wind direction	Degree true, 0
		0 11 002		*		Wind speed	m s ⁻¹ , 1
		0 12 101		*		Temperature/dry-bulb temperature (scale 2)	K, 2

		0 13 003		*	Relative humidity	%, 0
		0 08 023		*	First order statistics (= missing value)	Code table, 0
0 33 005				*	Quality information (AWS data)	Flag table, 0
0 33 006				*	Internal measurement status information (AWS)	Code table, 0

Notes:

- (1) The WMO international identification 0 01 001 (WMO block number) and 0 01 002 (WMO station number) shall be reported **as mandatory** if available for the particular station. 0 01 101 (WMO Member State identifier) and 0 01 102 (National AWS number) **may** be used to identify a station within the national numbering system. **If the WMO station identification is not available for the particular station, the National station identification shall be used.**
- (2) When reported, present weather shall be always represented by 0 20 003. When encoding present weather reported from an automatic weather station, the sequence of descriptors (proposed under 3 02 076) should also be used, if applicable.
- (3) Duration of precipitation represents number of minutes in which precipitation was registered.
- (4) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- (5) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- (6) To construct the required time range, descriptor 004024 has to be included two times.
- (7) Best estimate of standard deviation is counted out of a set of samples (signal measurements) recorded within the period specified; it should be reported as a missing value, if the measurements of the relevant element are not available from a part of the period specified by 0 04 025.
- (8) **Additional parameters required by regional or national reporting practices shall be accommodated in a similar way as recommended in Regulations B/C 1.9 and B/C 1.14 – Regulations for reporting SYNOP data in TDCF.**

ANNEX TO PARAGRAPH 3.1.7

Progress on JCOMM related templates

Template / Data Type	Current Status	Work completed or plans
BUOY	Operational use.	No changes required. Metadata to be included in future has been documented as part of the Meta-T pilot project. Main data processing centre (CLS Argos) is committed to BUFR and has built up significant expertise in this area.
TRACKOB	Testing and in progress on a simple template. Validation should go ahead in the next few months.	Template tested and validated from NOAA AOML. Additional descriptors are proposed. Presented at the 2nd Joint GOSUD/SAMOS Workshop, Seattle, 10-12 June 2008. e.g. <ul style="list-style-type: none"> - Intake Depth - TSG Instrument type - External Ref SST (with depth & instrument type) - Calibration Date - QC flags - Plus common elements from the BATHY template These have not been fully specified yet though, so a new template will be proposed in 2009
XBT	Testing in progress of existing template. Validation successfully completed by NCEP	New Template proposed just for XBT platforms in section 2 of this document. Includes more metadata than the previous template based on the requirements defined by the Meta-T Pilot project.
XCTD		New template will be developed in line with the XBT template, as required.
SHIP	No change	Metadata fields which need to be included within BUFR messages have been fully specified as part of the Meta-T pilot project. This has not been transitioned into a new template yet though by the Ship Observations Team or the JCOMM Data Management Programme Area. New template will be completed in 2009
TESAC	Operational use (Japan)	No changes requested for now
WAVEOB		Review of the template completed by BOM - Input by Australia
CLIMAT SHIP		No progress
PILOT SHIP TEMP SHIP		No progress
CLIMAT TEMP SHIP		No progress
Ocean Current	(Acoustic Doppler Current Profilers)	No Progress

FOR VALIDATION:

Proposed new BUFR template for XBT Temperature Profile data (sequence 3 15 004)

Descriptor	Name	Data Type	Units	Comment
NEW 0 22 176	Unique identifier for the profile	CCITT IA5 (Data Width 72)	-	As in GTSP Hash function or CRC
0 01 003	WMO region			non compulsory
0 01 020	WMO region sub-area			non compulsory
0 01 087	WMO Marine observing platform extended identifier			non compulsory
0 01 005	Buoy/platform identifier			
0 01 011	Ship call sign			
NEW 0 01 103	IMO Number. Unique Lloyd's registry. 0 to 9999999999	Numeric (Data Width 14)	-	Optional additional ship description
0 01 080	Ship line number according to SOOP			
0 05 036	Ship transect number according to SOOP			
0 01 036	Agency in charge of operating the observing platform			Important field
0 07 030	Height of station above MSL			
0 01 013	Speed of motion of moving observing platform			
0 01 012	Direction of motion of moving observing platform			
0 02 040	Method of removing platform direction and speed from current			
NEW 0 22 177	Height of XBT/XCTD Launcher	Numeric	m	from 5m to 50 m
0 22 068	Water temperature profile recorder type			
0 22 067	Instrument type for water temperature profile measurement			
NEW 0 22 178	XBT/XCTD launcher Type	NEW Code Table (0 22 178)		
NEW 0 22 179	Software version of profile recorder	CCITT IA5 (Data Width 256)		
NEW 0 22 180	Autolauncher software version number	CCITT IA5 (Data Width 256)		
NEW 0 22 181	Instrument manufacturer's serial number	CCITT IA5 (Data Width 32)		
0 08 041	Date Significance			NEW Value : 8? XBT Manufacture Date
3 01 011	Manufacturing Date	Date		
0 02 032	Indicator for digitization			
3 01 011	Date			
3 01 012	Time			
3 01 021	Latitude and longitude (high accuracy)			10-5 precision
0 07 032	Height of anemometer above station platform			Here height of anemometer
0 11 001	Wind direction			
3 02 021	Waves			
3 02 056	Sea Surface Temperature			[0 22 001],[0 22 011],[0 22 021]
NEW 3 15 004	Water temperature profile			NEW Sequence containing the profile itself
0 22 063	Total depth of water			
0 07 032	Height of thermometer above station platform			0 07 032 Here height of thermometer (for a BUOY)

0 12 103	Dew-point temperature (scale 2)			
3 06 005	<i>Depth, Direction, Speed and Method of current measurement</i>			0 02 031, 0 07 062, 0 22 004, 0 22 031 at depths
0 08 080	Qualifier for quality class			Value: 0=global water pressure profile
0 33 050	Global GTSPP quality class			For global water pressure profile as qualified above
0 08 080	Qualifier for quality class			Value: 1=global water temperature profile
0 33 050	Global GTSPP quality class			For global water temperature profile as qualified above

(1) integer, assigned by the operator, incremented for each new transect (i.e. all drop have the same transect number while the ship is moving from one end point of the line to the other end point; as soon as the ship arrived to port and goes back to start a new transect then transect number is incremented), initial value and subsequent values for transect numbers do not matter provided that each new transect by a ship on a line has a transect number higher than previous transect numbers for the same line and the same ship. In case a single cruise follows more than one SOOP line in a row, then transect number should be incremented each time the cruise changes line

(2) This field is indeed to be computed in quasi real-time and this is practically difficult to do. It is used in relation with the height of the typical weather instruments (e.g. air temp). It is not related to the height of the XBT recorder as this would be meaningless (the XBT depth is being provided anyway with each data point). In practice it can be left empty. On the other hand, this annex presents the existing template which we are going to deprecate and replace by the new one we are working at.

Proposed addition of a new Code Table

0 22 178

XBT/XCTD Launcher Type

Code figure	
0	Unknown
1	LM-2A Deck-mounted
2	LM-3A Hand-Held
3	LM-4A Thru-Hull
4-9	Reserved
10	AL-12 TSK Autolauncher (up to 12 Probes)
11-19	Reserved
20	SIO XBT Autolauncher (up to 6 probes)
21-29	Reserved
30	AOML XBT V6 Autolauncher (up to 6 Deep Blue probes)
31	AOML XBT V8.0 Autolauncher (up to 8 Deep Blue probes)
32	AOML XBT V8.1 Autolauncher (up to 8 Deep Blue&Fast Deep probes)
33-89	Reserved
90	CSIRO Devil Autolauncher
91-99	Reserved
100	MFSTEP Autolauncher (Mediterranean)
101-254	Reserved
255	Missing value

Proposed modifications to Code Tables

Shading indicates new values or corrections. Numbers are just suggestions and should be changed as required.

0 02 148

Data Collection or Location System

Code	
Figure	
0	Reserved
1	Argos
2	GPS
3	GOES DCP
4	METEOSAT DCP
5	ORBCOMM
6	INMARSAT
7	Iridium
8	Iridium and GPS
9-30	Reserved
31	Missing value

0 02 149

Type of data buoy

Code	
Figure	
0	Unspecified drifting buoy
1	SVP Standard Lagrangian drifter (Global Drifter Programme)
2	Standard FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy)
3	Wind measuring FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy)
4	Ice float
5	POPS Ice Buoy/Float
6	SVP-B Barometer drifter
7	SVPW (drifter with wind sensors)
8	Unspecified sub-surface float
9	SOFAR
10	ALACE
11	MARVOR
12	RAFOS
13	PROVOR
14	SOLO
15	APEX
16	Unspecified moored buoy
17	Nomad
18	3-metre discus
19	10-12-metre discus
20	ODAS 30 series
21	ATLAS
22	TRITON buoy
23	Reserved
24	Omnidirectional waverider
25	Directional waverider
26	Sub-surface ARGO float
27	PALACE
28	NEMO
29	NINJA
32	SVP-T Hurricane Drifter with Thermistor string
33	SVPS (drifter with salinity sensors)

34	Mooring Oceanographic (Timeseries)
35	Mooring Meteorological
36-62	Reserved
63	Missing value

0 08 080

Qualifier for GTSP quality flag

Code figure 10 **Water pressure/Depth** at a level

N.B This is a change in descriptor text only.

**Code table 4770-XXXX Recorder type - for alphanumeric codes
BUFR Code Table 0 22 068 Water temperature profile recorder types**

The proposed changes are that the Oceanographic/Animal Tracking communities would like to be able to identify an instrument on a Sea-Mammal in TESAC (or BATHY) code forms, so would like to add to the COMMON CODE TABLE C-4: Water temperature profile recorder types

85	SMRU CTD uncorrected salinity
86	SMRU CTD corrected salinity

0 33 050

Global GTSP quality flag

9	Good for operational use; Caution; check literature for other uses
---	--

0 08 041]

Date Significance

8	XBT Manufacture Date
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ADDITION IN MASTER TABLE 10:

0 01 009

JCOMM GTS message identifier

10	UUAA TEMP SHIP
11-14	Reserved
15	Missing value

Proposed addition of "Missing" value in code tables for Master Table 10:

0 01 007, 0 02 028, 0 02 007 (therefore 0 02 148),"Missing" value, described in Annex to paragraph 3.4.

Proposed new descriptors

[0 22 176]	Unique identifier for the profile	CCITT IA5		As in GTSP Hash function or CRC. Data Width 72
[0 01 103]	IMO Number. Unique Lloyd's registry.	Numeric		Data width 14
[0 22 177]	Height of XBT/XCTD Launcher	m	Scale 1	width 9, from 5m to 50 m
[0 22 178]	XBT/XCTD launcher Type	Code Table		
[0 22 179]	Software version of profile recorder	CCITT IA5		Data Width 256
[0 22 180]	Autolauncher software version number	CCITT IA5		Data Width 256
[0 22 181]	Instrument manufacturer's serial number	CCITT IA5		Data Width 32

Proposed new sequence

3 15 004

Water Temperature Profile

(Temperature profile observed by XBT or Buoy)

TABLE REFERENCE			TABLE REFERENCES			ELEMENT NAME
F	X	Y				
3	15	004	1	06	000	Delayed replication of 6 descriptors
			0	31	001	Replication factor
			0	07	063	Depth below sea surface
			0	08	080	Qualifier for quality class (qualifier = 10)
			0	33	050	GTSP quality class for depth
			0	22	045	Subsurface sea temperature
			0	08	080	Qualifier for quality class (qualifier = 11)
			0	33	050	GTSP quality class

**ANNEX TO PARAGRAPH 3.1.8.1
FOR URGENT VALIDATION**

**DATA DESCRIPTORS FOR VARIOUS DEEP-OCEAN TSUNAMETER SYSTEM MESSAGES
(DART BUOYS)**

The common and specific items required for the various types of tsunameter system messages are described as follows. Descriptors in red are not available in the WMO Manual on Codes.

Item	Description	Available/ Possible Descriptors
Common items for all tsunameter system messages 306027		
Station ID	5-digit buoy / platform ID e.g. 23401, 55401	0 01 005
Platform transmitter ID	Code table 1-character indicator P=Primary S=Secondary	0 01 050 numeric(6) 0 01 051 character(12) or new code table 0 01 052
Deep-ocean tsunameter platform type / manufacturer	DART II (PMEL) DART ETD SAIC Tsunami Buoy (STB) GFZ-Potsdam INCOIS (India) InaBuoy (Indonesia)	New code table required for type / manufacturer of deep-ocean tsunameters 0 02 047
Time transmitted to the ground systems	Year, month, day hour, minute, second when the standard hourly reports are transmitted. The day, hour and minute are used in the abbreviated header label (YYGGgg)	3 01 011 3 01 013
Specific Items for Tsunameter Surface Buoy Position Daily Report 306028		
Report observation time	Reference time for the values reported in the time series - year, month, day, hour, minute, second	3 01 011 3 01 013
Latitude and longitude (high accuracy)	Latitude and longitude up to 5 decimals	3 01 021
Common Items for Standard Hourly and Tsunami Event Reports 306029		
Water column height sampling interval (seconds)	Time interval in which water column height samples are integrated and reported, e.g. for the PMEL DART II systems, standard hourly reports are 15-sec samples reporting every 15 minutes at HH+15, 30, 45 and 60 minutes so sampling interval is 900 sec (15 minutes) Tsunami event first and second reports are 15-sec, other reports are 1-minute samples of 4 15-sec average values so sampling intervals are 15 sec and 60 sec respectively Extended tsunami event reports are 1-minute samples of 4 15-sec average values so sampling interval is 15 sec	New descriptor required 0 25 170

Water column height sample averaging period (seconds)	For the PMEL DART II systems, the sample averaging period is 15 sec for the standard hourly reports, 15 sec for the tsunami event first and second reports, 60 sec for the other reports, 60 sec for the extended event reports	New descriptor required 0 25 171
Number of samples	For averaged samples the number of samples collected during the sampling period	New descriptor required 0 25 172
Specific Items for Standard Hourly Reports 306030 (normally six hourly messages of four 15-second observations at 15-minute intervals are reported in one transmission block)		
Delayed replication	Usually six replications of hourly reports but it may be less if tsunami event occurs or more if transmission blocks are interrupted	1 11 000
Quality information for message status	Code table 1-character indicator 0=Message intact 1=Message corrupt	Code table 0 33 002 Quality Information
Report observation time	Reference time for the values reported in the time series - year, month, day, hour, minute, second	3 01 011 3 01 013
Battery voltage	BPR CPU voltage, normal range is 13.9 to 17.9 volts	0 25 025
Battery voltage	Acoustic modem DSP voltage, normal range is 4.0 to 4.3 volts	0 25 025
Battery voltage (large value)	Acoustic modem voltage, normal range is 34 to 48 volts	0 25 026
BPR transmission count	Number of transmission attempts to deliver BPR data	New descriptor required 0 22 185
Time increment to each data value in the time series	The time increment in minutes to be added to each data values in the time series to determine the time stamp of each report	0 04 065
Fixed replication	Replicate 1 descriptor 4 times	1 01 004
Water column height	Fixed replications 4 times of water column heights in mm at HH+15 ,H+30 ,H+45 and H+60	New descriptor required 0 22 182
Specific Items for Tsunami Event Reports 306031		
Tsunami event report message ID	2-digit sequence number allocated to the report for each tsunami event	New descriptor required 0 01 053
Common Items for Tsunami Event Reports and Extended Tsunami Event Reports 306031		
Quality information for message status	Code table 1-character indicator 0=Message intact 1=Message corrupt	Code table 0 33 002 Quality Information
Time of tsunami	Time when tsunami is detected according to the tsunami trigger algorithm	3 01 011 3 01 013
Reference time for the time series	Reference time for the time series. This is the first data value time stamp for the for the DARTII systems tsunami event data messages.	3 01 011 3 01 013
BPR transmission	Number of transmission attempts to deliver BPR	New descriptor

count	data	required 0 22 185
Water column height	Water column height reference value (m), for restoring the actual value from the deviations	New descriptor required 0 22 182
Time increment to reset the reference time	Time increment in seconds to be added to the reference time before the time series processing	0 04 016
Time increment to each data value in the time series	The time increment in seconds to be added to each data values in the time series to determine the time stamp of each report	0 04 066
Delayed replication	Delayed replication of 1 descriptor of water column height deviations 3 replications for the first Tsunami event report 15 replications for all other Tsunami event reports 119 replications for Extended tsunami event reports	1 01 000
Water column height deviation from the reference value	Water column height deviation from the reference value, Deviation = Actual value – Reference value	New descriptor required 0 22 184

BUFR/CREX template for tsunameter data and DART buoy system messages

Items in red are new descriptors suggested for review and incorporation in the WMO Manual on Codes.

3 06 027			Sequence for representation of DART buoy identification, transmitter ID, type of tsunameter and the time the message is transmitted to the ground system
	0 01 005		Buoy/platform identifier
	0 01 052		Platform transmitter identifier
	0 02 047		Deep-ocean tsunameter platform type/manufacturer
	3 01 011	0 04 001	Year (Time the message is transmitted to the ground system)
		0 04 002	Month
		0 04 003	Day
	3 01 013	0 04 004	Hour
		0 04 005	Minute
		0 04 006	Second

3 06 028			Sequence for representation of time of observation and DART buoy position daily report
	3 06 027		Buoy ID, transmitter ID, platform type, message transmission time
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Observation time
	3 01 013	0 04 004	Hour)
		0 04 005	Minute)
		0 04 006	Second)
	3 01 021	0 05 001	Latitude (high accuracy)

		0 06 001	Longitude (high accuracy)
--	--	----------	---------------------------

3 06 029			Sequence for representation of tsunameter sampling information for water column heights in the time series report
	0 25 170		Sampling interval (seconds)
	0 25 171		Sample averaging period (seconds)
	0 25 172		Number of samples

3 06 030			Sequence for representation of DART buoy standard hourly report
	3 06 027		Buoy ID, transmitter ID, platform type, message transmission time
	3 06 029		Tsunameter sampling information
	1 11 000		Delayed replication of 11 descriptors
	0 31 001		Delayed replication factor
	0 33 002		Quality information (for message status)
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Reference date/time for the time series
	3 01 013	0 04 004	Hour)
		0 04 005	Minute)
		0 04 006	Second)
	0 25 025		Battery voltage for BPR CPU
	0 25 025		Battery voltage for acoustic modem DSP
	0 25 026		Battery voltage for Acoustic modem
	0 22 185		BPR transmission count
	0 04 015		Time increment added to reset the reference time
	0 04 065		Time increment added to each data value in the time series
	1 01 004		Replicate 1 descriptor 4 times
	0 22 182		Water column height

3 06 031			Sequence for representation of DART buoy tsunami event reports and extended tsunami event reports
	3 06 027		Buoy ID, transmitter ID, platform type, message transmission time
	3 06 029		Tsunameter sampling information
	0 01 053		Tsunameter report sequence number triggered by a tsunami event
	0 33 002		Quality information (for message status)
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Time when tsunami is detected
	3 01 013	0 04 004	Hour)
		0 04 005	Minute)
		0 04 006	Second)
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Reference date/time for the time series
	3 01 013	0 04 004	Hour)

		0 04 005	Minute)
		0 04 006	Second)
	0 22 185		BPR transmission count
	0 22 182		Water column height reference for determination of actual value reported in the time series
	0 04 016		Time increment added to reset the reference time
	0 04 066		Time increment added to each data value in the time series
	1 01 000		Delayed replication of 1 descriptor
	0 31 001		Delayed replication factor
	0 22 184		Water column height deviation from the reference value

Encoding DART buoy data using the CREX tsunameter template:

Using the proposed CREX templates **D06028**, **D06030** and **D06031** the PMEL DART II system messages can be encoded as follows:

Conversion of DART buoy daily position report to CREX data sequence **D06028**

```
SZIO01 KWNB 271219
^^DD23401S 240121901
D$0 08/27/2008 01:13:04 0854.4827 N 08833.1062 E* 13 00-0NN 00E
```

Expanding **D06028**
D06027 D01011 D01013 D01021

Expanding **D06027**
B01005 **B01052** **B02047** D01011 D01013 D01011 D01013 D01021

Data sequence fully expanded
B01005 **B01052** **B02047** B04001 B04002 B04003 B04004 B04005 B04006 B04001 B04002
B04003 B04004 B04005 B04006 B05001 B06001

```
SZIO02 KWNB 271219
CREX++
T0002061400 A031007 P00008000 U00 S001 Y20080827 H1219 D06028++
23401 0 01 2008 08 27 12 19 01 2008 08 27 01 13 04 0890805 08855177++
7777
```

Conversion of DART buoy standard hourly report to CREX data sequence **D06030**

```
SZIO01 KWNB 260018
^^DD23401P 239001832
D$I 08/25/2008 18:15:00 1474142 3466543 3466565 3466588 3466611 1* 37
D$I 08/25/2008 19:15:00 1474142 3466635 3466659 3466675 3466694 1* 34
D$I 08/25/2008 20:15:00 1474142 3466711 3466728 3466739 3466747 1* 38
D$I 08/25/2008 21:15:00 1474142 3466754 3466758 3466766 3466770 1* 31
D$I 08/25/2008 22:15:00 1474142 3466774 3466770 3466766 3466759 1* 31
D$I 08/25/2008 23:15:00 1474142 3466752 3466737 3466723 3466708 1* 32 00-0NN 00E
```

Expanding **D06030**
D06027 **D06029** R11000
B033002 D01011 D01013 B25025 B25025 B25026 **B22185** B04015 **B04065** R01004 **B22182**

Data sequence fully expanded

B01005 B01052 B02047 B04001 B04002 B04003 B04004 B04005 B04006 B25170 B25171
B25172 R11000 B033002 B04001 B04002 B04003 B04004 B04005 B04006 B25025 B25025
B25026 B22185 B04015 B04065 R01004 B22182

```
SZIO02 KWNB 260018
CREX++
T0002061400 A031007 P00008000 U00 S001 Y20080826 H0018 D06030++
23401 0 01 2008 08 26 00 18 32 0900 0015 0001 0006
0 2008 08 25 18 15 00 147 041 420 001 -0015 15 3466543 3466565 3466588 3466611
0 2008 08 25 19 15 00 147 041 420 001 -0015 15 3466635 3466659 3466675 3466694
0 2008 08 25 20 15 00 147 041 420 001 -0015 15 3466711 3466728 3466739 3466747
0 2008 08 25 21 15 00 147 041 420 001 -0015 15 3466754 3466758 3466766 3466770
0 2008 08 25 22 15 00 147 041 420 001 -0015 15 3466774 3466770 3466766 3466759
0 2008 08 25 23 15 00 147 041 420 001 -0015 15 3466752 3466737 3466723 3466708++
7777
```

Conversion of DART buoy tsunami event reports to CREX data sequence D06031

A tsunami event triggered first report

```
SZPN01 KWNB 301854
^^DD46407P 121185436
D$2I 00 tt 18:53:30 ts 18:52:45 3266896
00000065006701* 27
00-0NN 00E
```

Expanding D06031

D06027 D06029 B01053 B033002 D01011 D01013 D01011 D01013 B22185 B22182 B04016
B04066 R01000 B22184

Data sequence fully expanded

B01005 B01052 B02047 B04001 B04002 B04003 B04004 B04005 B04006 B25170 B25171
B25172 B01053 B033002 B04001 B04002 B04003 B04004 B04005 B04006 B04001 B04002
B04003 B04004 B04005 B04006 B22185 B22182 B04016 B04066 R01000 B22184

```
SZPN02 KWNB 301854
CREX++
T0002061400 A031007 P00008000 U00 S001 Y20080430 H1854 D06031++
46407 0 01 2008 04 30 18 54 36 0015 0015 0001
00 0 2008 04 30 18 53 30 2008 04 30 18 52 45 3266896 -0015 0015 0003
0000 0101 0103 0001++
7777
```

A tsunami event triggered second report

```
SZPN01 KWNB 301857
^^DD46407P 121185741
D$2I 01 tt 18:53:30 ts 18:52:45 3266896
0000006500670066006300640061ffffcffffbfff7fff4fff4fff3fff201* 25
00-0NN 00E
```

```
SZPN02 KWNB 301857
CREX++
T0002061400 A031007 P00008000 U00 S001 Y20080430 H1857 D06031++
46407 0 01 2008 04 30 18 57 41 0015 0015 0001
01 0 2008 04 30 18 53 30 2008 04 30 18 52 45 0001 3266896 -0015 15 0015
0000 0101 0103 0102 0099 0100 0097 -0004 -0005 -0009 -0012 -0012 -0012 -0013 -0014++
7777
```

Additional table entries in Common Code Table C-13 for the tsunameter data sequence:

Regulation 95.3.1.2 for CREX Edition 2 requires a six-digit table indicator (nnnmmm) preceded by the letter A. The first three digits (nnn) define the data category referred to in CREX Table A. The next 3 digits (mmm) indicates the sub-category of the data from Common Code Table C-13.

Tsunameter data belong to 'Oceanographic Data' in the Data Category, code figure=031 for (nnn) but there is no code figure in the International Data Sub-category for 'Tsunameter data'. Code figure=007 for (mmm) is proposed.

ADDITIONAL CODE TABLES AND BUFR/CREX TABLE B ENTRIES FOR THE TSUNAMETER DATA SEQUENCE:

0 01 052

Platform transmitter identifier

Code	
Figure	
0	Primary
1	Secondary
2	Reserved
3	Missing value

0 02 047

Deep-ocean tsunameter platform type/manufacturer

Code	
Figure	
00	Reserved
01	DART II (PMEL)
02	DART ETD
03	SAIC Tsunami Buoy (STB)
04	GFZ - Potsdam
05	INCOIS (India)
06	InaBuoy (Indonesia)
07-14	Reserved
15	Missing value

Additional BUFR/CREX Table B entries for the DART buoy templates

TABLE REFERENCE	TABLE ELEMENT NAME	BUFR				CREX				
		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)		
F	X	Y								
0	01	053	Tsunami report sequence number triggered by a tsunami event	Numeric	0	0	7	Numeric	0	2
0	02	047	Deep-ocean tsunami type	Code table	0	0	7	Code table	0	2
0	01	052	Platform transmitter ID	Code table	0	0	3	Code table	0	1
0	25	170	sampling interval (time)	Second	0	0	10	Second	0	4
0	25	171	sample averaging period	Second	0	0	10	Second	0	4
0	25	172	Number of samples	Numeric	0	0	10	Numeric	0	4
0	22	182	Water column height (see Note 9)	m	3	0	23	m	3	7
0	22	184	Water column height deviation from the reference value	m	3	2000	12	m	3	4
0	22	185	BPR transmission count	Numeric	0	0	10	Numeric	0	3
0	04	066	Short time increment	Second	0	-128	8	Second	0	2

Footnote for BUFR TABLE B Class 22 – Oceanographic elements

Notes:

(9) The maximum deployment depth of deep-ocean tsunameters such as the PMEL Deep-Ocean Assessment and Reporting of Tsunamis (DART II) is about 6000 m.

**ANNEX TO PARAGRAPH 3.1.8.2
FOR URGENT VALIDATION**

PROPOSED NEW BUFR/CREX TEMPLATES FOR REPORTING TIME SERIES OF TIDE DATA

The design of any new templates for tidal elevations is focused in meeting the flexibility of a minimum number of cohesive common descriptors which can be grouped together while avoiding a long common sequence that requires a higher bandwidth for data transmission. Locations of sea level stations can be very remote and the data communication cost for transmitting high resolution data, e.g. 1-minute data for storm surge or tsunami warning purposes can be very expensive.

The following common sequences can be used for reporting sea level tide data for single and multiple sensors with the options of reporting ancillary meteorological data. Items in red are new descriptors suggested for review and incorporation in the WMO Manual on Codes.

3 06 011			Sequence for representation of tide station identification, method of transmission, time the message is transmitted and reference time for reports in a time series
	3 01 021	0 05 001	Latitude (high accuracy)
		0 06 001	Longitude (high accuracy)
	0 01 075		Tide station alphanumeric ID (5 characters)
	0 02 147		Method of transmission to collection centre
	3 01 011	0 04 001	Year (Time the message is transmitted to the collection centre)
		0 04 002	Month
		0 04 003	Day
	3 01 013	0 04 004	Hour
		0 04 005	Minute
		0 04 006	Second

3 06 012			Sequence for representation of sensor type, significance qualifier for sensor and status of operation
	0 02 007		Type of sensor for water level measuring instrument
	0 08 015		significance qualifier for sensor
	0 08 032		Status of operation
	3 06 029	0 25 170	Sampling interval (seconds)
		0 25 171	Sample averaging period (seconds)
		0 25 172	Number of samples

3 06 029			Sequence for representation of sampling information for water levels in the time series report
	0 25 170		Sampling interval (seconds)
	0 25 171		Sample averaging period (seconds)
	0 25 172		Number of samples

3 06 013			Sequence for representation of water level and residual in the time series
	3 06 012		sensor type, significance qualifier for sensor and status of operation
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Reference date/time for the time series
	3 01 013	0 04 004	Hour)

		0 04 005	Minute)
		0 04 006	Second)
	0 22 120		Tide station automated water level check
	0 22 121		Tide station manual water level check
	0 04 015		Time increment added to reset the reference time
	0 04 065		Time increment added to each data value in the time series
	1 02 000		Delayed replication of 2 descriptors
	0 31 001		Delayed replication factor
	0 22 038		Tidal elevation with respect to local chart datum
	0 22 040		Meteorological residual tidal elevation (surge or offset)

3 06 014			Sequence for representation of water level in the time series, similar to 306013 but with no residual
	3 06 012		Sensor type, significance qualifier for sensor and status of operation
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Reference date/time for the time series
	3 01 013	0 04 004	Hour)
		0 04 005	Minute)
		0 04 006	Second)
	0 22 120		Tide station automated water level check
	0 22 121		Tide station manual water level check
	0 04 015		Time increment added to reset the reference time
	0 04 065		Time increment added to each data value in the time series
	1 01 000		Delayed replication of 1 descriptor
	0 31 001		Delayed replication factor
	0 22 038		Tidal elevation with respect to local chart datum

3 06 016			Sequence for representation of ancillary meteorological data associated with water level data
	3 01 011	0 04 001	Year)
		0 04 002	Month)
		0 04 003	Day) Reference date/time for the time series
	3 01 013	0 04 004	Hour)
		0 04 005	Minute)
		0 04 006	Second)
	0 10 004		Station level pressure
	0 10 050		Mean sea level pressure
	3 02 032	0 07 032	Temperature and humidity data
		0 12 101	Dry bulb temperature
		0 12 103	Dew point temperature
		0 13 003	Relative humidity
		0 07 032	Height of sensor above local ground
		0 02 002	Type of instrument for wind measurement
		0 08 021	Time significance = 2 (time averaged)
		0 04 025	Time period, e.g. = 1 for 1-minute, = 10 for 10-minute
		0 11 001	Wind direction
		0 11 002	Wind speed

		0 04 025	Time period in minutes
		0 11 043	Maximum wind gust direction
		0 11 041	Maximum wind gust speed
		0 25 026	AWS battery voltage
		0 12 060	AWS enclosure internal temperature

Practical use of the new templates:

Using the proposed BUFR/CREX templates **306011, 306012, 306013, 306014, 306016** and **306029** some practical implementations can be encoded as follows in CREX:

Single sensor with no ancillary meteorological data:

```
CREX++
T0002061400 A001030 P00001000 U00 S001 Y20080901 H0651 D06011 D06013++
-1042940 10566940 46290 07 2008 09 01 06 51 00
03 1 00 60 60 60 2008 09 01 06 44 00 11 07 0000 01 0006
00261 -0083 00256 -0085 00205 -0134 00296 -0041 00166 -0169 00285 -0047++
7777
```

Stations with two sensors can choose to add a fixed replication descriptor or a delayed replication descriptor. The following example is an example of fixed replication of two sensors:

```
CREX++
T0002061400 A001030 P00001000 U00 S001 Y20080901 H0651 D06011 R01002 D06013++
```

Two sensors with ancillary meteorological data

```
CREX++
T0002061400 A001030 P00001000 U00 S001 Y20080901 H0651 D06011 R02002 D06013 D06016++
```

ADDITIONAL CODE TABLES AND BUFR/CREX TABLE B ENTRIES PROPOSED:

0 02 007

Types of sea level sensor

Code Figure	
00	Reserved
01	Shaft encoder float system
02	Ultrasonic
03	Radar
04	Pressure (single transducer)
05	Pressure (multiple transducer)
06	Pressure (in stilling well)
07	Bubbler pressure
08	Acoustic (with sounding tube)
09	Acoustic (in open air)
10-14	Reserved
15	Missing value
15-99	Not used in CREX

0 01 147

Method of data transmission to collection centre

Code	
Figure	
00	Reserved
01	Direct leased circuit
02	Dialled up connection
03	Internet ISP
04	DCP via Satellite (MTSAT, METEOSAT, etc.)
05	VSAT
06	GAN, BGAN
07	This terminal
08	Iridium satellites
09	Mobile telephony
10-14	Reserved
15	Missing value

0 08 015

Significance qualifier for sensor

Code	
Figure	
0	Single sensor
1	Primary sensor
2	Secondary sensor (Backup)
3-6	Reserved
7	Missing value
7-9	Not used in CREX

0 08 032

Status of operation for the water level report

Code	
Figure	
00	Routine operation
01	Event triggered by storm surge
02	Event triggered tsunami
03	Event Triggered manually
04	Installation testing
05	Maintenance testing
06-14	Reserved
15	Missing value

Additional BUFR/CREX Table B entries for the tidal elevation templates

TABLE REFERENCE			TABLE ELEMENT NAME	BUFR				CREX		
				UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
F	X	Y								
0	02	007	Type of sensor for water level measuring instrument	Code table	0	0	4	Code table	0	2
0	02	147	Method of transmission to collection centre	Code table	0	0	7	Code table	0	2
0	08	015	Significant qualifier for sensor	Code table	0	0	3	Code table	0	1
0	08	032	Status of operation	Code table	0	0	4	Code table	0	2
0	12	060	AWS enclosure internal temperature	K	1	0	12	°C	1	3
0	25	170	sampling interval (time)	Second	0	0	10	Second	0	4
0	25	171	sample averaging period	Second	0	0	10	Second	0	4
0	25	172	Number of samples	Numeric	0	0	10	Numeric	0	4

**ANNEX TO PARAGRAPH 3.1.9
FOR URGENT VALIDATION**

**BUFR TEMPLATE FOR SYNOPTIC REPORTS FROM FIXED LAND STATIONS
SUITABLE FOR SYNOP DATA AND FOR MARITIME DATA FROM COASTAL AND
ISLAND STATIONS**

Proposals

a) A new descriptor 0 20 058 (Visibility seawards from a coastal station) is proposed:

Table reference	Element name	BUFR				CREX		
		Unit	Scale	Reference value	Data width	Unit	Scale	Data width
0 20 058	Visibility seawards from a coastal station	m	-1	0	13	m	-1	4

b) TM 307079 as included in the ANNEX is proposed for pre-operational usage, provided that testing of the template takes place by the end of 2008.

TM 307079 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data and for maritime data from coastal and island stations

3 07 079		Sequence for representation of synoptic reports from fixed land stations suitable for SYNOP data and for maritime data from coastal stations
	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic "instantaneous" data
	3 02 036	Clouds with bases below station level
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short delayed descriptor replication factor
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short delayed descriptor replication factor
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	1 02 000	Delayed replication of 2 descriptors
	0 31 000	Short delayed descriptor replication factor
	0 22 061	State of the sea
	0 20 058	Visibility seawards from a coastal station
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short delayed descriptor replication factor
	3 02 056	Sea/water surface temperature, method of measurement, depth below water surface
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short delayed descriptor replication factor
	3 02 055	Icing and ice
	3 02 043	Basic synoptic "period" data
	3 02 044	Evaporation data

	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 02 045	Radiation data
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short delayed descriptor replication factor
	3 02 046	Temperature change

TM 307079 (BUFR template for synoptic reports from fixed land stations suitable for SYNOP data and for maritime data from coastal and island stations) further expands as follows:

				Unit, scale
3 01 090			Fixed surface station identification, time, horizontal and vertical coordinates	
	3 01 004	0 01 001	WMO block number II	Numeric, 0
		0 01 002	WMO station number iii	Numeric, 0
		0 01 015	Station or site name	CCITT IA5, 0
		0 02 001	Type of station (i_x)	Code table, 0
	3 01 011	0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day YY	Day, 0
	3 01 012	0 04 004	Hour GG	Hour, 0
		0 04 005	Minute gg	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy)	Degree, 5
		0 06 001	Longitude (high accuracy)	Degree, 5
	0 07 030		Height of station ground above mean sea level	m, 1
	0 07 031		Height of barometer above mean sea level	m, 1
3 02 031			Pressure data	
	3 02 001	0 10 004	Pressure P₀P₀P₀P₀	Pa, -1
		0 10 051	Pressure reduced to mean sea level PPPP	Pa, -1
		0 10 061	3-hour pressure change ppp	Pa, -1
		0 10 063	Characteristic of pressure tendency a	Code table, 0
		0 10 062	24-hour pressure change p₂₄P₂₄P₂₄	Pa, -1
		0 07 004	Pressure (standard level) a₃	Pa, -1
		0 10 009	Geopotential height of the standard level hhh	gpm, 0
3 02 035			Basic synoptic "instantaneous" data	
			Temperature and humidity data	
	3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)	m, 2
		0 12 101	Temperature/dry-bulb temperature(sc.2) s_nTTT	K, 2
		0 12 103	Dew-point temperature (scale 2) s_nT_dT_dT_d	K, 2
		0 13 003	Relative humidity	%, 0
			Visibility data	
	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	m, 2
		0 20 001	Horizontal visibility VV	m, -1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours R₂₄R₂₄R₂₄R₂₄	kg m ⁻² , 1
		0 07 032	Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) N	%, 0
		0 08 002	Vertical significance	Code table, 0

		0 20 011	Cloud amount (of low or middle clouds)	N_h	Code table, 0
		0 20 013	Height of base of cloud	h	m, -1
		0 20 012	Cloud type (low clouds C_L)	C_L	Code table, 0
		0 20 012	Cloud type (middle clouds C_M)	C_M	Code table, 0
		0 20 012	Cloud type (high clouds C_H)	C_H	Code table, 0
			Individual cloud layers or masses		
	1 01 000		Delayed replication of 1 descriptor		
	0 31 001		Delayed descriptor replication factor		Numeric, 0
	3 02 005	0 08 002	Vertical significance		Code table, 0
		0 20 011	Cloud amount (N_s)	N_s	Code table, 0
		0 20 012	Cloud type (C)	C	Code table, 0
		0 20 013	Height of base of cloud ($h_s h_s$)	$h_s h_s$	m, -1
			Clouds with bases below station level		
3 02 036	1 05 000		Delayed replication of 5 descriptors		
	0 31 001		Delayed descriptor replication factor		Numeric, 0
		0 08 002	Vertical significance		Code table, 0
		0 20 011	Cloud amount	N'	Code table, 0
		0 20 012	Cloud type	C'	Code table, 0
		0 20 014	Height of top of cloud	$H'H'$	m, -1
		0 20 017	Cloud top description	C_t	Code table, 0
			Direction of cloud drift	gr. 56 $D_L D_M D_H$	
1 01 000			Delayed replication of 1 descriptor		
0 31 000			Short delayed descriptor replication factor		Numeric, 0
3 02 047	1 02 003		Replicate 2 descriptors 3 times		
		0 08 002	Vertical significance = 7 (low cloud) = 8 (middle cloud) = 9 (high cloud)		Code table, 0
		0 20 054	True direction from which clouds are moving D_L, D_M, D_H		Degree true, 0
0 08 002			Vertical significance (set to missing to cancel the previous value)		Code table, 0
			Direction and elevation of cloud	gr. 57 $C D_a e_c$	
1 01 000			Delayed replication of 1 descriptor		
0 31 000			Short delayed descriptor replication factor		Numeric, 0
3 02 048	0 05 021		Bearing or azimuth	D_a	Degree true, 2
		0 07 021	Elevation angle	e_c	Degree, 2
		0 20 012	Cloud type	C	Code table, 0
		0 05 021	Bearing or azimuth (set to missing to cancel the previous value)		Degree true, 2
		0 07 021	Elevation angle (set to missing to cancel the previous value)		Degree, 2
			State of ground, snow depth, ground minimum temperature		
3 02 037	0 20 062		State of ground (with or without snow)	E or E'	Code table, 0
		0 13 013	Total snow depth	sss	m, 2
		0 12 113	Ground minimum temperature (scale2), past 12 hours $s_n T_g T_g$		K, 2
			State of the sea		
1 02 000			Delayed replication of 2 descriptors		
0 31 000			Short delayed descriptor replication factor		Numeric, 0
0 22 061			State of the sea	S	Code table, 0
0 20 058			Visibility seawards from a coastal station	V_s	m, -1
			Sea/water surface temperature, method of measurement, and depth below sea surface		
1 01 000			Delayed replication of 1 descriptor		

0 31 000			Short delayed descriptor replication factor	Numeric, 0
3 02 056	0 02 038		Method of sea/water temperature measurement	Code table, 0
	0 07 063		Depth below sea/water surface (for sea surface temperature measurement)	m, 2
	0 22 043		Sea/water temperature $s_s T_w T_w T_w$ or $925 T_w T_w$	K, 2
	0 07 063		Depth below sea/water surface (set to missing to cancel the previous value)	m, 2
			Icing and ice	
1 01 000			Delayed replication of 1 descriptor	
0 31 000			Short delayed descriptor replication factor	Numeric, 0
3 02 055	0 20 031		Ice deposit (thickness) $E_s E_s$	m, 2
	0 20 032		Rate of ice accretion R_s	Code table, 0
	0 20 033		Cause of ice accretion I_s	Flag table, 0
	0 20 034		Sea ice concentration c_i	Code table, 0
	0 20 035		Amount and type of ice b_i	Code table, 0
	0 20 036		Ice situation z_i	Code table, 0
	0 20 037		Ice development S_i	Code table, 0
	0 20 038		Bearing of ice edge D_i	Degree true, 0
3 02 043			Basic synoptic "period" data	
			Present and past weather	
	3 02 038	0 20 003	Present weather ww	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) W_1	Code table, 0
		0 20 005	Past weather (2) W_2	Code table, 0
			Sunshine data (from 1 hour and 24 hour period)	
	1 01 002		Replicate 1 descriptors 2 times	
	3 02 039	0 04 024	Time period in hours	Hour, 0
		0 14 031	Total sunshine SS and SSS	Minute, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours t_R	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow RRR	kg m ⁻² , 1
			Extreme temperature data	
	3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified $s_n T_x T_x T_x$	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified $s_n T_n T_n T_n$	K, 2
			Wind data	
	3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)	m, 2
		0 02 002	Type of instrumentation for wind measurement i_w	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0

		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction dd	Degree true, 0
		0 11 002	Wind speed ff	m s^{-1} , 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed $910f_{mf_m}$, $911f_{xf_x}$	m s^{-1} , 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Evaporation data	
3 02 044	0 04 024		Time period in hours	Hour, 0
	0 02 004		Type of instrument for evaporation or crop type for evapotranspiration i_E	Code table, 0
	0 13 033		Evaporation /evapotranspiration EEE	kg m^{-2} , 1
			Radiation data (from 1 and/or 24 hour period)	
1 01 000			Delayed replication of 1 descriptor	
0 31 001			Delayed descriptor replication factor	Numeric, 0
3 02 045	0 04 024		Time period in hours	Hour, 0
	0 14 002		Long-wave radiation, integrated over period specified $553SS\ 4FFFF$ or $553SS\ 5FFFF$, $55SSS\ 4F_{24}F_{24}F_{24}F_{24}$ or $55SSS\ 5F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -3
	0 14 004		Short-wave radiation, integrated over period specified $553SS\ 6FFFF$, $55SSS\ 6F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -3
	0 14 016		Net radiation, integrated over period specified $553SS\ 0FFFF$ or $553SS\ 1FFFF$, $55SSS\ 0F_{24}F_{24}F_{24}F_{24}$ or $55SSS\ 1F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -4
	0 14 028		Global solar radiation (high accuracy), integrated over period specified $553SS\ 2FFFF$, $55SSS\ 2F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -2
	0 14 029		Diffuse solar radiation (high accuracy), integrated over period specified $553SS\ 3FFFF$, $55SSS\ 3F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -2
	0 14 030		Direct solar radiation (high accuracy), integrated over period specified $55408\ 4FFFF$, $55508\ 5F_{24}F_{24}F_{24}F_{24}$	J m^{-2} , -2
			Temperature change group 54g₀s_nd_T	
1 01 000			Delayed replication of 1 descriptor	
0 31 000			Short delayed descriptor replication factor	Numeric, 0
3 02 046	0 04 024		Time period or displacement	Hour, 0
	0 04 024		Time period or displacement (see Note 3)	Hour, 0
	0 12 049		Temperature change over period specified s_nd_T	K, 0

Notes:

- 1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- 2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.
- 3) To construct the required time range, descriptor 004024 has to be included two times.

**ANNEX TO PARAGRAPH 3.1.10
FOR VALIDATION**

**EUCOS TEMPLATE FOR REPRESENTATION OF RADIOSONDE DATA WITH
GEOPOTENTIAL HEIGHT AS THE VERTICAL COORDINATE (REVISITED IN JUNE
2008)**

This template is suitable for representation of high resolution radiosonde data with geopotential height as the vertical coordinate, the vertical resolution being limited by the length of BUFR message.

3 01 111		Identification of launch site and instrumentation	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 013	Solar and infrared radiation correction	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
0 25 061		Software identification and version number	CCITT IA5
0 01 081		Radiosonde serial number	CCITT IA5
0 01 082		Radiosonde ascension number	Numeric
0 02 067		Radiosonde operating frequency	Hz, scale -5
0 02 095		Type of pressure sensor	Code table
0 02 096		Type of temperature sensor	Code table
0 02 097		Type of humidity sensor	Code table
0 02 081		Type of balloon	Code table
0 02 082		Weight of balloon	kg, scale 3
0 02 084		Type of gas used in balloon	Code table
3 01 113		Date/time of launch	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		Horizontal and vertical coordinates of launch site	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table
		Surface station measurements	
0 10 004		Pressure	Pa, scale -1
3 02 032	0 07 032	Height of sensor above local ground (for temperature measurement)	m, scale 2
	0 12 101	Temperature/dry-bulb temperature(scale 2)	K, scale 2
	0 12 103	Dew-point temperature (scale 2)	K, scale 2
	0 13 003	Relative humidity	%
0 07 032		Height of sensor above local ground (for wind measurement)	m, scale 2
0 02 002		Type of instrumentation for wind measurement	Flag table

0 11 001		Wind direction	Degree true
0 11 002		Wind speed	m s ⁻¹ , scale 1
0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, scale 2
0 20 003		Present weather	Code table
3 02 049		Cloud information reported with vertical soundings	
	0 08 002	Vertical significance	Code table
	0 20 011	Cloud amount (of low or middle clouds N _h)	Code table
	0 20 013	Height of base of cloud (h)	m, scale -1
	0 20 012	Cloud type (low clouds C _L)	Code table
	0 20 012	Cloud type (middle clouds C _M)	Code table
	0 20 012	Cloud type (high clouds C _H)	Code table
	0 08 002	Vertical significance (= missing value)	Code table
0 22 043		Sea/water temperature (for ship stations)	K, scale 2
		Temperature, dew-point, relative humidity and wind data at height levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 055		Temperature, dew-point, relative humidity and wind data at a height level with radiosonde position	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	0 13 009	Relative humidity (see Note 4)	%, scale 1
	0 12 103	Dew-point temperature (scale 2) (see Note 4)	K, scale 2
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s ⁻¹ , scale 1

- Notes: (1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.
- (2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds).
- (3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.
- (4) If the radiosonde is equipped with a relative humidity sensor, 0 13 009 shall be reported as mandatory and dew-point temperature may be included as a derived value. If the radiosonde is equipped with a dew-point temperature sensor, 0 12 103 shall be reported and 0 13 009 shall be set to a missing value.

**ANNEX TO PARAGRAPH 3.1.12
PREOPERATIONAL**

NEW DESCRIPTORS FOR GFA (GRAPHICAL FORECAST AIRMET) DATA

Proposed Table B entries

Table Reference	Element name	BUFR				CREX		
		Unit	Scale	Ref. value	Data width	Unit	Scale	Data width
0 01 039	Graphical Area Forecast (GFA) sequence identifier	CCITT IA5	0	0	40	Character	0	5
0 20 006	Flight Rules	Code Table	0	0	3	Code Table	0	1

Add the following new code/flag table values for BUFR/CREX Table B descriptors:

0 08 040

- 34 Freezing level base
- 35 Freezing level top
- 36 Flight level base
- 37 Flight level top

0 08 041

- 8 IFR Ceiling and Visibility
- 9 Mountain obscuration
- 10 Strong surface wind
- 11 Freezing level
- 12 Multiple freezing level

0 20 023

- 13 Wind shear

0 20 025

- 14 Cloud
- 15 Precipitation

Code tables for proposed new Table B descriptors:

Code Figure	0 20 006 Flight Rules
0	Low Instrument Flight Rules - Ceiling < 500 feet and/or Visibility < 1 mile
1	Instrument Flight Rules - Ceiling < 1000 feet and/or Visibility < 3 miles
2	Marginal Visual Flight Rules – 1000 feet <= Ceiling < 3000 feet and/or 3 miles <= Visibility < 5 miles
3	Visual Flight Rules - Ceiling >= 3000 feet and/or Visibility >= 5 miles
4-6	Reserved
7	Missing value

New Table D descriptors:

		(Graphical AIRMET Sierra)
3 16 071	3 01 014	Time period (for which AIRMET is valid)
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 075	GFA IFR Ceiling and Visibility
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 076	GFA Mountain Obscuration
		(Graphical AIRMET Tango)
3 16 072	3 01 014	Time period (for which AIRMET is valid)
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 077	GFA Turbulence
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 078	GFA Strong Surface Wind
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 079	GFA Low-Level Wind Shear
		(Graphical AIRMET Zulu)
3 16 073	3 01 014	Time period (for which AIRMET is valid)
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 080	GFA Icing
	1 01 000	Delayed replication
	0 31 002	Replication Factor
	3 16 081	GFA Freezing Level

		(GFA Identifier and Observed/Forecast Location)
3 16 074	0 01 039	GFA sequence identifier
	0 08 021	Time significance, 4=Forecast, 16=Analysis
	3 01 014	Time period (for which hazard is being observed/forecast)
	3 01 027	Description of Feature
	0 08 021	Time Significance, Missing=Cancel

		(GFA IFR Ceiling and Visibility)
3 16 075	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 041	Data significance, 8=IFR Ceiling and Visibility
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 20 006	Flight rules, 1=IFR
	0 33 042	Type of limit represented by following (cloud base) value, 2=Exclusive upper limit, 7=Missing
	0 20 013	Height of base of cloud
	0 33 042	Type of limit represented by following (visibility) value, 2=Exclusive upper limit, 7=Missing
	0 20 001	Horizontal visibility
	0 20 025	Obscuration
	0 20 026	Character of obscuration, 6=Blowing, 15=Missing
	0 08 041	Data significance, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Mountain Obscuration)
3 16 076	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 041	Data significance, 9=Mountain obscuration
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 20 006	Flight rules, 1=IFR
	0 20 025	Obscuration
	0 08 041	Data significance, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Turbulence)
3 16 077	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 011	Meteorological feature, 13=Turbulence
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 11 031	Degree of turbulence, 6=Moderate
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Strong Surface Wind)
3 16 078	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 041	Data significance, 10=Strong surface wind
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 33 042	Type of limit represented by following (wind speed) value, 0=Exclusive lower limit
	0 11 012	Wind speed at 10 m
	0 08 041	Data significance, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Low-Level Wind Shear)
3 16 079	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 011	Meteorological feature, 16=Phenomenon
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 20 023	Other weather phenomena, bit 12=Wind shear
	0 20 024	Intensity of phenomena
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Icing)
3 16 080	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 011	Meteorological feature, 15=Airframe Icing
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 20 041	Airframe icing, 4=Moderate Icing
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

		(GFA Freezing Level)
3 16 081	0 08 079	Product Status, 0=Normal, 1=COR, 2=AMD, 3=COR AMD, 4=CNL
	0 08 041	Data significance, 11=Freezing level, 12=Multiple freezing level
	3 16 074	GFA Identifier and Observed/Forecast Location
	0 08 041	Data significance, Missing=Cancel
	0 08 079	Product Status, Missing=Cancel

**ANNEX TO PARAGRAPH 3.1.13
FOR URGENT VALIDATION**

ENTRIES FOR VOLUME (3-D) RADAR DATA

Evaluated descriptors:

Table reference	Element name	BUFR			
		Unit	Scale	Reference value	Data width
0 01 099	Unique product definition	CCITTIA5	0	0	2048
0 02 137	Radar DualPRF ratio	Code table	0	0	4
0 02 138	Antenna rotation direction	Code table	0	0	2
0 05 035	Maximum size of X-dimension	Numeric	0	0	12
0 06 035	Maximum size of Y-dimension	Numeric	0	0	12
0 07 035	Maximum size of Z-dimension	Numeric	0	0	12
0 07 036	Level index of Z	Numeric	0	0	12
0 21 022	Range bin offset	m	1	0	14
0 21 023	Range bin size	m	0	0	14
0 21 024	Azimuth offset	Degree	1	0	12
0 21 025	Azimuthal resolution	Degree	1	0	8
0 30 033	Number of bins along the radial	Numeric	0	0	12
0 30 034	Number of azimuths	Numeric	0	0	12

**0 02 137
Radar DualPRF ratio**

Code figure

1	3:2
2	4:3
3	5:4
4-14	Reserved
15	Missing value

0 02 138
Antenna rotation direction

Code figure

- 1 clockwise rotation
- 2 counterclockwise rotation
- 3 Missing value

0 29 001
Projection type

Code figure

- 0 Gnomonic projection
- 1 Polar stereographic projection
- 2 Lambert's conformal conic projection
- 3 Mercator's projection
- 4 Scanning Cone (radar)*
- 5 **Reserved**
- 6 **no projection**
- 7 Missing value

Descriptors to be adapted:

F X Y	Element name	Unit	Scale	Reference value	Data width
0 21 018	extended NYQUIST velocity	m s ⁻¹	1	0	10
0 21 019	high NYQUIST velocity	m s ⁻¹	1	0	10

Descriptor for further validation:

The "**Type of product**" (descriptor **0 01 098**) seems to be redundant information. The information needed can be encoded using descriptor from category 30 (0 30 001 – 0 30 004, 0 30 031 for *images* and 0 21 XXX for *data*). So descriptor 0 01 098 should stay in validation status for further discussions.

Code table 0 01 098 (Type of product) should have the following entries:

0 01 098

Type of product

Code figure

- 1 Total power, 1 byte (DB_DBT)
- 2 Reflectivity corrected for ground clutter, 1 byte (DB_DBZ)
- 3 Velocity, 1 byte (DB_VEL)
- 4 Width, 1 byte (DB_WIDTH)
- 5 Differential reflectivity, 1 byte (DB_ZDR)
- 6 Corrected reflectivity, 1 byte (DB_DBZC)
- 7 Total power, 2 byte (DB_DBT2)
- 8 Reflectivity, 2 byte (DB_DBZ2)
- 9 Velocity, 2 byte (DB_VEL2)
- 10 Width, 2 byte (DB_WIDTH2)

11	Differential reflectivity, 2 byte (DB_ZDR2)
12	Rainfall rate, 2 byte (DB_RAINRATE2)
13	KDP (Differential phase), 1 byte (DB_KDP)
14	KDP (Differential phase), 2 byte (DB_KDP2)
15	PhiDP(Differential phase), 1 byte (DB_PHIDP)
16	Corrected velocity, 1 byte (DB_VELC)
17	SQI, 1 byte (DB_SQI)
18	RhoHV, 1 byte (DB_RHOHV)
19	RhoHV, 2 byte (DB_RHOHV2)
20	Corrected Reflectivity, 2 byte (DB_DBZC2)
21	Corrected velocity, 2 byte (DB_VELC2)
22	SQI, 2 byte (DB_SQI2)
23-4094	Reserved
4095	Missing value

**ANNEX TO PARAGRAPH 3.1.14
PREOPERATIONAL**

FOR THE ENCODING OF THE JASON2 OGDR DATA

It is proposed to use the following sequence of entries for the encoding of the JASON2 OGDR data (new entries are in *italicised and underlined*):

BUFR	Description	Unit	Scale	Reference	Width
F X Y	Satellite				
0 01 007	SATELLITE IDENTIFIER				
0 02 019	SATELLITE INSTRUMENTS				
0 01 096	ACQUISITION STATION IDENTIFIER				
0 25 061	SOFTWARE IDENTIFICATION				
0 05 044	SATELLITE CYCLE NUMBER				
0 05 040	ORBIT NUMBER				
0 01 030	NUMERICAL MODEL IDENTIFIER				
	Datation				
0 04 001	YEAR				
0 04 002	MONTH				
0 04 003	DAY				
0 04 004	HOUR				
0 04 005	MINUTE				
0 04 007	SECONDS WITHIN A MINUTE				
	Location and Surface Type				
0 05 001	LATITUDE (HIGH ACCURACY)				
0 06 001	LONGITUDE (HIGH ACCURACY)				
0 08 029	REMOTE SENSED SURFACE TYPE				
0 08 074	ALTIMETER ECHO TYPE				
<u>0 08 077</u>	<u>RADIOMETER SENSED SURFACE TYPE</u>	<u>CODE TABLE</u>	<u>0</u>	<u>0</u>	<u>7</u>
	Flags				
<u>0 40 011</u>	<u>INTERPOLATION FLAG</u>	<u>FLAG TABLE</u>	<u>0</u>	<u>0</u>	<u>8</u>
<u>0 25 097</u>	<u>THREE DIMENSIONAL ERROR ESTIMATE OF THE NAVIGATOR ORBIT</u>	<u>CODE TABLE</u>	<u>0</u>	<u>0</u>	<u>4</u>
0 25 095	ALTIMETER STATE FLAG	CODE TABLE			
<u>0 25 098</u>	<u>ALTIMETER DATA QUALITY FLAG</u>	<u>FLAG TABLE</u>	<u>0</u>	<u>0</u>	<u>9</u>
<u>0 25 099</u>	<u>ALTIMETER CORRECTION QUALITY FLAG</u>	<u>FLAG TABLE</u>	<u>0</u>	<u>0</u>	<u>9</u>
0 21 144	ALTIMETER RAIN FLAG				
0 25 096	RADIOMETER STATE FLAG				

<u>0 40 012</u>	<u>RADIOMETER DATA QUALITY FLAG</u>	<u>FLAG TABLE</u>	<u>0</u>	<u>0</u>	<u>8</u>
<u>0 40 013</u>	<u>RADIOMETER BRIGHTNESS TEMPERATURE INTERPRETATION FLAG</u>	<u>CODE TABLE</u>	<u>0</u>	<u>0</u>	<u>3</u>
<u>0 21 169</u>	<u>ICE PRESENCE INDICATOR</u>	<u>CODE TABLE</u>	<u>0</u>	<u>0</u>	<u>2</u>
	Altimeter: Ku Band				
0 22 151	KU BAND OCEAN RANGE				
<u>0 22 162</u>	<u>RMS OF 20 Hz KU BAND OCEAN RANGE</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>16</u>
<u>0 22 163</u>	<u>NUMBER OF 20Hz VALID POINTS FOR KU BAND</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
<u>0 25 160</u>	<u>KU BAND NET INSTRUMENTAL CORRECTION</u>	<u>M</u>	<u>4</u>	<u>-120000</u>	<u>18</u>
0 25 133	SEA STATE BIAS CORRECTION ON KU BAND				
0 22 156	KU BAND SIGNIFICANT WAVE HEIGHT				
<u>0 22 164</u>	<u>RMS 20 HZ KU BAND SIGNIFICANT WAVE HEIGHT</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>16</u>
<u>0 22 165</u>	<u>NUMBER OF 20HZ VALID POINTS FOR KU BAND SIGNIFICANT WAVE HEIGHT</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
<u>0 22 166</u>	<u>KU BAND NET INSTRUMENTAL CORRECTION FOR SIGNIFICANT WAVE HEIGHT</u>	<u>M</u>	<u>3</u>	<u>-1000</u>	<u>11</u>
0 21 137	KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT				
0 21 138	STD KU BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT				
<u>0 22 167</u>	<u>NUMBER OF VALID POINTS FOR KU BAND BACKSCATTER</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
0 21 139	KU BAND NET INSTRUMENTAL CORRECTION FOR AGC				
0 21 118	ATTENUATION CORRECTION ON SIGMA-0				
<u>0 21 145</u>	<u>KU BAND AUTOMATIC GAIN CONTROL</u>	<u>DB</u>	<u>2</u>	<u>0</u>	<u>13</u>
<u>0 21 146</u>	<u>RMS KU BAND AUTOMATIC GAIN CONTROL</u>	<u>DB</u>	<u>2</u>	<u>0</u>	<u>8</u>
<u>0 21 147</u>	<u>NUMBER OF VALID POINTS FOR KU BAND AUTOMATIC GAIN CONTROL</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>5</u>
	Altimeter: C band				
<u>0 22 168</u>	<u>C BAND OCEAN RANGE</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>31</u>
<u>0 22 169</u>	<u>RMS OF C BAND OCEAN RANGE</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>16</u>
<u>0 22 170</u>	<u>NUMBER OF 20Hz VALID POINTS FOR C BAND</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
<u>0 25 161</u>	<u>C BAND NET INSTRUMENTAL CORRECTION</u>	<u>M</u>	<u>4</u>	<u>-120000</u>	<u>18</u>

<u>0 25 162</u>	<u>SEA STATE BIAS CORRECTION ON C BAND</u>	<u>M</u>	<u>4</u>	<u>-6000</u>	<u>13</u>
<u>0 22 171</u>	<u>C BAND SIGNIFICANT WAVE HEIGHT</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>16</u>
<u>0 22 172</u>	<u>RMS 20HZ C BAND SIGNIFICANT WAVE HEIGHT</u>	<u>M</u>	<u>3</u>	<u>0</u>	<u>16</u>
<u>0 22 173</u>	<u>NUMBER OF 20HZ VALID POINTS FOR C BAND SIGNIFICANT WAVE HEIGHT</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
<u>0 22 174</u>	<u>C BAND NET INSTRUMENTAL CORRECTION FOR SIGNIFICANT WAVE HEIGHT</u>	<u>M</u>	<u>3</u>	<u>-1000</u>	<u>11</u>
<u>0 21 170</u>	<u>C BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT</u>	<u>DB</u>	<u>2</u>	<u>-32768</u>	<u>16</u>
<u>0 21 171</u>	<u>RMS C BAND CORRECTED OCEAN BACKSCATTER COEFFICIENT</u>	<u>DB</u>	<u>2</u>	<u>-32768</u>	<u>16</u>
<u>0 22 175</u>	<u>NUMBER OF VALID POINTS FOR C BAND BACKSCATTER</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
<u>0 21 172</u>	<u>C BAND NET INSTRUMENTAL CORRECTION FOR AGC</u>	<u>DB</u>	<u>2</u>	<u>-2048</u>	<u>12</u>
0 21 118	ATTENUATION CORRECTION ON SIGMA-0				
<u>0 21 173</u>	<u>C BAND AUTOMATIC GAIN CONTROL</u>	<u>DB</u>	<u>2</u>	<u>0</u>	<u>13</u>
<u>0 21 174</u>	<u>RMS C BAND AUTOMATIC GAIN CONTROL</u>	<u>DB</u>	<u>2</u>	<u>0</u>	<u>9</u>
<u>0 21 175</u>	<u>NUMBER OF VALID POINTS FOR C BAND AUTOMATIC GAIN CONTROL</u>	<u>NUMERIC</u>	<u>0</u>	<u>0</u>	<u>10</u>
	Radiometer				
0 02 153	SATELLITE CHANNEL CENTRE FREQUENCY				
0 12 063	BRIGHTNESS TEMPERATURE				
0 02 153	SATELLITE CHANNEL CENTRE FREQUENCY				
0 12 063	BRIGHTNESS TEMPERATURE				
0 02 153	SATELLITE CHANNEL CENTRE FREQUENCY				
0 12 063	BRIGHTNESS TEMPERATURE				
0 13 090	RADIOMETER WATER VAPOR CONTENT				
0 13 091	RADIOMETER LIQUID CONTENT				
	Wind				
0 07 002	HEIGHT OR ALTITUDE				
<u>0 11 097</u>	<u>WIND SPEED FROM ALTIMETER</u>	<u>M/S</u>	<u>2</u>	<u>0</u>	<u>12</u>
<u>0 11 098</u>	<u>WIND SPEED FROM RADIOMETER</u>	<u>M/S</u>	<u>2</u>	<u>0</u>	<u>12</u>
0 07 002	HEIGHT OR ALTITUDE				
0 11 095	U COMPONENT OF THE MODEL WIND VECTOR				
0 11 096	V COMPONENT OF THE MODEL WIND VECTOR				

	Dynamic Topography				
<u>0 10 096</u>	<u>MEAN DYNAMIC TOPOGRAPHY</u>	<u>M</u>	<u>3</u>	<u>-131072</u>	<u>18</u>
0 10 081	ALTITUDE OF COG ABOVE REFERENCE ELLIPSOID				
0 10 082	INSTANTANEOUS ALTITUDE RATE				
0 10 083	OFF NADIR ANGLE OF THE SATELLITE FROM PLATFORM DATA				
<u>0 10 101</u>	<u>SQUARED OFF NADIR ANGLE OF THE SATELLITE FROM WAVEFORM DATA</u>	<u>DEGREES^2</u>	<u>2</u>	<u>-32768</u>	<u>16</u>
0 25 132	IONOSPHERIC CORRECTION FROM MODEL ON KU BAND				
<u>0 25 163</u>	<u>ALTIMETER IONOSPHERIC CORRECTION ON KU BAND</u>	<u>M</u>	<u>3</u>	<u>-32768</u>	<u>16</u>
025 126	MODEL DRY TROPOSPHERIC CORRECTION				
0 25 128	MODEL WET TROPOSPHERIC CORRECTION				
<u>0 25 164</u>	<u>RADIOMETER WET TROPOSPHERIC CORRECTION</u>	<u>M</u>	<u>4</u>	<u>-5000</u>	<u>13</u>
0 10 085	MEAN SEA SURFACE HEIGHT				
<u>0 10 097</u>	<u>MEAN SEA SURFACE HEIGHT FROM ALTIMETER ONLY</u>	<u>M</u>	<u>3</u>	<u>-131072</u>	<u>18</u>
0 10 086	GEOID'S HEIGHT				
0 10 087	OCEAN DEPTH/LAND ELEVATION				
0 10 092	SOLID EARTH TIDE HEIGHT				
0 10 088	GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 1				
0 10 089	GEOCENTRIC OCEAN TIDE HEIGHT SOLUTION 2				
<u>0 10 098</u>	<u>LOADING TIDE HEIGHT GEOCENTRIC OCEAN TIDE SOLUTION 1</u>	<u>M</u>	<u>4</u>	<u>-2000</u>	<u>12</u>
<u>0 10 099</u>	<u>LOADING TIDE HEIGHT GEOCENTRIC OCEAN TIDE SOLUTION 2</u>	<u>M</u>	<u>4</u>	<u>-2000</u>	<u>12</u>
0 10 090	LONG PERIOD TIDE HEIGHT				
<u>0 10 100</u>	<u>NON-EQUILIBRIUM LONG PERIOD TIDE HEIGHT</u>	<u>M</u>	<u>4</u>	<u>-2000</u>	<u>12</u>
0 10 093	GEOCENTRIC POLE TIDE HEIGHT				
0 25 127	SEA SURFACE HEIGHT CORRECTION DUE TO PRESSURE LOADING				
<u>0 40 014</u>	<u>HIGH FREQUENCY FLUCTUATIONS OF THE SEA SURFACE TOPOGRAPHY CORRECTION</u>	<u>M</u>	<u>4</u>	<u>-3000</u>	<u>13</u>

It is proposed to allocate the Table D entry 3 40 005 for the above sequence.

Proposal for code and flag tables

0 08 077

Radiometer sensed surface type

Code figure	
0	Land
1	Sea
2	Coastal
3	Open ocean or semi-enclosed sea
4	Enclosed sea or lake
5	Continental ice
6-126	Reserved
127	Missing value

0 40 011

Interpolation flag

Bit number	
1	Mean sea surface (MSS) interpolation flag
2	Ocean tide solution 1 interpolation flag (0=4 points over ocean, 1=less than 4 points)
3	Ocean tide solution 2 interpolation flag (0=4 points over ocean, 1=less than 4 points)
4	Meteorological data interpolation flag (0=4 points over ocean, 1=less than 4 points)
5	Spare
6	Spare
7	Spare
All 8 bits	Missing

0 25 090

Orbit state flag

Code figure	
0	Orbit computed during a manoeuvre
1	Adjusted mission operations orbit
2	Extrapolated mission operations orbit
3	Adjusted (preliminary/precise) orbit
4	(preliminary/precise) orbit is estimated during a manoeuvre period
5	(preliminary/precise) orbit is interpolated over a tracking data gap
6	(preliminary/precise) orbit is extrapolated for a duration less than 1 day
7	(preliminary/precise) orbit is extrapolated for a duration that ranges from 1 day to 2 days
8	(preliminary/precise) orbit is extrapolated for a duration larger than 2 days, or that the orbit is extrapolated just after a manoeuvre
9	DORIS [†] DIODE [‡] navigator orbit
10 - 14	Reserved
15	Missing value

[†] DORIS stands for "Doppler Orbitography and Radio-positioning Integrated by Satellite".

[‡] DIODE means "Détermination Immédiate d'Orbite par Doris Embarqué" or immediate onboard orbit determination by DORIS. It is part of the DORIS instrument, which calculates the satellite's position and velocity.

0 25 097

Three dimensional error estimate of the navigator orbit

Code figure

0	Ranges between 0 and 30 cm
1	Ranges between 30 and 60 cm
2	Ranges between 60 and 90 cm
3	Ranges between 90 and 120 cm
4	Ranges between 120 and 150 cm
5	Ranges between 150 and 180 cm
6	Ranges between 180 and 210 cm
7	Ranges between 210 and 240 cm
8	Ranges between 240 and 270 cm
9	Ranges larger than 270 cm
10 - 14	Reserved
15	Missing value

0 25 098

Altimeter data quality flag

Bit number	(0 is good, 1 is bad)
1	Ku band range
2	C band range
3	Ku band SWH*
4	C band SWH*
5	Ku band backscatter coefficient
6	C band backscatter coefficient
7	Off nadir angle from Ku band waveform parameters
8	Off nadir angle from platform
All 9 bits	Missing

* SWH stands for "Significant wave height"

0 25 099

Altimeter correction quality flag

Bit number	(0 is good, 1 is bad)
1	Ku band range instrumental correction
2	C band range instrumental correction
3	Ku band SWH* instrumental correction
4	C band SWH* instrumental correction
5	Ku band backscatter coefficient instrumental correction
6	C band backscatter coefficient instrumental correction
7	Spare
8	Spare
All 9 bits	Missing

* SWH stands for "Significant wave height"

0 40 012

Radiometer data quality flag

Bit number	(0 is good, 1 is bad)
1	18.7 GHz brightness temperature
2	23.8 GHz brightness temperature
3	34 GHz brightness temperature
4	Spare
5	Spare
6	Spare
7	Spare
All 8 bits	Missing

0 40 013

Radiometer brightness temperature interpretation flag

Code figure	
0	Interpolation with no gap between JMR [§] data
1	Interpolation with gaps between JMR [§] data
2	Extrapolation of JMR [§] data
3	Failure of extrapolation and interpolation
4 - 6	Reserved
7	Missing

§ JMR stands for “JASON-1 Microwave Radiometer”

0 21 169

Ice presence indicator

Code figure	
0	No ice present
1	Ice present
2	Reserved
3	Missing

**ANNEX TO PARAGRAPH 3.1.15
FOR URGENT VALIDATION**

TEMPLATE FOR THE WAVE OBSERVATIONS FROM DIFFERENT PLATFORMS SUITABLE FOR WAVEOB DATA

TM 308015– BUFR template for WAVEOB data expressed as frequency (I_a=0 in FM-65 WAVEOB)

Descriptor	Name (unit)	Expanded descriptors	Remark, Corresponding groups in FM-65 WAVEOB
Identification			
001003	WMO region	001003	A ₁ - First digit of WMO number (e.g. 62024 => 6)
001020	WMO region sub-area	001020	b _w - Second digit of WMO number (e.g. 62024 => 2)
001005	Buoy/platform identifier	001005	n _b - Last 3 digits of WMO number (e.g. 62024 => 024)
001011	Ship or mobile land station identifier	001011	D D
001205	Satellite Identifier	001205	I ₆ I ₆ I ₆
001001	WMO block number	001001	II
001002	WMO station number	001002	iii – Iiii only apply to fixed sea stations.
002044	Indicator for method of calculating spectral wave data.	002044	I _m – TAC code table 1744, BUFR code table 2044
002045	Indicator for type of platform	002045	I _p – TAC code table 1747, BUFR code table 2045
301011	Date	004001 (year) 004002 (month) 004003 (day)	J - Date of observation MM YY
301012	Time	004004 (Hour) 004005 (Minutes)	GG - Time of observation Gg
301021	Latitude and longitude (high accuracy)	005001 (Lat; high accuracy) 006001 (Lon; high accuracy)	Q _c L _a L _a L _a L _a L _o L _o L _o L _o L _o
Basic data (WAVEOB Section 0)			
022063	Total water depth (m)	022063	1hhhh
105002	Replication 5 desc 2 times	105002	Replicate over sensor type
002098	Type of wave sensor	002098	Code table 2098, 0=heave sensor. 1=slope sensor.
022070	Significant wave height (m)	022070	2H _s H _s H _s H _s or 6H _{se} H _{se} H _{se} H _{se} - section 0
022071	Spectral peak wave period (s)	022071	3P _p P _p P _p P _p or 7P _{sp} P _{sp} P _{sp} P _{sp} - section 0
022073	Maximum wave height	022073	4H _m H _m H _m H _m
022074	Average wave period (s)	022074	5P _a P _a P _a P _a or 8P _{sa} P _{sa} P _{sa} P _{sa} - section 0
002098	Type of wave sensor	002098	Set to missing to cancel the previous value.
022076	Direction of coming dominant waves (deg)	022076	9d _d d _d - section 0
022077	Directional spread of dominant wave (deg)	022077	d _s d _s - section 0
022094	Total Number Of Wave Bands	022094	111 B _T B _T – Section 1
025043	Wave sampling interval (Time, s)	025043	SSSS – Section 1
022078	Duration of wave record (s)	022078	D'D'D'D' – Section 1
Spectral Data (WAVEOB Section 1 – 5)			
121000	Replication 21 desc	121000	Replication over sensor type
031001	Replication factor	031001	(0,1,2) normally 1
002098	Type of wave sensor	002098	Code table 2098, 0=heave sensor. 1=slope sensor.
022082	Maximum Non-Directional Spectral Wave Density (m ² /Hz)	022082	C _m C _m C _m - Section 2 or C _{sm} C _{sm} C _{sm} - Section 3
022084	Band Containing Maximum Non-Directional Spectral Wave Density	022084	n _m n _m - Section 2 or n _{sm} n _{sm} - Section 3
116000	Delayed replication 16 descriptors	116000	Replication over bands.

031001	Replication Factor	031001	111 B _T B _T - Section 1 (Num of band)
022080	Waveband central frequency (Hz)	022080	1f ₁ f ₁ f ₁ f ₁ x ... - Section 1
022085	Spectral Wave Density Ratio	022085	1 c ₁ c ₁ c ₂ c ₂ ... - Section 2 or 1 c _{s1} c _{s1} c _{s2} c _{s2} ... - Section 3
022086	Mean Direction From Which Waves Are Coming (deg)	022086	1d _{a1} d _{a1} - Section 4
022087	Principal Direction From Which Waves Are Coming (deg)	022087	d _{a2} d _{a2} - Section 4
022088	First Normalized Polar Coordinate From Fourier Coefficients	022088	r ₁ r ₁ - Section 4
022089	Second Normalized Polar Coordinate From Fourier Coefficients	022089	r ₂ r ₂ - Section 4
103000	Delayed Replication 3 Descriptors	103000	
031001	Replication Factor	031001	n - Section 5 (Num of directions counted); =0 if I _b = 1 (Directional)
022090	Non-Directional Spectral Estimate By Wave Frequency (m ² /Hz)	022090	1 A ₁ A ₁ A ₁ x..... - Section 5
022186	Direction From Which Waves Are Coming (deg)	022186	1 d ₁ d ₁ - Section 5
022187	Directional Spread Of Wave (deg)	022187	d _s d _s - Section 5
103000	Delayed Replication 3 Descriptors	103000	
031001	Replication Factor	031001	n - Section 5 (Num of directions counted); =0 if I _b = 0 (Non-Directional)
022092	Directional Spectral Estimate By Wave Frequency (M ² /Hz/Radian)	022092	1 A ₁ A ₁ A ₁ x..... - Section 5
022186	Direction From Which Waves Are Coming (deg)	022186	1 d ₁ d ₁ - Section 5
022187	Directional Spread Of Wave (deg)	022187	d _s d _s - Section 5
002098	Type of wave sensor	002098	Set to missing to cancel the previous value.

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

Descriptor	Name	Expanded descriptors	Remark, Corresponding groups in FM-65 WAVEOB
	Identification		
001003	WMO region	001003	A ₁ - First digit of WMO number (e.g. 62024 => 6)
001020	WMO region sub-area	001020	b _w - Second digit of WMO number (e.g. 62024 => 2)
001005	Buoy/platform identifier	001005	n _b - Last 3 digits of WMO number (e.g. 62024 => 024)
001011	Ship or mobile land station identifier	001011	D D
001205	Satellite Identifier	001205	I ₆ I ₆ I ₆
001001	WMO block number	001001	II
001002	WMO station number	001002	iii - Iiii only apply to fixed sea stations.
002044	Indicator for method of calculating spectral wave data.	002044	I _m - TAC code table 1744, BUFR code table 2044
002045	Indicator for type of platform	002045	I _p - TAC code table 1747, BUFR code table 2045
301011	Date	004001 (year) 004002 (month) 004003 (day)	J - Date of observation MM YY
301012	Time	004004 (Hour) 004005 (Minutes)	GG - Time of observation Gg
301021	Latitude and longitude (high accuracy)	005001 (Lat; high accuracy) 006001 (Lon; high accuracy)	Q _c L _a L _a L _a L _a L _o L _o L _o L _o L _o
	Basic data (WAVEOB Section 0)		
022063	Total water depth (m)	022063	1hhhh
105002	Replecation 5 desc 2 times	105002	Replication over sensor type
000298	Type of wave sensor	002098	Code table 2098, 0=heave sensor. 1=slope sensor.
022070	Significant wave height (m)	022070	2H _s H _s H _s H _s or 6H _{se} H _{se} H _{se} H _{se} - section 0
022072	Spectral peak wave length (m)	022072	3P _p P _p P _p P _p - section 0
022073	Maximum wave height	022073	4H _m H _m H _m H _m
022075	Average wave length (m)	022075	5P _a P _a P _a P _a - section 0
000298	Type of wave sensor	002098	Set to missing to cancel the previous value.
022076	Direction of coming dominant waves (deg)	022076	9d _d d _d - section 0
022077	Directional spread of dominant wave (deg)	022077	d _s d _s - section 0
022094	Total Number Of Wave Bands	022094	111 B _T B _T - Section 1
025044	Wave sampling interval (Space, m)	025044	SSSS - Section 1
022079	Length of wave record (m)	022079	D'D'D'D' - Section 1
	Spectral Data (WAVEOB Section 1 - 5)		
121000	Replecation 21 desc	121000	Replication over sensor type
031001	Replication factor	031001	(0,1,2) normally 1
002098	Type of wave sensor	002098	Code table 2098, 0=heave sensor. 1=slope sensor.
022083	Maximum Non-Directional Spectral Wave Number (m ³)	022083	C _m C _m C _m - Section 2 or C _{sm} C _{sm} C _{sm} - Section 3
022084	Band Containing Maximum Non-Directional Spectral Wave Density	022084	n _m n _m - Section 2 or n _{sm} n _{sm} - Section 3
116000	Delayed replication 16 descriptors	116000	Replication over band
031001	Replication Factor	031001	111 B _T B _T - Section 1 (Num of band)
022081	Waveband central wave number (1/m)	022081	1f ₁ f ₁ f ₁ x - Section 1
022085	Spectral Wave Density Ratio	022085	1 C ₁ C ₁ C ₂ C ₂ - Section 2 or 1 C _{s1} C _{s1} C _{s2} C _{s2} - Section 3
022086	Mean Direction From Which Waves Are Coming (deg)	022086	1d _{a1} d _{a1} - Section 4
022087	Principal Direction From Which Waves Are Coming (deg)	022087	d _{a2} d _{a2} - Section 4
022088	First Normalized Polar Coordinate From Fourier Coefficients	022088	r ₁ r ₁ - Section 4
022089	Second Normalized Polar Coordinate From Fourier Coefficients	022089	r ₂ r ₂ - Section 4

103000	Delayed Replication 3 Descriptors	103000	
031001	Replication Factor	031001	n - Section 5 (Num of directions counted); =0 if I _b = 1 (Directional)
022091	Non-Directional Spectral Estimate By Wave Number (m ³)	022091	1 A ₁ A ₁ A ₁ x..... - Section 5
022186	Direction From Which Waves Are Coming (deg)	022186	1 d ₁ d ₁ - Section 5
022187	Directional Spread Of Wave (deg)	022187	d _s d _s - Section 5
103000	Delayed Replication 3 Descriptors	103000	
031001	Replication Factor	031001	n - Section 5 (Num of directions counted); =0 if I _b = 0 (Non-Directional)
022093	Directional Spectral Estimate By Wave Number (m ³)	022093	1 A ₁ A ₁ A ₁ x..... - Section 5
022186	Direction From Which Waves Are Coming (deg)	022186	1 d ₁ d ₁ - Section 5
022187	Directional Spread Of Wave (deg)	022187	d _s d _s - Section 5
002098	Type of wave sensor	002098	Set to missing to cancel the previous value.

Notes:

1. Because WAVEOB can be reported from different platform, the descriptors for identification of all possible platforms are all included in the template. The irrelevant descriptors for identification shall be set to missing.

2. New descriptors:

002098 is introduced to express the type of wave sensor.

022186 is introduced to express the direction of “any wave”, as appose to the direction of “dominant wave” (022076), “mean direction” (022086), and “principal direction” (022087).

022187 is introduced to express the directional spread of “any wave”, as appose to the directional spread of “dominant wave” (022077).

TABLE REFERENCE			TABLE ELEMENT NAME	BUFR				CREX		
				UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
F	X	Y								
0	02	098	Type of wave sensor	Code table	0	0	4	Code table	0	2
0	22	186	Direction from which waves are coming	Degree true	0	0	9	Degree true	0	3
0	22	187	Directional spread of wave	Degree	0	0	9	Degree	0	3

Code table 002098 (New table)

Code figure

- 0 Heave sensor.
- 1 Slope sensor.
- 2-14 Reserved
- 15 Missing Value

**ANNEX TO PARAGRAPH 3.1.16
FOR RE-SUBMISSION**

PROPOSAL FOR UNIVERSAL BUFR TEMPLATE FOR REPRESENTATION OF LIGHTNING DATA

Where possible existing code sequences have been adopted, new and modified descriptors are detailed below and are in the annex table.

Note: some form of time replication may be needed for the whole table as there are about 10-40 strokes recorded per second, this really depends on the frequency of sending the messages.

a) Existing code

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 04 007	Second Within a Minute (Microsecond accuracy)	Second	6	0	26

Here ATDNet records to a point of a microsecond or 100 nano-seconds. This could be rounded up or truncated, or even a new value added using an operator 202129 to increase the accuracy to 10⁻⁷, but doing so will cause problems to non 64 bit systems processing the data. I would recommend truncation, but what do the ETDRC recommends here? An actual value here would be for example 55.1885403 rounded/truncated to 55.188540

Answer:

0-04-008 Seconds within minute (high accuracy)

BUFR Seconds 7 0 30

CREX Seconds 7 9

b)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 111	X-axis error ellipse major component	Km	2	0	17

Actual value e.g 6.40 Km range 0.00 to 1000.00 Km

Update 0-20-111 as follows:

0-20-111 X-axis error ellipse major component

BUFR m -1 0 17

c)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 112	Y-axis error ellipse minor component	Km	2	0	17

Here, if x=y then it is a radial error, and the angle (see 020114) will be zero

Actual value 2.41 Km, range 0.00 to 1000.00 Km

Update 0-20-112 as follows:

0-20-112 Y-axis error ellipse major component

BUFR m -1 0 17

d)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 113	Z-axis error ellipse component	Km	2	0	17

Here, if $x=y=z$ then it is a spherical error, and the angle (see 020115) will be zero
Actual Value 2.46 Km, range as above.

Update 0-20-113 as follows:

0-20-113 Z-axis error ellipse major component
BUFR m -1 0 17

e)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 114	Angle of X-axis in error ellipse	Degree	2	-18000	16

Here is the angle of the error defined in b & c above. Cartesian with sign bit
Actual value 33.40 range -180.00 to 180.00

f)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 115	Angle of Z-axis in error ellipse	Degree	2	-18000	16

Here is the angle of the error defined in b,c & d above. Cartesian with sign bit
Actual value 12.45

g)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 116	Emission Height of Cloud Stroke	M	0	0	16

This parameter is used by DWD(LINNET) for height above ground of stroke
Actual Value 1200m range 0-20000

h)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 117	Amplitude of Lightning Strike	A	0	0	18

Here we would need to introduce a amplitude measure in Amps or kA. This value was first developed nationally by DWD. Example 5.6KA coded as 5600 range 0 to 320000.

Update 0-20-117 as follows:

0-20-117 Amplitude of Lightning Strike

BUFR A 0 0 19

i)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 118	Lightning Detection Error	M	0	0	19

This seems to be radial error measured in Metres or Km. An alternative for systems not capable of describing in x,y and z. This value was first developed nationally by DWD.

Example 6900m range 0 to 500000

j)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 119	Polarity of Stroke	Code table	0	0	2

0	Not Defined
1	Positive
2	Negative
3	Missing Data

Here we have a simple table self explanatory.

k) 020120 Decision Method for Polarity (V or A) Code table 0,0,3 bits

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 120	Decision Method for Polarity	Code table	0	0	3

0	Not Defined
1	Individual voltage deflection
2	Current based, above a threshold
3	Voltage based, above a threshold
4	Consensus of sensors, Current above a threshold
5	Consensus of sensors, Voltage above a threshold
6	Reserved
7	Missing Data

Certain sensors use a current decision above a threshold, others directly measure the voltage deflection.

l)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 121	Threshold value for Polarity Decision	V	0	0	16

Used with k) 020120 or all zero if not defined, typically +1 Volt.

Remark:

Sub-group unable to confirm due to some uncertainty in the descriptor. Why is bit width 16 for typical value of +1, and why set to 0 rather than missing if no threshold value? Also, is scale of 0 giving sufficient precision?

m)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 122	Threshold value for Polarity Decision	A	0	0	16

Used with k) 020120 or all zero if not defined, typically +2000 A.

Remark:

Sub-group unable to confirm due to some uncertainty in the descriptor. Why set to 0 rather than missing if no threshold value? Also, is scale of 0 giving sufficient precision?

n)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 123	Minimum Threshold for Detection	V/M	3	0	16

This is the minimum signal level acceptable for processing.

e.g. 0.005v or 5mv , or typically just above the noise floor of the detector.

Remark:

Sub-group unable to confirm due to some uncertainty in the descriptor. Sub-group assumes that units are V and scale is 3 to give mV. Units in table refer to V/M which refers to electrical field strength.

o)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 124	Lightning Stroke or Flash	Code table	0	0	2

0	Not Defined
1	Lightning Stroke
2	Lightning Flash, by manual observation, or if equipment insensitive to stroke resolution
3	Missing Data

Another Simple table

p)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 125	Modified Residual	Numeric	2	0	13

Here the modified residual calculated from the loci of the sensors and signal to noise ratios for the flash. Actual value 0.71 range 0.00 to 10.00

q) Existing code

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 023	Other Weather	Flag table	0	0	18

Used to indicate cloud to ground or cloud to cloud.

r)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 20 126	Central Processor or system Identifier	Code table	0	0	8

0	Not Defined
1	Main Processor
2	Backup Processor
3-254	Reserved
255	Missing Data

This is where we identify the Flash Location Processor or system identity so that in multi integrated system we can identify where the event location was developed. Typically 1 here

s)

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
1 00 001	Delayed replication of 1 descriptor				
0 31 002	Extended delayed descriptor replication factor	Numeric			
3-03-054 3-01-058	Template for representation of lightning data				

As presented, this will define the number or sensors and locations taking part in the lightning stroke. This would be a minimum of 4 for ATDNet, typically 8 sensors contributing to the actual strike.

Remark:

Sequence descriptor 3-03-054 is already used. The sub-group notes that 3-03-055 was referred to later in the document, and it is also already used. The sub-group considers that sequence category 01 is more appropriate; 3-01-058 and 3-01-059 would be a good choice.

t) existing code

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 02 184	Type of Lightning Sensor	Code table	0	0	4

Here we need to introduce at least the ATDNet VLF waveform correlated sensor. Or code as 4.

Remark:

In code table 0-02-184, the sub-group proposes to add entry 6 for “ATDNet VLF waveform correlated sensor” with an appropriate name for the code table entry to be provided, specifying the type of sensor.

u) Existing code

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width
0 02 121	Mean Frequency	Hertz	-8	0	7

Here this is where systems could be split into cells that work on different frequencies.

You would need to know which sensors are associated with this frequency.

Actual value 13777 Hz so we change scales, with 202136,201236, before and reset after with 201000 and 202000.

In summary, we need at least 16 new descriptors.

TM 301058 Universal BUFR template for representation of Lightning data.

This template is suitable for representation of high resolution lightning data from Land, Ship, Mobile, Aircraft or Satellite. Developed by Paul Taylor Observations Development UK Met Office.

		Date/time of lightning event	
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
	0 04 007	Second within a minute (Microsecond accuracy)	Second
		Horizontal and vertical coordinates of lightning event	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 20 111	X-Axis error ellipse	Km scale 2,0,17
	0 20 112	Y-Axis error ellipse	Km scale 2,0,17
	0 20 113	Z-Axis error ellipse	Km scale 2,0,17
	0 20 114	Angle of X-Axis in error ellipse	Degree scale 2,-18000,16
	0 20 115	Angle of Z-Axis in error ellipse	Degree scale 2,-18000,16
	0 20 116	Emission Height of cloud stroke	M scale 0,0,16
		Emission information	
	0 20 117	Amplitude of Lightning Strike	A, scale 1,0,15
	0 20 118	Lightning Detection Error	M, scale 0,0,15
	0 20 119	Polarity of stroke	Code table scale 0,0,2
	0 20 120	Decision Method for Polarity (V or A)	Code table scale 0,0,3
	0 20 121	Threshold value for Polarity decision	V scale 0,0,16
	0 20 122	Threshold value for Polarity decision	A scale 0,0,16
	0 20 123	Minimum threshold for Detection	V/M scale 3,0,16
	0 20 124	Lightning Stroke or Flash	Code table scale 0,0,2
	0 20 125	Modified Residual	Numeric scale 2,0,13
	0 20 023	Other Weather (for c2g or c2c identification)	Flag table scale 0,0,18

		Sensor Processing	
	0 20 126	Central Processor Identifier	Code table, scale 0,0,8
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor Number of Sensors contributing	Numeric
3 01 059		Identification of sensor site and instrumentation for Lightning detection	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 001	Type of Station	Code table
	0 02 184	Type of Lightning Detection Sensor	Code table
	0 02 189	Capability to Discriminate Lightning Strike	Flag table
	0 02 036	Atmospherics Location Method	Code table
202136			
201136			
	0 02 121	Mean Frequency (to define centre frequency, if used)	Hertz,scale1,7
201000			
202000			
	0 25 061	Software identification and version number	CCITT IA5
	3 01 021	Latitude (high accuracy) of sensor	Degree, scale 5
		Longitude (high accuracy) of sensor	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 032	Height of sensor above local ground (for lightning)	m, scale 1

**ANNEX TO PARAGRAPH 3.2
FOR URGENT VALIDATION**

3 02 089 (LOCUST INFORMATION)

3 02 089		<i>Locust information</i>	
	0 20 101	Locust (acridian) name	L_n
	0 20 102	Locust (maturity) color	L_c
	0 20 103	Stage of development of locusts	L_d
	0 20 104	Organization state of swarm or band of locusts	L_g
	0 20 105	Size of swarm or band of locusts and duration of passage of swarm	s_L
	0 20 106	Locust population density	d_L
	0 20 107	Direction of movements of locust swarm	D_L
	0 20 108	Extent of vegetation	v_e

Extract of regulations:

B/C 1.9.1.3 Locust control-related observations

Following data shall be reported by all Members capable of doing so:

- (a) Locust (acridian) name (Code table 0 20 101),
- (b) Locust (maturity) color (Code table 0 20 102),
- (c) Stage of development of locusts (Code table 0 20 103),
- (d) Organization state of swarm or band of locusts (Code table 0 20 104),
- (e) Size of swarm or band of locusts and duration of passage of swarm (Code table 0 20 105),
- (f) Locust population density (Code table 0 20 106),
- (g) Direction of movements of locust swarm (Code table 0 20 107),
- (h) Extent of vegetation (Code table 0 20 108). [1/12.14.1]

**ANNEX TO PARAGRAPH 3.3.1
FOR VALIDATION**

RECALL:

**TYOLOGY OF INSTRUMENT/MISSIONS EXTRACTED FROM THE GAP ANALYSIS
(CGMS35WMOWP05)**

1. Multi-purpose VIS/IR imagery from LEO
2. Multi-purpose VIS/IR imagery from GEO
3. IR temperature/humidity sounding from LEO
4. IR temperature/humidity sounding from GEO
5. MW temperature/humidity sounding from LEO
6. MW temperature/humidity sounding from GEO
7. Conical scanning MW imagery (intermediate frequencies)
8. Low frequency MW imagery
9. Radio occultation sounding
10. Earth radiation budget from LEO
11. Earth radiation budget from GEO
12. Wind scatterometry
13. Radar altimetry
14. Ocean colour imagery from LEO
15. Ocean colour imagery from GEO
16. Imagery with special viewing geometry
17. Lightning imagery from LEO
18. Lightning imagery from GEO
19. Cloud and precipitation radar
20. Lidar based missions (for wind, for cloud/aerosol, for water vapour, for altimetry)
21. Cross nadir shortwave spectrometry (for chemistry) from LEO
22. Cross nadir shortwave spectrometry (for chemistry) from GEO
23. Cross nadir IR spectrometry (for chemistry) from LEO
24. Cross nadir IR spectrometry (for chemistry) from GEO
25. Limb sounding shortwave spectrometry
26. Limb sounding IR spectrometry
27. Limb sounding sub-millimetre wave spectrometry
28. High resolution shortwave imagery for land observation
29. Synthetic Aperture Radar

ACRONYMS

VIS	Visible channel
IR	Infrared channel
LEO	Low Earth Orbit
GEO	Geostationary orbit
MW	Microwave

In Section 1, BUFR Edition 4:

Octets 5 – 6	Identification of originating/generating centre (see Common Code Table C-11)
Octet 11	Data Category (Table A)
Octet 12	International data sub-category (See Common Table C-13)
Octet 13	Local data sub-category (defined locally by automatic data processing (ADP) centres)

In BUFR Table A — Data category

3	Vertical soundings (satellite)
5	Single level upper-air data (satellite)
12	Surface data (satellite)
21	Radiances (satellite measured)
101	Image data

- Data Category and International data sub-category identify the general and more specific type of data. These values are internationally coordinated.
- Each originating/generating centre identifies its distinct products by assigning them local data sub-categories within the most applicable data category and international sub-category.
- Thus each originating/generating centre can independently characterise up to 255 products per international data sub-category.

PROPOSAL FOR NEW DATA CATEGORIES IN BUFR TABLE A (new entries with grey highlight)

22	Radar (satellite) <i>but not altimeter and scatterometer</i>
23	Lidar (satellite)
24	Scatterometry (satellite)
25	Altimetry (satellite)
26	Spectrometry (satellite)
27	Gravity measurement (satellite)
28	Precision orbit (satellite)
29	Space environment (satellite)
30	Calibration datasets (satellite)
101	Image data (satellite)

REVISED INSTRUMENT/MISSION TYPOLOGY (INTERNATIONAL SUB-CATEGORIZATION) WITH ASSOCIATED MAPPINGS TO PROPOSED DATA CATEGORIES [CATEGORY IN SQUARE BRACKETS] (new entries with grey highlight)

- **Multi-purpose VIS/IR imagery** [101 - Image data]
- **IR temperature/humidity sounding** [3 - Vertical soundings (satellite)]
- **Hyperspectral temperature/humidity sounding** [3 - Vertical soundings (satellite)]
- **MW temperature/humidity sounding** [3 - Vertical soundings (satellite)]
- **Conical scanning MW imagery (intermediate frequencies)** [101 - Image data]
- **Low frequency MW imagery** [101 - Image data]

- **Radio occultation sounding** [3 - Vertical soundings (satellite)]
- **Earth radiation budget** [21 - Radiances (satellite measured)]
- **Wind scatterometry** [24 - Scatterometry (satellite)]
- **Radar altimetry** [25 - Altimetry (satellite)]
- **Ocean colour imagery** [101 - Image data]
- **Imagery with special viewing geometry** [101 - Image data]
- **Lightning imagery** [101 - Image data]
- **Cloud and precipitation radar** [22 - Radar (satellite)]
- **Lidar based missions (for wind, for cloud/aerosol, for water vapour, for altimetry)** [23 - Lidar (satellite)]
- **Cross nadir shortwave spectrometry (for chemistry)** [26 - Spectrometry (satellite)]
- **Cross nadir IR spectrometry (for chemistry)** [26 - Spectrometry (satellite)]
- **Limb sounding shortwave spectrometry** [26 - Spectrometry (satellite)]
- **Limb sounding IR spectrometry** [26 - Spectrometry (satellite)]
- **Limb sounding sub-millimetre wave spectrometry** [26 - Spectrometry (satellite)]
- **High resolution shortwave imagery for land observation** [101 - Image data]
- **Synthetic Aperture Radar** [22 - Radar (satellite)]
- **Gravity measurement** [27 - Gravity measurement (satellite)]
- **Precision orbit** [28 - Precision orbit (satellite)]
- **Space environment** [29 - Space environment (satellite)]
- **Calibration datasets** [30 - Calibration datasets (satellite)]

PROPOSED INTERNATIONAL DATA SUB-CATEGORIES PER DATA CATEGORY (new entries with grey highlight)

Category 3 Vertical sounding (satellite)

0	Temperature (SATEM)
1	TIROS (TOVS)
2	ATOVS
3	AMSU-A
4	AMSU-B
5	HIRS
6	MHS
7	IASI
20	IR temperature/humidity sounding
30	Hyperspectral temperature/humidity sounding
40	MW temperature/humidity sounding
50	Radio occultation sounding

Category 21 Radiances (satellite measured)

0	Earth radiation budget
---	------------------------

Category 22 Radar (satellite) but not altimeter and scatterometer

- 0 Cloud and precipitation radar
- 1 Synthetic Aperture Radar

Category 23 Lidar (satellite)

- 0 Lidar based missions (for wind, for cloud/aerosol, for water vapour, for altimetry)

Category 24 Scatterometry (satellite)

- 0 Wind scatterometry

Category 25 Altimetry (satellite)

- 0 Radar altimetry

Category 26 Spectrometry (satellite)

- 0 Cross nadir shortwave spectrometry (for chemistry)
- 1 Cross nadir IR spectrometry (for chemistry)
- 2 Limb sounding shortwave spectrometry
- 3 Limb sounding IR spectrometry
- 4 Limb sounding sub-millimetre wave spectrometry

Category 27 Gravity measurement (satellite)

No sub-categories identified as yet

Category 28 Precision orbit (satellite)

No sub-categories identified as yet

Category 29 Space environment (satellite)

No sub-categories identified as yet

Category 30 Calibration datasets (satellite)

No sub-categories identified as yet

Category 101 Image data

- 0 Multi-purpose VIS/IR imagery
- 1 Conical scanning MW imagery (intermediate frequencies)
- 2 Low frequency MW imagery
- 3 Ocean colour imagery
- 4 Imagery with special viewing geometry
- 5 Lightning imagery
- 6 High resolution shortwave imagery for land observation
- 7 SMOS data

SOME EXAMPLES OF SATELLITE DATA CATEGORIZATION

Full GRAS radio occultation data set from EUMETSAT:

Section 1, BUFR Edition 4

- Octets 5 – 6 Identification of originating/generating centre: **254**
- Octet 11 Data Category (Table A): **3**
- Octet 12 International data sub-category (See Common Table C-13): **50**
- Octet 13 Local data sub-category: **0**

Subsampled GRAS radio occultation data set from EUMETSAT:

Section 1, BUFR Edition 4

- Octets 5 – 6 Identification of originating/generating centre: **254**
- Octet 11 Data Category (Table A): **3**
- Octet 12 International data sub-category (See Common Table C-13): **50**
- Octet 13 Local data sub-category: **1**

Temperature sounding from HIRS by NOAA/NESDIS:

Section 1, BUFR Edition 4

- Octets 5 – 6 Identification of originating/generating centre: **160**
- Octet 11 Data Category (Table A): **3**
- Octet 12 International data sub-category (See Common Table C-13): **20**
- Octet 13 Local data sub-category: **0**

Humidity sounding from HIRS by NOAA/NESDIS:

Section 1, BUFR Edition 4

- Octets 5 – 6 Identification of originating/generating centre: **160**
- Octet 11 Data Category (Table A): **3**
- Octet 12 International data sub-category (See Common Table C-13): **20**
- Octet 13 Local data sub-category: **1**

ANNEX TO PARAGRAPH 3.3.2

OPERATIONAL

UPDATED COMMON CODE TABLE C-12: Sub-Centres of Originating Centres defined by entries in Common Tables C-1 or C-11 (new entries are in red)

ORIGINATING CENTRES		SUB-CENTRES	
C-1 or C-11		<i>BUFR Edition 3, Octet 5 in Section 1</i> <i>BUFR Edition 4, 0 01 034 and Octets 7-8 in Section1</i> <i>GRIB Edition 1, Octet 26 in Section 1</i> <i>GRIB Edition 2, Octets 8-9 in Section 1</i> <i>CREX Edition 2, ppp in Group Poooooopp of Section 1</i>	
Code figure	Name	Code figure	Name
		0	No Sub-Centre
Region II			
00034	Tokyo (RSMC), Japan Meteorological Agency	207	Syowa
		240	Kiyose
00039	Beijing (RSMC)	225	Beijing
		226	Guangzhou
		228	Urumuqi
00040	Seoul	243	Seoul
		245	Jincheon
00110	Hong-Kong, China	229	Hong-Kong
Region III			
00046	Brazilian Space Agency - INPE	10	Cachoeira Paulista (INPE)
		11	Cuiaba (INPE)
		12	Brasilia (INMET)
		13	Fortaleza (FUNCEME)
		14	Natal (Navy Hygrog. Centre)
		15	Manaus (SIVAM)
		16-20	Reserved
00147	COmision Nacional de Actividades Espaciales (CONAE) - Argentina	10	Córdoba
		20	Marambio
		30	Santiago de Chile
		40	Punta Arenas
		50	Base Presidente Frei
		60	Cotopaxi
Region IV			
00007	US National Weather Service, NCEP	1	NCEP Reanalysis Project
		2	NCEP Ensemble Products
		3	NCEP Central Operations
		4	Environmental Modeling Center
		5	Hydrometeorological Prediction Center
		6	Ocean Prediction Center
		7	Climate Prediction Center
		8	Aviation Weather Center
		9	Storm Prediction Center
		10	National Hurricane Center
		11	NWS Techniques Development Laboratory
		12	NESDIS Office of Research and Applications
		13	Federal Aviation Administration
		14	NWS Meteorological Development Laboratory
		15	North American Regional Reanalysis Project
		16	Space Weather Prediction Center
00160	U.S. NOAA/NESDIS	10	Tromso (Norway)
		11	McMurdo (Antarctica)
00161	U.S. NOAA Office of Oceanic and Atmospheric Research (NOAA/OAR)	1	Great Lakes Environmental Research Laboratory
		2	Earth System Research Laboratory
00173	US National Aeronautics and Space	1	Ames Research Center

	Administration (NASA)	2	Dryden Flight Research Center
		3	Glenn Research Center
		4	Goddard Space Flight Center
		5	Jet Propulsion Laboratory
		6	Johnson Space Center
		7	Kennedy Space Center
		8	Langley Research Center
		9	Marshall Space Flight Center
		10	Stennis Space Center
		11	Goddard Institute for Space Studies
		12	Independent Verification and Validation Facility
		13	NASA Shared Service Center
		14	Wallops Flight Facility
Region V			
00002	Melbourne	201	Casey
		203	Davis
		211	Melbourne Crib Point 1
		214	Darwin
		217	Perth
		219	Townsville
		232	Fiji
		235	Noumea
		237	Papeete
		250	Vladivostock
		251	Guam
		252	Honolulu
00069	Wellington (RSMC)	243	Kelburn
00072	Singapore	249	Singapore
Region VI			
00074	UK M.O., Exeter (RSMC)	1	Shanwick Oceanic Area Control Centre
		2	Fucino
		3	Gatineau
		4	Maspalomas
		5	ESA ERS Central Facility
		6	Prince Albert
		7	West Freugh
		13	Tromso
		21	Agenzia Spaziale Italiana (Italy)
		22	Centre National de la Recherche Scientifique (France)
		23	GeoForschungsZentrum (Germany)
		24	Geodetic Observatory Pecny (Czech Republic)
		25	Institut d'Estudis Espacials de Catalunya (Spain)
		26	Swiss Federal Office of Topography
		27	Nordic Commission of Geodesy (Norway)
		28	Nordic Commission of Geodesy (Sweden)
		29	Institute de Geodesie National (France)
		30	Bundesamt für Kartographie und Geodäsie (Germany)
		31	Institute of Engineering Satellite Surveying and Geodesy (U.K.)
00254	EUMETSAT Operation Centre	10	Tromso (Norway)
		20	Maspalomas (Spain)
		30	Kangerlussuaq (Greenland)
		40	Edmonton (Canada)
		50	Bedford (Canada)
		60	Gander (Canada)
		70	Monterey (USA)
		80	Wallops Island (USA)
		90	Gilmor Creek (USA)
		100	Athens (Greece)
		120	Ewa Beach, Hawaii
		130	Miami, Florida
		140	Lannion, France
		150	Svalbard, Norway
		170	St Denis (La Réunion)
		180	Moscow
		190	Muscat

ANNEX TO PARAGRAPH 3.3.3
PRE_OPERATIONAL

FOR SMOS SATELLITE DATA

Proposed new Table B entries

Table Reference	Element name	BUFR				CREX		
		Unit	Scale	Ref. value	Data width	Unit	Scale	Data width
001144	Snapshot identifier	Numeric	0	0	31	Numeric	0	10
015012	Total electron count per square metre	1/M**2	-16	0	6	1/M**2	-16	2
012165	Direct sun brightness temperature	K	0	0	23	K	0	7
012166	Snapshot accuracy	K	1	-4000	13	K	1	4
012167	Radiometric accuracy (pure polarisation)	K	1	0	9	K	1	3
012168	Radiometric accuracy (cross polarisation)	K	1	0	9	K	1	3
030010	Number of grid points	Numeric	0	0	13	Numeric	0	4
001124	Grid point identifier	Numeric	0	0	24	Numeric	0	8
007012	Grid point altitude	M	2	-50000	20	M	2	7
013048	Water fraction	%	1	0	10	%	1	4
012080	Brightness temperature real part	K	2	-10000	16	K	2	5
012081	Brightness temperature imaginary part	K	2	-10000	16	K	2	5
012082	Pixel radiometric accuracy	K	2	0	12	K	2	4
025081	Incidence angle	Degree	3	0	17	Degree	3	6
025082	Azimuth angle	Degree	3	0	19	Degree	3	6
025083	Faraday rotational angle	Degree	3	0	19	Degree	3	6
025084	Geometric rotational angle	Degree	5	0	26	Degree	5	8
027010	Footprint axis 1	M	-1	0	14	M	-1	5
028010	Footprint axis 2	M	-1	0	14	M	-1	5
025174	SMOS information flag	Flag table	0	0	14	Flag table	0	5
002099	Polarisation	Code table	0	0	3	Code table	0	1
033028	Snapshot overall quality	Code table	0	0	3	Code table	0	1

Note: In full polarisation the Level1c SMOS brightness temperature (BT) is complex number. The components of the complex BT are related to the Stokes parameters which are harmonic components of the brightness temperature. Third and fourth Stoke parameters can be negative, leading to negative values of the complex BT.

Proposed new BUFR Table D sequence for SMOS data

312070 001007
 002019
 001144
 001124
 030010
 301011
 301013
 301021
 007012
 015012
 012165
 012166
 012167
 012168
 027010
 028010
 002099
 013048
 025081
 025082
 025083
 025084
 012080
 012081
 012082
 025174
 033028

Add new Code tables:

0 33 028 - Snapshot overall quality

Code	Meaning
1	Nominal
2	Degraded by SW error; any error reported by the algorithms
3	Degraded by instrument error
4	Degraded by corrupted /missing ADF
5-6	Reserved
7	Missing value

0 02 099 Polarisation

Code	Meaning
0	HH polarisation
1	VV polarisation
2	HV polarisation real valued component
3	HV polarisation imaginary valued component
4-6	Reserved
7	Missing value

Add new Flag table:

0 25 174 - SMOS information flag

Bit number	Meaning
1	Pixel is affected by RFI effects
2	Pixel is located in the hexagonal Alias direction centred on Sun alias
3	Pixel is close to the border delimiting the extended Alias free zone
4	Pixel is inside the extended Alias free zone
5	Pixel is inside the exclusive of Alias free zone
6	Pixel is located in a zone where a Moon Alias was reconstructed
7	Pixel is located in a zone where Sun reflection has been detected
8	Pixel is located in a zone where Sun Alias was reconstructed
9	Flat target transformation has been performed during image reconstruction of this pixel
10	Scene has been combined with an adjustment scene in opposite polarisation during image reconstruction to account for cross-polarisation leakage
11	Direct Moon correction has been performed during image reconstruction of this pixel
12	Reflected Sun correction has been performed during image reconstruction of this pixel
13	Direct Sun correction has been performed during image reconstruction of this image
All 14	Missing value

Add the following new Sub category in Common Code Table C-13

Data category	International sub-category
101 Image data (satellite)	007 SMOS data

Add the following new satellite identifier in Common Code Table C-5:

46 SMOS

Add the following new satellite instrument in Common Code Table C-8

176	ESA	Radiometer	MIRAS	Microwave Imaging Radiometer Using Aperture Synthesis
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ANNEX TO PARAGRAPH 3.3.4(1)
PREOPERATIONAL

FOR GOME EXPERIMENT DATA

3-10-018 Ozone data

- 001007 – Satellite identifier
- 005040 – Orbit number
- 004001 – Year
- 004043 – Day of year
- 004004 – Hour
- 004005 – Minute
- 004006 – Second
- 207002 – Increase scale, reference value and data width
- 026030 – Measurement integration time**
- 207000 – Cancel increase scale, reference value and data width
- 005002 – Latitude
- 006002 – Longitude
- 033072 – Ozone error**
- 007025 – Solar zenith angle
- 005022 – Solar azimuth angle
- 207002 – Increase scale, reference value and data width
- 015001 – Total ozone
- 207000 – Cancel increase scale, reference value and data width
- 008003 - Vertical significance (“0” = surface)
- 207001 – Increase scale, reference value and data width
- 010004 – Pressure (terrain)
- 207000 - Cancel increase scale, reference value and data width
- 008003 - Vertical significance (“Missing” = Cancel)
- 008003 - Vertical significance (“2” = Cloud top)
- 033042 - Type of limit represented by following value (“0” = Exclusive lower limit)
- 207001 - Increase scale, reference value and data width
- 007004 – Pressure
- 207000 – Cancel increase scale, reference value and data width
- 207002 – Increase scale, reference value and data width
- 015001 – Total ozone (below cloud top pressure)
- 207000 – Cancel increase scale, reference value and data width
- 008003 – Vertical significance (“Missing” = Cancel)
- 207002 – Increase scale, reference value and data width
- 020081 – Cloud amount in segment (cloud fraction)
- 207000 – Cancel increase scale, reference value and data width
- 020065 – Snow cover
- 008029 – Remotely-sensed surface type
- 207004 – Increase scale, reference value and data width

015030 – Aerosol contamination index

207000 – Cancel increase scale, reference value and data width

008075 – Ascending/descending orbit qualifier

Table Reference	Element name	BUFR				CREX		
		Unit	Scale	Ref. value	Data width	Unit	Scale	Data width
0 26 030	Measurement integration time	Second	2	0	8	Second	2	3
0 33 072	Ozone error	Code table	0	0	5	Code table	0	2

0-33-072 Ozone error

0	Good retrieval
1	Reflectivity out of range
2	Larger Pixels (Number of cross-track pixels less than 32) or backward scans Error
3	Solar zenith angle greater than 88
4	Latitude/longitude out of range
5	Viewing zenith angle or solar zenith angle out of range
6	Step-one process failed in general
7	First guess ozone out of range
8	Too many iterations (exceed 8)
9	Step-one residue calculation failed
10	Step-two process failed in general
11	First guess ozone profile out of range
12	Step-two ozone value out of range
13	Step-two residue calculation failed
14	Step-three process failed in general
15	Polarization Correction Accuracy Alert
16	Radiance or irradiance less or equal to zero
17-30	Reserved
31	Missing

ANNEX TO PARAGRAPH 3.3.4(2)
PREOPERATIONAL
METOP GOME-2 BUFR TEMPLATE

3 22 028

	ELEMENT NAME
1	001007 SATELLITE IDENTIFIER
2	002019 SATELLITE INSTRUMENTS
3	004001 YEAR
4	004002 MONTH
5	004003 DAY
6	004004 HOUR
7	004005 MINUTE
8	004006 SECOND
9	005001 LATITUDE (HIGH ACCURACY)
10	006001 LONGITUDE (HIGH ACCURACY)
11	027001 LATITUDE (HIGH ACCURACY)
12	028001 LONGITUDE (HIGH ACCURACY)
13	027001 LATITUDE (HIGH ACCURACY)
14	028001 LONGITUDE (HIGH ACCURACY)
15	027001 LATITUDE (HIGH ACCURACY)
16	028001 LONGITUDE (HIGH ACCURACY)
17	027001 LATITUDE (HIGH ACCURACY)
18	028001 LONGITUDE (HIGH ACCURACY)
19	010001 HEIGHT OF LAND SURFACE
20	014019 SURFACE ALBEDO
21	007025 SOLAR ZENITH ANGLE
22	010080 VIEWING ZENITH ANGLE
23	005023 SUN TO SATELLITE AZIMUTH DIFFERENCE
24	020010 CLOUD COVER (TOTAL)
25	008003 VERTICAL SIGNIFICANCE (SATELLITE OBSERVATIONS)
26	007004 PRESSURE
27	014026 ALBEDO AT THE TOP OF CLOUDS
28	020014 HEIGHT OF TOP OF CLOUD
29	013093 CLOUD OPTICAL THICKNESS
30	105000 DELAYED REPLICATION OF FIVE DESCRIPTORS
31	031001 DELAYED DESCRIPTOR REPLICATION FACTOR
32	007004 PRESSURE
33	007004 PRESSURE
34	008043 ATMOSPHERIC CHEMICAL OR PHYSICAL CONSTITUENT TYPE
35	008044 CAS REGISTRY NUMBER
36	015021 INTEGRATED MASS DENSITY

A new category 22 for Chemical and Aerosol sequences is proposed to be used.

**ANNEX TO PARAGRAPH 3.3.5.1
FOR URGENT VALIDATION**

TABLE B AND TABLE D ENTRIES FOR ENCODING OF IASI PRINCIPAL COMPONENT SCORES

It is proposed to use the following sequence of entries for the encoding of the principal component scores resulting from the compression of hyper-spectral data from IASI data (new entries are in *italicised and underlined*):

F X Y	Description	Unit	Scale	Reference	Width
	Satellite processing information				
0 01 007	Satellite identifier				
0 01 031	Identification of originating/generating centre				
0 02 019	Satellite instruments				
0 02 020	Satellite classification				
	Date and time				
0 04 001	Year				
0 04 002	Month				
0 04 003	Day				
0 04 004	Hour				
0 04 005	Minute				
2 02 131	Add 3 to the scale				
2 01 138	Add 10 to the width				
0 04 006	Seconds				
2 01 000	Reset width to default				
2 02 000	Reset scale to default				
0 05 001	Latitude (high accuracy)				
	Location information				
0 06 001	Longitude (high accuracy)				
0 07 024	Satellite zenith angle				
0 05 021	Bearing or azimuth				
0 07 025	Solar zenith angle				
0 05 022	Solar azimuth				
0 05 043	Field of view number				
0 05 040	Orbit number				
2 01 133	Add 5 to the width				
0 05 041	Scan line number				
2 01 000	Reset width to default				
2 01 132	Add 4 to the width				
0 25 070	Major frame count				
2 01 000	Reset width to default				
2 02 126	Subtract 2 from the scale				
0 07 001	Height of station				
2 02 000	Reset scale to default				
	Quality information				
0 33 060	Gqisflagqual - individual IASI-System quality flag				
0 33 061	Gqisqualindex - indicator for instrument noise performance (contributions from spectral and radiometric)				

0 33 062	Gqisqualindexloc - indicator for geometric quality index				
0 33 063	Gqisqualindexrad - indicator for instrument noise performance (contributions from radiometric calibration)				
0 33 064	Gqisqualindexspect - indicator for instrument noise performance (contributions from spectral calibration)				
0 33 065	Gqissystecsondqual - output of system TEC (Technical Expertise Centre) quality function				
	AVHRR scene analysis				
0 02 019	Satellite instruments				
0 25 051	AVHRR channel combination				
1 01 007	Repeat next one descriptor 7 times				
3 40 004	IASI Level 1c AVHRR single scene				
0 20 081	Cloud amount in segment				
0 08 029	Remotely sensed surface type				
0 20 083	Amount of segment covered by scene				
0 08 029	Remotely sensed surface type				
0 33 007	Per cent confidence				
	Instrument band definition				
1 07 003	Repeat next 7 descriptors 3 times for bands 1 to 3				
0 25 140	Start channel				
0 25 141	End channel				
<u>0 40 015</u>	<u>Quantization factor</u>	<u>Numeric</u>	<u>2</u>	<u>0</u>	<u>16</u>
<u>0 40 016</u>	<u>Residual RMS in band</u>	<u>Numeric</u>	<u>0</u>	<u>0</u>	<u>16</u>
	Principal component scores for band				
1 01 000	Delayed replication of one descriptor				
0 31 002	Extended delayed replication factor				
<u>0 40 017</u>	<u>Non-normalised principal component score</u>	<u>Numeric</u>	<u>0</u>	<u>-1073741824</u>	<u>31</u>

It is proposed to allocate the Table D entry 3 40 006 for the above sequence.

Explanation of proposed new descriptors

1) Quantization factor, 0 40 015

Principal component scores are divided by this number, before they are rounded to the nearest integer.

2) Residual RMS in band, 0 40 016

The noise normalised residual RMS for each band is a quality indicator which is computed based on noise normalised reconstruction residuals before quantisation.

3) Non-normalised principal component score, 0 40 017

The principal component scores within each field are ordered by rank (scores corresponding to eigenvectors with higher eigenvalues first). The total number of scores for a particular band is given by the associated extended delayed replication factor.

**ANNEX TO PARAGRAPH 3.3.5.2
FOR URGENT VALIDATION**

TABLE B AND TABLE D ENTRIES FOR ENCODING OF ENHANCED DATA FROM IASI

Proposed descriptor sequences

1) Full IASI level 1c data set (all channels)

It is proposed to use the following sequence of entries for the encoding of the full (8700 channel) IASI level 1c data (new entries are in *italicised and underlined*, changes from 3-40-001 are highlighted in grey):

New Sequence Descriptor (3-40-007): "IASI Level 1c data (all channels)"

0-01-007	Satellite identifier
0-01-031	Identification of originating/generating centre
0-02-019	Satellite instruments
0-02-020	Satellite classification
0-04-001	Year
0-04-002	Month
0-04-003	Day
0-04-004	Hour
0-04-005	Minute
2-02-131	Add 3 to scale
2-01-138	Add 10 to width
0-04-006	Second
2-01-000	Reset width
2-02-000	Reset scale
0-05-001	Latitude (high accuracy)
0-06-001	Longitude (high accuracy)
0-07-024	Satellite zenith angle
0-05-021	Bearing or azimuth
0-07-025	Solar zenith angle
0-05-022	Solar azimuth
0-05-043	Field of view number
0-05-040	Orbit number
2-01-133	Add 5 to width
0-05-041	Scan line number
2-01-000	Reset width
2-01-132	Add 4 to width
0-25-070	Major frame count
2-01-000	Reset width
2-02-126	Subtract 2 from scale
0-07-001	Height of station
2-02-000	Reset scale
1-03-003	Repeat next 3 descriptor 3 times
0-25-140	Start channel
0-25-141	End channel
0-33-060	GQisFlagQual
0-33-061	QGisQualIndex
0-33-062	QGisQualIndexLoc
0-33-063	QGisQualIndexRad
0-33-064	QGisQualIndexSpect

0-33-065	GQisSysTecSondQual
<u>0-40-020</u>	<u>GQisFlagQualDetailed - Quality flag for the system</u>
1-01-010	Repeat next 1 descriptor 10 times
3-40-002	IASI Level 1c band description
1-01-087	Repeat next 1 descriptor 87 times
3-40-003	IASI Level 1c 100 channel sequence
0-02-019	Satellite instruments
0-25-051	AVHRR channel combination
1-01-007	Repeat next 1 descriptor 7 times
3-40-004	IASI Level 1c AVHRR single scene sequence
0-20-081	Cloud amount in segment
0-08-029	Remotely sensed surface type
0-20-083	Amount of segment covered by scene
0-08-029	Remotely sensed surface type
<u>0-40-018</u>	<u>Average of imager measurements</u>
<u>0-40-019</u>	<u>Variance of imager measurements</u>
<u>0-40-021</u>	<u>Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice</u>
<u>0-40-022</u>	<u>Number of missing, bad or failed AVHRR pixels</u>

2) Reduced IASI level 1c data set (subset of channels)

It is proposed to use the following sequence of entries for the encoding of the full (8700 channel) IASI level 1c data (new entries are in *italicised and underlined*, changes from 3-40-001 are highlighted in grey):

New Sequence Descriptor (3-40-008): "IASI Level 1c data (subset of channels)"

0-01-007	Satellite identifier
0-01-031	Identification of originating/generating centre
0-02-019	Satellite instruments
0-02-020	Satellite classification
0-04-001	Year
0-04-002	Month
0-04-003	Day
0-04-004	Hour
0-04-005	Minute
2-02-131	Add 3 to scale
2-01-138	Add 10 to width
0-04-006	Second
2-01-000	Reset width
2-02-000	Reset scale
0-05-001	Latitude (high accuracy)
0-06-001	Longitude (high accuracy)
0-07-024	Satellite zenith angle
0-05-021	Bearing or azimuth
0-07-025	Solar zenith angle
0-05-022	Solar azimuth
0-05-043	Field of view number
0-05-040	Orbit number
2-01-133	Add 5 to width
0-05-041	Scan line number
2-01-000	Reset width
2-01-132	Add 4 to width

0-25-070	Major frame count
2-01-000	Reset width
2-02-126	Subtract 2 from scale
0-07-001	Height of station
2-02-000	Reset scale
1-03-003	Repeat next 3 descriptor 3 times
0-25-140	Start channel
0-25-141	End channel
0-33-060	GQisFlagQual
0-33-061	QGisQualIndex
0-33-062	QGisQualIndexLoc
0-33-063	QGisQualIndexRad
0-33-064	QGisQualIndexSpect
0-33-065	GQisSysTecSondQual
<u>0-40-020</u>	<u>GQisFlagQualDetailed - Quality flag for the system</u>
1-01-010	Repeat next 1 descriptor 10 times
3-40-002	IASI Level 1c band description
1-04-000	Delayed replication of next 4 descriptors
0-31-002	Extended delayed replication factor
2-01-136	Add 8 to width
0-05-042	Channel number
2-01-000	Reset width
0-14-046	Scaled IASI radiance
0-02-019	Satellite instruments
0-25-051	AVHRR channel combination
1-01-007	Repeat next 1 descriptor 7 times
3-40-004	IASI Level 1c AVHRR single scene sequence
0-20-081	Cloud amount in segment
0-08-029	Remotely sensed surface type
0-20-083	Amount of segment covered by scene
0-08-029	Remotely sensed surface type
<u>0-40-018</u>	<u>Average of imager measurements</u>
<u>0-40-019</u>	<u>Variance of imager measurements</u>
<u>0-40-021</u>	<u>Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice</u>
<u>0-40-022</u>	<u>Number of missing, bad or failed AVHRR pixels</u>

Explanation of proposed new descriptors

New Element Descriptors:

Descriptor	Name	Units	Scale	Reference	Width
(0-40-018)	GlacAvgImaglIS - Average of imager measurements	W/(m ² sr m ⁻¹)	6	0	24
(0-40-019)	GlacVarImaglIS - Variance of imager measurements	W/(m ² sr m ⁻¹)	6	0	24
(0-40-020)	GQisFlagQualDetailed - Quality flag for the system	Flag Table	0	0	17
(0-40-021)	Fraction of weighted AVHRR pixel in IASI FOV covered with snow/ice	%	0	0	7
(0-40-022)	Number of missing, bad or failed AVHRR pixels	Numeric	0	0	7

New Flag Table (0-40-020) " GQisFlagQualDetailed - Quality flag for the system "

Bit number	Meaning
1	NZPD and Complex calibration error
2	Band 3 affected by spike
3	Band 3 affected by saturation
4	Band 2 affected by spike
5	Band 1 affected by spike
6	Overflow/Under Flow
7	On-board processing error
8	Spectral calibration error
9	Radiometric calibration error
10	Missing AVHRR data
11	Missing IIS data
12	Missing Sounder data
13	GQisFlagQual summary flag for all bands
14	On-Ground processing error
15	Inter-calibration error IASI/AVHRR
16	Spare
All 17	Missing

Acronyms:

AVHRR	Advanced Very High Resolution Radiometer
DVB	Digital Video Broadcast
FOV	Field of View
IASI	Infrared Atmospheric Sounding Interferometer
Metop	The Metop satellites carry on board a set of state-of-the-art sounding and imaging instruments that offer improved remote sensing capabilities to both meteorologists and climatologists. The Metop series is part of the Initial Joint Polar-Orbiting Operational Satellite System (IJPS) constellation, along with the NOAA-N and -N' satellites.
NZPD	Number of Zero Path Difference

ANNEX TO PARAGRAPH 3.3.5.3
OPERATIONAL

- **Kalpana-1**
 - Indian Geostationary satellite. A check has shown that a value of **410** is currently being used.
- **DMSP18**
 - Due to be launched in September 2008. The value is **286** as 285 were chosen for DMSP17 at the ETDRC meeting in Kuala Lumpur in 2004. This is due to be launched late October 2008.

The following 2 satellites are due to be launched next year:

- **NOAA19 223**
- **NPP 224**

**ANNEX TO PARAGRAPH 3.3.5.4
PREOPERATIONAL**

BUFR TABLE D AND CODE TABLE ENTRIES FOR ENCODING OF ALL SKY RADIANCE DATA

New code table entries

In order to describe the type of clouds from which cloudy radiances are associated, it is necessary to add three new entries to the code table 0-08-003, "Vertical significance (satellite observations)", highlighted in grey as follows:

"Vertical significance (satellite observations)", 0-08-003

Code	Meaning
0	Surface
1	Base of Satellite sounding
2	Cloud Top
3	Tropopause
4	Precipitable water
5	Sounding Radiances
7	Mean Temperatures
8	Ozone
9	Low cloud
10	Med Cloud
11	High cloud
12-62	Reserved
63	Missing value

New sequence descriptors

It is proposed to add three new sequence descriptors to Table D for the encoding of all sky radiance data. These are described below:

Sequence	Number of descriptors	Descriptors / sub-sequences
<i>All sky radiance product main sequence</i>		
310027	12	301071 Product information 301011 Date 301013 Time 301021 Latitude / longitude 030021 Number of pixels per row 030022 Number of pixels per column 010002 Orbit height 304036 All sky radiance cloud coverage

002152 Satellite instrument used
002167 Radiance computational method
101011 Replication operator
304035 All sky radiance data

Cloud coverage

304036 12

020082 Amount of segment cloud free
008012 Land-Sea Qualifier: Sea
020082 Amount of segment cloud free (sea)
008012 Cancel qualifier
020081 Cloud amount in segment
008003 Vertical significance: Low cloud
020081 Cloud amount in segment (low cloud)
008003 Vertical significance: Mid cloud
020081 Cloud amount in segment (mid cloud)
008003 Vertical significance: High cloud
020081 Cloud amount in segment (high cloud)
008003 Cancel significance

All sky radiance data

304035 15

002153 Satellite channel centre frequency
002154 Satellite channel band width
012063 Brightness temperature
008001 Pixel type: clear
012063 Brightness temperature (clear)
008001 Pixel type: cloudy
012063 Brightness temperature (cloudy)
008001 Cancel type
008003 Vertical significance: low cloud
012063 Brightness temperature (low cloud)
008003 Vertical_significance: mid cloud
012063 Brightness temperature (mid cloud)
008003 Vertical_significance: high cloud
012063 Brightness temperature (high cloud)
008003 Cancel_significance

**ANNEX TO PARAGRAPH 3.4
FOR VALIDATION**

MASTER TABLE FOR OCEANOGRAPHIC DATA

The proposed new version of Master Table 10 and its accompanying Code and Flag tables is a modification of the original Master Table definition, which involved minor changes to the Table B classes 1-9 to make it conform to current regulations covering BUFR Master Tables.

a) Class Definitions - The proposed changes made to the 1998 MT10 Class definitions are as follows:

- Class “0 03: Methods” to be moved to a new class “0 25: Methods”
- Class “0 05: Time and Frequency” to be moved to a new class “0 27: Time and Frequency” unless the answer to Question A (see below) is affirmative
- Class “0 06: Location (horizontal)” split into Classes “0 05: Location (horizontal -1)” and “0 06: Location (horizontal -2)”
- Class “0 08: Location (relative)” moved to Class “0 10: Observation Qualifiers”
- Class “0 09: Instrument Metadata” moved to a new Class “0 26: Instrument Metadata”
- Class “0 10: Observation qualifiers” previously had no comment to explain its purpose, so the following comment has been added “Observation characteristics, quality and location qualifiers”
- Class “0 28: Significance qualifiers” was moved to Class “0 08: Significance Qualifiers”
- Within Class “0 01: Identification” the element entitled *IGOSS message identifier* (0 01 009) was renamed JCOMM GTS identifier. The alternative is to deprecate 009 and insert a new descriptor.

BUFR MASTER 10 TABLE B — CLASSIFICATION OF ELEMENTS

F	X	Class	Comments
0	00	BUFR table entries	
0	01	Identification	Identifies origin and type of data
0	02	Instrumentation	Defines instrument types used
0	03	Reserved	
0	04	Location (time)	Defines time and time derivatives
0	05	Location (horizontal – 1)	Defines geographical position, including horizontal derivatives, in association with class 06 (first dimension of horizontal space)
0	06	Location (horizontal – 2)	Defines geographical position, including horizontal derivatives, in association with class 05 (second dimension of horizontal space)
0	07	Location (vertical)	Defines height, altitude, pressure level, including vertical derivatives of position
0	08	Significance qualifiers	Defines special character of data

0	09	Reserved	
0	10	Observation metadata	Observation characteristics, quality and location qualifiers
0	11	Meteorological elements	Observations of meteorological variables
0	20	Physical oceanographic elements	Observations of the physical oceanographic variables
0	21	Chemical elements	Observations of physical chemical variables
0	22	Geophysics	Observations of geophysical variables
0	23	Waves	Observations of surface gravity wave variables
0	24	Biological elements	Observations of biological variables
0	25	Methods	Defines methods used to make the observation
0	26	Instrument Metadata	Defines instrument characteristics
0	27	Time and Frequency	
0	29	Processing information	Processing history of the data.
0	31	Data descriptor operator qualifiers	Elements used in conjunction with data description operators.

Names in bold have been added or changed in 2008

b) Code and Flag table definitions - The proposed additions and modifications to code tables are summarized as follows. More detail is included in document 3.1.7

- Element 0 01 006 Type of data buoy: Various additions to code table 0 02 149 Type of data buoy
- Element 0 01 009 JCOMM GTS message identifier: Addition of one entry
- Element 0 02 007 Location System: Various additions to code table 0 02 148 Data Collection and Location System
- Element 0 02 008 to refer to code table 0 02 034
- Code figures added to Elements 0 01 007, 0 02 028, 0 02 007 (therefore 0 02 148), for "Missing" value

BUFR MASTER 10 TABLE B — CLASSIFICATION OF ELEMENTS

F	X	Class	Comments
0	00	BUFR table entries	
0	01	Identification	Identifies origin and type of data
0	02	Instrumentation	Defines instrument types used
0	03	Reserved	
0	04	Location (time)	Defines time and time derivatives
0	05	Location (horizontal – 1)	Defines geographical position, including horizontal derivatives, in association with class 06 (first dimension of horizontal space)
0	06	Location (horizontal – 2)	Defines geographical position, including horizontal derivatives, in association with class 05 (second dimension of horizontal space)
0	07	Location (vertical)	Defines height, altitude, pressure level, including vertical derivatives of position
0	08	Significance qualifiers	Defines special character of data
0	09	Reserved	
0	10	Observation metadata	Observation characteristics, quality and location qualifiers
0	11	Meteorological elements	Observations of meteorological variables
0	20	Physical oceanographic elements	Observations of the physical oceanographic variables
0	21	Chemical elements	Observations of physical chemical variables
0	22	Geophysics	Observations of geophysical variables
0	23	Waves	Observations of surface gravity wave variables
0	24	Biological elements	Observations of biological variables
0	25	Methods	Defines methods used to make the observation
0	26	Instrument Metadata	Defines instrument characteristics
0	27	Time and Frequency	
0	29	Processing information	Processing history of the data.
0	31	Data desc. operator qualifiers	Elements used in conjunction with data description operators.

Names in bold have been added or changed in 2008

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Class 01: Identification

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	1	1	Platform identifier	CCITT IA5	0	0	64
0	1	2	GTS bulletin originating centre (CCCC)	CCITT IA5	0	0	32
0	1	3	GTS bulletin type (TTAAll)	CCITT IA5	0	0	48
0	1	5	Profile type	code	0	0	7
0	1	6	Type of data buoy (BUFR 0 02149)	code	0	0	6
0	1	7	Data originator	code	0	0	10
0	1	8	Data collection identifier	CCITT IA5	0	0	80
0	1	9	JCOMM GTS message identifier	code	0	0	4

Class 02: Instrumentation

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	2	1	Dissolved oxygen instrument	code	0	0	3
0	2	2	Cast type	code	0	0	5
0	2	3	Current instrument	code	0	0	4
0	2	4	Wave instrument	code	0	0	5
0	2	5	Salinity instrument	code	0	0	4
0	2	6	Water temperature instrument	code	0	0	4
0	2	7	Location system (BUFR 0 02 148)	code	0	0	5
0	2	8	Drogue type (BUFR 0 02 034)	code	0	0	5

Class 03: Reserved**Class 04: Location (Time)**

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	4	1	Year	year	0	0	12
0	4	2	Month of the year	month	0	0	4
0	4	3	Day of the year (Jan 1st=1)	day	0	0	9
0	4	4	Hour	hour	0	0	5
0	4	5	Minute	minute	0	0	6
0	4	6	Second	second	0	0	6
0	4	7	Day of the month	day	0	0	6
0	4	8	Time period or displacement	year	0	-1024	11
0	4	9	Time period or displacement	month	0	-1024	11
0	4	10	Time period or displacement	day	0	-1024	11
0	4	11	Time period or displacement	hour	0	-2048	12
0	4	12	Time period or displacement	minute	0	-2048	12
0	4	13	Time period or displacement	second	0	-4096	13

Class 05: Location (horizontal – 1)

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	5	1	Latitude (high accuracy)	degrees	5	-9000000	25
0	5	2	Latitude (coarse accuracy)	degrees	2	-9000	15

Class 06: Location (horizontal-2)

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	6	1	Longitude (high accuracy)	degrees	5	-18000000	26
0	6	2	Longitude (coarse accuracy)	degrees	2	-18000	16

Class 07: Location (vertical)

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	7	1	Height/altitude above ground level	metres	-1	-40	16
0	7	2	Height above sea floor	metres	0	-10000	15
0	7	3	Bathymetric depth	metres	1	0	17
0	7	4	Depth below sea surface	metres	1	0	17
0	7	5	Height/altitude above mean sea level	metres	1	0	17
0	7	6	Height/altitude above sea surface	metres	1	0	17
0	7	7	Sea pressure (sea surface = 0)	decibars	3	0	24
0	7	8	Relative total pressure	decibars	3	0	24
0	7	9	Observed sea level	metres	3	-30000	16
0	7	10	Total pressure (atmosphere + sea pressure)	decibars	3	0	24

Class 08: Significance Qualifiers

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	8	1	Time significance	code	0	0	4
0	8	2	Coordinate	code	0	0	2
0	8	3	Vertical significance (surface observations) (BUFR 0 08 002)	code	0	0	6

Class 09: Reserved**Class 10: Observation metadata**

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	10	1	Selection of depth levels	code	0	0	4
0	10	2	Depth of drogue	metres	1	0	12
0	10	3	Chemical component	code	0	0	4
0	10	4	Chemical content qualifier code	code	0	0	4
0	10	5	Salinity units	code	0	0	3
0	10	10	Direction reference	code	0	0	3
0	10	11	First order statistics code	code	0	0	6
0	10	12	Specific time of observation	code	0	0	3
0	10	20	GTSP quality control code (BUFR 10-020)	code	0	0	3
0	10	21	JCOMM quality control code	code	0	0	4
0	10	22	Quality control test(s) performed	flag table	0	0	64
0	10	23	Quality control test(s) failed	flag table	0	0	64
0	10	24	Quality of location (WMO 3311)	code	0	0	3
0	10	25	Quality of buoy satellite transmission (WMO 3313)	code	0	0	2
0	10	30	Precision/accuracy indicator	code	0	0	4
0	10	31	Confidence interval	code	0	0	3

0	10	32	Data availability	code	0	0	3
0	10	33	Platform identifier type	code	0	0	4
0	10	36	Trace direction	code	0	0	3
0	10	37	Probe hit bottom indicator	code	0	0	1
0	10	38	Duplicate indicator	code	0	0	1
0	10	39	Wind speed indicator (WMO 1853)	code	0	0	3
0	10	40	Indicator for method of current measurement (WMO 2266)	code	0	0	3
0	10	75	Zenith angle of object from reference point	degrees	2	0	14
0	10	76	Across track displacement (starboard +ve)	metres	0	-30000	16
0	10	77	Along track displacement	metres	0	0	16
0	10	78	Bearing of object from reference point	degrees	1	0	12
0	10	79	Distance of object in direction from reference point	metres	0	-50000	17
0	10	80	Horizontal distance of object from reference point	metres	0	0	16
0	10	81	Direct distance of object from reference point	metres	0	0	16
0	10	82	Elevation angle of object from reference point	degrees	2	-9000	15
0	10	83	Vertical distance of object above reference point	metres	0	-10000	15
0	10	84	Pitch angle	degrees	2	0	14
0	10	85	Roll angle	degrees	2	-9000	15

Class 11: Meteorological elements

	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	11	1	Cloud cover (total)	percent	0	0	7
0	11	2	Total cloud amount (oktas, BUFR 20-011)	code	0	0	4
0	11	3	Height of base of cloud	meters	-1	-40	11
0	11	4	Cloud type (BUFR 20-012)	code	0	0	6
0	11	7	Present weather (BUFR 20-003)	code	0	0	9
0	11	8	Past weather(1) (BUFR 20-004)	code	0	0	5
0	11	9	Past weather(2) (BUFR 20-005)	code	0	0	5
0	11	12	Horizontal visibility	metres	-1	0	13
0	11	13	Total precipitation/ total water equivalent	kg/m ²	1	-1	14
0	11	14	Rainfall/water equivalent of snow (averaged rate)	kg/m ² /s	4	0	12
0	11	20	Pressure reduced to mean sea level	pa	-1	0	14
0	11	21	Pressure	pa	-1	0	14
0	11	22	Pressure change	pa	-1	-1024	11
0	11	23	Vapour pressure	pa	-1	0	10
0	11	24	Specific humidity	kg/kg	5	0	14
0	11	25	Relative humidity	percent	0	0	7
0	11	26	Humidity mixing ratio	kg/kg	5	0	14
0	11	40	Horizontal wind speed	m/s	1	0	12
0	11	41	Direction from which wind is blowing	degrees (true)	0	0	9
0	11	42	Maximum wind speed (gusts)	m/s	1	0	12
0	11	43	Maximum wind gust direction from which gust is blowing	degrees (true)	0	0	9
0	11	44	U component of wind speed (+ve east)	m/s	1	-4096	13
0	11	45	V component of wind speed (+ve north)	m/s	1	-4096	13
0	11	46	Absolute wind shear in 1 km layer below	m/s	1	0	12
0	11	47	Absolute wind shear in 1 km layer above	m/s	1	0	12
0	11	48	W component of wind speed	m/s	2	-4096	13
0	11	50	Temperature/dry bulb temperature	degrees C	1	-1024	12
0	11	51	Wet bulb temperature	degrees C	1	-1024	12

0	11	52	Dew point temperature	degrees C	1	-1024	12
0	11	53	Virtual air temperature	degrees C	1	-1024	12
0	11	60	Brightness temperature	degrees C	1	-1024	12
0	11	61	Short-wave direct radiation	w/m ²	-3	-2048	12
0	11	62	Short-wave diffuse radiation	w/m ²	-3	-2048	12
0	11	63	Short-wave incoming radiation	w/m ²	-3	-2048	12
0	11	64	Short-wave outgoing radiation	w/m ²	-3	-2048	12
0	11	65	Long-wave incoming radiation	w/m ²	-3	-2048	12
0	11	66	Long-wave outgoing radiation	w/m ²	-3	-2048	12
0	11	67	Net radiation	w/m ²	-4	-16348	15

Class 20: Physical oceanography elements

	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	20	1	Potential temperature	degrees C	3	-2000	16
0	20	2	Salinity	psu (practical salinity units)	3	0	14
0	20	3	Electrical conductivity	mhos/m	4	0	16
0	20	4	Chlorinity (parts/thousand)	kg/kg	3	0	16
0	20	5	Chlorosity	kg/m ³	3	0	16
0	20	6	Sea temperature	degrees C	3	-2000	16
0	20	7	Sea density	kg/m ³	6	0	23
0	20	8	Sound velocity	m/s	3	0	21
0	20	9	Horizontal current speed	m/s	3	0	14
0	20	10	Direction to which horizontal current is flowing	degrees (true)	1	0	12
0	20	11	East component of current	m/s	3	-10000	15
0	20	12	North component of current	m/s	3	-10000	15
0	20	15	Secchi disc depth	metres	1	0	13
0	20	25	Water colour (Forel-Ule scale)	code	0	0	4
0	20	26	Code for ice in vicinity of hydrographic observation	code	0	0	4

Class 21: Chemistry elements

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	21	1	Hydrogen ion concentration (pH)	numeric	3	0	14
0	21	2	Total alkalinity	mmol/m ³	1	10000	14
0	21	3	Carbonate alkalinity	mmol/m ³	1	10000	14
0	21	4	Chlorophyll-a content	mg/m ³	3	0	16
0	21	5	Dissolved oxygen	mmol/m ³	3	0	22
0	21	6	Phosphate (PO ₄ -P) content	mmol/m ³	2	0	10
0	21	7	Total phosphorous (P) content	mmol/m ³	2	0	10
0	21	8	Nitrate (NO ₃ -N) content	mmol/m ³	3	0	16
0	21	9	Nitrite (NO ₂ -N) content	mmol/m ³	3	0	12
0	21	10	Nitrate + nitrite content	mmol/m ³	3	0	16
0	21	11	Total nitrogen (N) content	mmol/m ³	3	0	16
0	21	12	Organic nitrogen content	mmol/m ³	3	0	17
0	21	13	Ammonium (NH ₄ -N) content	mmol/m ³	3	0	12
0	21	14	Silicate (SiO ₄ -Si) content	mmol/m ³	2	0	15
0	21	15	Total carbon (C) content	mmol/m ³	3	0	20
0	21	16	Organic carbon content	mmol/m ³	3	0	17
0	21	17	Hydrogen sulphide (H ₂ S-S) content	mmol/m ³	3	0	16

Class 22: Geophysics elements

	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	22	1	Bathymetric two way travel time	seconds	2	0	16
0	22	2	Total magnetic field	nanoteslas	0	0	16
0	22	3	Residual magnetic field	nanoteslas	0	-60000	17
0	22	4	Magnetic field correction	nanoteslas	0	-60000	17
0	22	5	Observed gravity	milligals	0	0	20
0	22	6	Free air gravity anomaly	milligals	0	-500	10
0	22	7	Bouger gravity anomaly	milligals	0	-500	10
0	22	8	Gravity eotvos correction	milligals	0	-500	10
0	22	9	Bathymetric datum indicator	code	0	0	5

Class 23: Wave elements

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	23	1	Sea state (WMO code 3700)	code	0	0	4
0	23	2	Visual average wave height	metres	2	0	13
0	23	3	Visual estimate of wave period	seconds	2	0	12
0	23	4	Visual estimate of direction from which waves come	degrees	0	0	9
0	23	5	Direction from which swell is coming	degrees	0	0	9
0	23	6	Swell height	metres	1	0	9
0	23	7	Swell period	seconds	0	0	6
0	23	10	Total water depth	metres	0	0	14
0	23	11	Still water depth	metres	0	0	14
0	23	12	Mean record water depth	metres	0	0	14
0	23	13	Maximum wave level	metres	2	0	13
0	23	14	Minimum wave level	metres	2	0	13
0	23	15	Second highest wave crest	metres	2	0	13
0	23	16	Second lowest wave trough	metres	2	0	13
0	23	17	Maximum crest to trough wave height	metres	2	0	13
0	23	18	Maximum zero crossing wave height	metres	2	0	13
0	23	19	Average height highest one third	metres	2	0	13
0	23	20	Tucker Draper significant wave height	metres	2	0	13
0	23	21	RMS wave displacement	metres	2	0	13
0	23	22	Characteristic wave height (4*RMS)	metres	2	0	13
0	23	30	Period of maximum zero crossing wave	seconds	2	0	13
0	23	31	Average zero crossing wave period	seconds	2	0	13
0	23	32	Average wave crest period	seconds	2	0	13
0	23	33	Spectral width (broadness)	numeric	2	0	10
0	23	40	Instantaneous water surface elevation	metres	2	-10000	15
0	23	41	Instantaneous heave acceleration	m/s ²	3	-10000	15
0	23	42	Water surface east-west tilt angle (+ve to east)	degrees	2	-9000	15
0	23	43	Water surface north-south tilt angle (+ve to north)	degrees	2	-9000	15
0	23	50	Wave variance spectral density: S(f)	m ² /hz	6	0	27
0	23	51	Wave spectrum peak period	seconds	2	0	12
0	23	52	Zeroeth moment of wave spectrum	m ²	6	0	27
0	23	53	First moment of wave spectrum	m ² .hz	6	0	27
0	23	54	Second moment of wave spectrum	(m.hz) ²	6	0	27
0	23	55	Third moment of wave spectrum	m ² .hz ³	6	0	27
0	23	56	Fourth moment of wave spectrum	m ² .hz ⁴	6	0	27
0	23	57	First negative moment of wave spectrum	m ² /hz	6	0	27

0	23	58	Second negative moment of wave spectrum	(m/hz)^2	6	0	27
0	23	59	Waves spectral width from moments	numeric	2	0	13
0	23	60	Spectral moments (-1,0) wave period	seconds	2	0	13
0	23	61	Spectral moments (0,1) wave period	seconds	2	0	13
0	23	62	Spectral moments (0,2) wave period	seconds	2	0	13
0	23	63	Spectral moments (2,4) wave period	seconds	2	0	13
0	23	70	Auto-spectrum of north-south tilt	deg^2/hz	6	0	27
0	23	71	Auto-spectrum of east-west tilt	deg^2/hz	6	0	27
0	23	72	Quad-spectrum of heave and n-s tilt	m.deg/hz	6	-50000000	27
0	23	73	Quad-spectrum of heave and e-w tilt	m.deg/hz	6	-50000000	27
0	23	74	Quad-spectrum of n-s and e-w tilts	deg^2/hz	6	-50000000	27
0	23	75	Co-spectrum of heave and n-s tilt	m.deg/hz	6	-50000000	27
0	23	76	Co-spectrum of heave and east-west tilt	m.deg/hz	6	-50000000	27
0	23	77	Co-spectrum of n-s and e-w tilts	deg^2/hz	6	-50000000	27
0	23	78	Wave number from cross spectra	degrees/m	6	0	27
0	23	79	Mean wave direction from cross spectra	degrees	2	0	16
0	23	80	Wave dir spread from cross spectra	degrees	2	0	15
0	23	81	Directional wave spectrum density	m^2/hz	6	0	27
0	23	82	Specified direction of wave energy propagation	degrees	0	0	9
0	23	84	Wave spectrum peak energy direction	degrees	2	0	16
0	23	85	Wave spectrum mean energy direction	degrees	0	0	9

Class 25 – Methods

	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	25	1	Free air gravity anomaly ref system	code	0	0	4
0	25	2	Reference residual magnetic field	code	0	0	4
0	25	3	Bathymetry sound velocity correct area	code	0	0	5
0	25	4	Prime navigation aid fix code	code	0	0	3
0	25	5	Free air gravity anomaly formula	code	0	0	3
0	25	12	Duration of application	code	0	0	3
0	25	13	Frequency sampling technique	code	0	0	3
0	25	14	Interval sampling code	code	0	0	3
0	25	15	Digitization method	code	0	0	4
0	25	16	Filter type	code	0	0	3
0	25	20	Correction procedure for depth from sound speed	code	0	0	4
0	25	21	Method of depth correction for sound speed	code	0	0	4
0	25	22	Method of sound velocity measurement	code	0	0	3
0	25	23	Density calculation	code	0	0	4
0	25	28	Method of current averaging	code	0	0	4
0	25	29	Duration and time of eulerian current measure (WMO 2264)	code	0	0	4
0	25	30	Period of current measurement (drift) (WMO 2265)	code	0	0	4
0	25	35	Method of temperature measurement	code	0	0	5
0	25	36	Method of salinity/depth measurement (WMO 2263)	code	0	0	3
0	25	37	Method of depth measurement	code	0	0	4
0	25	38	Pressure measurement method	code	0	0	3
0	25	45	Method code for position fixing	code	0	0	5
0	25	46	Method of wave calculation	code	0	0	4

Class 26 Instrument Metadata

	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	26	11	Platform heading	degrees	0	0	9
0	26	12	True platform speed across the ground	m/s	2	0	16
0	26	13	Azimuth of major axis of navigation error ellipse	degrees	0	0	9
0	26	14	Length of semimajor axis of navigation error ellipse	metres	0	0	13
0	26	15	Length of semiminor axis of navigation error ellipse	metres	0	0	13
0	26	16	Magnetic variation from true north (+ve clockwise)	degrees	1	0	12
0	26	17	Bearing of object from reference point (+ve clockwise)	degrees	0	0	9
0	26	18	Angle of attack (aircraft)	degrees	0	0	9
0	26	19	Indicated platform speed (aircraft)	m/s	2	0	16
0	26	20	Relative platform speed through the air/water	m/s	2	0	16
0	26	21	Vertical platform speed	m/s	2	0	16
0	26	22	Angle of sideslip (aircraft)	degrees	0	0	9

Class 27: Time and Frequency (could go to Class 4?)

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	27	1	Frequency	hertz	5	0	17
0	27	2	Frequency of spectral component	hertz	5	0	17
0	27	3	Bandwidth of spectral analysis	hertz	5	0	17
0	27	4	Bandwidth of spectral component	hertz	5	0	17
0	27	5	High frequency cutoff for integration under spectrum	hertz	5	0	17
0	27	6	Low frequency cutoff for integration under spectrum	hertz	5	0	17
0	27	7	Bandwidth of directional analysis	degrees	0	0	9

Class 29: Processing information

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	29	1	Processing centre	code	0	0	5
0	29	2	Processing function identifier	code	0	0	7
0	29	3	Version of processing function	numeric	2	0	10
0	29	4	Processing action taken	code	0	0	6
0	29	5	Parameter acted upon	code	0	0	8
0	29	6	Qualifier of parameter acted upon	numeric	3	0	25
0	29	7	Value of parameter before action taken	numeric	3	0	25

Class 31: Data descriptor operator qualifiers

F	X	Y	Element Name	Unit	Scale	Ref Value	Data Width
0	31	1	Delayed descriptor replication factor	numeric	0	0	8
0	31	2	Extended delayed descriptor replication factor	numeric	0	0	16
0	31	11	delayed descriptor and data repetition factor	numeric	0	0	8
0	31	12	Extended delayed descriptor repetition factor	numeric	0	0	16
0	31	21	Associated field significance	code	0	0	6
0	31	31	Data present indicator	flag table	0	0	1

Non-SI units used in the above tables

1. 0-20-002 Salinity in psu (practical salinity units). This is now the basic measure of salinity based on a ratio of conductivity of a sample compared to a reference conductivity. Functionally it is almost equivalent in value to the previous standard which had units of Kg/Kg (parts per thousand).
2. 0-22-005 to 008 gravity measurements in milligals. A gal = 1 cm/sec/sec. It is a cgs unit and as such while not SI, conversion is trivial.

CODE TABLES AND FLAG TABLES ASSOCIATED WITH BUFR MASTER TABLE 10, TABLE B

Notes: In developing code tables associated with BUFR Table B to specify units of elements, the following principles should be applied:

- (a) Code tables specifying the units for an element which is defined, in the Manual on Codes, by a single symbolic letter shall be compatible with the relevant existing WMO code tables;
- (b) Code tables combining two or more existing WMO code tables to specify the units for an element which is defined, in the Manual on Codes, by a group of symbolic letters shall be compatible with the combined Code figures of the relevant group of symbolic letters;
- (c) Code tables combining two or more existing WMO code tables to specify the units for an element which is defined, in the Manual on Codes, by different symbolic letters shall be compatible with the Code figures of the relevant symbolic letters, with successive tens or hundreds values added, as appropriate;
- (d) Code tables and flag tables should only be used for reporting qualitative information. Quantitative information should be reported as observed using entries in Table 13. "Data description operators" from Table C should be applied when a "scale change" or "data width change" is required;
- (e) Reference to existing specification(s) and code table(s) in the Manual on Codes, with explanation of possible deviations, shall be given in an additional table annexed to the code tables associated with BUFR Table B.

Additional Note: Letters and symbols enclosed by [] indicate codes used in the originating GF3 code scheme.

Last update: August 19, 2008

0 01 005: Profile Type

Code figure	Meaning
0	Temperature
1	Salinity
2	East component of current
3	North component of current
4	Sound velocity
5	Transmissivity
6	pH
7	CFC-11
8	CFC-12
9-19	Reserved
20	Carbonate alkalinity
21	Chlorinity
22	Chlorosity
23	Alkalinity
24-29	Reserved
30	Ammonia
31	Organic Carbon
32	Chlorophyll-A
33	Dissolved oxygen
34	Nitrate
35	Nitrite
36	Phosphate
37	Inorganic phosphate
38	Silicate
39-49	Reserved
50	Fluoride
51	Fluorescence
52	Sulphate
53	Vitamin B12
54-126	Reserved
127	Missing value

0 01 006: Type of Data Buoy BUFR Table 02 149 ** additions proposed September 2008****0 01 007: Data originator**

Code figure	Meaning
0	Bedford Institute of Oceanography (Canada)
1	Institute of Ocean Sciences (Canada)
2	Institut Maurice Lamontagne (Canada)
3	Wood's Hole Oceanographic Institute (USA)
4	Scripps Institution of Oceanography (USA)
5	Missing
6-1022	Reserved
1023	Missing value

0 01 009: JCOMM GTS message identifier ** addition proposed September 2008**

Code figure	Meaning
0	AAXX SYNOP message
1	BBXX SHIP message
2	JJXX message
3	KKXX TESAC message
4	ZZXX DRIFTER message
5	JJYY BATHY message
6	ZZYY BUOY message
7	NNXX TRACKOB message
8	JJVV BATHY message
9	KKYY TESAC message
10	UUAA TEMP SHIP
11-14	Reserved
15	Missing value

0 02 001: Dissolved oxygen instrument

Code figure	Meaning
0	In-situ oxygen probe [PR]
1	Titration [TI]
2-5	Reserved
6	Unspecified [XX]
7	Missing value

0 02 002 Cast type

Code figure	Meaning
0	Classical hydrographic station [WBR]
1	Rosette sampler with CTD [ROS]
2	CTD/STD cast
3	Mechanical BT [MBT]
4	Expendable BT [XBT]
5	Unspecified BT [UBT]
6	BATHY message [BTH]
7	TESAC message [TSC]
8	DRIFTER message [DRB]
9	Other [OTH]
10	Bucket measurement
11	Ship intake measurement
12	Infra-red scanner
13	Microwave scanner
14	Hull mounted sensor
15	Reversing thermometer
16	Thermosalinograph
17-29	Reserved
30	Unspecified [XXX]
31	Missing value

0 02 003: Current instrument

Code figure	Meaning
0	Mechanical measure type of sensor [M]
1	Acoustic measure type of sensor [A]
2	Electronic measure type of sensor [E]
3	Eulerian measure, method unspecified [EL]
4	Lagrangian measure, method unspecified [LG]
5	Buoy drift
6	GEK [geomagnetic electrokinetograph]
7	Ship set and drift
8-13	Reserved
14	Unspecified type of sensor [X]
15	Missing value

0 02 004: Wave instrument

Code figure	Meaning
0	Accelerometer (gimble)
1	Accelerometer (strapped down)
2	Shipborne wave records [B]
3	Inverted Echo Sounder [E]
4	Laser altimeter [L]
5	Bottom mounted pressure device [P]
6	Satellite altimeter [R]
7	Staff gauge [S]
8	Visual [V]
9	Synthetic aperture radar
10-28	Reserved
29	Unspecified instrumented sensor [X]
30	Unspecified sensor [U]
31	Missing value

0 02 005: Salinity instrument

Code figure	Meaning
0	Bench salinometer [BS]
1	In-situ conductivity probe [PR]
2	Titration [TI]
3	In-situ salinity sensor [SL]
4-13	Reserved
14	Unspecified [XX]
15	Missing value

0 02 006: Water temperature instrument

Code figure	Meaning
0	Reversing thermometer
1	Thermistor
2	Mechanical BT (MBT)
3	Infra-red scanner
4	Microwave scanner
5	Missing
6-14	Reserved
15	Missing value

0 02 007: Location system

BUFR Table 0 02 148 Data Collection or Location System **** – additions requested September 2008

0 02 008 Drogue type BUFR Table 02 034**0-08-001: Time significance**

Code figure	Meaning
0	GTS bulletin
1	Receipt time
2	Update time
3	Elapsed time
4	Duration
5	Interval
6	Processing time
7-14	Reserved
15	Missing value

0-08-002: Coordinate

Code figure	Meaning
0	This is not a coordinate
1	This is a coordinate
2	Reserved
3	Missing value

0-08-003: Vertical significance (surface observations) (BUFR table 08-002)

0-10-001: Selection of depth levels

Code figure	Meaning
0	Data selected at constant depth intervals from continuous profile [DI]
1	Data selected at inflexion points from continuous profile [IF]
2	Data selected at predefined fixed levels [FX]
3	Data selected from continuous profile using combination of above criteria [CB]
4	Observed levels only [OB]
5	Data interpolated to standard depth levels [ST]
6	Observed levels plus depth interpolations to standard levels [MX]
7-13	Reserved
14	Unspecified [XX]
15	Missing value

0-10-003: Chemical component

Code figure	Meaning
0	Dissolved component only [DX]
1	Particulate component only [PX]
2	Dissolved + particulate components [TX]
3	Total
4-13	Reserved
14	Component unspecified or unknown [XX]
15	Missing value

0-10-004: Chemical content qualifier

Code figure	Meaning
0	Concentration is less than recorded value [L]
1	Concentration is greater than recorded value [G]
2	Trace concentration [T]
3-14	Reserved
15	Missing value

0-10-005: Salinity units

Code figure	Meaning
0	Practical Salinity [P]
1	Salinity (pre 1978 definition) in parts/thousand
2	Unknown
3-6	Reserved
7	Missing value

0-10-010: Direction reference

Code figure	Meaning
0	Direction relative to true north
1	Direction relative to magnetic north
2	Direction relative to true east
3	Direction relative to magnetic east
4-6	Reserved
7	Missing value

0-10-011: First order statistics

Code figure	Meaning
0-1	Reserved
2	Maximum value
3	Minimum value
4	Mean value
5	Median value
6	Modal value
7	Mean absolute error
8-9	Reserved
10	Standard deviation
11	Harmonic mean
12	Variance
13-31	Reserved
32-62	Reserved for local use
63	Missing value

0-10-012: Specific time of observation

Code figure	Meaning
0	Time of observation (UTC)
1	Time of observation start (UTC)
2	Time of observation end (UTC)
3-6	Reserved
7	Missing value

0-10-020: GTSP quality control flags BUFR Table 33 050 Global GTSP quality flag**0-10-021:GTSP quality control code**

Code figure	Meaning
0	No quality control has been performed
1	Quality control performed, value appears correct.
2	Quality control performed, value appears inconsistent
3	Quality control performed, value appears suspect
4	Quality control performed, value appears wrong.
5	Quality control performed, value has been changed

6-8	Reserved
9	Value of the parameter is missing
10-14	Reserved
15	Missing value

0-10-022: Quality control tests performed

0-10-023: Quality control tests failed

Bit number	Meaning
1	Platform Identification
2	Impossible Date/Time
3	Impossible Location
4	Position on Land
5	Impossible Speed
6	Impossible Sounding
7	Global Impossible Parameter Values
8	Regional Impossible Parameter Values
9	Increasing Depth
10	Profile Envelop
11	Constant Profile
12	Freezing Point
13	Spike
14	Top and Bottom Spike
15	Gradient
16	Density Inversion
17	Bottom
18	Temperature Inversion
19	Levitus Seasonal Statistics
20	Emery and Dewar Climatology
21	Asheville Climatology
22	Levitus Monthly Climatology
23	Waterfall
24	Visual Inspection of Cruise Track
25	Visual Inspection of Profiles
26-62	Reserved (set to 0)
All 63	Missing value

0-10-024: Quality of location (WMO table 3311)

Code figure	Meaning
0	The value transmitted at the beginning of the report is a reliable value (location made over two satellite passes)
1	The values at the beginning of the report are the latest known values (no location over the corresponding pass)
2	Dubious quality. The location was made over one pass only; second solution is possible in 5% of the cases
3-6	Reserved
7	Missing value

0-10-025: Quality of the buoy satellite transmission (WMO table 3311)

Code figure	Meaning
0	Good quality (several identical reports have been received)
1	Dubious quality (no identical reports)
2	Reserved
3	Missing value

0-10-030: Precision/accuracy indicator

Code figure	Meaning
0-3	Reserved
4	Thousands of units
5	Hundreds of units
6	Tens of units
7	Units
8	Tenths of units
9	Hundredths of units
10	Thousandths of units
11-12	Reserved
13	Trace
14	Undetected
15	Missing value

0-10-031: Confidence interval

Code figure	Meaning
0	95%
1	66%
2-6	Reserved
7	Unknown – Missing value

0-10-032: Data availability

Code figure	Meaning
0	Originator only
1	Holding agency and originator only
2	Project participants
3	Public
4-6	Reserved
7	Missing value

0-10-033: Platform identifier type

Code figure	Meaning
0	ITU call sign
1	WMO platform identifier

2	WMO station identifier (Iliii)
3	CLS ARGOS identifier
4-14	Reserved
15	Unknown – Missing value

0-10-036: Trace direction

Code figure	Meaning
0	Data collected serially during descent of probe [D]
1	Data collected serially during ascent of probe [A]
2-5	Reserved
6	Not applicable or unspecified [X]
7	Missing value

0-10-037: Probe hit bottom indicator

Code figure	Meaning
0	Probe hit sea floor [1]
1	Unspecified/missing [0]

0-10-038: Duplicates indicator

Code figure	Meaning
0	Not a duplicate
1	Duplicates another record

0-10-039: Wind speed units indicator (WMO code 1853)

Code figure	Meaning
0	In m/s from land stations and ships with certified instruments
1	In knots m/s from land stations and ships with certified instruments
2	In m/s from ships with uncertified instruments
3	In knots from ships with uncertified instruments
4-7	Reserved
7	Missing value

0-10-040: Indicator for method of current measurement (WMO code 2266)

Code figure	Meaning
0	GEK (Geomagnetic ElectroKinetograph)
1	Ship's set and drift determined by fixes 3-6 hours apart
2	Ship's set and drift determined by fixes more than 6 hours but than 12 hours apart
3-6	Reserved
7	Missing value

0-11-002: Total cloud amount (BUFR table 20-011)

0-11-004: Cloud type (BUFR table 20-012)

0-11-007: Present weather code (BUFR table 20-003)

0-11-008: Past weather(1) (BUFR table 20-004)

0-11-009: Past weather(2) (BUFR table 20-005)

0-20-025: Water colour (Forel-Ule scale)

Code figure	Meaning
0	Deep Blue
1	Blue
2	Greenish Blue
3	Green
4	Light Green
5	Yellowish Green
6	Yellow Green
7	Green Yellow
8	Greenish Yellow
9	Yellow
10-14	Reserved
15	Missing value

0-20-026: Ice in vicinity of oceanographic observations

Code figure	Meaning
0	No ice
1	Ice present in vicinity but not identified as to type or amount
2	Few bergs (10 or less)
3	Many bergs (more than 10)
4	Pack ice more than 1 nautical mile from station: coverage 6/10 or less
5	Pack ice more than 1 nautical mile from station: coverage more than 6/10
6	Pack ice less than 1 nautical mile from station: coverage 6/10 or less
7	Pack ice less than 1 nautical mile from station: coverage more than 6/10
8	Station within heavy concentration of ice e.g. observations from islands, drifting pack, beset vessels, fast ice
9	No observations of ice made
10-14	Reserved
15	Missing value

0-22-009: Bathymetric Datum indicator

Code figure	Meaning
0	Lowest normal low water [01]
1	Mean lower low water [02]
2	Lowest low water [03]
3	Mean lower low water spring [04]
4	Indian spring low water [05]
5	Mean low water spring [06]
6	Mean sea level [07]
7	Mean low water [08]
8	Equatorial spring low water [09]
9	Tropic lower low water [10]
10	Lowest astronomical tide [11]
11-28	Reserved
29	Other [88]
30	No correction applied [sea level] [00]
31	Missing value

0-23-001: Sea state (WMO code 3700)

Code figure	Meaning
0	Calm (glassy): 0 height (m)
1	Calm (rippled): 0-0.1 height (m)
2	Smooth (wavelets): 0.1-0.5 height (m)
3	Slight: 0.5-1.25 height (m)
4	Moderate: 1.25-2.5 height (m)
5	Rough: 2.5-4 height (m)
6	Very rough: 4-6 height (m)
7	High: 6-9 height (m)
8	Very high: 9-14 height (m)
9	Phenomenal: Over 14 height (m)
10-14	Reserved
15	Missing value

0-25-001: Free air gravity anomaly reference system

Code figure	Meaning
0	IGSN 1971 reference system [-A]
1	Potsdam reference system [-P]
2	Local reference system [-L]
3-12	Reserved
13	Other reference system [-Z]
14	Unknown
15	Missing value

0-25-002: Reference residual magnetic field

Code figure	Meaning
0	IGFR 1965 [AA]
1	IGFR 1975 [AB]
2	IGFR 1980 [AC]
3	DGFR 1965 [DA]
4	DGFR 1970 [DB]
5	DGFR 1975 [DC]
6	PGFR 1975 [PA]
7-13	Reserved
14	Other reference field [XX]
15	Missing value

0-25-003: Bathymetry sound velocity correction area

Code figure	Meaning
	See "Echo Sounding Correction Tables", 3rd. edition N.P.139 (UK)

0-25-004: Prime navigation aid fix

Code figure	Meaning
0	Position is not primary navaid
1	Position is primary navaid [F]
2-6	Reserved
7	Missing value

0-25-005: Free air gravity anomaly formula

Code figure	Meaning
0	Heiskanen 1924 formula [A-]
1	International 1930 formula [B-]
2	IAG system 1967 formula [C-]
3-5	Reserved
6	Other formula [Z-]
7	Missing value

0-25-012: Duration application

Code figure	Meaning
0	Duration of processed observation [PR]
1	Duration of individual sample [SS]
2-6	Reserved
7	Missing value

0-25-013: Frequency sampling technique

Code figure	Meaning
0	Frequency of processed observations [PR]
1	Original sampling/digitization interval [SS]
2-6	Reserved
7	Missing value

0-25-014: Interval sampling code

Code figure	Meaning
0	Interval of processed observations – usually the same as the sampling of the data
1	Original sampling/digitization interval – used mainly in cases where the processed observation may be derived/extracted from higher resolution data. [SS]
2-6	Reserved
7	Missing value

0-25-015: Digitization method

Code figure	Meaning
0	Hand digitized
1	Analog reading by one operator
2	Analog reading by 2 or more operators
3	Digital data logger, unreduced values
4	Digital data logger, resolution reduced to less than instrument limits
5	Digital data logger, resolution reduced to instrument limits
6	Digitized from analog record
7-13	Reserved
14	Unknown
15	Missing value

0-25-016: Filter type

Code figure	Meaning
0	Digital filter has been used [F]
1	Analogue filter has been used [A]
2	Unspecified [X]
3-6	Reserved
7	Missing value

0-25-020: Correction procedure for depth from sound speed

Code figure	Meaning
0	Corrected depth [C-]
1	Uncorrected depth [U-]
2	Corrected depth including refraction effects [R-]
3	Uncorrected depth, assumed sound velocity = 1500m/s [UA]
4	Uncorrected depth, assumed sound velocity = 800 fathoms/s [UF]
5	Uncorrected depth, assumed sound velocity other than above [UZ]
6-14	Reserved
15	Missing value

0-25-021: Method of depth correction for sound speed

Code figure	Meaning
0	Used echo sounding correction tables [-T]
1	Used Mathews tables [-M]
2	Used velocimeter dips [-V]
3	Used W.D. Wilson formula on T-S data [-W]
4	Used Kuwahara formula on T-S data [-K]
5	Used Del Grosso formula on T-S data [-G]
6-13	Reserved
14	Used another technique [-Z]
15	Missing value

0-25-022: Method of sound velocity measurement

Code figure	Meaning
0	In-situ sound velocity probe [PR]
1	Computed from other parameters [CV]
2-5	Reserved
6	Unspecified [XX]
7	Missing value

0-25-023: Density calculation

Code figure	Meaning
0	International equation [1980] [EQ]
1	In-situ density probe [PR]
2-13	Reserved
14	Unspecified [XX]
15	Missing value

0-25-028: Method of current averaging

Code figure	Meaning
0	Scalar averaged method of averaging [S]
1	Vector averaged method of averaging [C]
2	Discrete value method of averaging [D]
3-13	Reserved
14	Unspecified method of averaging [X]
15	Missing value

0-25-029: Duration and time of eulerian current measurement (WMO code 2264)

Code figure	Meaning
1	Instantaneous (between H-1 and H)
2	Averaged over 3 minutes or less (between H-1 and H)
3	Averaged over more than 3 minutes, but 6 at the most (between H-1 and H)
4	Averaged over more than 6 minutes, but 12 at the most (between H-1 and H)
5	Instantaneous
6	Averaged over 3 minutes or less (between H-2 and H-1)
7	Averaged over more than 3 minutes, but 6 at the most (between H-2 and H-1)
8	Averaged over more than 6 minutes, but 12 at the most (between H-2 and H-1)
9	Vector or Doppler current profiling method not used
10-14	Reserved
15	Missing value

Note: H = time of observation

0-25-030: Period of current measurement (WMO code 2265)

Code figure	Meaning
1	1 hour or less
2	More than 1 hour but 2 at the most
3	More than 2 hours but 4 at the most
4	More than 4 hours but 8 at the most
5	More than 8 hours but 12 at the most
6	More than 12 hours but 18 at the most
7	More than 18 hours but 23 at the most
8	Reserved
9	Drift method not used
10-14	Reserved
15	Missing value

0-25-035: Method of temperature measurement

Code figure	Meaning
0	Bucket
1	Ship intake [BK]
2	In-situ probe [PR]
3	Infra-red scanner [RS]
4	Microwave scanner [MW]
5	Hull mounted sensor
6-9	Reserved
10	Reversing Thermometer [RT]
11	STD/CTD sensor [ST]
12	Mechanical BT [MT]
13	Expendible BT [ET]
14	Unspecified BT [BT]
15	Thermosalinograph
16-29	Reserved
30	Unspecified [XX]
31	Missing value

0-25-036: Method of salinity/depth measurement

Code figure	Meaning
0	No salinity measured
1	In situ sensor, accuracy better than 0.02 psu
2	In situ sensor, accuracy less than 0.02 psu
3	Sample analysis
4-6	Reserved
7	Missing value

0-25-037: Method of depth measurement

Code figure	Meaning
0	Pressure measurement [PR]
1	Reversing thermometer [RT]
2	Echo sounding [ES]
3	Wire length [WL]
4	Fixed [eg. attached to tower or ship hull] [FX]
5	Standard depth for interpolated data [ID]
6	Determined by fall rate [BT]
7-13	Reserved
14	Unspecified [XX]
15	Missing value

0-25-038: Pressure measurement method

Code figure	Meaning
0	Reversing thermometer [RT]
1	In-situ pressure probe [PR]
2-5	Reserved
6	Unspecified [XX]
7	Missing value

0-25-045: Method code for position fixing

Code figure	Meaning
0	Celestial [star fix, sun line] [CL]
1	Satellite navigation [NS]
2	Omega [OM]
3	Loran A [LA]
4	Loran C [RC]
5	Decca [EE]
6	Mid range navigational net (200-500 km) [MD]
7	Short range navigational net (<200 km) [SH]
8	Acoustic (SOFAR, SONAR, etc.) [AU]
9	RADAR [BB]
10	Dead reckoning [DR]
11	GPS
12	Digital GPS
13-29	Reserved
30	Unspecified [XX]
31	Missing value

0-25-046: Method of wave calculation

Code figure	Meaning
0	Fourier transform calculation [F]
1	Lag correlation calculation [L]
2	Simple computer analysis calculation [C]
4	Manual analysis of chart [M]
5	Visual estimation
5-13	Reserved
14	Unspecified method of calculation
15	Missing value

0-29-001: Processing centre

Code figure	Meaning
0	Australian Oceanographic Data Centre
1	Atlantic Oceanographic & Meteorological Laboratory (U.S.)
2	Commonwealth Scientific & Industrial Research Organization (Australia)
3	Fleet Numerical Oceanography Center (U.S.)
4	Bundesamt fur Seeschifffahrt und Hydrographie (Germany)
5	Japan Meteorological Agency
6	Integrated Science Data Management (formerly Marine Environmental Data Service) (Canada)
7	National Oceanographic Data Center (U.S.)
8	National Weather Service (U.S.)
9	Scripps Institution of Oceanography (U.S.)
10	TOGA Subsurface Data Centre (France)
11-30	Reserved
31	Missing value

0-29-002: Processing function identifier

Code figure	Meaning
0	MEDS software that reads IGOSS data in BUFR and convert to the ocean processing format
1	NODC converter of NODC UBT format to MEDS format
2	NODC converter of NODC IBT format to MEDS format
3	NODC converter of Navy Declassified IBT format to MEDS format
4	NODC duplicates software
5	NODC GTSPSP Quality Control Cruise Track Software
6	NODC GTSPSP software to remove duplicate stations found in an input file or in the database
7	NODC converter of SEAS III XBT format to GTSPSP format
8	NODC converter of TSDC1 XBT format to GTSPSP format
9	NODC converter of SEAS II XBT format to GTSPSP format
10	NODC converter of CEADO XBT format to GTSPSP format
11	NODC converter of TSDC2 XBT format to GTSPSP format
12	NODC converter of CSIRO TOGA XBT format to GTSPSP format
13	NODC converter of NODC UBT format to GTSPSP format
14	NODC converter of TAMU XBT (1-labelled fields) format to GTSPSP format
15	NODC converter of TAMU XBT (2-columnar fields) format to GTSPSP format
16	NODC converter of JODC XBT format to GTSPSP format
17	NODC converter of AODC XBT format to GTSPSP format
18	NODC converter of AODC XBT (2-RV Franklin) format to GTSPSP format
19	NODC converter of NODC CTD/STD (F022) format to GTSPSP format
20	NODC converter of TAMU CTD (1-labelled fields) format to GTSPSP format
21	NODC converter of NODC Station (SD1) format to GTSPSP

	format
22	NODC converter of CSIRO meds format to GTSP format
23	MEDS software to convert real-time IGOSS data to ocean processing structure
24	MEDS duplicates checking software.
25	MEDS duplicates review software
26	MEDS quality control software which checks ocean profiles
27	NODC program re-set QC temp flags from "2" to "1" if failed Levitus Climatology
28	MEDS convert Japanese JHD data to MEDS format
29	Update the MEDS archive
30	NODC converter of Bundesamtes fur Seeschiffahrt und Hydrographie (BSH) to GTSP format
31	NODC Duplicates software
32	Convert NODC OPDB format to GTSP format
33	NODC Delayed mode version of QCA1
34	MEDS quality control software which checks that the space and time location as well as the identification of a station is sensible
35	NODC GTSP QC Profiles software
36	AOML XBT QC Software
37	SCRIPPS
38	NODC
39	AOML XBT Edit software
40-126	Reserved
127	Missing value

0-29-004: Processing action taken

Code figure	Meaning
0	Change a quality flag
1	Create record
2	Constant temperature, hit bottom. The temperature profile exhibits constant temperature which is considered to be erroneous when compared to neighbouring profiles and/or climatology and/or known characteristics of the region. The constant temperatures could occur over all of the profile or part of it. (The reasons could be sensor failure, depth calculation error, nose falling off the XBT, XBT sitting on the bottom, etc.)
3	Change value
4	Station was checked by duplicate checking software
5	Edit a parameter value
6	Fine structure error: leakage, PET fault, cusping, sticking bit. The temperature profile exhibits erroneous fine structure when compared to neighbouring profiles and/or climatology and/or known characteristics of the region. (The reasons could be signal leakage, XBT recording system failures (sticking bit, cusping, PET Fault, etc), complete instrument failure, etc.)
7	This history group operates on the complete input record
8	Mixed layer error: bowing. The temperature profile exhibits erroneous features (such as false inversions) in the mixed layer when compared to neighbouring profiles and/or

	climatology and/or known characteristics of the region. (The reasons could be XBT bowing problem, instrument drift, etc.)
9	No good trace
10	Position error. Profile position has been erroneously encoded. Corrected if possible
11	Quality Control
12	Surface feature error: surface anomaly, chopped surface value. The temperature exhibits erroneous features at the surface when compared to neighbouring profiles and known characteristics of the region. (The reasons could be XBT start-up transients, general instrument equilibration problems, sensors recording prematurely before entering water, etc.)
13	Set a value
14	Time error. Profile date/time has been erroneously encoded. Corrected if possible
15	Temperature gradient error: insulation penetration, spikes, high frequency noise, wire break, modulo 10 spikes. The temperature profile exhibits erroneous temperature gradients when compared to neighbouring profiles and/or climatology and/or known characteristics of the region. (The reasons could be spiking, interference, XBT wire break, modulo 10 problem, XBT wire insulation penetration, etc.)
16	Temperature inversion error: wire stretch. The temperature profile exhibits erroneous temperature inversions when compared to neighbouring profiles and/or climatology and/or known characteristics of the region. (The reasons could be XBT wire stretch, sensor drift, encoding error, etc.)
17	Temperature/depth offset. The temperature profile exhibits erroneous temperature/depth offsets compared to neighbouring profiles and/or climatology and/or known characteristics of the region. The offsets can occur at depth, or over sections of the profile, or over the complete profile (The reason could be instrument drift/sensor failure, encoding error, XBT fall rate error, XBT start-of-descent timing error, etc.)
18	Station passed through the update program
19	Under resolved. Temperature data is encoded at standard depths/levels and can't be used to reconstitute a profile accurately
20-62	Reserved
63	Missing value

0-29-005: Parameter acted upon

Code figure	Meaning
0	Temperature
1	Salinity
2	East component of current
3	North component of current
4	Sound velocity
5	Transmissivity
6	pH
7	CFC-11

8	CFC-12
9-19	Reserved
20	Carbonate alkalinity
21	Chlorinity
22	Chlorosity
23	Alkalinity
24-29	Reserved
30	Ammonia
31	Organic Carbon
32	Chlorophyll-A
33	Dissolved oxygen
34	Nitrate
35	Nitrite
36	Phosphate
37	Inorganic phosphate
38	Silicate
39-49	Reserved
50	Fluoride
51	Fluorescence
52	Sulphate
53	Vitamin B12
54-254	Reserved
255	Missing value

0-31-021: Associated Field Significance

Code figure	Meaning
0	Reserved
1	1-bit indicator of quality 0 = good, 1 = suspect or bad
2	2-bit indicator of quality 0 = good, 1 = slightly suspect, 2 = highly suspect, 3 = bad
3-6	
7	Percentage confidence
8-20	Reserved
21	1-bit indicator of correction 0 = original value, 1 = substituted/corrected value
22-62	Reserved for local use
63	Missing value

0-31-031: Data Present Indicator

Code figure	Meaning
0	Data present
1	Data not present

ANNEX TO PARAGRAPH 3.5.1
OPERATIONAL

Proposal for new entries in Code table 0 08 002 and a new Note under Class 1 referring to 0 01 012

Specification of instrument detected cloud layers

It is proposed to add the following code figures into Code Table 0 08 002:

0 08 002

Vertical significance (surface observations)

Code figure

21	First instrument detected cloud layer
22	Second instrument detected cloud layer
23	Third instrument detected cloud layer
24	Fourth instrument detected cloud layer

Representation of stationary position of ship and course of ship unknown

It is proposed to add **Note (14) under Class 1:**

(14) Stationary position of ship shall be reported by 0 01 012 set to 0 and 0 01 013 set to 0. Course of ship unknown ($D_s = 9$) shall be reported by 0 01 012 set to 509.

ANNEX TO PARAGRAPH 3.5.2
OPERATIONAL

Problem of insufficient data width of 0 20 013 (Height of base of cloud)

Taking into account the fact that the height of base of clouds above 20 km is seldom reported and does not have remarkable operational significance, it is proposed to add a new Note under Class 20:

(5) When encoding height of cloud base between 20 050 and 21 000 m, 0 20 013 shall be set to 20050; when encoding height of cloud base above 21 000 m, 0 20 013 shall be set to 20060.

**ANNEX TO PARAGRAPH 3.5.3
FOR VALIDATION**

It is proposed to introduce the following new descriptors for UV radiation and Notes under Class 14:

Table reference	Element name	BUFR				CREX		
		Unit	Scale	Reference value	Data width	Unit	Scale	Data width
0 14 071	Global UV spectral irradiance	W. m ⁻² nm ⁻¹	6	-1048576	21	W m ⁻² nm ⁻¹	6	7
0 14 072	Global UV irradiation	J m ⁻²	-3	-8192	14	J m ⁻²	-3	4
0 14 073	Global erythema irradiation	J m ⁻²	-3	-32	6	J m ⁻²	-3	2

The proposed descriptors allow representation of values of irradiance and irradiation:

Range of values		kJ m ⁻²		J cm ⁻²		W. m ⁻² nm ⁻¹	
		max upward	max downward	max upward	max downward	max upward	max downward
0 14 071	Global UV spectral irradiance					-1.048576	1.048574
0 14 072	Global UV irradiation	-8192	8190	-819.2	-819.0		
0 14 073	Global erythema irradiation	-32	30	-3.2	3.0		

Notes:

- (1) Global UV spectral irradiance (0 14 071) is UV flux density for individual wavelengths specified. 0 14 071 shall be preceded by 0 02 071 (Spectrographic wavelength).
- (2) Global UV irradiation (0 14 072) is UV energy integrated over period specified for spectral band specified. 0 14 072 shall be preceded by a time period descriptor, 0 02 071 (Spectrographic wavelength) and 0 02 072 (Spectrographic width). E.g. If 0 14 072 is used for Global UV-B irradiation, 0 02 071 and 0 02 072 shall specify spectral band 280 to 315 nm.
- (3) Global erythema irradiation (0 14 073) is UV energy weighted by the CIE Action Spectrum integrated over period specified. 0 14 073 shall be preceded by a time period descriptor, 0 02 071 (Spectrographic wavelength) and 0 02 072 (Spectrographic width).

ANNEX TO PARAGRAPH 3.5.4
OPERATIONAL

NOTES FOR NON SI UNITS IN BUFR FOR AVIATION CODES AND IN CREX

Proposal:

1) To change regulation 95.3.4.1 in CREX. The new text of the regulation will be:

95.3.4.1 Units should be based on standard international units of the SI system. Alternatively, in exceptional cases, consideration may be given to other standard common units used by the data producer and the users, where a convincing case can be made that those units are more appropriate. In that case, priority shall be given to units contained in WMO Common Table C-6 or, in the case of descriptors for aviation products, ICAO Annex 5.

2) To add new regulations for BUFR:

94.5.7.1 The Unit of an Element descriptor, when not defined as Code Table, Flag Table or CCITT5, should be based on the international system of units, *Système International*, SI, established by the 11th *Conférence Générale des Poids et Mesures* (CGPM) in 1960, and extended at the 1980 conference. Alternatively, in exceptional cases, consideration may be given to other standard common units used by the data producer and the users, where a convincing case can be made that those units are more appropriate for the intended purpose of the descriptor. In that case, priority shall be given to units contained in WMO Common Table C-6 or, in the case of descriptors for aviation products, ICAO Annex 5.

94.5.7.2 In the case where an Element descriptor is defined as a Code Table that references values requiring units, regulation 94.5.7.1 shall apply.

ANNEX TO PARAGRAPH 3.5.5
FOR VALIDATION

New Table B descriptor for Surface Aviation Observation:

Table Reference	Element Name	BUFR				CREX		
		Unit	Scale	Reference Value	Data Width	Unit	Scale	Data Width
0 10 012	Density Altitude	m	0	-1525	13	m	0	4

Note: Density altitude is a parameter derived from air density at a particular location. It indicates the altitude in the ICAO Standard Atmosphere corresponding to a given air density.

**ANNEX TO PARAGRAPH 3.5.6
FOR CONSIDERATION WITH CIMO
REPRESENTATION OF WIND DIRECTION AT LOCATIONS NEAR THE POLES**

1. Background

The North Pole and the South Pole represent singular points with respect to wind direction.

In TAC data, wind direction at locations within 1° of the North Pole shall be reported using Code table 0878 and wind direction at locations within 1° of the South Pole shall be reported using Code table 0877 – these stations shall orient their azimuth rings so that the ring's zero coincides with the Greenwich 0° meridian.

GRIB 2 Regulation 92.1.10 provides guidance for encoding vector components at the North and South Poles. It is quite different from the recommendations for reporting wind direction in TAC.

This aspect has not yet been reflected in BUFR/CREX Table B, Class 11.

2. Proposal for addition of a new note under Class 11

It might be useful to consider adding a new note under Class 11, when CIMO will have agreed that this is still useful within a certain area around the Poles or now considered obsolete with the new technology of positioning:

Wind direction measured by a surface station within of the North Pole or within of the South Pole shall be reported in such a way that the azimuth ring shall be aligned with its zero coinciding with the Greenwich 0° meridian.

This note is proposed in compliance with paragraph 5.1.2 of WMO-No.8 and the above included recommendations for reporting TAC data to support the consistency of TDCF data with the TAC data.

3. Proposal for modification of Guide to Meteorological Instruments and Methods of Observation

3.1 The current text in paragraph 5.1.2 of WMO-No.8 Guide to Meteorological Instruments and Methods of Observation reads:

Wind direction at stations within 1° of the North Pole or 1° of the South Pole shall be reported according to Code table 0878 (the azimuth ring should be aligned with its zero coinciding with the Greenwich 0° meridian) found in the Manual on Codes (WMO, 1995).

Code Table 0878 applies only to locations within 1° of the North Pole and so it is proposed to request CIMO experts to correct the text accordingly. Besides that, representation of data in TDCF should be also considered. Therefore the text may be modified to read:

Wind direction at stations within 1° of the North Pole or 1° of the South Pole shall be reported so that the azimuth ring shall be aligned with its zero coinciding with the Greenwich 0° meridian.

3.2 It might be useful to request CIMO experts to reconsider the specification of the size of the area for which the recommendation in paragraph 5.1.2 of WMO-No.8 applies.

ANNEX TO PARAGRAPH 3.5.7
PREOPERATIONAL

CORRECTION OF BUFR CODE TABLES FOR SBUV2 DATA

Within the existing documentation of preoperational BUFR descriptors, replace the existing version of code tables 0-33-070 and 0-33-071 with the following versions:

0-33-070 Total ozone quality

0	Good retrieval
1	Bad aerosol information flag or NOAA-16 radiance anomaly
2	Solar zenith angle greater than 84 degrees
3	380nm residue greater than limit
4	Ozone inconsistency
5	Difference between profile ozone and step 3 total ozone exceeds threshold (set to 25 DU)
6	Step 1 ozone iteration did not converge
7	Any channel residue greater than 16 or bad radiance
8-14	Reserved
15	Missing

0-33-071 Profile ozone quality

0	Good retrieval
1	Solar zenith angle greater than 84 degrees
2	Difference between step 3 and profile total ozone greater than limit (25 DU)
3	Average final residue for wavelengths used in retrieval greater than threshold
4	Final residue greater than 3 times a priori error
5	Difference between retrieved and a priori greater than 3 times a priori error
6	Non-convergent solution
7	Upper level profile anomaly or stray light anomaly
8	Initial residue greater than 18.0 N-value units
9-14	Reserved
15	Missing

ANNEX TO PARAGRAPH 4.2.2
FOR CBS XIV

END OF ICAO REQUIREMENT FOR ROFOR (ROUTE FORECAST FOR AVIATION)

To reflect this change it is suggested that a note be added under FM 54-X Ext. ROFOR in the Manual on Codes (WMO-No.306), Volume I.1, Part A. The proposed note is identical to that already provided under FM 53-X Ext. ARFOR (Area forecast for aviation).

This note would read as follows:

“No aeronautical requirement for this code is stated by ICAO for international air navigation in ICAO Annex 3/WMO *Technical Regulations* [C.3.1]”.

**ANNEX TO PARAGRAPH 4.2.3
OPERATIONAL**

**CORRIGENDUM TO SUPPLEMENT NO. 6 TO THE MANUAL ON CODES, WMO-NO.
306, VOL. I.1**

DEFINITIONS to be added:

Prevailing visibility

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

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

Visibility (for aeronautical purposes)

Visibility for aeronautical purposes is the greater of:

- a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;
- b) the greatest distance at which lights in the vicinity of 1000 candelas can be seen and identified against an unlit background.

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

Page I.1-A-25

Group "State of the runway" in the METAR/SPECI code form should read :

(RD_RD_R/E_RC_R0_R0_RB_RB_R)

i.e. a "/" should be added between "D_RD_R" and "E_RC_R".

Pages I.1-A-33 and I.1-A-34

Group "State of the runway" in Regulations 15.13 and 15.13.6 should read :

(RD_RD_R/E_RC_R0_R0_RB_RB_R)

i.e. a "/" should be added between "D_RD_R" and "E_RC_R".

Page I.1-A-27:

15.6.1 should read:

The group VVVV shall be used to report prevailing visibility. When the horizontal visibility is not the same in different directions and when the visibility is fluctuating rapidly and the

prevailing visibility and less than 5 000 metres **cannot be determined**, the group VVVV shall be used to report the lowest visibility. When visibility sensors are used and they are sited in such a manner that no directional variations can be given, the abbreviation NDV shall be appended to visibility reported.

Page I.1-A-112:

Correct regulation

51.6.3

"....., and CAVOK or SKC are not appropriate, the abbreviation NSC shall be used."

to read:

"....., and CAVOK **is** not appropriate, the abbreviation NSC shall be used."

In English only: Page I.1-A-114:

Modify last line of 51.9.2:

TEMPO 2922/3001

Page I.1-B-23:

G₂G₂

Modify Note 2:

(2) When the period is between 25 and 48 hours after G₁G₁, G₂G₂ shall be encoded by adding 50 to the time of the ending period of the forecast (**however this note (2) does not apply to G₂G₂ in FM 51**).

Page I.1-A-28

Modify Regulation 15.7.1 to read:

15.7.1 During the periods when either the horizontal visibility **reported in the group VVVV** or the runway visual range for one or more runways available for landing is observed to be less than 1 500 m, one or more groups under Regulation 15.7 shall be included in the report.

(i.e. add "reported in the group VVVV" after "horizontal visibility")

Page I.1-A-31

Modify Regulation 15.8.14 and 15.8.15 to read:

15.8.14 For w'w' = **BR** to be reported, the visibility **reported in the group VVVV** shall be at least 1000 metres but not more than 5 000 metres.

15.8.15 For w'w' = **FG** to be reported without the qualities MI, BC or VC, the visibility **reported in the group VVVV** shall be less than 1000 metres.

(i.e. add "reported in the group VVVV" after "visibility")

Page I.1-A-33

Modify Regulation 15.10 (a) to read:

15.10 The word CAVOK shall be included in place of the groups under Reg. 15.6, 15.8 and 15.9, when the following conditions occur simultaneously at the time of observation:

- (a) Visibility reported in the group VVVV is 10 km or more and criteria for inclusion of the group $V_N V_N V_N V_N D_V$ are not met;
- (b)
- (c)

(i.e. add “reported in the group VVVV” and “and criteria for inclusion of the group $V_N V_N V_N V_N D_V$ are not met” after “visibility” and after “more”, respectively)

Page I.1-A-22

Modify the first paragraph of Regulation 12.4.10.1 to read:

12.4.10.1 This group shall be repeated to report a number of different layers or masses of cloud. *When reported from a manned station*, the number of such groups shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of groups can be four. *When the station operates in the automatic mode, the total number of groups shall not exceed four.*

Page I.1-C-33

In Table: 0519 C_R – Extent of runway contamination

Change Code figure 1 as:

- 1 Up to 10 per cent of runway contaminated (covered)

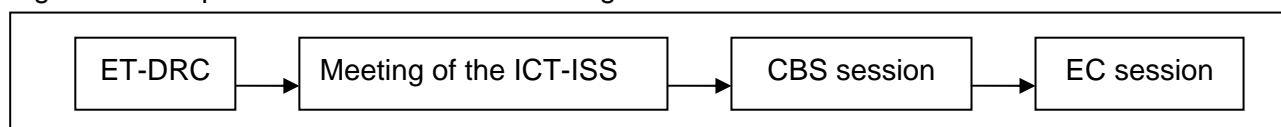
ANNEX TO PARAGRAPH 5.1.1

DRAFT PROCEDURES FOR THE DIRECT ADOPTION OF AMENDMENTS TO THE MANUAL ON CODES BETWEEN CBS SESSIONS

Procedures for the adoption of the amendments through a CBS session

1. In accordance with paragraph 14 of the introduction to the WMO Technical Regulations (WMO-No. 49), amendments to annexes to the Technical Regulations proposed by the technical commissions are normally approved by the Executive Council. As stipulated in the current rules and procedures for amending the Manual on Codes defined in Recommendation 4 (CBS-XII), a draft recommendation developed by the CBS Expert Team on Data Representation and Codes (ET/DRC) must be endorsed by the Implementation/ Coordination Team of the Open Programme Area Group on Information Systems and Services (ICT-ISS) prior to its consideration by CBS, which subsequently submits it for approval to the Executive Council.

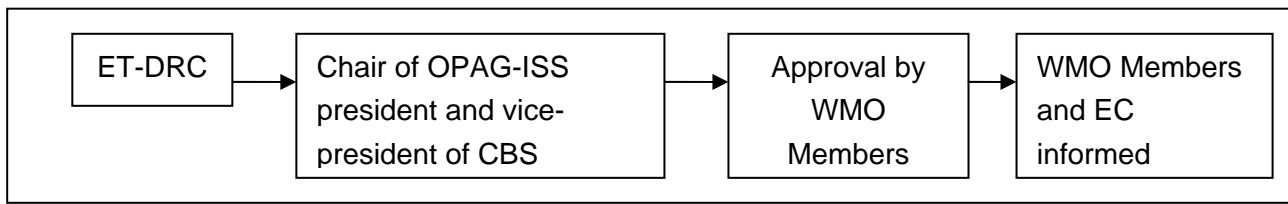
Figure 1 – Adoption of the amendments through a CBS session



Procedures for the adoption of amendments between CBS sessions

2. For the direct adoption of amendments between CBS sessions, as a first step, the ET-DRC submits its recommendation, including a date of implementation of the amendments, to the Chair of OPAG-ISS, president and vice-president of CBS. In a second step, upon approval of the president of CBS, the Secretariat sends the recommendation, including a date of implementation of the amendments, to all WMO Members for comments within two months; WMO Members are invited to designate a focal point responsible to discuss any comments/disagreements with the ET-DRC. If the discussion between the ET-DRC and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the ET-DRC (see also paragraph 3). Those WMO Members having not replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments. In a third step, once amendments are agreed by WMO Members, and after consultation with the chairman and co-chairman of the OPAG-ISS, president and vice-president of CBS, the Secretariat notifies at the same time the WMO Members and the members of the Executive Council (EC) of the approved amendments and of the date of their implementation. The date of implementation should be at least three months after the date of notification in order to give sufficient time to the WMO Members to implement the amendments.

Figure 2 - Adoption of amendments between CBS sessions



3. The procedures for the adoption of the amendments through a CBS session, as well as the fast track mechanism, defined in Recommendation 4 (CBS-XII) are kept in force. This will make it possible for the ET-DRC to use any of the procedures depending on the circumstances. In particular following the rejection of an amendment by Member(s) through the procedure between sessions, the ET-DRC may reconsider this amendment and submit a relevant recommendation through the procedure for adoption of amendments through a CBS session or between CBS sessions.

ANNEX TO PARAGRAPH 5.1.6

PROCEDURES FOR AMENDING THE MANUAL ON CODES

1. General validation and implementation procedures

1.1 Amendments to the Manual on Codes must be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements and include information on a contact point for technical matters.

1.2 The Expert Team on Data Representation and Codes (ET-DRC)², supported by the Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO Technical Regulations) and develop a draft recommendation to respond to the requirements, as appropriate.

1.3 A draft recommendation of the ET-DRC must be validated. A draft recommendation of the ET-DRC must be endorsed by the Implementation/Coordination Team (ICT-ISS) of the Open Programme Area Group on Information Systems and Services (OPAG-ISS). The ET-DRC should define a date of implementation in order to give sufficient time to the WMO Members to implement the amendments after the date of notification; the ET-DRC should document the reasons to propose a time span less than three months.

1.4 Depending on the type of amendments, the ET-DRC may select one of the following procedures for the approval of the amendments:

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

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

2. Fast track procedure

2.1 Fast track mechanism can be used for additions to BUFR or CREX Tables A, B, and D with associated code tables or flag tables, to code tables or templates in GRIB and to common tables C.

Note 2: The ET-DRC, the ICT-ISS and the OPAG-ISS are the current bodies dealing with data representation and codes within CBS. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities appropriately.

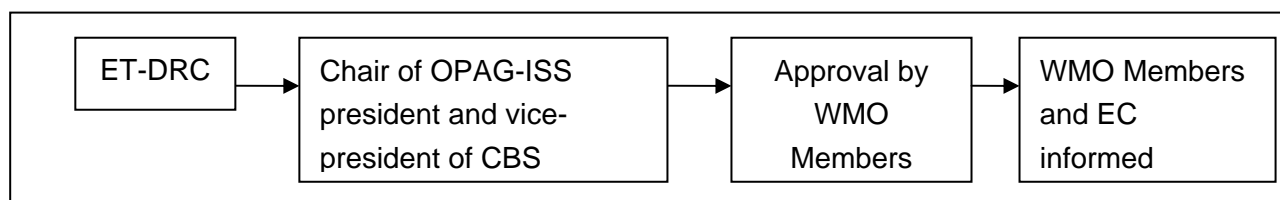
2.2 A draft recommendation of the ET-DRC must be validated in accordance with the procedures given in section 6 below. Draft recommendations developed by the ET-DRC must be endorsed by the Chair of OPAG-ISS. The filling of reserved and unused entries in the existing code and flag tables is considered as minor adjustments, and will be effected by the Secretary-General in consultation with the president of CBS. For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the focal points for codes and data representation matters for comments, with a deadline of two months for the reply. It should then be submitted to the president of CBS for its adoption on behalf of the Executive Council.

2.3 The implementation of amendments approved through the fast track procedure shall normally be limited to one per year. If the Chair/co-Chair of ET-DRC and OPAG-ISS agree that an exceptional situation exists, a second fast track implementation can be initiated.

3. Procedure for the adoption of amendments between CBS sessions

For the direct adoption of amendments between CBS sessions, as a first step, the ET-DRC submits its recommendation, including a date of implementation of the amendments, to the Chair of OPAG-ISS, president and vice-president of CBS. In a second step, upon approval of the president of CBS, the Secretariat sends the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments within two months; WMO Members are invited to designate a focal point responsible to discuss any comments/disagreements with the ET-DRC. If the discussion between the ET-DRC and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the ET-DRC. Those WMO Members having not replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments. In a third step, once amendments are agreed by WMO Members, and after consultation with the Chair and co-Chair of the OPAG-ISS, president and vice-president of CBS, the Secretariat notifies at the same time the WMO Members and the members of the Executive Council (EC) of the approved amendments and of the date of their implementation.

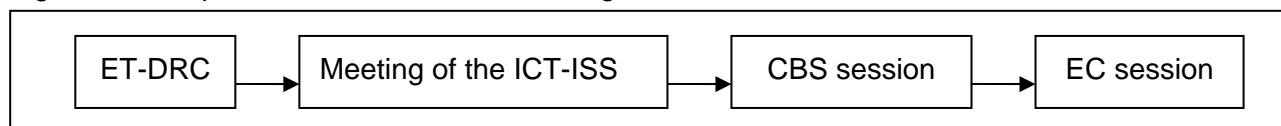
Figure 1- Adoption of amendments between CBS sessions



4. Procedure for the adoption of amendments during CBS sessions

For the adoption of amendments during CBS sessions, the ET-DRC submits its recommendation, including a date of implementation of the amendments, to the ICT-ISS. The recommendation is then submitted to a CBS session and then to an EC session.

Figure 2 – Adoption of the amendments through a CBS session



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

5.1 If an erroneous specification of an entry is found in an operational BUFR or CREX Element descriptor or Sequence descriptor, a new descriptor should preferably be added to the appropriate table through the fast track procedure or the procedure for adoption of amendments between CBS sessions. The new descriptor should be used instead of the old one for encoding (especially if it concerns data width). An appropriate explanation shall be added to the notes of the table to clarify the practice along with the date of the change. This situation is considered a minor adjustment according to subsection 2.2 above.

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

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

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

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

5.2.4 The version number of the master will be incremented.

6. Validation procedures

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

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

6.3 For new or modified WMO code and data representation forms, proposed changes should be tested by the use of at least two independently developed encoders and two

independently developed decoders which incorporated the proposed change. Where the data originated from a necessarily unique source (for example the data stream from an experimental satellite), the successful testing of a single encoder with at least two independent decoders would be considered adequate. Results should be made available to the ET-DRC with a view to verifying the technical specifications.

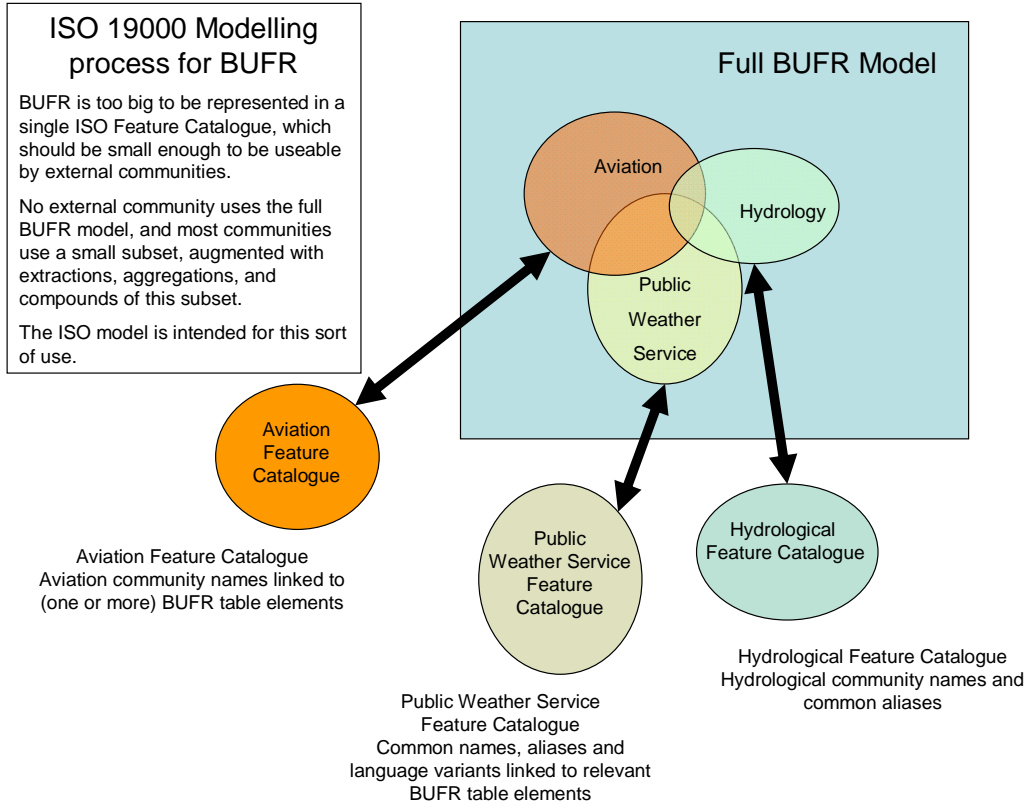
7. Urgent introduction of new descriptors or entries in BUFR, CREX and GRIB edition 2 tables

As agreed by CBS (see CBS-Ext. (02), paragraph 6.2.66 of the general summary), a three-step mechanism for the introduction of new descriptors or entries in BUFR, CREX and GRIB edition 2 tables accommodates urgent user needs, as follows:

- (a) Approval (by the chairperson of ET-DRC, the chairperson of OPAG-ISS and the president of CBS) of allocated entries after an expression of requirements. The list of allocated entries awaiting validation is kept on-line on the WMO web server;
- (b) After validation (according to 6.1, 6.2 and 6.3), declaration of pre-operational use (after approval by the chairperson of ET-DRC, the chairperson of OPAG-ISS and the president of CBS). The list of pre-operational entries is kept on-line on the WMO web server;
- (c) Finally, adoption of the amendments in accordance with the procedures detailed in above sections 2, 3 or 4.

ANNEX TO PARAGRAPH 6.7

DERIVING ISO FEATURE CATALOGUES FROM THE BUFR MODEL



ANNEX TO PARAGRAPH 7.2.1

**Results of Questionnaire on WMO Codes Processing
(December 2007)**

*(Counting numbers are shown in **bold**)*

33 Countries answered:

Australia, Belarus, Colombia, Czech Republic, Finland, France, Germany, Hong-Kong, Indonesia, Ireland, Japan, Latvia, Lithuania, Macedonia, Malaysia, Mongolia, Nepal, Netherlands Antilles, Netherlands, New Zealand, Nigeria, Norway, Oman, Romania, Senegal, Slovakia, Switzerland, Syria, Tanzania, Thailand, Turkey, UK, Uzbekistan

- 10 Developing countries out of 33 with one Least Developed Country.

RA I: 3
RA II: 7
RA III: 1
RA IV: 1
RA V: 4
RA VI: 17

Are you aware of the advantage of Table Driven Code Forms (BUFR and CREX) versus Traditional Alphanumeric Codes (e.g. SYNOP, TEMP, etc..)?	yes 31	no 2
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<p>1.</p>	<p>If, Yes, Please, elaborate:</p> <p><i>Belarus:</i> The table-driven code forms FM 94 BUFR offered great advantages in comparison with the traditional alphanumeric codes. The reliability of binary data transmission provides for an increase in data quality and quantity received at meteorological centers.</p> <p><i>Colombia:</i> The increase in data quality and quantity received and transmitted, the security and the uniform process on transmission and reception of data.</p> <p><i>Czech Republic:</i> The main advantages of Table Driven Code Forms are self-description, flexibility and expandability. Therefore TDCF are capable to provide more precise and detailed data information than TAC. In addition, BUFR is volume-effective and CREX is easily readable provided the check-digit option is not used.</p> <p><i>France:</i> MITRA, TWIM-TERMINAL</p> <p><i>Germany:</i> flexible, suitable for almost all data, minimise the "Volume-A problem", less faults caused by typing errors (at least regarding BUFR).</p> <p><i>Hong-Kong:</i> i) Increased data quantity and quality and hence generation of better products; (ii) Allow systematic exchange of metadata in report; (iii) Retrieval of parameters from archives by historical post-processing application is safer and simpler; (iv) Less development and maintenance work and reduced associated costs.</p> <p><i>Indonesia:</i> partial self description, universality, expandability, data packing(for BUFR), data readability (for CREX)</p> <p><i>Ireland:</i> Mainly to facilitate the needs of NWP centres. The WMO aim is to replace the Traditional Alphanumeric Codes and the many report formats that were human readable with BUFR codes that are only machine readable.</p> <p><i>Japan:</i> TDCFs are superior to the TACs in flexibility and expandability. It is easy to add or change parameters in TDCFs without affecting decoder software.</p> <p><i>Lithuania:</i> - participation in WMO RA VI Workshop on BUFR and Migration to TDCF (Lange, 17 to 20 April 2007)</p> <ul style="list-style-type: none"> - WMO Background Information on Migration to TDCF <p>More explanation is preferred, especially for developing National Migration Plan.</p> <p><i>Macedonia:</i> Because they are self-describable, flexible and expandable. They will contribute rapidly to evolving science and technology, in new observing systems capabilities.</p> <p><i>Malaysia:</i> TDCF contain more data and information and more flexible.</p> <p><i>Mongolia:</i> The code is flexible and expandable. Large amount of data could be exchanged.</p> <p><i>Nepal:</i> Replacing all existing codes</p> <p>Self-description, Flexibility, Expandability and Perenniality</p> <p>Freedom to choose required parameter with selected unit</p> <p>Applicable for domestic data exchange</p> <p><i>Netherland Antilles:</i> Easier for computers to process data entered in TDCF (smaller file sizes). They are also self-descriptive, flexible and expandable.</p> <p><i>Netherlands:</i> flexible, self-description, compression possible, less maintenance, simply expandable, archiving large data files, uniform.</p> <p><i>New Zealand:</i> TDCF are easily expandable to handle new data, data is more easily managed by automated systems, less chance of error in transmission. Changing Traditional alphanumeric codes is now very difficult.</p> <p><i>Nigeria:</i> It is self descriptive, flexible, expandable and reliability of data transmission is assured</p> <p><i>Norway:</i> One single format for all observations, flexibility, reliability, avoiding Volume A updating problems</p> <p><i>Oman:</i> Exchange data faster and more information</p>	
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	<p><i>Romania:</i> MITRA, TWIM-TERMINAL</p> <p><i>Senegal:</i> - Allow the availability of more meteorological parameters to be process for forecast purpose. Allow data compression.</p> <ul style="list-style-type: none"> - Allow Meta data availability and processing. <p><i>Slovakia:</i> TACs has been frozen; using them, it is not possible to disseminate all data and metadata required/needed by data users. TDCFs are flexible.</p> <p><i>Switzerland:</i> The new Codes are more flexible and include the description of the content. So you can encode more and new parameters and there is the possibility to include in the message as well metedata. With TDCF you use the same code for all data types.</p> <p><i>Tanzania:</i> MITRA, TWIM-TERMINAL</p> <p><i>Thailand:</i> TDCF is more flexibility and expandability code form than TAC.</p> <p><i>Turkey:</i> Efficient way to exchange meteorological data in cipher and with low telecommunication cost. TDCFs have the advantages such as expandability, self definition, flexibility and compression properties.</p> <p><i>UK:</i> Additional information, designed for modern IT systems, flexibility, compression etc.</p>	
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(A) PRESENT PROCESSING

DECODING

1.	Is your Agency/Service able to receive traditional alphanumeric codes (TAC) from other countries? (any Code from FM 12 to FM 88)	yes 33	no <input type="checkbox"/>
	<i>>>> if YES to question 1, How is the TAC data reaching your Agency/Service ?</i>		
	a) through GTS	yes 30	no 2
	b) through Internet	yes 21	no 7
	c) through workstation(s) dedicated to satellite reception (e.g. SADIS, ISCS, MDD, RETIM, MSG, etc.)	yes 24	no 3
	<i>>>> list the workstation(s) ISCS 4 / MITRA, TWIM-TERMINAL / SADIS 9 / Linux-server for EUMETCAST 3 / DWDSAT / RETIM 3 /Corobor's Messir and GST / Metlab / MSG 3 / MDD 2 / only as backup possibility / MITRA, TWIM-TERMINAL Too many to list individually</i>		
	d) through other means	yes 6	no 17
	<i>>>> please specify Iridium Satellite for BUOY AWS data/ Data Collection Platform (DCP)/ AFTN 3 / Direct feed</i>		

2.	Is the processing of traditional alphanumeric codes (TAC) automated?	yes 31	no 2
	<i>>>> if YES to question 2, What does the automated processing include?</i>		
	a) Decoding	yes 30	no 2
	b) Plotting	yes 28	no 2
	c) Database	yes 26	no 2
	> if YES to 2.c) <i>-is the data stored in WMO FM format? ; or</i>	yes 18	no 8

	-is the data first decoded and then stored in a different format?	yes 24	no 2
	>>> in which format?	Bit stream analog to BUFR sequence/ FREE FORMAT (ORACLE TABLES) Oracle database /plain data and BUFR/ MITRA, TWIM-TERMINAL/ BUFR/ Proprietary/ oracle database format (CLISYS from Meteo France International)/ BUFR-FM-94 format for NWP model assimilation and plotting and ASCII Text format for in-house Request-Reply retrieval by forecasters in the forecast offices/ Unique format/ ORACLE-"NIMBUS","CLIDATA";My SQL-"FMAN"/ RDMS (Oracle), ACCESS, Text files, BUFR/proprietary/ met.no internal file format, and in BUFR/ ASCII/MITRA, TWIM-TERMINAL/ both possibilities (messages and individual parameters)/ decoded parameter on a relational database/ informix database/ parameter by parameter separately/ Various	

d)	Hardware and software			
	On what computer platform(s) is the TAC decoding software presently running?	<i>make/model</i> IBM IBM P550/P650/P690 IBM IBM SP PC IBM X86_64 SUN Enterprise SUN Ultra 1 SUN SUN Fire V440 HITACHI/ SR11000 FUJITSU/ PRIMEPOWER Fujitsu Siemens (Server) Corobor Messir COROBOR V6.57.1.0 B2-766 -MESSIR-COM MESSIR-SADIS	<i>make/model</i> INTEL INTEL XEON 2.8 INTEL PIV INTEL INTEL SERVER SHG2 INTEL AMD Server INTEL xx86 (3) Intel PC Windows PC Linux-PC Pentium IV(2) 3SI Metlab PC/SUN, SYNERGIE VERSION 3.6/3.7 PC IMS PC	<i>make/model</i> HP RF7410 HP ML250 HP-UX HP Midrange Server HP rp3440 HP DS20E Alphaserver HP X3650 Dell Dimension 4600 Dell SC400 Dell 2950 Dell Poweredge 2950 Dec Vax-4200 Too many to list here (UK)
	- with which operating system? (UNIX, MS-DOS, Windows, etc.)	WINDOWS 17 (Win 2000- "NIMBUS") (Win Server 2000 "CLIDATA") VMS 5.5 Open VMS Too many to list here (UK)	LINUX 16 (Linux Fedora Core) (RH Linux ES 3.0) (RH Linux ES 5.0) (LINUX RedHat "FMAN") (Linux (Unix)) HPUX 11i QNX	UNIX 15 (UNIX Solaris 8) (UNIX(Solaris9)) (Solaris 10 (Unix)) (UNIX(AIX5.2)) Solaris 3 (AIX 3) (AIX 5.2)
	- language used by the decoder? (FORTRAN 90, C++, etc.)	FORTRAN 90 6 FORTRAN 4 FORTRAN 77 6 JAVA 5 Lex/Yacc 2 Visual Basic	C++ 12 C 14 Actual C Shell Scripts 2 DCL Scripts Pascal Perl	DELPHI v.7.0 Visual Basic Too many to list here (UK)

3.	Is your Agency/Service able to receive FM 94 BUFR binary code?		yes 27	no 6
	>>> if YES to question 3, How is the BUFR data reaching your Agency/Service ?			
	a)	through GTS	yes 25	no 2
	b)	through Internet	yes 12	no 10
	c)	through workstation(s) dedicated to satellite reception (e.g. SADIS, ISCS, MDD, RETIM, etc.) >>> list the workstation(s) ISCS 3 / METLAB 3 / EUMETCAST 2 / DWDSAT/ SADIS 6 / RETIM 3 / GST / as backup / MDD / Too many to list here (UK)	yes 20	no 5
	d)	through other means	yes 2	no 19
		>>> please specify RMDCN from ECMWF and UKMO and e-mail from BUOYs at fixed locations / direct ftp		
	e)	Is your Agency/Service able to decode FM 94 BUFR binary code? >>> If Yes, list for what types of data	yes 22	no 6
		TOVS	RA2_WWW (ENVSAT)	Wind and Wave data (ISX, ISZ)
		AVHRR	Altimeter data (Jason)	Quick Scatt
		AMV	TC Track Forecast	
		SYNOP, SYNOP MOBIL, SHIP	CLIMAT, CLIMAT SHIP	AWS data
		PILOT, PILOT SHIP	CLIMAT TEMP	SW charts
		TEMP, TEMP SHIP	CLIMAT TEMP SHIP	radar data Any
		all kind of satellite data	synoptical data	radiosonde
		windprofiler	radar data	surface data
		AMDAR		
		SYNOP	Radiosonde (Temp/Pilot)	AMDAR
		Satellite data	NWP Ensemble Products	
		SYNOP	BUOY	TEMP/PILOT/Profiler
		Upper Air	SHIP	SFLOC
		AMDAR, AIREP, ACARS	ERS/Scatterometer	SATOB, SATEM
		Conventional Obs. (SYNOP, TEMP, SHIP, CLIMAT, CLIMAT TEMP, BUOY, TESAC, TRACKOB, SATOB, SAREP, etc.)	Wind profilers	ACARS/AMDAR
		Satellite data (ATOVS, SSM/I, SSIMS, MODIS, CSR, QuikSCAT, AMSU, HIRS, MHS, ASCAT, GRAS))	Ground-Based GPS	Tropical storm
		Conventional Obs. (SYNOP, TEMP, SHIP, CLIMAT, CLIMAT TEMP, BUOY, TESAC, TRACKOB, SATOB, SAREP, etc.)	Wind profilers	ACARS/AMDAR
		RETIM/Significant maps	SigWX Charts 2	Mastertable 0
		RETIM/Radiosonde	Edition 2, 3 and 4	All data categories
		Aviation SIGWX	All types, by ECMWF BUFR decoding software (libemos)	-WAFS products from SADIS 2G
		Any	planned for 2008	SYNOP
		SYNOP	TEMP	TEMP
		Satellite, AMDAR	Other	SWC

	f) Hardware and software:			
	On what computer platform(s) is the decoding software for BUFR running?	<i>make/model</i> HP RP7410 HP UX HP DS20E Alphaserwer HP rp 3440 HP IBM IBM SP IBM 346 IBM X3650 PC IBM DELL 2950 Dell 2 3SI Metlab COROBOR V6.57.1.0 B2-766 MESSIR SADIS COROBOR	<i>make/model</i> Intel Intel PC Intel Server SHG2 INTEL xx86 INTEL AMD Pentium 4 PC Linux-PCs PC/SUN, SYNERGIE VERSION 3.6/3.7 SUN SUN FIRE FUJITSU/ PRIMEPOWER	<i>make/model</i> Silicon Graphic Challenge Windows PC HITACHI /SR11000 Dell Poweredge 2950 Visual Weather Various Too many to list here(UK)
	- with which operating system? (UNIX, MS-DOS, Windows, etc.)	HPUX 11i WINDOWS 6 (WINDOWS XP 3) OpenVMS	LINUX 15 (Linux Fedora Core) (RH Linux ES 5.0)	UNIX 10 (UNIX (Solaris 8)) (UNIX(Solaris9)) (UNIX(AIX5.2)) AIX 2 Various Too many to list here(UK)
	- which language is used by the decoder? (FORTRAN 90, C++, etc.)	FORTRAN 4 FORTRAN 90 6 (Fortran 90 "deprecated" not suitable for all data anymore)	FORTRAN-77 3 Shell Scripts C 13 C ++ 9	JAVA 5 Too many to list here(UK)

4.	Is your Agency/Service receiving alphanumeric table driven code FM 95 CREX data?			yes 18	no 14
	>>> if YES to question 4, >list what types of data:				
	D07043 total ozone	D07042	D07041 D09040		
	Ozone	Australian sea level data	SYNOP -CLIMAT-TEMP		
	How is the CREX data received?				
	a) through GTS			yes 18	no 1
	b) through Internet			yes 3	no 5
	c) through other means			yes 2	no 5
	>>> please specify Direct ftp (UK)				
	d) Does your Agency/Service automatically process CREX? >If yes, list for what types of data:			yes 4	no 9
	Cyclonic information/ Sea Level Data	Ozone	Australian sea level data		
	SYNOP	TEMP			

ENCODING

Questions			Alphanumeric code	Binary code
			FM 95 CREX	FM 94 BUFR
5.	a)	Encoding at national concentration or telecommunication centre?	yes 4 no 28	yes 11 no 21
		if YES, for which data types (Synop; Auto Synop, Radiosonde, soil, temperature, ozone, satellite data, etc.)	<i>data type</i> Sea level data TC Track Guidance Soil temperature Tropical Cyclone Ozone SYNOP CLIMAT SIGMET	<i>data type</i> SYNOP 7 TEMP (radiosonde) 5 CLIMAT 4 SHIP 2 RADOB 2 Wind profiler 3 AMDAR 2 Radar data 3 PILOT METAR/SPECI WAVEOB, BATHY, TESAC TESAC, BUOY, etc. ATOVS 2 CLIMAT, CLIMAT TEMP Satellite data (SATO, ATOVS) Auto Synop, Quikscat, Ascat, ERS-2 data synoptical data (Most types encoded internally, yet to be put on GTS) KLIM (nationally)
	b)	Encoding at observing site or platform?	yes 1 no 23 if yes: manual <input type="checkbox"/> automatic 1	yes 6 no 22
		if YES, for which data types (SYNOP, Auto SYNOP, Radiosonde, soil, temperature, ozone, satellite data, etc.)	<i>data type</i> total ozone	<i>data type</i> TEMP (radiosonde) 7 Synop AWS, Auto Synop 3 Radar data 3 Wind profiler

	c)		<i>(if automatic):</i> HP HP, IBM IBM SUN Ultra MESSIR- COM MSS Server	Intel Server, Silicon Graphic Intel PC 3 Linux server, Wndows-PCs INTEL Pentium 4, 2.8MHz Various Vary from station to station
		operating system? <i>(LINUX, etc.)</i>	MS-DOS Windows XP Pro 4 Windows 3	UNIX 2 HPUX 2 Solaris AIX 2 LINUX 5 (Linux Fedora Core)
		encoder language? <i>(FORTRAN 90, etc)</i>	FORTRAN 2 FORTRAN 77 FORTRAN 90 3 GW-BASIC CTT	C 7 C++ 2 JAVA 2 Don't know (Vaisala software)

6.	a)	Does your Agency/Service use BUFR for national/local/domestic data exchange?	yes 8	no 25
		<i>>> if YES to 6.a), list for what types of data</i>		
		Synop 2 AUTO SYNOP	Temp 2	Ship
		Buoy	AIREP	SATOB
		SATEM	Pilot	Radar 2 Winf profiler
		satellite data	reformatted FM-Code data	AMDAR
		SIGWX charts	Synoptic Charts	
		NWP outputs	Upper Air Charts	
		MARS data from ECMWF		
		High density AWS	Sea level	Wind profiler
		PACH21 LZIB PADH21 LZIB PAAH21 LZIB	PAAM22 LOWM PABM21 LOWM PAAH21 LSSW PAAM21 EDZW PAAM82 EDZW PABM21 OKPR PABM51 OKPR PABM61 OKPR PABH21 HABP	

(B) MIGRATION TO TABLE DRIVEN CODE FORMS: BUFR (CREX) and FUTURE PROCESSING
(within the next five years)

1.	Has your Agency/Service/NMHS already developed a National Migration Plan?	yes 20	no 13
a)	Did you nominate a national focal point on Codes matters and migration?	yes 31	no 2
b)	Do you have a national committee on migration to TDCF?	yes 11	no 21
c)	Is there a National Migration Plan currently being developed ?	yes 15	no 13
d)	Will a National Migration Plan be developed within the next five years ?	yes 23	no 5
e)	Are there any difficulties to define a National Migration Plan?	yes 16	no 14

>>> if yes to 1.e) please elaborate :

Colombia: the unknown on TDCF and the infrastructure on to define a national committee.

France: **Error! Not a valid bookmark self-reference..**

Indonesia: changing of data format from TAC format to BUFR or CREX, training for all computer operator

Ireland: We do not have the staffing resources to undertake the encoding work for our national observations. We did send two people to the Langen workshop in April 2007 and they both found it quite informative and useful. However, since then the lead person has transferred to another area of work and is no longer available. His replacement is already on a steep learning curve becoming used to the existing observation handling systems. Also, our capital budgets have been cut in 2008 so we do not have any allocation available to allow us to hire a third party company to do the work in 2008.

So, in 2008, all we can do is to set up a Project Board and to develop a detailed national migration plan for 2009 and assign the M-TDCF Project a very high priority so that sufficient funding and staffing resources can be found to implement the plan during the second half of 2009. It is likely that we will seek proposals from third party companies and then decide on how we will implement the plan.

Our only upper-air station at 03953 has a Vaisala DigiCora system and we will ask Vaisala to install and test the latest version [3.52 or later] of their software early in 2009.

Latvia: Technical education and finance

Lithuania: More explanation is preferred, especially for developing National Migration Plan.

Macedonia: We are aware of the benefit of the migration, but we do not have qualified staff in our Service, which will perform encoding and decoding for BUFR and CREX. Therefore, we have difficulties in preparation for National Migration Plan. In our country, almost the whole meteorological observing system is still manual, actions are not automated.

Malaysia: No experts on TDCF and lacking of programmers in coding matters

Mongolia: The followings are not clear: How could we have an encoding and decoding software?, Who or which country has that kind of software, which is suitable for our data processing system or Windows system?

We have tried to compile ECMWF's encoding/decoding software, but it does not work on our Red Hat Linux 9.0 with compiler f77 and gcc.

Nepal: Automation is necessary for TDCF data exchange. So, it needs extra financial cost.

Netherland Antilles: We still lack sufficient information, instructions and software to implement the migration to the TDCF.

Norway: Difficult to set up a time table, because key people also have other important tasks to do. I expect, however, that we will be able to produce SYNOP in BUFR early next year, probably without ever having set up a 'Plan'.

Senegal: It concerns the software for coding and decoding TAC to BUFR (using or not CIREX): to obtain and install to start experimental exchange.

Slovakia: It is not a priority of the NMHS.

Syria: We do not have staff to do it.

Thailand: There are various difficulties to define a national migration plan. Mostly when budgets involved are not provided. We plan to install such process via web base in near future.

f)	In your opinion, what are the international actions expected to address the problems identified in (e)?
	<p>Please elaborate:</p> <p><i>Colombia:</i> to give the BUFR and CREX software, for free, at all the WMO members.</p> <p><i>Indonesia:</i> sending expert team to guide changing data format, giving full training for all of computer</p> <p><i>Ireland:</i> We would like to know if there is a short list of WMO approved companies who have the capability and experience of installing BUFR encoders and who understand heterogeneous observation environments [manual synop, semi-AWS, AWS] and can teach local staff about the templates - which fields are essential and which are optional. It would also be useful to know what metadata is recommended for inclusion in each BUFR message and whether WMO expects bulletins of BUFR messages to be inserted on the GTS for groups of observing stations or should it be one BUFR message per station? Also, what will be the assigned or recommended abbreviated headers for the BUFR bulletins that will replace the TAC bulletin headers for Irish Observations? i.e. what will be the BUFR equivalent abbreviated headers be for: SNIE31 EIDB 271600; SIIE31 EIDB 271500; SMIE01 EIDB 271200? We would welcome guidelines on these aspects also.</p> <p><i>Macedonia:</i> My opinion is that training course to encoding and decoding for BUFR and CREX is necessary.</p> <p><i>Malaysia:</i> Technical supports and training.</p> <p><i>Mongolia:</i> - We need an information about the countries, which already solved the BUFR code related problems, and their software. - Training on UNIX, LINUX system and on how to handle the ECMWF' s encoding/decoding software - provide by easy to handle software</p> <p><i>Nepal:</i> Universal CREX BUFR encoder decoder softwares can reduce the required financial coast for the automation.</p> <p><i>Netherland Antilles:</i> We need more cooperation from regional training centers (Costa Rica, Barbados?) which have been designated to spread the information to Member States in Central America and the Caribbean Area. Regional workshops addressing this issue should be organized.</p> <p><i>Senegal:</i> WMO to organise visits of centers (ECMWF, etc) and for firms (MFI, etc) for RAI experts so that they can evaluate softwares for coding and decoding..</p> <p><i>Syria:</i> Making courses concerning the encoding and decoding.</p> <p><i>Thailand:</i> Provide financial supports both technical and capacity building.</p>

DECODING

Please note, if your Agency/Service is automated or the automation is planned for the reception of data, to complete the migration successfully, a **universal decoder software** for BUFR/CREX is indispensable. Access to binary data is required, although as an intermediate solution CREX can be received since it is an alphanumeric code. *The universal decoder software works for any data types using the complete set of WMO BUFR/CREX Code Tables.*

2.	Has your Agency/Service already secured the BUFR/CREX decoder software for the migration?; or			yes 17	no 15
	Will your Agency/Service secure the BUFR/CREX decoder software for the migration?			yes 11	no 10
<p>>>> if YES to the one or the other above questions under 2., Please describe who has developed (or will develop) the decoder software for the migration.</p>					
a)	Another Agency/Service (e.g ECMWF)	yes 15	no 6	INSTALLATION: already completed 9	date (to be) completed : (month/year) 1994 February 2007 2010
b)	a private company/ industrial sector	yes 14	no 4	already completed 4	date (to be) completed : (month/year) 10 /2005 September 2006 01 2007 06 2007 10 2008 2008 2010 2010 31 December 2011 TBD
c)	staff at our Agency/Service	yes 11	no 5	already completed 6	date (to be) completed : (month/year) April 2005 December 2007 December 2008 10 2009 12 2009 Unknown
d)	other >>> if other, please specify: OPERA project WEDIS	yes 2	no 7	already completed 1	date (to be) completed : (month/year) March 1996 10 2007
e)	<p>>>> if planned, when will the operational decoding be ready? (month/year): Ireland: ready now for BUFR decoding but not CREX/ 3rd quarter 2008/ 12 2008 / October 2009/ November 2009/ 2009/ 7 December 2009 / 01 2010 / 2010 /2010 /Depends on data type</p>				

3.	f)	Hardware and software			
		On what likely computer platform(s) will your decoder software for the migration run in the future?	<i>make/model</i> HP rp 3440 HP RP7410 HP SUN Enterprise NEC IBM 3 IBM zSeries IBM X3650 IBM COMPATIBLE PC	<i>make/model</i> Pentium Linux-PC PC 2 Windows-PC Stratus Continuum INTEL xx86 Intel Xeon 2.8 2 Intel PC AMD INTEL	<i>make/model</i> DELL 2950 Dell Dimension 4600 Dell Poweredge 2950 SUN SUN FIRE SUN Fire V440 Silicon Graphic Workstation
		- with which operating system? (UNIX, MS-DOS, Windows, etc.)	HPUX 11i HP-UX 11.0 LINUX 17 RH Linux ES 5.x	UNIX 7 (UNIX (Solaris8)) Solaris 2 AIX	WINDOWS 7
		- with which language for the decoder? (FORTRAN 90, C++, etc.)	FORTRAN 3 FORTRAN 90 7 Fortran-77 2	C++ 11 C 10	JAVA 3 Java/XML Perl

ENCODING

Questions:			Alphanumeric code		Binary code	
			FM 95 CREX		FM 94 BUFR	
4.	a)	Encoding at national concentration or telecommunication centre ?	yes 3 no 26		yes 17 no 14	
		if YES, for which data types (Synop, Auto Synop, Radiosonde, soil, temperature, ozone, satellite data, etc.)	<i>Data</i> <i>type:</i> soil temperature synop radiosonde Synop Radiosonde	<i>when:</i> <i>MM/YY</i> 06/98 10/09 10/09 2010 2010	<i>Data</i> <i>when:</i> <i>MM/YY</i> radar data 03/96 Radiosonde 01/07 SYNOP 03/07 synop 07/07 CLIMAT 09/07 Profiler data already Climat 01/08 Synop 02/08 Synop 04/08 Radiosonde 04/08 TEMP/PILOT 06/08 road data 10/08 Auto synop 11/08? KLIM 11/08? Deep See data (DART) 2008 TEMP 2008 SHIP/CLIMAT 12/08 CLIMAT TEMP 12/08 SYNOP 10/08 Radiosonde 10/08 CLIMAT 10/08 SYNOP 04/09 AUTO SYNOP 04/09 Radiosonde 09/09 synop 10/09 radiosonde 10/09 Synop 12/09 SHIP / BUOY 12/09 SYNOP,CLIMAT 2009 All Other OBS data 0110 CLIMAT TEMP 2010 Synop 2010 Radiosonde 2010 Auto Synop 2012 TAF/METAR/SPECI 12/12 METAR,SPECI,TAF 2014 Synop ? SYNOP AUTO SYNOP RADIOSONDE Temp ? ? Radiosonde	

				ozone Profiler HR TEMP PILOT TAF Depends on data type (UK)																																																												
		With which computer?	DELL WORKSTATION SUN Ultra PC workstation	DELL WORKSTATION DELL 2950 DELL Silicon Graphic SUN Enterprise SUN (HP for Profiler data) Linux Server PC workstation INTEL xx86 INTEL Fujitsu Siemens (MSS Server) IBM IBM zSeries Workstation																																																												
		operating system? (<i>LINUX, etc.</i>)	LINUX 2 UNIX Solaris WINDOWS	LINUX 9 Solaris UNIX 3 AIX RH Linux ES 5.x WINDOWS 2 (Windows for Profiler data)																																																												
		encoder language? (<i>FORTRAN 90, etc</i>)	FORTRAN 90, C++ FORTRAN 77 FORTRAN	FORTRAN 90 4 FORTRAN FORTRAN 77 C++ 4 C 3 (C for Profiler data) JAVA 2 Java/XML																																																												
		When validation exchange tests are planned?	<table border="0"> <tr> <td><i>Data</i></td> <td><i>when:</i></td> </tr> <tr> <td><i>type:</i></td> <td><i>MM/YY</i></td> </tr> <tr> <td>synop</td> <td>06/09</td> </tr> <tr> <td>radiosonde</td> <td>06/09</td> </tr> <tr> <td>SYNOP</td> <td></td> </tr> <tr> <td>12/2009</td> <td></td> </tr> <tr> <td>TEMP</td> <td></td> </tr> <tr> <td>12/2009</td> <td></td> </tr> <tr> <td>CLIMAT</td> <td></td> </tr> <tr> <td>12/2009</td> <td></td> </tr> <tr> <td>Synop</td> <td>2010</td> </tr> <tr> <td>Radiosonde</td> <td>2010</td> </tr> </table>	<i>Data</i>	<i>when:</i>	<i>type:</i>	<i>MM/YY</i>	synop	06/09	radiosonde	06/09	SYNOP		12/2009		TEMP		12/2009		CLIMAT		12/2009		Synop	2010	Radiosonde	2010	<table border="0"> <tr> <td><i>Data</i></td> <td><i>when:</i></td> </tr> <tr> <td><i>type:</i></td> <td><i>MM/YY</i></td> </tr> <tr> <td>Climat</td> <td>02/08</td> </tr> <tr> <td>Synop</td> <td>03/08</td> </tr> <tr> <td>Synop</td> <td>04/08</td> </tr> <tr> <td>Radiosonde</td> <td>04/08</td> </tr> <tr> <td>From Early summer 2008 depending on data type</td> <td></td> </tr> <tr> <td>road data</td> <td>06/08</td> </tr> <tr> <td>synop</td> <td>05/08</td> </tr> <tr> <td>TEMP/PILOT</td> <td>05/08</td> </tr> <tr> <td>TEMP</td> <td>08/08</td> </tr> <tr> <td>SHIP/CLIMAT</td> <td>11/08</td> </tr> <tr> <td>CLIMAT TEMP</td> <td>11/08</td> </tr> <tr> <td>SYNOP</td> <td>2008</td> </tr> <tr> <td>Radiosonde</td> <td>2008</td> </tr> <tr> <td>CLIMAT</td> <td>2008</td> </tr> <tr> <td>SYNOP,CLIMAT</td> <td>12/08</td> </tr> <tr> <td>SYNOP</td> <td>04 09</td> </tr> </table>	<i>Data</i>	<i>when:</i>	<i>type:</i>	<i>MM/YY</i>	Climat	02/08	Synop	03/08	Synop	04/08	Radiosonde	04/08	From Early summer 2008 depending on data type		road data	06/08	synop	05/08	TEMP/PILOT	05/08	TEMP	08/08	SHIP/CLIMAT	11/08	CLIMAT TEMP	11/08	SYNOP	2008	Radiosonde	2008	CLIMAT	2008	SYNOP,CLIMAT	12/08	SYNOP	04 09
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				synop 06/09 radiosonde 06/09 Climate Temps 09/09 Synop 10/09 SHIP/BUOY 10/09 All Other Surface data 10/09 CLIMAT TEMP 2009 Synop 2010 Radiosonde 2010 TAF/METAR/SPECI 11/12 METAR,SPECI,TAF 2012 Auto Synop 2012 None planned yet
Questions:			Alphanumeric code	Binary code
			FM 95 CREX	FM 94 BUFR
	b)	Encoding at observing site or platform ?	yes 2 no 22 if yes : manual 1 or automatic 1	yes 8 no 20
		if YES, for which data types (Synop, Auto Synop, Radiosonde, soil, temperature, ozone, satellite data, etc.)	Data type: total ozone 06/96 SYNOP 08/07	Data when: type: MM/YY AWS 10/02 TEMP 02/04 Radiosonde 2007 radiosonde 10/07 Wind profiler Already Radiosonde 01/08 Temp 05/08 CLIMAT TEMP 06/08 AWS (TM 307091) 10/08 Radiosonde 10/09 PAAH21 LZIB PACH21 LZIB PADH21 LZIB Temp ? ? Synop Auto Synop Depends on data type
		With which computer?	Intel PC	Intel PC INTEL x86 Radar computer and PC Dell-PCs DigiCora Server Vary from station to station Will depend on data type
		operating system? (LINUX, etc.)	MS-DOS	Windows 6 (windows 2000 pro, server) UNIX like Will depend on data type

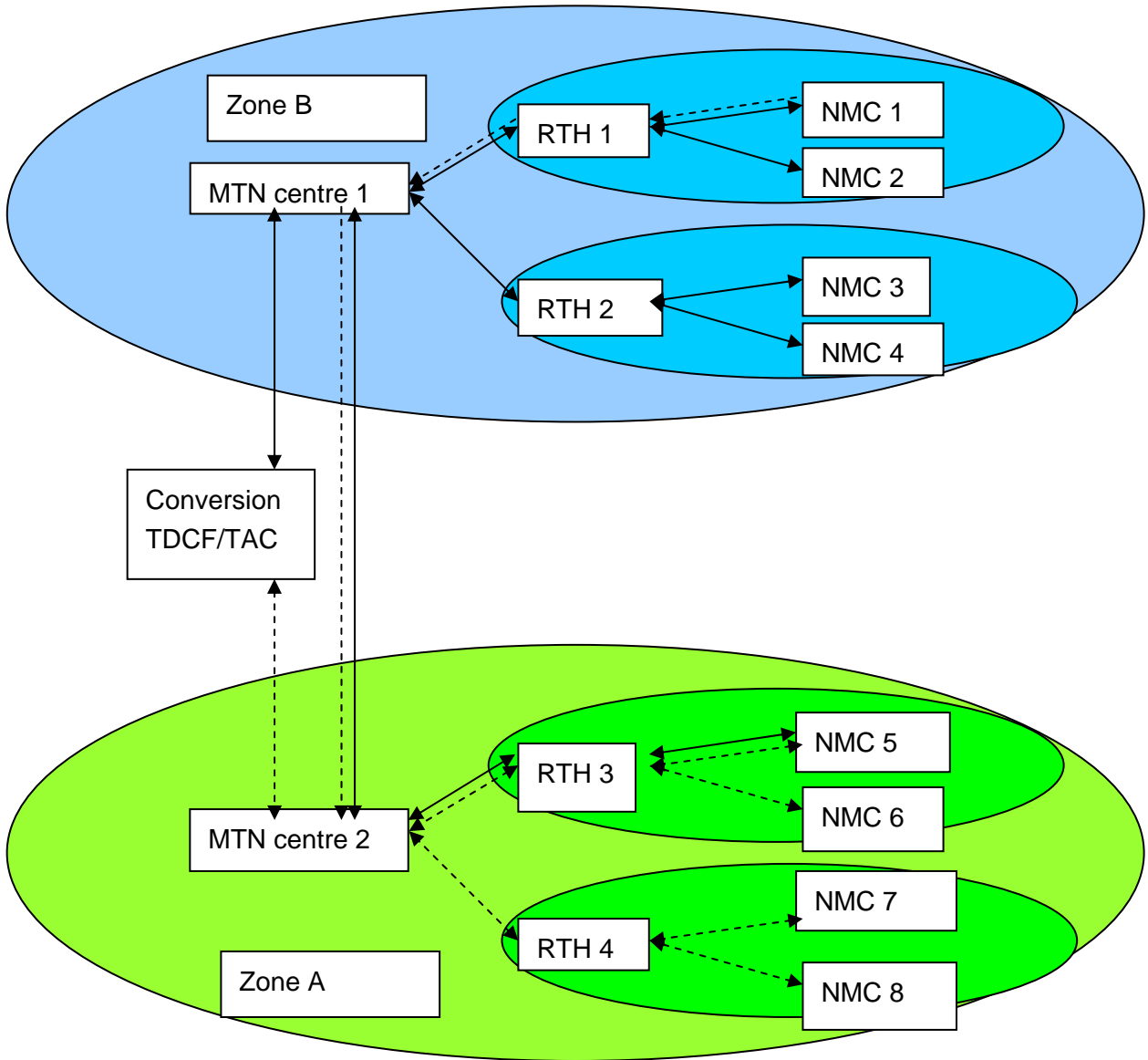
		encoder language? (FORTRAN 90, etc)	GW-BASIC	C, C++ 2 Vaisala Digicora III Version 3.5.2 Vaisala software Will depend on data type
		When validation exchange tests are planned (for which data type)?	Data type: SYNOP 11/2008	when: MM/YY radiosonde 12/07 CLIMAT TEMP 05/08 AWS (TM 307091) 07/08 RADIOSONDE 08/08 Radiosonde 09/09 Will depend on data type

5.	Note: During the migration process, NMHSs' encoding observations in BUFR may perform the so-called <i>double transmission</i> or <i>dual dissemination</i> , upon request, for users who are not able to process BUFR. In those cases, the observations transmitted in BUFR will have to be transmitted also in TAC (SYNOP, TEMP, etc.).		
	Does your Agency/Service plan to be able to perform a dual dissemination at the beginning of the migration process?	yes 24	no 4
	<p>Not yet decided 9 Any comments ?</p> <p><i>Czech Republic:</i> Dual dissemination should be mandatory at the beginning of the migration process.</p> <p><i>Ireland:</i> yes, probably the TAC format will continue to be sent from the old platform and the BUFR format can be sent on the GTS from new servers at the same time. Practical operational details have not been fully worked out yet.</p> <p><i>Switzerland:</i> we will send dual until WMO says, one can stop the dual dissemination</p>		

ANNEX TO PARAGRAPH 8.1

Arrangements for the step-by-step migration between a zone A and a zone B

Legend: Exchange of data in:
TAC ----->
TDCF ----->



ANNEX LIST OF ACRONYMS

ACARS	AirCraft Addressing and Reporting System
ADRS	Assessment of Data Representation Systems
ADS	Astrophysics Data System (USA)
AFWA	Air Force Weather Agency (USA)
AIRS	Advanced Infra-Red Sounder
AMDAR	Aircraft Meteorological Data Relay
AMS	American Meteorological Society
AMSU	Advanced Microwave Sounding Unit
ANC	Air Navigation Commission (ICAO)
ANSI	American National Standards Institute
AOML	Atlantic Oceanographic and Meteorological Laboratory
API	Application Program Interface
APSDEU	Asia Pacific Satellite Data Exchange and Utilization
ASCAT	Advanced SCATterometer
ATOVS	Advanced TIROS Operational Vertical Sounder
AWIPS	Advanced Weather Interactive Processing System
AWC	Aviation Weather Center
AWS	Automatic Weather Station
ATSR	Along Tack Scanning Radiometer
AVHRR	Advanced Very High Resolution Radiometer
BT	Brighness Temperature
BUFR	Binary Universal Form for data Representation
CAeM	Commission for Aeronautical Meteorology
CBS	Commission for Basic Systems
CBS-Ext.(98)	Extraordinary session of CBS held in 1998
CCI	Commission for Climatology (WMO)
CCSDS	Consultative Committee for Space Data Systems
CGMS	Coordination Group for Meteorological Satellites
CIMO	Commission for Instruments and Methods of Observations
CLM	CLoud Mask (EUMETSAT)
CLAI	CLoud Analysis Image (EUMETSAT)
CMA	China Meteorological Administration
CMC	Canadian Meteorological Centre
COST	European Co-Operation in the field of Scientific and Technical research
CREX	Character Representation form for data EXchange
CRM	Clear sky Reflectance Map (EUMETSAT)
CSV	Comma-Separated Value (format)
CT	Coordination Team
CTH	Cloud Top Height (EUMETSAT)
DART	Deep-Ocean Assessment and Reporting of Tsunami
DBCP	Drifting Buoy Cooperation Panel
DBMS	Data Base Management System
DCP	Data Collection Platform
DIF	Directory Interchange Format
DIODE	Détermination Immédiate d'Orbite par Doris Embarqué
DOD	Department Of Defence (USA)
DORIS	Doppler Orbitography and Radio-positioning Integrated by Satellite
DPFS	Data Processing and Forecasting Systems
DRT	Data Representation Template
DT	Data Template
DVB	Digital Video Broadcast
DWD	Deutscher Wetter Dienst
EANPG	European Air Navigation Planning Group
EARS	EUMETSAT ATOVS Retransmission Service
EBBT	Equivalent Black Body Temperature

EC	Executive Council of the WMO
ECMWF	European Centre for Medium-range Weather Forecast
EGOWS	European Group on Operational Workstation Systems
EOS	Earth Observation Science
EP	Ensemble Prediction
EPA	Environmental Protection Agency (USA)
EPS	Ensemble Prediction System
ESA	European Space Agency
ESCAP	<i>United Nations</i> Economic and Social Commission for Asia and the Pacific
ET	Expert Team
ET/EDF	Expert Team on Evolution of Data Formats
ET/DR&C	Expert Team on Data Representation and Codes
EUCOS	EUMETNET Composite Observing System
EUMETNET	European Meteorological Networks
EUMETSAT	EUropean organisation for the exploitation of METeorological SATellites
FAA	Federal Aviation Administration (USA)
FIR	FIRe Detection Product (EUMETSAT)
FIR	Flight Information Region
FNMOCC	Fleet Numerical Meteorology and Oceanography Centre
FORTTRAN	FORmula TRANslation
FOV	Field of View
FTP	File Transfer Protocol
FWIS	Future WMO Information System
GDPS	Global Data Processing System
GDT	Grid Definition Template
GEMS	Global and regional Earth-system Monitoring using Satellite and in situ data
GEO	Group on Earth Observation or GEOstationary Orbit
GFA	Graphical Forecast AIRMET
GHRSSST	GODAE High Resolution SST (Pilot Project)
GIF	Graphic Interchange Format
GIS	Geographic Information System
GMES	Global Monitoring for the Environment and Security
GODAE	Global Ocean Data Assimilation Experiment
GOME	Global Ozone Monitoring Experiment
GOS	Global Observing System
GRAS	Global RADIO occultation Sounder
GRIB 1	Processed data in the form of GRId-point values expressed in Binary form - GRIB Edition 1
GRIB 2	General Regularly distributed Information in Binary form - GRIB Edition 2
GTS	Global Telecommunications System
HIRS	High Resolution infrared Sounder
HMEI	HydroMeteorology Equipment Industry
HTML	Hyper Text Markup Language
HRPT	High Resolution Picture Transmission
IASI	Infrared Atmospheric Sounding Interferometer
ICAO	International Civil Aviation Organisation
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICT	Implementation/Coordination Team (of CBS)
ICT/DRC	Implementation/Coordination Team on Data Representation and Codes
ID	Identifier
IEC	International Electrotechnical Commission
IEEE	Institution of Electrical and Electronics Engineers
IGACO	Integrated Global Atmospheric Chemistry Observation (System)
IJPS	Initial Joint Polar orbiting operational satellite System
IOC	Intergovernmental Oceanographic Commission of UNESCO
IR	Infrared (channel)
ISO	International Standards Organization

ISS	Information Systems and Services (OPAG of CBS)
IUT	Indicator of Unit of Time
IWM	Integrated WWW Monitoring
JAXA	Japan Aerospace eXploration Agency
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JMA	Japan Meteorological Agency
JMBL	Joint Meteorological and Oceanographic (METOC) Broker Language (XML)
JPEG	Joint Photographic Experts Group format
LEO	Low Earth Orbit
LINUX	<i>Not an acronym – name of an operating system</i>
LZW	Lempel-Ziv-Welch compression
MEDS	Marine Environment Data Service
MHS	Microwave Humidity Sounder
MIP	Migration Implementation Project
MPE	Multi sensor Precipitation Estimate (EUMETSAT)
MS/DOS	/Disk Operating System
MSG	METEOSAT Second Generation
MSS	Message Switching System
MT	Master Table
MTDCF	Migration to Table Driven Code Forms
MTN	Main Telecommunications Network (of the GTS)
MW	MicroWave
NAEFS	North-American Ensemble Forecast System
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Centre (USA)
NCEP	National Centre for Environment Prediction (USA)
NetCDF	Network Common Data Form
NEDEX	North American Europe Data Exchange
NESDIS	National Environmental Satellite Data and Information Service
NMC	National Meteorological Centre
NMHS	National Meteorological or Hydrological Service
NMS	National Meteorological Service
NMTSG	National Migration to TDCF Steering Group
NDVI	Normalized differential vegetation index
NOAA	National Oceanographic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Center
NWP	Numerical Weather Prediction
NWS	National Weather Service (USA)
NZPD	Number of Zero Path Difference
OMF	weather Observation Markup Format
OPAG	Open Programme Area Group (of CBS)
OPAG-ISS	Open Programme Area Group on Information Systems and Services
PDT	Product Definition Template
PM	Particulate Matter
PNG	Portable Network Graphic
QPF	Quantitative Precipitation Forecasting
RA	Regional Association (WMO)
RARS	Regional ATOVS Retransmission Systems
RASS	Radio Acoustic Sounding System
RDBC	Regional Data Bank Centre
RSS	Radiosonde Replacement System (program) (USA)
RSMC	Regional Specialised Meteorological Centre
RTH	Regional Telecommunication Hub
SBUV	Solar Backscatter UltraViolet
SGDR&C	Sub-Group on Data Representation and Codes (CBS)
SGML	Standard Generalized Markup Language

SI	System International
SMOS	Soil Moisture and Ocean Salinity
SOOP	Ship Of Opportunity Programme
SOT	Ship Observation Team
SST	Sea Surface Temperature
SWH	Significant Wave Height
TAC	Traditional Alphanumeric Codes
TCP	Tropical Cyclone Programme
TCP/IP	Transport Control Protocol/Internet Protocol
TDCF	Table Driven Code Form
TDL	Techniques Development Laboratory
THORPEX	The Observing system Research and Predictability EXperiment
TIFF	Tagged Image File Format
TIGGE	Thorpex Interactive Grand Global Ensemble
TIROS	Television InfraRed Observation Satellite
TMA	Tanzania Meteorological Agency
TOVS	TIROS Operational Vertical Sounder
TWS	Tsunami Warning System
UGRN	Upgrading the Global Radiosonde Network
UKMO	United Kingdom Meteorological Office
UML	Unified Modeling Language
UNEP	United Nations Environment Programme
UNIX	<i>Not an acronym – name of an operating system</i>
URL	Uniform Resource Locator
USAP	United States Antarctic Programme
UTC	Universal Time Coordinate
UVI	Ultra Violet Index
VCP	Voluntary Cooperation Programme
VGISC	Virtual Global Information System Centre
VIS	Visible channel
VOS	Voluntary Observing Ship
WAFC	World Area Forecasting Centre (ICAO)
WAFS	World Area Forecasting System
WGDM	Working Group on Data Management (CBS)
WGMC	Working Group on Meteorological Codes (USA)
WGS	Working Group on Standards
WH	Weather-Huffman compression
WHO	World Health Organization
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WWW	World Weather Watch
W3C	World Wide Web Consortium
XBT	eXpendable Bathy Thermograph
XCTD	eXpendable Conductivity Temperature Depth sensor
XML	eXtensible Markup Language
4-DVAR	Four Dimensional VARiational Analysis