

AMENDMENTS TO MANUALS ON CODES AND THE GTS BY THE FAST-TRACK PROCEDURE

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I. MANUAL ON CODES

FM 92 GRIB:

1. Additional elements for optimal cloud analysis and instantaneous rain rate products [🔗](#)

ADD:

in Code table 4.2, Product discipline 3 – Space products, parameter category 1: quantitative products,

Number	Parameter	Units
98	Correlation coefficient between MPE rain-rates for the co-located IR data and the microwave data rain-rates	Numeric
99	Standard deviation between MPE rain-rates for the co-located IR data and the microwave data rain-rates	kg m ⁻² s ⁻¹

in Code table 4.2, Product discipline 3 – Space products, parameter category 2 – cloud properties,

Number	Parameter	Units
30	Measurement cost	Numeric
31	Upper layer cloud optical depth	Numeric
32	Upper layer cloud top pressure	Pa
33	Upper layer cloud effective radius	m
34	Error in upper layer cloud optical depth	Numeric
35	Error in upper layer cloud top pressure	Pa
36	Error in upper layer cloud effective radius	m
37	Lower layer cloud optical depth	Numeric
38	Lower layer cloud top pressure	Pa
39	Error in lower layer cloud optical depth	Numeric
40	Error in lower layer cloud top pressure	Pa

Note: Numbers 31 to 40 are deprecated.

in Code table 4.218 – Pixel scene type,

Code Figure	Meaning
111	Single Layer Water Cloud
112	Single Layer Ice Cloud

2. New fixed surface type in Code table 4.5 [🔗](#)

ADD:

in Code table 4.5 – Fixed surface types and units,

Code figure	Meaning	Unit
25	Highest level where radar reflectivity exceeds the specified value (echo top for a given threshold of reflectivity)	dBZ

3. New entry in GRIB2 Code table 4.9

ADD:

in Code table 4.9 – Probability type,

Code figure	Meaning
5	Probability of event equal to lower limit

4. New lightning GRIB parameters

ADD:

in Code table 4.2, Product discipline 0 – Meteorological products, parameter category 17: electrodynamics,

Number	Parameter	Units
2	Cloud-to-ground Lightning flash density	km ⁻² day ⁻¹
3	Cloud-to-cloud Lightning flash density	km ⁻² day ⁻¹
4	Total Lightning flash density (see Note 2)	km ⁻² day ⁻¹

Note 2 The total lightning flash density is the sum of cloud-to-ground and cloud-to-cloud lightning flash densities (see Lopez, P., 2016: A lightning parameterization for the ECMWF Integrated Forecasting System, Monthly Weather Review, 144, 3057-3075).

5. New GRIB2 Code table 4.2 entries

ADD:

in Code table 4.2, Product discipline 10 –Oceanographic products, parameter category 0: waves,

Parameter number	Parameter	Units
46	Peak wave direction	deg
47	Significant wave height of first swell partition	m
48	Significant wave height of second swell partition	m
49	Significant wave height of third swell partition	m
50	Mean wave period of first swell partition	s
51	Mean wave period of second swell partition	s
52	Mean wave period of third swell partition	s
53	Mean wave direction of first swell partition	deg
54	Mean wave direction of second swell partition	deg
55	Mean wave direction of third swell partition	deg

6. New precipitation types

ADD:

in Code table 4.201,

Code figure	Meaning
11	Drizzle
12	Freezing drizzle

7. New GRIB2 Code table 4.9 entries

ADD:

in Code table 4.9,

Code Figure	Meaning
6	Probability of event in above normal category (See Notes 1 and 2)
7	Probability of event in near normal category (See Notes 1 and 2)
8	Probability of event in below normal category (See Notes 1 and 2)

Notes:

- (1) Above normal, near normal and below normal are defined as three equiprobable categories based on climatology at each point over the geographical area covered by the grid. The type and methodology of the reference climatology are unspecified and should be documented concurrently by the data producer.
- (2) Product Definition Templates that use Code Table 4.9 may contain octets to store the values of lower and upper limits. When categorical probability is used (such as below, near and above normal), these octets shall be set to "all ones" (missing).

FM 94 BUFR

8. New BUFR sequence for describing satellite observations compressed using principal component analysis

ADD:

in BUFR Table D,

Table Reference F X Y	Table References	Element Name	Element Description
		(Observing satellite and instruments)	
3 01 129	0 01 007	Satellite identifier	
	0 01 031	Identification of originating/ generating centre	
	0 02 019	Satellite instruments	
	0 02 020	Satellite classification	
		(High precision timestamp)	
3 01 130	3 01 011	Year, month, day	
	3 01 012	Hour, minute	
	2 02 131	Change scale	Add 3 to scale
	2 01 138	Change data width	Add 10 to width
	0 04 006	Second	
	2 01 000	Change scale	Cancel
	2 02 000	Change data width	Cancel
		(Pixel geolocation)	
3 01 131	3 01 021	Latitude/longitude (high accuracy)	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 07 025	Solar zenith angle	
	0 05 022	Solar azimuth	
		(Radiance in channel)	
3 04 039	2 01 136	Change data width	Add 8 to width
	0 05 042	Channel number	
	2 01 000	Change data width	Cancel
	0 14 046	Scaled radiance	
		(Principal component score in band)	
3 04 040	0 25 140	Start channel	

	0 25 141	End channel	
	0 40 026	Score quantization factor	
	0 40 016	Residual RMS in band	
	0 25 062	Database identification	
	1 01 000	Delayed replicator of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	0 40 017	Non-normalized principal component score	
		(Principal component scores, channel selection and enhanced data collected on board a geostationary platform)	
3 40 016	3 01 129	Observing satellite and instruments	
	3 01 130	High precision timestamp	
	3 01 131	Pixel geolocation	
	2 02 134	Change scale	Add 6 to scale
	0 07 001	Height of station	
	2 02 000	Change scale	Cancel
	1 01 000	Delayed replicator of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 40 002	Band description	
	1 01 000	Delayed replicator of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 04 039	Radiance in channel	
	1 01 000	Delayed replicator of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 04 040	Principal component score in band	

AMEND:

0 14 046 "Scaled IASI radiance" to "Scaled radiance"

3 40 002 "IASI Level 1c band description" to "Band description"

9. BUFR descriptors for IASI Level 2 Products

ADD:

in BUFR/CREX Table B,

Descriptor	Name	Units	Scale	Reference	Width
0 40 043	Satellite manoeuvre indicator	Code table	0	0	3
		Code table	0		1
0 40 044	Dust index	Numeric	1	0	8
		Numeric	1		3
0 40 045	Cloud formation and height assignment	Flag table	0	0	5
		Flag table	0		2
0 40 046	Cloudiness summary	Code table	0	0	3
		Code table	0		1
0 40 047	Validation flag for IASI or IASI-NG level 1 product	Code table	0	0	3
		Code table	0		1

0 40 048	Validation flag of AMSU-A level 1 data flow	Code table	0	0	3
		Code table	0		1
0 40 049	Cloud tests executed and results	Flag table	0	0	16
		Flag table	0		5
0 40 050	Retrieval initialisation	Flag table	0	0	8
		Flag table	0		3
0 40 051	Convergence of the iterative retrieval	Code table	0	0	3
		Code table	0		1
0 40 052	Indication of super-adiabatic and super-saturation in final retrieval	Flag table	0	0	8
		Flag table	0		3
0 40 053	Number of iterations used for retrieval	Numeric	0	0	8
		Numeric	0		3
0 40 054	Potential processing and inputs errors	Flag table	0	0	13
		Flag table	0		4
0 40 055	Diagnostics on the retrieval	Flag table	0	0	21
		Flag table	0		7
0 40 056	General retrieval quality flag	Code table	0	0	3
		Code table	0		1
0 40 057	IASI level 2 retrieval flags	Flag table	0	0	31
		Flag table	0		10
0 40 058	Number of vectors describing the characterization matrices	Numeric	0	0	8
		Numeric	0		3
0 40 059	Number of layers actually retrieved	Numeric	0	0	8
		Numeric	0		3
0 40 060	Number of profiles retrieved in scanline	Numeric	0	0	8
		Numeric	0		3
0 40 061	Air partial columns on each retrieved layer	mol/cm ²	3	0	16
		mol/cm ²	3		5
0 40 062	A-priori partial columns on each retrieved layer	mol/cm ²	10	0	16
		mol/cm ²	10		5
0 40 063	Scaling vector multiplying the a priori CO vector in order to define	Numeric	5	0	26

	the retrieved CO vector				
		Numeric	5		8
0 40 064	Main eigenvalues of the sensitivity matrix	Numeric	6	0	31
		Numeric	6		10
0 40 065	Main eigenvectors of the sensitivity matrix	Numeric	6	-1000000000	31
		Numeric	6		10
0 40 066	Quality indicator for atmospheric water vapour	Numeric	1	0	8
		Numeric	1		3
0 40 067	Quality indicator for atmospheric temperature	Numeric	1	0	8
		Numeric	1		3
0 40 068	General retrieval quality flag for SO2	Code table	0	0	4
		Code table	0		2
0 40 069	PWLR* estimated retrieval error for surface air temperature	K	4	-1000000	21
		K	4		7
* PWLR stands for Piece-Wise Linear Regression-cube and is a first guess optimal estimation method.					
0 40 070	PWLR estimated retrieval error of surface dew point	K	4	-1000000	21
		K	4		7
0 40 071	Retrieval error covariance matrix for ozone in principal component domain	Numeric	4	-1000000	21
		Numeric	4		7
0 40 072	PWLR estimated retrieval quality indicator of atmospheric ozone	Numeric	1	0	8
		Numeric	1		3
0 40 073	PWLR estimated retrieval error of surface skin temperature	K	1	0	8
		K	1		3

0 40 043 Satellite manoeuvre indicator

Code Figure	Description
0	The platform is not undergoing a manoeuvre
1	The platform is undergoing a manoeuvre, nominal processing
2	The platform is undergoing a manoeuvre, no processing
3-6	Reserved
7	Missing value

0 40 045 Cloud formation and height assignment

Bit No	Description
--------	-------------

1	Cloud products retrieved with the chi-squared method.
2	Cloud products retrieved with the CO ² -slicing.
3	Height assignment performed with statistical first guess retrieval.
4	Height assignment performed with NWP forecasts.
All 5	Missing value.

0 40 046 Cloudiness summary

Code Figure	Description
0	The IASI IFOV is clear
1	Small cloud contamination possible
2	The IASI IFOV is partially covered by clouds
3	High or full cloud coverage
4-6	Reserved
7	Missing value

0 40 047 Validation flag for IASI or IASI-NG level 1 product

Code Figure	Description
0	The IASI measurements and side information are available and of good quality for L2 processing
1	The IASI L1c products are of degraded quality according to IASI L1c flags, no L2 processing.
2	Quality control indicates that the IASI L1c data are of degraded quality (not indicated by the IASI L1c flags), no L2 processing.
3-6	Reserved
7	Missing value

0 40 048 Validation flag of AMSU-A level 1 data flow

Code Figure	Description
0	The expected AMSU measurements are available, of good quality and collocated with IASI for processing.
1	AMSU-A data are available but of degraded quality (according to AMSU L1 flags or QC tests) and not used for processing.
2	No coincident (time and space) AMSU measurements available for processing.
3-6	Reserved
7	Missing value

0 40 049 Cloud tests executed and results

Bit No.	Description
1-3	Reserved
4	IASI cloud optical thickness indicates a cloud.
5	IASI cloud optical thickness computed.
6	AVHRR heterogeneity test indicates a cloud.
7	AVHRR heterogeneity test executed.
8	IASI-AVHRR ANN cloud test indicates a cloud.
9	IASI-AVHRR ANN cloud test executed.

10	AVHRR integrated cloud fraction indicates a cloud.
11	AVHRR integrated cloud fraction assessed.
12	AMSU cloud test indicates a cloud.
13	AMSU cloud test executed.
14	IASI Window cloud test indicates a cloud.
15	IASI Window cloud test executed.
All 16	Missing value

0 40 050 Retrieval initialisation

Bit No.	Description
1-4	Reserved
5	MHS included
6	AMSU included
7	IASI included
All 8	Missing value

0 40 051 Convergence of the iterative retrieval

Code Figure	Description
0	OEM not attempted
1	OEM aborted because first guess residuals too high
2	The minimisation did not converge, sounding rejected
3	The minimisation did not converge, sounding accepted
4	The minimisation converged but sounding rejected
5	The minimisation converged, sounding accepted
6	Reserved
7	Missing value

0 40 052 Indication of super-adiabatic and super-saturation in final retrieval

Bit No.	Description
1-3	Reserved
4	Supersaturation conditions in the OEM retrieval
5	Superadiabatic conditions in the OEM retrieval
6	Supersaturation conditions in the first guess
7	Superadiabatic conditions in the first guess
All 8	Missing value

0 40 054 Potential processing and inputs errors

Bit No.	Description
1	An error has been detected
2	Message from L1
3	Message from L2
4	Message from ancillary data
5	Message from fitting procedure
6	File opening
7	File reading
8	Quality flag
9	Level 2 "from linear regression"(F_Qual), report a pixel where L2 are not

	fully trusted
10	Empty field or data
11	Missing surface pressure value
12	Radiance filtering
All 13	Missing value

0 40 055 Diagnostics on the retrieval

Bit No.	Description
1	Radiance filtering
2	Polar regions
3	Location in the night
4	Negative altitude Surface below m.s.l.
5	Cloud covered scene
6	Scene above the sea
7	Scene above desert
8	Skin temperature
9	Skin temperature differential
10	Spectral line contrast too weak
11	Maximum number of iterations exceeded
12	Negative partial columns
13	Matrix ill conditioned
14	Fit diverged
15	Error in gsl usage
16	Residuals "biased"
17	Residuals "sloped"
18	Residuals rms large
19	Weird averaging kernels
20	Ice presence detected
All 21	Missing value

0 40 056 General retrieval quality

Code Figure	Description
0	Use not recommended
1	Use with caution
2	Best quality
3-6	Reserved
7	Missing value

0 40 057 IASI level 2 retrieval flags

Bit No.	Description
1	An error has been detected
2	Message from L1
3	Message from L2
4	Message from ancillary data
5	Message from fitting procedure
6	Reserved
7	Bad L1 or L2 flag raised
8	Level 2 not fully trusted
9	Missing temperature or humidity levels in the vertical profile
10	Missing surface pressure value
11	Radiance filtering
12	Polar regions
13	Location in the night
14	Negative altitude
15	Cloud covered scene

16	Scene above the sea
17	Scene above desert
18	Missing skin temperature
19	Retrieved skin temperature too different from model
20	Spectral line contrast too weak
21	Maximum number of iterations exceeds
22	Negative partial columns
23	Matrix ill conditioned
24	Fit diverged
25	Error in GSL usage
26	Residuals biased
27	Residuals sloped
28	Residuals RMS large
29	Weird averaging kernels
30	Ice presence detected
All 31	Missing value

0 40 068 General retrieval quality flag for SO2

Code Figure	Description
0	Values calculated with IASI L2
1	Pressure and temperature profiles missing in IASI L2 data; model / forecast data used instead
2	Best quality
3-14	Reserved
15	Missing value

0 31 021 Associated field significance

Code Figure	Associated field	
9	Status of ancillary data	0 = Data present, good, collocated
		1 = Data available but of degraded quality and not used
		2 = No spatiotemporally collocated data available
		3-14 = Not used (reserved)
		15 = Missing value

10. New BUFR sequence for snow water equivalent (SWE)

ADD:

in BUFR Table D,

Table Reference	Table References	Element Name
F X Y		
3 07 103		(Snow observation, snow density, snow water equivalent)
	3 01 150	WIGOS identifier
	3 07 101	Snow observation
	0 13 117	Snow density
	0 03 028	Method of snow water equivalent measurement
	0 13 163	Snow water equivalent

in BUFR/CREX table B,

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width (Bits)
F X Y					
0 03 028	Method of snow water equivalent measurement	Code table	0	0	6
		Code table	0		2
0 13 163	Snow water equivalent	kg m ⁻²	0	0	16
		kg m ⁻²	0		5

Code table 0 03 028 – Method of snow water equivalent measurement

Code figure	
0	Multi point manual snow survey
1	Single point manual snow water equivalent measurement
2	Snow pillow or snow scale
3	Passive gamma
4	GNSS/GPS methods
5	Cosmic ray attenuation
6	Time domain reflectometry
7-62	Reserved
63	Missing value

11. Revision of BUFR sequence 3 09 056 – Sequence for representation of radiosonde descent data

ADD:

Table Reference	Table References	Element Name	
F X Y			
		(Temperature, dewpoint and wind data at a pressure level with radiosonde position and higher precision of pressure and geopotential height)	
3 03 056	0 04 086	Long time period or displacement	Since launch time
	0 08 042	Extended vertical sounding significance	
	2 07 001	Increase scale, reference value and data width	
	0 07 004	Pressure	Scale: 0
	0 10 009	Geopotential height	Scale: 1
	2 07 000	Increase scale, reference value and data width	Cancel
	0 05 015	Latitude displacement (high accuracy)	Since launch site
	0 06 015	Longitude displacement (high accuracy)	Since launch site
	0 12 101	Temperature/air temperature	Scale: 2
	0 12 103	Dewpoint temperature	Scale: 2
	0 11 001	Wind direction	
	0 11 002	Wind speed	
			(Sequence for representation of radiosonde descent data)
3 09 056	3 01 150	WIGOS identifier	
	3 01 111	Identification of launch site and instrumentation	
	3 01 128	Additional information on radiosonde ascent	Valid also for

			decent
	3 01 113	Date/time of launch	(see Note 1)
	0 08 091	Coordinates significance	= 2 Start of observation
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 007	Height	Begin of descending of radiosonde above mean sea level
	0 08 091	Coordinates significance	Set to missing (cancel)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 056	Temperature, dewpoint and wind data at a pressure level with radiosonde position and higher precision of pressure and geopotential height	(see Notes 2 and 3)
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 03 051	Wind shear data at a pressure level with radiosonde position	

Notes:

- (1) Date/time of launch indicates date/time of start of descent measurement.
- (2) In this sequence for representation of radiosonde descent data, indication of standard levels using the extended vertical sounding significance (0 08 042) is not mandatory.
- (3) Data represented by this sequence should be sorted in descending order with respect to pressure.

12. New sequence for representation of radiosonde observation data with higher precision of pressure and geopotential height

ADD:

Table Reference	Table References	Element Name	Element Description
F X Y			
		(Sequence for representation of TEMP, TEMP SHIP and TEMP MOBIL observation type data with higher precision of pressure and geopotential height)	
3 09 057	3 01 150	WIGOS identifier	
	3 01 111	Identification of launch site and instrumentation for P, T, U and wind measurements	
	3 01 128	Additional information on radiosonde ascent	
	3 01 113	Date/time of launch	
	3 01 114	Horizontal and vertical coordinates of launch site	
	3 02 049	Cloud information reported with vertical soundings	
	0 22 043	Sea/water temperature	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 002	Extended delayed descriptor replication factor	
	3 03 056	Temperature, dewpoint and wind data at a pressure level with radiosonde position and higher precision of pressure and geopotential height	
	1 01 000	Delayed replication of 1 descriptor	

	0 31 001	Delayed descriptor replication factor	
	3 03 051	Wind shear data at a pressure level with radiosonde position	

13. Review sequence 3 10 067

ADD:

in Category 10 of BUFR Table D,

"(see Note 2)" to entry 3 10 067

Note (2): In the context of 3 10 067, pressure values which immediately follow occurrences of wind components should be understood to pertain to those components.

Table Reference F X Y	Table References	Element Name	Element Description
3 10 077		(Satellite-derived winds)	
		<i>Processing information</i>	
	0 01 033	Identification of originating/generating centre	
	0 01 034	Identification of originating/generating sub-centre	
	0 25 061	Software identification and version number	
	0 25 062	Database identification	
		<i>Satellite/Instrument identification</i>	
	0 01 007	Satellite identifier	
	0 02 153	Satellite channel centre frequency	
	0 01 012	Direction of motion of moving observing platform	
	2 01 138	Change data width	
	0 02 026	Cross-track resolution	
	0 02 027	Along-track resolution	
	2 01 000	Cancel change data width	
		<i>Methods</i>	
	0 02 028	Segment size at nadir in x-direction (target box size)	
	0 02 029	Segment size at nadir in y-direction (target box size)	
	0 02 161	Wind processing method	
	0 02 164	Tracer correlation method	
	0 02 023	Satellite derived wind computation method	
	0 08 012	Land/sea qualifier	
	0 08 013	Day/night qualifier	
		<i>Final AMV data</i>	
	0 01 124	Grid point identifier	.
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 04 001	Year	
	0 04 002	Month	
	0 04 003	Day	

	0 04 004	Hour	
	0 04 005	Minute	
	0 04 006	Second	
	0 04 086	Long time period or displacement (seconds)	
	0 02 162	Extended height assignment method	
	0 07 004	Pressure	
	0 11 001	Wind direction	
	0 11 002	Wind speed	
	0 11 003	Wind u-component	
	0 11 004	Wind v-component	
	0 12 001	Temperature	
	0 20 014	Height of top of cloud	
	0 07 024	Satellite zenith angle	
	0 01 023	Observation sequence number	
	1 04 000	Delayed replication of 4 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 02 162	Extended height assignment method	
	0 07 004	Pressure	
	0 12 001	Temperature	
	0 20 014	Height of top of cloud	
		<i>Image information (for each image used)</i>	
	1 13 000	Delayed replication of 13 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 04 086	Long time period or displacement (seconds)	
	0 02 020	Satellite classification	
	0 01 007	Satellite identifier	
	0 02 019	Satellite instruments	
	0 05 042	Channel number	
	0 02 153	Satellite channel centre frequency	
	0 05 040	Orbit number	
	0 07 024	Satellite zenith angle	
	0 05 021	Bearing or azimuth	
	0 02 162	Extended height assignment method	
	0 07 004	Pressure	
	0 12 001	Temperature	
	0 20 014	Height of top of cloud	
		<i>Intermediate vectors (for each component vector)</i>	
	1 19 000	Delayed replication of 19 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 04 086	Long time period or displacement (seconds)	
	0 04 086	Long time period or displacement (seconds)	
	0 05 001	Latitude (high accuracy)	
	0 06 001	Longitude (high accuracy)	
	0 11 003	u-component	
	0 11 004	v-component	
	0 11 113	Tracking correlation of vector	
	0 25 148	Coefficient of variation	

	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 08 023	First order statistics	
	0 11 003	u-component	
	0 11 004	v-component	
	0 08 023	First order statistics	Set to missing (cancel)
	1 03 000	Delayed replication of 3 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 20 111	x-axis error ellipse major component	
	0 20 112	y-axis error ellipse minor component	
	0 20 114	Angle of x-axis in error ellipse	
		<i>Corresponding forecast data</i>	
	0 01 033	Identification of originating/generating centre	
	0 08 021	Time significance	= 27 First guess
	0 07 004	Pressure	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
	0 08 021	Time significance	= 4 Forecast
	0 07 004	Pressure	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
	0 08 021	Time significance	Set to missing (cancel)
	0 08 086	Vertical significance for NWP	= 10 Level of best fit
	0 07 004	Pressure	
	0 11 095	u-component of the model wind vector	
	0 11 096	v-component of the model wind vector	
	0 08 086	Vertical significance for NWP	Set to missing (cancel)
		<i>Final AMV quality</i>	
	1 02 004	Replicate 2 descriptors 4 times	
	0 01 044	Standard generating application	
	0 33 007	Per cent confidence	
	0 08 092	Measurement uncertainty expression	= 0 Standard uncertainty
	0 07 004	Pressure	
	0 11 003	u-component	
	0 11 004	v-component	
	0 08 092	Measurement uncertainty expression	Set to missing (cancel)
	0 33 066	AMV Quality Flag	
		<i>Cloud data and microphysics (refers to the nominal image used for HA)</i>	
	0 20 081	Cloud amount	
	0 20 012	Cloud type	
	0 20 056	Cloud phase	
	1 17 000	Delayed replication of 17 descriptors	

	0 31 001	Delayed descriptor replication factor	
	0 08 023	First order statistics	
	0 20 016	Pressure at the top of cloud	
	0 08 092	Measurement uncertainty expression	= 0 Standard uncertainty
	0 08 003	Vertical significance (satellite observations)	= 2 Cloud top
	0 12 001	Temperature	
	0 08 003	Vertical significance (satellite observations)	Set to missing (cancel)
	0 20 016	Pressure at the top of cloud	
	0 08 092	Measurement uncertainty expression	Set to missing (cancel)
	0 25 149	Optimal estimation cost	
	0 20 016	Pressure at the top of cloud	
	0 20 014	Height of the top of cloud	
	0 13 093	Cloud optical thickness	
	0 13 109	Ice/liquid water path	
	0 40 038	Cloud particle size	
	0 08 011	Meteorological feature	= 12 Cloud
	0 14 050	Emissivity	
	0 08 011	Meteorological feature	Set to missing (cancel)
	0 08 023	First order statistics	Set to missing (cancel)

in BUFR/CREX Table B,

Table Reference F X Y	Element Name	Unit	Scale	Reference Value	Data Width (Bits)
0 01 044	Standard generating application	Code table	0	0	8
		Code table	0		3

0 01 044 Standard generating application

Code Figure	Description
0	Reserved
1	Full weighted mixture of individual quality tests
2	Weighted mixture of individual tests, but excluding forecast comparison
3	Recursive filter function
4	Common quality index (QI) without forecast
5	QI without forecast
6	QI with forecast
7	Estimated Error (EE) in m/s converted to a percent confidence
8-254	Reserved
255	Missing value

14. Revised BUFR template for surface observations from n-minute period

ADD:

in BUFR Table D,

Table Reference F X Y	Table References	Element Name	Element Description
		(BUFR template for surface observations from n-minute period)	
3 07 092	3 01 150	WIGOS identifier	
	3 01 001	WMO block and station numbers	
	2 08 040	Change width of CCITT IA5	
	0 01 019	Long station or site name	40 characters
	2 08 000	Change width of CCITT IA5	
	3 01 011	Year, month, day	The time identification refers to the end of the n-minute period.
	3 01 012	Hour, minute	
	3 01 021	Latitude/longitude (high accuracy)	
	0 07 030	Height of station ground above mean sea level	
	0 01 023	Observation Sequence number	
	1 08 000	Delayed replication of 8 descriptors	
	0 31 000	Short delayed descriptor replication factor	
	0 07 031	Height of barometer above mean sea level	
	2 04 018	Add associated field	
	0 31 021	Associated field significance	
	0 10 004	Pressure	Measured value of the air pressure at the sensor location and sensor height
	0 10 051	Pressure reduced to mean sea level	
	0 07 004	Pressure (standard level)	
	0 10 009	Geopotential height of the standard level	
	2 04 000	Cancel associated field	
	1 15 000	Delayed replication of 15 descriptors	
	0 31 001	Delayed descriptor replication factor	
	0 07 032	Height of sensor above local ground	
	0 08 010	Surface qualifier	
	2 04 018	Add associated field	
	0 31 021	Associated field significance	
	0 12 101	Temperature/Air-temperature	Scale: 2
	0 12 103	Dew-point temperature	Scale: 2
	2 02 129	Change scale	
	2 01 132	Change data width	
	0 13 003	Relative humidity	Mandatory to report (presuming a humidity sensor is installed), data width 11 Bits
	2 01 000	Cancel change data width	
	2 02 000	Cancel change scale	
	0 13 009	Relative humidity (original measured value)	
	2 04 000	Cancel associated field	
	0 07 032	Height of sensor above local ground	Set to missing (cancel)
	0 08 010	Surface qualifier	Set to missing (cancel)
	1 07 000	Delayed replication of 7 descriptors	
	0 31 001	Delayed descriptor replication factor	

0 07 061	Depth below land surface	
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 12 130	Soil temperature	
0 13 111	Soil moisture	
2 04 000	Cancel associated field	
0 07 061	Depth below land surface	Set to missing (cancel)
1 05 000	Delayed replication of 5 descriptors	
0 31 000	Delayed descriptor replication factor	
0 33 041	Attribute of following value	
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 20 001	Horizontal visibility	
2 04 000	Cancel associated field	
1 13 000	Delayed replication of 13 descriptors	
0 31 000	Short delayed descriptor replication factor	
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 20 010	Cloud cover (total)	
2 04 000	Cancel associated field	
1 07 000	Replicate 7 descriptors four times	
0 31 001	Delayed descriptor replication factor	
0 08 002	Vertical significance	
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 20 011	Cloud amount	
0 20 013	Height of base of cloud	
2 04 000	Cancel associated field	
0 08 002	Vertical significance	Set to missing (cancel)
1 05 000	Delayed replication of 5 descriptors	
0 31 000	Short delayed descriptor replication factor	
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 20 062	State of ground (with or without snow)	
0 13 013	Total snow depth	
2 04 000	Cancel associated field	
1 05 000	Delayed replication of 5 descriptors	
0 31 000	Short delayed descriptor replication factor	
0 04 025	Time period	= -n minutes
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 20 003	Present weather	
2 04 000	Cancel associated field	
1 05 000	Delayed replication of 5 descriptors	
0 31 000	Short delayed descriptor replication factor	
0 04 025	Time period	= -n minutes
2 04 018	Add associated field	
0 31 021	Associated field significance	
0 13 011	Total precipitation / total water equivalent of snow	
2 04 000	Cancel associated field	
1 15 000	Delayed replication of 15 descriptors	
0 31 001	Delayed descriptor replication factor	
0 07 032	Height of sensor above local ground	
0 08 021	Time significance	= 2 Time averaged
0 04 025	Time period	= -10 minutes, or number of minutes

			after a significant change of wind
2 04 018	Add associated field		
0 31 021	Associated field significance		
0 11 001	Wind direction		
0 11 002	Wind speed		
2 04 000	Cancel associated field		
0 08 021	Time significance		Set to missing (cancel)
2 04 018	Add associated field		
0 31 021	Associated field significance		
0 11 043	Maximum wind gust direction		
0 11 041	Maximum wind gust speed		
2 04 000	Cancel associated field		
0 07 032	Height of sensor above local ground		Set to missing (cancel)
1 05 000	Delayed replication of 5 descriptor		
0 31 000	Short delayed descriptor replication factor		
0 04 025	Time period		= -n minutes (Default n=10)
2 04 018	Add associated field		
0 31 021	Associated field significance		
0 14 031	Total sunshine		
2 04 000	Cancel associated field		
1 10 000	Delayed replication of 10 descriptors		
0 31 000	Short delayed descriptor replication factor		Open or close (1/0)
0 04 025	Time period		= -n minutes (Default n=10)
2 04 018	Add associated field		
0 31 021	Associated field significance		
0 14 002	Long-wave radiation, integrated over period specified		Upward long-wave radiation According to BUFR Table B, under Class 14, Note 2: negative values
0 14 002	Long-wave radiation, integrated over period specified		Downward long-wave radiation According to BUFR Table B, under Class 14, Note 1: positive values
0 14 004	Short-wave radiation, integrated over period specified		Upward short-wave radiation According to BUFR Table B, under Class 14, Note 2: negative values
0 14 028	Global solar radiation (high accuracy), integrated over period specified		
0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified		
0 14 030	Direct solar radiation (high accuracy), integrated over period specified		
2 04 000	Cancel associated field		
1 13 000	Delayed replication of 13 descriptors		
0 31 000	Short delayed descriptor replication factor		
0 04 025	Time period		= -n minutes (Default n = 10)
0 02 071	Spectrographic wavelength		UV-A: 315 nm

	0 02 072	Spectrographic width	UV-A: 85 nm
	2 04 018	Add associated field	
	0 31 021	Associated field significance	
	0 14 072	Global UV irradiation, integrated over period specified	UV-A irradiation According to BUFR Table B under Class 14, Note 8 <i>(ISO 21348: UV-A wave length range 315 ≤ λ ≤ 400 nm)</i>
	2 04 000	Cancel associated field	
	0 02 071	Spectrographic wavelength	UV-B: 280 nm
	0 02 072	Spectrographic width	UV-B: 35 nm
	2 04 018	Add associated field	
	0 31 021	Associated field significance	Quality flag
	0 14 072	Global UV irradiation, integrated over period specified	UV-B irradiation According to BUFR Table B under Class 14, Note 8 <i>(ISO 21348 UV-B wave length range 280 ≤ λ ≤ 315 nm)</i>
	2 04 000	Cancel associated field	

15. New BUFR sequence and code and flag tables for Sentinel-3 SRAL product

ADD:

in BUFR Table D,

Table Reference F X Y	Table References	Element Name	Element Description
		(Sentinel-3 (S3) Level 2 Water Product)	
3 40 017	001007	Satellite identifier	61 (Sentinel 3A) or 65 (Sentinel 3B)
	002019	Satellite instruments	178 (SRAL)
	005044	Satellite cycle number	
	001096	Station acquisition	
	005040	Orbit number	
	001040	Processing centre id code	
	025061	Software identification and version number	
	025182	L1 processing flag	
	025183	L1 processing quality	
	025181	L2 processing flag	
	025184	L2 product status	
	301011	Year, month, day	
	301013	Hour, minute, second	
	004007	Seconds within a minute (microsecond accuracy)	
	301021	Latitude/longitude (high accuracy)	
	005063	Spacecraft roll	

005064	Spacecraft pitch	
005066	Spacecraft yaw	
010081	Altitude of cog above reference ellipsoid	
010082	Instantaneous altitude rate	
008075	Ascending/descending orbit qualifier	
025090	Orbit state flag	
008029	Surface type	
201137	Change data width	Increase data width by 9 bits
202129	Change scale	Add 1 to scale
006021	Distance	
202000	Change scale	Cancel
201000	Change data width	Cancel
010087	Ocean depth/land elevation	
025096	Radiometer state flag	
040012	Radiometer data quality flag	
008077	Radiometer sensed surface type	
104002	Replicate 4 descriptors 2 times	
002153	Satellite channel centre frequency	
012063	Brightness temperature	
012065	Standard deviation brightness temperature	
040013	Radiometer brightness temperature interpretation flag	
007002	Height or altitude	
011098	Wind speed from radiometer	
013090	Radiometer water vapour content	
013091	Radiometer liquid content	
025164	Radiometer wet tropospheric correction	
025095	Altimeter state flag	
040023	Auxiliary altimeter state flags	
025113	Band specific altimeter correction quality flag	
008074	Altimeter echo type	
025190	Altimeter echo processing mode	
021144	Altimeter rain flag	
025191	Altimeter tracking mode	
021143	Ku band rain attenuation	
013055	Intensity of precipitation	
021169	Ice presence indicator	
010101	Squared off nadir angle of the satellite from waveform data	
015012	Total electron count per square metre	
007002	Height or altitude	
011097	Wind speed from altimeter	
040024	Meteorological map availability	
007002	Height or altitude	
025126	Model dry tropospheric correction	
025128	Model wet tropospheric correction	
040011	Interpolation flag	
007002	Height or altitude	

011095	U-component of the model wind vector	
011096	V-component of the model wind vector	
010088	Total geocentric ocean tide height (solution 1)	
010089	Total geocentric ocean tide height (solution 2)	
010090	Long period tide height	
010092	Solid earth tide height	
010093	Geocentric pole tide height	
010098	Loading tide height geocentric ocean tide solution 1	
010099	Loading tide height geocentric ocean tide solution 2	
010100	Non-equilibrium long period tide height	
025127	Inverted barometer correction	
040014	High-frequency fluctuations of the sea-surface topography correction	
010085	Mean sea surface height	
010086	Geoid's height	
010096	Mean dynamic topography	
010103	Mean dynamic topography accuracy	
010102	Sea surface height anomaly	
022080	Waveband central frequency	
008076	Type of band	
022189	Specific band ocean range	
022191	Rms of specific band ocean range	
022130	Number of valid points for specific band	
025165	Ionospheric correction from model on specific band	
025166	Sea state bias correction on specific band	
025167	Specific band net instrumental correction	
021183	Specific band corrected ocean backscatter coefficient	
021184	Std specific band corrected ocean backscatter coefficient	
022134	Number of valid points for specific band backscatter	
021122	Attenuation correction on sigma-0 (from tb)	
022190	Specific band significant wave height	
022131	Rms specific band significant wave height	
022132	Number of valid points for specific band sign. Wave height	
022133	Specific band net instr. Correction for significant wave height	
021186	Specific band automatic gain control	
021187	Rms specific band automatic gain control	
021188	Number of valid points for specific band automatic gain control	
021185	Specific band net instrumental correction for agc	
025112	Band specific altimeter data quality flag	
025113	Band specific altimeter correction quality flag	
033092	Band specific ocean quality flag	
008076	Type of band	

022189	Specific band ocean range	
022191	Rms of specific band ocean range	
022130	Number of valid points for specific band	
025165	Ionospheric correction from model on specific band	
025166	Sea state bias correction on specific band	
025167	Specific band net instrumental correction	
021183	Specific band corrected ocean backscatter coefficient	
021184	Std specific band corrected ocean backscatter coefficient	
022134	Number of valid points for specific band backscatter	
021122	Attenuation correction on sigma-0 (from tb)	
022190	Specific band significant wave height	
022131	Rms specific band significant wave height	
022132	Number of valid points for specific band sign. Wave height	
022133	Specific band net instr. Correction for significant wave height	
021186	Specific band automatic gain control	
021187	Rms specific band automatic gain control	
021188	Number of valid points for specific band automatic gain control	
021185	Specific band net instrumental correction for agc	
025112	Band specific altimeter data quality flag	
025113	Band specific altimeter correction quality flag	
033092	Band specific ocean quality flag	
025190	Altimeter echo processing mode	
011097	Wind speed from altimeter	
013090	Radiometer water vapour content	
013091	Radiometer liquid content	
021143	Ku band rain attenuation	
021184	Std specific band corrected ocean backscatter coefficient	
025128	Model wet tropospheric correction	
025163	Altimeter ionospheric correction on ku band	
025164	Radiometer wet tropospheric correction	
010102	Sea surface height anomaly	
022189	Specific band ocean range	
022191	Rms of specific band ocean range	
022130	Number of valid points for specific band	
025166	Sea state bias correction on specific band	
021183	Specific band corrected ocean backscatter coefficient	
021184	Std specific band corrected ocean backscatter coefficient	
022134	Number of valid points for specific band backscatter	
022190	Specific band significant wave height	
022131	Rms specific band significant wave height	
022132	Number of valid points for specific band sign.	

	Wave height	
025112	Band specific altimeter data quality flag	
025113	Band specific altimeter correction quality flag	
033092	Band specific ocean quality flag	
008049	Number of observations	
022080	Waveband central frequency	
134021	Replicate 34 descriptors 21 times	
301011	Year, month, day	
301013	Hour, minute, second	
004007	Seconds within a minute (microsecond accuracy)	
301021	Latitude/longitude (high accuracy)	
010081	Altitude of cog above reference ellipsoid	
010082	Instantaneous altitude rate	
008029	Surface type	
201137	Change data width	Add 9 bits to data width
202129	Change scale	Add 1 to scale
006021	Distance	
202000	Change scale	Cancel
201000	Change data width	Cancel
025191	Altimeter tracking mode	
021071	Peakiness	
010085	Mean sea surface height	
040011	Interpolation flag	
010102	Sea surface height anomaly	
022189	Specific band ocean range	
022146	Ocog range	
025165	Ionospheric correction from model on specific band	
025167	Specific band net instrumental correction	
021183	Specific band corrected ocean backscatter coefficient	
022190	Specific band significant wave height	
022133	Specific band net instr. Correction for significant wave height	
021177	Corrected ocog backscatter coefficient	
021185	Specific band net instrumental correction for agc	
013164	Sea ice freeboard	
202126	Change scale	Subtract 2 bits from scale
022046	Sea ice fraction	
202000	Change scale	Cancel
013117	Snow density (liquid water content)	
013013	Total snow depth	
025112	Band specific altimeter data quality flag	
033092	Band specific ocean quality flag	

in BUFR Table B,

Table Reference	Element Name	Unit	Scale	Reference Value	Data Width (Bits)
F X Y					
0 10 103	Mean dynamic topography accuracy	m	3	-131072	18
		m	3		6
0 13 164	Sea ice freeboard	m	3	-131072	18
		m	3		6
0 25 190	Altimeter echo processing mode	Code table	0	0	8
		Code table	0		3
0 25 191	Altimeter tracking mode	Code table	0	0	8
		Code table	0		3
0 33 092	Band specific ocean quality flag	Flag table	0	0	9
		Flag table	0		3

0 25 190 Altimeter echo processing mode

Code figure	Description
0	Low Resolution Mode (LRM)
1	Synthetic Aperture Radar (SAR)
2	LRM and SAR (interleaved)
3	Reserved
4	Pseudo-LRM (PLRM)
5	SAR Interferometric Mode (SARIN)
6-254	Reserved
255	Missing value

0 25 191 Altimeter tracking mode

Code figure	Description
0	Open loop
1	Closed loop
2	Open Loop Fixed Gain
3-254	Reserved
255	Missing value

0 33 092 Band specific ocean quality flag

Bit	Description
1	Altimeter operating
2	MicroWave Radiometer (MWR) operating
3-8	Reserved
All 9	Missing value

Common code tables

16. Proposal for new entries in Common Code table C-5 and C-8

ADD:

in Common Code Table C5,

Code figure for I ₆ I ₆ I ₆	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
423	423	423	Oceansat-3
503	503	503	Hai Yang 2B (HY-2B, SOA/NSOAS China)
802	802	802	CFOSAT

in Common Code Table C8,

Code	Agency	Type	Instrument short name	Instrument long name
943	CNSA	Scatterometer	SCAT (on CFOSAT)	Scatterometer

17. New entry in Common Code table C-2 for new radiosondes

AMEND:

in Common Code Table C-2 : "Radiosonde/sounding system used",

Date of assignment of number (necessary after 30/06/2007)	Code figure for r _a r _a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Needed	63-66	163-166	Vacant

TO

Date of assignment of number (necessary after 30/06/2007)	Code figure for r _a r _a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
07/11/2018	63	163	Modem M20 radiosonde w/thermistor sensor, capacitance relative humidity sensor, and derived pressure from GPS height (France)
07/11/2018	64	164	Modem PilotSonde GPS radiosonde (France)
Needed	65-66	165-166	Vacant

18. New entries in Common Code table C-12

ADD:

in Common Code Table C-12 : "Sub-centre of originating centres defined by entries in Common Code tables C-1 or C-11", under Region VI,

Code figure	Name	Code figure	Name
85	Toulouse (RSMC)	203	Aarhus University (Denmark)
85	Toulouse (RSMC)	204	the Institute of Environmental Protection – National Research Institute (Poland)

19. New entries in Common Code tables C-5 and C-8

ADD:

in Common Code table C-5 Satellite identifier,

Code figure for I ₆ I ₆ I ₆	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
803	803	803	GRACE C (GRACE-FO)
804	804	804	GRACE D (GRACE-FO)

in Common Code Table C8 - Satellite instruments,

Code	Agency	Type	Instrument short name	Instrument long name
104	NASA	GNSS occultation sounder	Tri-G	Triple-G (GPS, Galileo, GLONASS)

20. New entries in Common Code Table C-3

ADD:

in Common Code Table C-3,

Code figure for I _x I _x I _x	Code figure for BUFR (Code table 0 22 067)	Meaning	
		Instrument make and type	Equation Coefficients
			a
873	873	ALTO	Not applicable
874	874	SOLO_D_MRV	Not applicable

21. Global exchange of daily climate data

ADD:

in the Manual on Codes (WMO-No. 306), Volume I.2, Part C,

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

DATA CATEGORIES		INTERNATIONAL DATA SUB-CATEGORIES	
BUFR Edition 4, Octet 11 in Section 1		BUFR Edition 4, Octet 12 (if = 255, it means other sub-category or undefined)	
CREX Edition 2, nnn in Group Annnmmm of Section 1		CREX Edition 2, mmm in Group Annnmmm of Section 1	
Code figure	Name	Code figure	Name (corresponding traditional alphanumeric codes are in brackets)
0	Surface data – land	21	Climatological observations (monthly reports of daily climate data)

II. MANUAL ON THE GTS

1. New data designator for space weather

ADD:

in the Manual on the GTS (WMO-No. 386), Attachment II-5 (Data designators T1T2A1A2ii in abbreviated headings),

- $T_1 T_2 = F N$ for space weather advisories in abbreviated plain language; and
- $T_1 T_2 = L N$ for space weather advisories in IWXXM GML form.

2. Global exchange of daily climate data

ADD:

in the Manual on the GTS (WMO-No. 386), Attachment II-5 (Data designators T1T2A1A2ii in abbreviated headings),

T1	T2	A1	ii	Data type	TAC correspondence	Data Category Sub Category (Common Table C13)
I	S	C	60	Climatic observations (monthly reports of daily climate data)	n/a	000/021