CODE TABLE USED IN SECTION 0

Code table 0.0 – *Discipline of processed data in the GRIB message, number of GRIB Master table*

Code figure	Meaning
0	Meteorological products
1	Hydrological products
2	Land surface products
3	Space products
4–9	Reserved
10	Oceanographic products
11–191	Reserved
192–254	Reserved for local use
255	Missing

CODE TABLES USED IN SECTION 1

Code table 1.0 – *GRIB master tables version number*

Code figure	Meaning
0	Experimental
1	Version implemented on 7 November 2001
2	Version implemented on 4 November 2003
3	Version implemented on 2 November 2005
4	Version implemented on 7 November 2007
5	Version implemented on 4 November 2009
6	Version implemented on 15 September 2010
7	Version implemented on 4 May 2011
8	Version implemented on 2 November 2011
9	Version implemented on 2 May 2012
10	Version implemented on 7 November 2012
11	Version implemented on 8 May 2013
12	Version implemented on 14 November 2013
13	Version implemented on 7 May 2014
14	Version implemented on 5 November 2014
15	Version implemented on 6 May 2015
16	Version implemented on 11 November 2015
17	Version implemented on 4 May 2016
18	Version implemented on 2 November 2016
19	Version implemented on 3 May 2017
20	Pre-operational to be implemented by next amendment
21–254	Future versions
255	Missing

Code table 1.1 – *GRIB local tables version number*

Code figure	Meaning
0	Local tables not used. Only table entries and templates from the current master table are valid
1–254	Number of local tables version used
255	Missing

Code table 1.2 – *Significance of reference time*

Code figure	Meaning
0	Analysis
1	Start of forecast
2	Verifying time of forecast
3	Observation time
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 1.3 – *Production status of data*

Code figure	Meaning
0	Operational products
1	Operational test products
2	Research products
3	Re-analysis products
4	THORPEX Interactive Grand Global Ensemble (TIGGE)
5	THORPEX Interactive Grand Global Ensemble (TIGGE) test
6	S2S operational products
7	S2S test products
8	Uncertainties in Ensembles of Regional ReAnalyses project (UERRA)
9	Uncertainties in Ensembles of Regional ReAnalyses project (UERRA) test
10–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 1.4 – *Type of data*

Code figure	Meaning
0	Analysis products
1	Forecast products
2	Analysis and forecast products
3	Control forecast products
4	Perturbed forecast products
5	Control and perturbed forecast products
6	Processed satellite observations
7	Processed radar observations
8	Event probability
9–191	Reserved
192–254	Reserved for local use
255	Missing

Note: An initialized analysis is considered a zero-hour forecast.

Code table 1.5 – *Identification template number*

Code figure	Meaning
0	Calendar definition
1	Paleontological offset
2	Calendar definition and paleontological offset
3–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 1.6 – *Type of calendar*

Code figure	Meaning	Comments
0	Gregorian	
1	360-day	
2	365-day	Essentially a non-leap year
3	Proleptic Gregorian	Extends the Gregorian calendar indefinitely in the past
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

CODE AND FLAG TABLES USED IN SECTION 3

Code table 3.0 – *Source of grid definition*

Code figure	Meaning	Comments
0	Specified in Code table 3.1	
1	Predetermined grid definition	Defined by originating centre
2–191	Reserved	
192–254	Reserved for local use	
255	A grid definition does not apply to this product	

Code table 3.1 – *Grid definition template number*

Code figure	Meaning	Comments
0	Latitude/longitude	Also called equidistant cylindrical, or Plate Carrée
1	Rotated latitude/longitude	
2	Stretched latitude/longitude	
3	Stretched and rotated latitude/longitude	
4	Variable resolution latitude/longitude	
5	Variable resolution rotated latitude/longitude	
6–9	Reserved	
10	Mercator	
11–19	Reserved	
20	Polar stereographic projection	Can be south or north
21–29	Reserved	
30	Lambert conformal	Can be secant or tangent, conical or bipolar
31	Albers equal area	
32–39	Reserved	
40	Gaussian latitude/longitude	
41	Rotated Gaussian latitude/longitude	
42	Stretched Gaussian latitude/longitude	
43	Stretched and rotated Gaussian latitude/longitude	
44–49	Reserved	
50	Spherical harmonic coefficients	
51	Rotated spherical harmonic coefficients	
52	Stretched spherical harmonic coefficients	
53	Stretched and rotated spherical harmonic coefficients	
54–89	Reserved	
90	Space view perspective or orthographic	
91–99	Reserved	
100	Triangular grid based on an icosahedron	
101	General unstructured grid	
102–109	Reserved	
110	Equatorial azimuthal equidistant projection	
111–119	Reserved	
120	Azimuth-range projection	
121–139	Reserved	

(continued)

(Code table 3.1 – continued)

Code figure	Meaning
140	Lambert azimuthal equal area projection
141–999	Reserved
1000	Cross-section grid with points equally spaced on the horizontal
1001–1099	Reserved
1100	Hovmöller diagram grid with points equally spaced on the horizontal
1101–1199	Reserved
1200	Time section grid
1201–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 3.2 – *Shape of the Earth*

Code figure	Meaning
0	Earth assumed spherical with radius = 6 367 470.0 m
1	Earth assumed spherical with radius specified (in m) by data producer
2	Earth assumed oblate spheroid with size as determined by IAU in 1965 (major axis = 6 378 160.0 m, minor axis = 6 356 775.0 m, f = 1/297.0)
3	Earth assumed oblate spheroid with major and minor axes specified (in km) by data producer
4	Earth assumed oblate spheroid as defined in IAG-GRS80 model (major axis = 6 378 137.0 m, minor axis = 6 356 752.314 m, f = 1/298.257 222 101)
5	Earth assumed represented by WGS-84 (as used by ICAO since 1998)
6	Earth assumed spherical with radius of 6 371 229.0 m
7	Earth assumed oblate spheroid with major or minor axes specified (in m) by data producer
8	Earth model assumed spherical with radius of 6 371 200 m, but the horizontal datum of the resulting latitude/longitude field is the WGS-84 reference frame
9	Earth represented by the Ordnance Survey Great Britain 1936 Datum, using the Airy 1830 Spheroid, the Greenwich meridian as 0 longitude, and the Newlyn datum as mean sea level, 0 height
10–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) WGS-84 is a geodetic system that uses IAG-GRS80 as a basis.

(2) With respect to code figures 0, 1, 3, 6 and 7, coordinates can only be unambiguously interpreted, if the coordinate reference system in which they are embedded is known. Therefore, defining the shape of the Earth alone without coordinate system axis origins is ambiguous. Generally, the prime meridian defined in the geodetic system WGS-84 can be safely assumed to be the longitudinal origin. However, because these code figures do not specify the longitudinal origin explicitly, it is suggested to contact the originating centre if high precision coordinates are needed, in order to obtain the precise details of the coordinate system used (effective as from 16 November 2016).

Flag table 3.3 – *Resolution and component flags*

Bit No.	Value	Meaning
1–2		Reserved
3	0	i direction increments not given
	1	i direction increments given

(continued)

(Flag table 3.3 – continued)

Bit No.	Value	Meaning
4	0	j direction increments not given
	1	j direction increments given
5	0	Resolved u- and v- components of vector quantities relative to easterly and northerly directions
	1	Resolved u- and v- components of vector quantities relative to the defined grid in the direction of increasing x and y (or i and j) coordinates, respectively
6–8		Reserved – set to zero

Flag table 3.4 – *Scanning mode*

Bit No.	Value	Meaning
1	0	Points of first row or column scan in the +i (+x) direction
	1	Points of first row or column scan in the –i (–x) direction
2	0	Points of first row or column scan in the –j (–y) direction
	1	Points of first row or column scan in the +j (+y) direction
3	0	Adjacent points in i (x) direction are consecutive
	1	Adjacent points in j (y) direction is consecutive
4	0	All rows scan in the same direction
	1	Adjacent rows scans in the opposite direction
5	0	Points within odd rows are not offset in i (x) direction
	1	Points within odd rows are offset by Di/2 in i (x) direction
6	0	Points within even rows are not offset in i (x) direction
	1	Points within even rows are offset by Di/2 in i (x) direction
7	0	Points are not offset in j (y) direction
	1	Points are offset by Dj/2 in j (y) direction
8	0	Rows have Ni grid points and columns have Nj grid points
	1	Rows have Ni grid points if points are not offset in i direction
		Rows have Ni–1 grid points if points are offset by Di/2 in i direction
		Columns have Nj grid points if points are not offset in j direction
		Columns have Nj–1 grid points if points are offset by Dj/2 in j direction

Notes:

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

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

(3) If bit number 4 is set, the first row scan is as defined by previous flags.

(4) La1 and Lo1 define the first row, which is an odd row.

(5) Di and Dj are assumed to be positive, with the direction of i and j being given by bits 1 and 2.

(6) Bits 5 through 8 may be used to generate staggered grids, such as Arakawa grids (see Part B, GRIB Attachment II).

(7) If any of bits 5, 6, 7 or 8 are set, Di and Dj are not optional.

Flag table 3.5 – *Projection centre*

Bit No.	Value	Meaning
1	0	North Pole is on the projection plane
	1	South Pole is on the projection plane
2	0	Only one projection centre is used
	1	Projection is bipolar and symmetric

Code table 3.6 – *Spectral data representation type*

Code figure	Meaning
1	The associated Legendre functions of the first kind are defined by:

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

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

A field F(*λ,* μ) is represented by:

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

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

Code table 3.7 – *Spectral data representation mode*

Code figure	Meaning
0	Reserved
1	The complex numbers F_n^m (see code figure 1 in Code table 3.6) are stored for m ≥ 0 as pairs of real numbers Re(F_n^m), Im(F_n^m) ordered with n increasing from m to N(m), first for m = 0 and then for m = 1, 2, ... M (see Note)
2–254	Reserved
255	Missing

Note: Values of N(m) for common truncation cases:

Triangular:	M = J = K,	N(m) = J
Rhomboidal:	K = J + M,	N(m) = J + m
Trapezoidal:	K = J, K > M,	N(m) = J

Code table 3.8 – *Grid point position*

Code figure	Meaning
0	Grid points at triangle vertices
1	Grid points at centres of triangles
2	Grid points at midpoints of triangle sides
3–191	Reserved
192–254	Reserved for local use
255	Missing

Flag table 3.9 – *Numbering order of diamonds as seen from the corresponding pole*

Bit No.	Value	Meaning
1	0	Clockwise orientation
	1	Anti-clockwise (i.e. counter-clockwise) orientation
2–8		Reserved

Flag table 3.10 – *Scanning mode for one diamond*

Bit No.	Value	Meaning
1	0	Points scan in +i direction, i.e. from pole to Equator
	1	Points scan in –i direction, i.e. from Equator to pole
2	0	Points scan in +j direction, i.e. from west to east
	1	Points scan in –j direction, i.e. from east to west
3	0	Adjacent points in i direction are consecutive
	1	Adjacent points in j direction are consecutive
4–8		Reserved

Code table 3.11 – *Interpretation of list of numbers at end of section 3*

Code figure	Meaning
0	There is no appended list
1	Numbers define number of points corresponding to full coordinate circles (i.e. parallels), coordinate values on each circle are multiple of the circle mesh, and extreme coordinate values given in grid definition (i.e. extreme longitudes) may not be reached in all rows
2	Numbers define number of points corresponding to coordinate lines delimited by extreme coordinate values given in grid definition (i.e. extreme longitudes) which are present in each row
3	Numbers define the actual latitudes for each row in the grid. The list of numbers are integer values of the valid latitudes in microdegrees (scaled by 10^{-6}) or in unit equal to the ratio of the basic angle and the subdivisions number for each row, in the same order as specified in the "scanning mode flag" (bit no. 2) (see Note 2)
4–254	Reserved
255	Missing

Notes:

(1) For entry 1, it should be noted that depending on values of extreme (first/last) coordinates, and regardless of bit-map, effective number of points per row may be less than the number of points on the current circle.

(2) The value for the constant direction increment Di (or Dx) in the accompanying grid definition template should be set to all ones (missing).

Code table 3.15 – *Physical meaning of vertical coordinate*

Code figure	Meaning	Unit
0–19	Reserved	
20	Temperature	K
21–99	Reserved	
100	Pressure	Pa
101	Pressure deviation from mean sea level	Pa
102	Altitude above mean sea level	m
103	Height above ground (see Note 1)	m
104	Sigma coordinate	
105	Hybrid coordinate	
106	Depth below land surface	m
107	Potential temperature (theta)	K
108	Pressure deviation from ground to level	Pa
109	Potential vorticity	K m^{-2} kg^{-1} s^{-1}
110	Geometrical height	m

(continued)

(Code table 3.15 – continued)

Code figure	Meaning	Unit
111	Eta coordinate (see Note 2)	
112	Geopotential height	gpm
113	Logarithmic hybrid coordinate	
114–159	Reserved	
160	Depth below sea level	m
161–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Negative values associated to this coordinate will indicate depth below ground surface. If values are all below surface, use of entry 10^6 is recommended, with positive coordinate values instead.

(2) The Eta vertical coordinate system involves normalizing the pressure at some point on a specific level by the mean sea level pressure at that point.

Code table 3.20 – *Type of horizontal line*

Code figure	Meaning
0	Rhumb
1	Great circle
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 3.21 – *Vertical dimension coordinate values definition*

Code figure	Meaning
0	Explicit coordinate values set
1	Linear coordinates f(1) = C1 f(n) = f(n–1) + C2
2–10	Reserved
11	Geometric coordinates f(1) = C1 f(n) = C2 × f(n–1)
12–191	Reserved
192–254	Reserved for local use
255	Missing

CODE TABLES USED IN SECTION 4

Code table 4.0 – *Product definition template number*

Code figure	Meaning
0	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time
1	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
2	Derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer at a point in time
3	Derived forecasts based on a cluster of ensemble members over a rectangular area at a horizontal level or in a horizontal layer at a point in time
4	Derived forecasts based on a cluster of ensemble members over a circular area at a horizontal level or in a horizontal layer at a point in time
5	Probability forecasts at a horizontal level or in a horizontal layer at a point in time
6	Percentile forecasts at a horizontal level or in a horizontal layer at a point in time
7	Analysis or forecast error at a horizontal level or in a horizontal layer at a point in time
8	Average, accumulation, extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
9	Probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
10	Percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
11	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
12	Derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
13	Derived forecasts based on a cluster of ensemble members over a rectangular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
14	Derived forecasts based on a cluster of ensemble members over a circular area, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
15	Average, accumulation, extreme values, or other statistically processed values over a spatial area at a horizontal level or in a horizontal layer at a point in time
16–19	Reserved
20	Radar product
21–29	Reserved
30	Satellite product (deprecated)
31	Satellite product
32	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data
33	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data
34	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval for simulated (synthetic) satellite data
35–39	Reserved
40	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
41	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
42	Average, accumulation and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents

(continued)

(Code table 4.0 – continued)

Code figure	Meaning
43	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for atmospheric chemical constituents
44	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for aerosol
45	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for aerosol
46	Average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol
47	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol
48	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol
49	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol
50	Reserved
51	Categorical forecasts at a horizontal level or in a horizontal layer at a point in time
52	Reserved
53	Partitioned parameters at a horizontal level or in a horizontal layer at a point in time
54	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for partitioned parameters
55	Spatio-temporal changing tiles at a horizontal level or horizontal layer at a point in time
56	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for spatio-temporal changing tile parameters (deprecated)
57	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents based on a distribution function
58	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents based on a distribution function
59	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for spatio-temporal changing tile parameters (corrected version of template 4.56)
60	Individual ensemble reforecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
61	Individual ensemble reforecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous time interval
62–66	Reserved
67	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 based on a distribution function
68	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 based on a distribution function
69	Reserved
70	Post-processing analysis or forecast at a horizontal level or in a horizontal layer at a point in time
71	Post-processing individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
72	Post-processing 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

(continued)

(Code table 4.0 – continued)

Code figure	Meaning
73	Post-processing individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous time interval
74-90	Reserved
91	Categorical forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
92–253	Reserved
254	CCITT IA5 character string
255–999	Reserved
1000	Cross-section of analysis and forecast at a point in time
1001	Cross-section of averaged or otherwise statistically processed analysis or forecast over a range of time
1002	Cross-section of analysis and forecast, averaged or otherwise statistically processed over latitude or longitude
1003–1099	Reserved
1100	Hovmöller-type grid with no averaging or other statistical processing
1101	Hovmöller-type grid with averaging or other statistical processing
1102–32767	Reserved
32768–65534	Reserved for local use
65535	Missing

Code table 4.1 – *Parameter category by product discipline*

Note: When a new category is to be added to Code table 4.1 and more than one discipline applies, the choice of discipline should be made based on the intended use of the product.

Product discipline 0 – Meteorological products

Category	Description
0	Temperature
1	Moisture
2	Momentum
3	Mass
4	Short-wave radiation
5	Long-wave radiation
6	Cloud
7	Thermodynamic stability indices
8	Kinematic stability indices
9	Temperature probabilities
10	Moisture probabilities
11	Momentum probabilities
12	Mass probabilities
13	Aerosols
14	Trace gases (e.g. ozone, CO_2)
15	Radar
16	Forecast radar imagery
17	Electrodynamics
18	Nuclear/radiology
19	Physical atmospheric properties

(continued)

(Code table 4.1 – continued)

Category	Description
20	Atmospheric chemical constituents
21–189	Reserved
190	CCITT IA5 string
191	Miscellaneous
192–254	Reserved for local use
255	Missing

Note: Entries 9, 10, 11 and 12 are deprecated.

Product discipline 1 – Hydrological products

Category	Description
0	Hydrology basic products
1	Hydrology probabilities
2	Inland water and sediment properties
3–191	Reserved
192–254	Reserved for local use
255	Missing

Product discipline 2 – Land surface products

Category	Description
0	Vegetation/biomass
1	Agri-/aquacultural special products
2	Transportation-related products
3	Soil products
4	Fire weather products
5–191	Reserved
192–254	Reserved for local use
255	Missing

Product discipline 3 – Space products

Category	Description
0	Image format products (see Note 1)
1	Quantitative products (see Note 2)
2	Cloud properties
3	Flight rule conditions
4	Volcanic ash
5	Sea-surface temperature
6	Solar radiation
7–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) Data are numeric without units, although they might be given quantitative meaning through a code table defined external to this document. The emphasis is on a displayable “picture” of some phenomenon, perhaps with certain enhanced features. Generally, each datum is an unsigned, one octet integer, but some image format products might have another datum size. The size of a datum is indicated in section 5.

(2) Data are in specified physical units.

(continued)

(Code table 4.1 – continued)

Product discipline 10 – Oceanographic products

Category	Description
0	Waves
1	Currents
2	Ice
3	Surface properties
4	Subsurface properties
5–190	Reserved
191	Miscellaneous
192–254	Reserved for local use
255	Missing

Code table 4.2 – *Parameter number by product discipline and parameter category*

Notes:

(1) By convention, the flux sign is positive if downwards.

(2) When a new parameter is to be added to Code table 4.2 and more than one category applies, the choice of category should be made based on the intended use of the product. The discipline and category are an important part of any product definition, so it is possible to have the same parameter name in more than one category. For example, “water temperature” in discipline 10 (oceanographic products), category 4 (subsurface properties) is used for reporting water temperature in the ocean or open sea, and is not the same as “water temperature” in discipline 1 (hydrological products), category 2 (inland water and sediment properties), which is used for reporting water temperature in freshwater lakes and rivers.

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

Number	Parameter	Units
0	Temperature	K
1	Virtual temperature	K
2	Potential temperature	K
3	Pseudo-adiabatic potential temperature or equivalent potential temperature	K
4	Maximum temperature*	K
5	Minimum temperature*	K
6	Dewpoint temperature	K
7	Dewpoint depression (or deficit)	K
8	Lapse rate	K m^{-1}
9	Temperature anomaly	K
10	Latent heat net flux	W m^{-2}
11	Sensible heat net flux	W m^{-2}
12	Heat index	K
13	Wind chill factor	K
14	Minimum dewpoint depression*	K
15	Virtual potential temperature	K
16	Snow phase change heat flux	W m^{-2}
17	Skin temperature	K
18	Snow temperature (top of snow)	K
19	Turbulent transfer coefficient for heat	Numeric
20	Turbulent diffusion coefficient for heat	m^2 s^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
21	Apparent temperature**	K
22	Temperature tendency due to short-wave radiation	K s^{-1}
23	Temperature tendency due to long-wave radiation	K s^{-1}
24	Temperature tendency due to short-wave radiation, clear sky	K s^{-1}
25	Temperature tendency due to long-wave radiation, clear sky	K s^{-1}
26	Temperature tendency due to parameterization	K s^{-1}
27	Wet-bulb temperature	K
28	Unbalanced component of temperature	K
29	Temperature advection	K s^{-1}
30–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.
** Apparent temperature is the perceived outdoor temperature, caused by a combination of phenomena, such as air temperature, relative humidity and wind speed.

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

Number	Parameter	Units
0	Specific humidity	kg kg^{-1}
1	Relative humidity	%
2	Humidity mixing ratio	kg kg^{-1}
3	Precipitable water	kg m^{-2}
4	Vapour pressure	Pa
5	Saturation deficit	Pa
6	Evaporation	kg m^{-2}
7	Precipitation rate*	kg m^{-2} s^{-1}
8	Total precipitation***	kg m^{-2}
9	Large-scale precipitation (non-convective)***	kg m^{-2}
10	Convective precipitation***	kg m^{-2}
11	Snow depth	m
12	Snowfall rate water equivalent*	kg m^{-2} s^{-1}
13	Water equivalent of accumulated snow depth***	kg m^{-2}
14	Convective snow***	kg m^{-2}
15	Large-scale snow***	kg m^{-2}
16	Snow melt	kg m^{-2}
17	Snow age	d
18	Absolute humidity	kg m^{-3}
19	Precipitation type	(Code table 4.201)
20	Integrated liquid water	kg m^{-2}
21	Condensate	kg kg^{-1}
22	Cloud mixing ratio	kg kg^{-1}
23	Ice water mixing ratio	kg kg^{-1}
24	Rain mixing ratio	kg kg^{-1}
25	Snow mixing ratio	kg kg^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
26	Horizontal moisture convergence	kg kg^{-1} s^{-1}
27	Maximum relative humidity*	%
28	Maximum absolute humidity*	kg m^{-3}
29	Total snowfall***	m
30	Precipitable water category	(Code table 4.202)
31	Hail	m
32	Graupel (snow pellets)	kg kg^{-1}
33	Categorical rain	(Code table 4.222)
34	Categorical freezing rain	(Code table 4.222)
35	Categorical ice pellets	(Code table 4.222)
36	Categorical snow	(Code table 4.222)
37	Convective precipitation rate	kg m^{-2} s^{-1}
38	Horizontal moisture divergence	kg kg^{-1} s^{-1}
39	Per cent frozen precipitation	%
40	Potential evaporation	kg m^{-2}
41	Potential evaporation rate	W m^{-2}
42	Snow cover	%
43	Rain fraction of total cloud water	Proportion
44	Rime factor	Numeric
45	Total column integrated rain	kg m^{-2}
46	Total column integrated snow	kg m^{-2}
47	Large scale water precipitation (non-convective)***	kg m^{-2}
48	Convective water precipitation***	kg m^{-2}
49	Total water precipitation***	kg m^{-2}
50	Total snow precipitation***	kg m^{-2}
51	Total column water (Vertically integrated total water (vapour + cloud water/ice))	kg m^{-2}
52	Total precipitation rate**	kg m^{-2} s^{-1}
53	Total snowfall rate water equivalent**	kg m^{-2} s^{-1}
54	Large scale precipitation rate	kg m^{-2} s^{-1}
55	Convective snowfall rate water equivalent	kg m^{-2} s^{-1}
56	Large scale snowfall rate water equivalent	kg m^{-2} s^{-1}
57	Total snowfall rate	m s^{-1}
58	Convective snowfall rate	m s^{-1}
59	Large scale snowfall rate	m s^{-1}
60	Snow depth water equivalent	kg m^{-2}
61	Snow density	kg m^{-3}
62	Snow evaporation	kg m^{-2}
63	Reserved	
64	Total column integrated water vapour	kg m^{-2}
65	Rain precipitation rate	kg m^{-2} s^{-1}
66	Snow precipitation rate	kg m^{-2} s^{-1}
67	Freezing rain precipitation rate	kg m^{-2} s^{-1}
68	Ice pellets precipitation rate	kg m^{-2} s^{-1}
69	Total column integrated cloud water	kg m^{-2}
70	Total column integrated cloud ice	kg m^{-2}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
71	Hail mixing ratio	kg kg^{-1}
72	Total column integrated hail	kg m^{-2}
73	Hail precipitation rate	kg m^{-2} s^{-1}
74	Total column integrated graupel	kg m^{-2}
75	Graupel (snow pellets) precipitation rate	kg m^{-2} s^{-1}
76	Convective rain rate	kg m^{-2} s^{-1}
77	Large scale rain rate	kg m^{-2} s^{-1}
78	Total column integrated water (all components including precipitation)	kg m^{-2}
79	Evaporation rate	kg m^{-2} s^{-1}
80	Total condensate	kg kg^{-1}
81	Total column-integrated condensate	kg m^{-2}
82	Cloud ice mixing-ratio	kg kg^{-1}
83	Specific cloud liquid water content	kg kg^{-1}
84	Specific cloud ice water content	kg kg^{-1}
85	Specific rainwater content	kg kg^{-1}
86	Specific snow water content	kg kg^{-1}
87–89	Reserved	
90	Total kinematic moisture flux	kg kg^{-1} m s^{-1}
91	u-component (zonal) kinematic moisture flux	kg kg^{-1} m s^{-1}
92	v-component (meridional) kinematic moisture flux	kg kg^{-1} m s^{-1}
93	Relative humidity with respect to water	%
94	Relative humidity with respect to ice	%
95	Freezing or frozen precipitation rate	kg m^{-2} s^{-1}
96	Mass density of rain	kg m^{-3}
97	Mass density of snow	kg m^{-3}
98	Mass density of graupel	kg m^{-3}
99	Mass density of hail	kg m^{-3}
100	Specific number concentration of rain	kg^{-1}
101	Specific number concentration of snow	kg^{-1}
102	Specific number concentration of graupel	kg^{-1}
103	Specific number concentration of hail	kg^{-1}
104	Number density of rain	m^{-3}
105	Number density of snow	m^{-3}
106	Number density of graupel	m^{-3}
107	Number density of hail	m^{-3}
108	Specific humidity tendency due to parameterization	kg kg^{-1} s^{-1}
109	Mass density of liquid water coating on hail expressed as mass of liquid water per unit volume of air	kg m^{-3}
110	Specific mass of liquid water coating on hail expressed as mass of liquid water per unit mass of moist air	kg kg^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
111	Mass mixing ratio of liquid water coating on hail expressed as mass of liquid water per unit mass of dry air	kg kg^{-1}
112	Mass density of liquid water coating on graupel expressed as mass of liquid water per unit volume of air	kg m^{-3}
113	Specific mass of liquid water coating on graupel expressed as mass of liquid water per unit mass of moist air	kg kg^{-1}
114	Mass mixing ratio of liquid water coating on graupel expressed as mass of liquid water per unit mass of dry air	kg kg^{-1}
115	Mass density of liquid water coating on snow expressed as mass of liquid water per unit volume of air	kg m^{-3}
116	Specific mass of liquid water coating on snow expressed as mass of liquid water per unit mass of moist air	kg kg^{-1}
117	Mass mixing ratio of liquid water coating on snow expressed as mass of liquid water per unit mass of dry air	kg kg^{-1}
118	Unbalanced component of specific humidity	kg kg^{-1}
119	Unbalanced component of specific cloud liquid water content	kg kg^{-1}
120	Unbalanced component of specific cloud ice water content	kg kg^{-1}
121–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** Total precipitation/snowfall rate stands for the sum of convective and large-scale precipitation/snowfall rate.

*** Statistical process 1 (Accumulation) does not change units. It is recommended to use another parameter with “rate” in its name and accumulation in PDT.

Product discipline 0 – Meteorological products, parameter category 2: momentum

Number	Parameter	Units
0	Wind direction (from which blowing)	degree true
1	Wind speed	m s^{-1}
2	u-component of wind	m s^{-1}
3	v-component of wind	m s^{-1}
4	Stream function	m^2 s^{-1}
5	Velocity potential	m^2 s^{-1}
6	Montgomery stream function	m^2 s^{-2}
7	Sigma coordinate vertical velocity	s^{-1}
8	Vertical velocity (pressure)	Pa s^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
9	Vertical velocity (geometric)	m s^{-1}
10	Absolute vorticity	s^{-1}
11	Absolute divergence	s^{-1}
12	Relative vorticity	s^{-1}
13	Relative divergence	s^{-1}
14	Potential vorticity	K m^2 kg^{-1} s^{-1}
15	Vertical u-component shear	s^{-1}
16	Vertical v-component shear	s^{-1}
17	Momentum flux, u-component	N m^{-2}
18	Momentum flux, v-component	N m^{-2}
19	Wind mixing energy	J
20	Boundary layer dissipation	W m^{-2}
21	Maximum wind speed*	m s^{-1}
22	Wind speed (gust)	m s^{-1}
23	u-component of wind (gust)	m s^{-1}
24	v-component of wind (gust)	m s^{-1}
25	Vertical speed shear	s^{-1}
26	Horizontal momentum flux	N m^{-2}
27	u-component storm motion	m s^{-1}
28	v-component storm motion	m s^{-1}
29	Drag coefficient	Numeric
30	Frictional velocity	m s^{-1}
31	Turbulent diffusion coefficient for momentum	m^2 s^{-1}
32	Eta coordinate vertical velocity	s^{-1}
33	Wind fetch	m
34	Normal wind component**	m s^{-1}
35	Tangential wind component**	m s^{-1}
36	Amplitude function for Rossby wave envelope for meridional wind***	m s^{-1}
37	Northward turbulent surface stress****	N m^{-2} s
38	Eastward turbulent surface stress****	N m^{-2} s
39	Eastward wind tendency due to parameterization	m s^{-2}
40	Northward wind tendency due to parameterization	m s^{-2}
41	u-component of geostrophic wind	m s^{-1}
42	v-component of geostrophic wind	m s^{-1}
43	Geostrophic wind direction	degree true
44	Geostrophic wind speed	m s^{-1}
45	Unbalanced component of divergence	s^{-1}
46	Vorticity advection	s^{-2}
47–191	Reserved	
192–254	Reserved for local use	

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** In relation to local coordinate axes at a cell edge.

*** This parameter is described in more detail by (a) Lee, S. and I.M. Held, 1993: Baroclinic wave packets in models and observations. *J Atmos. Sci*., 50:1413-1428, (b) Chang, E.K.M., 1993: Downstream development of baroclinic waves as inferred from regression analysis. *J. Atmos. Sci*., 50:2038-2053, (c) Archambault, H.M., D. Keyser and L.F. Bosart, 2010: Relationships between large-scale regime transitions and major cool-season precipitation events in the northeastern United States. *Mon Wea. Rev*., 138:3454-3473, and (d) Zimin, A.V., I. Szunyogh, B.R. Hung and E. Orr, 2006: Extracting envelopes of nonzonally propagating Rossby wave packets. *Mon. Wea. Review*, 134:1329–1333.

**** Statistical process 1 (Accumulation) does not change units.

Product discipline 0 – Meteorological products, parameter category 3: mass

Number	Parameter	Units
0	Pressure	Pa
1	Pressure reduced to MSL	Pa
2	Pressure tendency	Pa s^{-1}
3	ICAO Standard Atmosphere Reference Height	m
4	Geopotential	m^2 s^{-2}
5	Geopotential height	gpm
6	Geometric height	m
7	Standard deviation of height	m
8	Pressure anomaly	Pa
9	Geopotential height anomaly	gpm
10	Density	kg m^{-3}
11	Altimeter setting	Pa
12	Thickness	m
13	Pressure altitude	m
14	Density altitude	m
15	5-wave geopotential height	gpm
16	Zonal flux of gravity wave stress	N m^{-2}
17	Meridional flux of gravity wave stress	N m^{-2}
18	Planetary boundary layer height	m
19	5-wave geopotential height anomaly	gpm
20	Standard deviation of sub-grid scale orography	m
21	Angle of sub-gridscale orography	rad
22	Slope of sub-gridscale orography	Numeric
23	Gravity wave dissipation	W m^{-2}
24	Anisotropy of sub-gridscale orography	Numeric
25	Natural logarithm of pressure in Pa	Numeric
26	Exner pressure	Numeric
27	Updraught mass flux	kg m^{-2} s^{-1}
28	Downdraught mass flux	kg m^{-2} s^{-1}
29	Updraught detrainment rate	kg m^{-3} s^{-1}
30	Downdraught detrainment rate	kg m^{-3} s^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
31	Unbalanced component of logarithm of surface pressure	–
32–191	Reserved	
192–254	Reserved for local use	
255	Missing	

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

Number	Parameter	Units
0	Net short-wave radiation flux (surface)*	W m^{-2}
1	Net short-wave radiation flux (top of atmosphere)*	W m^{-2}
2	Short-wave radiation flux*	W m^{-2}
3	Global radiation flux	W m^{-2}
4	Brightness temperature	K
5	Radiance (with respect to wave number)	W m^{-1} sr^{-1}
6	Radiance (with respect to wavelength)	W m^{-3} sr^{-1}
7	Downward short-wave radiation flux	W m^{-2}
8	Upward short-wave radiation flux	W m^{-2}
9	Net short wave radiation flux	W m^{-2}
10	Photosynthetically active radiation	W m^{-2}
11	Net short-wave radiation flux, clear sky	W m^{-2}
12	Downward UV radiation	W m^{-2}
13	Direct short-wave radiation flux	W m^{-2}
14	Diffuse short-wave radiation flux	W m^{-2}
15–49	Reserved	
50	UV index (under clear sky)**	Numeric
51	UV index**	Numeric
52	Downward short-wave radiation flux, clear sky	W m^{-2}
53	Upward short-wave radiation flux, clear sky	W m^{-2}
54–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** The Global Solar UVI is formulated using the International Commission on Illumination (CIE) reference action spectrum for UV-induced erythema on the human skin (ISO 17166:1999/CIE S 007/E-1998).

It is a measure of the UV radiation that is relevant to and defined for a horizontal surface. The UVI is a unitless quantity defined by the formula:

$$I_{UV} = k_{er} \cdot \int_{250nm}^{400nm} E_{\lambda} \cdot s_{er}(\lambda) d\lambda$$

where E_λ is the solar spectral irradiance expressed in W / (m^2·nanometre) at wavelength λ and dλ is the wavelength interval used in the summation. S_{er} λ is the erythema reference action spectrum, and k_{er} is a constant equal to 40 m^2 / W.

(continued)

(Code table 4.2 – continued)

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

Number	Parameter	Units
0	Net long-wave radiation flux (surface)*	W m^{-2}
1	Net long-wave radiation flux (top of atmosphere)*	W m^{-2}
2	Long-wave radiation flux*	W m^{-2}
3	Downward long-wave radiation flux	W m^{-2}
4	Upward long-wave radiation flux	W m^{-2}
5	Net long-wave radiation flux	W m^{-2}
6	Net long-wave radiation flux, clear sky	W m^{-2}
7	Brightness temperature	K
8	Downward long-wave radiation flux, clear sky	W m^{-2}
9–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

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

Number	Parameter	Units
0	Cloud ice	kg m^{-2}
1	Total cloud cover	%
2	Convective cloud cover	%
3	Low cloud cover	%
4	Medium cloud cover	%
5	High cloud cover	%
6	Cloud water	kg m^{-2}
7	Cloud amount	%
8	Cloud type	(Code table 4.203)
9	Thunderstorm maximum tops	m
10	Thunderstorm coverage	(Code table 4.204)
11	Cloud base	m
12	Cloud top	m
13	Ceiling	m
14	Non-convective cloud cover	%
15	Cloud work function	J kg^{-1}
16	Convective cloud efficiency	Proportion
17	Total condensate*	kg kg^{-1}
18	Total column-integrated cloud water*	kg m^{-2}
19	Total column-integrated cloud ice*	kg m^{-2}
20	Total column-integrated condensate*	kg m^{-2}
21	Ice fraction of total condensate	Proportion
22	Cloud cover	%
23	Cloud ice mixing ratio*	kg kg^{-1}
24	Sunshine	Numeric
25	Horizontal extent of cumulonimbus (CB)	%

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
26	Height of convective cloud base	m
27	Height of convective cloud top	m
28	Number of cloud droplets per unit mass of air	kg^{-1}
29	Number of cloud ice particles per unit mass of air	kg^{-1}
30	Number density of cloud droplets	m^{-3}
31	Number density of cloud ice particles	m^{-3}
32	Fraction of cloud cover	Numeric
33	Sunshine duration	s
34	Surface long-wave effective total cloudiness	Numeric
35	Surface short-wave effective total cloudiness	Numeric
36	Fraction of stratiform precipitation cover	Proportion
37	Fraction of convective precipitation cover	Proportion
38	Mass density of cloud droplets	kg m^{-3}
39	Mass density of cloud ice	kg m^{-3}
40	Mass density of convective cloud water droplets	kg m^{-3}
41–46	Reserved	
47	Volume fraction of cloud water droplets**	Numeric
48	Volume fraction of cloud ice particles**	Numeric
49	Volume fraction of cloud (ice and/or water)**	Numeric
50–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. Use another parameter in parameter category 1: moisture instead.

** The sum of the water and ice fractions may exceed the total due to overlap between the volumes containing ice and those containing liquid water.

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

Number	Parameter	Units
0	Parcel lifted index (to 500 hPa)	K
1	Best lifted index (to 500 hPa)	K
2	K index	K
3	KO index	K
4	Total totals index	K
5	Sweat index	Numeric
6	Convective available potential energy	J kg^{-1}
7	Convective inhibition	J kg^{-1}
8	Storm relative helicity	J kg^{-1}
9	Energy helicity index	Numeric
10	Surface lifted index	K
11	Best (4-layer) lifted index	K
12	Richardson number	Numeric
13	Showalter index	K
14	Reserved	

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
15	Updraught helicity	$m^2\ s^{-2}$
16	Bulk Richardson number	Numeric
17	Gradient Richardson number	Numeric
18	Flux Richardson number	Numeric
19	Convective available potential energy – shear	$m^2\ s^{-2}$
20–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 13: aerosols

Number	Parameter	Units
0	Aerosol type	(Code table 4.205)
1–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 14: trace gases

Number	Parameter	Units
0	Total ozone	DU
1	Ozone mixing ratio	$kg\ kg^{-1}$
2	Total column integrated ozone	DU
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 15: radar

Number	Parameter	Units
0	Base spectrum width	$m\ s^{-1}$
1	Base reflectivity	dB
2	Base radial velocity	$m\ s^{-1}$
3	Vertically integrated liquid water (VIL)	$kg\ m^{-2}$
4	Layer-maximum base reflectivity	dB
5	Precipitation	$kg\ m^{-2}$
6	Radar spectra (1)	–
7	Radar spectra (2)	–
8	Radar spectra (3)	–
9	Reflectivity of cloud droplets	dB
10	Reflectivity of cloud ice	dB
11	Reflectivity of snow	dB
12	Reflectivity of rain	dB
13	Reflectivity of graupel	dB
14	Reflectivity of hail	dB
15	Hybrid scan reflectivity	dB
16	Hybrid scan reflectivity height	m

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
17–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product Discipline 0 – Meteorological products, parameter category 16: forecast radar imagery

Number	Parameter	Units
0	Equivalent radar reflectivity factor for rain	$mm^6\ m^{-3}$
1	Equivalent radar reflectivity factor for snow	$mm^6\ m^{-3}$
2	Equivalent radar reflectivity factor for parameterized convection	$mm^6\ m^{-3}$
3	Echo top	m
4	Reflectivity	dB
5	Composite reflectivity	dB
6–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Note: Decibel (dB) is a logarithmic measure of the relative power, or of the relative values of two flux densities, especially of sound intensities and radio and radar power densities. In radar meteorology, the logarithmic scale (dBZ) is used for measuring radar reflectivity factor (obtained from the American Meteorological Society *Glossary of Meteorology*).

Product discipline 0 – Meteorological products, parameter category 17: electrodynamics

Number	Parameter	Units
0	Lightning strike density	$m^{-2}\ s^{-1}$
1	Lightning potential index (LPI) (see Note)	$J\ kg^{-1}$

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

Product discipline 0 – Meteorological products, parameter category 18: nuclear/radiology

Number	Parameter	Units
0	Air concentration of caesium 137	$Bq\ m^{-3}$
1	Air concentration of iodine 131	$Bq\ m^{-3}$
2	Air concentration of radioactive pollutant	$Bq\ m^{-3}$
3	Ground deposition of caesium 137	$Bq\ m^{-2}$
4	Ground deposition of iodine 131	$Bq\ m^{-2}$
5	Ground deposition of radioactive pollutant	$Bq\ m^{-2}$
6	Time-integrated air concentration of caesium pollutant (see Note 1)	$Bq\ s\ m^{-3}$
7	Time-integrated air concentration of iodine pollutant (see Note 1)	$Bq\ s\ m^{-3}$
8	Time-integrated air concentration of radioactive pollutant (see Note 1)	$Bq\ s\ m^{-3}$
9	Reserved	
10	Air concentration (see Note 2)	$Bq\ m^{-3}$
11	Wet deposition	$Bq\ m^{-2}$

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
12	Dry deposition	Bq m^{-2}
13	Total deposition (wet + dry)	Bq m^{-2}
14	Specific activity concentration (see Note 2)	Bq kg^{-1}
15	Maximum of air concentration in layer	Bq m^{-3}
16	Height of maximum air concentration	m
17	Column-integrated air concentration	Bq m^{-2}
18	Column-averaged air concentration in layer	Bq m^{-3}
19–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:
(1) Statistical process 1 (Accumulation) does not change units. It is recommended to use another parameter without the word “time-integrated” in its name and accumulation in PDT.
(2) Conversion factor between “Specific activity concentration” (14) and “Air concentration” (10) is “mass density” [kg m^{-3}].
(3) Parameters from 10 onward may be used in combination with product definition templates 4.40 – 4.43 and Common Code table C–14 (Code table 4.230) to represent any type of radioisotope.

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

Number	Parameter	Units
0	Visibility	m
1	Albedo	%
2	Thunderstorm probability	%
3	Mixed layer depth	m
4	Volcanic ash	(Code table 4.206)
5	Icing top	m
6	Icing base	m
7	Icing	(Code table 4.207)
8	Turbulence top	m
9	Turbulence base	m
10	Turbulence	(Code table 4.208)
11	Turbulent kinetic energy	J kg^{-1}
12	Planetary boundary-layer regime	(Code table 4.209)
13	Contrail intensity	(Code table 4.210)
14	Contrail engine type	(Code table 4.211)
15	Contrail top	m
16	Contrail base	m
17	Maximum snow albedo (see Note 1)	%
18	Snow free albedo	%
19	Snow albedo	%
20	Icing	%
21	In-cloud turbulence	%
22	Clear air turbulence (CAT)	%
23	Supercooled large droplet probability (see Note 2)	%
24	Convective turbulent kinetic energy	J kg^{-1}
25	Weather	(Code table 4.225)
26	Convective outlook	(Code table 4.224)

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
27	Icing scenario	(Code table 4.227)
28	Mountain wave turbulence (eddy dissipation rate)	$m^{2/3}\ s^{-1}$
29	Clear air turbulence (CAT)	$m^{2/3}\ s^{-1}$
30	Eddy dissipation parameter (see Note 3)	$m^{2/3}\ s^{-1}$
31	Maximum of eddy dissipation parameter in layer	$m^{2/3}\ s^{-1}$
32–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

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

(3) Eddy dissipation parameter is the third root of eddy dissipation rate [$m^2\ s^{-3}$].

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	Wet deposition by large-scale precipitation mass flux	$kg\ m^{-2}\ s^{-1}$
10	Wet deposition by convective precipitation mass flux	$kg\ m^{-2}\ s^{-1}$
11	Sedimentation mass flux	$kg\ m^{-2}\ s^{-1}$
12	Dry deposition mass flux	$kg\ m^{-2}\ s^{-1}$
13	Transfer from hydrophobic to hydrophilic	$kg\ kg^{-1}\ s^{-1}$
14	Transfer from SO_2 (sulphur dioxide) to SO_4 (sulphate)	$kg\ kg^{-1}\ s^{-1}$
15–49	Reserved	
50	Amount in atmosphere	mol
51	Concentration in air	$mol\ m^{-3}$
52	Volume mixing ratio (fraction in air)	$mol\ mol^{-1}$
53	Chemical gross production rate of concentration	$mol\ m^{-3}\ s^{-1}$
54	Chemical gross destruction rate of concentration	$mol\ m^{-3}\ s^{-1}$
55	Surface flux	$mol\ m^{-2}\ s^{-1}$
56	Changes of amount in atmosphere (see Note 1)	$mol\ s^{-1}$
57	Total yearly average burden of the atmosphere	mol

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
58	Total yearly averaged atmospheric loss (see Note 1)	mol s^{-1}
59	Aerosol number concentration (see Note 2)	m^{-3}
60	Aerosol specific number concentration (see Note 2)	kg^{-1}
61	Maximum of mass density in layer (see Note 1)	kg m^{-3}
62	Height of maximum mass density	m
63	Column-averaged mass density in layer	kg m^{-3}
64–99	Reserved	
100	Surface area density (aerosol)	m^{-1}
101	Vertical visual range	m
102	Aerosol optical thickness	Numeric
103	Single scattering albedo	Numeric
104	Asymmetry factor	Numeric
105	Aerosol extinction coefficient	m^{-1}
106	Aerosol absorption coefficient	m^{-1}
107	Aerosol lidar backscatter from satellite	m^{-1} sr^{-1}
108	Aerosol lidar backscatter from the ground	m^{-1} sr^{-1}
109	Aerosol lidar extinction from satellite	m^{-1}
110	Aerosol lidar extinction from the ground	m^{-1}
111	Angstrom exponent	Numeric
112–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) FirstFixedSurface and SecondFixedSurface of Code table 4.5 (Fixed surface types and units) to define the vertical extent, i.e. FirstFixedSurface can be set to 1 (Ground or water surface) and SecondFixedSurface set to 7 (Tropopause) for a restriction to the troposphere.

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

Product discipline 0 – Meteorological products, parameter category 190: CCITT IA5 string

Number	Parameter	Units
0	Arbitrary text string	CCITT IA5
1–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 0 – Meteorological products, parameter category 191: miscellaneous

Number	Parameter	Units
0	Seconds prior to initial reference time (defined in Section 1)	s
1	Geographical latitude	°N
2	Geographical longitude	°E
3	Days since last observation	d
4–191	Reserved	

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
192–254	Reserved for local use	
255	Missing	

Product discipline 1 – Hydrological products, parameter category 0: hydrology basic products

Number	Parameter	Units
0	Flash flood guidance (Encoded as an accumulation over a floating subinterval of time between the reference time and valid time)	kg m^{-2}
1	Flash flood runoff (Encoded as an accumulation over a floating subinterval of time)	kg m^{-2}
2	Remotely sensed snow cover	(Code table 4.215)
3	Elevation of snow-covered terrain	(Code table 4.216)
4	Snow water equivalent per cent of normal	%
5	Baseflow-groundwater runoff	kg m^{-2}
6	Storm surface runoff	kg m^{-2}
7	Discharge from rivers or streams	m^3 s^{-1}
8	Groundwater upper storage	kg m^{-2}
9	Groundwater lower storage	kg m^{-2}
10	Side flow into river channel	m^3 s^{-1} m^{-1}
11	River storage of water	m^3
12	Floodplain storage of water	m^3
13	Depth of water on soil surface	kg m^{-2}
14	Upstream accumulated precipitation	kg m^{-2}
15	Upstream accumulated snow melt	kg m^{-2}
16	Percolation rate	kg m^{-2} s^{-1}
17–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) Remotely sensed snow cover is expressed as a field of dimensionless, thematic values. The currently accepted values are for no-snow/no-cloud, 50, for clouds, 100, and for snow, 250 (see Code table 4.215).

(2) A data field representing snow coverage by elevation portrays at which elevations there is a snow pack. The elevation values typically range from 0 to 90 in 100-metre increments. A value of 253 is used to represent a no-snow/no-cloud data point. A value of 254 is used to represent a data point at which snow elevation could not be estimated because of clouds obscuring the remote sensor (when using aircraft or satellite measurements).

(3) Snow water equivalent per cent of normal is stored in per cent of normal units. For example, a value of 110 indicates 110 per cent of the normal snow water equivalent for a given depth of snow.

Product discipline 1 – Hydrological products, parameter category 1: hydrology probabilities

Number	Parameter	Units
0	Conditional per cent precipitation amount fractile for an overall period (Encoded as an accumulation)	kg m^{-2}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
1	Per cent precipitation in a sub-period of an overall period (Encoded as per cent accumulation over the sub-period)	%
2	Probability of 0.01 inch of precipitation (POP)	%
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 1 – Hydrological products, parameter category 2: inland water and sediment properties

Number	Parameter	Units
0	Water depth	m
1	Water temperature	K
2	Water fraction	Proportion
3	Sediment thickness	m
4	Sediment temperature	K
5	Ice thickness	m
6	Ice temperature	K
7	Ice cover	Proportion
8	Land cover (0 = water, 1 = land)	Proportion
9	Shape factor with respect to salinity profile	–
10	Shape factor with respect to temperature profile in thermocline	–
11	Attenuation coefficient of water with respect to solar radiation	m^{-1}
12	Salinity	kg kg^{-1}
13	Cross-sectional area of flow in channel	m^2

Product discipline 2 – Land surface products, parameter category 0: vegetation/biomass

Number	Parameter	Units
0	Land cover (0 = sea, 1 = land)	Proportion
1	Surface roughness	m
2	Soil temperature***	K
3	Soil moisture content*	kg m^{-2}
4	Vegetation	%
5	Water runoff	kg m^{-2}
6	Evapotranspiration	kg^{-2} s^{-1}
7	Model terrain height	m
8	Land use	(Code table 4.212)
9	Volumetric soil moisture content**	Proportion
10	Ground heat flux*	W m^{-2}
11	Moisture availability	%
12	Exchange coefficient	kg m^{-2} s^{-1}
13	Plant canopy surface water	kg m^{-2}
14	Blackadar's mixing length scale	m

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
15	Canopy conductance	m s^{-1}
16	Minimal stomatal resistance	s m^{-1}
17	Wilting point*	Proportion
18	Solar parameter in canopy conductance	Proportion
19	Temperature parameter in canopy	Proportion
20	Humidity parameter in canopy conductance	Proportion
21	Soil moisture parameter in canopy conductance	Proportion
22	Soil moisture***	kg m^{-3}
23	Column-integrated soil water***	kg m^{-2}
24	Heat flux	W m^{-2}
25	Volumetric soil moisture	m^3 m^{-3}
26	Wilting point	kg m^{-3}
27	Volumetric wilting point	m^3 m^{-3}
28	Leaf area index	Numeric
29	Evergreen forest cover	Proportion
30	Deciduous forest cover	Proportion
31	Normalized differential vegetation index (NDVI)	Numeric
32	Root depth of vegetation	m
33	Water runoff and drainage****	kg m^{-2}
34	Surface water runoff****	kg m^{-2}
35	Tile class	Code table 4.243
36	Tile fraction	Proportion
37	Tile percentage	%
38	Soil volumetric ice content (water equivalent) (see Note)	m^3 m^{-3}
39–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Note: For parameter 38 (Parameter category 0), ice volume is expressed as if the ice content were melted to liquid water and then its volume measured in the liquid state. This may be understood in the same manner as water equivalent snow depth.

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** It is recommended not to use this parameter, but another one with a more descriptive unit.

*** Parameter deprecated. Use another parameter in parameter category 3: soil products instead.

**** Statistical process 1 (Accumulation) does not change units.

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

Number	Parameter	Units
0	Soil type	(Code table 4.213)
1	Upper layer soil temperature*	K
2	Upper layer soil moisture*	kg m^{-3}
3	Lower layer soil moisture*	kg m^{-3}
4	Bottom layer soil temperature*	K
5	Liquid volumetric soil moisture (non-frozen)**	Proportion

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
6	Number of soil layers in root zone	Numeric
7	Transpiration stress-onset (soil moisture)**	Proportion
8	Direct evaporation cease (soil moisture)**	Proportion
9	Soil porosity**	Proportion
10	Liquid volumetric soil moisture (non-frozen)	$m^3\ m^{-3}$
11	Volumetric transpiration stress-onset (soil moisture)	$m^3\ m^{-3}$
12	Transpiration stress-onset (soil moisture)	$kg\ m^{-3}$
13	Volumetric direct evaporation cease (soil moisture)	$m^3\ m^{-3}$
14	Direct evaporation cease (soil moisture)	$kg\ m^{-3}$
15	Soil porosity	$m^3\ m^{-3}$
16	Volumetric saturation of soil moisture	$m^3\ m^{-3}$
17	Saturation of soil moisture	$kg\ m^{-3}$
18	Soil temperature	K
19	Soil moisture	$kg\ m^{-3}$
20	Column-integrated soil moisture	$kg\ m^{-2}$
21	Soil ice	$kg\ m^{-3}$
22	Column-integrated soil ice	$kg\ m^{-2}$
23	Liquid water in snow pack	$kg\ m^{-2}$
24	Frost index	$K\ day^{-1}$
25	Snow depth at elevation bands	$kg\ m^{-2}$
26	Soil heat flux	$W\ m^{-2}$
27	Soil depth	m
28–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Parameter deprecated. See Regulation 92.6.2 and use another parameter instead.

** It is recommended not to use this parameter, but another one with a more descriptive unit.

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

Number	Parameter	Units
0	Fire outlook	Code table 4.224
1	Fire outlook due to dry thunderstorm	Code table 4.224
2	Haines index	Numeric
3	Fire burned area	%
4	Fosberg index*	Numeric
5	Forest Fire Weather Index (Canadian Forest Service)	Numeric
6	Fine Fuel Moisture Code (Canadian Forest Service)	Numeric
7	Duff Moisture Code (Canadian Forest Service)	Numeric
8	Drought Code (Canadian Forest Service)	Numeric
9	Initial Fire Spread Index (Canadian Forest Service)	Numeric
10	Fire Buildup Index (Canadian Forest Service)	Numeric
11	Fire Daily Severity Rating (Canadian Forest Service)	Numeric
12–191	Reserved	

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
192–254	Reserved for local use	
255	Missing	

* The Fosberg index denotes the potential influence of weather on a wildland fire. It takes into account the combined effects of temperature, wind speed, relative humidity and precipitation. Higher values indicate a higher potential impact.

Product discipline 2 – Land surface products, parameter category 5: glaciers and inland ice

Number	Parameter	Units
1	Glacier temperature	K

Product discipline 3 – Space products, parameter category 0: image format products

Number	Parameter	Units
0	Scaled radiance	Numeric
1	Scaled albedo	Numeric
2	Scaled brightness temperature	Numeric
3	Scaled precipitable water	Numeric
4	Scaled lifted index	Numeric
5	Scaled cloud top pressure	Numeric
6	Scaled skin temperature	Numeric
7	Cloud mask	Code table 4.217
8	Pixel scene type	Code table 4.218
9	Fire detection indicator	Code table 4.223
10–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 3 – Space products, parameter category 1: quantitative products

Number	Parameter	Units
0	Estimated precipitation	kg m^{-2}
1	Instantaneous rain rate	kg m^{-2} s^{-1}
2	Cloud top height	m
3	Cloud top height quality indicator	Code table 4.219
4	Estimated u-component of wind	m s^{-1}
5	Estimated v-component of wind	m s^{-1}
6	Number of pixel used	Numeric
7	Solar zenith angle	°
8	Relative azimuth angle	°
9	Reflectance in 0.6 micron channel	%
10	Reflectance in 0.8 micron channel	%
11	Reflectance in 1.6 micron channel	%
12	Reflectance in 3.9 micron channel	%
13	Atmospheric divergence	s^{-1}
14	Cloudy brightness temperature	K
15	Clear-sky brightness temperature	K
16	Cloudy radiance (with respect to wave number)	W m^{-1} sr^{-1}

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
17	Clear-sky radiance (with respect to wave number)	W m^{-1} sr^{-1}
18	Reserved	
19	Wind speed	m s^{-1}
20	Aerosol optical thickness at 0.635 μm	
21	Aerosol optical thickness at 0.810 μm	
22	Aerosol optical thickness at 1.640 μm	
23	Angstrom coefficient	
24–26	Reserved	
27	Bidirectional reflectance factor (see Note 1)	numeric
28	Brightness temperature	K
29	Scaled radiance (see Note 2)	numeric
30–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) The ratio of the radiant flux reflected by a surface to that reflected into the same reflected-beam geometry and wavelength range by an ideal (lossless) and diffuse (Lambertian) standard surface, irradiated under the same conditions.

(2) Top of atmosphere radiance observed by a sensor, multiplied by pi and divided by the in-band solar irradiance.

Product discipline 3 – Space products, parameter category 2: cloud properties

Number	Parameter	Units
0	Clear sky probability	%
1	Cloud top temperature	K
2	Cloud top pressure	Pa
3	Cloud type	Code table 4.218
4	Cloud phase	Code table 4.218
5	Cloud optical depth	Numeric
6	Cloud particle effective radius	m
7	Cloud liquid water path	kg m^{-2}
8	Cloud ice water path	kg m^{-2}
9	Cloud albedo	Numeric
10	Cloud emissivity	Numeric
11	Effective absorption optical depth ratio	Numeric

Product discipline 3 – Space products, parameter category 3: flight rule conditions

Number	Parameter	Units
0	Probability of encountering marginal visual flight rule conditions	%
1	Probability of encountering low instrument flight rule conditions	%
2	Probability of encountering instrument flight rule conditions	%

(continued)

(Code table 4.2 – continued)

Product discipline 3 – Space products, parameter category 4: volcanic ash

Number	Parameter	Units
0	Volcanic ash probability	%
1	Volcanic ash cloud top temperature	K
2	Volcanic ash cloud top pressure	Pa
3	Volcanic ash cloud top height	m
4	Volcanic ash cloud emissivity	Numeric
5	Volcanic ash effective absorption optical depth ratio	Numeric
6	Volcanic ash cloud optical depth	Numeric
7	Volcanic ash column density	kg m^{-2}
8	Volcanic ash particle effective radius	m

Product discipline 3 – Space products, parameter category 5: sea-surface temperature

Number	Parameter	Units
0	Interface sea-surface temperature (see Note 1)	K
1	Skin sea-surface temperature (see Note 2)	K
2	Sub-skin sea-surface temperature (see Note 3)	K
3	Foundation sea-surface temperature (see Note 4)	K
4	Estimated bias between sea-surface temperature and standard	K
5	Estimated standard deviation between sea-surface temperature and standard	K

Notes:

(1) Theoretical temperature at the precise air-sea interface.

(2) Temperature of the water across a very small depth (approximately the upper 20 micrometers).

(3) Temperature at the base of the thermal skin layer.

(4) Temperature of the water column free of diurnal temperature variability or equal to the SST sub-skin in the absence of any diurnal signal.

Product discipline 3 – Space products, parameter category 6: solar radiation

Number	Parameter	Units
0	Global solar irradiance (see Note 1)	W m^{-2}
1	Global solar exposure (see Note 2)	J m^{-2}
2	Direct solar irradiance (see Note 3)	W m^{-2}
3	Direct solar exposure (see Note 4)	J m^{-2}
4	Diffuse solar irradiance (see Note 5)	W m^{-2}
5	Diffuse solar exposure (see Note 6)	J m^{-2}

Notes:

(1) The solar flux per unit area received from a solid angle of 2π sr on a horizontal surface.

(2) Time integral of global solar irradiance.

(3) The solar flux per unit area received from the solid angle of the sun’s disc on a surface normal to the sun direction.

(4) Time integral of direct solar irradiance.

(5) The solar flux per unit area received from a solid angle of 2π sr, except for the solid angle of the sun's disc, on a horizontal surface.

(6) Time integral of diffuse solar irradiance.

(continued)

(Code table 4.2 – continued)

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

Number	Parameter	Units
0	Wave spectra (1)	–
1	Wave spectra (2)	–
2	Wave spectra (3)	–
3	Significant height of combined wind waves and swell	m
4	Direction of wind waves	degree true
5	Significant height of wind waves	m
6	Mean period of wind waves	s
7	Direction of swell waves	degree true
8	Significant height of swell waves	m
9	Mean period of swell waves	s
10	Primary wave direction	degree true
11	Primary wave mean period	s
12	Secondary wave direction	degree true
13	Secondary wave mean period	s
14	Direction of combined wind waves and swell	degree true
15	Mean period of combined wind waves and swell	s
16	Coefficient of drag with waves	–
17	Friction velocity	$m\ s^{-1}$
18	Wave stress	$N\ m^{-2}$
19	Normalized wave stress	–
20	Mean square slope of waves	–
21	u-component surface Stokes drift	$m\ s^{-1}$
22	v-component surface Stokes drift	$m\ s^{-1}$
23	Period of maximum individual wave height	s
24	Maximum individual wave height	m
25	Inverse mean wave frequency	s
26	Inverse mean frequency of wind waves	s
27	Inverse mean frequency of total swell	s
28	Mean zero-crossing wave period	s
29	Mean zero-crossing period of wind waves	s
30	Mean zero-crossing period of total swell	s
31	Wave directional width	–
32	Directional width of wind waves	–
33	Directional width of total swell	–
34	Peak wave period	s
35	Peak period of wind waves	s
36	Peak period of total swell	s
37	Altimeter wave height	m
38	Altimeter corrected wave height	m
39	Altimeter range relative correction	–
40	10-metre neutral wind speed over waves	m s–1
41	10-metre wind direction over waves	°
42	Wave energy spectrum	$m^2\ s\ rad^{-1}$

(continued)

(Code table 4.2 – continued)

Number	Parameter	Units
43	Kurtosis of the sea-surface elevation due to waves	–
44	Benjamin–Feir index	–
45	Spectral peakedness factor	s^{-1}
46–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Further information concerning the wave parameters can be found in the *Guide to Wave Analysis and Forecasting* (WMO-No. 702).

Product discipline 10 – Oceanographic products, parameter category 1: currents

Number	Parameter	Units
0	Current direction	degree true
1	Current speed	m s^{-1}
2	u-component of current	m s^{-1}
3	v-component of current	m s^{-1}
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 2: ice

Number	Parameter	Units
0	Ice cover	Proportion
1	Ice thickness	m
2	Direction of ice drift	degree true
3	Speed of ice drift	m s^{-1}
4	u-component of ice drift	m s^{-1}
5	v-component of ice drift	m s^{-1}
6	Ice growth rate	m s^{-1}
7	Ice divergence	s^{-1}
8	Ice temperature	K
9	Module of ice internal pressure*	Pa m
10	Zonal vector component of vertically integrated ice internal pressure	Pa m
11	Meridional vector component of vertically integrated ice internal pressure	Pa m
12	Compressive ice strength	N m^{-1}
13–191	Reserved	
192–254	Reserved for local use	
255	Missing	

* Ice internal pressure or stress (Pa m) is the integrated pressure across the vertical thickness of a layer of ice. It is produced when concentrated ice reacts to external forces such as wind and ocean currents.

(continued)

(Code table 4.2 – continued)

Product discipline 10 – Oceanographic products, parameter category 3: surface properties

Number	Parameter	Units
0	Water temperature	K
1	Deviation of sea level from mean	m
2	Heat exchange coefficient	–
3–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 4: subsurface properties

Number	Parameter	Units
0	Main thermocline depth	m
1	Main thermocline anomaly	m
2	Transient thermocline depth	m
3	Salinity	kg kg^{-1}
4	Ocean vertical heat diffusivity	m^2 s^{-1}
5	Ocean vertical salt diffusivity	m^2 s^{-1}
6	Ocean vertical momentum diffusivity	m^2 s^{-1}
7	Bathymetry	m
8–10	Reserved	
11	Shape factor with respect to salinity profile	–
12	Shape factor with respect to temperature profile in thermocline	–
13	Attenuation coefficient of water with respect to solar radiation	m^{-1}
14	Water depth	m
15	Water temperature	K
16–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Product discipline 10 – Oceanographic products, parameter category 191: miscellaneous

Number	Parameter	Units
0	Seconds prior to initial reference time (defined in Section 1)	s
1	Meridional overturning stream function	m^3 s^{-1}
2	Reserved	
3	Days since last observation	d
4–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Code table 4.3 – *Type of generating process*

Code figure	Meaning
0	Analysis
1	Initialization
2	Forecast
3	Bias corrected forecast
4	Ensemble forecast
5	Probability forecast
6	Forecast error
7	Analysis error
8	Observation
9	Climatological
10	Probability-weighted forecast
11	Bias-corrected ensemble forecast
12	Post-processed analysis (see Note)
13	Post-processed forecast (see Note)
14	Nowcast
15	Hindcast
16	Physical retrieval
17	Regression analysis
18	Difference between two forecasts
19–191	Reserved
192–254	Reserved for local use
255	Missing

Note: Code figures 12 and 13 are intended in cases where code figures 0 and 2 may not be sufficient to indicate that significant post-processing has taken place on an initial analysis or forecast output.

Code table 4.4 – *Indicator of unit of time range*

Code figure	Meaning
0	Minute
1	Hour
2	Day
3	Month
4	Year
5	Decade (10 years)
6	Normal (30 years)
7	Century (100 years)
8–9	Reserved
10	3 hours
11	6 hours
12	12 hours
13	Second
14–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.5 – *Fixed surface types and units*

Code figure	Meaning	Unit
0	Reserved	
1	Ground or water surface	–
2	Cloud base level	–
3	Level of cloud tops	–
4	Level of 0 °C isotherm	–
5	Level of adiabatic condensation lifted from the surface	–
6	Maximum wind level	–
7	Tropopause	–
8	Nominal top of the atmosphere	–
9	Sea bottom	–
10	Entire atmosphere	–
11	Cumulonimbus (CB) base	m
12	Cumulonimbus (CB) top	m
13	Lowest level where vertically integrated cloud cover exceeds the specified percentage (cloud base for a given percentage cloud cover)	%
14	Level of free convection (LFC)	–
15	Convective condensation level (CCL)	–
16	Level of neutral buoyancy or equilibrium level (LNB)	–
17–19	Reserved	
20	Isothermal level	K
21	Lowest level where mass density exceeds the specified value (base for a given threshold of mass density)	kg m^{-3}
22	Highest level where mass density exceeds the specified value (top for a given threshold of mass density)	kg m^{-3}
23	Lowest level where air concentration exceeds the specified value (base for a given threshold of air concentration)	Bq m^{-3}
24	Highest level where air concentration exceeds the specified value (top for a given threshold of air concentration)	Bq m^{-3}
25–99	Reserved	
100	Isobaric surface	Pa
101	Mean sea level	
102	Specific altitude above mean sea level	m
103	Specified height level above ground	m
104	Sigma level	“sigma” value
105	Hybrid level	–
106	Depth below land surface	m
107	Isentropic (theta) level	K
108	Level at specified pressure difference from ground to level	Pa
109	Potential vorticity surface	K m^2 kg^{-1} s^{-1}
110	Reserved	
111	Eta level	–
112	Reserved	
113	Logarithmic hybrid level	
114	Snow level	Numeric
115	Sigma height level (see Note 4)	–
116	Reserved	

(continued)

(Code table 4.5 – continued)

Code figure	Meaning	Unit
117	Mixed layer depth	m
118	Hybrid height level	–
119	Hybrid pressure level	–
120–149	Reserved	
150	Generalized vertical height coordinate (see Note 5)	–
151	Soil level (see Note 6)	Numeric
152–159	Reserved	
160	Depth below sea level	m
161	Depth below water surface	m
162	Lake or river bottom	–
163	Bottom of sediment layer	–
164	Bottom of thermally active sediment layer	–
165	Bottom of sediment layer penetrated by thermal wave	–
166	Mixing layer	–
167	Bottom of root zone	–
168–173	Reserved	
174	Top surface of ice on sea, lake or river	–
175	Top surface of ice, under snow cover, on sea, lake or river	–
176	Bottom surface (underside) ice on sea, lake or river	–
177	Deep soil (of indefinite depth)	–
178	Reserved	
179	Top surface of glacier ice and inland ice	–
180	Deep inland or glacier ice (of indefinite depth)	–
181	Grid tile land fraction as a model surface	–
182	Grid tile water fraction as a model surface	–
183	Grid tile ice fraction on sea, lake or river as a model surface	–
184	Grid tile glacier ice and inland ice fraction as a model surface	–
185–191	Reserved	
192–254	Reserved for local use	
255	Missing	

Notes:

(1) The Eta vertical coordinate system involves normalizing the pressure at some point on a specific level by the mean sea level pressure at that point.

(2) Hybrid height level (Code figure 118) can be defined as:
$z(k) = A(k) + B(k) \times orog$
(k = 1,...,NLevels; orog = orography; z(k) = height in metres at level k)

(3) Hybrid pressure level, for which Code figure 119 shall be used instead of 105, can be defined as:
$p(k) = A(k) + B(k) \times sp$
(k = 1,...,NLevels; sp = surface pressure; p(k) = pressure at level k)

(4) Sigma height level is the vertical model level of the height-based terrain-following coordinate (Gal-Chen and Somerville, 1975). The value of the level = (height of the level – height of the terrain) / (height of the top level – height of the terrain), which is ≥ 0 and ≤ 1.

(5) The definition of a generalized vertical height coordinate implies the absence of coordinate values in Section 4 but the presence of an external 3D-GRIB message that specifies the height of every model grid point in metres (see Notes to Section 4 in the section above entitled Specification of Octet Contents), i.e., this GRIB message will contain the field with discipline = 0, category = 3, parameter = 6 (Geometric height).

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

Code table 4.6 – *Type of ensemble forecast*

Code figure	Meaning
0	Unperturbed high-resolution control forecast
1	Unperturbed low-resolution control forecast
2	Negatively perturbed forecast
3	Positively perturbed forecast
4	Multi-model forecast
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.7 – *Derived forecast*

Code figure	Meaning
0	Unweighted mean of all members
1	Weighted mean of all members
2	Standard deviation with respect to cluster mean
3	Standard deviation with respect to cluster mean, normalized
4	Spread of all members
5	Large anomaly index of all members (see Note 1)
6	Unweighted mean of the cluster members
7	Interquartile range (range between the 25th and 75th quantile)
8	Minimum of all ensemble members (see Note 2)
9	Maximum of all ensemble members (see Note 2)
10–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) Large anomaly index is defined as {(number of members whose anomaly is higher than 0.5 x SD) – (number of members whose anomaly is lower than –0.5 x SD)} / (number of members) at each grid point, where SD is defined as observed climatological standard deviation.

(2) It should be noted that the reference for "minimum of all ensemble members" and "maximum of all ensemble members" is the set of ensemble members and not a time interval and should not be confused with the maximum and minimum described by PDT 4.8.

Code table 4.8 – *Clustering method*

Code figure	Meaning
0	Anomaly correlation
1	Root mean square
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.9 – *Probability type*

Code figure	Meaning
0	Probability of event below lower limit
1	Probability of event above upper limit
2	Probability of event between lower and upper limits (the range includes the lower limit but not the upper limit)
3	Probability of event above lower limit
4	Probability of event below upper limit
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.10 – *Type of statistical processing*

Code figure	Meaning
0	Average
1	Accumulation (see Note 1)
2	Maximum
3	Minimum
4	Difference (value at the end of time range minus value at the beginning)
5	Root mean square
6	Standard deviation
7	Covariance (temporal variance) (see Note 2)
8	Difference (value at the start of time range minus value at the end)
9	Ratio (see Note 3)
10	Standardized anomaly
11	Summation
12–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) The original data value (Y in the note 4 of Regulation 92.9.4) has units of Code table 4.2 multiplied by second, unless otherwise noted on Code table 4.2.

(2) The original data value has squared units of Code table 4.2.

(3) The original data value is non-dimensional number without units.

Code table 4.11 – *Type of time intervals*

Code figure	Meaning
0	Reserved
1	Successive times processed have same forecast time, start time of forecast is incremented
2	Successive times processed have same start time of forecast, forecast time is incremented
3	Successive times processed have start time of forecast incremented and forecast time decremented so that valid time remains constant
4	Successive times processed have start time of forecast decremented and forecast time incremented so that valid time remains constant
5	Floating subinterval of time between forecast time and end of overall time interval*
6–191	Reserved
192–254	Reserved for local use
255	Missing

* Code figure 5 applies to instances where a single time subinterval was used to calculate the statistically processed field. The exact starting and ending times of the subinterval are not given, but it is known that it is contained inclusively between the beginning time and the ending time of the overall interval.

Code table 4.12 – *Operating mode*

Code figure	Meaning
0	Maintenance mode
1	Clear air
2	Precipitation
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.13 – *Quality control indicator*

Code figure	Meaning
0	No quality control applied
1	Quality control applied
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.14 – *Clutter filter indicator*

Code figure	Meaning
0	No clutter filter used
1	Clutter filter used
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.15 – *Type of spatial processing used to arrive at given data value from the source data*

Code figure	Meaning
0	Data is calculated directly from the source grid with no interpolation (see Note 1)
1	Bilinear interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
2	Bicubic interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
3	Using the value from the source grid grid-point which is nearest to the nominal grid-point
4	Budget interpolation using the 4 source grid grid-point values surrounding the nominal grid-point (see Note 2)
5	Spectral interpolation using the 4 source grid grid-point values surrounding the nominal grid-point
6	Neighbor-budget interpolation using the 4 source grid grid-point values surrounding the nominal grid-point (see Note 3)
7–191	Reserved
192–254	Reserved for local use
255	Missing

Notes:

(1) This method assumes that each field really represents box averages/maxima/minima where each box extends halfway to its neighboring grid point in each direction to represent averages/maxima/minima of values from the source grid with no interpolation.

(2) Budget interpolation means a low-order interpolation method that quasi-conserves area averages. It would be appropriate for interpolating budget fields such as precipitation. This method assumes that the field really represents box averages/maxima/minima where each box extends halfway to its neighboring grid point in each direction. The method actually averages bilinearly interpolated values in a square array of points distributed within each output grid box.

(3) Performs a budget interpolation at the grid point nearest to the nominal grid point.

Code table 4.91 – *Type of Interval*

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

Code table 4.201 – *Precipitation type*

Code figure	Meaning
0	Reserved
1	Rain
2	Thunderstorm
3	Freezing rain
4	Mixed/ice
5	Snow
6	Wet snow
7	Mixture of rain and snow
8	Ice pellets
9	Graupel
10	Hail
11–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.202 – *Precipitable water category*

Code figure	Meaning
0–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.203 – *Cloud type*

Code figure	Meaning
0	Clear
1	Cumulonimbus
2	Stratus
3	Stratocumulus
4	Cumulus
5	Altostratus
6	Nimbostratus
7	Altocumulus
8	Cirrostratus
9	Cirrocumulus
10	Cirrus
11	Cumulonimbus – ground-based fog beneath the lowest layer
12	Stratus – ground-based fog beneath the lowest layer
13	Stratocumulus – ground-based fog beneath the lowest layer
14	Cumulus – ground-based fog beneath the lowest layer
15	Altostratus – ground-based fog beneath the lowest layer
16	Nimbostratus – ground-based fog beneath the lowest layer
17	Altocumulus – ground-based fog beneath the lowest layer
18	Cirrostratus – ground-based fog beneath the lowest layer
19	Cirrocumulus – ground-based fog beneath the lowest layer
20	Cirrus – ground-based fog beneath the lowest layer

(continued)

(Code table 4.203 – continued)

Code figure	Meaning
21–190	Reserved
191	Unknown
192–254	Reserved for local use
255	Missing

Note: Code figures 11–20 indicate all four layers were used and ground-based fog is beneath the lowest layer.

Code table 4.204 – *Thunderstorm coverage*

Code figure	Meaning
0	None
1	Isolated (1–2%)
2	Few (3–5%)
3	Scattered (6–45%)
4	Numerous (> 45%)
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.205 – *Presence of aerosol*

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

Code table 4.206 – *Volcanic ash*

Code figure	Meaning
0	Not present
1	Present
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.207 – *Icing*

Code figure	Meaning
0	None
1	Light
2	Moderate
3	Severe
4	Trace
5	Heavy

(continued)

(Code table 4.207 – continued)

Code figure	Meaning
6–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.208 – *Turbulence*

Code figure	Meaning
0	None (smooth)
1	Light
2	Moderate
3	Severe
4	Extreme
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.209 – *Planetary boundary-layer regime*

Code figure	Meaning
0	Reserved
1	Stable
2	Mechanically driven turbulence
3	Forced convection
4	Free convection
5–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.210 – *Contrail intensity*

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

Code table 4.211 – *Contrail engine type*

Code figure	Meaning
0	Low bypass
1	High bypass
2	Non-bypass
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.212 – *Land use*

Code figure	Meaning
0	Reserved
1	Urban land
2	Agriculture
3	Range land
4	Deciduous forest
5	Coniferous forest
6	Forest/wetland
7	Water
8	Wetlands
9	Desert
10	Tundra
11	Ice
12	Tropical forest
13	Savannah
14–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.213 – *Soil type*

Code figure	Meaning
0	Reserved
1	Sand
2	Loamy sand
3	Sandy loam
4	Silt loam
5	Organic (redefined)
6	Sandy clay loam
7	Silt clay loam
8	Clay loam
9	Sandy clay
10	Silty clay
11	Clay
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.215 – *Remotely sensed snow coverage*

Code figure	Meaning
0–49	Reserved
50	No-snow/no-cloud
51–99	Reserved
100	Clouds
101–249	Reserved
250	Snow

(continued)

(Code table 4.215 – continued)

Code figure	Meaning
251–254	Reserved for local use
255	Missing

Code table 4.216 – *Elevation of snow-covered terrain*

Code figure	Meaning
0–90	Elevation in increments of 100 m
91–253	Reserved
254	Clouds
255	Missing

Code table 4.217 – *Cloud mask type*

Code figure	Meaning
0	Clear over water
1	Clear over land
2	Cloud
3	No data
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.218 – *Pixel scene type*

Code figure	Meaning
0	No scene identified
1	Green needle-leafed forest
2	Green broad-leafed forest
3	Deciduous needle-leafed forest
4	Deciduous broad-leafed forest
5	Deciduous mixed forest
6	Closed shrub-land
7	Open shrub-land
8	Woody savannah
9	Savannah
10	Grassland
11	Permanent wetland
12	Cropland
13	Urban
14	Vegetation/crops
15	Permanent snow/ice
16	Barren desert
17	Water bodies
18	Tundra
19	Warm liquid water cloud

(continued)

(Code table 4.218 – continued)

Code figure	Meaning
20	Supercooled liquid water cloud
21	Mixed-phase cloud
22	Optically thin ice cloud
23	Optically thick ice cloud
24	Multilayered cloud
25–96	Reserved
97	Snow/ice on land
98	Snow/ice on water
99	Sun-glint
100	General cloud
101	Low cloud/fog/Stratus
102	Low cloud/Stratocumulus
103	Low cloud/unknown type
104	Medium cloud/Nimbostratus
105	Medium cloud/Altostratus
106	Medium cloud/unknown type
107	High cloud/Cumulus
108	High cloud/Cirrus
109	High cloud/unknown
110	Unknown cloud type
111–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.219 – *Cloud top height quality indicator*

Code figure	Meaning
0	Nominal cloud top height quality
1	Fog in segment
2	Poor quality height estimation
3	Fog in segment and poor quality height estimation
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.220 – *Horizontal dimension processed*

Code figure	Meaning
0	Latitude
1	Longitude
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.221 – *Treatment of missing data*

Code figure	Meaning
0	Not included
1	Extrapolated
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.222 – *Categorical result*

Code figure	Meaning
0	No
1	Yes
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 4.223 – *Fire detection indicator*

Code figure	Meaning
0	No fire detected
1	Possible fire detected
2	Probable fire detected
3	Missing

Code table 4.224 – *Categorical outlook*

Code figure	Meaning
0	No risk area
1	Reserved
2	General thunderstorm risk area
3	Reserved
4	Slight risk area
5	Reserved
6	Moderate risk area
7	Reserved
8	High risk area
9–10	Reserved
11	Dry thunderstorm (dry lightning) risk area
12–13	Reserved
14	Critical risk area
15–17	Reserved
18	Extremely critical risk area
19–254	Reserved
255	Missing

Code table 4.225 – *Weather*

(see FM 94 BUFR/FM 95 CREX Code table 0 20 003 – Present weather)

Code table 4.227 – *Icing scenario (weather/cloud classification)*

Code figure	Meaning
0	None
1	General
2	Convective
3	Stratiform
4	Freezing
5–191	Reserved
192–254	Reserved for local use
255	Missing value

Code table 4.230 – *Atmospheric chemical constituent type*

(See Common Code table C–14)

Code table 4.233 – *Aerosol type*

(See Common Code table C–14)

Code table 4.234 – *Canopy cover fraction (to be used as partitioned parameter in product definition template 4.53 or 4.54)*

Code figure	Meaning
1	Crops, mixed farming
2	Short grass
3	Evergreen needleleaf trees
4	Deciduous needleleaf trees
5	Deciduous broadleaf trees
6	Evergreen broadleaf trees
7	Tall grass
8	Desert
9	Tundra
10	Irrigated crops
11	Semidesert
12	Ice caps and glaciers
13	Bogs and marshes
14	Inland water
15	Ocean
16	Evergreen shrubs
17	Deciduous shrubs
18	Mixed forest
19	Interrupted forest
20	Water and land mixtures

Code table 4.236 – *Soil texture fraction (to be used as partitioned parameter in product definition template 4.53 or 4.54)*

Code figure	Meaning
1	Coarse
2	Medium
3	Medium-fine
4	Fine
5	Very-fine
6	Organic
7	Tropical-organic

Code table 4.240 – *Type of distribution function*

Code figure	Meaning
0	No specific distribution function given
1	Delta functions with spatially variable concentration and fixed diameters D_l (*p*1) in metre (see Note 1)
2	Delta functions with spatially variable concentration and fixed masses M_l (*p*1) in kg (see Note 2)
3	Gaussian (normal) distribution with spatially variable concentration and fixed mean diameter D_l (*p*1) and variance σ (*p*2) (see Note 3)
4	Gaussian (normal) distribution with spatially variable concentration, mean diameter and variance (see Note 4)
5	Log-normal distribution with spatially variable number density, mean diameter and variance (see Note 5)
6	Log-normal distribution with spatially variable number density, mean diameter and fixed variance σ (*p*1) (see Note 6)
7	Log-normal distribution with spatially variable number density and mass density and fixed variance σ (*p*1) and fixed particle density ρ (*p*2) (see Note 7)
8	No distribution function. The encoded variable is derived from variables characterized by type of distribution function of type No. 7 (see above) with fixed variance σ (p1) and fixed particle density ρ (p2)
9–49151	Reserved
49152–65534	Reserved for local use
65535	Missing value

Notes:

(1) Bin model or delta function with N concentrations $c_l(r)$ in class (or mode) l.
Concentration–density function:

$$f(r;d) = \sum_{l=1}^{N} c_l(r)\,\delta(d - D_l)$$

where
N – number of modes in the distribution
δ – delta function
d – diameter
D_l – diameter of mode l (*p*1)

(continued)

(Code table 4.240 – continued)

(2) Bin model or delta function with N concentrations $c_l(r)$ in class (or mode) l.
Concentration–density function:

$$f(r;m) = \sum_{l=1}^{N} c_l(r)\,\delta(m - M_l)$$

where
N – number of modes in the distribution
δ – delta function
m – mass
M_l – mass of mode l (*p*1)

(3) N-modal concentration–density function consisting of Gaussian functions:

$$f(r;d) = \sum_{l=1}^{N} c_l(r)\frac{1}{\sqrt{2\pi}\sigma_l} e^{-\left(\frac{d-D_l}{\sigma_l}\right)^2}$$

where
N – number of modes in the distribution$d$ – diameter
D_l – mean diameter of mode l (*p*1)
σ_l – variance of mode l (*p*2)
with N fields of concentration $c_l(r)$.

(4) N-modal concentration–density function consisting of Gaussian functions:

$$f(r;d) = \sum_{l=1}^{N} c_l(r)\frac{1}{\sqrt{2\pi}\sigma_l(r)} e^{-\left(\frac{d-D_l(r)}{\sigma_l(r)}\right)^2}$$

with 3N fields of concentration $c_l(r)$, variance $\sigma_l(r)$ and mean diameter $D_l(r)$.

(5) N-modal log-normal-distribution for the number density:

$$f(r;d) = \sum_{l=1}^{N} \frac{n_l(r)}{\sqrt{2\pi}\log\sigma_l(r)} e^{-\frac{\log^2\frac{d}{D_l(r)}}{2\log^2\sigma_l(r)}}$$

where
d – diameter
with 3N fields of number density $n_l(r)$, variance $\sigma_l(r)$ and mean diameter $D_l(r)$.

(6) N-modal log-normal-distribution for the number density:

$$f(r;d) = \sum_{l=1}^{N} \frac{n_l(r)}{\sqrt{2\pi}\log\sigma_l} e^{-\frac{\log^2\frac{d}{D_l(r)}}{2\log^2\sigma_l}}$$

where
σ_l – variance of mode l (*p*1)
with 2N fields of number density $n_l(r)$ and mean diameter $D_l(r)$.

(7) N-modal log-normal-distribution for the number density as in Note 6, but with a prescribed mass density $m_l(r)$, from which the diameter $D_l(r)$ is calculated by:

$$D_l = \left(\frac{m_l(r)}{n_l(r)\frac{\pi}{6}\rho_{p,l}e^{\frac{9}{2}\log^2\sigma_l}}\right)^{1/3}$$

where
σ_l – variance of mode l (*p*1)
$\rho_{p,l}$ – particle density (*p*2)
with 2N fields of number density $n_l(r)$ and mass density $m_l(r)$.

Code table 4.241 – *Coverage attributes*

Code figure	Meaning
0	Undefined
1	Unmodified
2	Snow covered
3	Flooded
4	Ice covered
5–191	Reserved
192–254	Reserved for local use
255	Missing value

Code table 4.242 – *Tile classification*

Code figure	Meaning
0	Reserved
1	Land use classes according to ESA-GlobCover GCV2009
2	Land use classes according to European Commission–Global Land Cover Project GLC2000
3–191	Reserved
192–254	Reserved for local use
255	Missing value

Code table 4.243 – *Tile class*

Code figure	Meaning
0	Reserved
1	Evergreen broadleaved forest
2	Deciduous broadleaved closed forest
3	Deciduous broadleaved open forest
4	Evergreen needle-leaf forest
5	Deciduous needle-leaf forest
6	Mixed leaf trees
7	Freshwater flooded trees
8	Saline water flooded trees
9	Mosaic tree/natural vegetation
10	Burnt tree cover
11	Evergreen shrubs closed-open
12	Deciduous shrubs closed-open
13	Herbaceous vegetation closed-open
14	Sparse herbaceous or grass
15	Flooded shrubs or herbaceous
16	Cultivated and managed areas
17	Mosaic crop/tree/natural vegetation
18	Mosaic crop/shrub/grass
19	Bare areas
20	Water
21	Snow and ice
22	Artificial surface

(continued)

(Code table 4.243 – continued)

Code figure	Meaning
23	Ocean
24	Irrigated croplands
25	Rainfed croplands
26	Mosaic cropland (50–70%) – vegetation (20–50%)
27	Mosaic vegetation (50–70%) – cropland (20–50%)
28	Closed broadleaved evergreen forest
29	Closed needle-leaved evergreen forest
30	Open needle-leaved deciduous forest
31	Mixed broadleaved and needle-leaved forest
32	Mosaic shrubland (50–70%) – grassland (20–50%)
33	Mosaic grassland (50–70%) – shrubland (20–50%)
34	Closed to open shrubland
35	Sparse vegetation
36	Closed to open forest regularly flooded
37	Closed forest or shrubland permanently flooded
38	Closed to open grassland regularly flooded
39	Undefined
40–32767	Reserved
32768–	Reserved for local use

CODE TABLES USED IN SECTION 5

Code table 5.0 – *Data representation template number*

Code figure	Meaning
0	Grid point data – simple packing
1	Matrix value at grid point – simple packing
2	Grid point data – complex packing
3	Grid point data – complex packing and spatial differencing
4	Grid point data – IEEE floating point data
5–39	Reserved
40	Grid point data – JPEG 2000 code stream format
41	Grid point data – Portable Network Graphics (PNG)
42	Grid point and spectral data – CCSDS recommended lossless compression
43–49	Reserved
50	Spectral data – simple packing
51	Spherical harmonics data – complex packing
52–60	Reserved
61	Grid point data – simple packing with logarithm pre-processing
62–199	Reserved
200	Run length packing with level values
201–49151	Reserved
49152–65534	Reserved for local use
65535	Missing

Code table 5.1 – *Type of original field values*

Code figure	Meaning
0	Floating point
1	Integer
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.2 – *Matrix coordinate value function definition*

Code figure	Meaning
0	Explicit coordinate values set
1	Linear coordinates f(1) = C1 f(n) = f(n–1) + C2
2–10	Reserved
11	Geometric coordinates f(1) = C1 f(n) = C2 × f(n–1)
12–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.3 – *Matrix coordinate parameter*

Code figure	Meaning
1	Direction degrees true
2	Frequency (s^{-1})
3	Radial number (2pi/lambda) (m^{-1})
4–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.4 – *Group splitting method*

Code figure	Meaning
0	Row by row splitting
1	General group splitting
2–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.5 – *Missing value management for complex packing*

Code figure	Meaning
0	No explicit missing values included within data values
1	Primary missing values included within data values
2	Primary and secondary missing values included within data values
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.6 – *Order of spatial differencing*

Code figure	Meaning
0	Reserved
1	First-order spatial differencing
2	Second-order spatial differencing
3–191	Reserved
192–254	Reserved for local use
255	Missing

Code table 5.7 – *Precision of floating-point numbers*

Code figure	Meaning
0	Reserved
1	IEEE 32-bit (I=4 in section 7)
2	IEEE 64-bit (I=8 in section 7)
3	IEEE 128-bit (I=16 in section 7)
4–254	Reserved
255	Missing

Code table 5.40 – *Type of compression*

Code figure	Meaning
0	Lossless
1	Lossy
2–254	Reserved
255	Missing

CODE TABLES USED IN SECTION 6

Code table 6.0 – *Bit map indicator*

Code figure	Meaning
0	A bit map applies to this product and is specified in this Section
1–253	A bit map predetermined by the originating/generating centre applies to this product and is not specified in this Section
254	A bit map defined previously in the same “GRIB” message applies to this product
255	A bit map does not apply to this product