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GRIB edition 3

**Parameters table**

*Submitted by Enrico Fucile*

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**Summary and Purpose of Document**

A revised version of the parameters table is proposed.

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**ACTION PROPOSED**

The Team is asked to review the proposal and accept it for validation.

**DISCUSSIONS**

A temporary table of parameters was introduced in the first draft of GRIB edition 3. Several parameters from the corresponding GRIB-2 table were not included because there wasn’t a clear knowledge of how the time statistics was going to be developed. If the proposed time interval is accepted most of the deprecated parameters can be re-introduced. In this proposal the full GRIB-2 parameters table is proposed with some decision on the deprecated parameters (re-introduced or permanently deleted). The aim is to have a table as close as possible to GRIB-2 table for compatibility reasons, but without any deprecated entry.

**PROPOSAL**

**Code table 7.3** – *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 7.3 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 K
 or equivalent potential temperature

 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

 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 m2 s–1

 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, K s–1
 clear sky

 25 Temperature tendency due to long-wave radiation, K s–1
 clear sky

 26 Temperature tendency due to parameterization K s–1

 27 Wet-bulb temperature K

 28–191 Reserved

 192–254 Reserved for local use

 255 Missing

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\*\* Apparent temperature is the perceived outdoor temperature, caused by a combination of phenomena, such as air temperature, relative humidity and wind speed.

*(continued)*

*(Code table 4.2 – continued)*

**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

 26 Horizontal moisture convergence kg kg–1 s–1

 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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 kg m–2

 (vapour + cloud water/ice))

 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

 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 kg m–2
 including precipitation)

 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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 kg kg–1 m s–1
 flux

 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 kg kg–1 s–1
 parameterization

 109–191 Reserved

 192–254 Reserved for local use

 255 Missing

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

**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 m2 s–1

 5 Velocity potential m2 s–1

 6 Montgomery stream function m2 s–2

 7 Sigma coordinate vertical velocity s–1

 8 Vertical velocity (pressure) Pa s–1

 9 Vertical velocity (geometric) m s–1

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 10 Absolute vorticity s–1

 11 Absolute divergence s–1

 12 Relative vorticity s–1

 13 Relative divergence s–1

 14 Potential vorticity K m2 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

 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 m2 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 m s–1
 for meridional wind\*\*\*

 37 Northward turbulent surface stress N m–2 s

 38 Eastward turbulent surface stress N m–2 s

 39 Eastward wind tendency due to m s–2
 parameterization

 40 Northward wind tendency due to m s–2
 parameterization

 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

 45–191 Reserved

 192–254 Reserved for local use

 255 Missing

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

*(continued)*

*(Code table 4.2 – continued)*

\*\*\* 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.

**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 m2 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

 31–191 Reserved

 192–254 Reserved for local use

 255 Missing

*(continued)*

*(Code table 4.2 – continued)*

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

 Number Parameter Units

 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

 52–191 Reserved

 192–254 Reserved for local use

 255 Missing

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\*\* 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:

 where Eλ is the solar spectral irradiance expressed in W / (m2·nanometre) at wavelength λ and dλ is the wave-
 length interval used in the summation. Ser λ is the erythema reference action spectrum, and ker is a constant
 equal to 40 m2 / W.

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

 Number Parameter Units

 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 7 Brightness temperature K

 8–191 Reserved

 192–254 Reserved for local use

 255 Missing

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**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

 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) %

 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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

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\*\* 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

 15 Updraught helicity m2 s–2

 16 Bulk Richardson number Numeric

 17 Gradient Richardson number Numeric

 18 Flux Richardson number Numeric

 19–191 Reserved

 192–254 Reserved for local use

 255 Missing

*(continued)*

*(Code table 4.2 – continued)*

**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

 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 mm6 m–3

 1 Equivalent radar reflectivity factor for snow mm6 m–3

 2 Equivalent radar reflectivity factor for mm6 m–3
 parameterized convection

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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

**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 Bq s m–3
 pollutant (see Note 1)

 7 Time-integrated air concentration of iodine Bq s m–3
 pollutant (see Note 1)

 8 Time-integrated air concentration of radioactive Bq s m–3
 pollutant (see Note 1)

 9 Reserved

 10 Air concentration Bq m*–*3

 11 Wet deposition Bq m*–*2

 12 Dry deposition Bq m*–*2

 13 Total deposition (wet + dry) Bq m*–*2

 14–191 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) 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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)

 27 Icing scenario (Code table 4.227)

 28 Mountain wave turbulence (eddy dissipation rate) m2/3 s–1

 29–191 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.

**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) 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 kg m–2 s–1
 flux

 10 Wet deposition by convective precipitation mass kg m–2 s–1
 flux

 *(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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 SO2 (sulphur dioxide) to SO4 kg kg–1 s–1
 (sulphate)

 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) mol s–1

 57 Total yearly average burden of the atmosphere mol

 58 Total yearly averaged atmospheric loss (see Note) mol s–1

 59 Aerosol number concentration m–3

 60–99 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

 111–191 Reserved

 192–254 Reserved for local use

 255 Missing

Note: 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.

**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

*(continued)*

*(Code table 4.2 – continued)*

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

 Number Parameter Units

 0 Seconds prior to initial reference time s
 (defined in Section 1)

 1 Geographical latitude °N

 2 Geographical longitude °E

 3 Days since last observation d

 4–191 Reserved

 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 kg m–2
 (Encoded as an accumulation over a floating
 subinterval of time between the reference time
 and valid time)

 1 Flash flood runoff kg m–2
 (Encoded as an accumulation over a floating
 subinterval of time)

 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 m3 s–1

 8 Groundwater upper storage kg m–2

 9 Groundwater lower storage kg m–2

 10 Side flow into river channel m3 s–1 m–1

 11 River storage of water m3

 12 Floodplain storage of water m3

 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

 16–191 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.

*(continued)*

*(Code table 4.2 – continued)*

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

 Number Parameter Units

 0 Conditional per cent precipitation amount kg m–2
 fractile for an overall period
 (Encoded as an accumulation)

 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 m–1
 to solar radiation

 12 Salinity kg kg–1

 13 Cross-sectional area of flow in channel m2

**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 %

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 12 Exchange coefficient kg m–2 s–1

 13 Plant canopy surface water kg m–2

 14 Blackadar’s mixing length scale m

 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 m3 m–3

 26 Wilting point kg m–3

 27 Volumetric wilting point m3 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) m3 m–3
 (see Note)

 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.

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

 Number Parameter Units

 0 Soil type (Code table 4.213)

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 5 Liquid volumetric soil moisture (non-frozen)\*\* Proportion

 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) m3 m–3

 11 Volumetric transpiration stress-onset (soil moisture) m3 m–3

 12 Transpiration stress-onset (soil moisture) kg m–3

 13 Volumetric direct evaporation cease (soil moisture) m3 m–3

 14 Direct evaporation cease (soil moisture) kg m–3

 15 Soil porosity m3 m–3

 16 Volumetric saturation of soil moisture m3 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

 26–191 Reserved

 192–254 Reserved for local use

 255 Missing

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\*\* 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 Numeric

 Service)

 6 Fine Fuel Moisture Code (Canadian Forest Numeric
 Service)

 7 Duff Moisture Code (Canadian Forest Service) Numeric

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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

 192–254 Reserved for local use

 255 Missing

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\* 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 %

 *(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 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

 17 Clear-sky radiance (with respect to wave W m–1 sr–1
 number)

 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

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 2 Probability of encountering instrument flight %
 rule conditions

 **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 Numeric
 ratio

 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 K
 temperature and standard

 5 Estimated standard deviation between sea- K
 surface temperature and standard

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.

*(continued)*

*(Code table 4.2 – continued)*

(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.

**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 m
 and swell

 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 –

*(continued)*

*(Code table 4.2 – continued)*

 Number Parameter Units

 40 10-metre neutral wind speed over waves m s–1

 41 10-metre wind direction over waves °

 42 Wave energy spectrum m2 s rad–1

 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 Pa m
 integrated ice internal pressure

 11 Meridional vector component of vertically Pa m
 integrated ice internal pressure

 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

 2–191 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 m2 s–1

 5 Ocean vertical salt diffusivity m2 s–1

 6 Ocean vertical momentum diffusivity m2 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 m–1
 solar radiation

 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 s
 (defined in Section 1)

 1 Meridional overturning stream function m3 s–1

 2 Reserved

 3 Days since last observation d

 4–191 Reserved

 192–254 Reserved for local use

 255 Missing