## 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 | Status |
|---|---|---|
| 3 | Satellite remote sensing products | Validation |
| 4 | Space weather products | Validation |
| 5–9 | Reserved | Validation |

## CODE TABLES USED IN SECTION 1

NONE

## CODE TABLES USED IN SECTION 3

### Code table 3.1 – Grid definition template number

| Code figure | Meaning | Comments | Status |
|---|---|---|---|
| 11 | Rotated Mercator projection | | Validation |
| 12–19 | Reserved | | Validation |

### Code table 3.2 – Shape of the reference system

| Code figure | Meaning | Status |
|---|---|---|
| 10 | Earth model assumed WGS84 with corrected geomagnetic coordinates (latitude and longitude) defined by Gustafsson et al., 1992 | Validation |
| 11 | Sun assumed spherical with radius = 695,990,000 m (Allen, C.W., 1976 Astrophysical Quantities (3rd Ed.; London: Athlone)) and Stonyhurst latitude and longitude system with origin at the intersection of the solar central meridian (as seen from Earth) and the solar equator (Thompson, W, Coordinate systems for solar image data, A&A 449, 791–803 (2006)). | Validation |
| 12 | Sun assumed spherical with radius = 695,990,000 m (Allen, C.W., 1976 Astrophysical Quantities (3rd Ed.; London: Athlone)) and Carrington latitude and longitude system that rotates with a sidereal period of 25.38 days (Thompson, W, Coordinate systems for solar image data, A&A 449, 791–803 (2006)). | Validation |
| 13–191 | Reserved | Validation |

## CODE TABLES USED IN SECTION 4

### Code table 4.0 – Product definition template number

| Code figure | Meaning | Status |
|---|---|---|
| 50 | Analysis or forecast of a multi component parameter or matrix element at a point in time | Validation |
| 55 | Spatio-temporal changing tiles at a horizontal level or horizontal layer at a point in time | Validation |
| 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 | Validation |
| 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 | Validation |
| 62 | Statistics over an ensemble reforecast, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval | Validation |

### Code table 4.1 – Parameter category by product discipline

Product discipline 4 – Space weather products

| Category | Description | Status |
|---|---|---|
| 0 | Temperature | Validation |
| 1 | Momentum | Validation |
| 2 | Charged particle mass and number | Validation |
| 3 | Electric and magnetic fields | Validation |
| 4 | Energetic particles | Validation |
| 5 | Waves | Validation |
| 6 | Solar electromagnetic emissions | Validation |
| 7 | Terrestrial electromagnetic emissions | Validation |
| 8 | Imagery | Validation |
| 9 | Ion-neutral coupling | Validation |
| 10–191 | Reserved | Validation |
| 192–254 | Reserved for local use | Validation |
| 255 | Missing | Validation |

### Code table 4.2 - Parameter number by product discipline and parameter category

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

| Number | Parameter | Units | Status |
|---|---|---|---|
| 7 | Brightness temperature (See Note 1) | K | Validation |

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

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

| Number | Parameter | Units | Status |
|---|---|---|---|
| 38 | Soil volumetric ice content | m3 m-3 | Validation |

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

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

| Number | Parameter | Units | Status |
|---|---|---|---|
| 1 | Glacier temperature | K | Validation |

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

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

| Number | Parameter | Units | Status |
|---|---|---|---|
| 23 | Liquid water in snow pack | kg m-2 | Validation |

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

Product discipline 4 – Space weather products, parameter category 0: temperature

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Temperature | K | Validation |
| 1 | Electron temperature | K | Validation |
| 2 | Proton temperature | K | Validation |
| 3 | Ion temperature | K | Validation |
| 4 | Parallel temperature | K | Validation |
| 5 | Perpendicular temperature | K | Validation |
| 6–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 1: momentum

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Velocity magnitude (speed) | m s–1 | Validation |
| 1 | 1st vector component of velocity (coordinate system dependent) | m s–1 | Validation |
| 2 | 2nd vector component of velocity (coordinate system dependent) | m s–1 | Validation |
| 3 | 3rd vector component of velocity (coordinate system dependent) | m s–1 | Validation |
| 4–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 2: charged particle mass and number

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Particle number density | m–3 | Validation |
| 1 | Electron density | m–3 | Validation |
| 2 | Proton density | m–3 | Validation |
| 3 | Ion density | m–3 | Validation |
| 4 | Vertical electron content | m–2 | Validation |
| 5 | HF absorption frequency | Hz | Validation |
| 6 | HF absorption | dB | Validation |
| 7 | Spread F | m | Validation |
| 8 | h'F | m | Validation |

| Number | Parameter | Units | Status |
|---|---|---|---|
| 9 | Critical frequency | Hz | Validation |
| 10 | Scintillation | Numeric | Validation |
| 11–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 3: electric and magnetic fields

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Magnetic field magnitude | T | Validation |
| 1 | 1st vector component of magnetic field | T | Validation |
| 2 | 2nd vector component of magnetic field | T | Validation |
| 3 | 3rd vector component of magnetic field | T | Validation |
| 4 | Electric field magnitude | V m–1 | Validation |
| 5 | 1st vector component of electric field | V m–1 | Validation |
| 6 | 2nd vector component of electric field | V m–1 | Validation |
| 7 | 3rd vector component of electric field | V m–1 | Validation |
| 8–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 4: energetic particles

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Proton flux (differential) | (m2 s sr eV)–1 | Validation |
| 1 | Proton flux (integral) | (m2 s sr)–1 | Validation |
| 2 | Electron flux (differential) | (m2 s sr eV)–1 | Validation |
| 3 | Electron flux (integral) | (m2 s sr)–1 | Validation |
| 4 | Heavy ion flux (differential) | (m2 s sr eV/nuc)–1 | Validation |
| 5 | Heavy ion flux (integral) | (m2 s sr)–1 | Validation |
| 6 | Cosmic ray neutron flux | h–1 | Validation |
| 7–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 5: waves

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 6: solar electromagnetic emissions

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Integrated solar irradiance | W m–2 | Validation |
| 1 | Solar x-ray flux (XRS long) | W m–2 | Validation |
| 2 | Solar x-ray flux (XRS short) | W m–2 | Validation |
| 3 | Solar EUV irradiance | W m–2 | Validation |
| 4 | Solar spectral irradiance | W m–2 nm–1 | Validation |
| 5 | F10.7 | W m–2 Hz–1 | Validation |
| 6 | Solar radio emissions | W m–2 Hz–1 | Validation |
| 7–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 7: terrestrial electromagnetic emissions

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Limb intensity | m–2 s–1 | Validation |
| 1 | Disk intensity | m–2 s–1 | Validation |
| 2 | Disk intensity day | m–2 s–1 | Validation |
| 3 | Disk intensity night | m–2 s–1 | Validation |
| 4–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 8: imagery

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | X-ray radiance | W sr–1 m–2 | Validation |
| 1 | EUV radiance | W sr–1 m–2 | Validation |
| 2 | H-alpha radiance | W sr–1 m–2 | Validation |
| 3 | White light radiance | W sr–1 m–2 | Validation |
| 4 | CaII-K radiance | W sr–1 m–2 | Validation |
| 5 | White light coronagraph radiance | W sr–1 m–2 | Validation |
| 6 | Heliospheric radiance | W sr–1 m–2 | Validation |
| 7 | Thematic mask | Numeric | Validation |
| 8–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

Product discipline 4 – Space weather products, parameter category 9: ion-neutral coupling

| Number | Parameter | Units | Status |
|---|---|---|---|
| 0 | Pedersen conductivity | S m–1 | Validation |
| 1 | Hall conductivity | S m–1 | Validation |
| 2 | Parallel conductivity | S m–1 | Validation |
| 3–191 | Reserved | | Validation |
| 192–254 | Reserved for local use | | Validation |
| 255 | Missing | | Validation |

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

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

| Number | Parameter | Units | Status |
|---|---|---|---|
| 46 | 2-dim spectral energy density E (f, θ) | m2 s | Validation |
| 47 | Frequency spectral energy density E (f) = $\int$ E (f,θ) dθ | m2 s | Validation |
| 48 | Directional spectral energy density E (θ)= $\int$ E (f,θ) df/m0 | – | Validation |
| 49–191 | Reserved | | Validation |

**Code table 4.5 – Fixed surface types and units**

| Code figure | Meaning | Unit | Status |
|---|---|---|---|
| 167–169 | Reserved | | Validation |
| 170 | Ionospheric D-region level | | Validation |
| 171 | Ionospheric E-region level | | Validation |
| 172 | Ionospheric F1-region level | | Validation |
| 173 | Ionospheric F2-region level | | Validation |
| 174 | Top surface of sea, lake or river ice | | Validation |
| 175 | Top surface of sea, lake or river ice, under snow cover | | Validation |
| 176 | Bottom surface (underside) of sea, lake or river ice | | Validation |
| 177 | Deep soil (of indefinite depth) | | Validation |
| 178 | Reserved | | Validation |

| | | |
|---|---|---|
| 179 | Inland or glacier ice (top surface) | Validation |
| 180 | Deep inland or glacier ice (of indefinite depth) | Validation |
| 181 | Grid tile land fraction as a model surface | Validation |
| 182 | Grid tile water fraction as a model surface | Validation |
| 183 | Grid tile sea, lake or river ice fraction as a model surface | Validation |
| 184 | Grid tile inland or glacier ice fraction as a model surface | Validation |

### 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 | Confidence index (see Note 4) | Validation |
| 13 | Quality indicator (see Note 5 and Code table 4.244) | Validation |
| 14–191 | Reserved | |
| 192–254 | Reserved for local use | |
| 255 | Missing | |

Notes:

| | | |
|---|---|---|
| (4) | The original data value is a non-dimensional number from 0 to 1, when 0 indicates no confidence and 1 indicates maximal confidence. | Validation |
| (5) | The original data value is defined by Code table 4.244. | Validation |

### Code table 4.213 – Soil type

| Code figure | Meaning | Status |
|---|---|---|
| 12 | Loam | Validation |
| 13 | Peat | Validation |
| 14 | Rock | Validation |
| 15 | Ice | Validation |
| 16 | Water | Validation |
| 17–191 | Reserved | Validation |

### Code table 4.240 – Type of distribution function

| Code figure | Meaning | Status |
|---|---|---|
| 0 | No specific distribution function given | Validation |
| 1 | Delta functions with spatially variable concentration and fixed diameters Dl (p1) in meter (see Note 1) | Validation |
| 2 | Delta functions with spatially variable concentration and fixed masses Ml (p1) in kg (see Note 2) | Validation |
| 3 | Gaussian (Normal) distribution with spatially variable concentration and fixed mean diameter Dl (p1) and variance σ (p2) (see Note 3) | Validation |
| 4 | Gaussian (Normal) distribution with spatially variable concentration, mean diameter and variance (see Note 4) | Validation |
| 5 | Log-normal distribution with spatially variable number density, mean diameter and variance (see Note 5) | Validation |
| 6 | Log-normal distribution with spatially variable number density, mean diameter | Validation |

| | | |
|---|---|---|
| | and fixed variance σ (p1) (see Note 6) | |
| 7 | Log-normal distribution with spatially variable number density and mass density and fixed variance σ (p1) and fixed particle density ρ (p2) (see Note 7) | Validation |
| 8-49151 | Reserved | Validation |
| 49152-65534 | Reserved for local use | Validation |
| 65535 | Missing | Validation |

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 ($p_1$)

(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 ($p_1$)
$\sigma_l$ – 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

$\sigma_l$ – 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

$\sigma_l$ – 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 4.244 – Quality indicator**

| Code figure | Meaning | Status |
|---|---|---|
| 0 | No quality information available | Validation |
| 1 | Failed | Validation |
| 2 | Passed | Validation |

## CODE TABLES USED IN SECTION 5

### Code table 5.0 – Data representation template number

| Code figure | Meaning | Status |
|---|---|---|
| 42 | Grid point and spectral data – CCSDS recommended lossless compression | Validation |
| 43–49 | Reserved | Validation |