

# NEW ADDITIONS TO GRIB EDITION 2 (AWAITING VALIDATION)

(Updated **31/10/08**)

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## NEW GRID DEFINITION TEMPLATE FOR IRREGULAR LAT/LONG GRID

### Grid Definition Template 3.130: Irregular Latitude/longitude grid

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

### Add in:

#### Code Table 3.1: Grid Definition Template Number

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

## NEW TEMPLATES FOR CATEGORICAL FORECAST DATA

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

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

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

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

Note:

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

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

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12	Type of generating process (see Code Table 4.3)
13	Background generating process identifier (defined by originating Centre)
14	Forecast generating process identifier (defined by originating Centre)
15-16	Hours after reference time of data cut-off (see Note 1)
17	Minutes after reference time of data cut-off
18	Indicator of unit of time range (see Code Table 4.4)
19-22	Forecast time in units defined by octet 18 (see Note 2)
23	Type of first fixed surface (see Code Table 4.5)
24	Scale factor of first fixed surface
25-28	Scaled value of first fixed surface
29	Type of second fixed surface (see Code Table 4.5)
30	Scale factor of second fixed surface
31-34	Scaled value of second fixed surface
35	NC - Number of categories
Repeat the following 12 octets for each category ( i = 1,NC )	
(36+12(i-1))	Code figure
(37+12(i-1))	Type of interval for first and second limit (see Code Table 4.91)
(38+12(i-1))	Scale factor of first limit
(39+12(i-1))- (42+12(i-1))	Scaled value of first limit
(43+12(i-1))	Scale factor of second limit
(44+12(i-1))- (47+12(i-1))	Scaled value of second limit
(48+12(NC -1))- (49+12(NC -1))	Year of end of overall time interval
(50+12(NC -1))	Month of end of overall time interval
(51+12(NC -1))	Day of end of overall time interval
(52+12(NC -1))	Hour of end of overall time interval
(53+12(NC -1))	Minute of end of overall time interval
(54+12(NC -1))	Second of end of overall time interval
(55+12(NC -1))	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
(56+12(NC -1))- (59+12(NC -1))	Total number of data values missing in statistical process.
60-71	<i>Specification of the outermost (or only) time range over which statistical processing is done</i>
(60+12(NC -1))	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
(61+12(NC -1))	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
(62+12(NC -1))	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
(63+12(NC -1))- (66+12(NC -1))	Length of the time range over which statistical processing is done, in units defined by the previous octet
(67+12(NC -1))	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)

(68+12(NC -1))- (71+12(NC -1))Time increment between successive fields, in units defined by the previous octet (see Note 3)

$72-nn$  These octets are included only if  $n > 1$ , where  $nn = 72 + 12*(n-1) + 12*(NC-1)$

(72+12(NC -1))- (83+12(NC -1)) As octets (60+12(NC -1)) to (71+12(NC -1)), next innermost step of processing

(84+12(NC -1))-nn Additional time range specifications, included in accordance with the value of n. Contents as octets (60+12(NC -1)) to (71+12(NC -1)), repeated as necessary.

Notes:

- (1).Hours greater than 65534 will be coded as 65534.
- (2).The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
- (3).An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets (60+12(NC -1)), (73+12(NC -1)), (85+12(NC -1)) ...). For all but the innermost (last) time range, the next inner range is then processed using these references and forecast times as the initial reference and forecast time.

**New table entries in code table 4.0:**

**Code Table 4.0: Product Definition Template Number**

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

## New code table 4.91:

### Code Table 4.91: Type of Interval

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

## Renamed code table 4.205:

### Code Table 4.205: Presence of aerosol

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

## NEW TEMPLATES FOR ATMOSPHERIC AEROSOLS *FOR URGENT VALIDATION*

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

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

Note:

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

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

Octet Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
25	Type of generating process (see Code Table 4.3)
26	Background generating process identifier (defined by originating Centre)
27	Forecast generating process identifier (defined by originating Centre)
28-29	Hours after reference time of data cutoff (see Note 1)
30	Minutes after reference time of data cutoff
31	Indicator of unit of time range (see Code Table 4.4)
32-35	Forecast time in units defined by octet 18
36	Type of first fixed surface (see Code Table 4.5)
37	Scale factor of first fixed surface
38-41	Scaled value of first fixed surface

42	Type of second fixed surface (see Code Table 4.5)
43	Scale factor of second fixed surface
44-47	Scaled value of second fixed surface
48	Type of ensemble forecast (see Code Table 4.6)
49	Perturbation number
50	Number of forecasts in ensemble

Note:

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

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

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

62	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
63-66	Length of the time range over which statistical processing is done, in units defined by the previous octet
67	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
68-71	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
71-nn	These octets are included only if $n > 1$ , where $nn = 59 + 12 * n$
71-74	As octets 47 to 58, next innermost step of processing
75-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary.

Notes:

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

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

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12	Type of generating process (see Code table 4.3)
12-13	Aerosol type (see Code Table 4.233)
14	Type of interval for first and second size (see Code Table 4.91)
15	Scale factor of first size
16-19	Scaled value of first size in meters
20	Scale factor of second size
21-24	Scaled value of second size in meters
25	Background generating process identifier (defined by originating centre)
26	Forecast generating process identifier (defined by originating centre)
27-28	Hours after reference time of data cut-off (see Note 1)
29	Minutes after reference time of data cut-off
30	Indicator of unit of time range (see Code table 4.4)
31-34	Forecast time in units defined by octet 18 (see Note 2)
35	Type of first fixed surface (see Code table 4.5)
36	Scale factor of first fixed surface
37-40	Scaled value of first fixed surface
41	Type of second fixed surface (see Code table 4.5)
42	Scale factor of second fixed surface

43-46	Scaled value of second fixed surface
47	Type of ensemble forecast (see Code table 4.6)
48	Perturbation number
49	Number of forecasts in ensemble
50-51	Year of end of overall time interval
52	Month of end of overall time interval
53	Day of end of overall time interval
54	Hour of end of overall time interval
55	Minute of end of overall time interval
56	Second of end of overall time interval
57	n — number of time range specifications describing the time intervals used to calculate the statistically-processed field
58-61	Total number of data values missing in statistical process
	<i>62-73 Specification of the outermost (or only) time range over which statistical processing is done</i>
62	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
63	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
64	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
65-68	Length of the time range over which statistical processing is done, in units defined by the previous octet
69	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
70-73	Time increment between successive fields, in units defined by the previous octet (see Note 3)
	<i>74-nn These octets are included only if n&gt;1, where nn = 61 + 12 x n</i>
74-85	As octets 62 to 73, next innermost step of processing
74-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 62 to 73, repeated as necessary

Notes:

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

**New entries in table 4.0:**

**Code Table 4.0: Product Definition Template Number**

Number	Description
44	Aerosol analysis or forecast at a horizontal level or in a horizontal layer at a point in time
45	Aerosol individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
46	Aerosol average, accumulation, and/or extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
47	Aerosol individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non continuous time interval for Aerosol

**New code table type of interval.**

**Code Table 4.91: Type of Interval**

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

**Code Table 4.233: Aerosol type**

*(See Common Code Table C-14)*

**NEW ENTRIES FOR SOIL, CLOUD, VEGETATION *FOR URGENT VALIDATION*:**

In Code Table 4.2:

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

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

<b>Meteorological products, momentum category</b>				
DISCIPLINE	CATEGORY	Proposed PARAMETER number	PARAMETER NAME	Unit
0	2	31	Turbulent diffusion coefficient for momentum	m <sup>2</sup> s <sup>-1</sup>

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

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

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

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

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

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

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

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

#### New entries in CODE TABLE 4.213: SOIL TYPE

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

## PRODUCT DEFINITION TEMPLATE 4.50: ANALYSIS OR FORECAST OF A MULTI COMPONENT PARAMETER OR MATRIX ELEMENT AT A POINT IN TIME

(Additions to PDT 4.0 are marked in red)

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

Notes:

- (1) Hours greater than 65534 will be coded as 65534.
- (2) In case of ocean wave spectra e.g., according to Code Table 5.3, the physical significance values are 1 (Direction Degrees true) and 2 (Frequency ( $s^{-1}$ )).
- (3) The dimensions define the number of GRIBs needed for reconstruction of a complete matrix (e.g. wave spectrum) at one or more grid points. In case of vectors (1-dim-matrices), the second dimension must be set to 1 and the second dimension physical significance must be set to 255 (missing).

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

### New entry in Table 4.0:

Code Table 4.0:	Product Definition Template Number
Number	Description
50	Analysis or forecast of a multi component parameter or matrix element at a point in time

## NEW GRID DEFINITION FOR GENERAL UNSTRUCTURED GRID:

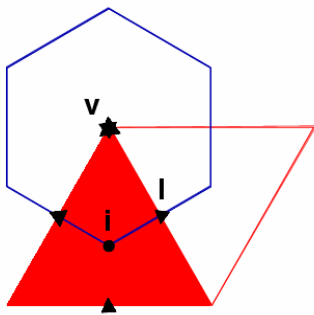
### Grid definition template 3.101 General Unstructured Grid

Octet no.

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

Note:

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



Variables can be defined on different positions in the triangle.

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

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

### Additional entry in Code Table 3.1: Grid template definition number

- 101 General Unstructured Grid

## NEW DATA REPRESENTATION TEMPLATE FOR NEW COMPRESSION CCSDS SZIP

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

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

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

#### Notes:

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

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

The coding methods include:

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

A detailed description can be found in:

Consultative Committee for Space Data Systems: Lossless Data Compression.  
CCSDS Recommendation for Space System Data Standards,  
CCSDS 121.0-B-1, Blue Book, May 1997.



CCSDS121.0b1.pdf CCSDS120.0g2.pdf

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

**Additional entry in Code Table 5.0: Data representation template number**

42            Grid point and spectral data - CCSDS szip

## ADDITIONS IN GRIB2 FOR PALEO CLIMATE

### 1.) Add in Section 1 - Identification Section:

Octet no.

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

### 2.) Add as Note:

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