TEMPLATE DEFINITIONS USED IN SECTION 3

Grid definition template 3.0 – latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	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
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47–50	La1 – latitude of first grid point (see Note 1)
51–54	Lo1 – longitude of first grid point (see Note 1)
55	Resolution and component flags (see Flag table 3.3)
56–59	La2 – latitude of last grid point (see Note 1)
60–63	Lo2 – longitude of last grid point (see Note 1)
64–67	Di – i direction increment (see Notes 1 and 5)
68–71	Dj – j direction increment (see Notes 1 and 5)
72	Scanning mode (flags – see Flag table 3.4)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Notes 2 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) For data on a quasi-regular grid, where all the rows or columns do not necessarily have the same number of grid points, either Ni (octets 31–34) or Nj (octets 35–38) and the corresponding Di (octets 64–67) or Dj (octets 68–71) shall be coded with all bits set to 1 (missing). The actual number of points along each parallel or meridian shall be coded in the octets immediately following the grid definition template (octets [xx+1]–nn), as described in the description of the grid definition section.

(3) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points or variable spacing. The first point in each row (column) shall be positioned at the meridian (parallel) indicated by octets 47–54. The grid points shall be evenly spaced in latitude (longitude).

(4) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth is derived from applying the appropriate scale factor to the value expressed in metres.

(5) It is recommended to use unsigned direction increments.

Grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as Grid definition template 3.0 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) Three parameters define a general latitude/longitude coordinate system, formed by a general rotation of the sphere. One choice for these parameters is:

   (a) The geographic latitude in degrees of the southern pole of the coordinate system, θ_p for example;

   (b) The geographic longitude in degrees of the southern pole of the coordinate system, λ_p for example;

   (c) The angle of rotation in degrees about the new polar axis (measured clockwise when looking from the southern to the northern pole) of the coordinate system, assuming the new axis to have been obtained by first rotating the sphere through λ_p degrees about the geographic polar axis, and then rotating through $(90 + \theta_p)$ degrees so that the southern pole moved along the (previously rotated) Greenwich meridian.

(3) See Note 3 under grid definition template 3.0.

Grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as Grid definition template 3.0 (see Note 1)
73–76	Latitude of the pole of stretching
77–80	Longitude of the pole of stretching
81–84	Stretching factor
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The stretching is defined by three parameters:

   (a) The latitude in degrees (measured in the model coordinate system) of the “pole of stretching”;

   (b) The longitude in degrees (measured in the model coordinate system) of the “pole of stretching”; and

   (c) The stretching factor C in units of 10^{-6} represented as an integer.

   The stretching is defined by representing data uniformly in a coordinate system with longitude λ and latitude θ^1, where:

$$\theta^1 = \sin^{-1} \frac{(1 - C^2) + (1 + C^2) \sin \theta}{(1 + C^2) + (1 - C^2) \sin \theta}$$

   and λ and θ are longitude and latitude in a coordinate system in which the “pole of stretching” is the northern pole. C = 1 gives uniform resolution, while C > 1 gives enhanced resolution around the pole of stretching.

(3) See Note 3 under grid definition template 3.0.

Grid definition template 3.3 – stretched and rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée)

Octet No.	Contents
15–72	Same as Grid definition template 3.0 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–88	Latitude of the pole of stretching
89–92	Longitude of the pole of stretching
93–96	Stretching factor
97–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 3 under grid definition template 3.0.

Grid definition template 3.4 – variable resolution latitude/longitude

Octet No.	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
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47	Resolution and component flags (see Flag table 3.3 and Note 2)
48	Scanning mode (flags – see Flag table 3.4)
49–ii	List of longitudes (see Notes 1 and 3)
(ii+1)–jj	List of latitudes (see Notes 1 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the longitudes and latitudes. For these descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to the respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The resolution flag (bit 3–4 of Flag table 3.3) is not applicable.

(continued)

(Grid definition template 3.4 – continued)

(3) The list of Ni longitudes and Nj latitudes shall be coded in the octets immediately following the grid definition template in octets 49 to ii and octets ii+1 to jj respectively, where ii = 48 + 4Ni and jj = 48 + 4Ni + 4Nj.

(4) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth is derived from applying appropriate scale factor to the value expressed in metres.

Grid definition template 3.5 – variable resolution rotated latitude/longitude

Octet No.	Contents
15–48	Same as Grid definition template 3.4 (see Note 1)
49–52	Latitude of the southern pole of projection (see Note 4)
53–56	Longitude of the southern pole of projection (see Note 4)
57–60	Angle of rotation of projection (see Note 4)
61–ii	List of longitudes (see Notes 1 and 3)
(ii+1)–jj	List of latitudes (see Notes 1 and 3)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the longitudes and latitudes. For these descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to the respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) Three parameters define a general latitude/longitude coordinate system, formed by a general rotation of the sphere. One choice for these parameters is:
   (a) The geographic latitude in degrees of the southern pole of the coordinate system, e.g., θ_p;
   (b) The geographic longitude in degrees of the southern pole of the coordinate system, e.g., λ_p;
   (c) The angle of rotation in degrees about the new polar axis (measured clockwise when looking from the southern to the northern pole) of the coordinate system, assuming the new axis to have been obtained by first rotating the sphere through λ_p degrees about the geographic polar axis, and then rotating through $(90 + \theta_p)$ degrees so that the southern pole moved along the (previously rotated) Greenwich meridian.

(3) For the list of Ni longitude bounds and Nj latitude bounds at the end of the section:
ii = 60 + 4Ni and jj = 60 + 4Ni +4Nj

(4) Regulation 92.1.6 applies.

Grid definition template 3.10 – Mercator

Octet No.	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
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude(s) at which the Mercator projection intersects the Earth (Latitude(s) where Di and Dj are specified)

(continued)

(Grid definition template 3.10 – continued)

Octet No.	Contents
52–55	La2 – latitude of last grid point
56–59	Lo2 – longitude of last grid point
60	Scanning mode (flags – see Flag table 3.4)
61–64	Orientation of the grid, angle between i direction on the map and the Equator (see Note 1)
65–68	Di – longitudinal direction grid length (see Note 2)
69–72	Dj – latitudinal direction grid length (see Note 2)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Notes 2 and 3 of Grid definition template 3.1)

Notes:

(1) Limited to the range of 0 to 90 degrees; if the angle of orientation of the grid is neither 0 nor 90 degrees, Di and Dj must be equal to each other.

(2) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(3) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.12 – transverse Mercator

Octet No.	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
31–34	Ni – number of points along i-axis
35–38	Nj – number of points along j-axis
39–42	LaR – geographic latitude of reference point
43–46	LoR – geographic longitude of reference point
47	Resolution and component flags (see Flag table 3.3)
48–51	m – scale factor at reference point ratio of distance on map to distance on spheroid (IEEE 32-bit floating-point values)
52–55	XR – false easting, i-direction coordinate of reference point in units of 10^{-2} m
56–59	YR – false northing, j-direction coordinate of reference point in units of 10^{-2} m
60	Scanning mode (flags – see Flag table 3.4)
61–64	Di – i-direction increment length in units of 10^{-2} m
65–68	Dj – j-direction increment length in units of 10^{-2} m
69–72	x1 – i-direction coordinate of the first grid point in units of 10^{-2} m
73–76	y1 – j-direction coordinate of the first grid point in units of 10^{-2} m
77–80	x2 – i-direction coordinate of the last grid point in units of 10^{-2} m
81–84	y2 – j-direction coordinate of the last grid point in units of 10^{-2} m

Grid definition template 3.20 – polar stereographic projection

Octet No.	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
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3 and Note 1)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – orientation of the grid (see Note 2)
56–59	Dx – x-direction grid length (see Note 3)
60–63	Dy – y-direction grid length (see Note 3)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)

Notes:

(1) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(2) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(3) Grid length is in units of 10^{-3} m at the latitude specified by LaD.

(4) Bit 2 of the projection flag is not applicable to the polar stereographic projection.

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.30 – Lambert conformal

Octet No.	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
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – longitude of meridian parallel to y-axis along which latitude increases as the y-coordinate increases
56–59	Dx – x-direction grid length (see Note 1)

(continued)

(Grid definition template 3.30 – continued)

Octet No.	Contents
60–63	Dy – y-direction grid length (see Note 1)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)
66–69	Latin 1 – first latitude from the pole at which the secant cone cuts the sphere
70–73	Latin 2 – second latitude from the pole at which the secant cone cuts the sphere
74–77	Latitude of the southern pole of projection
78–81	Longitude of the southern pole of projection

Notes:

(1) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(2) If Latin 1 = Latin 2, then the projection is on a tangent cone.

(3) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(4) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.31 – Albers equal area

Octet No.	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
31–34	Nx – number of points along the x-axis
35–38	Ny – number of points along the y-axis
39–42	La1 – latitude of first grid point
43–46	Lo1 – longitude of first grid point
47	Resolution and component flags (see Flag table 3.3)
48–51	LaD – latitude where Dx and Dy are specified
52–55	LoV – longitude of meridian parallel to y-axis along which latitude increases as the y-coordinate increases
56–59	Dx – x-direction grid length (see Note 1)
60–63	Dy – y-direction grid length (see Note 1)
64	Projection centre flag (see Flag table 3.5)
65	Scanning mode (see Flag table 3.4)
66–69	Latin 1 – first latitude from the pole at which the secant cone cuts the sphere
70–73	Latin 2 – second latitude from the pole at which the secant cone cuts the sphere
74–77	Latitude of the southern pole of projection
78–81	Longitude of the southern pole of projection

Notes:

(1) Grid lengths are in units of 10^{-3} m, at the latitude specified by LaD.

(2) If Latin 1 = Latin 2, then the projection is on a tangent cone.

(3) The resolution flags (bits 3–4 of Flag table 3.3) are not applicable.

(continued)

(Grid definition template 3.31 – continued)

(4) LoV is the longitude value of the meridian which is parallel to the y-axis (or columns of the grid) along which latitude increases as the y-coordinate increases (the orientation longitude may or may not appear on a particular grid).

(5) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.40 – Gaussian latitude/longitude

Octet No.	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
31–34	Ni – number of points along a parallel
35–38	Nj – number of points along a meridian
39–42	Basic angle of the initial production domain (see Note 1)
43–46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)
47–50	La1 – latitude of first grid point (see Note 1)
51–54	Lo1 – longitude of first grid point (see Note 1)
55	Resolution and component flags (see Flag table 3.3)
56–59	La2 – latitude of last grid point (see Note 1)
60–63	Lo2 – longitude of last grid point (see Note 1)
64–67	Di – i direction increment (see Notes 1 and 5)
68–71	N – number of parallels between a pole and the Equator (see Note 2)
72	Scanning mode (flags – see Flag table 3.4)
73–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

(4) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points. The first point in each row (column) shall be positioned at the meridian (parallel) indicated by octets 47–54. The grid points shall be evenly spaced in latitude (longitude).

(5) It is recommended to use unsigned direction increments.

Grid definition template 3.41 – rotated Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 4 under grid definition template 3.40.

Grid definition template 3.42 – stretched Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the pole of stretching
77–80	Longitude of the pole of stretching
81–84	Stretching factor
85–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 4)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 4 under grid definition template 3.40.

Grid definition template 3.43 – stretched and rotated Gaussian latitude/longitude

Octet No.	Contents
15–72	Same as grid definition template 3.40 (see Note 1)
73–76	Latitude of the southern pole of projection
77–80	Longitude of the southern pole of projection
81–84	Angle of rotation of projection
85–88	Latitude of the pole of stretching
89–92	Longitude of the pole of stretching
93–96	Stretching factor
97–nn	List of number of points along each meridian or parallel. (These octets are only present for quasi-regular grids as described in Note 5)

(continued)

(Grid definition template 3.43 – continued)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes, and direction increments. For these last six descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number. For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) The number of parallels between a pole and the Equator is used to establish the variable (Gaussian) spacing of the parallels; this value must always be given.

(3) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(4) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(5) See Note 4 under grid definition template 3.40.

Grid definition template 3.50 – spherical harmonic coefficients

Octet No.	Contents
15–18	J – pentagonal resolution parameter
19–22	K – pentagonal resolution parameter
23–26	M – pentagonal resolution parameter
27	Representation type indicating the method used to define the norm (see Code table 3.6)
28	Representation mode indicating the order of the coefficients (see Code table 3.7)

Note: The pentagonal representation of resolution is general. Some common truncations are special cases of the pentagonal one:

Triangular: M = J = K

Rhomboidal: K = J + M

Trapezoidal: K = J, K > M

Grid definition template 3.51 – rotated spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the southern pole of projection
33–36	Longitude of the southern pole of projection
37–40	Angle of rotation of projection

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.52 – stretched spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the pole of stretching
33–36	Longitude of the pole of stretching
37–40	Stretching factor

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.53 – stretched and rotated spherical harmonic coefficients

Octet No.	Contents
15–28	Same as grid definition template 3.50
29–32	Latitude of the southern pole of projection
33–36	Longitude of the southern pole of projection
37–40	Angle of rotation of projection
41–44	Latitude of pole of stretching
45–48	Longitude of pole of stretching
49–52	Stretching factor

Notes:

(1) See the Note under grid definition template 3.50 – spherical harmonic coefficients.

(2) See Note 2 under grid definition template 3.1 – rotated latitude/longitude (or equidistant cylindrical, or Plate Carrée).

(3) See Note 2 under grid definition template 3.2 – stretched latitude/longitude (or equidistant cylindrical, or Plate Carrée).

Grid definition template 3.90 – space view perspective or orthographic

Octet No.	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
31–34	Nx – number of points along x-axis (columns)
35–38	Ny – number of points along y-axis (rows or lines)
39–42	Lap – latitude of sub-satellite point
43–46	Lop – longitude of sub-satellite point
47	Resolution and component flags (see Flag table 3.3)
48–51	dx – apparent diameter of Earth in grid lengths, in x-direction
52–55	dy – apparent diameter of Earth in grid lengths, in y-direction
56–59	Xp – x-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)
60–63	Yp – y-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)
64	Scanning mode (flags – see Flag table 3.4)
65–68	Orientation of the grid; i.e. the angle between the increasing y-axis and the meridian of the sub-satellite point in the direction of increasing latitude (see Note 3)
69–72	Nr – altitude of the camera from the Earth's centre, measured in units of the Earth's (equatorial) radius multiplied by a scale factor of 10^6 (see Notes 4 and 5)
73–76	Xo – x-coordinate of origin of sector image
77–80	Yo – y-coordinate of origin of sector image

Notes:

(1) It is assumed that the satellite is at its nominal position, i.e. it is looking directly at its sub-satellite point.

(2) Octets 69–72 shall be set to all ones (missing) to indicate the orthographic view (from infinite distance).

(3) It is the angle between the increasing y-axis and the meridian 180°E if the sub-satellite point is the North Pole; or the meridian 0° if the sub-satellite point is the South Pole.

(4) The apparent angular size of the Earth will be given by $2 \times \arcsin((10^6)/Nr)$.

(5) For orthographic view from infinite distance, the value of Nr should be encoded as missing (all bits set to 1).

(continued)

(Grid definition template 3.90 – continued)

(6) The horizontal and vertical angular resolutions of the sensor (Rx and Ry), needed for navigation equation, can be calculated from the following:

$$Rx = 2 \times \arcsin((10^6)/Nr)/dx$$

$$Ry = 2 \times \arcsin((10^6)/Nr)/dy$$

(7) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

(8) General reference information pertaining to the projections used for satellite data can be found in Section 4.4 of "LRIT/HRIT Global Specification", Doc. No. CGMS 03, issue 2.6, dated 12 August 1999 (http://www.eumetsat.int/Home/Main/AboutEUMETSAT/International Relations/CGMS/groups/cps/documents/document/pdf_cgms_03.pdf, page 20 onwards).

Grid definition template 3.100 – triangular grid based on an icosahedron (see Attachment, Volume I.2, Part B, Att.GRIB)

Octet No.	Contents
15	n2 – exponent of 2 for the number of intervals on main triangle sides
16	n3 – exponent of 3 for the number of intervals on main triangle sides
17–18	ni – number of intervals on main triangle sides of the icosahedron
19	nd – number of diamonds
20–23	Latitude of the pole point of the icosahedron on the sphere
24–27	Longitude of the pole point of the icosahedron on the sphere
28–31	Longitude of the centre line of the first diamond of the icosahedron on the sphere
32	Grid point position (see Code table 3.8)
33	Numbering order of diamonds (flags – see Flag table 3.9)
34	Scanning mode for one diamond (flags – see Flag table 3.10)
35–38	nt – total number of grid points

Notes:

(1) For more details see in Part B of this volume the Attachment entitled “Definition of a triangular grid based on an icosahedron” (I.2–Att.GRIB–1 to 8).

(2) The origin of the grid is an icosahedron with 20 triangles and 12 vertices. The triangles are combined to nd quadrangles, the so-called diamonds (e.g. if nd = 10, two of the icosahedron triangles form a diamond, and if nd = 5, 4 icosahedron triangles form a diamond). There are two resolution values called n2 and n3 describing the division of each triangle side. Each triangle side is divided into ni equal parts, where $ni = 3^{n3} \times 2^{n2}$ with n3 either equal to 0 or to 1. In the example of the Attachment, the numbering order of the rectangles is anti-clockwise with a view from the pole point on both hemispheres. Diamonds 1 to 5 are northern hemisphere and diamonds 6 to 10 are southern hemisphere.

(3) The exponent of 3 for the number of divisions of triangle sides is used only with a value of either 0 or 1.

(4) The total number of grid points for one global field depends on the grid point position. If e.g. the grid points are located at the vertices of the triangles, then nt = (ni + 1) x (ni + 1) x nd since grid points at diamond edges are contained in both adjacent diamonds and for the same reason the pole points are contained in each of the five adjacent diamonds.

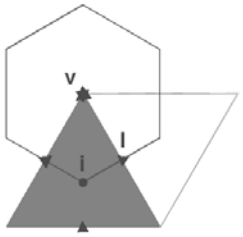
Grid definition template 3.101 – general unstructured grid

Octet No.	Contents
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)
20–35	Universally Unique Identifier of horizontal grid

(continued)

(Grid definition template 3.101 – continued)

Note: The number given refers to a specific grid required for formulating differential operators. The grid may consist of a centre and an arbitrary surrounding polygon. As model variables may be defined on vertices of the polygons or in the middle of a polygon edge, this generates some different grid descriptions, because each of those is defining their own centre and surrounding polygon. Each of these dependent grids needs their own set of centre longitude/latitude and the longitude/latitude of the boundary polygon vertices. The following picture shows a triangle as base, a hexagon around the triangle's vertices and a quadrilateral around the edge midpoints.



(a) Triangles (i) (pressure, temperature, ...)
(b) Quadrilaterals (l) (wind velocity ...)
(c) Hexagons (or pentagons, respectively) (v) (vorticity, ...)

Grid definition template 3.110 – Equatorial azimuthal equidistant projection

Octet No.	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
31–34	Nx – number of points along x-axis
35–38	Ny – number of points along y-axis
39–42	La1 – latitude of tangency point (centre of grid)
43–46	Lo1 – longitude of tangency point
47	Resolution and component flags (see Flag table 3.3)
48–51	Dx – x-direction grid length in units of 10^{-3} m as measured at the point of the axis
52–55	Dy – y-direction grid length in units of 10^{-3} m as measured at the point of the axis
56	Projection centre flag
57	Scanning mode (see Flag table 3.4)

Note: A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.120 – azimuth-range projection

Octet No.	Contents
15–18	Nb – number of data bins along radials (see Note)
19–22	Nr – number of radials
23–26	La1 – latitude of centre point
27–30	Lo1 – longitude of centre point
31–34	Dx – spacing of bins along radials
35–38	Dstart – offset from origin to inner bound

(continued)

(Grid definition template 3.120 – continued)

Octet No.	Contents
39	Scanning mode (flags – see Flag table 3.4)
	40–(39+4Nr) For each of Nr radials:
(40+4(X–1))–(41+4(X–1))	Azi – starting azimuth, degrees x 10 (degrees as north)
(42+4(X–1))–(43+4(X–1))	Adelta – azimuthal width, degrees x 100 (+ clockwise, – counterclockwise), with X = 1 to Nr

Note: A data bin is a data point representing the volume centred on it.

Grid definition template 3.1000 – cross-section grid with points equally spaced on the horizontal

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	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
31–34	Number of horizontal points
35–38	Basic angle of the initial production domain (see Note 1)
39–42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)
43–46	La1 – latitude of first grid point (see Note 1)
47–50	Lo1 – longitude of first grid point (see Note 1)
51	Scanning mode (flags – see Flag table 3.4)
52–55	La2 – latitude of last grid point (see Note 1)
56–59	Lo2 – longitude of last grid point (see Note 1)
60	Type of horizontal line (see Code table 3.20)
61–62	Number of vertical points
63	Physical meaning of vertical coordinate (see Code table 3.15)
64	Vertical dimension coordinate values definition (see Code table 3.21)
65–66	NC – number of coefficients or values used to specify vertical coordinates
67–(66+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes. For these last descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.1100 – Hovmöller diagram grid with points equally spaced on the horizontal

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	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
31–34	Number of horizontal points
35–38	Basic angle of the initial production domain (see Note 1)
39–42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)
43–46	La1 – latitude of first grid point (see Note 1)
47–50	Lo1 – longitude of first grid point (see Note 1)
51	Scanning mode (flags – see Flag table 3.4)
52–55	La2 – latitude of last grid point (see Note 1)
56–59	Lo2 – longitude of last grid point (see Note 1)
60	Type of horizontal line (see Code table 3.20)
61–64	NT – number of time steps
65	Unit of offset from reference time (see Code table 4.4)
66–69	Offset from reference of first time (negative value when first bit set)
70	Type of time increment (see Code table 4.11)
71	Unit of time increment (see Code table 4.4)
72–75	Time increment (negative value when first bit set)
	76–82 Last date/time
76–77	Year
78	Month
79	Day
80	Hour
81	Minute
82	Second

Notes:

(1) Basic angle of the initial production domain and subdivisions of this basic angle are provided to manage cases where the recommended unit of 10^{-6} degrees is not applicable to describe the extreme longitudes and latitudes. For these last descriptors, the unit is equal to the ratio of the basic angle and the subdivisions number.
For ordinary cases, zero and missing values should be coded, equivalent to respective values of 1 and 10^6 (10^{-6} degrees unit).

(2) A scaled value of radius of spherical Earth, or major or minor axis of oblate spheroid Earth, is derived by applying the appropriate scale factor to the value expressed in metres.

Grid definition template 3.1200 – time section grid

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	Contents
15–18	NT – number of time steps
19	Unit of offset from reference time (see Code table 4.4)
20–23	Offset from reference of first time (negative value when first bit set)
24	Type of time increment (see Code table 4.11)
25	Unit of time increment (see Code table 4.4)
26–29	Time increment (negative value when first bit set)
	30–36 Last date/time
30–31	Year
32	Month
33	Day
34	Hour
35	Minute
36	Second
37–38	Number of vertical points
39	Physical meaning of vertical coordinate (see Code table 3.15)
40	Vertical dimension coordinate values definition (see Code table 3.21)
41–42	NC – number of coefficients or values used to specify vertical coordinates
43–(42+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)

TEMPLATE DEFINITIONS USED IN SECTION 4

Product definition template 4.0 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off 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

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time

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)
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)
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
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	Type of ensemble forecast (see Code table 4.6)
36	Perturbation number
37	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.2 – derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer at a point in time

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)
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)
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
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.3 – 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

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)
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)
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
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high resolution control belongs
39	Number of cluster to which the low resolution control belongs

(continued)

(Product definition template 4.3 – continued)

Octet No.	Contents
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Northern latitude of cluster domain
46–49	Southern latitude of cluster domain
50–53	Eastern longitude of cluster domain
54–57	Western longitude of cluster domain
58	N_c – number of forecasts in the cluster
59	Scale factor of standard deviation in the cluster
60–63	Scaled value of standard deviation in the cluster
64	Scale factor of distance of the cluster from ensemble mean
65–68	Scaled value of distance of the cluster from ensemble mean
69–(68+N_c)	List of N_c ensemble forecast numbers (N_c is given in octet 58)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.4 – 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

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)
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)
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
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high resolution control belongs
39	Number of cluster to which the low resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Latitude of central point in cluster domain
46–49	Longitude of central point in cluster domain
50–53	Radius of cluster domain
54	N_c – number of forecasts in the cluster

(continued)

(Product definition template 4.4 – continued)

Octet No.	Contents
55	Scale factor of standard deviation in the cluster
56–59	Scaled value of standard deviation in the cluster
60	Scale factor of distance of the cluster from ensemble mean
61–64	Scaled value of distance of the cluster from ensemble mean
65–(64+N_c)	List of N_c ensemble forecast numbers (N_c is given in octet 54)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.5 – probability forecasts at a horizontal level or in a horizontal layer at a point in time

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)
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)
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
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	Forecast probability number
36	Total number of forecast probabilities
37	Probability type (see Code table 4.9)
38	Scale factor of lower limit
39–42	Scaled value of lower limit
43	Scale factor of upper limit
44–47	Scaled value of upper limit

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.6 – percentile forecasts at a horizontal level or in a horizontal layer at a point in time

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)
13	Background generating process identifier (defined by originating centre)
14	Forecast generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.6 – continued)

Octet No.	Contents
15–16	Hours after reference time of data cut-off (see Note)
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
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	Percentile value (from 100% to 0%)

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.7 – analysis or forecast error at a horizontal level or in a horizontal layer at a point in time

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or 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
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

Notes:

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

(2) This template should not be used. Product definition template 4.0 should be used instead.

Product definition template 4.8 – 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

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)
13	Background generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.8 – continued)

Octet No.	Contents
14	Analysis or 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
35–36	Year } Time of end of overall time interval
37	Month
38	Day
39	Hour
40	Minute
41	Second
42	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
43–46	Total number of data values missing in statistical process
	47–58 Specification of the outermost (or only) time range over which statistical processing is done
47	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
48	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
49	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
50–53	Length of the time range over which statistical processing is done, in units defined by the previous octet
54	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
55–58	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	59–nn These octets are included only if n > 1, where nn = 46 + 12 x n
59–70	As octets 47 to 58, next innermost step of processing
71–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 47 to 58, 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.

(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 48, 60, 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 times.

Product definition template 4.9 – probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

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)
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	Forecast probability number
36	Total number of forecast probabilities
37	Probability type (see Code table 4.9)
38	Scale factor of lower limit
39–42	Scaled value of lower limit
43	Scale factor of upper limit
44–47	Scaled value of upper limit
48–49	Year of end of overall time interval
50	Month of end of overall time interval
51	Day of end of overall time interval
52	Hour of end of overall time interval
53	Minute of end of overall time interval
54	Second of end of overall time interval
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 the statistical process
	60–71 Specification of the outermost (or only) time range over which statistical processing is done
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 Note 3)

(continued)

(Product definition template 4.9 – continued)

Octet No.	Contents
	72–nn These octets are included only if n > 1, where nn = 59 + 12 x n
72–83	As octets 60 to 71, next innermost step of processing
84–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 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 46, 58, 70, ...). 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 times.

Product definition template 4.10 – percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to the WMO Secretariat (Observing and Information Systems Department) to assist for validation.

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)
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 for data cut-off
18	Indicator of unit of time range (see Code table 4.4)
19–22	Forecast time in units defined by previous octet (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	Percentile value (from 100% to 0%)
36–37	Year of end of overall time interval
38	Month of end of overall time interval
39	Day of end of overall time interval
40	Hour of end of overall time interval
41	Minute of end of overall time interval
42	Second of end of overall time interval
43	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
44–47	Total number of data values missing in the statistical process

(continued)

(Product definition template 4.10 – continued)

Octet No.	Contents
	48–59 Specification of the outermost (or only) time range over which statistical processing is done
48	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
49	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
50	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
51–54	Length of the time range over which statistical processing is done, in units defined by the previous octet
55	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
56–59	Time increment between successive fields, in units defined by the previous octet (see Note 3)
	60–nn These octets are included only if n > 1, where nn = 47 + 12 x n
60–71	As octets 48–59, next innermost step of processing
72–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 48 to 59, 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 raingauge.

Product definition template 4.11 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

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)
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	Type of ensemble forecast (see Code table 4.6)
36	Perturbation number

(continued)

(Product definition template 4.11 – continued)

Octet No.	Contents
37	Number of forecasts in ensemble
38–39	Year of end of overall time interval
40	Month of end of overall time interval
41	Day of end of overall time interval
42	Hour of end of overall time interval
43	Minute of end of overall time interval
44	Second of end of overall time interval
45	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
46–49	Total number of data values missing in statistical process
	50–61 Specification of the outermost (or only) time range over which statistical processing is done
50	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
51	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
52	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
53–56	Length of the time range over which statistical processing is done, in units defined by the previous octet
57	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
58–61	Time increment between successive fields, in units defined by the previous octet (see Note 3)
	62–nn These octets are included only if n > 1, where nn = 49 + 12 x n
62–73	As octets 50 to 61, next innermost step of processing
74–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 50 to 61, 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 51, 63, 75, ...). 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 times.

Product definition template 4.12 – derived forecasts based on all ensemble members at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval

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)
13	Background generating process identifier (defined by originating centre)

(continued)

(Product definition template 4.12 – continued)

Octet No.	Contents
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37–38	Year of end of overall time interval
39	Month of end of overall time interval
40	Day of end of overall time interval
41	Hour of end of overall time interval
42	Minute of end of overall time interval
43	Second of end of overall time interval
44	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
45–48	Total number of data values missing in statistical process
	49–60 Specification of the outermost (or only) time range over which statistical processing is done
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
52–55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
57–60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	61–nn These octets are included only if n > 1, where nn = 48 + 12 x n
61–72	As octets 49 to 60, next innermost step of processing
73–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, 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.

(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 50, 62, 74, ...). 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 times.

Product definition template 4.13 – 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 time interval

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)
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)
37	Cluster identifier
38	Number of cluster to which the high resolution control belongs
39	Number of cluster to which the low resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Northern latitude of cluster domain
46–49	Southern latitude of cluster domain
50–53	Eastern longitude of cluster domain
54–57	Western longitude of cluster domain
58	N_C – number of forecasts in the cluster
59	Scale factor of standard deviation in the cluster
60–63	Scaled value of standard deviation in the cluster
64	Scale factor of distance of the cluster from ensemble mean
65–68	Scaled value of distance of the cluster from ensemble mean
69–70	Year of end of overall time interval
71	Month of end of overall time interval
72	Day of end of overall time interval
73	Hour of end of overall time interval
74	Minute of end of overall time interval
75	Second of end of overall time interval
76	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
77–80	Total number of data values missing in statistical process
	81–92 Specification of the outermost (or only) time range over which statistical processing is done
81	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)

(continued)

(Product definition template 4.13 – continued)

Octet No.	Contents
82	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
83	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
84–87	Length of the time range over which statistical processing is done, in units defined by the previous octet
88	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
89–92	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	93–nn These octets are included only if n > 1, where nn = 80 + 12 x n
93–104	As octets 81 to 92, next innermost step of processing
105–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 81 to 92, repeated as necessary
(nn+1)–(nn+N_C)	List of N_C ensemble forecast numbers (N_C is given in octet 58)

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.

(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 82, 94, 106,....). 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 times.

Product definition template 4.14 – 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 time interval

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)
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	Derived forecast (see Code table 4.7)
36	Number of forecasts in the ensemble (N)

(continued)

(Product definition template 4.14 – continued)

Octet No.	Contents
37	Cluster identifier
38	Number of cluster to which the high resolution control belongs
39	Number of cluster to which the low resolution control belongs
40	Total number of clusters
41	Clustering method (see Code table 4.8)
42–45	Latitude of central point in cluster domain
46–49	Longitude of central point in cluster domain
50–53	Radius of cluster domain
54	N_C – number of forecasts in the cluster
55	Scale factor of standard deviation in the cluster
56–59	Scaled value of standard deviation in the cluster
60	Scale factor of distance of the cluster from ensemble mean
61–64	Scaled value of distance of the cluster from ensemble mean
65–66	Year of end of overall time interval
67	Month of end of overall time interval
68	Day of end of overall time interval
69	Hour of end of overall time interval
70	Minute of end of overall time interval
71	Second of end of overall time interval
72	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
73–76	Total number of data values missing in statistical process
	77–88 Specification of the outermost (or only) time range over which statistical processing is done
77	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
78	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
79	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
80–83	Length of the time range over which statistical processing is done, in units defined by the previous octet
84	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
85–88	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	89–nn These octets are included only if n > 1, where nn = 76 + 12 x n
89–110	As octets 77 to 88, next innermost step of processing
111–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 77 to 88, repeated as necessary
(nn+1)–(nn+N_C)	List of N_C ensemble forecast numbers (N_C is given in octet 54)

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.

(continued)

(Product definition template 4.14 – continued)

(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.

(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 78, 90, 112, ...). 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 times.

Product definition template 4.15 – 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

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off 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	Statistical process used within the spatial area defined by octet 36 (see Code table 4.10)
36	Type of spatial processing used to arrive at given data value from the source data (see Code table 4.15)
37	Number of data points used in spatial processing defined in octet 36

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.20 – radar product

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)
13	Number of radar sites used
14	Indicator of unit of time range
15–18	Site latitude (in 10^{-6} degree)
19–22	Site longitude (in 10^{-6} degree)
23–24	Site elevation (metres)
25–28	Site ID (alphanumeric)
29–30	Site ID (numeric)
31	Operating mode (see Code table 4.12)
32	Reflectivity calibration constant (tenths of dB)
33	Quality control indicator (see Code table 4.13)
34	Clutter filter indicator (see Code table 4.14)
35	Constant antenna elevation angle (tenths of degree true)
36–37	Accumulation interval (minutes)
38	Reference reflectivity for echo top (dB)
39–41	Range bin spacing (metres)
42–43	Radial angular spacing (tenths of degree true)

Product definition template 4.30 – satellite product

Note: This template is deprecated. Template 4.31 should be used instead.

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)
13	Observation generating process identifier (defined by originating centres)
14	Number of contributing spectral bands (NB)
	Repeat the following 10 octets for each contributing band (nb = 1, NB)
(15+10(nb–1))–(16+10(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(17+10(nb–1))–(18+10(nb–1))	Satellite numbers of band nb (code table defined by originating/generating centre)
(19+10(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(20+10(nb–1))	Scale factor of central wave number of band nb
(21+10(nb–1))–(24+10(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Note: For “satellite series of band nb”, “satellite numbers of band nb” and “instrument types of band nb”, it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

Product definition template 4.31 – satellite product

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)
13	Observation generating process identifier (defined by originating centres)
14	Number of contributing spectral bands (NB)
	Repeat the following 11 octets for each contributing band (nb = 1, NB)
(15+11(nb–1))–(16+11(nb–1))	Satellite series of band nb (code table defined by originating/generating centre)
(17+11(nb–1))–(18+11(nb–1))	Satellite numbers of band nb (code table defined by originating/generating centre)
(19+11(nb–1))–(20+11(nb–1))	Instrument types of band nb (code table defined by originating/generating centre)
(21+11(nb–1))	Scale factor of central wave number of band nb
(22+11(nb–1))–(25+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Note: For “satellite series of band nb”, “satellite numbers of band nb” and “instrument types of band nb”, it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

Product definition template 4.32 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for simulated (synthetic) satellite data

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier
15–16	Hours of observational data cut-off after reference time (see Note 2)
17	Minutes of observational data cut-off 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	Number of contributing spectral bands (NB)
	Repeat the following 11 octets for each contributing band (nb = 1, NB)
(24+11(nb–1))–(25+11(nb–1))	Satellite series of band nb (Code table defined by originating/generating centre)
(26+11(nb–1))–(27+11(nb–1))	Satellite number of band nb (Code table defined by originating/generating centre)
(28+11(nb–1))–(29+11(nb–1))	Instrument types of band nb (Code table defined by originating/generating centre)
(30 +11(nb–1))	Scale factor of central wave number of band nb
(31+11(nb–1))–(34+11(nb–1))	Scaled value of central wave number of band nb (units: m^{-1})

Notes:

(1) For "satellite series of band nb", "satellite numbers of band nb" and "instrument types of band nb", it is recommended to encode the values as per BUFR Code tables 0 02 020, 0 01 007 (Common Code table C–5) and 0 02 019 (Common Code table C–8), respectively.

(2) Hours greater than 65534 will be coded as 65534.

Product definition template 4.40 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17–18	Hours of observational data cut-off after reference time (see Note)
19	Minutes of observational data cut-off after reference time
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.41 – individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.42 – 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

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note 1)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37–38	Year
39	Month
40	Day
41	Hour
42	Minute
43	Second
44	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
45–48	Total number of data values missing in statistical process
	49–60 Specification of the outermost (or only) time range over which statistical processing is done
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
52–55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
57–60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	61–nn These octets are included only if n > 1, where nn = 48 + 12 x n
61–72	As octets 49 to 60, next innermost step of processing
73–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary.

Notes:

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

(continued)

(Product definition template 4.42 – continued)

(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.

(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 50, 62, 74, …). 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 times.

Product definition template 4.43 – 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

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Atmospheric chemical constituent type (see Code table 4.230)
14	Type of generating process (see Code table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17–18	Hours after reference time of data cut-off (see Note 1)
19	Minutes after reference time of data cut-off
20	Indicator of unit of time range (see Code table 4.4)
21–24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code table 4.5)
26	Scale factor of first fixed surface
27–30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code table 4.5)
32	Scale factor of second fixed surface
33–36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble
40–41	Year of end of overall time interval
42	Month of end of overall time interval
43	Day of end of overall time interval
44	Hour of end of overall time interval
45	Minute of end of overall time interval
46	Second of end of overall time interval
47	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
48–51	Total number of data values missing in statistical process
	52–63 Specification of the outermost (or only) time range over which statistical processing is done
52	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
53	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
54	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)

(continued)

(Product definition template 4.43 – continued)

Octet No.	Contents
55–58	Length of the time range over which statistical processing is done, in units defined by the previous octet
59	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
60–63	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	64–nn These octets are included only if n > 1, where nn = 51 + 12 x n
64–75	As octets 52 to 63, next innermost step of processing
76–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 52 to 63, 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.

(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 53, 65, 77, …). 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 times.

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 No.	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 sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
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 of observational data cut-off after reference time (see Note)
30	Minutes of observational data cut-off after reference time
31	Indicator of unit of time range (see Code table 4.4)
32–33	Forecast time in units defined by octet 31
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: 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 No.	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 sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
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 cut-off (see Note)
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 31
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: 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 No.	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 sizes (see Code table 4.91)
15	Scale factor of first size
16–19	Scaled value of first size in metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
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

(continued)

(Product definition template 4.46 – continued)

Octet No.	Contents
31	Indicator of unit of time range (see Code table 4.4)
32–35	Forecast time in units defined by octet 31 (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 – time of end of overall time interval
50	Month – time of end of overall time interval
51	Day – time of end of overall time interval
52	Hour – time of end of overall time interval
53	Minute – time of end of overall time interval
54	Second – time of end of overall time interval
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 Specification of the outermost (or only) time range over which statistical processing is done
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)
	72–nn These octets are included only if n > 1, where nn = 59 + 12n
72–83	As octets 60 to 71, next innermost step of processing
84–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 raingauge.

(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 times.

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)
13–14	Aerosol type (see Code table 4.233)
15	Type of interval for first and second sizes (see Code table 4.91)
16	Scale factor of first size
17–20	Scaled value of first size in metres
21	Scale factor of second size
22–25	Scaled value of second size in metres
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 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 31 (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	Type of ensemble forecast (see Code table 4.6)
49	Perturbation number
50	Number of forecasts in ensemble
51–52	Year of end of overall time interval
53	Month of end of overall time interval
54	Day of end of overall time interval
55	Hour of end of overall time interval
56	Minute of end of overall time interval
57	Second of end of overall time interval
58	n – number of time range specifications describing the time intervals used to calculate the statistically processed field
59–62	Total number of data values missing in statistical process
	63–74 Specification of the outermost (or only) time range over which statistical processing is done
63	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
64	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
65	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
66–69	Length of the time range over which statistical processing is done, in units defined by the previous octet
70	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
71–74	Time increment between successive fields, in units defined by the previous octet (see Note 3)

(continued)

(Product definition template 4.47 – continued)

Octet No.	Contents
	75–nn These octets are included only if n > 1, where nn = 62 + 12n
75–86	As octets 63 to 74, next innermost step of processing
87–nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 63 to 74, 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 reference and forecast times as the initial reference and forecast times.

Product definition template 4.48 – analysis or forecast at a horizontal level or in a horizontal layer at a point in time for optical properties of aerosol

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–13	Aerosol type (see Common Code table C–14)
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 metres
20	Scale factor of second size
21–24	Scaled value of second size in metres
25	Type of interval for first and second wavelength (see Code table 4.91)
26	Scale factor of first wavelength
27–30	Scaled value of first wavelength in metres
31	Scale factor of second wavelength
32–35	Scaled value of second wavelength in metres
36	Type of generating process (see Code table 4.3)
37	Background generating process identifier (defined by originating centre)
38	Analysis or forecast generating process identifier (defined by originating centre)
39–40	Hours of observational data cut-off after reference time (see Note)
41	Minutes of observational data cut-off after reference time
42	Indicator of unit of time range (see Code table 4.4)
43–46	Forecast time in units defined by octet 42
47	Type of first fixed surface (see Code table 4.5)
48	Scale factor of first fixed surface
49–52	Scaled value of first fixed surface
53	Type of second fixed surface (see Code table 4.5)
54	Scale factor of second fixed surface
55–58	Scaled value of second fixed surface

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.51 – categorical forecasts at a horizontal level or in a horizontal layer at a point in time

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)
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)
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
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 limits (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: 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 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)
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

(continued)

(Product definition template 4.91 – continued)

Octet No.	Contents
	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 limits (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 Specification of the outermost (or only) time range over which statistical processing is done
(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 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 (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 reference and forecast times as the initial reference and forecast times.

Product definition template 4.254 – CCITT IA5 character string

Octet No.	Contents
10	Parameter category (see Code table 4.1)
11	Parameter number (see Code table 4.2)
12–15	Number of characters

Product definition template 4.1000 – cross-section of analysis and forecast at a point in time

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off 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

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1001 – cross-section of averaged or otherwise statistically processed analysis or forecast over a range of time

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note 1)
17	Minutes of observational data cut-off 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
23–26	Total number of data values missing in the statistical process
27	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
28	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
29	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
30–33	Length of the time range over which statistical processing is done, in units defined by the previous octet
34	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)
35–38	Time increment between successive fields, in units defined by the previous octet (see Note 2)

(continued)

(Product definition template 4.1001 – continued)

Notes:

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

(2) 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.

Product definition template 4.1002 – cross-section of analysis and forecast, averaged or otherwise statistically processed over latitude or longitude

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off 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	Horizontal dimension processed (see Code table 4.220)
24	Treatment of missing data (e.g. below ground) (see Code table 4.221)
25	Type of statistical processing (see Code table 4.10)
26–29	Start of range
30–33	End of range
34–35	Number of values

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1100 – Hovmöller-type grid with no averaging or other statistical processing

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note)
17	Minutes of observational data cut-off 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

(continued)

(Product definition template 4.1100 – continued)

Octet No.	Contents
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

Note: Hours greater than 65534 will be coded as 65534.

Product definition template 4.1101 – Hovmöller-type grid with averaging or other statistical processing

Preliminary note: This template is simply experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests. (Octets 35–50 are very similar to octets 43–58 of product definition template 4.8, but the meaning of some fields differs slightly.)

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)
13	Background generating process identifier (defined by originating centre)
14	Analysis or forecast generating process identifier (defined by originating centre)
15–16	Hours of observational data cut-off after reference time (see Note 1)
17	Minutes of observational data cut-off 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 (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
35–38	Total number of data values missing in the statistical process
39	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code table 4.10)
40	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)
41	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)
42–45	Length of the time range over which statistical processing is done, in units defined by the previous octet
46	Indicator of unit of time for increment between the successive fields used (see Code table 4.4)
47–50	Time increment between successive fields, in units defined by the previous octet (see Note 3)

Notes:

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

(2) Reference = reference time (section 1) + forecast range (PDT) + offset and increments from reference time (GDT).

(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.

TEMPLATE DEFINITIONS USED IN SECTION 5

Data representation template 5.0 – Grid point data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	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 used for each packed value for simple packing, or for each group reference value for complex packing or spatial differencing
21	Type of original field values (see Code table 5.1)

Note: Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.1 – Matrix values at grid point – simple packing

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to WMO Secretariat (Observing and Information Systems Department) to assist for validation.

Note: For most templates, details of the packing process are described in Regulation 92.9.4

Octet No.	Contents
12–21	Same as data representation template 5.0
22	0, no matrix bit maps present; 1–matrix bit maps present
23–26	Number of data values encoded in Section 7
27–28	NR – first dimension (rows) of each matrix
29–30	NC – second dimension (columns) of each matrix
31	First dimension coordinate value definition (Code table 5.2)
32	NC1 – number of coefficients or values used to specify first dimension coordinate function
33	Second dimension coordinate value definition (Code table 5.2)
34	NC2 – number of coefficients or values used to specify second dimension coordinate function
35	First dimension physical significance (Code table 5.3)
36	Second dimension physical significance (Code table 5.3)
37–(36+NC1x4)	Coefficients to define first dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point value)
(37+NC1x4)–(36+4(NC1+NC2))	Coefficients to define second dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point value)

Notes:

(1) This form of representation enables a matrix of values to be depicted at each grid point; the two dimensions of the matrix may represent coordinates expressed in terms of two elemental parameters (e.g. direction and frequency for wave spectra). The numeric values of these coordinates, beyond that of simple subscripts, can be given in a functional form, or as a collection of explicit numbers.

(2) Some simple coordinate functional forms are tabulated in Code table 5.2. Where a more complex coordinate function applies, the coordinate values shall be explicitly denoted by the inclusion of the actual set of values rather than the coefficients. This shall be indicated by a code figure 0 from Code table 5.2; the number of explicit values coded shall be equal to the appropriate dimension of the matrix for which values are presented and they shall follow octet 36 in place of the coefficients.

(3) Matrix bit maps will be present only if indicated by octet 22. If present, there shall be one bit map for each grid point with data values, as defined by the primary bit map in Section 6, each of length (NR x NC) bits: a bit set to 1 will indicate a data element at the corresponding location within the matrix. Bit maps shall be represented end-to-end, without regard for octet boundaries; the last bit map shall, if necessary, be followed by bits set to zero to fill any partially used octet.

(4) Matrices restricted to scanning in the +i direction (left to right) and in the –j direction (top to bottom).

Data representation template 5.2 – Grid point data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–21	Same as data representation template 5.0
22	Group splitting method used (see Code table 5.4)
23	Missing value management used (see Code table 5.5)
24–27	Primary missing value substitute
28–31	Secondary missing value substitute
32–35	NG – number of groups of data values into which field is split
36	Reference for group widths (see Note 12)
37	Number of bits used for the group widths (after the reference value in octet 36 has been removed)
38–41	Reference for group lengths (see Note 13)
42	Length increment for the group lengths (see Note 14)
43–46	True length of last group
47	Number of bits used for the scaled group lengths (after subtraction of the reference value given in octets 38–41 and division by the length increment given in octet 42)

Notes:

(1) Group lengths have no meaning for row by row packing, where groups are coordinate lines (so the grid description section and possibly the bit-map section are enough); for consistency, associated field width and reference should then be encoded as 0.

(2) For row by row packing with a bit-map, there should always be as many groups as rows. In case of rows with only missing values, all associated descriptors should be coded as zero.

(3) Management of widths into a reference and increments, together with management of lengths as scaled incremental values, are intended to save descriptor size (which is an issue as far as compression gains are concerned).

(4) Management of explicitly missing values is an alternative to bit-map use within Section 6; it is intended to reduce the whole GRIB message size.

(5) There may be two types of missing value(s), such as to make a distinction between static misses (for instance, due to a land/sea mask) and occasional misses.

(6) As an extra option, substitute value(s) for missing data may be specified. If not wished (or not applicable), all bits should be set to 1 for relevant substitute value(s).

(7) If substitute value(s) are specified, type of content should be consistent with original field values (floating-point - and then IEEE 32-bit encoded-, or integer).

(8) If primary missing values are used, such values are encoded within appropriate group with all bits set to 1 at packed data level.

(9) If secondary missing values are used, such values are encoded within appropriate group with all bits set to 1, except the last one set to 0, at packed data level.

(10) A group containing only missing values (of either type) will be encoded as a constant group (null width, no associated data) and the group reference will have all bits set to 1 for primary type, and all bits set to 1, except the last bit set to 0, for secondary type.

(11) If necessary, group widths and/or field width of group references may be enlarged to avoid ambiguities between missing value indicator(s) and true data.

(12) The group width is the number of bits used for every value in a group.

(13) The group length (L) is the number of values in a group.

(14) The essence of the complex packing method is to subdivide a field of values into NG groups, where the values in each group have similar sizes. In this procedure, it is necessary to retain enough information to recover the group lengths upon decoding. The NG group lengths for any given field can be described by Ln = ref + Kn x len_inc, n = 1, NG, where ref is given by octets 38–41 and len_inc by octet 42. The NG values of K (the scaled group lengths) are stored in the data section, each with the number of bits specified by octet 47. Since the last group is a special case which may not be able to be specified by this relationship, the length of the last group is stored in octets 43–46.

(15) See data template 7.2 and associated Notes for complementary information.

Data representation template 5.3 – Grid point data – complex packing and spatial differencing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–47	Same as data representation template 5.2
48	Order of spatial differencing (see Code table 5.6)
49	Number of octets required in the data section to specify extra descriptors needed for spatial differencing (octets 6–ww in data template 7.3)

Notes:

(1) Spatial differencing is a pre-processing before group splitting at encoding time. It is intended to reduce the size of sufficiently smooth fields, when combined with a splitting scheme as described in data representation template 5.2. At order 1, an initial field of values f is replaced by a new field of values g, where $g_1 = f_1$, $g_2 = f_2 – f_1$, …, $g_n = f_n – f_{n–1}$. At order 2, the field of values g is itself replaced by a new field of values h, where $h_1 = f_1$, $h_2 = f_2$, $h_3 = g_3 – g_2$, …, $h_n = g_n – g_{n–1}$. To keep values positive, the overall minimum of the resulting field (either g_{min} or h_{min}) is removed. At decoding time, after bit string unpacking, the original scaled values are recovered by adding the overall minimum and summing up recursively.

(2) For differencing of order n, the first n values in the array that are not missing are set to zero in the packed array. These dummy values are not used in unpacking.

(3) See data template 7.3 and associated Notes for complementary information.

Data representation template 5.4 – Grid point data – IEEE floating point data

Octet No.	Contents
12	Precision (see Code table 5.7)

Data representation template 5.40 – Grid point data – JPEG 2000 code stream format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	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 (i.e. depth of the grayscale image) (see Note 2)
21	Type of original field values (see Code table 5.1)
22	Type of compression used (see Code table 5.40)
23	Target compression ratio, M:1 (with respect to the bit-depth specified in octet 20), when octet 22 indicates lossy compression. Otherwise, set to missing (see Note 3)

Notes:

(1) The purpose of this template is to scale the grid point data to obtain the desired precision, if appropriate, and then subtract out the 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 JPEG 2000 code stream format. To unpack the data field, the JPEG 2000 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 JPEG 2000 standard specifies that the bit-depth must be in the range of 1 to 38 bits.

(3) The compression ratio M:1 (e.g. 20:1) specifies that the encoded stream should be less than ((1/M) x depth x number of data points) bits, where depth is specified in octet 20 and the number of data points in octets 6–9 of the data representation section.

(continued)

(Data representation template 5.40 – continued)

(4) The order of the data points should remain as specified in the scanning mode flags (Flag table 3.4) set in the appropriate grid definition template, even though the JPEG 2000 standard specifies that an image is stored starting at the top left corner. Assuming that the encoding software is expecting the image data in raster order (left to right across rows for each row), users should set the image width to Ni (or Nx) and the height to Nj (or Ny) if bit 3 of the scanning mode flag equals 0 (adjacent points in i (x) order), when encoding the "image". If bit 3 of the scanning mode flags equals 1 (adjacent points in j (y) order), it may be advantageous to set the image width to Nj (or Ny) and the height to Ni (or Nx).

(5) This template should not be used when the data points are not available on a rectangular grid, such as occurs if some data points are bit-mapped out or if section 3 describes a quasi-regular grid. If it is necessary to use this template on such a grid, the data field can be treated as a one-dimensional image where the height is set to 1 and the width is set to the total number of data points specified in octets 6–9.

(6) Negative values of E or D shall be represented according to Regulation 92.1.5.

(7) JPEG 2000 should not be used for bit-mapped or quasi-regular grid data.

Data representation template 5.41 – Grid point data – Portable Network Graphics (PNG) format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	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 (i.e. depth of the image) (see Note 2)
21	Type of original field values (see Code table 5.1)

Notes:

(1) The purpose of this template is to scale the grid point data to obtain the desired precision, if appropriate, and then subtract out the 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 an image and is then encoded into PNG format. To unpack the data field, the PNG 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) PNG does not support all bit-depths in an image, so it is necessary to define which depths can be used and how they are to be treated. For grayscale images, PNG supports depths of 1, 2, 4, 8 or 16 bits. Red-Green-Blue (RGB) colour images can have depths of 8 or 16 bits with an optional alpha sample. Valid values for octet 20 can be:

1, 2, 4, 8, or 16 : Treat as grayscale image

24 : Treat as RGB colour image (each component having 8-bit depth)

32 : Treat as RGB w/ alpha sample colour image (each component having 8-bit depth)

(3) The order of the data points should remain as specified in the scanning mode flags (Flag table 3.4) set in the appropriate grid definition template, even though the PNG standard specifies that an image is stored starting at the top left corner and scans each row from left to right, starting with the top row. Users should set the image width to Ni (or Nx) and the height to Nj (or Ny) if bit 3 of the scanning mode flag equals 0 (adjacent points in i (x) order), when encoding the "image". If bit 3 of the scanning mode flags equals 1 (adjacent points in j (y) order), it may be advantageous to set the image width to Nj (or Ny) and the height to Ni (or Nx).

(4) This template should not be used when the data points are not available on a rectangular grid, such as occurs if some data points are bit-mapped out or if section 3 describes a quasi-regular grid. If it is necessary to use this template on such a grid, the data field can be treated as a one-dimensional image where the height is set to 1 and the width is set to the total number of data points specified in octets 6–9.

(5) Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.50 – Spectral data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	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 used for each packed value (field width)
21–24	Real part of (0.0) coefficient (IEEE 32-bit floating-point value)

Notes:

(1) Removal of the real part of (0.0) coefficient from packed data is intended to reduce the variability of the coefficients, in order to improve packing accuracy.

(2) For some spectral representations, the (0.0) coefficient represents the mean value of the parameter represented.

(3) Negative values of E or D shall be represented according to Regulation 92.1.5.

Data representation template 5.51 – Spherical harmonics data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
12–20	Same as data representation template 5.50
21–24	P – Laplacian scaling factor (expressed in 10^{-6} units)
25–26	J_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
27–28	K_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
29–30	M_S – pentagonal resolution parameter of the unpacked subset (see Note 1)
31–34	T_S – total number of values in the unpacked subset (see Note 1)
35	Precision of the unpacked subset (see Code table 5.7)

Notes:

(1) The unpacked subset is a set of values defined in the same way as the full set of values (on a spectrum limited to J_S, K_S and M_S), but on which scaling and packing are not applied. Associated values are stored in octets 6 onwards of Section 7.

(2) The remaining coefficients are multiplied by $(n \times (n+1))^P$, scaled and packed. The operator associated with this multiplication is derived from the Laplacian operator on the sphere.

(3) The retrieval formula for a coefficient of wave number n is then:

$Y = (R + X \times 2^E) \times 10^{-D} \times (n \times (n+1))^{-P}$ where X is the packed scaled value associated with the coefficient.

Data representation template 5.61 – Grid point data – simple packing with logarithm pre-processing

Preliminary note: This template is experimental, was not validated at the time of publication and should be used only for bilateral previously agreed tests.

Octet No.	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 used for each packed value
21–24	Pre-processing parameter (B) (IEEE 32-bit floating-point value)

(continued)

(Data representation template 5.61 – continued)

Notes:

(1) This template is appropriately designed for data sets with all non-negative values and a wide variability range (more then 5 orders of magnitude). It must not be used for data sets with negative values or smaller variability range.

(2) A logarithm pre-processing algorithm is used to fit the variability range into one or two order of magnitudes before using the simple packing algorithm. It requires a parameter (B) to assure that all values passed to the logarithm function are positive. Thus scaled values are Z = ln (Y+B), where Y are the original values, ln is the natural logarithm (or Napierian) function and B is chosen so that Y+B > 0.

(3) Best practice follows for choosing the B pre-processing parameter.

  (a) If the data set minimum value is positive, B can be safely put to zero.

  (b) If the data set minimum is zero, all values must be scaled to become greater than zero and B can be equal to the minimum positive value in the data set.

(4) Data shall be packed using Data template 7.

Data representation template 5.200 – Grid point data – run length packing with level values

Octet No.	Contents
12	Number of bits used for each packed value in the run length packing with level
13–14	MV – maximum value within the levels that are used in the packing
15–16	MVL – maximum value of level (predefined)
17	Decimal scale factor of representative value of each level
18–(19+2(lv–1))	List of MVL scaled representative values of each level from lv = 1 to MVL

TEMPLATE DEFINITIONS USED IN SECTION 7

Data template 7.0 – Grid point data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Data template 7.1 – Matrix values at grid point – simple packing

Preliminary note: This template was not validated at the time of publication and should be used with caution. Please report any use to WMO Secretariat to assist for validation.

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Note: Group descriptors mentioned above may not be physically present; if associated field width is 0.

Data template 7.2 – Grid point data – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–xx	NG group reference values (X1 in the decoding formula), each of which is encoded using the number of bits specified in octet 20 of data representation template 5.0. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary
[xx+1]–yy	NG group widths, each of which is encoded using the number of bits specified in octet 37 of data representation template 5.2. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary
[yy+1]–zz	NG scaled group lengths, each of which is encoded using the number of bits specified in octet 47 of data representation template 5.2. Bits set to zero shall be appended as necessary to ensure this sequence of numbers ends on an octet boundary (see Note 14 of data representation template 5.2)
[zz+1]–nn	Packed values (X2 in the decoding formula), where each value is a deviation from its respective group reference value

Notes:

(1) Group descriptors mentioned above may not be physically present; if associated field width is 0.

(2) Group lengths have no meaning for row by row packing; for consistency, associated field width should then be encoded as 0. So no specific test for row by row case is mandatory at decoding software level to handle encoding/decoding of group descriptors.

(3) Scaled group lengths, if present, are encoded for each group. But the true last group length (unscaled) should be taken from data representation template.

(4) For groups with a constant value, associated field width is 0, and no incremental data are physically present.

Data template 7.3 – Grid point data – complex packing and spatial differencing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–ww	First value(s) of original (undifferenced) scaled data values, followed by the overall minimum of the differences. The number of values stored is 1 greater than the order of differentiation, and the field width is described at octet 49 of data representation template 5.3 (see Note 1)
[ww+1]–xx	NG group reference values (X1 in the decoding formula), each of which is encoded using the number of bits specified in octet 20 of data representation template 5.0. Bits set to zero shall be appended where necessary to ensure this sequence of numbers ends on an octet boundary
[xx+1]–nn	Same as for data representation template 7.2

Notes:

(1) Referring to the notation in Note 1 of data representation template 5.3, at order 1, the values stored in octets 6–ww are g_1 and g_{min}. At order 2, the values stored are h_1, h_2, and h_{min}.

(2) Extra descriptors related to spatial differencing are added before the splitting descriptors, to reflect the separation between the two approaches. It enables to share software parts between cases with and without spatial differencing.

(3) The position of overall minimum after initial data values is a choice that enables less software management.

(4) Overall minimum will be negative in most cases. First bit should indicate the sign: 0 if positive, 1 if negative.

Data template 7.4 – Grid point data – IEEE floating point data

Octet No.	Contents
6–nn	Binary data values

Data template 7.40 – Grid point data – JPEG 2000 code stream format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	JPEG 2000 code stream as described in Part 1 of the JPEG 2000 standard (ISO/IEC 15444-1:2000)

Note: For simplicity, image data should be packed specifying a single component (i.e. grayscale image) instead of a multi-component colour image.

Data template 7.41 – Grid point data – Portable Network Graphics (PNG) format

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	PNG encoded image

Note: If octet 20 of data representation template 5.41 specifies the data are packed into either 1, 2, 4, 8, or 16 bits, then encode the "image" as a grayscale image. If octet 20 specifies 24 bits, encode the "image" as a Red-Green-Blue (RGB) colour image with 8-bit depth for each colour component, and finally if octet 20 is 32, encode the "image" as an RGB colour image with an alpha sample using 8-bit depth for each of the four components.

Data template 7.50 – Spectral data – simple packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–nn	Binary data values – binary string, with each (scaled) data value

Data template 7.51 – Spherical harmonics – complex packing

Note: For most templates, details of the packing process are described in Regulation 92.9.4.

Octet No.	Contents
6–(5+I$\times$T$_S$)	Data values from the unpacked subset (IEEE floating-point values on I octets)
(6+I$\times$T$_S$)–nn	Binary data values – binary string, with each (scaled) data value out of the unpacked subset

Notes:

(1) Values ordering within the unpacked subset is defined according to the source of grid definition associated with the data.

(2) Number of octets associated with each value of the unpacked subset (I) is defined in Code table 5.7, according to the actual value in octet 35 of data representation template 5.51.

(3) Values ordering within the packed data is done according to the source of grid definition, skipping the values processed in the unpacked subset.