TEMPLATE DEFINITIONS USED IN SECTION 3

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

Octet No.	Contents	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Ni - number of points along a parallel	Operational
35-38	Nj - number of points along a meridian	Operational
39-42	Basic angle of the initial production domain (see Note 1)	Operational
43-46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)	Operational
47-50	La1 - latitude of first grid point (see Note 1)	Operational
51-54	Lo1 - longitude of first grid point (see Note 1)	Operational
55	Resolution and component flags (see Flag table 3.3)	Operational
56-59	La2 - latitude of last grid point (see Note 1)	Operational
60-63	Lo2 - longitude of last grid point (see Note 1)	Operational
64-67	Di - i direction increment (see Note 1)	Operational
68-71	Dj - j direction increment (see Note 1)	Operational
72	Scanning mode (flags - see Flag table 3.4)	Operational
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)	Operational

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.

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

Octet No.	Contents	Status
15-72	Same as grid definition template 3.0 (see Note 1)	Operational
73-76	Latitude of the southern pole of projection	Operational
77-80	Longitude of the southern pole of projection	Operational

(continued)

(Grid definition template 3.1 - continued)

Octet No.	Contents	Status
81-84	Angle of rotation of projection	Operational
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)	Operational

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	Status
15-72	Same as grid definition template 3.0 (see Note 1)	Operational
73-76	Latitude of the pole of stretching	Operational
77-80	Longitude of the pole of stretching	Operational
81-84	Stretching factor	Operational
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)	Operational

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 $\underset{.}{\lambda}$ 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 $\underset{.}{\lambda}$ and $\underset{.}{\theta}$ 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	Status
15-72	Same as grid definition template 3.0 (see Note 1)	Operational
73-76	Latitude of the southern pole of projection	Operational
77-80	Longitude of the southern pole of projection	Operational
81-84	Angle of rotation of projection	Operational
85-88	Latitude of the pole of stretching	Operational
89-92	Longitude of the pole of stretching	Operational
93-96	Stretching factor	Operational
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)	Operational

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 3.10 - Mercator

Octet No.	Contents	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Ni - number of points along a parallel	Operational
35-38	Nj - number of points along a meridian	Operational
39-42	La1 - latitude of first grid point	Operational
43-46	Lo1 - longitude of first grid point	Operational
47	Resolution and component flags (see Flag table 3.3)	Operational
48-51	LaD - latitude(s) at which the Mercator projection intersects the Earth (Latitude(s) where Di and Dj are specified)	Operational
52-55	La2 - latitude of last grid point	Operational
56-59	Lo2 - longitude of last grid point	Operational
60	Scanning mode (flags - see Flag table 3.4)	Operational
61-64	Orientation of the grid, angle between i direction on the map and the Equator (see Note 1)	Operational
65-68	Di - longitudinal direction grid length (see Note 2)	Operational
69-72	Dj - latitudinal direction grid length (see Note 2)	Operational
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 GDT 3.1)	Operational

(continued)

(Grid definition template 3.10 - continued)

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 3.20 - polar stereographic projection

Octet No.	Contents	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Nx - number of points along the x-axis	Operational
35-38	Ny - number of points along the y-axis	Operational
39-42	La1 - latitude of first grid point	Operational
43-46	Lo1 - longitude of first grid point	Operational
47	Resolution and component flags (see Flag table 3.3 and Note 1)	Operational
48-51	LaD - latitude where Dx and Dy are specified	Operational
52-55	LoV - orientation of the grid (see Note 2)	Operational
56-59	Dx - x-direction grid length (see Note 3)	Operational
60-63	Dy - y-direction grid length (see Note 3)	Operational
64	Projection centre flag (see Flag table 3.5)	Operational
65	Scanning mode (see Flag table 3.4)	Operational

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	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational

(continued)

(Grid definition template 3.30 - continued)

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

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	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Nx - number of points along the x-axis	Operational
35-38	Ny - number of points along the y-axis	Operational
39-42	La1 - latitude of first grid point	Operational
43-46	Lo1 - longitude of first grid point	Operational
47	Resolution and component flags (see Flag table 3.3)	Operational
48-51	LaD - latitude where Dx and Dy are specified	Operational
52-55	LoV - longitude of meridian parallel to y-axis along which latitude increases as the y-coordinate increases	Operational
56-59	Dx - x-direction grid length (see Note 1)	Operational
60-63	Dy - y-direction grid length (see Note 1)	Operational
64	Projection centre flag (see Flag table 3.5)	Operational
65	Scanning mode (see Flag table 3.4)	Operational
66-69	Latin 1 - first latitude from the pole at which the secant cone cuts the sphere	Operational

(continued)

(Grid definition template 3.31 - continued)

Octet No.	Contents	Status
70-73	Latin 2 - second latitude from the pole at which the secant cone cuts the sphere	Operational
74-77	Latitude of the southern pole of projection	Operational
78-81	Longitude of the southern pole of projection	Operational

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 3.40 - Gaussian latitude/longitude

Octet No.	Contents	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Ni - number of points along a parallel	Operational
35-38	Nj - number of points along a meridian	Operational
39-42	Basic angle of the initial production domain (see Note 1)	Operational
43-46	Subdivisions of basic angle used to define extreme longitudes and latitudes, and direction increments (see Note 1)	Operational
47-50	La1 - latitude of first grid point (see Note 1)	Operational
51-54	Lo1 - longitude of first grid point (see Note 1)	Operational
55	Resolution and component flags (see Flag table 3.3)	Operational
56-59	La2 - latitude of last grid point (see Note 1)	Operational
60-63	Lo2 - longitude of last grid point (see Note 1)	Operational
64-67	Di - i direction increment (see Note 1)	Operational
68-71	N - number of parallels between a pole and the Equator (see Note 2)	Operational
72	Scanning mode (flags - see Flag table 3.4)	Operational
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)	Operational

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).

Grid definition template 3.41 - rotated Gaussian latitude/longitude

Octet No.	Contents	Status
15-72	Same as grid definition template 3.40 (see Note 1)	Operational
73-76	Latitude of the southern pole of projection	Operational
77-80	Longitude of the southern pole of projection	Operational
81-84	Angle of rotation of projection	Operational
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)	Operational

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	Status
15-72	Same as grid definition template 3.40 (see Note 1)	Operational
73-76	Latitude of the pole of stretching	Operational
77-80	Longitude of the pole of stretching	Operational
81-84	Stretching factor	Operational
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)	Operational

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	Status
15-72	Same as grid definition template 3.40 (see Note 1)	Operational
73-76	Latitude of the southern pole of projection	Operational
77-80	Longitude of the southern pole of projection	Operational
81-84	Angle of rotation of projection	Operational
85-88	Latitude of the pole of stretching	Operational
89-92	Longitude of the pole of stretching	Operational
93-96	Stretching factor	Operational
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)	Operational

(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 3.44 - latitude/longitude with data-sampling from a higher resolution latitude/longitude source-grid

Octet No.	*Contents*	*Status*
15-72	*Same as grid definition template 3.0 (see Note 1)*	*Validation*
73-76	*Nis - number of points along a parallel in source-grid*	*Validation*
77-80	*Njs - number of points along a meridian in source-grid*	*Validation*
81-84	*Basic angle of the initial production domain for source-grid (see Note 1)*	*Validation*
85-88	*Subdivisions of basic angle used to describe extreme latitudes and longitudes, direction increments and differencing of latitudes and longitudes for the source-grid (see Note 1)*	*Validation*
89-92	*La1S - latitude of first grid point of source-grid (see Note 1)*	*Validation*
93-96	*Lo1S - longitude of first grid point of source-grid (see Note 1)*	*Validation*
97	*Resolution and component flags of source-grid (see Flag table 3.3)*	*Validation*
98-101	*La2S - latitude of last grid point of source-grid (see Note 1)*	*Validation*
102-105	*Lo2S - longitude of last grid point of source-grid (see Note 1)*	*Validation*
106-109	*Dis - i direction increment of source-grid (see Note 1)*	*Validation*
110-113	*Djs - j direction increment of source-grid (see Note 1)*	*Validation*
114	*Type of sampling employed to select data from source-grid (see Code table 3.30)*	*Validation*
115-118	*For statistical sampling over a rectangular lat/long area, (latitude of top of rectangle - latitude of nominal point). For statistical sampling over a rectangular surface area, distance in metres between top of rectangle and the nominal point)*	*Validation*
119-122	*For statistical sampling over a rectangular lat/long area, (latitude of bottom of rectangle - latitude of nominal point). (see Note)* *For statistical sampling over a rectangular surface area, distance in metres between bottom of rectangle and the nominal point*	*Validation*
123-126	*For statistical sampling over a rectangular lat/long area, (longitude of right side of rectangle- longitude of nominal point). For statistical sampling over a rectangular surface area, distance in metres between right side of rectangle and the nominal point*	*Validation*
127-130	*For statistical sampling over a rectangular lat/long area, (longitude of left side of rectangle - longitude of nominal point). For statistical sampling over a rectangular surface area, distance in metres between left side of rectangle and the nominal point*	*Validation*

Note:

(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).

Grid definition template 3.50 - spherical harmonic coefficients

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

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	Status
15-28	Same as grid definition template 3.50	Operational
29-32	Latitude of the southern pole of projection	Operational
33-36	Longitude of the southern pole of projection	Operational
37-40	Angle of rotation of projection	Operational

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	Status
15-28	Same as grid definition template 3.50	Operational
29-32	Latitude of the pole of stretching	Operational
33-36	Longitude of the pole of stretching	Operational
37-40	Stretching factor	Operational

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	Status
15-28	Same as grid definition template 3.50	Operational
29-32	Latitude of the southern pole of projection	Operational
33-36	Longitude of the southern pole of projection	Operational
37-40	Angle of rotation of projection	Operational
41-44	Latitude of pole of stretching	Operational
45-48	Longitude of pole of stretching	Operational
49-52	Stretching factor	Operational

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	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Nx - number of points along x-axis (columns)	Operational
35-38	Ny - number of points along y-axis (rows or lines)	Operational
39-42	Lap - latitude of sub-satellite point	Operational
43-46	Lop - longitude of sub-satellite point	Operational
47	Resolution and component flags (see Flag table 3.3)	Operational
48-51	dx - apparent diameter of Earth in grid lengths, in x-direction	Operational
52-55	dy - apparent diameter of Earth in grid lengths, in y-direction	Operational
56-59	Xp - x-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)	Operational
60-63	Yp - y-coordinate of sub-satellite point (in units of 10^{-3} grid length expressed as an integer)	Operational
64	Scanning mode (flags - see Flag table 3.4)	Operational
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)	Operational
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)	Operational
73-76	Xo - x-coordinate of origin of sector image	Operational
77-80	Yo - y-coordinate of origin of sector image	Operational

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 x 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	Status
15	n2 - exponent of 2 for the number of intervals on main triangle sides	Operational
16	n3 - exponent of 3 for the number of intervals on main triangle sides	Operational
17-18	ni - number of intervals on main triangle sides of the icosahedron	Operational
19	nd - number of diamonds	Operational
20-23	Latitude of the pole point of the icosahedron on the sphere	Operational
24-27	Longitude of the pole point of the icosahedron on the sphere	Operational
28-31	Longitude of the centre line of the first diamond of the icosahedron on the sphere	Operational
32	Grid point position (see Code table 3.8)	Operational
33	Numbering order of diamonds (flags - see Flag table 3.9)	Operational
34	Scanning mode for one diamond (flags - see Flag table 3.10)	Operational
35-38	nt - total number of grid points	Operational

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.

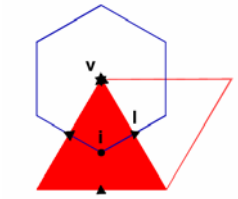
(4) The total number of grid points for one global field depends on the grid point position. If e.g. the grid points are located at the vertices of the triangles, then nt = (ni + 1) x (ni + 1) x nd since grid points at diamond edges are contained in both adjacent diamonds and for the same reason the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

Grid definition template 3.101 - general unstructured grid

Octet No.	*Contents*	*Status*
15	*Shape of the Earth (see Code table 3.2)*	*Validation*
16-18	*Number of grid used (defined by originating centre)*	*Validation*
19	*Number of grid in reference (to allow annotating for Arakawa C-grid on arbitrary grid) (see Note 1)*	*Validation*

Note:

(1) The Number is associated with an attribute of the respective grid description which consists of the centre longitude/latitude and the longitude/latitude of the boundary polygon vertices. Variables can be defined on different positions in the triangle.



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

1. triangles (i) (pressure, temperature,..)

2. quads (l) (wind velocity ..)

3. hexagons respectively pentagons (v) (vorticity)

Grid definition template 3.110 - Equatorial azimuthal equidistant projection

Octet No.	Contents	Status
15	Shape of the Earth (see Code table 3.2)	Operational
16	Scale factor of radius of spherical Earth	Operational
17-20	Scaled value of radius of spherical Earth	Operational
21	Scale factor of major axis of oblate spheroid Earth	Operational
22-25	Scaled value of major axis of oblate spheroid Earth	Operational
26	Scale factor of minor axis of oblate spheroid Earth	Operational
27-30	Scaled value of minor axis of oblate spheroid Earth	Operational
31-34	Nx - number of points along x-axis	Operational
35-38	Ny - number of points along y-axis	Operational
39-42	La1 - latitude of tangency point (centre of grid)	Operational
43-46	Lo1 - longitude of tangency point	Operational
47	Resolution and component flags (see Flag table 3.3)	Operational
48-51	Dx - x-direction grid length in units of 10^{-3} m as measured at the point of the axis	Operational
52-55	Dy - y-direction grid length in units of 10^{-3} m as measured at the point of the axis	Operational
56	Projection centre flag	Operational
57	Scanning mode (see Flag table 3.4)	Operational

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	Status
15-18	Nb - number of data bins along radials (see Note)	Operational
19-22	Nr - number of radials	Operational
23-26	La1 - latitude of centre point	Operational
27-30	Lo1 - longitude of centre point	Operational
31-34	Dx - spacing of bins along radials	Operational
35-38	Dstart - offset from origin to inner bound	Operational
39	Scanning mode (flags - see Flag table 3.4)	Operational
	40-(39+4Nr) For each of Nr radials:	Operational
(40+4(X-1))-(41+4(X-1))	Azi - starting azimuth, degrees x 10 (degrees as north)	Operational
(42+4(X-1))-(43+4(X-1))	Adelta - azimuthal width, degrees x 100 (+ clockwise, - counterclockwise), with X = 1 to Nr	Operational

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

Grid definition template 3.130 - irregular latitude/longitude grid

Octet No.	*Contents*	*Status*
15	*Shape of the earth (see Code table 3.2)*	*Validation*
16	*Scale factor of radius of spherical Earth*	*Validation*
17-20	*Scaled value of radius of spherical Earth*	*Validation*
21	*Scale factor of major axis of oblate spheroid Earth*	*Validation*
22-25	*Scaled value of major axis of oblate spheroid Earth*	*Validation*
26	*Scale factor of minor axis of oblate spheroid Earth*	*Validation*
27-30	*Scaled value of minor axis of oblate spheroid Earth*	*Validation*
31-(Nx4x2)	*Ordered list of latitude/longitude pairs for each grid point. The list of numbers are integer values of the valid latitudes in micro degrees (scaled by 10^6). Each integer value is represented in 4 octets and general regulations 92.1.7 and 92.1.8*	*Validation*

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	Status
15	Shape of the Earth (see Code table 3.2)	Experimental
16	Scale factor of radius of spherical Earth	Experimental
17-20	Scaled value of radius of spherical Earth	Experimental
21	Scale factor of major axis of oblate spheroid Earth	Experimental
22-25	Scaled value of major axis of oblate spheroid Earth	Experimental
26	Scale factor of minor axis of oblate spheroid Earth	Experimental
27-30	Scaled value of minor axis of oblate spheroid Earth	Experimental
31-34	Number of horizontal points	Experimental
35-38	Basic angle of the initial production domain (see Note 1)	Experimental
39-42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)	Experimental
43-46	La1 - latitude of first grid point (see Note 1)	Experimental
47-50	Lo1 - longitude of first grid point (see Note 1)	Experimental
51	Scanning mode (flags - see Flag table 3.4)	Experimental
52-55	La2 - latitude of last grid point (see Note 1)	Experimental
56-59	Lo2 - longitude of last grid point (see Note 1)	Experimental
60	Type of horizontal line (see Code table 3.20)	Experimental
61-62	Number of vertical points	Experimental
63	Physical meaning of vertical coordinate (see Code table 3.15)	Experimental
64	Vertical dimension coordinate values definition (see Code table 3.21)	Experimental
65-66	NC - number of coefficients or values used to specify vertical coordinates	Experimental
67-(66+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)	Experimental

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	Status
15	Shape of the Earth (see Code table 3.2)	Experimental
16	Scale factor of radius of spherical Earth	Experimental
17-20	Scaled value of radius of spherical Earth	Experimental
21	Scale factor of major axis of oblate spheroid Earth	Experimental
22-25	Scaled value of major axis of oblate spheroid Earth	Experimental
26	Scale factor of minor axis of oblate spheroid Earth	Experimental
27-30	Scaled value of minor axis of oblate spheroid Earth	Experimental
31-34	Number of horizontal points	Experimental
35-38	Basic angle of the initial production domain (see Note 1)	Experimental
39-42	Subdivisions of basic angle used to define extreme longitudes and latitudes (see Note 1)	Experimental
43-46	La1 - latitude of first grid point (see Note 1)	Experimental
47-50	Lo1 - longitude of first grid point (see Note 1)	Experimental
51	Scanning mode (flags - see Flag table 3.4)	Experimental
52-55	La2 - latitude of last grid point (see Note 1)	Experimental
56-59	Lo2 - longitude of last grid point (see Note 1)	Experimental
60	Type of horizontal line (see Code table 3.20)	Experimental
61-64	NT - number of time steps	Experimental
65	Unit of offset from reference time (see Code table 4.4)	Experimental
66-69	Offset from reference of first time (negative value when first bit set)	Experimental
70	Type of time increment (see Code table 4.11)	Experimental
71	Unit of time increment (see Code table 4.4)	Experimental
72-75	Time increment (negative value when first bit set)	Experimental
	76-82 Last date/time	Experimental
76-77	Year	Experimental
78	Month	Experimental
79	Day	Experimental
80	Hour	Experimental
81	Minute	Experimental
82	Second	Experimental

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	Status
15-18	NT - number of time steps	Experimental
19	Unit of offset from reference time (see Code table 4.4)	Experimental
20-23	Offset from reference of first time (negative value when first bit set)	Experimental
24	Type of time increment (see Code table 4.11)	Experimental
25	Unit of time increment (see Code table 4.4)	Experimental
26-29	Time increment (negative value when first bit set)	Experimental
	30-36 Last date/time	Experimental
30-31	Year	Experimental
32	Month	Experimental
33	Day	Experimental
34	Hour	Experimental
35	Minute	Experimental
36	Second	Experimental
37-38	Number of vertical points	Experimental
39	Physical meaning of vertical coordinate (see Code table 3.15)	Experimental
40	Vertical dimension coordinate values definition (see Code table 3.21)	Experimental
41-42	NC - number of coefficients or values used to specify vertical coordinates	Experimental
43-(42+NCx4)	Coefficients to define vertical dimension coordinate values in functional form, or the explicit coordinate values (IEEE 32-bit floating-point values)	Experimental

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Analysis or forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours of observational data cutoff after reference time (see Note)	Operational
17	Minutes of observational data cutoff after reference time	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Type of ensemble forecast (see Code table 4.6)	Operational
36	Perturbation number	Operational
37	Number of forecasts in ensemble	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in ensemble	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in the ensemble (N)	Operational
37	Cluster identifier	Operational
38	Number of cluster to which the high resolution control belongs	Operational
39	Number of cluster to which the low resolution control belongs	Operational

(continued)

(Grid definition template 4.3 - continued)

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

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in the ensemble (N)	Operational
37	Cluster identifier	Operational
38	Number of cluster to which the high resolution control belongs	Operational
39	Number of cluster to which the low resolution control belongs	Operational
40	Total number of clusters	Operational
41	Clustering method (see Code table 4.8)	Operational
42-45	Latitude of central point in cluster domain	Operational
46-49	Longitude of central point in cluster domain	Operational
50-53	Radius of cluster domain	Operational
54	N_c - number of forecasts in the cluster	Operational

(continued)

(Grid definition template 4.4 - continued)

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

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Forecast probability number	Operational
36	Total number of forecast probabilities	Operational
37	Probability type (see Code table 4.9)	Operational
38	Scale factor of lower limit	Operational
39-42	Scaled value of lower limit	Operational
43	Scale factor of upper limit	Operational
44-47	Scaled value of upper limit	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational

(continued)

(Grid definition template 4.6 - continued)

Octet No.	Contents	Status
15-16	Hours after reference time of data cutoff (see Note)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Percentile value (from 100% to 0%)	Operational

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

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational

(continued)

(Grid definition template 4.8 - continued)

Octet No.	Contents	Status
14	Analysis or forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35-36	Year } time of end of overall time interval	Operational
37	Month }	Operational
38	Day }	Operational
39	Hour }	Operational
40	Minute }	Operational
41	Second }	Operational
42	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
43-46	Total number of data values missing in statistical process	Operational
	47-58 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational
48	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Operational
49	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Operational
50-53	Length of the time range over which statistical processing is done, in units defined by the previous octet	Operational
54	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Operational
55-58	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)	Operational
	59-nn These octets are included only if n>1, where nn = 46 + 12 x n	Operational
59-70	As octets 47 to 58, next innermost step of processing	Operational
71-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 47 to 58, repeated as necessary	Operational

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs and the rainfall measured by a rain gauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 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 time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Forecast probability number	Operational
36	Total number of forecast probabilities	Operational
37	Probability type (see Code table 4.9)	Operational
38	Scale factor of lower limit	Operational
39-42	Scaled value of lower limit	Operational
43	Scale factor of upper limit	Operational
44-47	Scaled value of upper limit	Operational
48-49	Year of end of overall time interval	Operational
50	Month of end of overall time interval	Operational
51	Day of end of overall time interval	Operational
52	Hour of end of overall time interval	Operational
53	Minute of end of overall time interval	Operational
54	Second of end of overall time interval	Operational
55	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
56-59	Total number of data values missing in the statistical process	Operational
	60-71 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational
61	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Operational
62	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Operational
63-66	Length of the time range over which statistical processing is done, in units defined by the previous octet	Operational
67	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Operational
68-71	Time increment between successive fields, in units defined by the previous octet (see Note 3)	Operational

(continued)

(Grid definition template 4.9 - continued)

Octet No.	Contents	Status
	72-nn These octets are included only if n>1, where nn = 59 + 12 x n	Operational
72-83	As octets 60 to 71, next innermost step of processing	Operational
84-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary.	Operational

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs and the rainfall measured by a rain gauge. The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 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 time.

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	Status
10	Parameter category (see Code table 4.1)	Validation
11	Parameter number (see Code table 4.2)	Validation
12	Type of generating process (see Code table 4.3)	Validation
13	Background generating process identifier (defined by originating centre)	Validation
14	Forecast generating process identifier (defined by originating centre)	Validation
15-16	Hours after reference time of data cutoff (see Note 1)	Validation
17	Minutes after reference time for data cutoff	Validation
18	Indicator of unit of time range (see Code table 4.4)	Validation
19-22	Forecast time in units defined by previous octet (see Note 2)	Validation
23	Type of first fixed surface (see Code table 4.5)	Validation
24	Scale factor of first fixed surface	Validation
25-28	Scaled value of first fixed surface	Validation
29	Type of second fixed surface (see Code table 4.5)	Validation
30	Scale factor of second fixed surface	Validation
31-34	Scaled value of second fixed surface	Validation
35	Percentile value (from 100% to 0%)	Validation
36-37	Year of end of overall time interval	Validation
38	Month of end of overall time interval	Validation
39	Day of end of overall time interval	Validation
40	Hour of end of overall time interval	Validation
41	Minute of end of overall time interval	Validation
42	Second of end of overall time interval	Validation
43	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Validation
44-47	Total number of data values missing in the statistical process	Validation

(continued)

(Grid definition template 4.10 - continued)

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

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 rain gauge.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Type of ensemble forecast (see Code table 4.6)	Operational
36	Perturbation number	Operational

(continued)

(Grid definition template 4.11 - continued)

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

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 time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational

(continued)

(Grid definition template 4.12 - continued)

Octet No.	Contents	Status
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in the ensemble (N)	Operational
37-38	Year of end of overall time interval	Operational
39	Month of end of overall time interval	Operational
40	Day of end of overall time interval	Operational
41	Hour of end of overall time interval	Operational
42	Minute of end of overall time interval	Operational
43	Second of end of overall time interval	Operational
44	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
45-48	Total number of data values missing in statistical process	Operational
	49-60 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Operational
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Operational
52-55	Length of the time range over which statistical processing is done, in units defined by the previous octet	Operational
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Operational
57-60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)	Operational
	61-nn These octets are included only if n>1, where nn = 48 + 12 x n	Operational
61-72	As octets 49 to 60, next innermost step of processing	Operational
73-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary	Operational

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 time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in the ensemble (N)	Operational
37	Cluster identifier	Operational
38	Number of cluster to which the high resolution control belongs	Operational
39	Number of cluster to which the low resolution control belongs	Operational
40	Total number of clusters	Operational
41	Clustering method (see Code table 4.8)	Operational
42-45	Northern latitude of cluster domain	Operational
46-49	Southern latitude of cluster domain	Operational
50-53	Eastern longitude of cluster domain	Operational
54-57	Western longitude of cluster domain	Operational
58	N_C - number of forecasts in the cluster	Operational
59	Scale factor of standard deviation in the cluster	Operational
60-63	Scaled value of standard deviation in the cluster	Operational
64	Scale factor of distance of the cluster from ensemble mean	Operational
65-68	Scaled value of distance of the cluster from ensemble mean	Operational
69-70	Year of end of overall time interval	Operational
71	Month of end of overall time interval	Operational
72	Day of end of overall time interval	Operational
73	Hour of end of overall time interval	Operational
74	Minute of end of overall time interval	Operational
75	Second of end of overall time interval	Operational
76	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
77-80	Total number of data values missing in statistical process	Operational
	81-92 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational

(continued)

(Grid definition template 4.13 - continued)

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

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 time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Forecast generating process identifier (defined by originating centre)	Operational
15-16	Hours after reference time of data cutoff (see Note 1)	Operational
17	Minutes after reference time of data cutoff	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18 (see Note 2)	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Derived forecast (see Code table 4.7)	Operational
36	Number of forecasts in the ensemble (N)	Operational

(continued)

(Grid definition template 4.14 - continued)

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

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)

(Grid 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 time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Background generating process identifier (defined by originating centre)	Operational
14	Analysis or forecast generating processes identifier (defined by originating centre)	Operational
15-16	Hours of observational data cutoff after reference time (see Note)	Operational
17	Minutes of observational data cutoff after reference time	Operational
18	Indicator of unit of time range (see Code table 4.4)	Operational
19-22	Forecast time in units defined by octet 18	Operational
23	Type of first fixed surface (see Code table 4.5)	Operational
24	Scale factor of first fixed surface	Operational
25-28	Scaled value of first fixed surface	Operational
29	Type of second fixed surface (see Code table 4.5)	Operational
30	Scale factor of second fixed surface	Operational
31-34	Scaled value of second fixed surface	Operational
35	Statistical process used within the spatial area defined by octet 36 (see Code table 4.10)	Operational
36	Type of spatial processing used to arrive at given data value from source data (see Code table 4.15)	Operational
37	Number of data points used in spatial processing defined in octet 36	Operational

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

Product definition template 4.20 - radar product

Octet No.	Contents	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Number of radar sites used	Operational
14	Indicator of unit of time range	Operational
15-18	Site latitude (in 10^{-6} degree)	Operational
19-22	Site longitude (in 10^{-6} degree)	Operational
23-24	Site elevation (metres)	Operational
25-28	Site ID (alphanumeric)	Operational
29-30	Site ID (numeric)	Operational
31	Operating mode (see Code table 4.12)	Operational
32	Reflectivity calibration constant (tenths of dB)	Operational
33	Quality control indicator (see Code table 4.13)	Operational
34	Clutter filter indicator (see Code table 4.14)	Operational
35	Constant antenna elevation angle (tenths of degree true)	Operational
36-37	Accumulation interval (minutes)	Operational
38	Reference reflectivity for echo top (dB)	Operational
39-41	Range bin spacing (metres)	Operational
42-43	Radial angular spacing (tenths of degree true)	Operational

Product definition template 4.30 - satellite product

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

Octet No.	Contents	Status
10	Parameter category (see Code table 4.1)	Deprecated
11	Parameter number (see Code table 4.2)	Deprecated
12	Type of generating process (see Code table 4.3)	Deprecated
13	Observation generating process identifier (defined by originating centres)	Deprecated
14	Number of contributing spectral bands (NB)	Deprecated
	Repeat the following 10 octets for each contributing band (nb = 1, NB)	Deprecated
(15+10(nb-1))-(16+10(nb-1))	Satellite series of band nb (code table defined by originating/generating centre)	Deprecated
(17+10(nb-1))-(18+10(nb-1))	Satellite numbers of band nb (code table defined by originating/generating centre)	Deprecated
(19+10(nb-1))	Instrument types of band nb (code table defined by originating/generating centre)	Deprecated
(20+10(nb-1))	Scale factor of central wave number of band nb	Deprecated
(21+10(nb-1))-(24+10(nb-1))	Scaled value of central wave number of band nb (units: m^{-1})	Deprecated

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12	Type of generating process (see Code table 4.3)	Operational
13	Observation generating process identifier (defined by originating centres)	Operational
14	Number of contributing spectral bands (NB)	Operational
	Repeat the following 11 octets for each contributing band (nb = 1, NB)	Operational
(15+11(nb-1))-(16+11(nb-1))	Satellite series of band nb (code table defined by originating/generating centre)	Operational
(17+11(nb-1))-(18+11(nb-1))	Satellite numbers of band nb (code table defined by originating/generating centre)	Operational
(19+11(nb-1))-(20+11(nb-1))	Instrument types of band nb (code table defined by originating/generating centre)	Operational
(21+11(nb-1))	Scale factor of central wave number of band nb	Operational
(22+11(nb-1))-(25+11(nb-1))	Scaled value of central wave number of band nb (units: m^{-1})	Operational

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*	*Status*
10	*Parameter category (see Code table 4.1)*	*Validation*
11	*Parameter number (see Code table 4.2)*	*Validation*
12	*Type of generating process (see Code table 4.3)*	*Validation*
13	*Background generating process identifier (defined by originating centres)*	*Validation*
14	*Analysis or forecast generating process identifier*	*Validation*
15-16	*Hours of observational data cutoff after reference time (see Note)*	*Validation*
17	*Minutes of observational data cutoff after reference time (see Note)*	*Validation*
18	*Indicator of unit of time range (see Code table 4.4)*	*Validation*
19-22	*Forecast time in units defined by octet 18*	*Validation*
23	*Number of contributing spectral bands (NB)*	*Validation*
	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)*	*Validation*
(26+11(nb-1))-(27+11(nb-1))	*Satellite number of band nb (Code table defined by originating/generating centre)*	*Validation*
(28+11(nb-1))-(29+11(nb-1))	*Instrument types of band nb (Code table defined by originating/generating centre)*	*Validation*
(30 +11(nb-1))	*Scale factor of central wave number of band nb*	*Validation*
(31+11(nb-1))-(34+11(nb-1))	*Scaled value of central wave number of band nb (units: m^{-1})*	*Validation*

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12-13	Atmospheric chemical constituent type (see Code table 4.230)	Operational
14	Type of generating process (see Code table 4.3)	Operational
15	Background generating process identifier (defined by originating centre)	Operational
16	Analysis or forecast generating process identifier (defined by originating centre)	Operational
17-18	Hours of observational data cutoff after reference time (see Note)	Operational
19	Minutes of observational data cutoff after reference time	Operational
20	Indicator of unit of time range (see Code table 4.4)	Operational
21-24	Forecast time in units defined by octet 20	Operational
25	Type of first fixed surface (see Code table 4.5)	Operational
26	Scale factor of first fixed surface	Operational
27-30	Scaled value of first fixed surface	Operational
31	Type of second fixed surface (see Code table 4.5)	Operational
32	Scale factor of second fixed surface	Operational
33-36	Scaled value of second fixed surface	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12-13	Atmospheric chemical constituent type (see Code table 4.230)	Operational
14	Type of generating process (see Code table 4.3)	Operational
15	Background generating process identifier (defined by originating centre)	Operational
16	Forecast generating process identifier (defined by originating centre)	Operational
17-18	Hours after reference time of data cutoff (see Note)	Operational
19	Minutes after reference time of data cutoff	Operational
20	Indicator of unit of time range (see Code table 4.4)	Operational
21-24	Forecast time in units defined by octet 20	Operational
25	Type of first fixed surface (see Code table 4.5)	Operational
26	Scale factor of first fixed surface	Operational
27-30	Scaled value of first fixed surface	Operational
31	Type of second fixed surface (see Code table 4.5)	Operational
32	Scale factor of second fixed surface	Operational
33-36	Scaled value of second fixed surface	Operational
37	Type of ensemble forecast (see Code table 4.6)	Operational
38	Perturbation number	Operational
39	Number of forecasts in ensemble	Operational

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12-13	Atmospheric chemical constituent type (see Code table 4.230)	Operational
14	Type of generating process (see Code table 4.3)	Operational
15	Background generating process identifier (defined by originating centre)	Operational
16	Analysis or forecast generating process identifier (defined by originating centre)	Operational
17-18	Hours after reference time of data cutoff (see Note 1)	Operational
19	Minutes after reference time of data cutoff	Operational
20	Indicator of unit of time range (see Code table 4.4)	Operational
21-24	Forecast time in units defined by octet 20 (see Note 2)	Operational
25	Type of first fixed surface (see Code table 4.5)	Operational
26	Scale factor of first fixed surface	Operational
27-30	Scaled value of first fixed surface	Operational
31	Type of second fixed surface (see Code table 4.5)	Operational
32	Scale factor of second fixed surface	Operational
33-36	Scaled value of second fixed surface	Operational
37-38	Year	Operational
39	Month	Operational
40	Day	Operational
41	Hour	Operational
42	Minute	Operational
43	Second	Operational
44	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
45-48	Total number of data values missing in statistical process	Operational
	49-60 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational
50	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Operational
51	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Operational
52-55	Length of the time range over which statistical processing is done, in units defined by the previous octet	Operational
56	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Operational
57-60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)	Operational
	61-nn These octets are included only if n>1, where nn = 48 + 12 x n	Operational
61-72	As octets 49 to 60, next innermost step of processing	Operational
73-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 49 to 60, repeated as necessary.	Operational

Notes:

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

(continued)

(Grid 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 rain gauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 50, 62, 74, …). For all but the innermost (last) time range, the next inner range is then processed using these references and forecast times as the initial reference and forecast time.

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	Status
10	Parameter category (see Code table 4.1)	Operational
11	Parameter number (see Code table 4.2)	Operational
12-13	Atmospheric chemical constituent type (see Code table 4.230)	Operational
14	Type of generating process (see Code table 4.3)	Operational
15	Background generating process identifier (defined by originating centre)	Operational
16	Forecast generating process identifier (defined by originating centre)	Operational
17-18	Hours after reference time of data cutoff (see Note 1)	Operational
19	Minutes after reference time of data cutoff	Operational
20	Indicator of unit of time range (see Code table 4.4)	Operational
21-24	Forecast time in units defined by octet 20 (see Note 2)	Operational
25	Type of first fixed surface (see Code table 4.5)	Operational
26	Scale factor of first fixed surface	Operational
27-30	Scaled value of first fixed surface	Operational
31	Type of second fixed surface (see Code table 4.5)	Operational
32	Scale factor of second fixed surface	Operational
33-36	Scaled value of second fixed surface	Operational
37	Type of ensemble forecast (see Code table 4.6)	Operational
38	Perturbation number	Operational
39	Number of forecasts in ensemble	Operational
40-41	Year of end of overall time interval	Operational
42	Month of end of overall time interval	Operational
43	Day of end of overall time interval	Operational
44	Hour of end of overall time interval	Operational
45	Minute of end of overall time interval	Operational
46	Second of end of overall time interval	Operational
47	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Operational
48-51	Total number of data values missing in statistical process	Operational
	52-63 Specification of the outermost (or only) time range over which statistical processing is done	Operational
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)	Operational
53	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Operational
54	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Operational
55-58	Length of the time range over which statistical processing is done, in units defined by the previous octet	Operational
59	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Operational
60-63	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)	Operational

(continued)

(Grid definition template 4.43 - continued)

Octet No.	Contents	Status
	64-nn These octets are included only if n>1, where nn = 51 + 12 x n	Operational
64-75	As octets 52 to 63, next innermost step of processing	Operational
76-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 52 to 63, repeated as necessary.	Operational

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 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 time.

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

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*	*Status*
10	*Parameter category (see Code table 4.1)*	*Validation*
11	*Parameter number (see Code table 4.2)*	*Validation*
12-13	*Aerosol type (see Code table 4.233)*	*Validation*
14	*Type of interval for first and second size (see Code table 4.91)*	*Validation*
15	*Scale factor of first size*	*Validation*
16-19	*Scaled value of first size in meters*	*Validation*
20	*Scale factor of second size*	*Validation*
21-24	*Scaled value of second size in meters*	*Validation*
25	*Type of generating process (see Code table 4.3)*	*Validation*
26	*Background generating process identifier (defined by originating centre)*	*Validation*
27	*Forecast generating process identifier (defined by originating centre)*	*Validation*
28-29	*Hours after reference time of data cutoff (see Note 1)*	*Validation*
30	*Minutes after reference time of data cutoff*	*Validation*
31	*Indicator of unit of time range (see Code table 4.4)*	*Validation*
32-35	*Forecast time in units defined by octet 18*	*Validation*
36	*Type of first fixed surface (see Code table 4.5)*	*Validation*
37	*Scale factor of first fixed surface*	*Validation*
38-41	*Scaled value of first fixed surface*	*Validation*
42	*Type of second fixed surface (see Code table 4.5)*	*Validation*
43	*Scale factor of second fixed surface*	*Validation*
44-47	*Scaled value of second fixed surface*	*Validation*
48	*Type of ensemble forecast (see Code table 4.6)*	*Validation*
49	*Perturbation number*	*Validation*
50	*Number of forecasts in ensemble*	*Validation*

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*	*Status*
10	*Parameter category (see Code table 4.1)*	*Validation*
11	*Parameter number (see Code table 4.2)*	*Validation*
12-13	*Aerosol type (see Code table 4.233)*	*Validation*
14	*Type of interval for first and second size (see Code table 4.91)*	*Validation*
15	*Scale factor of first size*	*Validation*
16-19	*Scaled value of first size in meters*	*Validation*
20	*Scale factor of second size*	*Validation*
21-24	*Scaled value of second size in meters*	*Validation*
25	*Type of generating process (see Code table 4.3)*	*Validation*
26	*Background generating process identifier (defined by originating centre)*	*Validation*
27	*Analysis or forecast generating process identifier (defined by originating centre)*	*Validation*
28-29	*Hours after reference time of data cutoff (see Note 1)*	*Validation*
30	*Minutes after reference time of data cutoff*	*Validation*

(continued)

(Grid definition template 4.46 - continued)

Octet No.	Contents	Status
31	Indicator of unit of time range (see Code table 4.4)	Validation
32-35	Forecast time in units defined by octet 18 (see Note 2)	Validation
36	Type of first fixed surface (see Code table 4.5)	Validation
37	Scale factor of first fixed surface	Validation
38-41	Scaled value of first fixed surface	Validation
42	Type of second fixed surface (see Code table 4.5)	Validation
43	Scale factor of second fixed surface	Validation
44-47	Scaled value of second fixed surface	Validation
48-49	Year - time of end of overall time interval	Validation
50	Month - time of end of overall time interval	Validation
51	Day - time of end of overall time interval	Validation
52	Hour - time of end of overall time interval	Validation
53	Minute - time of end of overall time interval	Validation
54	Second - time of end of overall time interval	Validation
55	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Validation
56-59	Total number of data values missing in statistical process.	Validation
	60-71 Specification of the outermost (or only) time range over which statistical processing is done	Validation
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)	Validation
61	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Validation
62	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Validation
63-66	Length of the time range over which statistical processing is done, in units defined by the previous octet	Validation
67	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Validation
68-71	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)	Validation
	72-nn These octets are included only if n>1, where nn = 59 + 12n	Validation
72-83	As octets 60 to 71, next innermost step of processing	Validation
84-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 60 to 71, repeated as necessary.	Validation

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

(3) An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a rain gauge.

(4) The reference and forecast times are successively set to their initial values plus or minus the increment, as defined by the type of time increment (one of octets 61, 72 ...). For all but the innermost (last) time range, the next inner range is then processed using these reference and forecast times as the initial reference and forecast time.

Product definition template 4.47 - individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval for aerosol

Octet No.	Contents	Status
10	Parameter category (see Code table 4.1)	Validation
11	Parameter number (see Code table 4.2)	Validation
12	Type of generating process (see Code table 4.3)	Validation
13-14	Aerosol type (see Code table 4.233)	Validation
15	Type of interval for first and second size (see Code table 4.91)	Validation
16	Scale factor of first size	Validation
17-20	Scaled value of first size in meters	Validation
21	Scale factor of second size	Validation
22-25	Scaled value of second size in meters	Validation
26	Background generating process identifier (defined by originating centre)	Validation
27	Forecast generating process identifier (defined by originating centre)	Validation
28-29	Hours after reference time of data cutoff (see Note 1)	Validation
30	Minutes after reference time of data cutoff	Validation
31	Indicator of unit of time range (see Code table 4.4)	Validation
32-35	Forecast time in units defined by octet 18 (see Note 2)	Validation
36	Type of first fixed surface (see Code table 4.5)	Validation
37	Scale factor of first fixed surface	Validation
38-41	Scaled value of first fixed surface	Validation
42	Type of second fixed surface (see Code table 4.5)	Validation
43	Scale factor of second fixed surface	Validation
44-47	Scaled value of second fixed surface	Validation
48	Type of ensemble forecast (see Code table 4.6)	Validation
49	Perturbation number	Validation
50	Number of forecasts in ensemble	Validation
51-52	Year of end of overall time interval	Validation
53	Month of end of overall time interval	Validation
54	Day of end of overall time interval	Validation
55	Hour of end of overall time interval	Validation
56	Minute of end of overall time interval	Validation
57	Second of end of overall time interval	Validation
58	n - number of time range specifications describing the time intervals used to calculate the statistically-processed field	Validation
59-62	Total number of data values missing in statistical process	Validation
63-74	Specification of the outermost (or only) time range over which statistical processing is done	Validation
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)	Validation
64	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Validation
65	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Validation
66-69	Length of the time range over which statistical processing is done, in units defined by the previous octet	Validation
70	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Validation
71-74	Time increment between successive fields, in units defined by the previous octet (see Note 3)	Validation

(continued)

(Grid definition template 4.47 - continued)

Octet No.	Contents	Status
75-nn	These octets are included only if n>1, where nn = 62 + 12n	Validation
75-86	As octets 63 to 74, next innermost step of processing	Validation
87-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 62 to 73, repeated as necessary	Validation

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

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

Product definition template 4.50 - analysis or forecast of a multi component parameter or matrix element at a point in time

Octet No.	Contents	Status
10	Parameter category (see Code table 4.1)	Validation
11	Parameter number (see Code table 4.2)	Validation
12	Type of generating process (see Code table 4.3)	Validation
13	Background generating process identifier (defined by originating centre)	Validation
14	Analysis or forecast generating processes identifier (defined by originating centre)	Validation
15-16	Hours of observational data cutoff after reference time (see Note 1)	Validation
17	Minutes of observational data cutoff after reference time	Validation
18	Indicator of unit of time range (see Code table 4.4)	Validation
19-22	Forecast time in units defined by octet 18	Validation
23	Type of first fixed surface (see Code table 4.5)	Validation
24	Scale factor of first fixed surface	Validation
25-28	Scaled value of first fixed surface	Validation
29	Type of second fixed surface (see Code table 4.5)	Validation
30	Scale factor of second fixed surface	Validation
31-34	Scaled value of second fixed surface	Validation
35	First dimension physical significance (Code table 5.3) (see Note 2)	Validation
36	Second dimension physical significance (Code table 5.3) (see Note 2)	Validation
37-40	First dimension coordinate value (IEEE 32-bit floating-point value)	Validation
41-44	Second dimension coordinate value (IEEE 32-bit floating-point value)	Validation
45-48	First dimension (rows) of the complete matrix (see Note 3)	Validation
49-52	Second dimension (columns) of the complete matrix (see Note 3)	Validation

Notes:

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

(2) In case of ocean wave spectra e.g., according to Code Table 5.3, the physical significance values are 1 (Direction Degrees true) and 2 (Frequency (s^{-1}).

(3) The dimensions define the number of GRIBs needed for reconstruction of a complete matrix (e.g. wave spectrum) at one or more grid points. In case of vectors (1-dim-matrices), the second dimension must be set to 1 and the second dimension physical significance must be set to 255 (missing). In case of multi component parameter (e.g. no matrix or vector element), first and second dimension are set to 1.

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

Octet No.	*Contents*	*Status*
10	*Parameter category (see Code table 4.1)*	*Validation*
11	*Parameter number (see Code table 4.2)*	*Validation*
12	*Type of generating process (see Code table 4.3)*	*Validation*
13	*Background generating process identifier (defined by originating centre)*	*Validation*
14	*Forecast generating process identifier (defined by originating centre)*	*Validation*
15-16	*Hours after reference time of data cutoff (see Note 1)*	*Validation*
17	*Minutes after reference time of data cutoff*	*Validation*
18	*Indicator of unit of time range (see Code table 4.4)*	*Validation*
19-22	*Forecast time in units defined by octet 18*	*Validation*
23	*Type of first fixed surface (see Code table 4.5)*	*Validation*
24	*Scale factor of first fixed surface*	*Validation*
25-28	*Scaled value of first fixed surface*	*Validation*
29	*Type of second fixed surface (see Code table 4.5)*	*Validation*
30	*Scale factor of second fixed surface*	*Validation*
31-34	*Scaled value of second fixed surface*	*Validation*
35	*NC - number of categories*	*Validation*
	Repeat the following 12 octets for each category (i = 1,NC)	*Validation*
(36+12(i-1))	*Code figure*	*Validation*
(37+12(i-1))	*Type of interval for first and second limit (see Code table 4.91)*	*Validation*
(38+12(i-1))	*Scale factor of first limit*	*Validation*
(39+12(i-1))-(42+12(i-1))	*Scaled value of first limit*	*Validation*
(43+12(i-1))	*Scale factor of second limit*	*Validation*
(44+12(i-1))-(47+12(i-1))	*Scaled value of second limit*	*Validation*

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*	*Status*
10	*Parameter category (see Code table 4.1)*	*Validation*
11	*Parameter number (see Code table 4.2)*	*Validation*
12	*Type of generating process (see Code table 4.3)*	*Validation*
13	*Background generating process identifier (defined by originating centre)*	*Validation*
14	*Forecast generating process identifier (defined by originating centre)*	*Validation*
15-16	*Hours after reference time of data cutoff (see Note 1)*	*Validation*
17	*Minutes after reference time of data cutoff*	*Validation*
18	*Indicator of unit of time range (see Code table 4.4)*	*Validation*
19-22	*Forecast time in units defined by octet 18 (see Note 2)*	*Validation*
23	*Type of first fixed surface (see Code table 4.5)*	*Validation*
24	*Scale factor of first fixed surface*	*Validation*
25-28	*Scaled value of first fixed surface*	*Validation*
29	*Type of second fixed surface (see Code table 4.5)*	*Validation*
30	*Scale factor of second fixed surface*	*Validation*
31-34	*Scaled value of second fixed surface*	*Validation*
35	*NC - number of categories*	*Validation*

(continued)

(Grid definition template 4.91 - continued)

Octet No.	*Contents*	*Status*
	Repeat the following 12 octets for each category (i = 1,NC)	*Validation*
(36+12(i-1))	*Code figure*	*Validation*
(37+12(i-1))	*Type of interval for first and second limit (see Code table 4.91)*	*Validation*
(38+12(i-1))	*Scale factor of first limit*	*Validation*
(39+12(i-1))-(42+12(i-1))	*Scaled value of first limit*	*Validation*
(43+12(i-1))	*Scale factor of second limit*	*Validation*
(44+12(i-1))-(47+12(i-1))	*Scaled value of second limit*	*Validation*
(48+12(NC-1))-(49+12(NC-1))	*Year of end of overall time interval*	*Validation*
(50+12(NC-1))	*Month of end of overall time interval*	*Validation*
(51+12(NC-1))	*Day of end of overall time interval*	*Validation*
(52+12(NC-1))	*Hour of end of overall time interval*	*Validation*
(53+12(NC-1))	*Minute of end of overall time interval*	*Validation*
(54+12(NC-1))	*Second of end of overall time interval*	*Validation*
(55+12(NC-1))	*n - number of time range specifications describing the time intervals used to calculate the statistically-processed field*	*Validation*
(56+12(NC-1))-(59+12(NC-1))	*Total number of data values missing in statistical process*	*Validation*
	60-71 Specification of the outermost (or only) time range over which statistical processing is done	*Validation*
(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)*	*Validation*
(61+12(NC-1))	*Type of time increment between successive fields used in the statistical processing (see Code table 4.11)*	*Validation*
(62+12(NC-1))	*Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)*	*Validation*
(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*	*Validation*
(67+12(NC-1))	*Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)*	*Validation*
(68+12(NC-1))-(71+12(NC-1))	*Time increment between successive fields, in units defined by the previous octet (see Note 3)*	*Validation*
	72-nn These octets are included only if n>1, where nn = 72+12(n-1) +12(NC-1)	*Validation*
(72+12(NC-1))-(83+12(NC-1))	*As octets (60+12(NC-1)) to (71+12(NC-1)), next innermost step of processing*	*Validation*
(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*	*Validation*

Notes:

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

(2) The reference time in section 1 and the forecast time together define the beginning of the overall time interval.

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

Product definition template 4.254 - CCITT IA5 character string

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

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	Status
10	Parameter category (see Code table 4.1)	Experimental
11	Parameter number (see Code table 4.2)	Experimental
12	Type of generating process (see Code table 4.3)	Experimental
13	Background generating process identifier (defined by originating centre)	Experimental
14	Analysis or forecast generating process identifier (defined by originating centre)	Experimental
15-16	Hours of observational data cutoff after reference time (see Note)	Experimental
17	Minutes of observational data cutoff after reference time	Experimental
18	Indicator of unit of time range (see Code table 4.4)	Experimental
19-22	Forecast time in units defined by octet 18	Experimental

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	Status
10	Parameter category (see Code table 4.1)	Experimental
11	Parameter number (see Code table 4.2)	Experimental
12	Type of generating process (see Code table 4.3)	Experimental
13	Background generating process identifier (defined by originating centre)	Experimental
14	Analysis or forecast generating process identifier (defined by originating centre)	Experimental
15-16	Hours of observational data cutoff after reference time (see Note 1)	Experimental
17	Minutes of observational data cutoff after reference time	Experimental
18	Indicator of unit of time range (see Code table 4.4)	Experimental
19-22	Forecast time in units defined by octet 18	Experimental
23-26	Total number of data values missing in the statistical process	Experimental
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)	Experimental
28	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Experimental
29	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Experimental
30-33	Length of the time range over which statistical processing is done, in units defined by the previous octet	Experimental
34	Indicator of unit of time for the increment between the successive fields used (see Code table 4.4)	Experimental
35-38	Time increment between successive fields, in units defined by the previous octet (see Note 2)	Experimental

(continued)

(Grid 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 rain gauge.

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	Status
10	Parameter category (see Code table 4.1)	Experimental
11	Parameter number (see Code table 4.2)	Experimental
12	Type of generating process (see Code table 4.3)	Experimental
13	Background generating process identifier (defined by originating centre)	Experimental
14	Analysis or forecast generating process identifier (defined by originating centre)	Experimental
15-16	Hours of observational data cutoff after reference time (see Note)	Experimental
17	Minutes of observational data cutoff after reference time	Experimental
18	Indicator of unit of time range (see Code table 4.4)	Experimental
19-22	Forecast time in units defined by octet 18	Experimental
23	Horizontal dimension processed (see Code table 4.220)	Experimental
24	Treatment of missing data (e.g. below ground) (see Code table 4.221)	Experimental
25	Type of statistical processing (see Code table 4.10)	Experimental
26-29	Start of range	Experimental
30-33	End of range	Experimental
34-35	Number of values	Experimental

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	Status
10	Parameter category (see Code table 4.1)	Experimental
11	Parameter number (see Code table 4.2)	Experimental
12	Type of generating process (see Code table 4.3)	Experimental
13	Background generating process identifier (defined by originating centre)	Experimental
14	Analysis or forecast generating process identifier (defined by originating centre)	Experimental
15-16	Hours of observational data cutoff after reference time (see Note)	Experimental
17	Minutes of observational data cutoff after reference time	Experimental
18	Indicator of unit of time range (see Code table 4.4)	Experimental
19-22	Forecast time in units defined by octet 18	Experimental
23	Type of first fixed surface (see Code table 4.5)	Experimental
24	Scale factor of first fixed surface	Experimental
25-28	Scaled value of first fixed surface	Experimental

(continued)

(Grid definition template 4.1100 - continued)

Octet No.	Contents	Status
29	Type of second fixed surface (see Code table 4.5)	Experimental
30	Scale factor of second fixed surface	Experimental
31-34	Scaled value of second fixed surface	Experimental

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	Status
10	Parameter category (see Code table 4.1)	Experimental
11	Parameter number (see Code table 4.2)	Experimental
12	Type of generating process (see Code table 4.3)	Experimental
13	Background generating process identifier (defined by originating centre)	Experimental
14	Analysis or forecast generating process identifier (defined by originating centre)	Experimental
15-16	Hours of observational data cutoff after reference time (see Note 1)	Experimental
17	Minutes of observational data cutoff after reference time	Experimental
18	Indicator of unit of time range (see Code table 4.4)	Experimental
19-22	Forecast time in units defined by octet 18 (see Note 2)	Experimental
23	Type of first fixed surface (see Code table 4.5)	Experimental
24	Scale factor of first fixed surface	Experimental
25-28	Scaled value of first fixed surface	Experimental
29	Type of second fixed surface (see Code table 4.5)	Experimental
30	Scale factor of second fixed surface	Experimental
31-34	Scaled value of second fixed surface	Experimental
35-38	Total number of data values missing in the statistical process	Experimental
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)	Experimental
40	Type of time increment between successive fields used in the statistical processing (see Code table 4.11)	Experimental
41	Indicator of unit of time for time range over which statistical processing is done (see Code table 4.4)	Experimental
42-45	Length of the time range over which statistical processing is done, in units defined by the previous octet	Experimental
46	Indicator of unit of time for increment between the successive fields used (see Code table 4.4)	Experimental
47-50	Time increment between successive fields, in units defined by the previous octet (see Note 3)	Experimental

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 rain gauge.

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	Status
12-15	Reference value (R) (IEEE 32-bit floating-point value)	Operational
16-17	Binary scale factor (E)	Operational
18-19	Decimal scale factor (D)	Operational
20	Number of bits used for each packed value for simple packing, or for each group reference value for complex packing or spatial differencing	Operational
21	Type of original field values (see Code table 5.1)	Operational

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

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	Status
12-21	Same as data representation template 5.0	Operational
22	Group splitting method used (see Code table 5.4)	Operational
23	Missing value management used (see Code table 5.5)	Operational
24-27	Primary missing value substitute	Operational
28-31	Secondary missing value substitute	Operational
32-35	NG - number of groups of data values into which field is split	Operational
36	Reference for group widths (see Note 12)	Operational
37	Number of bits used for the group widths (after the reference value in octet 36 has been removed)	Operational
38-41	Reference for group lengths (see Note 13)	Operational
42	Length increment for the group lengths (see Note 14)	Operational
43-46	True length of last group	Operational
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)	Operational

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	Status
12-47	Same as data representation template 5.2	Operational
48	Order of spatial differencing (see Code table 5.6)	Operational
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)	Operational

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	Status
12	Precision (see Code table 5.7)	Operational

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	Status
12-15	Reference value (R) (IEEE 32-bit floating-point value)	Operational
16-17	Binary scale factor (E)	Operational
18-19	Decimal scale factor (D)	Operational
20	Number of bits required to hold the resulting scaled and referenced data values (i.e. depth of the grayscale image) (see Note 2)	Operational
21	Type of original field values (see Code table 5.1)	Operational
22	Type of compression used. (see Code table 5.40)	Operational
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)	Operational

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)

(Grid definition 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	Status
12-15	Reference value (R) (IEEE 32-bit floating-point value)	Operational
16-17	Binary scale factor (E)	Operational
18-19	Decimal scale factor (D)	Operational
20	Number of bits required to hold the resulting scaled and referenced data values (i.e. depth of the image) (see Note 2)	Operational
21	Type of original field values (see Code table 5.1)	Operational

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 5.42 - Grid point and spectral data - CCSDS szip

Octet No.	*Contents*	*Status*
12-15	*Reference value (R) (IEEE 32-bit floating-point value)*	*Validation*
16-17	*Binary scale factor (E)*	*Validation*
18-19	*Decimal scale factor (D)*	*Validation*
20	*Number of bits required to hold the resulting scaled and referenced data values*	*Validation*
21	*Type of original field values (see Code table 5.1)*	*Validation*
22	*szip options mask*	*Validation*
23	*szip bits per pixel*	*Validation*
24-25	*szip pixels per block*	*Validation*
26-27	*szip pixels per scan line*	*Validation*

Notes:

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

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

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

A detailed description can be found in:

Consultative Committee for Space Data Systems: Lossless Data Compression.

CCSDS Recommendation for Space System Data Standards,

CCSDS 121.0-B-1, Blue Book, May 1997.

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

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	Status
12-15	Reference value (R) (IEEE 32-bit floating-point value)	Operational
16-17	Binary scale factor (E)	Operational
18-19	Decimal scale factor (D)	Operational
20	Number of bits used for each packed value (field width)	Operational
21-24	Real part of (0.0) coefficient (IEEE 32-bit floating-point value)	Operational

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	Status
12-20	Same as data representation template 5.50	Operational
21-24	P - Laplacian scaling factor (expressed in 10^{-6} units)	Operational
25-26	J_S - pentagonal resolution parameter of the unpacked subset (see Note 1)	Operational
27-28	K_S - pentagonal resolution parameter of the unpacked subset (see Note 1)	Operational
29-30	M_S - pentagonal resolution parameter of the unpacked subset (see Note 1)	Operational
31-34	T_S - total number of values in the unpacked subset (see Note 1)	Operational
35	Precision of the unpacked subset (see Code table 5.7)	Operational

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	Status
12-15	Reference value (R) (IEEE 32-bit floating-point value)	Experimental
16-17	Binary scale factor (E)	Experimental
18-19	Decimal scale factor (D)	Experimental
20	Number of bits used for each packed value	Experimental
21-24	Pre-processing parameter (B) (IEEE 32-bit floating-point value)	Experimental

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	Status
12	Number of bits used for each packed value in the run length packing with level	Operational
13-14	MV - maximum value within the levels that are used in the packing	Operational
15-16	MVL - maximum value of level (predefined)	Operational
17	Decimal scale factor of representative value of each level	Operational
18-(19+2(lv-1))	List of MVL scaled representative values of each level from lv=1 to MVL	Operational

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	Status
6-nn	Binary data values - binary string, with each (scaled) data value	Operational

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	Status
6-nn	Binary data values - binary string, with each (scaled) data value	Validation

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	Status
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	Operational
[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	Operational
[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)	Operational
[zz+1]-nn	Packed values (X2 in the decoding formula), where each value is a deviation from its respective group reference value	Operational

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	Status
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)	Operational
[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	Operational
[xx+1]-nn	Same as for data representation template 7.2	Operational

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	Status
6-nn	Binary data values	Operational

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	Status
6-nn	JPEG 2000 code stream as described in Part 1 of the JPEG 2000 standard. (ISO/IEC 15444-1:2000)	Operational

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	Status
6-nn	PNG encoded image	Operational

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	Status
6-nn	Binary data values - binary string, with each (scaled) data value	Operational

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	Status
6-(5+Ix $_S$)	Data values from the unpacked subset (IEEE floating-point values on I octets)	Operational
(6+IxT$_S$)-nn	Binary data values - binary string, with each (scaled) data value out of the unpacked subset	Operational

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.