

ADDITIONS TO GRIB EDITION 2 FOR PRE-OPERATIONAL IMPLEMENTATION
(updated 31/10/08)

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NEW TEMPLATES FOR CHEMICALS

Addition of:

- a new category to Product Discipline 0 in In Code Table 4.1
- a set of new parameters in In Code **Table 4.2**
- a new Section 4 Code Table occupying 2 octets: Code Table 4.230, referring to a new **Common Code Table C-14: Atmospheric chemical or physical constituent type**
- new Product Definition Templates which include the new Code Table 4.230: **4.40 to 4.43**

In Code Table 4.1 proposed new entry:

Product Discipline 0:	Meteorological products
Category Description	
20	<i>Atmospheric chemical constituents</i>
21-189	Reserved

In Code Table 4.2 the following addition:

Product Discipline 0: Meteorological products, Parameter Category 20: Atmospheric chemical constituents

Number	Parameter	Units
0	Mass density (concentration)	kg m ⁻³
1	Column-integrated mass density (see Note 1)	kg m ⁻²
2	Mass mixing ratio (mass fraction in air)	kg kg ⁻¹
3	Atmosphere emission mass flux	kg m ⁻² s ⁻¹
4	Atmosphere net production mass flux	kg m ⁻² s ⁻¹
5	Atmosphere net production and emission mass flux	kg m ⁻² s ⁻¹
6	Surface dry deposition mass flux	kg m ⁻² s ⁻¹
7	Surface wet deposition mass flux	kg m ⁻² s ⁻¹
8	Atmosphere re-emission mass flux	kg m ⁻² s ⁻¹
9-49	Reserved	
50	Amount in atmosphere	mol
51	Concentration in air	mol m ⁻³
52	Volume mixing ratio (fraction in air)	mol mol ⁻¹
53	Chemical gross production rate of concentration	mol m ⁻³ s ⁻¹
54	Chemical gross destruction rate of concentration	mol m ⁻³ s ⁻¹
55	Surface flux	mol m ⁻² s ⁻¹
56	Changes of amount in atmosphere (see Note 1)	mol s ⁻¹
57	Total yearly average burden of the	mol

1 FirstFixedSurface and SecondFixedSurface of Code Table 4.5 (Fixed surface types and units) to define the vertical extent, i.e. FirstFixedSurface can be set to 1 (Ground or water surface) and SecondFixedSurface set to 7 (Tropopause) for a restriction to the troposphere.

	atmosphere	
58	Total yearly averaged atmospheric loss (see Note 1)	mol s ⁻¹
59-99	Reserved	
100	Surface area density (aerosol)	m ⁻¹
101	Atmosphere optical thickness	m
102-191	Reserved	
192-254	Reserved for local use	
255	Missing	

Code Table 4.230: Atmospheric chemical constituent type
(see *Common Code Table C-14 below, but to be validated*)

PROPOSED NEW PRODUCT DEFINITION TEMPLATES:

The following proposed Product Definition Templates are based on existing templates with the inclusion of the new proposed Code Table 4.230.

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 Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17-18	Hours of observational data cutoff after reference time (see Note 1)
19	Minutes of observational data cutoff after reference time
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface

Note:

1. 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 Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code Table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble

Note:

1. 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 Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Analysis or forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37-38	Year
39	Month
40	Day
41	Hour
42	Minute
43	Second
44	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
45-48	Total number of data values missing in statistical process
	<i>49-60 Specification of the outermost (or only) time range over which statistical processing is done</i>
49	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
50	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
51	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
52-55	Length of the time range over which statistical processing is done, in units defined by the previous octet
56	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
57-60	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	<i>61-nn These octets are included only if $n > 1$, where $nn = 48 + 12 * n$</i>
61-72	As octets 49 to 60, next innermost step of processing
73- nn	Additional time range specifications, included in accordance with the

value of n. Contents as octets 49 to 60, repeated as necessary.

Notes:

1. Hours greater than 65534 will be coded as 65534.
2. The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
3. An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a 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 Number(s)	Contents
10	Parameter category (see Code Table 4.1)
11	Parameter number (see Code Table 4.2)
12-13	<i>Atmospheric chemical constituent type (see Code Table 4.230)</i>
14	Type of generating process (see Code Table 4.3)
15	Background generating process identifier (defined by originating centre)
16	Forecast generating process identifier (defined by originating centre)
17-18	Hours after reference time of data cutoff (see Note 1)
19	Minutes after reference time of data cutoff
20	Indicator of unit of time range (see Code Table 4.4)
21-24	Forecast time in units defined by octet 20 (see Note 2)
25	Type of first fixed surface (see Code Table 4.5)
26	Scale factor of first fixed surface
27-30	Scaled value of first fixed surface
31	Type of second fixed surface (see Code Table 4.5)
32	Scale factor of second fixed surface
33-36	Scaled value of second fixed surface
37	Type of ensemble forecast (see Code Table 4.6)
38	Perturbation number
39	Number of forecasts in ensemble
40-41	Year of end of overall time interval
42	Month of end of overall time interval
43	Day of end of overall time interval
44	Hour of end of overall time interval
45	Minute of end of overall time interval
46	Second of end of overall time interval
47	n - Number of time range specifications describing the time intervals used to calculate the statistically processed field
48-51	Total number of data values missing in statistical process
	<i>52-63 Specification of the outermost (or only) time range over which statistical processing is done</i>
52	Statistical process used to calculate the processed field from the field at each time increment during the time range (see Code Table 4.10)
53	Type of time increment between successive fields used in the statistical processing (see Code Table 4.11)
54	Indicator of unit of time for time range over which statistical processing is done (see Code Table 4.4)
55-58	Length of the time range over which statistical processing is done, in units defined by the previous octet
59	Indicator of unit of time for the increment between the successive fields used (see Code Table 4.4)
60-63	Time increment between successive fields, in units defined by the previous octet (see Notes 3 and 4)
	<i>64-nn These octets are included only if $n > 1$, where $nn = 51 + 12 * n$</i>

64-75	As octets 52 to 63, next innermost step of processing
76-nn	Additional time range specifications, included in accordance with the value of n. Contents as octets 52 to 63, repeated as necessary.

Notes:

1. Hours greater than 65534 will be coded as 65534.
2. The reference time in section 1 and the forecast time together define the beginning of the overall time interval.
3. An increment of zero means that the statistical processing is the result of a continuous (or near continuous) process, not the processing of a number of discrete samples. Examples of such continuous processes are the temperatures measured by analogue maximum and minimum thermometers or thermographs, and the rainfall measured by a 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.

UPDATE CODE TABLE 4.0:

Code Table 4.0: Product Definition Template Number

Number	Description
0	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time
1	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer at a point in time
2	Derived forecast based on all ensemble members at a horizontal level or in a horizontal layer at a point in time
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
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
5	Probability forecasts at a horizontal level or in a horizontal layer at a point in time
6	Percentile forecasts at a horizontal level or in a horizontal layer at a point in time
7	Analysis or forecast error at a horizontal level or in a horizontal layer at a point in time
8	Average, accumulation, extreme values or other statistically processed values at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
9	Probability forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
10	Percentile forecasts at a horizontal level or in a horizontal layer in a continuous or non-continuous time interval
11	Individual ensemble forecast, control and perturbed, at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
12	Derived forecasts based in all ensemble members at a horizontal level or in a horizontal layer, in a continuous or non-continuous interval
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 interval
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 interval
15-19	Reserved
20	Radar product
21-29	Reserved
30	Satellite product (deprecated)
31	Satellite product
32-39	Reserved
40	Analysis or forecast at a horizontal level or in a horizontal layer at a point in time for atmospheric chemical constituents
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
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
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
44-253	Reserved
254	CCITT IA5 character string
255-999	Reserved
1000	Cross section of analysis and forecast at a point in time
1001	Cross section of averaged or otherwise statistically processed analysis or forecast over a range of time
1002	Cross-section of analysis and forecast, averaged or otherwise statistically processed
1003-1099	Reserved
1100	Hovmöller-type grid with no averaging or other statistical processing
1101	Hovmöller-type grid with averaging or other statistical processing
1102-32767	Reserved
32768-65534	Reserved for local use
65535	Missing

NEW COMMON CODE TABLE C-14:

TO BE VALIDATED URGENTLY

Atmospheric chemical or physical constituent type

Code figure	Meaning	Chemical formula
0	Ozone	O ₃
1	Water vapour	H ₂ O
2	Methane	CH ₄
3	Carbon dioxide	CO ₂
4	Carbon monoxide	CO
5	Nitrogen dioxide	NO ₂
6	Nitrous oxide	N ₂ O
7	Formaldehyde	HCHO
8	Sulphur dioxide	SO ₂
9	Ammonia	NH ₃
10	Ammonium	NH ₄ ⁺
11	Nitrogen monoxide	NO
12	Atomic oxygen	O
13	Nitrate radical	NO ₃
14	Hydroperoxyl radical	HO ₂
15	Dinitrogen pentoxide	N ₂ O ₅
16	Nitrous acid	HONO
17	Nitric acid	HNO ₃
18	Peroxynitric acid	HO ₂ NO ₂
19	Hydrogen peroxide	H ₂ O ₂
20	Molecular hydrogen	H ₂
21	Atomic nitrogen	N
22	Sulphate	SO ₄ ²⁻
23	Radon	Rn
24	Elemental mercury	Hg(0)
25	Divalent mercury	Hg ²⁺
26	Atomic chlorine	Cl
27	Chlorine monoxide	ClO
28	Dichlorine peroxide	Cl ₂ O ₂
29	Hypochlorous acid	HClO
30	Chlorine nitrate	ClONO ₂
31	Chlorine dioxide	ClO ₂
32	Atomic bromine	Br
33	Bromine monoxide	BrO
34	Bromine chloride	BrCl
35	Hydrogen bromide	HBr
36	Hypobromous acid	HBrO
37	Bromine nitrate	BrONO ₂
38-9999	Reserved	
10000	Hydroxyl radical	OH
10001	Methyl peroxy radical	CH ₃ O ₂
10002	Methyl hydroperoxide	CH ₃ O ₂ H
10004	Methanol	CH ₃ OH
10005	Formic acid	CH ₃ OOH
10006	Hydrogen Cyanide	HCN
10007	Aceto nitrile	CH ₃ CN
10008	Ethane	C ₂ H ₆
10009	Ethene (= Ethylene)	C ₂ H ₄

10010	Ethyne (= Acetylene)	C_2H_2
10011	Ethanol	C_2H_5OH
10012	Acetic acid	C_2H_5OOH
10013	Peroxyacetyl nitrate	$CH_3C(O)OONO_2$
10014	Propane	C_3H_8
10015	Propene	C_3H_6
10016	Butanes	C_4H_{10}
10017	Isoprene	C_5H_{10}
10018	Alpha pinene	$C_{10}H_{16}$
10019	Beta pinene	$C_{10}H_{16}$
10020	Limonene	$C_{10}H_{16}$
10021	Benzene	C_6H_6
10022	Toluene	C_7H_8
10023	Xylene	C_8H_{10}
10024-10499	reserved for other simple organic molecules (e.g. higher aldehydes, alcohols, peroxides,...)	
10500	Dimethyl sulphide	CH_3SCH_3 (DMS)
10501-20000	Reserved	
20001	Hydrogen chloride	
20002	CFC-11	
20003	CFC-12	
20004	CFC-113	
20005	CFC-113a	
20006	CFC-114	
20007	CFC-115	
20008	HCFC-22	
20009	HCFC-141b	
20010	HCFC-142b	
20011	Halon-1202	
20012	Halon-1211	
20013	Halon-1301	
20014	Halon-2402	
20015	Methyl chloride (HCC-40)	
20016	Carbon tetrachloride (HCC-10)	
20017	HCC-140a	CH_3CCl_3
20018	Methyl bromide (HBC-40B1)	
20019	Hexachlorocyclohexane (HCH)	
20020	Alpha hexachlorocyclohexane	
20021	Hexachlorobiphenyl (PCB-153)	
20022-29999	Reserved	
30000-59999	Reserved	
60000	HOx radical (OH+HO2)	
60001	Total inorganic and organic peroxy radicals ($HO_2 + RO_2$)	RO_2
60002	Passive Ozone	
60003	NOx expressed as nitrogen	NO_x
60004	All nitrogen oxides (NO_y) expressed as nitrogen	NO_y
60005	Total inorganic chlorine	Cl_x
60006	Total inorganic bromine	Br_x
60007	Total inorganic chlorine except HCl, ClONO2: ClOx	
60008	Total inorganic bromine except HBr, BrONO2: BrOx	
60009	Lumped Alkanes	

60010	Lumped Alkenes	
60011	Lumped Aromatic Compounds	
60012	Lumped Terpenes	
60013	Non-methane volatile organic compounds expressed as carbon	NMVOC
60014	Anthropogenic non-methane volatile organic compounds expressed as carbon	aNMVOC
60015	Biogenic non-methane volatile organic compounds expressed as carbon	bNMVOC
60016	Lumped oxygenated hydrocarbons	OVOC
60017-61999	Reserved	
62000	Total aerosol	
62001	Dust dry	
62002	Water in ambient	
62003	Ammonium dry	
62004	Nitrate dry	
62005	Nitric acid trihydrate	
62006	Sulphate dry	
62007	Mercury dry	
62008	Sea salt dry	
62009	Black carbon dry	
62010	Particulate organic matter dry	
62011	Primary particulate organic matter dry	
62012	Secondary particulate organic matter dry	
62013-65534	Reserved	
65535	Missing	

NEW DATA REPRESENTATION TEMPLATE FOR RUN LENGTH PACKING WITH LEVEL VALUES

New entry to the Code Table 5.0

200 Run length packing with level values

New Data Representation Template

5.200 Grid point data - Run length packing with level values

12 Number of bits used for each packed value in the run length packing with level values

13-14 MV - Maximum value within the levels that are used in the packing

15-16 MVL - Maximum value of level (Predefined)

17 Decimal scale factor of representative value of each level

18-19+2*(lv-1) List of MVL scaled representative values of each level from lv=1 to MVL