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| WORLD METEOROLOGICAL ORGANIZATION  COMMISSION FOR BASIC SYSTEMS  -----------------------------  FIRST MEETING OF  INTER-PROGRAMME EXPERT TEAM ON CODES MAINTENANCE  GENEVA, SWITZERLAND, 24 - 28 JULY 2017 |  | IPET-CM-I / Doc. 2.6 (8)  (11. 7. 2017)  -------------------------  ITEM 2.6  ENGLISH ONLY |

GRIB edition 3

**Vertical Domain template and template component for model levels**

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**Summary and Purpose of Document**

Vertical domain template and template component to define model level are proposed.

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**ACTION PROPOSED**

The Team is asked to review the proposal and accept it for validation.

**DISCUSSIONS**

Model levels are defined using a list of parameters and some fields to compute the height or the pressure level. In GRIB 2 all the model levels are using the same “Optional list of coordinate values or vertical grid information” which is part of section 4. In GRIB 3 we propose to define the list of parameters and the field to compute height, depth or pressure in appropriate template components.

A table with the description of the algorithm to be used to convert model level (integer value) to height, depth or pressure level using the given list of parameters and the auxiliary fields is proposed. The proposal is incomplete as these algorithm table is not included and has to be developed with the help of domain specific experts at a later stage.

To facilitate the comparison we report GRIB 2 section 4 with all the notes. The aim is to have template components covering with their element all the notes and a reduced number of notes needed to explain the use of the template components.

**GRIB 2 - Section 4 – Product definition section**

Octet No. Contents

1–4 Length of section in octets (nn)

5 Number of section (4)

6–7 Number of coordinate values after template or number of information according to 3D vertical coordinate GRIB2 message (see Notes 1 and 5)

8–9 Product definition template number (see Code table 4.0)

10–xx Product definition template (see template 4.X, where X is the product definition template number given in octets 8–9)

[xx+1]–nn Optional list of coordinate values or vertical grid information (see Notes 2, 3, 4 and 5)

Notes:

(1) Coordinate values are intended to document the vertical discretization associated with model data on hybrid coordinate vertical levels. A number of zero in octets 6–7 indicates that no such values are present. Otherwise the number corresponds to the whole set of values.

(2) Hybrid systems, in this context, employ a means of representing vertical coordinates in terms of a mathematical combination of pressure and sigma coordinates. When used in conjunction with a surface pressure field and an appropriate mathematical expression, the vertical coordinate parameters may be used to interpret the hybrid vertical coordinate.

(3) Hybrid coordinate values, if present, should be encoded in IEEE 32-bit floating point format. They are intended to be encoded as pairs.

(4) Two distinct pressure-based hybrid coordinate formulations can be expressed in GRIB Edition 2. If the hybrid coordinate being used is based on pressure, then level type 105 (Code table 4.5) shall be used to specify the vertical level type. If the formulation is based on the natural logarithm of pressure then level type 113 (Code table 4.5) shall be used. In both cases Notes 1 to 3 (above) apply fully.

(5) In the case of a generalized vertical height coordinate (fixed surface type 150), no pairs of coordinate values follow after the template, but six sets of additional information (each 4 octets long and encoded in IEEE 32-bit floating point format) follow, starting with the number of vertical levels and the identification number of the used vertical system in the additional GRIB2 message with the 3D vertical system. This identification number together with an UUID (Universally Unique IDentifier) in four parts allows a unique identification of the grid.

[xx+1] – [xx+4] Number of vertical levels

[xx+5] – [xx+8] Identification number of 3D vertical grid GRIB2 message

(defined by originating centre)

[xx+9] – [xx+12] UUID part 1 of 4

[xx+13] – [xx+16] UUID part 2 of 4

[xx+17] – [xx+20] UUID part 3 of 4

[xx+21] – [xx+24] UUID part 4 of 4

**PROPOSAL**

***Vertical Domain Template Component 5.2 – Model level parameters list***

|  |  |
| --- | --- |
| Byte No. | Contents |
| 1-4 | NP - Number of parameters |
| 5 | Algorithm to compute height, depth or pressure level (code table 5.2) |
| 6 - 6+NP\*4 | List of parameters. (IEEE 32-bit floating-point) |

Notes:

(1) The list of parameters is ordered and the algorithm to compute height, depth or pressure has to be clearly explained in code table 5.x.

***Code Table 5.2 – Algorithm to compute height, depth or pressure level***

|  |  |
| --- | --- |
| Code figure | Meaning |
| 0 | The atmosphere is divided into NLEV layers. These layers are defined by the pressures at the interfaces between them (the ‘half-levels’), and these pressures are given by  pk+1/2 = Ak+1/2 + Bk+1/2 ps (1)  for 0 ≤ k ≤ NLEV. The Ak+1/2 and Bk+1/2 are constants whose values effectively define the vertical coordinate and ps is the surface pressure field.  The values of the A k+1/2 and Bk+1/2 for all 0 ≤ k ≤ NLEV are the list of parameters an ps is the auxiliary field needed to compute the pressure pk associated with each model level (middle of layer) from  pk = 1/2 (pk−1/2 + pk+1/2) with 1 ≤ k ≤ NLEV by using (1) and the surface pressure field. |
| 255 | Missing |

***Vertical Domain Template Component 5.3 – URL of auxiliary fields for model levels***

|  |  |
| --- | --- |
| Byte No. | Contents |
| 1-2 | scheme (code table 5.3) |
| 3 | Nhost - number of bytes used by host |
| 4 - 4+Nhost | host |
| 5+Nhost - 6+Nhost | port (unsigned integer) |
| 7+Nhost - 9+Nhost | Npath -number of bytes used by path |
| 10+Nhost - 10+Nhost+Npath | path |
| 11+Nhost+Npath - 13+Nhost+Npath | Nquery -number of bytes used by query |
| 14+Nhost+Npath - 15+Nhost+Npath+Nquery | query |

Note:

(1) A URL is a Uniform Resource Locator that is identifying a web resource and is used in this context to locate and retrieve a GRIB message providing the fields to be used to compute height, depth or pressure for a given model level.

The syntax of the URL is:

**scheme://host**[**:port**]**/path**[?**query**]

where port and query are optional and can be missing.

**Code table 5.3** – *URL scheme*

Code figure Meaning

0 http

1 https

2 ftp

3 file

65535 Missing

***Vertical Domain Template Component 5.4 – Model level***

|  |  |
| --- | --- |
| Byte No. | Contents |
| 1-4 | Model level |

***Vertical Domain Template Component 5.5 – URL of model level parameters list***

|  |  |
| --- | --- |
| Byte No. | Contents |
| 1-2 | scheme (code table 5.x) |
| 3 | Nhost - number of bytes used by host |
| 4 - 4+Nhost | host |
| 5+Nhost - 6+Nhost | port (unsigned integer) |
| 7+Nhost - 9+Nhost | Npath -number of bytes used by path |
| 10+Nhost - 10+Nhost+Npath | path |
| 11+Nhost+Npath - 13+Nhost+Npath | Nquery -number of bytes used by query |
| 14+Nhost+Npath - 15+Nhost+Npath+Nquery | query |

Note:

(1) A URL is a Uniform Resource Locator that is identifying a web resource and is used in this context to locate and retrieve a GRIB message providing the list of model levels and the algorithm to be used to compute height, depth or pressure for a given model level.

The syntax of the URL is:

**scheme://host**[**:port**]**/path**[?**query**]

where port and query are optional and can be missing.

**TEMPLATES**

***Vertical Domain Template 5.2 – Model level with list of parameters and URL of auxiliary fields***

|  |  |
| --- | --- |
| Component Code | Component Name |
| 5.4 | Model level |
| 5.2 | Model level parameters list |
| 5.3 | URL of auxiliary fields for model levels |

***Vertical Domain Template 5.3 – Model level with URL of list of parameters and URL of auxiliary fields***

|  |  |
| --- | --- |
| Component Code | Component Name |
| 5.4 | Model level |
| 5.5 | URL of model level parameters list |
| 5.3 | URL of auxiliary fields for model levels |

***Vertical Domain Template 5.5 – Layer of model level with list of parameters and URL of auxiliary fields***

|  |  |
| --- | --- |
| Component Code | Component Name |
| 5.4 | Model level |
| 5.4 | Model level |
| 5.2 | Model level parameters list |
| 5.3 | URL of auxiliary fields for model levels |

***Vertical Domain Template 5.6 – Layer of model level with URL of list of parameters and URL of auxiliary fields***

|  |  |
| --- | --- |
| Component Code | Component Name |
| 5.4 | Model level |
| 5.4 | Model level |
| 5.5 | URL of model level parameters list |
| 5.3 | URL of auxiliary fields for model levels |