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| WORLD METEOROLOGICAL ORGANIZATION  COMMISSION FOR BASIC SYSTEMS  -----------------------------  THIRD MEETING OF  INTER-PROGRAMME EXPERT TEAM ON DATA REPRESENTATION MAINTENANCE AND MONITORING  BEIJING, CHINA, 20 - 24 JULY 2015 |  | IPET-DRMM-III / Doc.2.2(8)  (22.06.2015)  -------------------------    ITEM 2.2    ENGLISH ONLY |

**New parameters in GRIB2 Code Table 4.2 and Encoding of some cloud base fields in GRIB2.**

*Submitted by Charles Sanders, Weiqing Qu (Australia)*

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**Summary and Purpose of Document**

This document proposes some new table entries in GRIB2 Code Table 4.2 and solutions on encoding of some cloud base fields.

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**ACTION PROPOSED**

The meeting is requested to review the proposed new entries and approve them for pre-operational use.

# 1. Add the following to GRIB-2 table 4.2

We request that the following be added to GRIB edition 2 table 4.2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Domain | Parameter Category | Parameter Number | Description | Units | Comment or note |
| 0 | 0 | 022 | Wet bulb temperature | K |  |
| 0 | 6 | 040 | Mass density of convective cloud water droplets | kg m-3 |  |
| 0 | 6 | 041 | Mass density of stratiform cloud water droplets | kg m-3 | Not required (note 1) |
| 0 | 6 | 042 | Mass density of convective cloud ice particles | kg m-3 | Not required (note 1) |
| 0 | 6 | 043 | Mass density of stratiform cloud ice particles | kg m-3 | Not required (note 1) |
| 0 | 6 | 044 | Mass density of convective cloud (ice+water) | kg m-3 | Not required (note 1) |
| 0 | 6 | 045 | Mass density of stratiform cloud (ice+water) | kg m-3 | Not required (note 1) |
| 0 | 6 | 046 | Total mass density of cloud (convective+stratiform, ice+water) | kg m-3 | Not required (note 1) |
| 0 | 6 | 047 | Volume fraction of cloud water droplets | m3 m-3 | Note 2 |
| 0 | 6 | 048 | Volume fraction of cloud ice particles | m3 m-3 | Note 2 |
| 0 | 6 | 049 | Volume fraction of cloud (ice and water) | m3 m-3 | Note 2 |
| 0 | 4 | 013 | Direct short wave radiation flux | W m-2 |  |
| 0 | 4 | 014 | Diffuse short wave radiation flux | W m-2 |  |

Notes:

1. These are not required by the Bureau of Meteorology, but have been included in the request for completeness. It seems to be inconsistent to request a separate parameter number for the convective version of a parameter without also requesting the stratiform version, and similarly for liquid and solid water.
2. The sum of the water and ice fractions may exceed the total due to overlap between the volumes containing ice and those containing liquid water.

# 2. Clarify sought for the meaning of the following entries in GRIB-2 table 4.2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Discipline | Parameter category | Parameter number | Description | Units |
| 0 | 6 | 32 | Fraction of cloud cover | Numeric |
| 0 | 6 | 36 | Fraction of stratiform precipitation cover | Numeric |
| 0 | 6 | 37 | Fraction of convective precipitation cover | Numeric |

We request that the team clarify the meaning of these. It is not completely clear whether they are area fractions, volume fractions, or some other measure. If they are area fractions, then perhaps they should be "Area fraction of ..." or "Horizontal fraction of ...". Using units of m2 m-2 could make this clearer. It has been found in the IPET-DRMM report that the original description in the proposal for 36 and 37 was "Horizontal ...", so it seems as though area fraction was intended. The use of m2 m-2 as a unit has a precedence in the mixing ratio and specific humidity and other similar parameters where kg kg-1 is used.

# 3. Encoding of some cloud base fields in GRIB-2

The UK UM model used by the UK, BoM and KMA generates cloud base fields, which are the lowest level where the vertically integrated cloud cover first exceeds a given threshold. GRIB-2 currently does not offer a good method of encoding of those fields. The vertically integrated cloud cover is the accumulated coverage between the surface and a specified level after accounting for cloud layers overlapping. Alternatively, this can be stated as the total cloud coverage visible from the surface due to clouds at or below a given level.

There are at least two possibilities, the first of which we prefer, while a software vendor indicated a preference for a new template for this and similar data.

A: Add an entry to GRIB-2 code table 4.5

|  |  |  |
| --- | --- | --- |
| Code figure | Meaning | Unit |
| 013 | Lowest level where vertically integrated cloud cover exceeds the specified percentage (cloud base for a given percentage cloud cover) | % |

B: Devise a new template for this and similar conditional fields

Add an entry to GRIB-2 code table 4.0

|  |  |
| --- | --- |
| Code figure | Meaning |
| 016 | Analysis of forecast over a horizontal domain of the value of one parameter at a level where another parameter meets a specified condition. |

Create a new GRIB-2 Product definition template 4.016

|  |  |  |
| --- | --- | --- |
| Octet Number(s) | Contents | Comment or note |
| 10 | Parameter category (see Code table 4.1) | Note 1 |
| 11 | Parameter number (see Code table 4.2) | Note 1 |
| 12 | Type of generating process (see Code table 4.3) |  |
| 13 | Background generating process identifier (defined by originating centre) |  |
| 14 | Analysis or forecast generating process identifier (defined by originating centre) |  |
| 15-16 | Hours of observational data cut-off after reference time | Note 2 |
| 17 | Minutes of observational data cut-off after reference time |  |
| 18 | Indicator of unit of time range (see Code table 4.4) |  |
| 19–22 | Forecast time in units defined by octet 18 |  |
| 23 | Parameter category of field defining the level | Note 3 |
| 24 | Parameter number of field defining the level | Note 3 |
| 25 | Indicator of which of multiple levels is intended (see Code table 4.16) |  |
| 26 | Condition to be applied to threshold (see Code table 4.17) |  |
| 27 | Scale factor of threshold |  |
| 28-31 | Scaled value of threshold |  |

The team may wish to use lower and upper thresholds similar to template 4.5

Notes:

1. These are the parameter that is being encoded.
2. Hours greater than 65534 will be coded as 65534.
3. These are the field that is being compared with the threshold to determine the level.

New code table 4.16 – which level of multiple levels is intended.

|  |  |
| --- | --- |
| Code figure(s) | Meaning |
| 0 | Lowest level meeting criteria |
| 1-62 (N) | N+1th level meeting criteria, counting from the bottom |
| 63 | 64th level meeting criteria, counting from the bottom |
| 64 | Highest level meeting criteria |
| 65-126 (N) | N-63th level meeting criteria, counting from the top |
| 127 | 64th level meeting criteria, counting from the top |
| 128-191 | Reserved |
| 192-254 | Reserved for local use |
| 255 | Missing |

It will be very rare to use values other than 0 (lowest) and 64 (highest) in this table, but given the range expressible in one octet it seems to be ridiculous to not use the range to allow the second lowest and similar surfaces to be expressed.

New code table 4.17 – Condition used to specify a level or for other purposes

|  |  |
| --- | --- |
| Code figure(s) | Meaning |
| 0 | Parameter less than the threshold |
| 1 | Parameter greater than or equal to the threshold |
| 2-191 | Reserved |
| 192-254 | Reserved for local use |
| 255 | Missing |

The team may wish to add additional entries for completeness. With some renaming, it may be possible to merge this with code table 4.9. Additional entries will be required if upper and lower thresholds are used.

Additional entry in code table 4.2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Discipline | Parameter category | Parameter number | Description | Units |
| 0 | 6 | 038 | Vertically integrated cloud cover from the surface upwards. (Note 2) | % |

Note 2: This is obtained by vertically integrating the cloud cover from the surface upwards, taking overlap in to account, and is the total cloud cover as viewed from the surface due to clouds at or below the level.

For the particular case of the ACCESS cloud base, the template values could be

|  |  |  |  |
| --- | --- | --- | --- |
| Octet Number(s) | Contents | Value | Meaning |
| 10 | Parameter category (see Code table 4.1) | 3 | Mass |
| 11 | Parameter number (see Code table 4.2) | 5 | Geopotential height (gpm) |
| 12 | Type of generating process (see Code table 4.3) |  |  |
| 13 | Background generating process identifier (defined by originating centre) |  |  |
| 14 | Analysis or forecast generating process identifier (defined by originating centre) |  |  |
| 15-16 | Hours of observational data cut-off after reference time |  |  |
| 17 | Minutes of observational data cut-off after reference time |  |  |
| 18 | Indicator of unit of time range (see Code table 4.4) |  |  |
| 19–22 | Forecast time in units defined by octet 18 |  |  |
| 23 | Parameter category of field defining the level | 6 | Cloud |
| 24 | Parameter number of field defining the level | 38 | Integrated cloud cover |
| 25 | Indicator of which of multiple levels is intended (see Code table 4.16) | 0 | Lowest |
| 26 | Condition to be applied to threshold (see Code table 4.17) | 1 | >= |
| 27 | Scale factor of threshold | 2 |  |
| 28-31 | Scaled value of threshold | 1.25, 18.75, 31.25, 43.75, 56.25, 68.75, 81.25, 98.75 | 0.1, 1.5, 2.5, 3.5, 4.5, 6.5, 7.9 okta |