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MANUAL ON CODES: TABLE-DRIVEN CODE FORMS

FM 92 GRIB

New parameters and types of level for Ocean modelling

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**Summary and Purpose of Document**

This document proposes new entries to GRIB Code table 4.2 Product discipline 10 –*Oceanographic products*, parameter category 3: *surface properties* and three new types of level to GRIB Code table 4.5 *Fixed surface type and units* for our ocean model.

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**ACTION PROPOSED**

The team is requested to approve the content of this proposal for inclusion within the next update to the WMO manual on Codes.

**DISCUSSIONS**

In the context of ocean activities (including S2S), ECMWF is requesting a new parameter and three new types of level for ocean modelling.

During the last Fast Track, ECMWF requested the parameter “practical salinity” as a sub-surface property (discipline 0, category 4), we would like to extend it to surface property as well (discipline 0, category 3).

The practical salinity, which measures the amount of ionic salt in water, is defined in terms of the ratio of the electrical conductivity of the sea water sample, at a temperature of 15°C and a pressure of one standard atmosphere, to that of a potassium chloride (KCl) solution, in which the mass fraction of KCl is 32.4356 x 10-3 at the same temperature and pressure. Note that practical salinity is dimensionless but a common practice is to use “psu” (“practical salinity units”) to avoid confusion with salinity defined in kg kg-1.

In ocean modelling, the most common vertical coordinate systems are: (1) absolute depth (z-coordinates), (2) normalized depth (σ-coordinates), (3) density (isopycnal coordinates) or (4) an hydrid coordinate system (combining for instance σ and z coordinates). The z-coordinates system can be easily encoded using code 160 in Code Table 4.5 because the depth of a specific level is constant over the whole horizontal grid. The σ-coordinates system defines levels as fractions of the total depth for each grid point. For this coordinate system, it is more convenient to use generic ocean levels where a level “n” is referred to using index n (in the similar way that generalized height levels are defined). The vertical physical quantity associated with these levels will be specified in a separate GRIB message. In the case of σ-coordinates system, the separate GRIB message will contain the depth at each grid point for each level.

The ocean mixed layer depth (sometimes called ocean mixed layer thickness) is an important parameter in ocean modelling. There are numerous ways (criteria) to define the ocean mixed layer depth.

Ocean mixed layer depth can be defined using a sigma-theta difference criterion (Δσθ = 0.01 kg m-3). The mixed layer depth is defined as the ocean depth at which sigma-theta has increased by 0.01 kg m-3 relative to the near-surface value at 10 m depth. Sigma-theta (σθ) is calculated as follows:

σθ(θ, S, P0) = ρθ(θ, S, P0) - 1000

where ρθ is potential density, θ is potential temperature, S is in situ salinity, and P0 is a reference pressure of 0 bar.

Ocean mixed layer depth can also be defined using a potential temperature difference criterion (Δθ = 0.2 K). The mixed layer depth is defined as the ocean depth at which the potential temperature has decreased by 0.2 K relative to the near-surface value at 10 m depth.

To encode both types of ocean mixed layer depth, we propose to use the parameter “water depth” (existing parameter 14 in Code Table 4.2 Discipline 0, category 4) and 2 new types of fixed surface in Code Table 4.5 (see below in the proposal section). The criterion is encoded using scaling factor and scaled value of the fixed surface.

**PROPOSAL**

**Code table 4.2, Product discipline 10 – Oceanographic products, parameter category 3: surface properties**

**ADD** the following entry (in red)

**EDIT** the range of reserved entries (in blue)

|  |  |  |
| --- | --- | --- |
| **Code** | **Name** | **Units** |
| **3** | Practical salinity | psu (numeric) |
| **4-191** | Reserved |  |

**Code table 4.5 – Fixed surface types and units**

**ADD** the following entry (in red)

**EDIT** the range of reserved entries (in blue)

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| --- | --- | --- |
| **Code** | **Name** | **Units** |
| **168** | Ocean model level | numeric |
| **169** | Ocean level defined by water density (sigma-theta) difference from near-surface to level (see Note 7) | kg m-3 |
| **170** | Ocean level defined by water potential temperature difference from near-surface to level (see Note 7) | K |
| **171-173** | Reserved |  |

(7) The level is defined by a water property difference from the near-surface to the level. The near-surface is typically chosen at 10 m depth. The physical quantity used to compute the difference can be water density (σθ) when using level type 169 or water potential temperature (θ) when using level type 170.