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| WORLD METEOROLOGICAL ORGANIZATION  COMMISSION FOR BASIC SYSTEMS  -----------------------------  SECOND MEETING OF  INTER-PROGRAMME EXPERT TEAM ON CODES MAINTENANCE  OFFENBACH, GERMANY, 28 MAY - 1 JUNE 2018 |  | IPET-CM-II / Doc. 2.2 (4)  16.05.2018  -------------------------  ITEM 2.2  ENGLISH ONLY |

MANUAL ON CODES: TABLE-DRIVEN CODE FORMS

FM 92 GRIB

New lightning GRIB parameters

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**Summary and Purpose of Document**

Parameters and new table entries needed by ECMWF to encode new products are proposed.

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**ACTION PROPOSED**

The team is requested to examine the list, validate the parameters and accept them for FT2-2018.

**DISCUSSIONS**

ECMWF has recently developed the capability to diagnose lightning activity from a set of predictors already produced by the convective parameterization of its Integrated Forecasting System (IFS). Those predictors are the convective available potential energy (CAPE), the contents in convective hydrometeors (cloud condensate and frozen precipitation) and the convective cloud base height (see Lopez 2016 for details). The new lightning products (described below) will be relevant to both weather forecasters and decision makers, especially aviation (both at airports and in-flight), power supply companies and forestry (wildfires).

Physically, a lightning flash is usually defined as one or several electrical discharges (or strokes) that occur within less than a second and within a horizontal radius of 15 km. It can be useful to distinguish between intra-cloud flashes which transfer electrical charges within cloud regions and cloud-to-ground flashes which transfer charges between the cloud and the ground.

The new lightning parameterization computes lightning flash densities or in other words the number of lightning flashes per unit area and per unit time. In its current version, only “total” lightning flash densities are calculated, which means that there is no discrimination between cloud-to-ground and intra-cloud flashes. However, work is ongoing to also predict flash densities for cloud-to-ground and intra-cloud lightning separately.

Reference:

Lopez, P., 2016: A lightning parameterization for the ECMWF Integrated Forecasting System, Monthly Weather Review, 144, 3057-3075.

**PROPOSAL**

The following new GRIB parameters are proposed to be added to table 4.2. The modification to the table are highlighted in red

**Product discipline 0 – Meteorological products, parameter category 17: electrodynamics**

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| Number | Parameter | Units |
| 0 | Lightning strike density | m–2 s–1 |
| 1 | Lightning potential index (LPI) (see Note 1) | J kg–1 |
| 2 | Cloud-to-ground Lightning flash density | km-2 day-1 |
| 3 | Cloud-to-cloud Lightning flash density | km-2 day-1 |
| 4 | Total Lightning flash density (see Note 2) | km-2 day-1 |

Note:

(1) Definition of LPI after Lynn et al.: Lynn, B. and Y. Yair, 2010: Prediction of lightning flash density with the WRF model, Adv. Geosci., 23:11–16; Yair, Y., B. Lynn, C. Price, V. Kotroni, K. Lagouvardos, E. Morin, A. Mugnai and M. Llasat, 2010: Predicting the potential for lightning activity in Mediterranean storms based on the Weather Research and Forecasting (WRF) model dynamic and microphysical fields, Journal of Geophysical Research, 115, D04205, doi:10.1029/2008JD010868.

(2) The total lightning flash density is the sum of cloud-to-ground and cloud-to-cloud lightning flash densities (see Lopez, P., 2016: A lightning parameterization for the ECMWF Integrated Forecasting System, Monthly Weather Review, 144, 3057-3075).

Comments:

* The difference between Lightning stroke density and Lightning Flash density relies in the fact that a “flash” is composed by one or more “strokes” occurring within a defined space within one second.
* The units are chosen to be km-2 day-1 to reflect the very low occurrence of events (flashes) in time and space. If expressed in m-2 s-1, a typical value for these parameters would be in the order of 10^-16.