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Recent updates in the aerosol component of the C-IFS model run by ECMWF

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The Composition-Integrated Forecast System (C-IFS) is a global atmospheric composition forecasting tool, run by ECMWF within the framework of the Copernicus Atmospheric Monitoring Service (CAMS). The aerosol model of C-IFS is a simple bulk scheme that forecasts 5 species: dust, sea-salt, black carbon, organic matter and sulfate. Three bins represent the dust and sea-salt, for the super-coarse, coarse and fine mode of these species (Morcrette et al., 2009). This talk will present recent updates of the aerosol model, and also introduce forthcoming developments. It will also present the impact of these changes as measured scores against AERONET Aerosol Optical Depth (AOD) and Airbase PM10 observations.

The next cycle of C-IFS will include a mass fixer, because the semi-Lagrangian advection scheme used in C-IFS is not mass-conservative. C-IFS now offers the possibility to emit biomass-burning aerosols at an injection height that is provided by a new version of the Global Fire Assimilation System (GFAS). Secondary Organic Aerosols (SOA) production will be scaled on non-biomass burning CO fluxes. This approach allows to represent the anthropogenic contribution to SOA production; it brought a notable improvement in the skill of the model, especially over Europe. Lastly, the emissions of SO_2 are now provided by the MACCity inventory instead of and older version of the EDGAR dataset. The seasonal and yearly variability of SO_2 emissions are better captured by the MACCity dataset.

Upcoming developments of the aerosol model of C-IFS consist mainly in the implementation of a nitrate and ammonium module, with 2 bins (fine and coarse) for nitrate. Nitrate and ammonium sulfate particle formation from gaseous precursors is represented following Hauglustaine et al. (2014); formation of coarse nitrate over pre-existing sea-salt or dust particles is also represented. This extension of the forward model improved scores over heavily populated areas such as Europe, China and Eastern United States. A new sea-salt scheme following Grythe et al (2014) has been adapted into C-IFS, which brings optical depths closer to MODIS values over oceans, and also has a beneficial impact on PM10 forecasts over Europe. The model also offers the possibility to use dynamically computed dry deposition velocities following Zhang et al (2001). These new developments come as options in C-IFS; the decision of use these options in the operational configuration will be taken by ECMWF after considering input from various parties.