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# Comparing ECMWF UV processor and aerosol scheme with ground-based measurements

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The ECMWF (European Centre for Medium-Range Weather Forecasts) system offers an alternative approach to provide global UV data products which can support environmental assessments of UV radiation, biological and photochemical impact studies, and to contribute to the global climatology of UV radiation. The ECMWF model includes the effect of aerosols as a part of its radiation transfer calculations. During the first steps of the development of the UV processor, an aerosol climatology was used. In the latest version, however, prognostic aerosols have been coupled with the UV processor which, as a result, provides information about the global UV radiation and can be an alternative to satellite observations.

The aim of this study is to evaluate the ECMWF UV/aerosol optical depth (AOD) model against ground-based measurements and further develop the UV Processor. The data used for the study is MACC reanalysis AOD and UV intensities for the period 2003-2006. The evaluation was done by comparing the model data with measurements from EUVDB (European UV Database), NSF (National Science Foundation) and AERONET (Aerosol Robotic Network). The ECMWF shortwave radiative transfer scheme provides the UV radiation at the surface for wavelengths between 280 and 400nm. However, for this analysis, the wavelength ranges 290-320 (UVB) and 320-340 (UVA) were used. This is the first time when a global model such as the ECMWF is evaluated for the performance of AOD at a UV wavelength.

The results show that the MACC system generally provides a good representation of the AOD on a monthly basis, showing a realistic seasonal cycle. The model is mostly able to capture major dust load events and also the peak months of biomass burning correctly. When comparing hourly AOD values, the model-measurement agreement is better for biomass burning and dust sites than for urban sites, with an average correlation coefficient around 0.90 for biomass burning sites, around 0.77 for dust sites, and below 0.70 for urban sites. All sites included in the study show a relative mean bias at 340 nm smaller (or more negative) than that at 500 nm, indicating a strong wavelength-dependence in the performance of the AOD in the MACC system. A comparison against fine and coarse mode AOD of the AERONET indicates that this has to do with the size distribution of the model: generally, the ECMWF model overestimates the contribution by coarse mode particles.

Validating the UV Processor, in all the UV validation sites, the model-measurement ratio decreased with increasing solar zenith angle (SZA). This effect is larger for UVB than for UVA wavelengths, which could also be seen in most of the sites. In spite of this systematic difference under conditions of low Sun, the UV validation results overall show a fairly good agreement between UV processor and ground-based UV intensities, with CC > 0.9 for the summer period and CC > 0.85 for the winter.