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# Comparison between in-situ surface measurements and global climate model outputs of particle light scattering coefficient as a function of relative humidity

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Ambient aerosol particles can take up water and thus change their optical properties depending on their hygroscopicity, their size, and the relative humidity (RH) of the surrounding air. Knowledge of the hygroscopicity effect is of importance for radiative forcing calculations but is also needed for the evaluation of remote sensing and model results with in-situ measurements. The dependence of particle light scattering on RH can be described by the scattering enhancement factor $f$(RH), which is defined as the particle light scattering coefficient at a given RH divided by the scattering coefficient at dry conditions (see e.g. Titos et al., 2016).

In this study, $f$(RH) measurements performed at 26 sites - with a wide global coverage and representing a variety of aerosol types - have been re-analyzed and harmonized to provide a benchmark data set (open access via EBAS, http://ebas.nilu.no/). Most of the stations which provided data are part of active measurement networks such as ACTRIS or NOAA. An identical data treatment process has been applied to all measurements and data quality has been assured by a thorough inspection of each dataset.

The ultimate goal of this AeroCom project is to assess how well global models simulate the aerosol/water interaction using in-situ measurements of aerosol hygroscopicity. In this study, we show for the first time a comparison between our in-situ benchmark dataset for aerosol hygroscopicity and output from several models. Modelled and measured scattering enhancement factors at RH=85% are compared for various sites that are representative of a range of aerosol types. First results show distinct consistencies: e.g., f(RH) values at Artic sites are underestimated by some models while others overestimate them; at Marine and Rural sites GEOS5-MERRAero provides constant f(RH) values and similarly, CAM5.3-Oslo provides constant values at Rural sites while measurements show larger variability in these cases. These two models also show inconsistent values for Urban sites compared with in-situ measurements likely due to the larger variability in aerosol emission sources along the day. These results indicate that this approach shows potential for constraining simulations of aerosol/water interactions and improve model RF estimations.

Titos, G. et al., (2016). Effect of hygroscopic growth on the aerosol light-scattering coefficient: A review of measurements, techniques and error sources, Atmos. Environ. doi: 10.1016/j.atmosenv.2016.07.021