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A global overview of the effect of water uptake on aerosol particle light scattering using in-situ surface measurements

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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 for a recent review).

In this study, f(RH) measurements performed at 25 sites (with a wide global coverage and representing a variety of aerosol types) have been compiled and harmonized to provide a benchmark data set. Most of the measurement 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 in terms of instruments corrections, postcalibrations, fitting assumptions, etc. Data quality is assured by a thorough inspection of each dataset, quality checks, instrument metadata has been reviewed, and flags indicating the quality of the measurements have been added. Due to instrumentation and experimental set-ups differences, some site-specific corrections were also needed.

In this study, we will show the results of the joint analysis of high frequency humidogram data. The climatology of worldwide f(RH) values under different atmospheric conditions and predominant aerosol type will be presented. This study is part of a model-measurement exercise embedded within the AeroCom project, in which the ultimate goal is to assess how well global models simulate the aerosol/water interaction using in-situ measurements of aerosol hygroscopicity.

Reference:
Titos, G., A. Cazorla, P. Zieger, E. Andrews, H. Lyamani, M.J. Granados-Muñoz, F.J. Olmo, and L. Alados-Arboledas (2016), Effect of hygroscopic growth on the aerosol light-scattering coefficient: A review of measurements, techniques and error sources, Atmos. Environ., 141, 494-507.