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Towards an aerosol classification scheme for EarthCARE lidar observations

Silke Gross (1), Josef Gasteiger (2), Daniel Sauer (1,2), Bernadett Weinzierl (1,2)

(1) DLR, Institut für Physik der Atmosphäre, Wessling, Germany (silke.gross@dlr.de), (2) LMU, Meteorologisches Institut, München, Germany

Aerosols are a major component of the Earth's atmosphere and have substantial impact on the Earth's radiation budget and on the hydrological cycle. The distribution of aerosols and their microphysical and optical properties vary strongly with space and time. Furthermore the vertical distribution of aerosols and the presence of clouds affect the sign and magnitude of the aerosol radiative forcing. To improve our knowledge about the climate impact of aerosols regular observations with high temporal and vertical resolution are required. Space borne lidar measurements are an appropriate tool to obtain altitude resolved information of the aerosol distribution on global scale. However, an aerosol classification from current space borne lidar measurements is only possible with further assumptions. The next generation satellite mission of the European Space Agency, the Earth Clouds, Aerosols and Radiation Explorer (EarthCARE) mission, expected for launch in 2015, will be equipped with a polarization sensitive high spectral resolution lidar (HSRL) system operating at 355 nm (ATLID – Atmospheric Lidar). The potential of polarization sensitive HSRL measurements for aerosol type classification was demonstrated on the basis of airborne HSRL measurements. However, these airborne measurements were performed at 532 nm. The open question is how the results of these HSRL classification schemes at 532 nm can be transferred to measurements at 355 nm with ATLID on EarthCARE.

We will present an analysis of the wavelength dependence of the optical properties required for an aerosol type classification based on ATLID measurements, the particle linear depolarization ratio and the particle lidar ratio. For this analysis we use ground based measurements of polarization sensitive Raman lidar systems at 355 nm and 532 nm and airborne HSRL measurements at 532 nm. Furthermore we use model simulations of the lidar-relevant optical properties of different aerosol types taking into account their particle shapes. Airborne in-situ measurements of the size distribution and refractive index of several aerosol types are used as input parameters for the model simulations.