A comprehensive analysis of aerosol property retrieval from the MicroNeph–GRASP system

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The phase function (F_{11}) and polarized phase function (F_{12}) are important elements of the scattering matrix that contain implicit information regarding aerosol microphysical properties such as the size distribution, refractive index, and shape. The F_{11} and F_{12} can be measured *in situ* with polar imaging nephelometry [1]. The microphysical properties of the aerosol being measured can be inferred from these data by employing aerosol retrieval algorithms such as the Generalized Retrieval Algorithm of Surface and Aerosol Properties (GRASP) [2,3]. Recently, the development began on a miniature version of a polar imaging nephelometer called MicroNeph. The goal of this study is to test the GRASP algorithm on the MicroNeph data.

A thorough numerical analysis is conducted to investigate the retrieval of particle size distribution, refractive index and shape distribution) from the combined MicroNeph–GRASP system. For a number of aerosol models encompassing a variety of microphysical properties, MicroNeph measurements (F_{11} and F_{12} at three visible wavelength) are simulated with the GRASP forward model. The simulated results are subjected to synthetic error and instrument-related parameters such as measured wavelength and angular resolution are manipulated. These data are then introduced to the GRASP inverse model, and the quality of the retrieval is investigated. The role of *a priori* assumptions in the GRASP inverse model on the retrieval quality is also assessed for various parameters such as the spectral refractive index. Finally, it is planned to test the GRASP algorithm on real MicroNeph data using either well-defined aerosol samples or independent measurements of aerosol microphysical properties.

References

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