

Inferring of Aerosol Core–Shell Structure from AERONET Observations

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Although atmospheric aerosols can have complex internal structure, they are typically represented as homogeneous particles in present-day operational remote sensing algorithms. This constrain is largely due to the lack of measurements sensitivity and increasing number of parameters to be considered for describing the aerosol inhomogeneity. At the same time, it is known that aerosol internal structure affects directional scattering and polarization of light and can significantly modify aerosol radiative effects. In addition, information on aerosol internal structure is important because reflects aerosol mixing state and aging processes. Assessing aerosol liquid fraction is also important for evaluating the dry Particulate Matter (PM) via remote sensing and for studying of aerosol-cloud interactions. Our recent work examined sensitivity of directional and polarimetric measurements to aerosol inhomogeneity represented by the concentric core/shell particle model. A varying proportion of core/shell thickness, and varying refractive index of core, were parameterized and integrated into the GRASP remote sensing retrieval algorithm. Sensitivity to the core/shell aerosol model were then analyzed under single scattering approximation and on the level of synthetic and real radiances measured by sun/sky photometer of AERONET. Though, the AERONET radiances sensitivity to aerosol core/shell model remains limited, examples of its polarimetric measurements show more stable retrieval. In particular, integration of the core/shell model improves distinguishing the signal of aerosol non-sphericity, which appears to mimic inhomogeneity. Besides, logical patterns in liquid shell retrievals are observed at AERONET sites across various environments.

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