Remote Sensing and Retrievals of Atmospheric Aerosols and Clouds

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ABSTRACT

A knowledge of aerosol and cloud radiative properties and their variationin space and time is especially crucial to the understanding of the radiative forcing in all climate related studies. The role of clouds in modifying the Earth's radiation balance - albedo cooling effect in shortwave radiation and greenhouse warming effect in longwave radiation - is well recognized as a key source of uncertainty. Man-made processes, both burning of fossil fuels and biomass, generate greenhouse gases and aerosol particles. Directly, aerosol particles can scatter and absorb the sun light. Indirectly, these particles may serve as cloud condensation nuclei and alter cloud albedo. Ship tracks have provided intriguing examples of cloud albedo modification by anthropogenic aerosols. There has been a general concern that the potential climate forcing from the indi-rect effects of aerosol on clouds can be of comparable magnitude, but oppo-site in sign, to greenhouse gas forcing.

Global monitoring of aerosol and cloud radiative effects relies on advanced Earth Observing Systems (e.g., NASA's EOS and NASDA's ADEOS). Key advances include simultaneous observation of radiation budget and aerosol/cloud properties, additional information on particle size, phase, and vertical layer structure. Comprehensive radiation models are used to develop retrieval algorithms. This paper presents an overview of the science and technique in remote sensing and retrievals of atmospheric aerosols and clouds. High quality multispectral imagery, together with nadir propagating lidar measurements, acquired from high altitude aircraft in many field experiments are served as examples for discussion. The paper gives a brief summary of the aerosol/cloud/radiation problem, and discusses the critical observations needed to support further investigations.