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Variational retrieval of extinction coefficient from synthetic LIDAR and radiometric measurements

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Vertical distribution of aerosols and differentiating between fine and coarse particles are important factors when calculating their radiative impact. Vertical distribution of black carbon may perturb the temperature profile and thus alter regional circulation and the hydrological cycle. Difference in vertical distribution of sulphate aerosols among models explains in some degree the diverse sulphate radiative forcing presented in the literature. Large concentration of fine particles can reduce droplet size, increase reflectance and reduce precipitation whereas coarse particles can counteract some of these effects by allowing precipitation and cleaning the atmosphere of fine particles. The advent of the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), to be launched in 2006, will provide profiles of attenuated backscattering coefficients of aerosol and clouds at 532 and 1064 nm. It will fly in formation with the AQUA mission with MODIS onboard. Both satellites will observe the same spot on ground with only a few minutes difference. Analysis of lidar and radiometric measurements will generate datasets that will combine information on the vertical distribution of aerosols from CALIPSO and the detailed size information from MODIS. We apply variational data retrieval to a simplified radiative transfer model to retrieve the extinction coefficient profile of fine and coarse aerosol modes from synthetic lidar and radiometric measurements. Perturbations were applied to the synthetic observations in order to introduce noise to the retrieval. The retrieved information does not correspond in most of the cases to the true state of the atmosphere. Therefore special emphasis will be given to the study of the quality of the retrieval under different conditions of inversion.