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Aerosol-cloud radiative interaction in a 3D cumulus field in Brazil

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Cloud-aerosol three-dimensional (3D) radiative interactions impact clear region radiances and associated aerosol retrievals in a cumulus cloud fields. Here we study an example in a biomass burning region of Brazil. The bias in 1D estimated aerosol optical thickness is quite significant for clear areas immediately adjacent to cloud. Such retrievals are very important for studies of aerosol indirect forcing of climate. To quantify this impact, we use MODIS retrieved cloud optical properties to produce a realistic cloud field with the cloud top height estimated from MODIS brightness temperature at 11 microns. MODIS aerosol optical depth is used in both 3D and 1D simulations. Since both 3D and 1D radiation codes are very accurate, the difference between the true 3D radiation field from MC simulation and that from 1D approximation in clear regions of the cumulus cloud field isolates the 3D impact due to aerosol-cloud radiative interactions. Using ASTER to estimate cloud optical properties, we will further examine 3D aerosol-cloud interactions at scales not resolved by MODIS. Assuming the 3D bias in 1D estimated aerosol optical thickness is linear as a function of aerosol optical thickness, the true aerosol optical thickness in clear regions will be estimated.

Reference

Wen, G., A. Marshak, and R. F. Cahalan, 2005: Impact of 3D Clouds on Clear Sky Reflectance and Aerosol Retrieval in a Biomass Burning Region of Brazil. IEEE Geo. & Rem. Sens. Lett.. (In press)