AGU ABSTRACT

Estimates of Aerosol Direct Effects on the Radiation Budget from MISR Retrievals

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A new generation of remote sensing instruments is providing global information on aerosol optical thickness and particle type with unprecedented accuracy. At the same time an effort is underway to validate the remote measurements with many ground-based and airborne campaigns. We performed a sensitivity study to determine how well remote observations from the MISR (Multi-angle Imaging Spectro-Radiometer) instrument on the Terra spacecraft can measure perturbations to the terrestrial radiation budget (internal atmosphere and surface fluxes) caused by aerosol loading. Our numerical study examined perturbations to the surface absorbed flux and atmospheric absorbed flux for a variety of surface types and mixtures of aerosol types, including sulfate, mineral dust, and black carbon, and for a variety of aerosol optical depths between 0.05 and 1.6. Current uncertainties in MISR aerosol optical depth retrievals range from 0.02 to 0.05 or larger (up to 0.2 of the optical depth for optical depth greater than 0.25). We mapped these uncertainties to uncertainties in absorbed fluxes due to aerosols. Any aerosol loading decreases absorbed flux at the surface due to flux scattered back to space and absorbed in the atmosphere by the aerosol. The amount absorbed in the atmosphere depends heavily on the mineral dust and carbon content of the aerosol. These numbers are insensitive to surface type. We calculate quantitative fluxes and uncertainties which can be coupled with retrieved optical depths and particle types in the MISR data product to estimate global radiation budget perturbations. These estimates are for the direct effect of aerosols on the radiation budget (they do not address effects via aerosol influence on cloud condensation). This work was performed by the Jet Propulsion Laboratory, California Institute of Technology.