IRS2012-514
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Estimation of the direct aerosol radiative effect over China based on satellite remote sensing measurements

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Aerosols influence the radiative budget of the Earth-atmosphere system directly by scattering and absorbing solar and thermal infrared radiation, and indirectly by modifying the microphysical, and hence the radiative properties and lifetimes of clouds. However, the quantification of aerosol radiative effects is complex and large uncertainties still exist, mainly due to the high spatial and temporal variation of the aerosol concentration and mass, as well as their relatively short lifetime in the atmosphere.

Satellites offer an opportunity to observe the spatial distribution of aerosol properties with adequate resolution and coverage from regional to global scales. In this work multisensor satellite observations are used to estimate the direct aerosol radiative effect at the top of the atmosphere over China within the shortwave (SW, 0.3-5 μm) region. The Moderate Imaging Spectroradiometer (MODIS) onboard NASA's Terra and Aqua platforms offer global observations of aerosol and cloud optical properties nearly on a daily basis, whereas the Clouds and the Earth's Radian Energy System (CERES) instruments measure simultaneously TOA broadband fluxes. Hence, the instantaneous aerosol direct radiative effect for a month at TOA can be estimated using the MODIS aerosol optical depth (AOD) and coincident broadband flux from the CERES instrument by performing a linear regression between the two parameters. The instantaneous values are converted to monthly means by using a radiative transfer code. In this work results of the aerosol direct effect over China between 2004 and 2010 will be introduced. The uncertainties related to this method are studied using radiative transfer models e.g. by simulating the CERES broadband measurements.