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Satellite Observed and Model Simulated Influences of Asian Dust on Cloud Properties and Radiative Forcing

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Abstract

Dust aerosol can change the macro and micro cloud properties and cloud radiative forcing (CRF). In this study, we investigated the impact of dust on cloud properties and radiative forcing by means of analysis of multiple satellite datasets and modeling. Satellite data employed include CERES (Cloud and the Earth's Radiant Energy Budget Scanner) and MODIS (Moderate Resolution Imaging Spectroradiometer) Aqua Edition 1A SSF (Single Scanner Footprint) data, and Fu-liou radiative transfer model is used to simulate. The satellite observed data analysis results show that water cloud effective particle diameter, ice cloud effective particle diameter, cloud optical depth of CLD (no-dust cloud) are 29.1%, 11.1%, 38.7% less, respectively, than those derived from COD (cloud-over-dust). Both the data analysis and the model simulation show that dust influences on cloud properties induce CRF changes at the top of atmosphere (TOA) and the surface. Dust aerosol usually exerts different impact of CRF upon TOA and surface fluxes. For the optically thick cloud (τ >10), it has a shortwave (SW) warming effect at the TOA and remains a cooling effect at the surface. For the optically thin cloud (τ <10), aerosol has a cooling effect both at TOA and surface.