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Dust aerosol radiative forcing over West Africa : A case study from the AMMA SOP

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Aerosols affect the Earth energy budget directly by scattering and absorbing radiation and indirectly by acting as cloud condensation nuclei. However, large uncertainties exist in current estimates of aerosol forcing. In this presentation, the impact of aerosol on solar and Infra-Red fluxes and the heating rate due to dust over West Africa are investigated using the radiative code STREAMER, as well as satellite observations, space-borne and dropsondes observations gathered during the African Monsoon Multidisciplinary Analysis Special Observing Period. Aircraft operations were conducted on 13 and 14 June 2006, over Benin and Niger, before and after the passage of a mesoscale convective system (MCS). On these days the dust observed over Benin and Niger originated from the Bodélé depression and from West Sudan. In this study, are used aerosol extinction coefficient derived from lidar observations, temperature, pressure, water vapour profiles derived from dropsondes and clouds properties. The surface albedo is diagnosed from MODIS observations. A serie of retrieval is carried out on between 9 and 15 June 2006 to investigate the dust radiative forcing as a function of latitude, from 6°N to 15°N, i.e. between the vegetated coast of the Guinea Gulf and the arid Sahel. The retrievals are made both in terrestrial and in solar spectrum and show a maximum heating rate associated with the dust plume on these days was between 1.5 K/day and 3 K/day, depending on the latitude and the concentration of dust. The maximum heating rate is observed to the North, where a deep plume of dust is detected. This maximum is diagnosed around 3 km where the concentration of dust is significant. Sensitivity studies to surface albedo, aerosol backscatter-to-extinction ratio, temperature, water vapor mixing ratio profiles and cloud properties are also conducted.