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

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The massive transport of arid dust by the African easterly jet (AEJ) can impact the dynamic of the AEJ and modify the development of westerly African waves through modifications of horizontal temperature gradient. Hence, it is important to evaluate the radiative impact of dust and their effect on thermodynamical properties of the AEJ.

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 space-borne and airborne lidars (CALIPSO and LEANDRE 2, respectively) as well as dropsonde observations acquired during the African Monsoon Multidisciplinary Analysis Special Observing Period. Aircraft operations were conducted on 13 and 14 June 2006, over Benin and Niger. On these days the dust observed over Benin and Niger originated from the Bodélé depression and from West Sudan.

In this study, we use aerosol extinction coefficient derived from lidar, as well as temperature, pressure and water vapour profiles derived from dropsondes as inputs to STREAMER. The surface albedo is obtained with MODIS.

A series of runs was carried out on 13 and 14 June 2006, around mid-day, 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.

In the solar spectrum, the maximum heating rate associated with the dust plume on these days was comprised between 1.5 K/day and 3 K/day, depending on the aerosol load, over the entire Sudanian and Sahel regions as inferred from CALIPSO. Sensitivity studies to surface albedo, aerosol backscatter-to-extinction ratio, temperature and water vapor mixing ratio profiles were also conducted.