

Interactive comment on “Radiative forcing associated with a springtime case of Bodélé and Sudan dust transport over West Africa” by C. Lemaître et al.

Anonymous Referee #2

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In this paper, authors investigate radiative forcing due to dust over West Africa using remote sensing and in situ data gathered during AMMA SOP field campaign. Dust can have a significant impact on the atmospheric radiation. Dust not only scatters but also absorbs solar radiation and also absorbs and emits long wave radiation. The magnitude and even the sign of direct radiative forcing by dust is uncertain according to fourth assessment report by IPCC. Dust radiative forcing, in fact, depends on a number of parameters, such as the optical properties of dust, its vertical distribution, cloud cover and the albedo of the underlying surface. In this context, results reported in this paper are important. Limitations are (a) data for a limited duration (b) assumption of externally mixed aerosols, lack of validation and (c) errors resulting from non-spherical

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shape of dust aerosols. Detailed comments are listed below.

Specific comments

Section-2.1: (a) Aerosol back-scatter to extinction ratio (BER) is assumed constant with altitude. Error in dust radiative forcing resulting from this assumption needs to be presented. (b) BER is also assumed wavelength independent BER. Please justify these two assumptions. (c) Several instruments (Aethalometer from Magee Scientific for example) are designed for ground-based measurements. As a response to changes in pressure at different altitudes, flow through these instruments can vary. Please describe these effects and corrections applied. (d) Various correction factors applied to absorption and scattering coefficients may be provided. Section-2.2.1: It appears that lidar inversion used in LEANDRE-2 lidar (section-2.1) assumes altitude independent BER and CALIOP inversion (section-2.2.1) uses altitude dependent BER. If so, please justify. Section-2.3.1: Was there any surface reflectance measurements from aircrafts? Surface reflectance is a vital parameter while assessing radiative forcing especially in bright surfaces like deserts. Uncertainty in MODIS surface albedo product can lead to errors in the estimated dust forcing. Section-5: Investigations as part of Aerosol Characterization Experiment-Asia (ACE-Asia) have shown that the dust we observe may not be just dust, but it may be dust mixed with other aerosols. Dust particles mixed with soot, sulfates, nitrates or aqueous solutions can have drastically different properties. I understand that information on aerosol state of mixing, though vital, is not at all discussed in this study. Was there any Scanning Electron Microscope analysis of aerosol samples? I suggest that authors may address this aspect. Section-5.1: Considering the fact that a number of assumptions are involved in the assessment of dust radiative forcing, I feel that section 5.1 (sensitivity studies) is too short. Authors may provide a detailed sensitivity analysis and come up with an overall uncertainty in the dust forcing. No validation for dust forcing is presented. Do you have data from upward and downward looking radiometer at least from one flight? If so, it is possible to validate the estimated dust forcing.

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