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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiative budget in the presence of multi-layered aerosol structures in the framework of AMMA SOP-0" *by* J.-C. Raut and P. Chazette

Anonymous Referee #3

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This paper presents an extensive characterization of the radiative impact of layers of different aerosol types, based on a suite of aerosol observations performed during one week in january 2006, when layers of desert dusts and biomass burning aerosol, or mixing of them, were present and detected both remotely and in-situ from the ground and from airborne platforms. The dataset is well presented and its consistency is thoroughly discussed. The retrieval of the aerosol refractive index, a key parameter to their optical and radiative properties, has been accomplished by comparing and discussing different approaches on different subsets of data. Limits and consistency of each approach have been discussed widely, to find the most reliable ones. Aerosol radiative effect has been assessed by means of a radiative transfer model run in two

different configurations employing respectively the classical 2-stream D-Eddington approximation and a 4-stream discrete ordinate approach. Sensitivity tests have been finally performed, with respect to the optical depth, refractive index and aerosol vertical distribution and overall aerosol optical properties. This is a comprehensive study that surely deserves publication in ACP: the observations and methods are well presented and carefully discussed, the underlying science is well addressed and referenced, so I consider it as a valuable contribution to the studies of aerosol climatic effect, both in term of methodology and of results. Some minor comments and technicalities in the following.

(figs. 1 to 5 panels b, and comment in the text 12474, 23-26) in the graphs of the Angstrom coefficient, the addition of this parameter as computed from the PCASP size distributions might be beneficial, either to compare with the other two measurements, and to spot out regions where the particles left undetected by PCASP resided. (Fig. 5b) There is a generally good coincidence between the lidar-nephelometer derived Angstrom coefficient and the sunphotometer one, being the latter close to the value the former attains in the lower layers, where the optical length is greater. This should also apply to the fig. 5b case but in fact it does not. Could the authors comment on that? (12478, 8) the sentence "at not-forward angles Mie theory overestimates the scattering" is not true in general, but only at scattering angles close to the forward and backward directions. This is implicitly acknowledged in the following lines 16-19. Nevertheless, the abovementioned sentence is misleading and should be clarified. (12478, 20-22) The fact that the extinction for equivalent area spheres is lower than the extinction for aspherical particles does not apply to all possible size distributions, since it is - very weakly - dependent on the average size parameter. Is it as stated for small size parameters. I understand that for this particular case it does apply. However this might be stated to avoid misinterpretations, also in view of the caveats one should bear in mind when using the measured size distributions, which might mis-estimate the larger radii tail of the distribution. (12481, 10) There and in the following, it is not clear whether the uncertainties attributed to ACRI are due to the variability of the dataset,

ACPD

8, S5286–S5288, 2008

to the propagation of measurement errors in the respective methods, or a combination of both. In this latter case, how does the two compare? For instance, the isopleths of the A1 method, as in fig. 6, are more inclined with respect to each other than those of the A2. This would mean that the former more effectively constrain the two determined parameter, with respect to the latter. Has it been taken into account in the computation of the uncertainties? (12489, 13- 12490,15) It is difficult to compare these radiative forcings with other from other cases, with maybe the same aerosol kinds, but different burdens distribuited vertically; the authors should quote their respective optical depths along with the radiative forcings, at least.

(12462, 24) "sensitivity" for "sensitive to" (12465, 13) "complimented" for "complemented" (12468, 27) "interpolated" for "extrapolated" (12468, 24) "interpolation" for "extrapolation" (12477,15) "sensible" for "sensitive" (12488, 5-7) Please use "discrepancy"instead of "error"

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8, S5286–S5288, 2008

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