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Interactive comment on "Optical properties of Saharan dust aerosol and contribution from the coarse mode as measured during the Fennec 2011 aircraft campaign" *by* C. L. Ryder et al.

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This is a very nice and well-structured paper which discusses problems in measuring microphysical properties of mineral dust particles. A (self-)critical review of commonly applied measurement techniques is presented, which confirms quantitatively that previous aircraft measurements were attended with losses of coarse mode particles leading to overestimations of derived or calculated values of the solar single scattering albedo (SSA) of Saharan mineral dust. New instruments were applied to extend the detection range for coarse mode particles. My impression, as a modeller, is that all measurements were carried out very carefully and their results were critically discussed. The

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consideration of the cloud imaging probe (CIP) seems to be the most promising instrument for future airborne particle measurements, since no optical corrections are required and it is possible to get information about the geometrical size of the particles more or less directly.

The equipment as used here to observe dust plumes close to source regions should also be applied to investigate long-range transport events. This application would be very interesting in order to quantify the fraction of deposited coarse mode particles as a function of the transport distance, which is also proposed by the authors (p. 26814, l. 3-8): The consideration of data collected over the Canary Islands will be very helpful here. With regard to this point I would like to mention that over this location a Saharan dust plume was already observed in 1997 during the campaign ACE-2. The (less complex) measurements performed at that time demonstrated the presence of coarse mode particles up to an altitude of about 6 km above sea level. However, I am sure that Fennec will provide more detailed measurement information to answer the question.

Figure 6 nicely shows the differences in dust size distributions measured during various campaigns in the past. The shape of a distribution then affects the optical properties, and it is not the presence or absence of the coarse mode alone which determines the value of the SSA. It is hence truly stated (p. 26806, l. 5-8) that it depends on the fraction of finer and coarser particles or, generally spoken, on the particular shape of the distribution. Thus, dust ensembles with different fractions may be represented, in combination with, e.g., a size-dependent complex refractive index, by the same value of SSA. Ambiguity problems like this might then be the reason why remote sensing products (e.g. AERONET) might be the result of a retrieval that internally overestimates the fine mode and underestimates the coarse mode number concentration, as also indicated in the conclusions (p. 26813-26814, l. 27-28,1-2), which then leads to an overestimated retrieved SSA.

In the conclusions it becomes also obvious that the overestimation of SSA derived by measurement data influenced by instrumental limitations is evident and now more

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correct measurements of, e.g., coarse mode particles are possible. I consider these statements to be the most important contribution of the paper which I strongly recommend for publication in ACP.

The only critical point I see refers to Eqn. (1): To which base of the logarithm refers the used symbol log?

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 26783, 2012.