Atmos. Chem. Phys. Discuss., 12, C10496–C10499, 2012
www.atmos-chem-phys-discuss.net/12/C10496/2012/

Atmospheric Chemistry and Physics Discussions

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.

G. Chen (Referee)

gao.chen@nasa.gov

Received and published: 12 December 2012

This manuscript presented aircraft observations of the Saharan dust microphysical and optical properties which were made during the Fennec 2011. The observed dust particles appear to have originated from Mali, Mauritania and Algeria. The dust absorption and scattering coefficients were measured by PSAP and TSI nephelometer, respectively. The particle size distribution observations were made by a combination of wing-mounted and inlet-based instruments. The authors have carefully examined the dust properties as a function of altitude and age or the proximity to the source regions. The authors used the improvement to the existing wing-mounted instruments, i.e., PCASP

and CDP, for better characterization of the coarse mode of the dust particles. The authors explore the limitation of the aircraft sampling inlet to the measurement of coarse dust particles. The coarse mode observation also led to indications of potential overestimate of dust particles. This reviewer believes this work represents some significant advances in the dust particle observations and will motivate researchers to come out with new and innovative direct measurements of coarse particle optical properties and more conclusive method to determine the Sahara dust particle SSA. This manuscript is well organized and well written. The presented research is methodical and rigorous. This reviewer would like to recommend this manuscript be published with some minor changes as listed below.

Specific Comments:

1) Both PCASP measurement and the SSA assessment associated with the coarse particles are based on an implicit assumption that the dust particle refractive index does not have a significant dependence on particle size. This assumption should be explicitly stated in the manuscript.

2) It is unclear whether or not the number of the bins and the size of bins of PCASP were changed after the refractive index correction. As the number concentration tends to be rather low for coarse particles, it would be important to provide some information on the number of counts for the larger size bins over the integration time.

3) The PSAP is a centrally important instrument in this study. The cited data processing document by Turnbull is a FAAM document. Fortunately, it can be found through Google. It would be ideal if a URL can be provided. In addition, the authors should point out the difference between the Turnbull approach and the original Bond et al. (1999) as well as more recent work by Lack et al. (2008) and Virkkula et al. (2010). These differences may directly affect the uncertainty in the refractive index estimate and may contribute to the overall uncertainty of the SSA assessment from this work.

4) Several works have suggested potential problems (i.e., truncation correction) in

coarse particle scattering measurement using nephelometer, e.g., Heintzenberg et al. (2006) and Quirantes et al., (2008). This issue should be briefly discussed and may be considered as part of the uncertainty for both refractive index and SSA estimate.

5) The authors have stated that the dust particle size distribution remained relatively constant during long range transport. One additional reference, i.e., Liu et al. (2006), should be cited to support this hypothesis. At the same time, it should be mentioned that this observation is not consistent with the current particle sedimentation theory.

6) Based on the author's definition, the imaginary part of the refractive index should be referred as k not ki, or #.### not #.###i.

7) It would be much easier to read the figures if the authors can use larger font sizes for tick labels and axis labels.

8) "colour" and "color" should be consistently spelled as "color" which is more internationally acceptable.

Heintzenberg, J., Wiedensohler, A., Tuch, T. M., Covert, D. S., Sheridan, P., Ogren, J. A., Gras, J., Nessler, R., Kleefeld, C., Kalivitis, N., Aaltonen, V., Wilhelm, R. T., and Havlicek, M.: Intercomparisons and aerosol calibrations of 12 commercial integrating nephelometers of three manufacturers, Journal of Atmospheric and Oceanic Technology, 23, 902-914, 2006.

Lack, D. A., Cappa, C. D., Covert, D. S., Baynard, T., Massoli, P., Sierau, B., Bates, T. S., Quinn, P. K., Lovejoy, E. R., and Ravishankara, A. R.: Bias in filter-based aerosol light absorption measurements due to organic aerosol loading: Evidence from ambient measurements, Aerosol Science and Technology, 42, 1033-1041, 10.1080/02786820802389277, 2008.

Liu, Z. Y., Omar, A., Vaughan, M., Hair, J., Kittaka, C., Hu, Y. X., Powell, K., Trepte, C., Winker, D., Hostetler, C., Ferrare, R., and Pierce, R.: Calipso lidar observations of the optical properties of saharan dust: A case study of long-range transport, Journal of

Geophysical Research-Atmospheres, 113, D07207 10.1029/2007jd008878, 2008.

Quirantes, A., Olmo, F. J., Lyamani, H., and Alados-Arboledas, L.: Correction factors for a total scatter/backscatter nephelometer, Journal of Quantitative Spectroscopy & Radiative Transfer, 109, 1496-1503, 10.1016/j.jqsrt.2007.12.014, 2008.

Virkkula, A: Correction of the Calibration of the 3-wavelength Particle Soot Absorption Photometer (3 PSAP), AEROSOL SCIENCE AND TECHNOLOGY, 44, 8, 706-712, 2010.

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