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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne observations of mineral dust over Western Africa in the summer monsoon season: spatial and vertical variability of physico-chemical and optical properties" *by* P. Formenti et al.

Anonymous Referee #2

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General comment

The manuscript presents observations of physico-chemical and optical properties of mineral dust observed during AMMA in the area south of the Sahel. Data are reported from airborne observations, while measurements from ground-based stations are included in the data analysis. The manuscript presents important observation data and deserves publication in ACP. The paper is scientifically sound and well structured. The presentation however requires careful check of English language. Minor revisions have

to be considered before publication, which will be explained in the following.

Specific comments

1. The methods operated on board of the ATR include an absorption measurement (spectral Aethalometer), scattering coefficient measurement (Integrating Nephelometer), size distribution measurement by means of an optical particle counter OPC (GRIMM 1.108), and sampling for post-flight chemical analysis. All applied methods require considerable corrections for mineral dust: Aethalometer correction for the conversion of an attenuation measurement to an absorption coefficient measurement; truncation angle correction for the Integrating Nephelometer; refractive index adjustment and particle non-sphericty effects of the OPC response. Since all of these correction schemes were not developed for irregularly shaped super-μm sized dust particles, the manuscript requires a careful discussion of potential uncertainties arising from these correction methods.

2. The authors compare some of their results with results from ground-based measurements during the recent SAMUM-1 study in Morocco. However, from SAMUM also airborne observations of dust size distributions (Wagner et al., 2009; Weinzierl et al., 2009) and dust refractive index (Petzold et al., 2009) are available. I suggest to compare AMMA airborne observations also with SAMUM airborne observations. In particular the data for the imaginary part of the refractive index are in the same range as the values reported for fresh dust from the northwest Sahara (Petzold et al., 2009). The comparison of the presented size distributions with airborne observations of fresh dust from the northwest Sahara may extend the interpretation because in the current version the authors refer only to dust size distributions measured after several days of atmospheric transport. Including the SAMUM size distributions data may also allow the investigation of potential differences in size distributions of dust from different sources.

3. The spectral single-scattering albedo is presented in Figure 12. Respective data stem from the Aethaometer and from the Integrating Nephelometer. Since both meth-

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ods required significant correction of data, an evaluation of the resulting errors of the single-scattering albedo is essential for the presentation of these data. The current presentation does not allow to decide whether or not the shown differences are statistically significant. An error analysis is definitely required for the single-scattering albedo. This error analysis is also an indispensable pre-requisite of the conclusions drawn on the single-scattering albedo and potential radiative effects.

Minor comments:

Abstract: Please rephrase the last two sentences of the abstract (page 2550, line 16ff). In the current version this statement is not understandable.

Page 2557, line 18: the sentence suggests that total particle number concentrations were measured, but since the instrumentation does not include a CPC, I assume that this sentence refers to the number concentrations obtained from OPC data. Please specify.

Figure 3, 5: x-axis and y-axis grid lines will improve the quality of the figure significantly. STP definition in the figure caption does not agree with the STP definition on page 2557.

Figure 6-9: x-axis and y-axis grid lines will improve the quality of the figure significantly.

References:

Petzold, A., Rasp, K., Weinzierl, B., Esselborn, M., Hamburger, T., Dörnbrack, A., and co-authors, 2009: Saharan dust refractive index and optical properties from aircraft-based observations during SAMUM 2006. Tellus, 61B, 118-130.

Wagner, F., D. Bortoli, S. Pereira, M. João Costa, A.M. Silva, N. Belo, B. Weinzierl, M. Esselborn, A. Petzold, K. Rasp, B. Heinold, I. Tegen, 2009: Long-range transport of desert dust particles from Africa to Portugal during DARPO, and SAMUM, Tellus, 61B, 297-306.

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Weinzierl, B., A. Petzold, M. Esselborn, M. Wirth, K. Rasp, K. Kandler, L. Schütz, P. Koepke, and M. Fiebig, 2009: Airborne measurements of dust layer properties, particle size distribution and mixing state of Saharan dust during SAM

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 2549, 2011.