

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.

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The paper presents chemical, microphysical and optical properties of dust and mixed aerosol over Western Africa. Sahelian and Saharan dusts in a few episodes during summer time are investigated by aircraft soundings. New data material is presented.

The discussed methods are appropriate and established. Some more detail on the procedures could be given, including uncertainties.

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The conclusions are sound in general, and there are no major critical points to address in my view.

Thus, it is recommended to be published in ACP.

However, I'd encourage the authors to have the manuscript checked by a native English speaker. Several formulations seem strange to me, but being not a native speaker myself I cannot correct them appropriately. Some suggestions of rewording are given below.

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Comments

2552/10: One could argue here, that the soil particle size distribution might favor coarser particles in the Sahara than in the Sahelian due to different a kind of weathering, so that the size distributions at dust emission are already different.

2555/21 Redmond et al. (2010) report a value range of 1.53 to 1.56. Thus, at first, the assumption of 1.53 is rather at the lower end. Second, all the works cited by the review of Redmond et al. (2010) as reference source for the value of 1.53 (i.e. Haywood et al., 2003; McConnell et al., 2008; Osborne et al., 2008; Schladitz et al., 2009) take this fixed value from the model atmosphere of “World Climate Program (WCP)/IAMAP, A preliminary cloudless standard atmosphere for radiation computation, WMO, Geneva, 1986”, which unfortunately doesn't seem to be available any more. Actual measurements – some of them reviewed by Redmond et al. (2010) – seem to point to higher values for the Sahara and lower ones for Asia.

2556/5 Are the 10 to 15 % relative to the fine mode extinction or to the total extinction? If the latter, 10 to 15 % shouldn't be neglected.

2556/17-18 Why where the particular values for the imaginary part of the refractive index chosen?

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2557/2 Was any contamination identified?

2557/17 Was the mentioned independency of wavelength a result of the measurement or an assumption?

2561/18-21 The Al concentrations show a high variation for the same latitude between 13 and 16°N. A really good agreement – as stated – doesn't become visible.

2562/4 The correlation of Ca and Mg is readily explained by the presence of dolomite. How about the correlation between Ca and K?

2562/17 As it can be expected, the mass is dominated by Si, not Al (Table 2). Of course, as Al most probably has a close connection to Si, the regression coefficient should be high for both. Please reword.

2562/27-2563/4 The comparison of this work's elemental concentrations with others measured with a different (and, seemingly, uncharacterized (Formenti et al., 2008)) aircraft inlet seems to be pointless, especially, if the data are uncorrected for the inlet efficiency (not mentioned).

2565/27 Bristow et al. (2010) report an average Fe/Ca mass ratio of 2 for the Bodélé depression with values ranging between 0.8 and 4.5. This variability – also in comparison to Formenti et al. (2008) – leads to the conclusion, that it can't be regarded as source with an uniform composition.

2566/27+28 The ratio between scattering coefficient and particle concentration is not dimensionless. Please add the unit to the "1".

2570/4 Kandler and Schütz (2007) have not measured or described any chemical composition. Is it Kandler et al. (2007)? These authors report a elemental mass ratio of Fe/Ca=2.1

2570/10 How does wet deposition remove preferentially particles between 0.3 and 1 μm ?

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2570/17 How is Ca associated to clay minerals? Kaolinite usually does not contain Ca.

2575/12-17 Discussion of the first mode should be skipped. It is speculative, as no data for a potential maximum location are available.

2575/18-19 Were the mode center diameters obtained as the maximum of the measured points or by log-function fitting? The latter approach should be more suitable.

2576/2-5 The conclusion from the increase of large particles with decreasing altitude on longer transport pathways of the upper layers doesn't seem to be valid – this behavior should be expected also after some transport for an aerosol which was homogeneous at the beginning, due to sedimentation of the larger particles from upper towards lower layers.

2607/2608 Fig. 10/11: What is the difference between these two types of figure? Which units are really shown on the y-axis

2577/2 Experimental errors should be specified in the manuscript

2577/16 Only the imaginary part of the refractive index was left as a free variable.

2678/2-10 Please specify when external and when internal mixing is meant.

2580/7-8 Can this be proven by microscopy images? It was mentioned above, that electron microscopy was performed on the filters.

2581/17-19 and 2581/27-2582/2 Size distribution measurements in this work as well in the work of Reid et al. (2008) were performed behind an inlet with a 50 % cut-off at or below 10 μm . A larger variation in particle concentration would be expected particularly for larger particles (e. g., d'Almeida and Schütz, 1983; Jaenicke and Schütz, 1978; Kandler et al., 2009; Mikami et al., 2005), so it might not be detected by these methods. Thus, no conclusions regarding the variability of the full size distribution can be made from these measurements. This should be specified.

2582/17 Uncertainties should be given together with the single scattering albedos to

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address the relevance of the following estimation.

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Minor points/Typos

2550/25 “radiation”

2551/4 “streaming”? replace by a more suitable notion

2551/10 correct “Sokolik”

2551/14 “long-term”?

2551/17 “elevated” in comparison to what?

2551/20 can the Harmattan really be addressed as cold?

2551/23 wet ? humid?

2552/8 “composition”

2552/9 “size distributions”

2553/2: at their maximum

2553/12 “The instruments”

2553/16 “dynamic and thermodynamic”

2553/17 Suggestion: Only describe what was used in this work. Surely, many more instruments were used onboard the aircraft.

2553/18 is AVIRAD an acronym? Please explain

2553/19 Formenti et al. 2011 not present in references

2553/25 and 2556/20 absorption or extinction?

2554/2 with an inlet cut-off at 9 μm the OPC surely doesn't deliver representative size

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distributions up to 20 μm (though it might be capable of doing so, if the particles are transmitted into the instrument). Please correct.

2555/5 occurring or not occurring?

2555/14 Adapt OPC size range to the inlet transmission!

2555/19 Please mention explicitly, whether the OPC was really calibrated for this work with PSL, or whether the factory calibration (usually aiming towards a correct mass measurement) was used.

2555/20-22 correct grammar

2555/26 Please avoid phrases like “up to” and give the range reported by the referenced authors.

2556/9 correct “at an airflow of”

2556/9 and 2556/27 Was it a volumetric air flow or an equivalent mass flow at STP?

2558/20-22 How was the grain saltation measured? Please describe or insert the appropriate reference.

2559/6 reference Kalapureddy et al. (2010) is missing in references

2559/17 reference Said et al. (2010) is missing in references

2562/2 missing “,” (comma)

2562/21 “our experience and observations of previous works”

2563/12 “eight hours”?

2564/8+10 and 2602: V024 is occurring twice. Is the first one V023? If you correct, also check the description (2564/10).

2564/28 reference Said et al. (2010) is missing in references

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2565/1 reference Canut et al. (2010) is missing in references
2566/22 remove “up”
2567/2+4 Is the size 0.5 μm a typo here (instead 0.3 μm)?
2567/4 “minor” ? “weaker”
2567/9 Instead of “For . . . , they were . . .” better use “Si/Al values ranged between . . .”
2569/13 reference Said et al. (2010) is missing in references
2570/9 wrong section number reference, should be 4.4
2570/14 “usually dominant”?
2571/3 “a more detailed view”?
2571/20 “decoupled”?
2571/25-26 “do not support”
2572/11-12 If the Bodélé is depleted in Fe, Fe/Ca should decrease or Ca/Fe should increase. Please correct.
2573/27 “The profiles”
2574/10 “higher wind speed”
2574/27-28 “This flight ended with”
2574/28 remove “of opportunity”
2575/21-23 Rephrase sentence
2577/16 Rephrase second half of sentence
2579/5 “together with”?
2580/4 remove “concentrations”

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2590/8 reformat
2600, Fig. 3, x axis “degrees north”
2600 Fig. caption: Though from the manuscript it becomes clear what is meant with an “optical diameter”, a more precise notion should be used.
2602 a) Fig. has quite small lettering. b) The three wavelengths are not discussed separately. Maybe it would be easier for the reader to plot the Ångström exponent of scattering instead (less curves).
2606 “the elemental ratios of the intermediate layers”?
2608 The graphs should have different colors each or any other possibility to distinguish the flight levels.

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