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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of Saharan dust microphysical and optical properties from the Eastern Atlantic during NAMMA airborne field campaign" *by* G. Chen et al.

Anonymous Referee #1

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The paper reports on aerosol size distribution, volatility, scattering and absorption measurements on board of an aircraft during the NAMMA campaign in 2006. Additionally, some results of electron microscopy are discussed. New data material is presented. The publication is appropriate in formal terms, and it addresses a relevant subject. Literature is referenced well.

However, the described experiment has the same problem as, e. g., the SHADE campaign: the aircraft inlet, which prohibits large particles from being measured, though we know that they are present. While this should surely not hinder publication, they drawbacks should be clearly addressed in this work and they authors should refrain

from claiming representativity of the findings for the "complete" Saharan dust.

Detailed comments

page 13451/lines 15-22: Unfortunately it is not mentioned by the authors, which of the inlets (UH, UNH, LaRC) described in the referenced work (McNaughton et al. 2007) was used. Judging from the state 50% transmission diameter of 4 μm, it has to be assumed that they used the UNH inlet. However, they authors do not explain that the given diameter is aerodynamic diameter and translates to about 2.5 μm geometric diameter for mineral dust (according to the referenced McNaughton et al. 2007). The argumentation below regarding the particle size in terms of optical properties should rather be done referencing the approximated geometrical particle size.

13452/5-7: Does this mean the heating tube was unevenly heated? Or what gradient was present in the tube to account for 30 % of thermophoretic losses?

13452/27: It doesn't make any sense here to speak of 0.7 - 20 μm integrated diameter, if the inlet has a 50% cut-off at 4 μm aerodynamic diameter.

13454/11-14: More information on the type of analysis performed (type of electron microscopy, used parameters and substrate, and, especially, the number and size of measured particles) would help the reader to understand a potential significance of the results. Which type of soluble material was found to be mixed with mineral dust (and, with which type of dust? Silicates, carbonates, . . .?)

13456/24-25: This is true for most of the mineral dusts. However, iron oxide in mineral dust is not necessary present as pure iron oxide particles, though than can occur. In contrast, it often is incorporated into or on the surface of the said silicates as small grains (Kandler et al., 2009; Lafon et al., 2006; Ro et al., 2005). Thus, from a dominant presence of silicates it is not possible to conclude on the iron oxide content (and the refractive index, subsequently). In addition, the authors state the presence of clays – how were they discriminated from other silicates?

13456++: "Closure": A closure is performed, when there several ways of determining a variable with according uncertainties, and if they agree on a chosen level of significance, closure is achieved. While this is the case in principle in this work, though – given the large uncertainties in SCF and refractive index, where the authors have chosen a "most suitable" SCF of 1.27 and n_i of 0.0022 – the representativity of an achieved closure can be doubted.

13461/19-25: The authors state that the variability for size distribution and scattering measurements is linked, but that there are systematic differences in the values. Despite that, they conclude that the characterization of the dust properties is accurate. That seems to be illogic.

13462/28-29: Concluding from a non-volatile-fraction of 70 % and a "potential" (unknown?) particle loss of 30 % in the heating tube to the presence of well over 90 % non-volatile particles is quite speculative, though the stated value is not unreasonable for mineral dust. However, these values should then be rather addressed as a tendency.

13463/2: Is the potential particle loss of 30 % included in the value 45 % $\pm$ 26 %?

13463/24-26: As we know from other measurements (McConnell et al., 2008; Weinzierl et al., 2009) and many ground-based measurements, there are significant amounts of large particles with d > 5 μm in Saharan dust. Given the lack of large particles in the size distributions shown here and the knowledge about the inlet transmission, it is not justified to claim representativity with respect to Saharan dust for the size distributions shown in this work. Maybe they can be addressed as being representative for PM_2.5.

13464/14: There is no evidence given that the submicron particles influencing the size distribution can be addressed as "dust". Given a size range starting at 0.3 μm, there is probably ammonium sulfate present, also anthropogenic material can occur. If there is more information existing (i. e. electron microscopy as mentioned above), it should be presented.

13464/24-27: With the steep decrease in inlet transmission, of course the VMD is limited to smaller values. And so is its representativity for the aerosol outside the aircraft.

13465/8: Given uncertainties of 35% and 25%, values in a broad range can be declared as agreement. The level of confidence for this agreement being representative is low, conclusions based thereon should be avoided. However, the data scatter shown in Fig. 6 seems to exhibit closer connection than the uncertainties may imply.

13465/18-21: Again, the inlet is limiting the variability of the VMD, and thus, the VMD inside the aircraft is not a good measure the represent and draw conclusions for the SAL, although the reasons given for a slowly changing size distribution are plausible.

13470/19-20: Size distribution uniformity in terms of PM_2.5!

13482: The definition "U=eastward/westward wind speed component" is somewhat misleading, positive values (a positive eastward/westward wind) would mean an easterly wind, but it looks like negative values means easterlies – this should be rephrased.

13489/Fig 5 caption: Please mention the type of particle diameter for this graph in the caption.

References

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