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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.

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This is a nice paper that reports on the microphysical and optical properties of Saharan mineral dust. I recommend it for publication, of course. However, I would like to note the following.

I am not an expert in measuring particles but know about the problems in detecting large aerosol particles. Here 'Large' should mean particles with diameters larger than approximately 4 micrometers. Due to cut-off problems it is not easy to measure these particles, since the inlets to the instruments lead to significant particle losses. If one tries to sample large particles via FSSP instruments, this is also associated with cer-

tain measurement errors, of course. All in all I am sure that the authors had done their best to account for these problems. Thus, they state in 'Summary and conclusion' (page 13473, lines 11-20) that their particle measurements are restricted to particles with diameters lower than approximately 4 micrometers. However, to conclude that 'Sahara dust particles are [...] weak-absorbing in nature' (page 13472, lines 22-23) seems to be prematurely with regard to the particle losses as mentioned before and to previous Saharan dust campaigns as cited in the paper. Furthermore, reading the Abstract (page 13447, lines 21-22) one also gets the impression that the single scattering albedo (SSA; at 532 nm?) is 0.97 'in nature'. In fairness, it should be said that this value corresponds to accumulation mode particles only, as also done by McConnell et al. (2010) who defined this particle mode up to particle optical diameters less than approximately 3 micrometers. The same holds for the discussion of the SSA in the main text (page 13467, lines 8-26). It is stated 'that the dust particles are only weakly absorbing in the visible wavelength range' and certain literature is cited (Haywood et al., 2003; McConnell et al., 2008; Osborne et al., 2008; and Schladitz et al., 2009; see the references in the paper). All these cited papers report from the restriction to accumulation mode particles. For example, McConnell et al. (2008) discussed that the addition of coarse mode particles may lead to values of SSA at 532 nm of 0.9. Even lower values are not unrealistic (down to 0.8), if large particles are considered that are found to be more absorbing than accumulation mode particles (see the SAMUM-1 findings). Beyond, AERONET is cited to affirm the value of 0.97. W.r.t. AERONET and the performance of retrievals of dust SSA I would like to refer to the critical paper of Müller et al. (2010). Finally, the authors state that the use of only supermicron dust particles results in a value of SSA at 532 nm of 0.94 (page 13467, lines 22-24). What refractive index is behind this value, especially what imaginary part? What assumptions w.r.t. the coarse mode were done for this calculation, since this particle fraction was not measured? I performed comparable calculations applying SAMUM-1 size distributions measured on 19 May 2006 (Weinzierl et al., 2009) at two altitudes above sea level (asl). Figure 1 shows SSA at 532 nm for spherical particles as a function of 1) the maximum particle diameter (MPD) of the measured size distribution and 2) the imaginary part of the refractive index (real part was set to 1.56 as observed during SAMUM-1). Thus, the variation of MPD simulates the truncation of the size distribution due to particle losses by instruments. Indeed, an imaginary part of 0.001 (lower bound of the range of the imaginary part, see page 13460, line 20) may lead to a SSA of 0.94, if MPD is about 20 micrometers. However, if the imaginary part is about 0.004 (upper bound of the range of the imaginary part, see page 13460, line 20) SSA is about 0.85 for the same MPD of about 20 micrometers. Therefore, the high values of SSA 'derived from both in-situ and remote sensing observations' (page 13467, lines 24-26) might also not be advised for modeling studies. At least, the presented range of SSA of Saharan mineral dust particle ensembles at 532 nm (0.94-1.0) seems not to be an effective way to address the measurement uncertainties associated with particle losses. I suggest to refer the found value of SSA of 0.97 to accumulation mode.

References:

McConnell et al., Using aircraft measurements to determine the refractive index of Saharan dust during the DODO Experiments, ACP, 10, 2010.

Müller et al., Mineral dust observed with AERONET Sun photometer, Raman lidar, and in situ instruments during SAMUM 2006: Shape-independent particle properties, JGR, 115, 2010.

Weinzierl et al., Airborne measurements of dust layer properties, particle size distribution and Mixing state of Saharan dust during SAMUM 2006, Tellus, 61 B, 2009.

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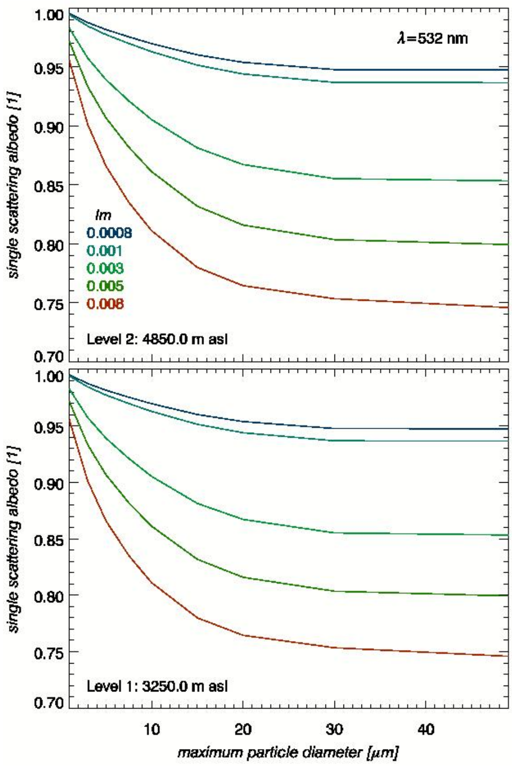

Fig. 1. Single scattering albedo of Saharan mineral dust at 532 nm measured during SAMUM-1 as a function of maximum particle diameter of the measured size distributions for various imaginary parts.