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Atmospheric Measurement Techniques Discussions

Interactive comment on "Dust mass, CCN, and INP profiling with polarization lidar: Updated POLIPHON conversion factors from global AERONET analysis" *by* Albert Ansmann et al.

Anonymous Referee #1

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The paper by Ansmann et al presents updated conversion factors for dust in the POLIPHON retrieval. The conversion factors are based on AERONET inversion results for a range of stations around the globe affected by desert dust. Overall the paper is well-written and useful and could be published in AMT after revisions.

General comments:

A validation with independent data would be very useful in general. I understand that such independent data sets that could be used for that purpose are not easy to obtain. Are such comparisons for same stations around the globe planned in the future?

The surface area concentration s_d is used for an INPC estimation approach (page 3

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Discussion paper

/ line 17). It seems to me that it would be better not to use the complete AERONET size range starting at 50nm to calculate the surface area concentration, because of the following reasons:
1) Such small particles are probably not relevant for INPC (the other appoach considers only particles with r>=250nm probably because of this).
2) The AERONET observations are not really sensitive to aerosol in the first size bins.
3) A large fraction of these small particles (if they are no inversion artefact) are probably not mineral dust particles as shown in several studies, e.g. by Konrad Kandler.
To illustrate the importance of the small size bins for the surface area calculations, I created a plot (see attached Figure 1) with the surface area concentration calculated from the AERONET dust data measured in Dakar (dust cases, i.e. Angstrom<0.3 and τ_{532}>0.1). The upper left plot (starting at first bin) corresponds to the Dakar data in Figure 1b of the discussion paper. If the first bins are not considered for the calculation of surface area the spread gets much smaller. When the surface area is calculated starting at bin 5 or 7 (≈250nm) the data is almost on a line (middle right and lower left plot). The lower right plot of the attached figure shows the complete surface area versus the surface area starting at bin 7. It can be seen that sometimes the surface area for r>250nm (where dust is usually dominating in desert aerosols) is only one fifth of the complete surface area in the AERONET data set. Though a factor of five is still less than an order of magnitude (as taken into account by the authors in the discussion) I think it is worth to take into consideration the minimum radius in the surface area calculations. In my view, r>=250nm would make much more sense than 50nm for the reasons given above. Maybe the authors want to discuss this.

Minor corrections:

Page 1 / line 4: "miccrophysical" –> "microphysical"

Page 1 / line 22: "separation of dust from aerosol pollution optical properties" is a bit confusing. Please rephrase.

Page 2 / line 14: "The technique is based on the conversion of lidar-derived particle extinction coefficients into ...": As far as I understand POLIPHON uses backscatter coefficients (+ depol) as input (also shown in Fig. 8). Therefore I think "extinction coefficient" should be exchanged here by "backscatter coefficient".

Page 5 / line 6: After "21 AERONET station" a reference to Tab. 2 should be added. Otherwise one asks at this point: Which 21 stations?

Page 5 / line 20: "enough" should be removed.

Page 7 / line 12: "inside" –> "insight"

Page 8 / line 14: I think the unit here should be cm^{-3} not cm^{-1}.

Page 8 / line 28-30 and Fig 7b: The part about the forward trajectories is in principle interesting but I am not sure if it fits very well here as it may confuse the reader and leaves some questions. For example, is there some wash-out during the further transport?

Page 10 / line 8: "sets" –> "set"

Table 1: In the line with $n_{100,d}(z)$: Shouldn't σ_d not be divided by some "normalization extinction coefficient", for example that "$\sigma_d^{x_d}(z)$" gets "$(\frac{\sigma_d}{1Mm^{-1}})^{x_d}(z)$"? Otherwise the units don't make sense.

Figure 10: "$c_{250,d}$" and "$c_{s,d}$" in the figure probably could be removed.

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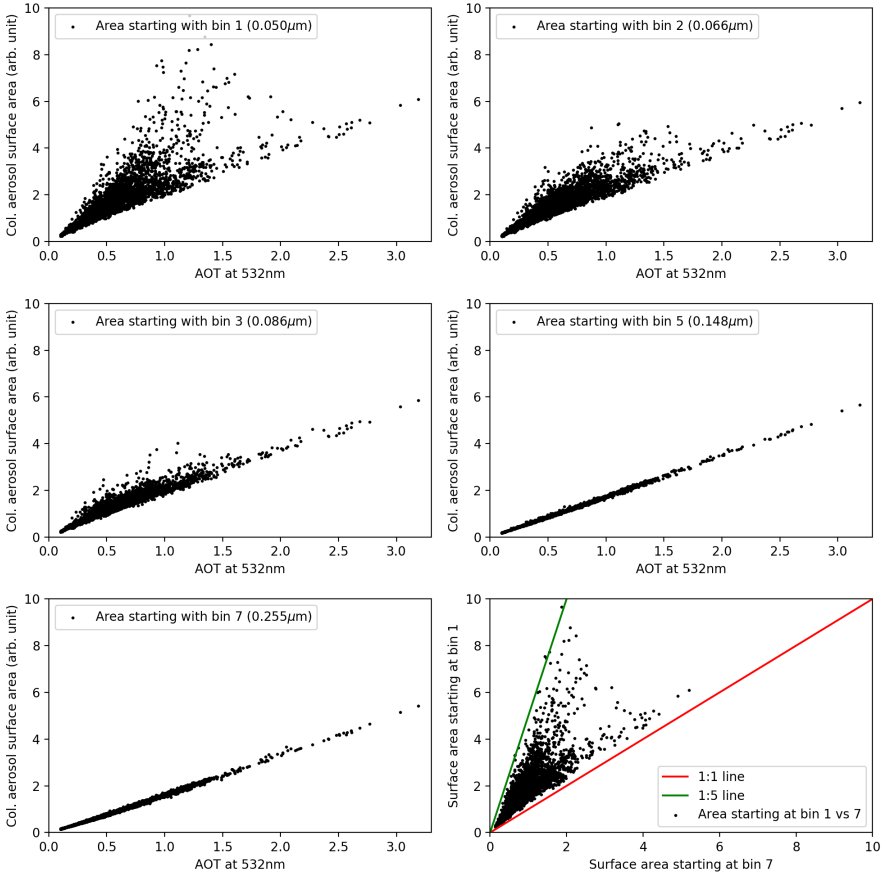

Fig. 1. Surface area concentrations from AERONET inversions for 'dust cases' at Dakar.

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