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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spectral- and size-resolved mass absorption efficiency of mineral dust aerosols in the shortwave: a simulation chamber study" *by* Lorenzo Caponi et al.

Anonymous Referee #1

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The paper presents needed results on dust optical properties (mass absorption efficiency and absorption Angstrom exponent) for D<2.5um and D<10um particles, relating them to chemical composition. The samples analyzed are from 12 locations in northern Africa (5 samples), Namibia (1 sample), northern China (1 sample), the Middle East (2 samples), North America (1 sample), South America (1 sample) and Australia (1 sample). I have no substantial issues with the analysis or the paper. I recommend publication after addressing the minor points below:

1) In the Abstract and somewhere earlier in the paper (before the Results section) the

location where the samples were collected from should be presented. Some information about sample collection is also needed – i.e.: a) Was only one sample collected at each location, or were multiple samples collected then combined? b) Were the samples collected from locations know to be preferential sources for atmospheric dust or was the collection location just random? The latter point is important, since it's know that atmospheric dust comes from preferential locations.

2) Abstract, pg. 2, lines 33-34: "The size-independence of AAE suggests that, for a given size distribution, the possible variation of dust composition with size would not affect significantly the spectral behavior of shortwave absorption." Either that or the composition simply DIDN'T vary with size for this set of samples – so I'd reword this a bit.

3) pg. 2, line 39: Need to spell out AAOD this first time that you use it.

4) pg. 2, lines 40-41: ". . .which is relevant to the development of remote sensing of light-absorption aerosols from space . . ." Not only from space! This approach has also been used extensively for AERONET (surface-based remote sensing) AAOD attribution.

5) pg. 3 line 56 contains a partial sentence ("In the solar spectrum (Boucher et al., 2013)").

6) pg. 6, lines 162-163: "The total uncertainty, including the effects of photon counting and the deposit inhomogeneity, on the absorption coefficient measurement is estimated at 8%." Is there a basis/reference for this?

7) pg. 7, line 170: It would be useful to give typical total masses and/or the fractional error/uncertainty in total aerosol gravimetric mass based on this error in filter mass.

8) pg. 8, line 223 equation: When I read this my immediate question was: "How does this compare to the measure of total gravimetric mass?". You answer this question (appropriately) in the results section but I still think it would be useful to add a note

here pointing to the fact the in your results discussion you found this agreed well with the total gravimetric mass.

9) pg. 10: Do you have any estimate / sense of how well the dust suspended by this "shaking" compares to the dust lofted by winds?

10) pg. 11, line 209: Mauritania is not listed as one of the sample site locations in Table 3. ?

11) pg. 11, lines 309-310 (an onward): The results here are said to agree well with that found for atmospheric aerosols in other studies, but the values in these studies is not given so this feels very hand-waving and unconvincing. Are you referring to the values given in Table 5? If so, please refer directly to them. If not, the comparison here needs to be more quantitative (discuss numbers from the literature vs. what is found here).

12) pg. 13, lines 353-354: If you have results for Niger why not show them?

13) pg. 14, lines 387-388: MAE doesn't vary linearly inversely with wavelength, it varies linearly inversely with the log of the wavelength (hence our ability to use the AAE relationship).

14) pg. 15, lines 429-434: A few things: a) "satisfactory" and "loose" are not quantitative terms, nor are they really appropriate for a scientific paper. What constitutes "satisfactory"? Best is to just give the correlations. b) The high correlation coefficients for PM2.5 are really driven by one high data point and so are probably not very robust.

15) pg. 16, lines 455-456: How can fine-mode-only AAOD be GREATER than total aerosol AAOD?

16) pg. 17, lines 487-488: As written this implies Solomon et al. varied SSA by 5%. For, say, SSA of 0.9, that they varied SSA by 0.045. That is, the co-albedo (or absorption) was varied by 45% (0.1+/-0.045). This is the proper comparison to make to the variation in MAE that you calculate.

17) Overall: Some editing is needed for language throughout. Here I list some that stood out to me – all small stuff but editing would help readability:

pg. 3, line 67-68: "in the last ten years or so" (too casual for scientific writing)

pg. 3, line 74: "A significant body of observations have been performed. . .."

pg. 8, lines 214-215: "The linear deconvolution, performed the Athena IFEFFIT freeware analysis program (Ravel and Newville, 2005), provided with the proportionality factors alpha_i representing the mass fraction of elemental iron to be assigned to the i-th standard mineral." (I found this sentence nearly impossible to follow. . .)

pg. 10, line 253: "the chamber was evacuated by to" (delete "by")

pg. 10, line 259: "dust particles produced was" –> "dust particles produced were"

pg. 10, lines 279 "dust on filter for" –> "dust on the filter for"

pg. 10, line 280: "by placing the loaded filter holders": This reads as if you are placing LOADED FILTERS (vs holders with blank filters in them, which is what I assume you mean). Reword.

pg. 11, line 206: "the origin of used dust samples". I think this should be "the origin of our dust samples", yes?

pg. 12, line 315: "Henceforth, and contrary to the soil samples. . ."

pg. 12, lines 317-318: ". . .could reflect more that of the parent sedimentary soil than not the other samples."

pg. 12, line 335: "An the exception"

pg. 13, lines 353-354: "As a matter of fact, the number fraction of particles in the size classes above 0.5 μm in diameter are different in the dust aerosol generated in the Alfaro et al. (2004) study with respect to ours."

pg. 13, line 364: "On the contrary" –> "In contrast"

pg. 13, line 365: “These differences could yield either to difference in the . . .”

pg. 15, lines 415-417: “using a power-law function fit as from Equation 2, provides with the values of. . .”

pg. 16, line 448: “The size-dependence, yielding significantly higher MAE values. . .”

pg. 17, line 470: “A closer look to observations” –> “A closer look at observations”

pg. 17, line 478: “our estimated MAE average at” –> “our average MAE values are”

pg. 17, line 490: “As Moosmuller et al.” –> “As in Moosmuller et al.”

pg. 18, line 503-504: “pointing out to the” –> “pointing out the”

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