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# *Interactive comment on* "Aethalometer multiple scattering correction $C_{ref}$ for mineral dust aerosols" *by* Claudia Di Biagio et al.

**Anonymous Referee #2**

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This is a very nice paper – it's well-written and describes a well-designed experiment with useful results. The paper is appropriate for AMT. Kudos to the authors for making multiple checks/closure investigations on the measurements to make sure the data were consistent. I've made some minor editorial suggestions below. I guess some might also be considered science comments, but they are also minor.

Minor editorial and minor science comments:

Line 40 – Replace 'As for today,' with 'Currently'

Line 52 – Change to 'This is particularly true when compared to other aerosol species, such as soot, for which. . .'

Line 57 – should be '. . .global scales. . .'



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Line 69-70 – Change to ‘One instrument used to obtain aerosol light absorption. . .’

Line 72-73 – Change to ‘The aethalometer reports equivalent black carbon mass concentration. . .’ [comment: Petzold et al 2013 suggest the terminology ‘equivalent black carbon’ ]

Line 98 – Change to ‘Thus, the value of . . .’

Line 119 – Change to ‘The MAAP is commonly assumed to provide the most reliable filter-based, direct estimate. . .’ [I think photoacoustic spectrometers are typically considered more reliable than filter based absorption measurements as there’s no filter involved to confound the measurement]

Line 122 – Change to ‘. . .although Müller et al. (2011) measured. . .’

Line 123 – wavelength is spelled wrong

Line 134 – Move to Line 108 after the sentence ‘The experimental set-up. . .’ and change so it reads ‘ Instrumental details and uncertainties are summarized in Table 1.

Line 156-159 – say whether any conditioning (drying) was done to ambient particles.

Line 258 – change to ‘. . .which was then applied to extrapolate beta_sca to 630 and 660 nm.’

Line 285 – missing parenthesis around ’13)’ [comment – I’d probably call these equations 12a and 12b or just have one equation with d1 and d2 and say the range is 0.3-1.0 um for fine and 1-10 um for coarse.

Line 295++ – change to ‘. . .uncertainties of . . .’ [Comment – I think it’s more common/standard to refer to the ‘uncertainty of’ rather than the ‘uncertainty on’ so lots of instances to change in this paragraph

Line 317 – change to ‘. . .performance of the. . .’





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Line 320 – change to ‘This is further demonstrated by . . .’

Line 316-324 –instrument uncertainties are listed in Table 1. This would be a good place to cite the instrument uncertainties and note that the difference is well within the uncertainties for the two instruments. Sherman et al (2015) supplemental materials is a good reference for the nephelometer uncertainties.

Line 351 – change to ‘In contrast, for more absorbing. . .’

Line 361-362 – Probably should move this sentence into previous sentence rather than have a 1 sentence paragraph. In some ways it seems in conflict with the previous paragraph where you discuss Crefs being larger/smaller than each other depending on the ATT threshold. Can you make a plot or include numbers for the lower threshold in a table to definitively demonstrate that the 10 or 20% ATT threshold doesn’t make a difference? Or maybe just put this sentence (lines 361-362) in the previous paragraph before the larger/smaller discussion so that the reader knows that, despite the Crefs being larger or smaller for the 10% versus the 20% threshold, the absolute difference is very small.

Line 364 - change to ‘. . .are reported. . .’

Line 372-381 - Were the ambient aerosol particles dried in any way? If not, does the ambient SSA vary with ambient and/or measurement RH? (I don’t know, but am guessing Paris might be damp/humid in November). The TSI nephelometer tends to run warmer than many other instruments so potentially could have discrepancies in scattering estimate if neph measure of scattering drives off more water than CAPS-MAAP estimate of scattering. There’s a slight suggestion of that in Fig 4 where I think the lowest group of extinction points are for ambient air and they look to be more below the 1:1 line than the other points (fig 4 is log scale, so hard to tell!). The closure still looks great and the focus of this paper was on lab generated dust so I’m more just curious.





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Line 382 – change to '. . .serve two purposes.'

Line 386 – change to '. . .on relative amounts of particle absorption. . .'

Line 407-408 – could site Lack et al (2008) here – they saw enhanced absorption for filter-based measurements when more organic was present (for PSAP not aethalometer, but I imagine the there could be a similar effect).

Line 412-414 – it should be relatively straightforward (although admittedly annoying – sorry!) to recalculate results for MAAP at 630 nm to see how much of a role this wavelength discrepancy might play. I see from the acknowledgements that Andreas Petzold advised on this paper – perhaps ask him what he thinks about the MAAP measurement wavelength value.

Line 424 – change to '. . .particles, and may be linked. . .'

Line 426 – delete 'In correspondence,'

Line 435 – [comment – interesting that kaolinite has a significantly different absorption Angstrom exponent than dust. Isn't it often used as a surrogate for dust? Does this have any implications?

Line 442 – change to 'In contrast, no dependence of Cref on Deff,fine is found (R2<=0.44, not shown).'

Line 454++ change to 'Using these values of Cref, the dust absorption coefficient estimated by the aethalometer will be about 2% (450 nm)) and 11% (660 nm) higher than obtained. . .'

Line 474 – delete ', even if beyond the scope of the paper,'

Line 483-484 – change to 'This trend was only observed when the entire dataset was considered, but not if the dataset was limited to just the dust observations, making it difficult to draw clear conclusions.





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Line 485 change '..of Cref is required...' Line 733 (and line 794) – change to '...(referred to as R(C2010))...'

Line 738 (and line 818) – change to '...kaolinite occurred between the...'

Table 1 – where do these uncertainty values come from? There are more recent (better!) references for the nephelometer uncertainty (e.g., Sherman et al 2015 – see their supplemental materials).

Figure 5 – why are f values so different for niger 1 and niger 2 and does this have an effect on results? Suggests results aren't totally reproducible.

Figure 8d (lower right) should the word 'niger 1' be in the figure legend? If so, there should be a space between it and (W2003)

General comment - A paper that might be of interest (if you haven't seen it) is Engelbrecht et al (2016) which has optical properties (e.g., SSA) for a bunch of different types of dust (i.e., dust from many different locations). I don't think you need to cite it (though you could). They used a photoacoustic instrument with a reciprocating nephelometer to obtain dust SSA values. If you and they have any overlapping dust samples it'd be nice to show/mention that the aethalometer had a similar response to dust as the photoacoustic since it's much simpler/cheaper to operate an aethalometer than a photoacoustic. Filter-based absorption instruments are often looked down on by some segments of the measurement community.

References

Engelbrecht et al (2016) Atmos. Chem. Phys, 16, 10809, 2016

Lack et al (2008) Aerosol Science and Technology, 42:1033–1041, 2008

Petzold et al (2013) Atmos. Chem. Phys., 13, 8365–8379, 2013

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