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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of iron and black carbon in aerosol light absorption" *by* Y. Derimian et al.

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1 General comments

This is a very good paper that is well written and worthy of publication. It ties AERONET radiometric measurements to in situ compositional measurements, and provides an empirical relationship between ssa and aerosol iron content that may be useful at many AERONET sites. The only thing missing from this paper that I would like to see remedied is a discussion of the sensitivity of ssa to aerosol size, and the impact of this sensitivity on the empirical relationship that the authors present (see "specific comments" below). All of my other comments are fairly minor.

2 Specific comments

I would like to see the sensitivity of ssa to aerosol size addressed. Specifically, two size distributions with identical compositions (i.e., identical refractive indices) but different effective radii will have different ssa and different spectral dependencies for the ssa. How does this affect the empirical results of this paper? Some discussion on this topic would be valuable. For instance, what if the abscissa in Figures 2 and 6 were replaced by the AERONET fine mode fraction? What are the AERONET fine mode fractions for the red symbols in Figure 3? Are the AERONET coarse mode concentrations well-correlated with the Fe concentrations? I don't expect the authors to make all these changes to their figures, but some discussion indicating that you considered the effect of aerosol size on the ssa and spectral variability of the ssa would strengthen the paper.

3 Technical corrections

Page 8161-2: Every author certainly has the right to choose their own nomenclature, but I would like to suggest that the authors drop the term "equivalent" from "equivalent BC." The reason that I make this suggestion is because the operational definition of "BC" (proposed by A.D.A. Hansen somewhere, sometime ago) already implies an optically equivalent carbon content. See the aethalometer instruction manual for MaGee Scientific and some of Hansen's earlier papers. There is also a nice section on nomenclature in the review paper by Bond and Bergstrom (2006; best obtained from http://cee.uiuc.edu/research/bondresearch/).

Page 8162, the authors state "...models may ...adequately estimate BC concentrations..." Actually, models are very poor at estimating BC concentrations; see some of the emission papers by Bond and Streets.

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Page 8165, line 21: I found the grammar for the sentence beginning with “The retrievals utilized. . . " to be a bit difficult.

Page 8166, line 23: What value did the authors use for the BC_e fixed absorption efficiency? This value (or range of values) should be clearly stated.

Page 8166: It is not clear to me at this point how the BC absorption is separated from the Fe absorption in the SFU analysis. It is possible (probable?) that the BC absorption overwhelms the Fe absorption, and that no separation of components is necessary. However, a sentence or two about how dust contamination on the filter is handled in the absorption $\rightarrow$ BC conversion should be mentioned in this section. . . OK . . . I now see that this topic is discussed in Section 4.2; however, you might alert the reader on this page that you are going to address this topic.

Page 8168: While it is fairly common knowledge that the absorption coefficient decreases with respect to wavelength for BC aerosols, I would like to see a reference indicating that the ssa for polluted aerosols decreases wrt wavelength in the 440 to 1020 nm spectral region.

Page 8168: I would like to see a reference or some other evidence that Angstrom exponents greater than 1 indicate that the aerosol size distribution is dominated by fine mode aerosols. My own study (Schuster et al., 2006) indicated that Angstrom exponents between 1 and 2 could be dominated by either coarse aerosols or fine aerosols (see also the references to Eck et al., 1999 and Westphal and Toon, 1991 in my 2006 paper).

Page 8172: Does the ratio $\tau_{ext}/\sigma_{scatt0}$ indicate an equivalent *aerosol height* or an equivalent *aerosol layer thickness*?

Figure 5: I can’t read the particle size scales.

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Interactive Comment