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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Attribution of aerosol light absorption to black carbon, brown carbon, and dust in China – interpretations of atmospheric measurements during EAST-AIRE" *by* M. Yang et al.

M. Yang et al.

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Q: I have a similar remark than reviewer 1: why use 2 different densities for dust in the paper? Page 10925 line 4 you use 2.0 g cm-3 whereas in part 4, a more common value of 2.6 g cm-3 is used?

A: For the correction of the APS size distribution in part 2, when converting from aerodynamic diameters to equivalent geometric diameters (as if the particles are spherical), 2.0 g cm-3 was chosen to approximately account for the large shape factor of the plate-like dust particles (as proposed by Reid et al., 2003). This is because an irregular-shaped particle is accelerated faster in the APS sheath flow than a sphere

of the same mass due to the larger surface area, and hence appears to be smaller to the instrument. We therefore need to use an effective density that is lower than the actual density in the conversion from aerodynamic to equivalent geometric diameters. In part 4, the dust volume is derived from the APS size distribution already corrected for particle shape factor, as described in part 2. Thus to estimate mass from volume, the typical mineral density of 2.6 g cm-3 was used.

Reid, J.S., Jonsson, H.H., Maring, H.B., Smirnov, A., Savoie, D.L., Cliff, S.S., Reid, E.A., Livingston, J.M., Meier, M.M., Dubovik, O., and Tsay, S.C.: Comparison of size and morphological measurements of coarse mode dust particles from Africa, J. Geophys. Res., 108 (D19), 8593, doi:10.1029/2002JD002485, 2003.

Q: Paragraph 3.1 lines 14 to 27: this part of the description that leads to the classification scheme should be clarified for the reader. Could you more clearly state how you came up with the criteria stated in Table 1. Are lines 14 to 27 necessary for the rest of your argument? If yes, explain better how you were lead to choose these criteria.

A: Our strategy for defining the classification scheme is to find intensive properties characteristic of each individual air mass. The thresholds of one standard deviation away from the median is somewhat arbitrary, but in practice appear to be strict enough to capture distinctions in airmasses and yet lenient enough so that a decent sample size remains. As in the dust example, we have more confidence in our air mass identification when multiple proxies converge (in this case calcium and coarse scattering). That being said, aside from the background information on carbon monoxide, lines 14 to 27 are not essential for the air mass classification argument. I will simplify and also clarify this section.

Q: Paragraph 3.2: please indicate that the scattering Angstrom exponent of dust show very large variations that could be caused by: different mineralogy, size distributions or coatings. Can you explain in a simple way why BC has a low absorption Angstrom exponent ?

ACPD

8, S11568–S11570, 2009

A: Suggestion accepted regarding the scattering Angstrom exponent of dust. BC has a low absorption Angstrom exponent because of the small particle size and constant imaginary component of the refractive index in the visible spectrum. BC particles are usually small relative to the wavelengths of visible light, and thus absorb in the Rayleigh regime. In this regime, absorption should follow an inverse-wavelength relationship as long as the refractive index is not a function of wavelength. This theoretical Angstrom exponent of one for BC is confirmed by numerous field and laboratory experiments, as listed in page 10916.

Q: Page 10931 last line and page 10932 line 1: “We can further assume that BC is the only significant light absorber at 950 nm, since both brown carbon and dust absorb weakly in the near-IR”; please give a reference for both.

A: Inferred from Andreae and Gelencser, 2006 and Sokolik and Toon 1999 for brown carbon and dust, respectively. Both are already referenced in the manuscript.

Q: Paragraph 4.2 You should mention the work of Putaud et al., 2004 that illustrates very well that the nitrate fraction is found in the coarse mode in the presence of dust whereas it is in the fine mode the air is devoid of dust. Putaud, J.-P., Van Dingenen, R., Dell’Acqua, A., Raes, F., Matta, E., Decesari, S., Facchini, M. C., and Fuzzi, S.: Size-segregated aerosol mass closure and chemical composition in Monte Cimone (I) during MINATROC, Atmos. Chem. Phys., 4, 889-902, 2004, SRef-ID: 1680-7324/acp/2004-4-889.

A: Excellent reference. I will certainly cite it. Thanks.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10913, 2008.

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8, S11568–S11570, 2009

Interactive Comment