Atmos. Chem. Phys. Discuss., 8, S5965–S5968, 2008
www.atmos-chem-phys-discuss.net/8/S5965/2008/


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.**

Received and published: 14 August 2008

Much appreciation for the stimulating comments from Anonymous Referee #1, here are our responses:

Q: Suggest mentioning in the abstract that the MAE for brown carbon is actually a lower limit value.

A: Suggestion accepted.

Q: Page 10917 line 1: "...increased by 30% as a result": increased compared to what?

A: Change this line to "Modeling studies have suggested that total soot absorption is increased by ˜30% as a result of the aforementioned aggregation compared to singular primary spherules (Fuller et al., 1999)."

Q: Page 10919 line 16: a particle number over 10ˆ4 cm-3: what is the lower cut-off diameter?

A: The lower cut-off diameter of the CPC is 12 to15 nm.

Q: Page 10919 line 20: "humidity below 40%": this is the campaign average, but how did the humidity vary from day to day? Was the sampled air brought at a standard RH for the scattering measurements? If not, how would this affect the results?

A: Humidity did not vary much from day to day. The sampled air was drawn from the roof of the IAP building into a heated room with a pretty constant and low RH. Variability in scattering due to changes in RH should therefore be small.

Q: Page 10920 lines 3-21: I feel this belongs rather to the introduction section. (Line 15: Filter should be filters).

A: Suggestion accepted.

Q: Page 10920 line 7: "..might have been enhanced..": compared to what?

A: Change line to "In many households, furnaces are partially choked on purpose to moderate temperature and prolong burning time (personal experience); this inefficient way of burning coal might elevate the amount of brown carbon generated compared to efficient and complete combustion."

Q: Page 10921 line 17: "attenuation" needs a definition.

A: Add line "Attenuation (ATN) here is defined as 100*Ln(Io/I), where Io and I are light intensities through portions of the filter that are clear of and laden with aerosols, respectively."



**ACPD**

8, S5965–S5968, 2008

Interactive Comment

Q: Page 10921 line 24: I presume the origin of this equation is explained in more detail in Yang (2007), so rather provide this reference already at this point.

A: Suggestion accepted.

Q: Page 10922 line 11: suggest "We can remove much of the apparent variability"

A: Suggestion accepted.

Q: Page 10925 line 4: what is the motivation for using an effective density of 2 g cm-3?

A: While clay minerals usually have densities from 2.2 to 2.8 g cm-3, they are generally plate-shaped, and hence can have a large shape factor. An effective density of 2.0 g cm-3 is an approximate that aims to take shape into account.

Q: Section 3.2 may be structured a bit more, e.g. by making sub-sections for each of the end-member air masses, and referring to figure 5 when appropriate; as would be the case on page 10929 line 18-19. Apparently biomass burning air masses are not discussed? Lines 3 to 5 of page 10930 would fit better immediately before "The fine absorption and scattering fractions" (line 1).

A: Making references to Figure 5 when appropriate is a great suggestion. This section was originally structured into sub-sections; but that format was abandoned due to the shortness of each sub-section. Add "Compared to the respective project averages, biomass burning aerosols had similar wavelength-dependences in absorption and scattering; slightly lower FAF and FSF values suggest somewhat more large particles. The short durations and weak signals of this air mass limit our confidence in the interpretation of its optical properties."

Q: Page 10930 line 12-13: does this really indicate coarse particles, or could it also be more accumulation mode particles?

A: There could be more accumulation mode particles also, but only particles large enough to be in the geometric scattering regime can lower the scattering Ångstrom



**ACPD**

8, S5965–S5968, 2008

exponent.

Q: Page 10930 line 15: what is meant with the typical atmosphere?

A: Change line to "The background air, which was identified by low scattering, closely resembled the average atmosphere in Xianghe in terms of the single scatter albedo."

Q: Page 10930 line 24: suggest: "a likelihood reinforced by the relatively strong wavelength-dependence"

A: Change line to "This implies that total light absorption cannot be explained by soot carbon alone, a suggestion supported by the relatively strong wavelength-dependence."

Q: Page 10932 line 16: encapsulation may indeed be a possible explanation, but also the fact that the BC absorption Ångstrom exponent is not exactly one. How sensitive are the resulting MAEs on this assumption? A small sensitivity analysis would be welcome.

A: The discrepancy between our EC MAE and that recommended by Bond and Bergstrom can be accounted for if we had used an absorption Ångstrom of ˜0.6 for the BC absorption extrapolation. However, as shown in Figure 5, the ambient absorption Ångstrom rarely got below 1 during EAST-AIRE. Even fresh chimney plumes, which we think resembled soot carbon the closest, had an Ångstrom of ˜1.2. In fact, we tried the BC absorption extrapolation using an Ångstrom of 1.2, which led to an increase in EC MAE of ˜10% at 550 nm compared to the results we have presented. Overall, we think an absorption Ångstrom of unity is the most consistent with the Rayleigh scattering theory, and varying the Ångstrom exponent by ś0.2 (a reasonable range) in the extrapolation doesn't affect the outcome and our conclusion very much.

---

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



**ACPD**

8, S5965–S5968, 2008

Interactive Comment