

## ***Interactive comment on* “Estimation of the mass absorption cross section of the organic carbon component of aerosols in the Mexico City Metropolitan Area (MCMA)” by J. C. Barnard et al.**

**J. C. Barnard et al.**

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We thank Dr. Subramanian for his comments.

Some recent work has shown that filter-based absorption measurements of BC (like the PSAP) are affected by organic matter. For instance, the work by Chris Cappa comparing the PASS and PSAP (it was recently presented at the ICCPA, and is "in press" at Aero. Sci. & Tech.) shows that PSAP absorption (usually attributed to BC after scattering corrections like Bond et al. 1999) is enhanced by organic matter, so that the measured BC is actually biased high. Since the Aethalometer is basically a similar measurement as the PSAP (light transmission through a fibrous filter), this bias will likely affect the Aethalometer as well.

[My "yellow beads" paper in AS&T suggests this is due to liquid organic matter forming films/beads on the fibers whether PSAP or quartz fiber filters, hence my assertion that Chris's results are applicable - in a broader sense - to the Aethalometer as well.] This affects the results of the current manuscript in two ways: the calculated H (Eq. 2) may be biased low, and the absorption attributed to OC (numerator in Eq. 5) may also be biased low (which might explain the zero/negative MACs?) One possibility is these errors exactly cancel each other, but that seems improbable at first glance. Comment?

[reply] The reviewer is quite right to be concerned about the aethalometer measurements. The reviewer is also correct in stating that the H values may be biased too low, if the BC concentration obtained from the aethalometer are too high. However, aethalometer measurements are in no way involved in the numerator of equation 5 (except for the implicit corrections to tau and SSA for absorbing gases, mentioned in our response to reviewer #2). The assumptions regarding BC that enter into the numerator are: (1) BC is the only absorber at 870 nm, and (2) BC absorption follows the  $1/\lambda$  "law" (used to estimate the BC absorption for wavelengths less than 870 nm). I think these two points are made clear in the text.

Alas, the work by Cappa is not yet published; at least, we could not find it on the Aerosol Sci. & Tech. web page, therefore we could not look at it. Does the reviewer actually mean Lack et al., 2008 (Cappa is the second author on this paper)? The paper by Lack has already been mentioned in our paper:

Lack, D. A., Cappa, C. D., Baynard, T., Massoli, P., Covert, D. S., Sierau, B., Bates, T. S., Quinn, P. K., Lovejoy, E. R., and Ravishankara, A. R.: Bias in filter based aerosol absorption measurements due to organic aerosol loading: evidence from ambient sampling, accepted, Aerosol Sci. Tech., 2008.

The issue of organic matter biasing filter-based measurements has been covered in other papers, a few of which we cite in our paper. We fully acknowledge in our paper that the aethalometer measurements are subject "to considerable uncertainty". For-

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tunately, the lidar depolarization measurements, which find the height of the aerosol mixed layer, provide a "back up"; estimate of the scale height obtained from the aethalometer. As noted in our paper, the medians of the scale heights obtained from the lidar and from the aethalometer differ by about 20%. We have arbitrarily assigned 20% as the uncertainty in the scale height. Given the measurements that are available, that's the best we can do. We don't think that there's much to be gained by trying to correct the aethalometer measurements for filter contamination, particularly because we have no basis for deriving a numerical correction factor.

However, based on the reviewer's comment, we have revised and added some text to expand upon the possible bias of the aethalometer BC measurements, in section 2.3:

"We acknowledge that this method is subject to considerable uncertainties, not the least of which is the aethalometer measurements. These measurements are based on light attenuation, rather than a direct chemical determination of BC mass concentration, and are subject to large uncertainties (for example, see Jeong et al., 2004; Kirchstetter and Novakov, 2007, among others) that could considerably compromise the determination of H. Some of this large uncertainty may stem from filter contamination by OA, as discussed in Lack et al. (2008) and Subramanian et al. (2007). This contamination may artificially enhance absorption that is attributed to BC, which in turn would result in BC concentrations that are too large, and therefore tend to make our inferences of H too small."

Then we launch into a discussion about the lidar measurements.

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