Authors' reply to Darrel Baumgardner's review

We thank Darrel Baumgardner for his helpful comments and suggestions and respond to his comments point by point:

1. Comment on instrument precision: "There are no major obstacles for proceeding to AMT except, of course, the one that John Ogren has already raised, i.e. including in the tables and figures an indication of the expected uncertainties in both the Neph+PSAP results and those from the new instrument. The correlation plots are difficult to evaluate without knowing a priori how much scatter would be expected."

Reply: Expected uncertainties were determined for baseline fluctuations by using particle-free air (see Fig. 8) and for instrument precision by using laboratory ambient air. This set-up needs better explanation in the text which has been added in the revised manuscript. Bars indicating the uncertainties (1 σ) values of the averages are already shown in Fig. 7a but they are too small to be clearly visible. We have revised Fig. 7a to make this clearer.

2. Comment on fast response time: The time response of the CAPS PMex instrument has been published previously. Please see Massoli et al. (2010) for details.

3. Request for adding a curve for the ratio between the two methods to Fig. 6: We will include this suggestion in the revision of the manuscript.

4. Comment on precision determination: "Why was the precision of the new instrument estimated only from ambient measurements? How did the two new instruments perform under the laboratory conditions.?"

Reply: The instrument precision was determined for laboratory ambient air which was relatively well temperature controlled and reasonably dry because of the air conditioning of the laboratory, thus minimizing any potential external factors that may influence either one or the other instrument independently. This qualifier has been added to the revised manuscript.

5. Comment on the comparison of average results: "The comparison of average results from the new instrument is quite interesting and show, on average, very good comparison with the NEPH+PSAP. ... Is the overestimation by the new instrument a bias in this instrument or a failure in the other instruments due to uncorrected biases? In Fig. 7b, where are those outlier points coming from?"

Reply: Revisiting Table 3 and Fig. 7a demonstrates that the deviation between NEPH+PSAP and CAPS PMex is randomly distributed instead of being correlation to the absolute value of σ_{ep}. For example, for high extinction levels of 300 Mm^{-1} for absorbing aerosol, the ratio of CAPS PMex to NEPH+PSAP is 0.94, for mixed aerosol, this ratio is 1.0 and for pure AS it is 1.06. Respective numbers for an extinction level of approx. 100 Mm^{-1} are 0.99 (BC), 0.97 (MIX), and 1.14 (AS). In total there is no clear link between the extinction level and the ratio of CAPS PMex to NEPH+PSAP. We have included a discussion of the lack of link between the measured σ_{ep} ratios and σ_{ep} in the revised manuscript.

The outlier points in Figure 7b are significant fluctuations in the extinction levels averaging 1-2 seconds in duration (near time resolution of monitor) in one or the other CAPS PMex instrument (not simultaneous) that are likely due to the stochastic nature of sampling large particles. These fluctuations occur with similar frequencies in both instruments; hence the outliers occur above and below the 1:1 line.

References

Massoli, P., Kebabian, P. L., Onasch, T. B., Hills, F. B., and Freedman, A.: Aerosol Light Extinction Measurements by Cavity Attenuated Phase Shift (CAPS) Spectroscopy: Laboratory Validation and Field Deployment of a Compact Aerosol Particle Extinction Monitor, Aerosol Sci. Technol., 44, 428-435, doi: 10.1080/02786821003716599, 2010.