Authors' Reply to John Ogren's comment

We thank John Ogren for his useful request for clarification and respond to his comments point by point:

1. Pathlength adjustment

John's comment: "If the user multiplies the extinction coefficient reported by the instrument by a factor of 1.05, as recommended by the authors, what is the resulting uncertainty of the measured extinction coefficient? The regressions based on the PSL tests can be interpreted as an assessment of the uncertainty of the CAPS PMex, and it would be very helpful to users of the instrument if the authors include this assessment in the paper."

Reply: The factor of 1.05 arises from a pathlength adjustment as explained in the manuscript. The pathlength adjustment was conducted for a single instrument. However, side-by-side run data as shown in Fig. 7b provide evidence that the pathlength correction is similar for all instruments. Note, that the slope of the regression line for two instruments run side-by-side is unity. Hence we don't see further sources for uncertainty here and conclude that the pathlength correction factor of 1.05 is robust. Finally, all CAPS PMex instruments are now delivered with the 5% pathlength adjustment already included and users don't have to apply this adjustment again. We have included a clear statement on this issue in the revised manuscript.

2. Suggestion on replacing NEPH-PSAP by NEPH+PSAP

Reply: We have included this suggestion in the revises manuscript.

3. Comment on RH impact: "Finally, the statement that "the small disagreement between CAPS PMex and NEPH+PSAP is a function of neither aerosol SSA nor relative humidity" is based on a very cursory discussion and examination of the data at high RH. Heating from the nephelometer lamp will reduce the sample RH inside the nephelometer substantially below the RH in the CAPS PMex or the PSAP - this heating is typically around 4C. If the nephelometer RH is above 80%, as was observed at the end of Episode 1, then the RH in the CAPS PMex could easily have been over 90%, resulting in a significant increase in the extinction coefficient inside the CAPS PMex. I recommend that the authors conduct a separate evaluation of the CAPS PMex vs. NEPH+PSAP for the high-RH cases, and include an assessment of the differences in sample RH in the three instruments."

Reply:

We have removed the short time period during the thunderstorm passing where the RH > 80% as measured in the NEPH and modified the sentence in question as follows, "Night-time data for RH as recorded by the NEPH RH sensor were approx. 30% while peak RH data were > 80% at the end of Episode 1 before the thunderstorm passage and below 55% during Episode 2. The episode where NEPH measured RH > 80% is not included in the comparative analysis as these high RH conditions may affect the particle sampling due to condensation in the lines and may independently affect the measurements by the two instruments, which had slightly different internal temperatures (~2 K). The analyzed data set consists of NEPH measured RH conditions less than 70%." Having observed the slight disagreement between CAPS PMex and NEPH+PSAP from the scatter plot (Fig. 11 of Petzold et al. (2012)) for the first time, our initial idea was to look for RH effects. We separated the data sets according to RH and investigated the linear correlation between the two methods for different RH

ranges. However, there appeared to be no discernible connection between the slope of the regression line and the RH level. Furthermore, maximum RH values of 70%, as measured inside the NEPH, were observed during Episode 2; however, there is no significant difference in the regression slopes between Episodes 1 and 2 (see Fig. 11 of the discussion paper). The observed temperature difference of approx. 2 K between CAPS PMex and NEPH implies a potential RH difference between the two instruments of ~13%, with the CAPS PMex instrument experiencing a higher maximum RH of ~83%. Assuming ammonium sulfate particles, this RH difference could potentially lead to significant differences between the extinction measurements of the two techniques with the CAPS PMex theoretically measuring higher extinctions, which were not observed. Typical particle compositions measured at the measurements site (i.e., Aerodyne Research, Inc., Billerica, MA), though conducted separately and at different times, indicate that the particles are composed primarily of organics, which will have a significantly reduced hygroscopicity changes under these RH conditions. Finally, the observed differences in measured extinction between the two instruments indicates that the NEPH+PSAP extinctions were, on average, slightly higher than the CAPS PMex extinctions (ref. Figure 12), which is in the opposite direction of any potential impact due to the temperature and RH differences between the two instruments. Based on these various findings we excluded RH effects as potential reasons for the slight disagreement between the two methods. We have added a paragraph on this issue to the revised manuscript.