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Atmospheric Measurement Techniques Discussions

AMTD

8, C5353–C5355, 2016

Interactive Comment

Interactive comment on "Aerosol effective density measurement using scanning mobility particle sizer and quartz crystal microbalance with the estimation of involved uncertainty" *by* B. Sarangi et al.

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Anonymous Referee #2

Specific comments: The analysis of uncertainty components is the most valuable part of the paper. However, this analysis is quite hard to follow, eg the combined uncertainty estimates for the inorganic lab study are not given in Table 3, and seem to only appear in the conclusions. The combined results should first be presented and discussed in Section 3.2.

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Interactive Discussion

Discussion Paper

Response: We thank to reviewer to pointing out the mistakes. As suggested by the reviewer, we have incorporate combined uncertainty of inorganic salts, e.g. AS, SC and AN in Section 3.2. Suggested corrections have been done in Table 3 in the revised version. Also in Conclusion section (Page No. 12917, Line No. 16), by mistake we had written "expanded uncertainty". Now in the revised manuscript, it is change to "combined uncertainty".

The modifications, incorporations are done in red ink as under:

Page No. 12897, Line No. 12-23:

"The uncertainties due to different parameters involved during the measurement of effective density are estimated for laboratory generated aerosol particles (of AS, SC and AN). The combined standard uncertainty for the measurement of effective density (u()) can be expressed as:

u()/= √((u(m)/m)ˆ2+(u(V)/V)ˆ2) (7)

where u()/, u(m)/m and u(V)/V represent the combined relative standard uncertainty in density, mass and volume of the particles, respectively. Using Eq. (7) the combined standard uncertainty in the measurement of effective density of AS, SC and AN was estimated to be 0.24, 0.19 and 0.28 g cm-3. The detail uncertainty budget for the estimation of uncertainty in measurement of _eff of all the inorganic salts species (considered in this study, i.e. AS, SC and AN) is shown in Table 3. The succeeding sections discuss the individual combined relative standard uncertainty for both mass and volume for ammonium sulphate particles as an example."

Page No. 12917, Line No. 16:

"Using this approach, the effective density of laboratory generated ammonium sulphate, sodium chloride and ammonium nitrate particles with combined uncertainty is found to be 1.76±0.24 (±13.6%), 2.08±0.19 (±9.13%) and 1.69 g cm-3±0.28 g cm-3 (±16.6%), respectively."

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Table 3: The values have been corrected, combined uncertainty has been incorporated.

Technical correction

P12892 line 10: “seizer” should be “sizer”.

Response: Done

P12892 line 16: it is not clear what the impactor dimension (“0.0457 cm”) refers to. It would be more useful to state the cut-off size.

Response: We use different nozzle sizes for different sample flow rates in SMPS. For flow rate 0.2 to 0.8 L min-1, 0.0457 cm nozzle size is recommended. We use a flow rate 0.24 L min-1 in our measurements, the cut-off size (D50) of the impactor at this flow rate is 472 nm. Following the comment we have modified the text as:

Page 12892, Line no. 15 $\sim$: SMPS consists of an electrostatic classifier (EC, TSI 3080, including an impactor (0.0457 cm, TSI 1 502 296) and Kr-85 bipolar charger (TSI 3077), differential mobility analyzer (DMA, TSI 3081) and condensation particle counter (CPC, TSI 3788). Different nozzle sizes for different sample flow rates are used in SMPS, e.g. for flow rate 0.2 to 0.8 L min-1, 0.0457 cm nozzle size of the impactor is recommended. We use a sample flow rate 0.48 L min-1 in all the measurements, the cut-off size (D50) of the impactor at this flow rate is 472 nm.

P12924 Table 3: the figure 2.96 in the relative standard uncertainty AN column and u4(m) row appears to be incorrect.

Response: We thank reviewer for pointing out this typo mistake. Following the comment, we have corrected the value. Also we found one more typo mistake just above this column. This correction is also incorporated in the revised manuscript. Please see red ink marks in above Table 3.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 12887, 2015.