

Interactive comment on “Aerosol size distributions during the Atmospheric Tomography (ATom) mission: methods, uncertainties, and data products” by Charles A. Brock et al.

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We thank both referees for their thorough and helpful reviews of this manuscript. We respond to each comment below in brackets.

Reviewer #2

GENERAL COMMENT The manuscript describes with large richness of detail the methods applied for obtaining particle size distributions from the aerosol instrumentation deployed during ATom 1 to 4 on the DC-8, including the uncertainties associated to the parameters and derived data products, such as the aerosol scattering coefficient

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or the aerosol mass concentration. The applied methods and associated uncertainties are described very carefully, whereas in-depth intercomparisons between different instruments and, wherever appropriate, between instrument parameters and data products demonstrate the high data quality of the ATom data set. The manuscript will serve as the reference document for any scientific analysis based on the ATom aerosol data set. It is therefore of high relevance for the scientific community and will set a standard for future research campaigns using instrument combinations. The manuscript fits perfectly into the scope of AMT. It is clearly structured, well organized and very well written. Only technical corrections are required before the manuscript is acceptable for publication in AMT.

[Thank you for your positive comments regarding the manuscript.]

MINOR COMMENTS 1. Page 2, line 6: the authors refer sometimes to “the paper”, sometimes to “the manuscript”. I suggest using “the manuscript” throughout the text.

[Done.]

2. In the abstract, the authors specify the range of particle measurements from 2.7 nm to 4.8 diameter (page 1, line 18), whereas in the instrumentation section they specify the range as from 3 nm to 930 μm diameter (page 2, line 17). These different ranges are caused by instrument specificities, but later in the manuscript the authors never used the range from 4.8 μm and larger. It might be worthwhile to state this in the abstract.

[The text has been modified to ensure that the range of size distributions (2.7 to 4.8 μm dry diameter, and up to 930 μm including the near-ambient cloud probes) is described consistently.]

3. On page 3, line 9, the authors may add “this refractive index range of the atmospheric aerosol”.

[Done.]

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4. On page 4, line 26, there is a typo "located 'aft' of the UH/LARGE inlet." Please correct.

[This is correct usage of the nautical/aeronautical term "aft", meaning "at, near, or toward the stern of a ship or tail of an aircraft."]

5. On page 5, line 5, the authors introduce filter samples collected during the flight which were used for post-flight chemical analyses. Please state the sampling time and the resulting spatial resolution.

[This information has been added to the manuscript. Sampling times varied, but usually ranged from ~4 to ~20 minutes; roughly 2-10 km vertically and 50-250 km horizontally.]

6. On page 6, line 15ff, the authors mention briefly the flow through the CAPS instrument and refer to Spanu et al. (2019) for the flow-induced errors in aerosol. Compared to the detailed discussion of the other instruments' uncertainties, a few more details would be good. In particular, how does the analysis of corrections published by Spanu et al. (2019) compare to the recently published detailed study on the thermodynamic correction of particle concentrations measured by underwing probes on fast-flying aircraft (Weigel et al., 2016)?

[The analyses are different, because Spanu et al. evaluated the effects on the flow caused by both the probe housing and the aircraft wing using CFD, while Weigel et al. focused on the probe only, primarily using thermodynamic calculations. There is currently a discussion on the Spanu et al. manuscript at AMTD regarding the differences between these approaches. However, because the CAPS measurements are only a minor part of the current manuscript, which focuses on the dry size distribution measurements, we wish to avoid a digression into the differences between the two studies. We therefore will keep the original phrasing of the current manuscript unchanged.]

7. On page 11, line 32, there is an erroneous line break inserted.

[Corrected.]

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8. In Fig. 1, neither the track for Atom-4 is shown nor is an explanation given why this is not the case. Please specify.

[At the time of submission the ATom-4 data had not yet been finalized and publicly released. We now include the ATom-4 flight track on Fig. 1.]

9. In Fig. 7, the y-axis title is missing for the left panel.

[Thanks for noticing this error caused by cropping; corrected.]

10. In Fig. 10, the title of the y-axis is too close to the axis labels for both panels.

[Corrected.]

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