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Interactive comment on "Intercomparison of aerosol volume size distributions derived from AERONET ground based remote sensing and LARGE in situ aircraft profiles during the 2011–2014 DRAGON and DISCOVER-AQ experiments" *by* Joel S. Schafer et al.

Anonymous Referee #2

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This manuscript presents an interesting intercomparison of aerosol volume size distributions between AERONET and in-situ aircraft profiles. There is an inherent difficulty when comparing different measurement techniques, but this kind of exercise is necessary for an appropriate assessment of different aerosol measurements and products. The manuscript is clear and well written, but figures quality could be improved (font size, proper labelling of axes and units, etc). It benefits from a considerable amount of aircraft profiles that enhance the significance of the comparison. The manuscript is

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Discussion paper

suitable for AMT and could be accepted after major revisions.

Major comments:

Section 2: The authors should include a more detail description of the in-situ instruments, particularly the UHSAS. This is as important as the AERONET data in this paper and should be describe in detail (including measurement principle, calibration, possible issues with this type of measurement, references of previous intercomparison of UHSAS with other size distribution instruments, etc). Concerning the UHSAS, some major points that should be discussed include:

- How the calibration with ammonium sulphate (AS) might affect the measurements. The authors state that the instrument is calibrated with AS, but the ambient aerosol may have a different refractive index which will affect the retrieve size of the particles. This is a common issue in aerosol optical counters, and the retrieved diameters can be corrected accordingly to the "real" refractive index. This can be a major source of discrepancy depending on the predominant aerosol type and should be taken into account.

See for example Pío, C. A., J. G. Cardoso, M. A. Cerqueira, A. Calvo, T. V. Nunes, C. A. Alves, D. Custódio, S. M. Almeida, and M. Almeida-Silva (2014), Seasonal variability of aerosol concentration and size distribution in Cape Verde using a continuous aerosol optical spectrometer, Front. Environ. Sci., 2, 15, doi:10.3389/fenvs.2014.00015.

- The authors directly talk about volume size distribution but the UHSAS measures number size distribution, so a comment on the conversion from number to volume should be included.

Section 3: The methodology section should include a specific subsection dedicated to the retrieval of the GF from the nephelometer tandem+PSAP data explaining how the GF is retrieved and how it is applied to the measured size distribution from the UHSAS. What is the range of GF retrieved?

Section 4: Ambient relative humidity profiles should be included in the manuscript, stating at least maximum RH encountered in the profiles. This is important to understand the effect of hygroscopic correction, and could be more useful than CWV in Figure 3. How the difference of peak radius and width change as a function of maximum or median RH in the profile?

Minor comments

Page 7, line 3: remove “best quality”, I don’t think this is necessary. . .

Table 1: +/- standard deviation? State it in the table caption. Also, adjust the number of significant figures according to the +/- value.

Page 7, line 10: “. . . is often correlated with higher relative humidity in these regions due to hygroscopic growth. . .” -> This sentence, as it is written, it is not a result from this study since this is not clearly seen in Figure 3. In my opinion, it is really speculative, for the MD campaign, there are only 3 data points in Figure 3 (so it is not possible to infer any kind of trend) and for the Texas campaign it is also difficult to see a clear trend of increasing difference with AOD and CWD. . .

Page 7, line 13: Totally agree with this statement, but this should be the same for the radius. The association is not clear for neither of them.

Table 2: The average difference in peak radius and width for these same cases but without applying the hygroscopic growth correction should be included in the table for comparison. Table 2 is not directly comparable with Table 1 because of the cases included are different.

Figure 5: The discussion is focused in the peak radius and width of the size distribution, but looking at Figure 5 there are cases in which the volume concentrations agree well between in-situ and AERONET and others than do not agree. The authors could comment on that.

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