

## Author comments to Referee #2 (RF2)

### **Response to general comments:**

The authors would like to thank RF2 for his/her thorough review of our manuscript. All his/her comments and suggestions were carefully considered and addressed.

### **Response to specific comments:**

- 1) Page 1, Line 19: This reviewer believes the McFarquhar reference is missing. These references are just examples so should be prefaced with "e.g."  
McFarquhar reference was not missing, but the DOI was missing from the reference. That was fixed. (e.g.) was added to the citation.
- 2) Page 2, Line 20: This reviewer suggests using "focused on" instead of "in" Page 3, Line 8: This reviewer suggests using "non-representative" instead of "unrepresentative"  
Fixed.
- 3) Page 3, Lines 10-14: Text makes it sound like only 2 spirals were flown in TCAP. Which sounds incorrect. Please also explain that HSRL-2 was only deployed in phase 1 of TCAP. It would be nice to mention the in situ aircraft by name (DOE G-1) and perhaps use the corresponding reference (Schmid et al., 2014). Definitely must explain why hygroscopic adjustments were not necessary. Also please quantify the level of agreement instead of just saying "good agreement". It might also be worth mentioning comparisons done in TCAP Phase I between HSRL-2 and another remote sensing method (4STAR, Shinozuka et al., 2013a, b).  
Paragraph was modified accordingly. The level of agreement was not explicitly quantified in the original paper by Muller et al, 2014. The sentence was modified to "Agreement within the uncertainties of the two methods was observed between the HSRL-2 retrievals and the in situ measurements". With respect to the hygroscopic corrections, please refer to item 8 of the authors' comments to RF1.
- 4) Page 4, Line 4: Missing "the" before NASA  
Fixed.
- 5) Page 5: Line 5: micron symbol got lost  
Fixed.
- 6) Page 6, Line 25: Please specify that this is the airborne version of UHSAS mounted in the free airstream. Who good is sizing of UHSAS near 1 micron?  
The section title has been modified to "Airborne in situ measurements". The characterization of the UHSAS instrument is presented in Cai et al (2008).
- 7) Page 8, Line 22: "most" leads me to ask the question "why not all" data are publicly available.

The HSRL-2 microphysical retrievals are still considered a research product under development and therefore have not been uploaded to the public archive. The data are available upon request.

- 8) Page 9, Line 8: The size range of UHSAS is a subset of the size range the Neph and PSAP sees unless a size cut-off of 1 micron was used which is not mentioned. You need the LAS data for the larger sizes. Have you done a cumulative scattering calculation as in Kassianov et al. to see what percentage of scattering the UHSAS is missing?

That's correct. The revised manuscript discusses that. A cumulative scattering calculation was not done but, by suggestion of Referee #1 (see item 33 of his/her review), we added a comparison of AOT calculated from integrating in situ extinction coefficients to those obtained from AERONET at the spiral sites.

- 9) Page 11, Line 25: At this point in the manuscript this reviewer was very surprised to learn that only the fine mode had been considered. Finding this out on page 11 is too late and a bit frustrating.

The authors added a sentence in the introduction to note that the comparison of size parameters was limited to the fine mode.

- 10) Page 12, Line 4: At this point you need to say that the cut-off is likely not sharp at exactly 5 microns. Rather it probably has an S-shape. Some particles larger than the cut-off will still make it through the inlet, whereas some that are smaller than the cut-off won't. So is 5 micron the 50% efficiency point?

At the beginning of Section 4 (In situ instruments) the authors had already mentioned the 50% cutoff efficiency of the P3B inlet at 5  $\mu\text{m}$ .

- 11) Page 12, Line 4: Very late in the manuscript (p.12) to say that supermicron data from LAS were not available for DAQ TX.

We mention that earlier in the revised manuscript.

- 12) Page 12, Line 11. Good to see this improvement!

It was!

- 13) Page 12, Line 14. Unclear. Increase of what?

What increases is the backscatter efficiency, which is the ratio between the backscattering cross section to the particle's geometric cross section.

- 14) Page 20, Line 25. Some strange symbols

Fixed.

- 15) Figure 2: Should use a different symbol than alpha as this is used already for extinction. In 3 beta +2 alpha.

Fixed in Figures 2 and 3.