

Interactive comment on “HSRL-2 aerosol optical measurements and microphysical retrievals vs. airborne in situ measurements during DISCOVER-AQ 2013: an intercomparison study” by Patricia Sawamura et al.

Anonymous Referee #1

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This work is a very important step towards space-borne observations of vertical distribution of aerosol microphysical properties. It evaluates airborne HSRL-derived aerosol number concentration, surface area concentration, volume concentration and effective radius against collocated airborne in-situ measurements during the DISCOVER-AQ campaign in Texas and in California. This work is worthy of publication, after minor revisions:

Page2, Line 16-19: “The (...) retrieval technique compares favorably to column-integrated retrieval (...)”. The reader would benefit from quantitative results here.

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Page2, Line 20: “ (..) limited case of continental pollution outflow (..).” Please add location and season.

Page 4, line 25: consider replacing “equation functional form has been recently been” by “equation (2) was recently called into . . .”

Page 5, Line 16: “both” is repeated

Page 5, line 18: is there any reference for “refractive index of ammonium sulfate aerosol is closer to that of most atmospheric particles”?

Page 5, line 25: the authors might want to add that there were no airborne instruments retrieving refractive index (RI) during DISCOVER AQ (e.g. DASH-SP or PINeph during SEAC4RS) for a direct comparison to their HSRL-2-retrieved RI?

Page 6, Line 4: The connection between the shallow wintertime boundary layer in California and the larger impact of the spherical filter is not straightforward. The authors should explain/ expand more.

Page 6, Line 17 and Figure 2 & 3: Can the red points (i.e. “Mie retr”) be changed to green, as they are retrieved outputs? I also suggests to (i) change the red arrows in black, (ii) change red text in black on figure 3, (iii) delete green arrow and text on fig 3 as this is implied by the red text above, (iv) change $m_{i,j}$ into (mRdry, mldry) and delete i,j , (v) change Q_{dry} and Q_{amb} in green instead of black, (vi) add “ Houston, TX” after “Channel View”

Page 6, Line 17: “good agreement” needs more quantification e.g. within how many percent?

Page 6, Line 24 and 28: “internally mixed” is repeated twice.

Page 7, line 25: “Examples of profile-to-profile”

Page 7, line 28: is it “10-15%” on all parameters?

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Page 7, line 30: “108 coincident profiles (see section 5.1)” instead of “points”

Page 8, line 1: The reader would benefit from a table showing statistics, equivalent to Table 1 or at least add the correlation coefficients on Figure 6. Comparisons regarding number concentration and effective radius also need to be described in the text.

Page 8, line 10: “are expected to be similar” and “<60% RH”

Page 8, line 19: “measured” is repeated twice

Page 8, line 28: please add “vertical integration of ambient extinction coefficient”

Page 8, line 26 to Page 9, line 18: the authors use 6 figures (i.e. figure 8, S1, 9, S2, S3, 11) to explain that the coarse aerosol mode (as well as the presence of aerosols below the aircraft in California) is the cause of the difference between HSRL-2 and insitu scattering and extinction coefficients. The reasoning could be clarified and some figures could be merged together. For example, why not show the HSRL AOD together with AERONET and insitu AOD on Figure 9? The switching back and forth between supplementary and main figures is not obvious as well. Also Figure 10 should be described in much more detail and paired with the description of figure 8.

Figure 9, legend: add “vertical integration”

Figure 11, legend: “scaled to a maximum aerosol layer height of 1 km for CA..” needs more explanation and (B) should also read AERONET/DRAGON

Figure S2, legend: should read “ratio of insitu AOD to AERONET AOD”

Page 9, line 7: “AERONET” should be added after “median”

Page 9, Line 23: The authors need to be cautious: “excellent agreement” is a strong statement and does not apply to the HSRL-derived effective radius for example.

Page 9, line 25: “within roughly 50% of the insitu values”. This does not seem to have been described in the text. Figure 6 needs to show +- 50% lines.

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