

Response to Editor

We thank the editor for their feedback. We have taken care to respond directly to each comment. The text from your comments are shown in black, and our responses are shown in blue. The responses include the manuscript text that was changed, removed, or added.

Thank you for your revisions to the manuscript. The reviewer recommends minor revisions (edging toward major) and points out some issues of clarity that need to be resolved. One primary one is some confusion about AOD calculated from the HSRL in the cases of partial profiles where the in situ aircraft did not reach higher altitudes. Please be very clear in the manuscript how you are integrating the HSRL profiles and ensure that they are consistently calculated in values that are quoted in the text and tables. I would also like for you to remove the section on the Stokes parameters, which reads as a bit of tutorial and is not really discussed again in the manuscript (some of the terms do appear in later equations). You can place the Stokes discussion in the Appendix.

We addressed each of the points in this comment in the below “Detailed Comments” section. We reaffirmed that the ISARA-AOD is calculated with only the available data and is not directly comparable to the total column AOD derived from either the HSRL-2 or the RSP. Additionally, we moved the Stoke’s vector discussion to Appendix A.

There were numerous typographical errors which I detail below. Each of them individually is small but they add up to a significant concern in the readability of the manuscript, especially in the case of missing words in sentences. Please address these carefully, proofread thoroughly, and run a spelling and grammar check prior to submission of a revised manuscript.

After addressing each of the comments, we made sure to carefully proofread this draft. We apologize for the frequency of typos in the previous version.

I find this work to be scientifically very useful and interesting. As I know from my own work, consistency analysis using multiple techniques and platforms is challenging. While the publication process has been long and trying, I think the end result will be a very solid contribution to the field. Thank you for your efforts.

Thank you for all of your effort in this peer revision of this manuscript.

Detailed comments:

1. When effective radius and effective variance are first used in the text, please refer to the appropriate equations in Appendix A.

We added references to Equations B4 and B5 where these terms are first discussed in the text.

2. Line 239. Incomplete sentence.

We completed this sentence as follows: “, and n° is the logarithmic size-resolved aerosol number concentration”.

3. Line 240. “The term (blank) is used per convention to represent... ”

We added the missing term “ n° ”.

4. There is no need to fully describe the Stokes parameters (lines 195-217). This information could be placed in Appendix A or in the Supplemental Material.

As suggested, we moved this information to Appendix A.

5. Line 320 Define lidar ratio and refer to the appropriate equation in the Appendix A.

We updated the text to include both the written out definition of lidar ratio and the reference to Eq. B9. The text has been updated as follows:

Unlike standard elastic backscatter lidars such as Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), the HSRL-2 has the ability to measure total and molecular backscatter separately from which aerosol backscatter and extinction can be derived (Hair et al., 2008). The HSRL-2 measurements can also be used to derive the ratio of aerosol extinction to backscatter coefficients, i.e., the lidar ratio (LR; see Eq. B9), as well as the linear depolarization ratio (LDR; see Eq. B10) (Burton et al., 2016, 2018).

6. Line 335 RRI already defined.

We remove this redundant definition.

7. Lines 338 to 341. I believe the “native” reported resolution of the HSRL is 1s, which is then averaged to 60s. I cannot access the data files to confirm.

The HSRL-2 team has confirmed that the publicly available data are subsampled from the native resolution. No changes needed.

8. Line 348. Do you not mean 225 x 15 m as the size of each bin for which you determine smoke counts?

This is written correctly as is. 60 s is the native horizontal resolution and 225 m is the native vertical resolution. For clarification, we added “(vertical resolution × horizontal resolution)” where this convention is first used.

9. Line 371. I believe the optical diameter (approximately the geometric diameter) is the aerodynamic diameter *divided* by the square root of (the relative density times the inverse of the shape factor). Thus it is less, not greater, than the aerodynamic diameter. This might affect your choice of maximum size bin when you integrate size distributions to compare with the aerodynamically filtered optical measurements.

Thank you for the comment and for the correction. We have removed this text. This cutoff choice was governed significantly based on the success rate of ISARA observed in the internal consistency results.

10. Line 387. Change “dependant” to “dependent”.

We changed “dependant” to “dependent”.

11. Line 402 “AS” should be “As”.

We changed “AS” to “As”.

12. Line 485 change “an” to “and”.

We changed “an” to “and”.

13. Line 505 change to “reported by Nakayama et al.”

We added “as reported by”.

14. Fig. 4. Specify that $f(RH)$ is at 80% RH in the caption or legend. (Figure 9 also.)

We added “550 nm $f(RH)$ at RH = 80%” to Figs. S9 and S14.

15. Line 522. Sentence ends with “using”.

We changed the text to “...using the standard temperature conversion factor provided with the data.”.

16. Line 524. Change to “properties were examined”.
We changed the text to “properties are examined”.
- 90
17. Lines 527-539. You may want to present these as a commented, in-text list rather than as a numbered list to help save space.
We changed the list format to be in-text.
- 95
18. Line 539. Define NRMSD (refer to equation in appendix).
We defined NRMSD and added the reference to Eq. C8. Where applicable, we also added references to associated equations for rest of the terms in this list.
- 100
19. Fig. 5 caption. Change “meats”to “meets”.
We changed “meats”to “meets”.
20. Line 595. Change “synthetic in situ measurements of dry” to “synthetic dry in situ measurements”.
We changed “synthetic in situ measurements of dry” to “synthetic dry in situ measurements”.
- 105
21. The sentence spanning lines 596 to 597 needs a verb.
To address this, we changed “Measurement noise bounded...” to “Measurement noise is bounded...”.
22. Line 617. Change “idyllic” to “ideal”.
We changed “idyllic” to “ideal”.
- 110
23. Line 621. By different “transport paths of aerosol” do you mean spatial and temporal heterogeneity? Or something about plumes? This is a little confusing.
We were referring to the spatial and temporal heterogeneity. To address this, we changed “transport paths” to “spatial and temporal heterogeneity”.
- 115
24. Line 629. Mis-spelling of “closest”.
We corrected the spelling of “closest”.
25. Line 641. “Controlled” ascent or descent? I hope they were controlled!
We removed “controlled” from the text.
- 120
26. Line 643. Change “decent”to “descent” twice.
We changed “decent” to “descent” in three places.
- 125
27. Line 645. It would be helpful to mention the typical ascent or descent rate of the Falcon, and the typical vertical distance covered in a 45-s SMPS scan, to get a sense of the vertical resolution of the in situ measurements.
We replaced “airspeed to 180 m s^{-1} ” with “rate of altitude change to $\sim 150 \text{ m min}^{-1}$ ” in both places of the text and added “The SMPS scans typically cover 112–113 m in a 45 second scan.” to the end of this paragraph.

- 130 28. Line 649. I'm not sure how you average the ISARA values to the 225 m HSRL bins. Assuming an ascent or descent rate of 300 meters per minute (1000 feet per minute), each 45-s SMPS-based ISARA bin should be about 225 m, so you won't be averaging those to match the HSRL bins. Or do you mean that you average the HSRL data to match the ISARA bins? This might be backwards in the text.
The Falcon measurements are tied directly to time but only indirectly to position through the combination of airspeed and ascent/descent rates. From a time perspective, the 60 second resolution of the HSRL-2 is larger than the SMPS scan of 45 seconds. Additionally, the Falcon's descent rate was closer to 150 m min^{-1} , which further justifies the descision to average to the HSRL-2 profiles.
- 135
29. Line 661. This sentence needs a verb and initial capital letter.
We corrected this sentence as follows: "Additionally, we categorize points where $\text{LDR} > 0.08$ and $\text{LR} > 35$ as a distribution of spheroids, $\text{CRI} = 1.52 + 0.0043i$, and $\kappa = 0.1$ ".
- 140
30. Line 684. Please change "Section B" to "Appendix B".
We changed "Section" to "Appendix".
- 145
31. Lines 685-686. I don't know what "lost" values mean, or how the 97.4% success rate was calculated. Please clarify both.
We did define the success rate metric with Eq. 13. By "lost" we were referring to failed retrievals. We clarified the text as follows: "Out of all possible retrievals, 2.60% failed the κ but had a successful IRI retrieval. This retrieval success rate (see Eq. 13) is 97.40%, which is close to the 95.84% success rate observed in the ACTIVATE retrieval of κ ".
- 150
32. Line 722. Capitalize "size". This sentence is nonsensical.
We removed this sentence.
33. Line 765. When comparing the HSRL-2-integrated AOD with the ISARA derived values, are you integrating the HSRL-2 over the altitude range of the profile shown in Table 3? This is not stated anywhere in the text where I can find it, and would logically go in this paragraph.
We would like to note that we do not aim to represent the ISARA-derived AOD as a total column AOD. We made effort to clarify this in Sect. 4.5, which has text that states "Note that for ISARA-derived AOD, the ambient extinction is vertically integrated with sample altitude and does not account for the altitude bins above or below the sample altitudes. This allows us to estimate the amount of the total aerosol column that was sampled by the Falcon.". For further clarity we changed the second sentence to "This allows us to estimate the amount of the total aerosol column that was sampled by the Falcon and compare that to the standard column AOD products derived from the HSRL-2 and the RSP" after "...Falcon".
- 155
- 160
34. Line 784. You may want to mention that this was the deepest profile conducted by the Falcon with viable data for comparison with the HSRL-2.
To capture this information, we removed the last sentence and put in another point for this list. The text added is "this profile extends more than 4 km, which is the largest extent of any profile by 2 km over the next largest profile".
- 165
35. Line 790. Remove the hyphen between "vertically-sample".
We removed the hyphen.
- 170

36. Fig. 13, panel I, x-axis needs units.
We added units to the x-axis of panel (i) on Figs. S18 and S5.
- 175
37. Line 863. “are considered to be in good to moderate agreement this profile, which depends on the property” needs to be more understandable.
We changed this sentence to be “The ISARA- and RSP-derived fine properties are within $2 s_{\text{weight}}$ of their respective uncertainty estimations for this profile. Fine r_{eff} , IRI, and spectral SSA are all within $1 s_{\text{weight}}$ of their respective uncertainty estimations.”. We also reorganized this paragraph and the subsequent paragraph for clarity.
- 180
38. Line 870. Change to “One possibility is that there are some...”
We changed “One possibility there are some...” to “One possibility is that there are some...”.
- 185
39. Line 874. Sentence is incomplete.
We added the term “ κ ” to complete this sentence.
40. Line 910. Change “art all” to “at all”.
We changed “art all” to “at all”.
- 190
41. Line 942. “Additionally The range is 15—19%, with the lowest observed in the 532 nm wavelength.” Please remove the unneeded capitalization of “The”. Also, it is not clear to which parameter the range of 15-19% refers.
We replaced “The” with “the”. The missing term “NRMSD” was also added.
- 195
42. Line 944. Change “This low bias result is also...” to “Similar low bias results are also...”.
We changed “This low bias result is also...” to “Similar low bias results are also...”.
43. Fig. 15. The figure caption does not describe panels j, k, or l.
We changed the caption as follows:
- 200 Scatterplots of the following altitude-resolved aerosol properties: (a) 355 nm C_{ext} , (b) 532 nm C_{ext} , (c) 1064 nm C_{ext} , (d) 355 nm C_{bsc} , (e) 532 nm C_{bsc} , (f) 1064 nm C_{bsc} , (g) 355 nm LDR, (h) 532 nm LDR, (i) 1064 nm LDR, (j) 355 nm LR, (k) 532 nm LR, (l) N, using 2020–2022 ACTIVATE data. The blue points are data from vertical profiles that contained 3 or more points, the red points are data from all vertical profiles, and the dashed line represents the one-to-one line. The error bars shown indicate the standard deviation of a given aerosol property. The consistency statistics for these data are shown in Table S10 for profiles with 3 or more data points and in Table S3 for data from all profiles.
- 205
44. Line 975. Change “is more” to “are more...”.
We changed “is more...” to “are more...”.
- 210
45. Line 980. Please fix “range is 0.39–0.74 that decreasing with increasing wavelength”.
We replaced “decreasing” with “decreases”.
46. Line 986. Change to, “These results show relative biases that are...”
We replaced “These results have a relative bias that are...” with “These results show relative biases that are...”.
- 215

47. Line 1012. Please change “Section B” to “Appendix B”
We replaced “Section” with “Appendix”.
48. Line 1030. “(i.e.,)”.
220 We changed “(i.e.,)” to “(i.e., $SRB \approx 20\%$)” and put it at the end of the sentence.
49. Lines 1049. “Consistency”
We changed “consistent” to “consistency”.
50. Line 1050 -1050. Please fix “...optical N Schlosser”.
225 Thank you for the comment. We changed “...optical N Schlosser et al. (2022).” to “...optical N (Schlosser et al., 2022).”.
51. Supplemental Materials: Please state that Table S3 is for Case 9.
230 Table S3 is for all data without filtering and not Case 9. We have clarified the caption as follows: “Consistency statistics that result from the comparisons of altitude-resolved spectral C_{ext} , C_{bse} , and LR, as well as N. The consistency statistics shown correspond to the unfiltered data set. The unfiltered data set are shown as gray circles in the scatterplots shown on Fig. S20.”.
52. References: Please ensure that all references comply with the Copernicus guidelines. For example, many of the refer-
235 ences use capitalization for the article titles, which is not consistent with the Copernicus standards. This saves the time for our copy-editing staff and helps speed the production of the manuscript.
We have reviewed the references and corrected the ones that were not consistent with the Copernicus standards. The references appear to be correct now.

240 **Response to Reviewer 4**

We thank the reviewer for their feedback. We have taken care to respond directly to each comment. The text from your comments are shown in black, and our responses are shown in blue. The responses include the manuscript text that was changed, removed, or added.

245 I would like to thank the authors for addressing some of my previous comments. For the new manuscript, there are enough typos that I would advise the authors to proofread more carefully next time (e.g., L980). In terms of content, despite the authors providing more explanation, I still find the manuscript unclear at times. Below are my questions and comments that suggests this manuscript needs at least MINOR revisions (I think it really sits right between MINOR and MAJOR revisions), but I think the authors can address the following relatively quickly.

250 We have carefully addressed each of your general and specific comments to add clarity where it was lacking. We also made sure to carefully proofread this revision. We apologize for the frequency of typos in the previous version.

General comment: I am not clear in the way the authors set up the synthetic consistency analysis. Specifically, in response to Reviewer 3's comment on expanding the variety of synthetic size distributions, the authors gave Figure 5 as an example of a bimodal size distribution that appears unimodal to me. Are there other examples of size distributions that the authors could offer for different layers of the sampled atmosphere?

255 We have replaced the previous example with one that has a more distinct bimodal size distribution. We also added the sentence "There are 473 good fits identified that comprise the final set of fitted size distributions." to Section 4.4. While some of these size distributions of this set do not appear as biomodal, the fitting constraints are still met. We believe that this provides an adequate variety of "real world" size distributions without needing extraneous information such as aerosol species or sample altitude.

Figure 15 shows a clear high bias in remote-sensing retrieved values (e.g., C_{ext}) compared to the ISARA values that the authors did not explain well. Besides the reported statistics, the authors seem convinced that the bias is from under-sampling of coarse-mode particles. Given the high uncertainty in retrieved kappa and refractive index values, I would be more convinced in the bias coming from one of these retrieved values.

265 We would like to point out that we do mention this bias exists in two places in this section:

270 These MRB indicate that the in-situ data is biased low from the HSRL-2, showing that the in-situ instruments retrieve lower values of C_{ext} than the HSRL-2 throughout the ACTIVATE campaign. Similar low bias results are also seen in Sawamura et al. (2017), which are MRB = 31% and 53% for California and Texas, respectively. The SRB for those cases are 5% and 11%, respectively. Compared to that work, we demonstrate marked improvement in our observed C_{ext} consistencies.

and

275 It is observed that there is a systematic underestimation between ISARA- and HSRL-2-derived 355 and 532 nm C_{ext} and C_{bsc} ; however, this is more important at lower signals ($C_{\text{ext}} < 50 \text{ Mm}^{-1}$ and $C_{\text{bsc}} < 1 \text{ Mm}^{-1} \text{sr}^{-1}$). This discrepancy with the remote sensing retrievals is possibly due to difficulties in data coincidence, due to loss of aerosols from the diameter cutoff of the inlet and through the in-situ sampling pathways as discussed in the Introduction and undersampling of the coarse aerosol, due morphologic and composition complexities, or due to limitations of the hygroscopicity parameterizations. Although in-situ values are lower than the HSRL-2 ones, reasonable agreement is evident by the MB ranges.

280 We have also added the hygroscopicity parameterization as a source of error: "This discrepancy with the remote sensing retrievals is possibly due to 1) difficulties in data coincidence, 2) due to loss of aerosols from the diameter cutoff of the inlet and through the in-situ sampling pathways as discussed in the Introduction and undersampling of the coarse aerosol, 3) due morphologic and composition complexities, or 4) due to limitations of the hygroscopicity parameterizations.". Finally, we also mention this information among the list of limitations in the conclusion as well.

I am still unclear on the uncertainty associated with the gamma parameterization. Is there a reported uncertainty somewhere on the manuscript that I may have missed?

290 Because calculating γ is not a straightforward process, there is no generally acceptable way to quantify this error. This error is assumed to be much smaller than the 10% and 2 Mm^{-1} scattering coefficient error and was not relevant in previous similar works that relied on this parameter (e.g., Ziemba et al., 2013; Sawamura et al., 2017).

Specific comments/questions:

295 1. L204: The ACTIVATE “mission” or “field campaign”. The authors’ response of to a similar comment made by Reviewer 3 was not satisfactory. On L110 in the Introduction section, the authors already used the term “ACTIVATE field campaign” as well as “ACTIVATE mission” on L138, so there should be no issue to use something similar on L204. “The ACTIVATE featured...” sentence reads awkwardly, otherwise.
We added “mission”.

300 2. L212: Did you mean S_I (theta) is the angular light intensity and not S_1 (theta)?
Note that this part of the text has moved to Appendix A. We corrected the notation here. S_I is the Stoke’s vector. We changed this sentence to: “where $S_1(\theta)$ is the angular light intensity and $S_2(\theta)$, $S_3(\theta)$, and $S_4(\theta)$ correspond to the proportion of light in various polarization states.”.

305 3. L369: “... 1 um aerodynamic cutoff for scattering coefficient measurements only.” Then delete the next sentence. As the sentence is currently, it reads a little odd.
We added “...for scattering coefficient measurements only.” and removed the subsequent sentence.

310 4. L432: change “an relative accuracy” to “a relative accuracy”.
We changed “an relative accuracy” to “a relative accuracy”.

315 5. L446-447: The following sentence seems vague to me: “As such, the external consistency analysis is most useful from vertical profiles where the in-situ platform samples the column of air above an arbitrary ground location.” Instead of “above an arbitrary ground location,” it would sound better to say “to an approximate altitude of $> 230 \text{ m}$ ” (based on reported spiral altitudes in Table 3).
We changed “above an arbitrary ground location” to “to an altitude of 150-250 m”.

320 6. L456-457: The first sentence (“As discussed above, ... for ACTIVATE 2021-2022.”) summarized the same info from L365-380, so it is redundant and should be removed.
We removed this sentence.

325 7. L490: Replace “measurement” with “value”. You did not technically measure gamma but calculate it from the measured scattering coefficients.
We replaced “measurement” with “value”.

8. Figure 4 caption: for (a) IRI...
We changed “of retrieved” to “for”.

- 330 9. L525: Specify that “...properties are presented in Sect. A at the end of the main manuscript.” Otherwise, it is hard to tell whether this Sect. A is in the SI document or somewhere else. I also think the authors can just remove the list of statistical metrics here since you already put it in Sect. A. You just need to write out the terms before using the acronym in the text.
We changed “Section” to “Appendix” for clarity. Additionally, we truncated the page space this list takes up by changing the format to in-text. We do feel this list saves effort in relating the acronyms to their definitions and equations without taking up more space further on in the text and has value.
- 335
10. L553: Remove “if” from “..., if the CAS data are used.” Or it would be best if the authors remove the sentences on L553-554. The authors are repeating what coarse mode aerosol data to use as stated previously on L428-429.
We removed the sentences on L553-554 and added the word “primary” to the proceeding sentence.
- 340
11. L585: Remove “With the ground truth size distributions generated,”
We replaced “With the ground truth size distributions generated, we then...” with “Next, we...”.
- 345 12. Figure 5: The example size distribution is unimodal, so wouldn’t it better to show an example of bimodal size distribution?
We have replaced the previous example with one that has a more distinct bimodal size distribution.
- 350 13. L605: “is” adjusted
We added “is” before adjusted.
- 355 14. Table 4: Is HSRL-2 AOD from the reported HSRL-2 data that accounts for the entire sampled column from 9 km downward looking to the ground? The reported in-situ AODs are from Falcon’s vertical profiles that mostly got up to 1-2 km based on Table 3. This is not an apple-to-apple comparison which Table 4 seems to imply. This goes back to the previous comment #6 from Reviewer 3 for the R2 version of this manuscript. I would suggest the authors to add a footnote or be explicitly clear in the text for Table 4 that there is a difference between the 2 AOD columns. Otherwise, the authors could add a “HSRL-2 equivalent AOD with in-situ profile” (or something to that effect) that only accounts for the sampled altitude performed by the Falcon (e.g., up to 1.47 km for case #9).
We did address this in the text where we stated “Note that for ISARA-AOD, the ISARA-derived ambient extinction is vertically integrated with sample altitude and does not account for the altitude bins above or below the sample altitudes.”.
For added clarity, we have repeated this statement to the caption of Table S7.
- 360
15. L684: Similar to Sect. A, specify that “...B6 and B7 in Sect. B at the end of the main manuscript.”
For clarity, we replaced “Section” with “Appendix” throughout the text.
- 365 16. L710: Extra space between “non-zero” and “measurements”.
We added the missing term “ n^o ” between “non-zero” and “measurements”.
- 370 17. L731: ...there “are” still some cases
We replaced “is” with “are”.

18. L780-793: Mention Fig. 10 somewhere in these 2 paragraphs when you describe Case 7.

We changed “the Falcon spiral began at 14:56 UTC and ended at 15:22 UTC, while the RSP sample time was at 15:19 UTC” to “As illustrated by Fig. S15, the Falcon spiral began at 14:56 UTC and ended at 15:22 UTC, while the RSP sample time was at 15:19 UTC”.

19. L792: change “scene” to “scenario”.

We changed “scene” to “scenario”.

20. Figure 10: Explain what the red and blue lines represent either in the caption or in the legend.

We added “The blue and red lines represent the Falcon and King Air flight paths, respectively.” to Figs. S15 and S1.

21. Figure 13: Panels (i, k, l) need units for the x-axis.

We changed the caption as follows:

Scatterplots of the following altitude-resolved aerosol properties: (a) 355 nm C_{ext} , (b) 532 nm C_{ext} , (c) 1064 nm C_{ext} , (d) 355 nm C_{bsc} , (e) 532 nm C_{bsc} , (f) 1064 nm C_{bsc} , (g) 355 nm LDR, (h) 532 nm LDR, (i) 1064 nm LDR, (j) 355 nm LR, (k) 532 nm LR, (l) N, using 2020–2022 ACTIVATE data. The blue points are data from vertical profiles that contained 3 or more points, the red points are data from all vertical profiles, and the dashed line represents the one-to-one line. The error bars shown indicate the standard deviation of a given aerosol property. The consistency statistics for these data are shown in Table S10 for profiles with 3 or more data points and in Table S3 for data from all profiles.

22. L816-817: “There also appears to be two noticeable nonspherical coarse aerosol layers within the column as evident from the spikes in LDR between 3 and 5 km” – does this refer to the vertical profile of LDR in Fig. 13c? I do not see any spike in LDR values in specified altitude range.

This paragraph was intended for Case 9 and has been moved to the appropriate spot in the text.

23. L819-820: “The lower layer of coarse aerosol have LR $\approx$ 35 sr. The upper layer of coarse aerosol has LR $\approx$ 45 sr, is less depolarizing, and appears to be more absorbing than the lower layer.”.

+ Change “have” to “has”.

We changed “has” to “have” in three places where we’re referring to aerosol in this paragraph.

+ Fig. 12 panels (g) and (h) both show LR but at 2 different wavelengths, so please clarify which wavelength these sentences refer to.

For clarity, this text is referring to Fig. S4.

24. L867-899: “The latter of the two findings is evident from both the profile’s limited vertical extent of 1.02 km and in Table 4, which shows that the ISARA-derived AOD is only 20% of the RSP- and HSRL-2-derived AOD for this profile.” – since the Falcon completed a limited spiral up to 1.02 km only, why not cut off HSRL-2 AOD value from altitude above maximum-sampled altitude by the Falcon? This way the only difference between HSRL-2 AOD and in-situ AOD would be the missing sampled altitude from the ground level to the bottom of the spiral.

As was mentioned in the previous comment, this text is referring to Case 9 and was moved to the appropriated place in the text. Additionally, we are not attempting to show that the ISARA-derived AOD can be made equivalent. It is

useful to know that in Case 7, where the Falcon sampled a large portion of the column, we see good agreement between the AOD derived from the HSRL-2 and ISARA. We have also addressed this in the previous comment related to Table S7.

25. L957-958: “The consistency statistics between HSRL-2- and ISARA-derived ambient LR and LDR are generally worse, relative to C_{ext} and $C_{\text{ext},...}$ ” – did you mean C_{ext} and C_{bsc} ?

We did intend to put C_{bsc} . We changed the repeated “ C_{ext} ” to “ C_{bsc} ”.

26. L981: “These ranges are the highest if any of the comparisons within this data set” – this sentence does not make sense. We replaced “...respectively. These ranges are the highest if any of the comparisons within this data set” with “...respectively, and are larger than the values observed when comparing C_{ext} , C_{bsc} , LR, and N.”.

27. L 986: “Overall, the N comparisons are considered to be closed relatively successfully when...” – do the authors mean “...comparisons are considered to be relatively successful when...”?

We clarified the text as follows: “Overall, the N comparisons are considered to be consistent. These values are comparable to results of Schlosser et al. (2022)’s evaluation of HSRL-2+RSP-derived N using N derived from ISARA.”.

28. Figure 15: Since the presented statistics in Table 7 and the discussion of plotted data in Figure 15 focus on the blue points (data from vertical profiles with 3+ points), I highly suggest the authors to plot the red points on Fig. 15 as greyed out points (gray points with alpha value < 0.5 if plotted with Python). Otherwise, the existing Fig. 15 panels are too busy on the eyes. The authors could also show a version of Fig. 15 with ALL red data points highlighted and the blue points grayed out in the SI document for clarity and to pair with Table S3.

We have changed the color of the red points to gray and gave them a 50% transparency. The text referring to these points has been updated to reflect this change in appearance.

+ For the blue data points, do the outliers (e.g., elevated HSRL-2 532-nm C_{bsc} values in panel (e) correspond to low/high altitude bins? I.e., is there any clear bias in sampling/retrieval when you look at ALL the blue points vs. just Case 7/9 earlier? Expanding on your explanation for the relative difference between HSRL-2 and ISARA values would add value to the manuscript. As it stands, the generalized study section reads more like a list of statistical values.

We had originally colored the points displayed in Fig. S20 by altitude but did not observe any clear altitude dependence. We added the following text to capture this finding: “The biases in C_{ext} and C_{bsc} have no clear altitude dependence.”. Additionally, we have already shown the distinct difference between Case 7 and Case 9 in the previous section. This information would seem redundant here. We discuss with some depth about the variety of limitation that our study has, and we cannot make any more specific statements regarding the reasons these relative differences occur.

29. L1003: Remove “the” before “ISARA”

We removed “the” from before “ISARA”.

30. L1049: extra word “the”

We removed the repeated word “the”.