

## ***Interactive comment on “Demonstration of an off-axis parabolic receiver for near-range retrieval of lidar ozone profiles” by Betsy M. Farris et al.***

**Betsy M. Farris et al.**

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Received and published: 2 December 2018

Both reviewers have provided very helpful insights and we concur with all of the reviewers' suggestions. A complete point-by-point reply is provided below, along with changes to the manuscript where appropriate. The authors graciously thank the reviewers for the time and effort in enhancing the quality of this work.

Anonymous Referee #2 Received and published: 9 October 2018 Review of “Demonstration of an off-axis parabolic receiver for near-range retrieval of lidar ozone profiles” by Farris et al. General Comments: The authors report on significant upgrades to the Langley Mobile Ozone Lidar (LMOL) system, particularly the addition of a new receiver to allow the retrieval of near-surface ozone values down to 0.1 km. Com-

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Discussion paper



parisons with ozonesonde and POM profile measurements validate the near-field lidar measurements during the OWLETS air quality campaign in summer 2017. The paper has spelling and technical errors, but is otherwise generally well written, and the technical description of the upgraded lidar system and ozone profile validation makes this suitable for AMT. I have minor corrections and one figure suggestion to be addressed, after which I recommend publication.

Discussion paper Specific Comments: Abstract: Please quote some statistics that describe the lidar comparisons with the ozonesondes and POM measurements. There is currently no description of the results in the abstract.

Thank you, text was added to include more information in the abstract.

Figures 3 and 4: The lidar appears to have a consistent high bias compared to the ozonesondes from 400-600 m on 2 August. Care to speculate on the causes?

Thank you, we appreciate your comment. We noticed this too but previously avoided speculation. A more rigorous observation study under more stable atmospheric conditions would be needed to really resolve this question. We added an additional plot in Figure 4 showing % difference as a function of height for all flights with propagated uncertainties. For the case with the largest deviation at 500 m, we found using the lidar profile 20 minutes prior to the sonde launch shows a significant improvement in the 500 m region, supporting the theory that spatial variability in slightly different sampling volume is a significant factor. We added some additional text on this in the error discussion section. (Page 9 line 1)

Table 1: What exactly is being compared here (an average over particular altitudes)? I don't find a comparison of the average values to be very helpful and I think Table 1 should be replaced by a figure. A more useful comparison would be to take the profiles from Figure 4 and present profiles of the percentage or mixing ratio differences. The 4.43% mean difference quoted on Page 7 is made up of compensating low and high biases in the profile comparisons.

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In the original table, we are comparing column averaged data to determine if an overall general bias exists between the profile and sonde. While still useful, we agree with the reviewer that additional information regarding height differences is appropriate. We added an additional plot to figure 4, showing % differences as a function of height for each flight, as well as the average of the flight differences. In the table we have added additional absolute difference information, and included some additional text descriptions to better define and clarify the analysis. These changes have been added primarily in the description for Figure 4, and error analysis sections. In addition, the values previously reported are based on a slightly outdated processing routine from 2017 with some known minor issues with the analog to photon counting merge routine. We had time recently to reprocess the data and used this as an opportunity to reevaluate sonde differences, resulting in an update of all profiles and table data. The results are essentially the same as before, but with a small decrease on 0.1-1 km column reported sonde-lidar bias value (now 2.3% instead of prior 4.3%).

Technical Corrections: Page 1, Line 21: “can cause. . .” Corrected

Page 1, Line 22: “the elderly. . .” Corrected

Page 1, Line 23 (and other places, please review): Passive voice, suggest rewriting sentence. Corrected

Page 1, Line 26: “insights into boundary layer and free troposphere dynamics, providing a. . .” Corrected

Page 1, Line 29: “measuring ozone from the ground level to stratospheric altitudes.” Corrected

Page 2, Line 11: Stick with cm, not inches. Corrected

Page 2, Lines 13-14: Suggested rewrite – “. . . LMOL instrument in a small, compact form, and, unlike traditional refractive elements, is able to simultaneously measure green and UV wavelengths more easily.” Please check. Corrected

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Page 2, Line 23: Need a space between “7.6” and “cm.” Corrected

Figures 1 and 2: Why is Figure 2 to the left of Figure 1? Did something get switched around? Reverse or renumber the figures, please. Corrected

Page 3, Lines 5-6: This is not a complete sentence. “Outputs” in this case is a noun—reworded to help clarify. Page 3, Line 23: There seems to be a missing word here. Corrected

Page 3, Line 22: “i.e.” not “ie.” Corrected

Page 4, Line 8: Is the temperature and pressure information obtained from the radiosonde data? Yes, added words to explain. It is also mentioned in the next paragraph.

Page 4, Line 30: “ozonesondes” spelled incorrectly. Corrected (paragraphs rearranged)

Page 5, Lines 12-13: Assuming you mean Aug. 2 here, not Aug. 1. “in the early morning hours of Aug. 2. . .” Corrected

Page 5, Lines 14-15: Write as “. . .OAP capability illustrates that the temporal evolution of ozone can be complex, and more clearly reveals how near-surface ozone layers influence surface ozone levels.” Corrected

Page 7, Line 4: “ozonesonde” spelled incorrectly again here and on Line 15. Please check all instances. Corrected

Page 7, Line 12: Take out the ampersand and replace with “and.” Corrected

Page 8, Line 1: Leblanc does not need to be italicized. Corrected

Page 8, Line 14: Do you mean the biases between the UAV and lidar are of different sign than the ozonesonde/lidar comparisons? Please make this clear. Changed “biased opposite” to “biased opposite in sign” to clarify (Page 9, line 15).

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Page 8, Line 22: “closest in range has the greatest. . .” Corrected

Page 8, Line 34: “with use of a reflective focusing element” (?) Seems that there is a word missing. Corrected

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-178, 2018.

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