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Atmospheric Measurement Techniques Discussions

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

Anonymous Referee #1

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General Comments: The manuscript describes a substantial improvement in the return of the Langley ozone lidar system. The manuscript discusses the improvement of the LMOL data retrieval in the lowest 1km by using an OAP (off axis parabolic) reflector. The article describes the technical make-up and design change to the system to incorporate the OAP then justifies the changes by showing robust results from the OWLETS (southeast VA) campaign. The lidar showed higher ozone on average than ozonesondes, but lower than the insitu measurements provided by a UAV holding a POM.

The low level return is an important improvement in the information gathered by the system. The vertical transport and evolution of ozone in the lowest levels of the atmosphere is most pertinent to the evolution of surface concentrations, which most directly

impact human health, monitoring, and ultimately policy. While the overall evolution of the boundary layer provides important information to the evolution of surface ozone the ability to properly resolve the near-surface layer is imperative for fine scale dynamics which transpire near the ground. This manuscript provides a technically driven discussion on the set-up of the near-field retrieval, and then displays its practicality in an operational environment, demonstrating the usefulness of the improvement. The manuscript itself seems well written, quite technical for those unfamiliar with the intricacies of the lidar design, but otherwise well structured with good flow with only minor science questions/suggestions and a few technical corrections.

Sciences Questions/Suggestions: Page 2 line 24: "(F#=1)" Does this mean the f-number of the OAP is 1? The notation caught me a bit off-guard as f-number hadn't been discussed prior to this.

Page 4 line 5: Where does the background value come from?

Page 4 line 9: How do you know pressure and temperature at altitude? Do you use a rawinsonde?

Page 5, lines 8-15: This section shows the capability of the OAP and ozone lidar well. However, there are a lot of assumptions, so the interpretation should be handled with care. Overall questions and suggestions in this section do not change the conclusion that the new OAP adds incredible value to the lidar, but that additional instrumentation complimenting the lidar can add huge explanatory value to the ozone observed.

line 8: It is not entirely clear on the figure how the boundary layer collapses. Are you referring to a collapsing of ozone to the surface or collapsing in total depth? If the former, is that collapse hidden behind the UAV observations rectangles near the surface and ozone has mixed down from 400m to the surface around 20UTC? From the surface observations at the bottom of the figure, it looks like ozone has increased by 18UTC thus more likely the collapse refers the PBL total depth decreasing, to the drop in ozone concentrations above 500m, and the enhancement in ozone centered

around 400m at the same time. Is that enhancement at 400m due to this collapse or is it possibly due to advection? Did ceilometers capture a PBLH decrease? These questions are beyond the scope of this paper's purpose, but important to recognize.

Figures 4 & Table 1: It was not initially clear that the flights listed in table 1 were the same as those in figure 4. Matching the times and/or titling the profiles in Figure 4 as "Flight #" could help the reader.

Page 7 line 3: Does "all-profile" mean 120m – 1.0 km? Connecting table 1 to figure 4 would help clarify that.

Page 8 line 9: Flight 4 is also closest to dawn, when heterogeneity is typically greatest. That, plus any low level jet could create large spatial differences reflected in differences between sonde and lidar.

Technical concerns: Page 2 line 28: "Sheer Plate". "Shear Plate" seems to be another possible spelling.

Page 3: Figures 1 and 2. Are the figure captions switched under the figures? At the very least, it may be prudent to have "Figure 1" first (on the left) and "Figure 2" (on the right of the page).

Page 3 line 16: Comma necessary after FOV? Also, I assume FOV means field of view, but this hasn't been defined in the text.

Page 3 line 21-23: Strangely worded or missing a word...maybe meant to say "...optimized ˆforˆ the near field..." ?

Page 4 line 11: Unclear if this was meant to be a new paragraph.

Page 5, line 13 – 14: Is that supposed to be Aug 2?

Page 8, line 14: "...larger than the than the..."

Page 8, line 15: "...but could be potentially be..."

Page 8, line 21 - more efficient to eliminate "in another paper" and take "Gronoff et al., 2018" out of parentheses?

Page 8, line 34 - I think there is a word missing: "measurements due use of"

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