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Interactive comment on "University of Kentucky measurements of wind, temperature, pressure and humidity in support of LAPSE-RATE using multi-site fixed-wing and rotorcraft UAS" *by* Sean C. C. Bailey et al.

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Response to Referee Report #2 for
University of Kentucky measurements of wind, temperature, pressure and humidity in support of LAPSE-RATE using multi-site fixed-wing and rotorcraft UAS
submitted to Earth System Science Data

Thank you for taking the time to review and report on our manuscript. We have made

appropriate revisions to our original manuscript submission (which are indicated in the manuscript using blue text) and provide point-by-point responses to individual comments below. For convenience the original referee comments are provided in italics with our responses added below each one:

Specific comments:

1. *Providing pictures of the various UAS used with details of the location of the various sensors would be very useful for the data users*

   We have added photographs of each of the aircraft and the flux tower as Figures 1 and 2 respectively.

2. *I liked Figure 3b and these figures should also be included for the other flight days. In addition, tables with timing of each flight should be provided in my opinion for a data report.*

   We have replaced Figure 2 with a new figure showing the flight cadence for each day.

   Please keep in mind that the dataset being described in this paper comprises 178 files corresponding each flight. This makes providing information about individual flights in a tabulated format inefficient and lengthy.

3. *Figure 3a is not very clear. I think that zooming in the area of the flight operations would make the flightpaths much clearer. Perhaps a 2D, rather than 3D map would also make things clearer.*

   We have split figure 3a into two separate figures to improve clarity and better illustrate flight trajectories as we can zoom in closer to the aircraft locations. Due to overlapping flight trajectories, we feel the 3D plot is a better illustration of the spatial coverage provided by these flights.

4. *Ascent and descent rates of the UAS (in particular the multi-rotor UAS) AND their justification should be provided. Also, were these rates kept constant every time for the multi-rotor UAS?*

   This information has been added to the text (2-3 m/s for the SOLOW and 1 m/s for the S1000). The justification has also been added which was to provide a balance between minimizing vertical resolution and maximizing the number of individual profiles for the SOLOW and maximizing the vertical resolution of a single profile while measuring to a higher altitude for the S1000.

5. *Line 96: how was the optimal mast height determined? Perhaps it was not so 'optimal' given the bias that was found (in section 4, see also later comment)*

   We have revised the text to note that the optimal height was found by increasing the post length until running the the UAS motors at full speed did not result in a change in reading. Note that bias described in Section 4 is due to the sonic anemometer design itself and is dependent on the the flow angle relative to the anemometer. For the intercomparison measurements described in Barbieri et al. (2019), in which the aircraft was hovering at the height of a reference system on a mast (rather than profiling), the measured velocities tracked very well with that of the reference system.

6. *Line 227-230: This needs some clarification: a.Expand on 'acceptance range violations' b.What 'intermittency' of occurrences? I thought that the multirotor UAS ascended and descended in a continuous fashion? c.If data were not removed were they at least flagged in the data files?*

   a. The acceptance range violations are the instances when the cone angle exceeded the $\pm 30^{\circ}$ limitation described in section 2.2. The text has been modified to clarify this point. b. As the horizontal wind magnitude was variable, there would be flights when the net direction vector would be within the acceptance cone when the induced vertical velocity due ascent/descent was imposed on the

   wind vector. Note that, the descent velocity was slower (2 m/s) which resulted in the improved reliability of the results from this flight direction. c. We had not initially flagged the data, but due to the reviewer's comment, we have uploaded a new set of data with the ascents flagged with -9999.9.

7. *Can the temperature and humidity data collected during a descent be used without any correction (due to e.g. slow time response of sensors)? Please provide an example figure in which temperature and humidity are plotted for ascent and descent during one flight*

   Note that this example figure was already provided as Figure 4 for both fixed-wing and rotorcraft and showed no dependence of measured values on ascent or descent for either temperature or humidity for either system. In addition, this figure showed good agreement between the different aircraft. Note that in the revised manuscript, these profiles are Figure 9.

8. *Line 240-244: These biases represent a major weakness in this data set. As a scientist potentially interested in using these data, I am not satisfied by the action taken by the authors that "These biases have been removed in the data files made openly available". Much more detailed information need to be provided about possible causes. Was there no dependency of the bias on the wind speed? Was the same bias present during hovering and ascending flights? How about wind direction? Was the bias equal in u and v component of the wind? Anyhow, at this point, without any additional information, I would be very skeptical about using the data.*

   We agree that these biases are of some concern, which is why they are explicitly mentioned in the text, such that researchers interested in using this data do so with full understanding of their presence. We have added additional context in the text. Note that their removal does result in satisfactory intercomparison between different aircraft (as presented in Figure 9, for example) as well as satisfactory in-

tercomparison with the independent systems of the University of Colorado MURC (presented in the intercomparison study of Barbieri et al.), and ASOS system at Saguache airport (manuscript under preparation). As we intentionally remove them uniformly without adjustment in any way on either a day-to-day or per-flight basis, and their removal results in agreement between multiple types of instruments and platforms, we feel their source is intrinsic sensor bias such that their removal is justified and does not detract from the usefulness of this dataset.

9. *line 245: Mention somewhere what time sunrise was on July 18.*

   Sunrise and sunset times have been added to the description of the area of operations.

10. *Minor typo: remove duplicate 'of' in line 25.*

    Removed.

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