This document provides a response to the comments raised by the two reviewers who have provided interactive comments on manuscript essd-2020-173 ("Measurements from mobile surface vehicles during LAPSE-RATE"). The reviewer comments in included in **black** and author responses are included in **red**.

General comments from the authors: We appreciate the time provided by the two reviewers and the editorial team and have done our best to address the comments provided. Additionally, we have updated references to meet ESSD formatting requirements and include the most up-to-date information. Finally, in review of this manuscript we noticed an error with one of the figures (7d), where for CoMeT-1, vehicle heading had mistakenly been plotted instead of wind direction. Therefore, we have updated that figure, resulting in the removal of the large "spike" at around 140 degrees that was present in the previous version. Direct responses to the reviewer comments are provided below.

Reviewer 1:

Review ESSD-2020-173

LAPSE data nicely organised on Zenodo, easy to access and download files specific to this manuscript.

Thank you for this positive comment. We are also impressed with Zenodo as an archive and will likely use it for publication of future results!

Line 213: "50-foot mast" Reading a tower height in US units here seems a bit strange after description of most measurements on most vehicles in metric units up to this point.

Thank you for pointing this out – we have updated the text to read "15.2 m mast"

Line. 390: "close proximity" Many readers / data users will find the time periods of proximity useful for data intercomparison assessments. As implied by Figure 4 (and perhaps also by Figure 7 but harder to distinguish), vehicle proximity not only of CoMeT-1 to CoMeT-2 but also between NSSL and UNL or among all three could have occurred multiple times per day? I do not see these periods identified in the CoMeT-1 data nor flagged in the NSSL data. User would need to find periods when GPS lat, lon and UTC coincide among two, three or four platforms? These authors will know data quality and utility better than outside reviewers; would an explicit summary of these proximity opportunities represent a useful addition? Eventually, direct intercomparison periods among sUAS and ground-based systems will drive an overall all intercomparison opportunity chart / graphic?

The reviewer is correct that there is no "proximity flag" available in the data that are posted to Zenodo. While we understand the potential usefulness of such a flag, it is also important to understand that these vehicles are not always deployed together and therefore implementing such a flag is not practical from the perspective of the standard processing associated with these systems.

Given that all three vehicle files report GPS position, it should not be too difficult for a user to establish when the vehicles were in "close proximity". At the recommendation of the reviewer (and, to some extent Reviewer #2), we have added a paragraph that offers an overview of direct comparison data from the time periods where the vehicles were close together (< 300 m apart), and added a figure (figure 9) that provides a direct comparison of the measurements during these times.

Funding for three CoMeT vehicles mentioned in acknowledgements but only two vehicles used in the deployment described here?

Thank you for pointing this out – it was a copy and paste error, and the reference to CoMeT-3 has been removed from the acknowledgments.

Table 2 & Table 3: response time for RM Young propeller-vane anemometer shown in units of "m" in both tables. But both of those tables also use 'm' as a length unit, e.g. m/s. Response time of anemometers in 'm' = minutes? E.g. 2.7 minutes for speed, 1.3 minutes for direction? That seems too slow? Check these units? Do not use "m" to designate both length and time?

The response "time" of wind sensors for cup and propeller systems is in fact measured in meters, not seconds. It's not a response time so much as a distance constant. Literally the length of fluid flow required to result in a 1/e response to a change in the observed winds. We have updated the entry into the tables (now tables 1 and 2, in response to comments from reviewer 2) to include the comment "distance constant".

Reviewer 2:

The title of the manuscript is very attractive and this work is also very meaningful. But after reading the entire article, I was still a little disappointed. For articles published in ESSD, the production of data sets and their quality evaluation are the most important. However, the depth of the current version of the article is not enough. The full text looks like a report, with too many lists and simple descriptions, not a research paper. The work is well done, but the organization and presentation of the article is not enough.

Major comments:

1. The observation period (14 and 20 July 2018) of the data is too short. It is difficult to say that this data can have too much contribution to scientific researchers around the world. But the research methods (mobile surface vehicles) are very meaningful.

While we respect the reviewer's opinion, we disagree with this assessment. There are already published and in-progress studies conducted leveraging the LAPSE-RATE data, including the data collected from these vehicles. It is important to remember that these measurements are part of a bigger campaign that featured over 50 UAS platforms, and a variety of other surface-based remote sensors. The papers that have been prepared include a UAS measurement intercomparison study (Barbieri et al., 2019), advancement of UAS capabilities (Islam et al., 2019), a study to evaluate

the ability of UAS to track coherent atmospheric structures (Nolan et al., 2018), in addition to two in-preparation articles evaluating the influence of assimilated UAS observations on prediction of weather in complex terrain (Jensen et al., 2020a and 2020b), and an in-preparation paper evaluating the structure and intensity of cold-air drainage from the Saguache Canyon (Bailey et al., 2020).

2. The observation items of the data are too conventional, basically meteorological data (temperature, wind speed, temperature, etc.), without special data. The article's comparison of these data is also relatively superficial.

We're not sure what the reviewer means by "special data". We believe that temperature, wind speed, humidity and other standard meteorological quantities represent the backbone of much of our understanding of the atmosphere. We do not believe that ESSD is in place only to support the publication of "special" data, but rather that the publication is meant to support the documentation and publication of all datasets related to Earth Science.

Regarding the comparison of the data, we included Figure 7 to provide some information on how the different measurements compare. We realize that this is not an in-depth comparison, though each of these systems undergoes routine calibrations at their home facilities. Additionally, we have added a second figure (figure 9) from time periods where the different vehicles were in close proximity (< 300 m apart), and added some text describing this figure. Note that we believe that the observations we currently have do not support an in-depth intercomparison between these vehicles (that wasn't the point of this field campaign), and that doing that well would require a new campaign (and a lot of data analysis that extends beyond the reaches of an ESSD article).

3. If there is an introduction about the route setting, the structure of the entire equipment, and the cost, it may provide a more valuable reference for related scientists.

We're not sure that we understand this comment. What is meant by the "route setting"? Is this in reference to determining where the vehicles would be positioned on a given date? If so, we believe that this is captured in section 3 (lines 168-205) and the references provided to offer a broader overview of the LAPSE-RATE campaign (de Boer et al., 2020a and 2020b). Regarding the "structure of the entire equipment and the cost", we believe that section 2 and references therein provide adequate descriptions of the systems. While the cost is not specifically included, we don't necessarily believe that this is relevant for documentation of the collected dataset (primary objective of ESSD), and, frankly doesn't seem to be something that needs to be published. Given the rapid change in equipment and instrumentation pricing, along with the massive differences in vehicle costs, there is no clear way to provide a regionally and temporally accurate cost estimate that could be used in any meaningful way by the reader.

4. Data processing and quality control should not be considered as innovations of this article, but the article uses a larger amount of space. What do you want to express?

ESSD articles, in general, are not the place to publish "innovations". Those are more suitably published in either technology-centric journals (e.g. AMT, J. Tech) or scientific journals (ACP, AMS, AGU, Springer journals). The text provided in the current article is meant to provide the reader with background on the processes employed to collect and process this dataset. We believe

that we have done a reasonable job with offering the reader insight into what calculations are performed, what quality control is applied, and what sensors are used. For many of the applied techniques, we provide references the offer details on the earlier innovations supporting the development and collection of this dataset.

5. The biggest problem with mobile observation maybe its representation of time and space. Has the author elaborated this in the manuscript? How the author chooses the route and the sampling time?

It is true that connecting the temporal and spatial variability observed using the mobile observing platforms can pose challenges. The extent to which these challenges need to be overcome are specific to the scientific questions to be answered and the phenomena to be observed. As an example, the spatial and temporal variability in these observations is actually quite useful for trying to evaluate the physical characteristics and drivers of something like a valley drainage flow. We did not dedicate time in the current manuscript on this topic given that this would require an in depth analysis to understand the considerations for answering a given scientific question of interest, which is broadly beyond the scope of an ESSD publication.

With regard to the selected routes and sampling times for the current dataset, the rationales supporting the deployment locations of each platform were described in Section 3 and the cited publications therein. The times selected were meant to align with scientific objectives of the LAPSE-RATE campaign (e.g. detecting early morning drainage flows, capturing the boundary layer evolution, assessing the initiation and development of convection through the morning into the early afternoon).

6. The introduction of observation items and instruments (Table1-3) can be integrated into a table so that everyone can understand the system more directly.

We're not sure that we understand the comment. If we read it directly, the reviewer is requesting that the information provided in table form be put into a table, which doesn't make sense. Possibly the suggestion is to combine these items into a single table, though the current breakdown is meant to offer individual tables for the three different types of mobile systems deployed during LAPSE-RATE. Given that the NSSL MM and UNL CoMeT systems have identical instrumentation, we have combined tables 2 and 3 into a single table 2. Beyond this, we would prefer to keep the MURC table separate from the other two. We apologize if we misunderstood the reviewer's comment.

In summary, I don't think the current version is suitable for publication on ESSD.

Nevertheless, we appreciate the time provided by the reviewer in commenting on this manuscript. We strongly believe that this article is a good fit for ESSD, and would be happy to hear the editorial staff's opinion on whether additional components should be included prior to publication.

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