Anonymous Referee #3

We thank reviewer #3 for constructive comments, we really appreciate their time spent reading our manuscript.

General Comments:

The manuscript by Brus et al. presents a summary of the data registered during the Lower Atmospheric Process Studies at Elevation - a Remotely piloted Aircraft Team Experiment (LAPSE-RATE) by the Finnish Meteorological Institute (FMI) and the Kansas State University (KSU) team. This campaign was conducted in the San Luis Valley of Colorado (USA) during July of 2018. Data collected with small Unmanned Aerial systems (sUAS) and ground-based instrumentation includes aerosol particle number concentrations and size distributions, concentrations of CO2 and water vapor, and meteorological parameters. This review is exclusive of the material included in the manuscript and it is not an analysis of the datasets cited in line 11. This appears to be a straightforward manuscript to read but there are some major concerns in the specific comments below. Once the revision appropriately addresses all comments, the final manuscript should be evaluated again.

Specific Comments:

RC1) 1) Because many other teams participated in the campaign and collected similar parameters, it is recommended to make the title specific to the participating teams in this manuscript (FMI-KSU flight team as mentioned in line 34).

AR1) The title was changed to:" Atmospheric aerosol, gases and meteorological parameters measured during the LAPSE-RATE campaign by Finnish Meteorological Institute and Kansas State University"

RC2) l. 4: Define "FMI" here and remove it from line 35.

AR2) Changed accordingly

RC3) l. 5: Define "KSU" here.

AR3) Changed accordingly

RC4) l.38: Define SLV.

AR4) Defined in Abstract, line 2.

RC5) l. 63 and l. 82: The manuscript should mention the thickness of the polylactide (PLA) foam cover to protect the sensors from solar radiation and display an image. This material is not really protective from the photons of the sun. The statement that ". . . the surface sensor module was covered from all sides with PLA foam to protect sensors from solar radiation . . ." is also questionable as it would be expected that at least a percentage of photons should have made it through the PLA layer.

AR5) The sentences were changed as follows: "… module was covered from all sides except the bottom with a polylactide (PLA) foam cover (2.5 cm thick) to shade the sensors from direct sun and keep the particle module thermally stable."

RC6) l. 64-69 and l. 153-154: From the cited paper by Barbieri et al. can be concluded that if the BME280 sensor was not forcefully aspirated, the measurements are not reliable (and there is a lag). This appears

highly problematic for the work in the manuscript to provide valid data. The pressure, temperature, relative humidity sensors mounted in the second rotorcraft suffers the same problem. In conclusion, the applied compensation to the Vaisala GMP343 sensor for pressure, temperature, relative humidity (obtained from the BME280 sensor) in the postprocessing step for reporting data will only yield invalid data (for example data in Figures 2 and 3, which captions should clearly indicate the sensors used). The information in Table 1 is not valid for the BME280 sensor as mounted and operated in this work.

AR6) In Barbieri et al. 2019 it was discussed that placement of the sensor (shielded/not-shielded, aspirated/not-aspirated) plays dominant role rather than its own accuracy and uncertainty, that was also valid in our case, sensors shielded but not forcefully aspirated. When BME280 sensors were calibrated in environmental chamber – well controlled conditions, against national standard at FMI, their response was very satisfactory, please see FIG 1.

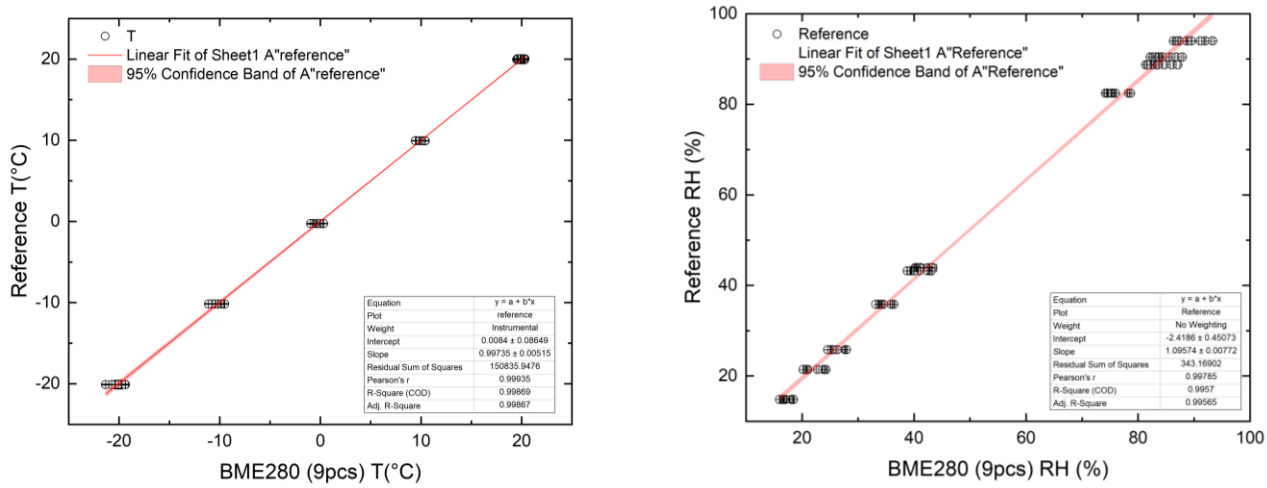

Figure 1. T and RH calibration for 9 pcs of BME280 sensors against FMI national standard.

Yes, we compensated the GMP343 with temperature, RH and pressure obtained from the BME280 sensor that showed a bias of about +2 C in temperature, −12 % in RH and +2 hPa in pressure during the LAPSE-RATE inter-comparison measurements against MURC (Barbieri et al., 2019), we also accounted for that bias in compensation. Even when accounting for the maximum error the resulting change (increase) in CO2 concentration was only 2 ppm.

Table 1 caption was updated to “Table 1. An overview of sensors and their operational characteristics provided by manufacturer….”

RC7) l. 89-90: Details of the custom electronics should be provided here for reproducibility.

AR7) The word “custom” was omitted; it was used inaccurately in this context.

RC8) l. 156: The laboratory calibration for both CO2 sensors needs to be disclosed in this manuscript.

AR8) The following sentence was added to line 174: “The following laboratory-derived calibration constants were applied to the datasets collected by both sensors:
Licor_new=0.95785×Licor_measured+8.66055 with R^2=0.9999 and

GMP_new=0.99878×GMP_compensated+8.77014 with R^2=0.99999. Please note GMP_compensated used in the equation above and that the Vaisala compensation algorithm is confidential."

RC9) l. 20-23: There are a number of relevant publications in this sUAS research that should be included here to diversify the reference list and expand it from the work of the authors. The authors are encouraged to check for other new literature to be covered in this part of the introduction.

AR 9) The references were updated.

RC10) l. 186-187: Similar arguments for reporting only data in the ascent direction have been reported by others but have not been referenced here.

AR10) We reference here to reviewer #2 comment 5) and our answer in there.

RC11) Figure 1 should include in panels A and B a reference line to indicate length.

AR11) Figure 1 was updated accordingly.