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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement report: Properties of aerosol and gases in the vertical profile during the LAPSE-RATE campaign" *by* David Brus et al.

Anonymous Referee #1

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Review of a manuscript titled with "Measurement report: Properties of aerosol and gases in the vertical profile during the LAPSE-RATE campaign" by David Brus, et al. 2020

General comments: This paper demonstrates the unique aerosol and gas measurements via UASs and provides a promising data example for environmental research. The authors presented a very useful payload for the atmospheric study and shared the exciting datasets from July 14 – July 18, 2018. However, analysis of the measurements is limited, and lack of a meaningful uncertainty estimation, which is critical for many data applications, such as the modeling evaluation.

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Specific comments: P3, section 2.1: What is the typical flight operation? “The maximum endurance of these rotorcraft was about 15 minutes.” (in line 61) Does that suggest the measurements with this platform only last for 15 mins? If so, it is too short for any study. Maybe the authors can explain how to operate this platform to provide meaningful vertical datasets?

P4, section 2.2, line 89, is this “basic meteorological sensor” the Arduino Bosh BME280 sensor?

P4, section 2.2, There is no uncertainty or accuracy information about the CPCs and OPC. The BME280 sensor accuracy mentioned in this section (in line 100) are all based on manufacturer statements, and very different from the comparison difference discussed in line 106-107. Does the field environment affect those manufacturer’s accuracy? Were other sensors compared with high precision “siblings” in the laboratory, like CO2 sensors? If so, that information should be included here too. Does the KSU Matrice 600 Pro contain any other met sensors? POPS was not shielded from direct sunlight during the flights. Does that cause any overheating? What is the optical chamber temperature during the flights?

P6, section 3.1.1, the ground meteorological comparison is meaningless because two sites are 15 km apart. Maybe change the Fig 4 (Surface vs. MURC) to diurnal variation plot (time vs. T, RH, P).

P7, section 3.1.2, if I understand the section 2.2 correctly, a duplicate CPC, OPC, and POPS were operated on the ground. Do you compare them with the flying version on the ground?

Figure 8, “POPS and OPC-N2 overlap well over eight size bins” may overstate the comparison. The figure is in log scale, and POPS seemed to be a factor of 2 of the OPC-N2.

P8, section 3.2.1, The BME280 sensor has a +2 C difference comparing to the MURC.

Will this difference constant for the hysteresis temperature profile? Will the observed T and RH data scientifically useful?

P9, section 3.2.2, it is great to see the new particle formation detection capability developed here. It will be beneficial to correct the over-counting behavior of CPC2 before calculating the delta(CPC). Line 266, if the descending rotorcraft would push aerosol particles downwards. Would the ascending flight push aerosol particles upwards? What is the ascending and descending rate of this flight?

Line 273, the site is about 700 m AGL. Will the 1000 AGL Flexpart dispersion model represent the 700 m AGL condition?

P10, section 3.2.3, It sounds that the platform motion has an impact on the POPS data. Please quantify the impactor. Does the author characterize the inlet loss for all the aerosol instruments – CPC, POPS, and OPC? It is critical to know the inlet loss for OPC during the descending and ascending because the concentration is very low – 5 cmˆ-3.

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