

Interactive comment on “Observations of the thermodynamic and kinematic state of the atmospheric boundary layer over the San Luis Valley, CO using remotely piloted aircraft systems during the LAPSE-RATE field campaign” by Elizabeth A. Pillar-Little et al.

Anonymous Referee #3

Received and published: 23 October 2020

summary: The authors describe measurements of the CopterSonde 2 remotely piloted aircraft systems (RPAS) over complex terrain in the San Luis Valley, Colorado. The CopterSonde 2 and the flight strategy is briefly described, the data processing, availability and quality are discussed. The operations focused on convection initiation studies, diurnal transition studies, internal comparison flights and cold air drainage flows. Coordinated flights shall provide insight into the horizontal heterogeneity. The data set, as a part of the LAPSE-RATE campaign is publicly available.

C1

general remarks: The introduction should explain the scientific goals of the LAPSE-RATE field campaign into more detail. Choice of location, previous measurements on the sight, typical and/or seasonal conditions, wind speeds and direction in this complex terrain with regard to synoptic conditions and so on. Further, the applied remote sensing techniques and the other measurement efforts during the campaign should be outlined in the introduction. A global overview of RPAS efforts for ABL studies should be given, rather than highlighting only OU's efforts in the field. The data processing chapter (4) should be moved to the description of the RPAS in Chapter 2 and the Data availability could be mentioned in Flight Strategies (2.2) alongside table 3, for example. The whole section 3 should be strengthened with more plots and details, comparisons to other measurement systems and further evaluations of the described atmospheric thermodynamic and kinematic state.

specific comments: L6 ff: The data from these coordinated flights provides insight into the horizontal heterogeneity of the atmospheric state over complex terrain as well as the expected horizontal footprint of RPAS profiles. What is meant with footprint? Footprint of the RPAS is confusing.

L18: What kind of conventional remote sensing techniques were applied?

L21: What are the scientific objectives?

L24-34: What about similar efforts of other institutions?

Figure 1: Does the manuscript include any data of that tower?

L64: Why is Table 4 in the very end and where are the accuracies coming from? What is meant by indirectly?

L64/L68/L69: Measurements at 10 and 20 Hz should be shown with a spectral analysis. Do the sensor resolve fluctuations that fast? Please provide spectra of an ascend of the copter to further discuss the resolution of the sensors.

L103-118: Is this section needed?

C2

Figure 3 and Figure 4 should be next to each other

L137-143: Vague explanations. Please provide further details of how, where and when the feature of interest occur and why this implies the location of CI.

Section 3.2: The comparison should include other measurement systems like remote sensing devices, that were on sight. Further, the wind speed is too low in order to compare something. Both systems show unusual wind speed profiles, that do not agree. Maybe not much related to wind speed at all, but to attitude control parameters of the pixhawk autopilot system. Also the wind direction should be shown. Further comparison is needed, otherwise this section is not useful.

Section 3.3: Please provide further information. Time of sunrise and so on. L167 ff: Surface-based vertical mixing, above 300 m relatively steady-state for most of the early growth and entrainment-based heating of the growing ABL are only very briefly derived and need further

Figure 6 and Figure 7: It would be helpful to mark the features in the graphs and provide further data and graphs of the phenomena under discussion.

Section 3.4: Please provide further data and plots. What about wind speed and direction during this period?

L208: averaging intervals and time constants are fundamental. Why is it 1 s? Please provide further details and analysis.

L210: subjectively omitted? By hand? Algorithms should detect outliers systematically.

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2020-194>, 2020.