

Atmos. Meas. Tech. Discuss., author comment AC2  
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## Reply on RC1 (General Comments)

Matthias Zeeman

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Author comment on "Use of thermal signal for the investigation of near-surface turbulence" by Matthias Zeeman, Atmos. Meas. Tech. Discuss.,  
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### General Comments

*The author presents a measurement technique which combines a thermal imaging instrument and distributed temperature sensing system in order to monitor spatial and temporal fluctuations of the temperature. Those measurements are supplemented by point observations of the temporal wind fluctuations, which are used in order to provide a more thorough insight of the local ambient conditions. The article is in general well written and the measuring techniques and the data analysis are presented in detail.*

*However, I think that the results presented in the submitted manuscript are lacking an assessment of how accurate and precise the estimation of the measured temperature fluctuations are. This is discussed briefly in the text and a qualitative comparison could be performed visually from the results in Figure 3. However, it will contribute to the assessment of the measuring capability of this setup if a direct comparison with the reference sensors is performed.*

**Response:** Assessments of measuring capabilities were the subject of earlier studies and I chose not to repeat those here to avoid redundancy. As the reviewer points out, the reader may be inclined to use Figure 3 for a qualitative comparison of temperature observations, but the presented detail is not well-suited for a performance assessment. I agree that the addition of a comparison between the temperature methods would be helpful. I further suggest to add text to the interpretation of the Allan variance results (Figure A7), which had not been included in previous studies and reveals insights for possible improvement of the calibration of DTS data.

*Moreover, I think that it is not explained clearly the reason for selecting the specific shape and size for the experimental setup. This information is going to be useful for understanding and interpreting the results of this study.*

**Response:** Thank you for the suggestion. In a nutshell, the design was intended to support studies on coherent temperature structures, advection processes and conditional sampling methodology. Both as empirical research and in combination with fluid dynamics models. Placement of the wind sensors at the corners and at the center was used for the determination of a representative wind vector at the walls of the box. It was thought that placing tripods at the center of a wall would result in more uncertainty. The dimensions and shape were primarily limited by the maximum range of the DTS instrument, which

can support up to 1.8 km of optical fibre per channel. The DTS profile height was extended to reach sufficiently above the sonic anemometers at 3 m. In an initial design, the guyed mast would be taller and placed in the center. A compromise had to be made during deployment and the mast was moved to a corner. This also had obvious implications for the field of view of the TIR system.

The setup was not a stand-alone experiment. Other experiments were conceptualized to use the setup, as part of cooperative research during the experimental campaign (ScaleX; <https://scalex.imk-ifu.kit.edu/>; line 70-76). To name a few:

- Adjacent to the setup, a transect of cable temperature observed horizontal and vertical gradients over a distance across the shallow valley, and during a different period in parallel to a transect of sonic anemometers (Mauder and Zeeman 2018);
- The combined DTS setup was included in an area of TIR mapping by UAV (Brenner et al. 2018) with the intend to evaluate an approach similar to the aquatic study mentioned in the specifc comments below (by Dzara et al);
- The setup was located inside a larger valley area observed by a network of multi-Doppler lidar, SODAR/RASS and meteorological stations (Zeeman, Emeis, Obleitner and colleagues);
- Adjacent to the setup, a team observed advection of trace gasses and energy in a similarly oriented 20x20m area (Peng Zhao and colleagues);
- Adjacent to the setup, trace gas and water vapour fluxes were observed by a network of automated chamber systems (e.g., Zhao et al 2018);
- Adjacent to the setup, a team investigated patterns in air pressure perturbations (Manuel Mohr and colleagues)