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Atmospheric Measurement Techniques Discussions

Interactive comment on "Eddies in motion: visualizing boundary-layer turbulence above an open boreal peatland using UAS thermal videos" *by* Pavel Alekseychik et al.

Anonymous Referee #2

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Dear Authors, This study used the aerial thermal imaging to detect the turbulence characteristics near the ground surface. It is compared with the ground-based sonic anemometer measurement in an EC site. Although the time-sequential TIR imaging has already been used for the same purpose, the use of UAS to capture wider area has not been accomplished before and its knowledge is useful. Meanwhile, there are some points to be clarified especially in the data analysis to keep the generality of the discussion.

Comments: L91 Delete ","

L134 Please explain what is the Structural Similarity Index. Also, how are the RMSE

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and SNR defined in this process?

L181 Please explain why the authors selected 150 m in this process.

L182, L185 Please show how sensitive these parameters (14 m and +-3.5 m) for the latter discussion (i.e. the ratio of the length and width of the isolated structures, Figs.11 and 12).

P210 Please describe how large the interrogation area in meters, and also the time increment to derive the velocity in sec.

P212 Please describe the mean height of the roughness elements (vegetations) of the observation area.

P219 How is the flux footprint used in the latter analysis and/or discussion?

L285 Is this FFT analysis applied for the time series of the surface temperature at a certain point in the images, and later it is averaged horizontally? Is there any reason why the two spectra in Fig,7 are different at the low frequency region? Are there -1 power law region (e.g. Drobinski et al. 2004) both in the spectra of EC Ts and UAV Tg?

L308 "The relatively small . . ." It is difficult to understand this sentence just from the corresponding figures (Fig.8a,b).

L318 "Wall effects at the forest edge . . ." This is not certain yet from the snapshots of the temperature anomaly. It should be evaluated, for example, after ensemble or temporal average to extract the effect of the heterogeneous roughness.

Figure 8 Is there any extra process to obtain these velocity vectors after the image correlation calculation? Please describe details about it if there are any (i.e. smoothing, averaging, handling of the error vectors, etc.). Also, please describe how the result of PIV calculation is sensitive to the accuracy of the image registration and/or georeferencing.

L335 “the EC WS was higher . . .” This is interesting since the movement of the surface temperature structures seems to be associated with the convective thermal structures in this observation, which probably move faster than the bottom air whose speed is measured by EC (z=3m, below RSL) if the mean wind profile follow the typical log-law plus MOS function. Please explain why EC WS is faster. Some discussion were seen in Garai et al (2013) and Inagaki et al. (2013).

Figure 9 Are the periods of the lower wavelet power, which are the majority of the entire period, corresponding to the quiescent period as in Fig.8b? Please describe what happens in it.

L365 Probably, the spectral powers at 128m and 10m are selected due to the FOV and the resolution of the observation. Are they representing the entire spectral shapes? Please describe, for example, they are within the energy containing range or the inertial subrange if those wavenumber spectra follow the ordinal spectral shape of turbulence.

L427 “. . . were contemporaneous with . . .” Does this mean that 5-min average is not enough long relative to the time scale of the large coherent structures?

An extra comment. This study is motivated to examine the applicability of the TIR imaging for the surface heat flux measurement as written in the entire of the manuscript. It is also obviously written in the last section. Besides, there is no direct comparison between the ground-based sensible heat flux and the TIR images. Therefore, I recommend to add the data of the sensible heat flux together with that of TIR (e.g. show together with Fig.9,12,13).

References: Drobinski P, Carlotti P, Newsom RK, Banta RM, Foster RC, RedelspergerJ-L (2014) The Structure of the Near-Neutral Atmospheric Surface Layer. J Atmos Sci 61(6), 699–714. Garai A, Pardyjak E, Steeneveld G-J, Kleissl J (2013) Surface Temperature and Surface-Layer Turbulence in a Convective Boundary Layer. Boundary-Layer Meteorol, 148, 51–72. Inagaki A, Kanda M, Onomura S, Kumemura H (2013) Thermal Image Velocimetry. Boundary-Layer Meteorol, 149, 1–18.

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