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Discussions

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Interactive comment on "On surface fluxes at night – the virtual chamber approach" *by* Bruce B. Hicks et al.

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The authors present an interesting approach of using a "virtual chamber" to discuss the influence of the complicated condition of the atmospheric turbulence at night on chamber measurements. This is an important contribution to making chamber measurements more representative, even if some problems are still open like the validation. Furthermore, the design of experiments for virtual chambers must be updated. The three experiments used can only provide a first guess. A discussion in the community would be helpful; perhaps we have better-equipped experiments for further studies. For the validation I propose eddy-covariance measurements with high resolution in time on the basis of a wavelet analysis (Schaller et al. 2019).

The authors highlighted problems like low level jets and breaking gravity waves that affect the turbulent exchange significantly, mainly after midnight. Closed chambers cannot usually measure (or only partly measure) these higher exchange rates. In the discussion I am missing another effect: at night, closed chambers have a longwave net radiation near zero. That means they always have neutral stratification, whereas outside a strong stable stratification exists (Riederer et al. 2014). Please discuss this effect too. In Figure 7b, before midnight such a radiation effect for the closed chamber may be possible. However, the virtual chamber cannot reproduce the radiation effect and I am probably seeing the influence of a strong stable stratification that is very typical before midnight, while after midnight it is often the case that condensation (dew) reduces the degree of stability. Some minor remarks:

Line 33: Recently eddy-covariance is used instead of eddy-correlation.

Line 109: I think sigma w is an important parameter to describe the influence of turbulence on fluxes. Because the basic instrumentation of the three experiments is a Bowen-ratio installation, please make some remarks about the measurements of sigma w.

Line 144: The linear gradient should be the first guess.

Line 145: Please explain the square root in connection with Figure 1 more clearly.

Fig. 4 and 7: Because I am colour-blind, I see nothing (only with scientific background and context am I able to form an impression). Could you please use black and grey instead of red and green?

The paper should be accepted with minor revisions.

References:

Riederer M, Serafimovich A and Foken T (2014) Eddy covariance – chamber flux differences and its dependence on atmospheric conditions. Atmos Meas Techn. 7:1057–1064.

Schaller C, Kittler F, Foken T and Göckede M (2019) Characterisation of short-term extreme methane fluxes related to non-turbulent mixing above an Arctic permafrost ecosystem. Atmos Chem Phys. 19:4041-4059.

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