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Biogeosciences Discussions

Interactive comment on "Role of net radiation on energy balance closure in heterogeneous grasslands" *by* C. Shao et al.

Anonymous Referee #2

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General remarks

This manuscript investigates the influence of net radiation measurements on the energy balance closure. The study is based on data from three grassland eddy-covariance sites where in one experiment the effect of the natural spatial variability was investigated and in another experiment inhomogeneity of the vegetation height was deliberately created by different clipping regimes of the grass within the footprint area. In addition the effect of dome aging of the Q7.1 net radiometers was also analysed. Other net-radiometers used in this study were of type CNR-1 by Kipp and Zonen.

Weaknesses of this study are

- the use of Q7.1 instruments, which are known to be low quality sensors, and not suited

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for high-precision measurements and energy-balance closure studies, but apparently they are still in use at some long-term flux measurement sites, therefore there is some justification for this analysis

- the influence of radiation sensor uncertainty on energy balance closure has already been investigated in a much more comprehensive study by Kohsiek et al., where a wide selection of instruments was deployed and a number of high-quality radiation sensors (secondary-standard) were available

- based on the experience from previous studies on energy balance closure and from fundamental considerations, it is clear from the beginning that the uncertainty of net radiation measurements, may it be due to instrumental error or due to spatial variability, is of more or less random nature and will therefore not be able to explain the systematic bias that we are looking for and as it manifests itself in the commonly found lack of energy balance closure (convective heat fluxes generally 10-30% lower than the available energy at the surface).

- Incomplete post-processing of the eddy-covariance data

Strengths/interesting aspects of this study are

- investigation of the impact of spatial variability of net radiation, which may lead to a mis-match in footprints/source areas of radiation measurements and eddy-covariance flux-measurements

Therefore this reviewer suggests major revisions focusing on the interesting aspect, i.e. the spatial variability. This means the overall research question should also be shifted. However, if the authors agree to do so, more and deeper analysis is required. It is necessary to compute flux-footprints of the eddy-covariance measurements and compare them with the source areas of the net radiometers. Particularly, the experiment with different clipping regimes could be yield interesting results. In order to improve the comparison with the eddy-covariance measurements more effort needs to be directed

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into a comprehensive data-post-processing of these flux measurements including all necessary corrections and quality checks.

Minor comments

The use of the English language is gerenally okay but sometimes the wording is not as precise as it should be, e.g. the word “energy” and the word “flux” are sometimes interchanged.

L60: available energy instead of available flux

L66/67: Better: Yet no universally valid theories for

L96: here it is not sufficient to speak of our sites when they are not introduced yet, be more precise and neutral, e.g. measurements for this study were conducted at three test sites in Inner Mongolia.

L99: mobile energy flux measurement system instead of mobile energy system

L123: Better: Spatial variability of Rn with the EC flux footprint instead of within the EC flux towers

In general, it would be helpful to show schematic maps of the set-ups of the experiments 1 and 2

L157: dominant instead of dominate

L205: The double rotation method and the Webb-Pearman-Leuning expression are two completely different processing steps. More details about the post-processing is required, e.g. correction of spectral losses etc.

L231: turbulent flux instruments instead of turbulent energy instruments

L232: periods instead of period

L304: could be reduced instead of could be neglected

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L312: too small instead of smaller

L318: Please differentiate between random measurement errors and the systematic underestimation of the convective energy fluxes

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Interactive comment on Biogeosciences Discuss., 8, 2001, 2011.