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Interactive comment on "How representative are FLUXNET measurements of surface fluxes during temperature extremes?" *by* Sophie V. J. van der Horst et al.

Anonymous Referee #2

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The manuscript by van der Horst et al. addresses the availability of eddy covariance (EC) flux measurements under extreme temperature conditions, whereby 'extreme' is defined relative to each site. The analysis in this manuscript is, in my opinion, very well conducted and the results are described and presented in a very concise and clear manner. Potential caveats and misinterpretation of the results are well explained. This study will certainly be of interest to both the eddy covariance and land surface model community, and it will be very helpful for researchers selecting sites that experience temperature extremes.

I do not have major criticism concerning the overall approach of this study, but some

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(mostly minor) suggestions on how the results are presented and discussed:

Second paragraph of the introduction section: I agree that land surface models need a better representation of physiological processes under extreme conditions, but I do not think that eddy covariance data are the key to provide these formulations. In this paragraph it reads a bit as if the authors try to suggest that with the right selection, EC data could be used to parameterize photosynthesis/respiration response curves in land surface model, which would be a huge stretch. EC data provide information on a big-leaf photosynthesis (provided that flux partitioning is correct), which cannot be directly used to parameterize LSMs which require information at leaf level. In addition, I am not sure how well NEE partitioning algorithms are tested/evaluated in extreme conditions. That being said, EC data are of course not useless for land surface modelers, but will be most useful (at least for physiology) in model evaluation/benchmarking, in which emergent canopy-level model results can be directly compared to EC data. The use of these data is mentioned at several points in the manuscript, and I would simply suggest some rewording here to not give the reader a wrong impression of what this study could be used for.

Figure 1: as the authors explain in the results section, the sudden increase in the availability of flux measurements relative to temperature measurements above approx. 40 degrees is mostly caused by a few sites that experience such high temperatures, thus it could be a site selection effect and not a robust pattern. In order to make this clearer in this Figure (and not just in the text), one could present e.g. dashed lines (instead of solid lines), wherever the number of sites/site years is below a certain value, just to give the reader an idea about the robustness of the results at different temperatures.

page 2, l.35: is 'high-frequency' really the right term here?

page 2, l. 40ff: I suggest to list some more relevant studies here. It would be useful to get a better idea of what and how EC measurements taken under extreme conditions

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can be used for.

page 3, l. 7ff: '...whether the availability of direct observations...' would be better here?

page 3, l. 33f: I suggest to move this sentence to the last paragraph of the introduction section.

page 4, l. 10: what exactly do you mean by 'lack enough measurements'?

page 5, l. 10f.: so where do the rainfall amounts in Figure 5 come from? Were they calculated from the same measurements that were used in this analysis? Please describe this in more detail here. Please add 'mean annual' precipitation and temperature to axis labels of Figure 5.

page 5, l. 12ff: For me the absence of any relationship is the most striking aspect of Figure 5, and it would make sense to describe this first.

page 5, l. 29ff: presentation of results is very detailed here and could be shortened for the sake of readability.

page 6, l. 4ff: I think these results are also useful for observation-based studies, not only for modeling, which could be mentioned here or later in the paper.

page 7, l. 4: if there is no 'second', remove the 'first'

page 7, l. 27f.: maybe clarify that the removed data points are gapfilled and hence not used for this analysis, which focuses on measured data only.

page 8, l. 6: delete 'are excluded'

page 8, l. 35ff.: this paragraph belongs mostly to the Results section.

Please do not present new results in the Conclusions (l.30ff.)

Figure 9 caption: 'separately', not 'seperatly'

Table S4: Please add whether the data come from the LaThuile or the FLUXNET2015

dataset.

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