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Comment on hess-2021-549

Anonymous Referee #1

Referee comment on "Evaporation from a large lowland reservoir – observed dynamics and drivers during a warm summer" by Femke A. Jansen et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-549-RC1, 2022

Review of Jansen et al., Evaporation from a large lowland reservoir—Observed dynamics during a warm summer.

This manuscript is well-organized and generally well-written. The topic is of interest to HESSD readers. The gist of the study is to use eddy covariance sensible and latent heat fluxes from two towers located on a large shallow lake in the Netherlands, to determine which underlying variables drive shallow lake evaporation.

The abstract describes the work pretty well. One thing that caught my attention was the assertion that the Penman equation disagrees with the study results. After reading the rest of the paper, I think the authors are saying that the net radiation Rn and the ground heat flux G terms of Penman are extremely difficult to interpret in the context of a shallow lake. Deriving Rn-G directly from global radiation does not account for the heat capacity within the water column.

The experiment is well-designed. The flux footprint analysis is helpful in determining which eddy covariance flux data correspond entirely to lake evaporation and which time periods are contaminated with land fluxes as well. The figures are well-designed. I found Figure 5 (the Venn diagrams) especially informative.

Specific comments.

- Page 6 line 18 says that the data were collected during the summer of 2019 and 2020. Section 3.1 describes the large fraction of time that lake fluxes were unavailable or of limited quality. My impression is that these statistics refer to 30-minute averaging periods. If I understand this correctly, it is not clear how daily, monthly, and yearly data were obtained from these data. How were gaps filled? In particular, how would long periods of time with flux footprints falling outside the lake be handled? While the paper is generally clearly written, more attention is needed to specify the time-scales for the various figures, tables, and in-text statistics. Finally on this point,

- When I read that Penman's equation does not work for these data, I was surprised. I thought the authors were claiming that they physics behind the equation were incorrect. But I think the authors agree with the physics of the Penman equation. They simply cannot determine the available energy with any reasonable certainty for this water body. Do I understand this correctly?
- Maybe this is just a re-wording of the previous comment, but the energy input, heating/cooling of the lake air stability, etc. do determine the fluxes. The temperatures and humidities at various heights and depths adjust according the these principles. The point of the paper is to determine which easily-measured variables give the best access to the fluxes.
- In figure 5 in particular, are the diagrams only for the summer months?
- Page 16 lines 4-6. Typically, if measurements have a restricted range of variability, this results in a smaller R2 value, because random fluctuations are large relative to the observed changes. It looks like the authors are claiming the opposite effect here. Please explain.
- In Figure 5 d, the central intersection has an R2 value smaller than some of the other intersections. How could adding a variable explain LESS variability than simply not including it?
- Throughout the paper I kept wondering why lake water stability was not included. Surely there must be seasonal changes in stability and thus of mixing depth within the lake. Did this have an impact on the data?