Comment on tc-2021-218

Anonymous Referee #2

Referee comment on "Evaporation over a glacial lake in Antarctica" by Elena Shevnina et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-218-RC2, 2021

The paper deals with the evaporation of a glacial lake in Antarctica, based on eddy covariance measurements during a 2-month period of the short polar summer. The proposed perspective is rather classical, i.e. to evaluate various evaporation estimation approaches (bulk aerodynamic, Dalton) by comparing them with observations and ERA5 reanalysis outputs.

First, I would like to congratulate the authors on the absolutely unique database they have managed to obtain. I do a lot of fieldwork myself and can appreciate the monstrous logistical challenges they faced. I think the measurement campaign seems to have been well designed, especially in terms of the positioning of the flux tower relative to the prevailing winds, as well as the concern for measuring water temperature, which is critical to the problem at hand.

While I embarked on the review of this paper with great enthusiasm and excitement, I must say that I was, all in all, quite disappointed. I find that the analysis does not do justice to the quality of the dataset. I feel that there is a major refocusing of the paper that needs to be done, in addition to correcting some aspects of the methodology and improving the analyses. Once these major revisions are accomplished, I believe this paper would be worth considering for publication in The Cryosphere.

My main comments are:

1) The paper needs to be refocused on its main theme (evaporation from a lake in Antarctica) and avoid repetition.

- Introduction: too much emphasis on glacial lakes, but not enough on evaporation itself.

What is known about evaporation from water bodies at very high latitudes?
- ERA5: I understand that ERA5 is not a good tool for estimating lake evaporation in Antarctica (not a huge surprise, let's be honest), but I think it is given too much emphasis in the paper.
- Description of weather conditions during the field campaign. Merge into one section, as they are scattered in various sections.
- Appendix: I do not see the relevance in this paper.

2) Propose complete figures, without repetition and with a good finish.

- Figure 1: To be merged with Figure 4. Detail each color code.
- Figure 2: Not helpful, the compass rose in figure 4c does the job.
- Figure 3: Not useful.
- Figure 4: add a footprint analysis to show that the retained data is contained on the lake.
- Figure 6a: not useful.
- Figure 7: add shaded areas indicating +- standard deviation

In general, there could be more homogeneity in the plots.

3) Data processing

It is not ok to fill in missing data with medians only, a more robust approach is needed (neural networks, marginal distribution sampling, etc.).

4) Bulk transfer approach

What is the impact of strong katabatic winds on lake surface roughness and consequently on C_{DzN}? What justifies the use of a constant value of 0.00181? Consider discussing this with the additionnal analysis I am recommending (see below).

5) Elaborate 1-2 analyses looking at the processes controlling evaporation, to better value the dataset. Two suggestions:

- What is the impact of katabatic winds on evaporation? I understand that this is not your main study goal, but katabatic winds are there and they definitely play a big role,

so they have to be considered!

- What is the relationship between lake stratification and evaporation?

Specific comments:

L37-38: rephrase 'The authors concluded that over 25%..."

L57: I disagree, eddy covariance is a direct measure of turbulent water vapor fluxes.

L64: cite examples.

L105: A climatology is usually accomplished over a 30-year period. Also, how can the average incoming solar radiation be so high? How is it calculated?