

Geosci. Model Dev. Discuss., referee comment RC2  
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## **Comment on gmd-2021-432**

Anonymous Referee #2

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Referee comment on "Modeling subgrid lake energy balance in ORCHIDEE terrestrial scheme using the FLake lake model" by Anthony Bernus and Catherine Ottlé, Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-432-RC2>, 2022

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I have reviewed "Modeling subgrid lake energy balance in ORCHIDEE terrestrial scheme using the FLake lake model". In the manuscript, the authors indicate the importance of including lakes in ESM and also do a first attempt. I think the approach used by the authors is used before (e.g. the VIC model also includes lakes for the same reason), however, the approach is novel as it uses several lake depths ranges to represent the distribution of lakes over the different depths.

The manuscript is well-written, and I have only comments on some clarity points especially I suggest to critically look at the clarity of the figures:

L41 "Regarding the carbon and nitrogen cycles, lakes emissions are poorly constrained but it is recognized that their contribution is significant". --> needs a reference

L80: "and various developments have been done to assess the lakes features and set up the new parameterizations" --> I suggest making this a bit more clear on what these various developments include

L103: "for the following developments" --> what developments do the authors mean here?

L126: "The data are available for some lakes back to the year 1850 (Benson, 2002)." And till when does this dataset run? Is it daily updated?

L128: "Different atmospheric reanalysis are used to force the ORCHIDEE model and assess the model sensitivity to meteorological forcing uncertainties." Do the authors mean in this study or by others. In the case of this study, some more details are required. In case it is by others, I suggest adding a reference.

L161 "This procedure is fully presented in Lurton et al. (2020) and more recently in Harper et al., in preparation" Given that Harper at all presents the procedure again in a yet unpublished paper, I was wondering if anything changed in the procedure. And if so, which version was used in this study?

L168: NWP is only used twice, so for clarification perhaps it can be just fully written here.

L184 "FLake does not model the hypolimnion, the layer under the thermocline which is present or may appear seasonally in stratified lakes and where the water density is the highest with a constant temperature around 4 C" What do the authors mean with constant temperature around 4C? The hypolimnion can be in some cases several degrees deviating from 4 degrees Celcius as a quick search on the internet shows.

L242 "..but given that the use of on a constant value " --> it seems that the word 'on' should be deleted

Figure 2 needs some more clarification on what the different panels show (now only fractions and depths are provided, but I do not see 2 graphs but 8). Moreover, I suggest adding the word median depth to the caption to indicate that the values for depth are median and not mean values.

Paragraph 3.4: do the authors mean with lake tiles the 3 lake depth categories: >5m, 5-25m, and <25m? If so I suggest referring to this in paragraph 3.4 to clarify. (later in the manuscript I see this is indeed the case, but at this point this needs clarification)

L303 "4.1.1 LWST" This abbreviation needs to be written fully

L309 "This sampling is representative of the area lake distribution plotted in Figure 2" It is not so clear how I can see this. Related to this, I was wondering if figure 3 thus compares representative lakes for a certain grid with real lakes? And how is this done? By comparing a real lake with the tile it falls in?

Figure 3 shows on top and to the right two scales, one for the number of lakes and one for

the RMSE. However, it is not clear which scale is for which variable. I can only hope that 0-75 is not for the RMSE, but this is not indicated.

L332: what are "height lakes"? I first thought of mountainous lakes, but Lake Tai is definitely not a mountainous lake.

Figure 5. The excess of especially the scatter plots needs more explanation.

I think the prescribed step described at L395 is more for the methods section.