

Geosci. Model Dev. Discuss., author comment AC2
<https://doi.org/10.5194/gmd-2021-432-AC2>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC2

Anthony Bernus and Catherine Ottlé

Author 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-AC2>, 2022

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.

Response: We would like to thank Reviewer 2 for taking the time to read and thoroughly examine our manuscript. Your thoughtful comments have helped us to improve and strengthen our paper.

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

Response: We added the following reference : Methane emissions from lakes: Dependence of lake characteristics, two regional assessments, and a global estimate, David Bastviken, Jonathan Cole, Michael Pace, Lars Tranvik, 2004.

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

Response: The sentence has been revised

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

Response: sorry for the ambiguous sentence: we were meaning future developments concerning the modeling of the water budget of lakes and the connection to the river routing module. We modified this sentence in the revised manuscript to avoid confusion, into: "This specificity will insure the consistency of our future developments around the modeling of the lake water budgets and the lake-river interactions".

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?

Response: Sorry, the dataset was not presented in sufficient details: the time series are very heterogeneous among the lakes, most of them cover a period of 20 years and some can reach more than 100 years. The database has been updated in 2020 and includes data up to this year. We have modified in the revised version the presentation of the database and especially described how the ice-on/off and duration were defined, in order to better understand the model-observations discrepancies.

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.

Response: Yes, we were meaning this work, sorry for the error in the tense of this sentence. We have corrected it.

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?

Response: no the procedure did not change and is fully presented in Lurton et al.,2020. We have removed Harper's reference, since it is not published yet.

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

Response: done

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.

Response: sorry, the sentence has been modified, the hypolimnion, unlike the thermocline, is quite isolated and presents a temperature close to 4°C in deep temperate lakes, but can be much larger in tropical regions. The sentence has been corrected to be more precise.

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

Response: agree

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.

Response: we have completely redone this figure following also the other reviewers suggestions.

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)

Response: we agree, we have revised this paragraph following your advices.

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

Response: It was a typo, we meant LSWT which is defined at the beginning of the document in line 114.

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?

Response: we wanted to say that the latitudinal/longitudinal distributions of lakes are similar to the lake fractions derived from HydroLAKES database which were also plotted in Messager et al.,'s paper. We revised this sentence in the manuscript. For the comparison simulation/observations, yes you are correct, we compare the real lakes to the simulated tile it falls in the ORCHIDEE grid. We modified the text to make it more clear.

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.

Response: there was an error in the legend, it has been corrected in the new version of the figure.

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

Response: sorry for the mistake, we meant eight lakes instead !

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.

Response: we have moved this part in the methods section following your advices.