

Geosci. Model Dev. Discuss., referee comment RC3  
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## **Comment on gmd-2021-432**

Anonymous Referee #3

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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-RC3>, 2022

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Reviewer's comments on

Modeling subgrid lake energy balance in ORCHIDEE terrestrial scheme  
using the FLake lake model

by Bernus Anthony and Ottlé Catherine

This study presents new prognostic lake parametrizations in the ORCHIDEE surface modelling system within the global IPSL earth system model. Parametrizations of in-lake variables are based on Freshwater Lake (FLake model). Simulated lake water temperatures and ice phenology are compared against global observational data sets. The resolution of the atmospheric forcing, that is derived from various reanalyses, is shown to play important role for the simulated lake surface energy balance. It was found that lakes generally freeze earlier and melt later in the model than according to the observations. Uncertainties in modelling of freezing and melting of lake ice are discussed. Seasonal LWST distribution was found to be realistic in the majority of lakes studied.

The manuscript reports results of extensive modelling and intercomparison work in a systematic way. The results mostly confirm earlier findings reported in literature during the last more than ten years. The authors are well aware of the previous studies related to the implementation of FLake parametrizations into different NWP and climate models and build their system taking this experience into account. An idea of treating lakes of different depth using prescribed separate subgrid tiles is suggested.

The essential things are presented and discussed, valid methods used and the results seem reliable. Use of external data sets is well documented and references given. A problem of the study may be that it covers too much areas, topics, data, models in the global scale and tries to reach conclusions on everything.

Would it be possible to discuss shortly the specifics of lakes in a global land-surface models v.s. high-resolution regional weather models? FLake has been applied in both, quite a lot of reports exist in the literature about the NWP-model side results.

Unfortunately the manuscript leaves a somewhat raw impression. It is not always easy to follow the reasoning of the authors, clarifications would be needed in several places. It would be good for the authors to go carefully through the whole text in order to improve the presentation, correct typos and English language mistakes. Some comments are given below in the specific remarks.

#### Specific remarks

#### Abstract

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l. 13-14 Which one of CRUJRA or ERA5 has smaller RMSE error ("best and worst")? c.f. l. 369-370.

#### 2. Data and modelling framework

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l. 92 Please define PFTs here when using the acronym the first time

l. 97- Could you please comment the use and differences between HydroLakes and Global Lake Data Base (GLDB), which is the native lake depth data base for FLake.

l. 142-243. The last sentence is unclear, please clarify.

l. 180 Please tell how the surface extent is used in FLake within the ORCHIDEE grid.

### 3. ORCHIDEE-FLake coupling developments

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I. 204 typo: parametrized

I. 276 Lake Baikal (i, not the French double i)

I. 282-283 Please clarify the circular shape

I. 288 What exactly means configuration without lakes - what kind of surface was assumed instead of lakes?

I. 291-92 What means 20 years of spin-up? Since 1980?

I. 294 How many characters? Four or perhaps 3-5?

### 4. Results

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I. 321 How did you derive SOF and EOF from the model simulation results? Based on simulated ice thickness, LWST? Please specify.

I. 331 typo eight (not height)

I. 339 mistake: variations ... are

I. 361-362. Please clarify the first sentence. What means correct depth class tile here?

### 5. Discussion and conclusions

I. 493-496 Is this an attempt to evaluate the reanalysis results? Perhaps it would be better to refer to their own considerations instead of suggesting simplified interpretations.

