

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-433

Bertrand Guenet (Referee)

Referee comment on "A framework for ensemble modelling of climate change impacts on lakes worldwide: the ISIMIP Lake Sector" by Malgorzata Golub et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-433-RC2>, 2022

The paper submitted by Golub et al. is a presentation of the lake sector of the ISIMIP initiative. ISIMIP is definitely a key project to structure our community and the work done is absolutely amazing. The lake sector in itself is also very important, in particular because most of the Earth system models don't include lakes despite their importance in the land/atmosphere exchanges of heat, water and greenhouse gases. The paper is well written and clear. It fits well with the scope of the journal. I proposed few modifications to help improving the reading. Two may need a bit of restructuration and all the others are minors.

- First, I found a bit misleading to mix results from ISIMIP2 and the new protocol of ISIMIP3. To improve this, I propose first to change the title of the paper into something like "The ISIMIP Lake Sector: an ensemble modelling of climate change impacts on lakes worldwide. Results from the last simulations and framework for the next step". I also propose to better separate in particular in section 3 what is coming from ISIMIP2 and what will be done in ISIMIP3. Maybe a dedicated section for ISIMIP 3 will help the reader to make the difference between what is done what will be done. Another option could be to split the paper into 2 parts to separate both but I let the decision to the editor.
- You compared model metrics in table 3 (RMSE and R2) but the models can be adjusted on a different number of parameters. As a consequence, the model with more parameters to adjust can better explore the space and at the end have better RMSE or R2 because of an overparameterization. I suggest to used metrics that take the number of adjusted parameters into account such as the BIC.

Minor comments:

P4 line 16-17 "...lakes are among the most anthropogenically altered ecosystems on Earth..." This kind of statement is a bit weird I would prefer to read specific examples such as eutrophication, change in the water regimes etc.

P8 line 14: Maybe worth to better define what is a representative lake.

Section 3.2: In general when the ISIMIP3 protocol is presented it would be nice to have few lines to explain what is the rationale behind the modifications from ISIMIP2 to ISIMIP3.

P10 line 22-23: So at the end you may have situations with more than one lake within a grid cell. In this case how do you manage, do you "merge" the 2 lakes to have a single water body or do you have a more complex description of the sub grid heterogeneity.

Section 3.3: It would be interesting to know what are the criteria to be included in the group of models. For instance, should a model pass a couple of benchmarks before being incorporated? Is it based on the representation of some key mechanisms?

Section 3.5: I am not really a specialist of lake model parametrization so I assume that it was done following state of the art methods.

P24 line 10: Maybe it worth reminding here that all information to download the data are in the code and data availability section.

Table S2 and S3 for some models (GOTM, CLM Mylake there is no answer to the question "Was a spinup scenario used?". I guess that when it is not answered yes it means no but it should be clearly written to avoid confusion.

Fig2: The letters are visible in the plots.