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Interactive comment on "Parametrization of lakes water dynamics in the ISBA-CTRIP land surface system (SURFEX v8.1)" *by* Thibault Guinaldo et al.

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<General Comments>

This manuscript presents the new lake mass balance scheme (MLAKE) in ISBA-CTRIP model. As lake is usually not explicitly treated in the land surface component of global climate models, this work on the description of lake model development and analysis has a potential contribution to Earth system modelling community. I found the model description is well written, while some improvements are needed mainly on the presentation quality before publication. Detailed comments are summarized below.

<Specific Comments>

Abstract: First paragraph

Printer-friendly version

Discussion paper

This paragraph on the research background is too long as a part of the abstract. Please think about shortening this by summarizing an important point.

L44: Lakes are of fundamental importance to ensure

The first paragraph is too long. You can start the second paragraph from this sentence, as importance of lakes is explained from this part, while the previous part discusses about hydrological cycle in climate system.

L50: Where present, lakes play a triple role in the Earth system. . .

Again, you can start a new paragraph here, focusing on the roles of the lake. Probably, you can explain each of the three roles in a separated paragraph, as the explanation of each role contains several sentences. This will largely increase readability. Also, it is very difficult to guess what is “triple roles” only from this sentence. This sentence only contains: 1) energy and water balance in GCM, 2) impact on local climate and hydrology. Based on the following discussion, “3) interaction with biogeochemical cycle” is missing from this sentence.

L52: First, they influence...

In addition to the lake surface impact on atmosphere, the changes in timing and volume of freshwater discharge to oceans might affect both local and global ocean circulations. This is better to be included as the first role of lakes in Earth System.

L57 “Economic lever”

Is it appropriate to use the word “economic” in this context? We may say “ecological lever”. If “economic lever” is more suitable, please explain.

L98: In the recent years, many studies have focused on

Again, I think this paragraph is too long, and you can start a new sentence from here focusing on recent studies on lake representation.

L139: Section 5 shows the

Description of “Section 4” is missing.

L189: Manning equation

Strictly, Manning’s equation is to give friction energy loss. Flow velocity is not directly given only from the Manning’s roughness equation, and it should be “kinematic wave approximation of shallow water equation, with Manning’s roughness equation as friction energy term).

L205: This resolution framework assures the resolution is done

It is not clear what the authors want to mean by the frase “the resolution is done”. Please explain.

L274: The approach used herein to resolve this issue is

How this modification was done? Is this done manually? If so, how long did it take correct the issues in the test domains of this study? Is it feasible to perform similar amount of modifications at a global scale? Please discuss.

L425: which is the second largest lake

You need to add “in terms of surface area”, because the size of lakes are explained in different metrics throughout the manuscript.

L465: Atmospheric forcing

Please explain why two different forcing datasets are used in this study? What is the purpose of using different forcing only for France?

L483: Biases may appear in simulated surface/sub-surface variables

This sentence is confusing, as this is “excuse” to use multiple forcing datasets. It is better to state that “multiple forcing datasets are used in this study” for better understanding of this paragraph.

L513: with an average discharge increased by 0.7 %

Is it reasonable that the average discharge increased? What was the background physics mechanism? Please explain. I guess this could be due to the change in discharge timing, and it changes the discharge at the start and/or end of the simulation period resulting in a slight difference in the total discharge. In this case, the 0.7% increase is negligible and better to state "average discharge is not affected" rather than "0.7% increased".

L525: where the weir width is increased by a factor of five compared to ctrip_mlake_w1.

I wonder whether this simulation setting (500% of the control experiment) is reasonable or not. Given that the "lake outlet width" is observable parameter, there must be a reasonable range for this parameter. I think the sensitivity test should be designed within this "reasonable parameter range".

L620: lake level variations (sigma_s = 1069 m3s−1, sigma_o = 1003 m3s−1).

Is the unit (m3/s) correct? As this sentence mentioned for lake level.

L633: The NIC score has. . .

What is "NCC score"? It once appears in the abstract first, and appears first time here in the maintext without any definition or explanation. Please provide the description of NIC score.

L666: the worlds largest freshwater continental water body

Please explain "largest in terms of what?"

L693: with a net decrease in the peak discharge.

What does "net decrease in the peak discharge"? Usually the term "net" is used for the total summation, but the term is used for "peak (maximum)" here. How can we define "net decrease in the peak"?

L717: Simulations reveal the capability of the non-calibrated CTRIP-MLake

This paragraph mainly discusses the impact of lake internal dynamics caused by wind, rather than discussing the overall limitation of the proposed model. The lake internal dynamic parts is better to be shown as a separate sub-section (i.e. 6.1 lake internal dynamics), as the following discussion points are explicitly shows with sub section title. I also suggest that the most significant difficulty of the internal height variation appears in the comparison between modeled and observed water levels. This point should be discussed explicitly.

In addition, freezing of lake surface could cause significant difference in simulations. Is this represented in the current model? If not, better to explain as one of the major limitations.

L764: Historical Lake Victoria level drops

I think it is better to remove this “sub-section title”, to keep the consistency with other paragraphs.

L865: the lake outlet size

The term “lake outlet size” only appears here. Please use “lake outlet width” to keep consistency.

L871: Finally.

It is a bit strange to see “Finally” after the sentence starting from “Last but not least”.

Figure 3:

Please change the figure caption from French to English.

Figure 4:

It is difficult to know what the authors want to discuss with this figure. Please explain what does this figure want to explain in the caption, for better understanding of the

river/lake map preparation.

Figure 9:

Is it possible to add observed discharge in this figure?

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