

Geosci. Model Dev. Discuss., referee comment RC1  
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## **Comment on gmd-2021-250**

Laura M. V. Soares (Referee)

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Referee comment on "Effects of dimensionality on the performance of hydrodynamic models for stratified lakes and reservoirs" by Mayra Ishikawa et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-250-RC1>, 2021

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### General comments:

The authors applied 1D, 2D, and 3D numerical models running with identical initial and boundary conditions to simulate hydrodynamic processes in a medium-sized drinking water reservoir. The results of the models supported a further understanding of how dimensionality affects model performance and the authors highlighted which dimensions are better suited for representing different hydrodynamic processes.

I think the authors have created a very interesting manuscript, and that the findings presented here have the potential to make a good contribution to the literature. It should be well received by model users and by a broad audience of the Geoscientific Model Development journal. The manuscript is well-structured, includes valuable and useful figures, and is based on relevant and recent literature. The models are well-described, the authors indicated which version was applied, and the results are sufficient to support the interpretations and conclusions. I recommend the acceptance of the work for publication after a number of comments have been addressed. I have few scientific questions/issues about the methodological approach and additional pieces of information that I believe should be included in the manuscript, and a list of purely technical corrections. I have outlined my comments below as either specific comments (relating to the methods/findings) or technical corrections (relating to word choice or content organization).

### Specific comments:

- Introduction Page 2, Lines 49–50: I suggest the authors expand a bit further that the selection of a model's dimension is ultimately defined by the research question and must be bound by justifiable simplifications to balance the variable of interest, the ecosystem, and knowledge, not making the model more complex than the data set can support. This would help the reader understand the recommendations listed by the authors in the conclusions regarding the suitability of 1D, 2D, and 3D models for representing different hydrodynamic variables.
- P 6, L 178: How could the modeled discharge of Passaúna River be calibrated? Is there a discharge gauge station on the Passaúna River? If so, please indicate in Fig. 1.
- P 7, L 213: I am wondering if your approach of manual calibration is somehow biased as the models require quite different efforts to this procedure, for instance, calibration of the 1D model demands much lower effort than for the 3D model. My reasoning is that if an automatic calibration was performed applying the same calibration range and the same number of iterations in each model, the results would be better comparable. Perhaps, a brief discussion should be included about how the manual calibration could affect the results.
- Table 1: Why did the authors adopt different time steps for each model? Wouldn't it be possible to adopt the same time step for the 3 models? Do you envisage how this might influence model performance?
- Section 5: The key point of the manuscript is the performance assessment of the hydrodynamic models based on statistical metrics calculated for the variables of interest. However, the description of the indices for comparison is somehow incomplete and must be clearly outlined. For example, in section 5 – indices for comparison, the authors present: stratification duration based on the ST, UML, temperature, and flow velocities. But the authors also analyzed other variables beyond the above-mentioned: water level, spillway discharge, evaporation rate, the formation of currents, and substance transport. Some of those variables appear in the Results section for the first time, but they should be introduced in section 5. Also, in section 5.1 – Statistics the authors present the following metrics: standard deviation,  $r$ , cRMSE, and MAE. However, not all statistics are present for the variables of interest. For example, I missed the standard deviation,  $r$ , and cRMSE for water level. In addition, other statistics were applied by the authors (coefficient of determination, percentiles, and percentage difference) and they should be stated in section 5.1. Hence, I recommend the authors describe all statistics and variables of interest in section 5 aiming at a better structure of the methods and thus the reader can better follow the results. Perhaps, adding a table synthesizing all statistic metrics for each hydrodynamic variable would help to visualize the results.
- P 21, topic 6.3.3. In section 4, the authors explain that the tracers are implemented starting from 1 Aug 2018. Could you please explain the presence of the tracers in the intake region since the beginning of the simulation period (March 2018)?

Technical corrections:

- P 1, L 35: "land use" instead of "land usage"?

- P 2, L 51: "as well as to the assessment" instead of "as well to assessment"?

- P 2, L 67: This sentence is not a conclusion from the work of Polli and Blenninger, 2019, neither from Soares et al., 2019. I suggest removing these citations from here.

- P 2, L 69-70: What do you mean by "good results"?

- P 3, L 84-85: The sentence is disconnected from the idea of this paragraph and its content is more close to the idea of lines 49-50. I suggest the authors move these lines to be closer to line 50.

- P 5, L 153: The format of the reference here is not correct. Could you correct it, please?

- Fig. 1: what is PPA?

- Fig. 2: I missed the time-series of rainfall. Could you provide it, please?

- P 6, L 179: "beseflow" instead of "baseline"?

- Table 1: What does the \* mean in the second line of GLM column?

- P 9, L 226: The format of the reference here is not correct. Could you correct it, please?

- P 11, L 260: The format of equation 2 is not correct. Could you revise it, please?

- P 11, L 276: "only for the period" instead of "only the period".

- P 12, L 294: The format of the reference here is not correct. Could you correct it, please?

- P 13, L 334-335: Could you rephrase that line ("Persistent thermal stratification developed in spring, and retained over summer"), please?

- Figure SI 1a: unit "m.a.s.l." instead of "m".
  
- Fig. 4: Why simulation results of GLM is at 0.5 m depth rather than at 1 m depth to be at the same depth of measurements? It would provide a better comparison between (a) and (b). Also, by a visual inspection, it seems that temperature simulated by GLM is higher than the measured. If the authors use the simulated temperature by GLM at 1 m depth, the same depth of measurements, the contour plots would be better comparable.
  
- Fig. 4 caption: "intake" instead of "Intake".
  
- P 15, L 335: "0.5 °C" instead of "0.5°C".
  
- P 15, L 359: "Schmidt stability" instead of "Schmidt number".
  
- P 15, L 363: The correlation coefficient ( $r$ ) rather than the coefficient of determination ( $R^2$ ) is a better metric to provide a measure of the correlation between simulated and observed variables. The same is valid for P 15, L 366.
  
- Please review the citation of figures along the text. For instance, Fig SI 3 is cited in the text before Fig SI 2; Fig. 10 is cited in the text before Fig. 9; and Fig. 7 is not cited in the text.
  
- P 19, L 419: "deviation" instead of "deviations".
  
- P 20, L 443: "was" instead of "were".
  
- P 23, L 491-492: The sentence presents results and should be placed on Results section rather than in Discussion section.
  
- P 23, L 492: "water level is similar" instead of "water level similar".
  
- P 24, L 529: "strength of vertical" instead of "strength if vertical".

- P 25, L 562: The format of the reference here (Zamani et al., 2020) is not correct. Could you correct it, please?

- P 26, L 628: The sentence lacks punctuation. Could you correct it, please?

- P 27, L 651: "large effects on subsequent simulations" instead of "large effects subsequent simulations".

- Could you please provide the DOI for the following references, please: Chung et al. 2014, Dai et al., 2013; Kobler et al., 2018; Lorke and Peeters, 2006.