

Geosci. Model Dev. Discuss., referee comment RC1  
<https://doi.org/10.5194/gmd-2022-59-RC1>, 2022  
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## Comment on gmd-2022-59

Anonymous Referee #1

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Referee comment on "Water balance model (WBM) v.1.0.0: a scalable gridded global hydrologic model with water-tracking functionality" by Danielle S. Grogan et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-59-RC1>, 2022

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The model description paper of Grogan et al. describes an Open Source version of the model WBM. Overall, they provide a well-structured summary of the model. I like to also highlight the availability of data and model source code. However, I also think the manuscript requires some clarifications to be a helpful addition to the scientific community.

Foremost, the abstract and introduction provide no indication of why the model is relevant and how its result already has or will contribute to our scientific knowledge. It is also unclear how this model differs from the vast collection of other global hydrological models. What are the features that make it unique? Why should I be interested as a potential user and scientist to have a closer look? What are the current challenges?

Additional notes:

Previous GMD guidelines stated that the model version needs to be noted in the manuscript title. Please check if that is still the case.

11: what does long mean? Maybe instead, refer to the first published version in year X

12: So, the previous versions have not included it, and this is a new feature?

14: I do not think it is necessary to refer to the GitHub link in the abstract. Please instead describe what makes WBM unique and why it is useful. I am halfway into the abstract and still have no idea why I should care about the model

15: Remove unnecessary technical detail in the abstract.

16-17: Ok, so what have you learned? What is the model able to do? Why should I care as a scientist and possible user?

17 - 22: Ok, so this is really interesting, but the sentences are long. If this is a unique feature of this model, it should be stated. In what new ways can we perform experiments with that model that are not possible with other models? After reading only the abstract, it is still unclear why I should care about this model and how it has maybe already contributed to science and will continue to be of interest. What are the scientific questions that it is designed to answer or will enable us to answer in the future? How does it differ from other models? How well or bad does it perform overall / compared to other models? What is the spatial resolution?  
These are all questions that can be touched upon in the abstract.

Introduction: I think you provide an excellent summary of what has been developed. However, I wonder if that should be condensed to a table instead. Half of the text is just references. Also, it would be nice to focus more on why we build these global models and what kind of questions they are supposed to answer, and what they can't do. There are obvious limitations, and people have been criticizing them a lot (sometimes fairly, sometimes not); because of that I think it is essential to highlight the ongoing discussion of what they are and what scientific insights we gained. And specifically, what the remaining challenges are - possibly hinting on your model? How is it different from all the literature that you are outlining?

Fig.1: This is very helpful. Could you add the timescales on which these fluxes and storages are simulated?

Table 1: I think this can be moved to the supplement.

199: This documentation should be appended as supplemental material or uploaded somewhere to provide a doi. If the GitHub repository is lost, this link is not really helpful. This is also the case in various other places in the manuscript.

Fig3: The y-axis is different on the plots and thus confusing. Also, the quality does not seem to be high. Not much to see when zooming in.  
Please also add a comparison to other global models. If it performs worse, state why the model's unique features are still useful.  
Further, I was expecting to see something like Fig 6 and 5 here. Maybe move Fig. 3 to the supplement and refer to the result section.

Fig.4: Please refer to Table 6.

Table6: Please add the model name. Is that the absolute difference to the simulation that you are showing? Or the absolute value? The description text is confusing on this matter.