



To: Editors of Geoscientific Model Development

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Subject: revised manuscript

Dear Editor, Dear Wolfgang Kurtz,

We have improved our manuscript with all the reviewers' comments, and we are happy to inform you that we have managed to add a comparison with GRACE data. We have implemented the changes as we suggested in our final response of April 19, 2023. Please see in **red** below the specific lines of the changes in the revised document:

- Introduction:* Based on literature, we will add a paragraph to the beginning of Section 1 about which developments are needed to improve global groundwater models beyond the current state-of-the-art. This will also identify as one these improvements increasing the resolution and increasing the speed of computation to make this possible. This will then immediately make clear which of these possible improvements are the focus of this paper.
See line 51-60 'From the work... proceed further.', and line 65-67 'and the native... GLOBGM'.
- Methods:* In Section 2.2.1, "Description of the GLOBGM", we will add a paragraph about the assumptions and limitations of our GLOBGM model with respect the work for the 5' global groundwater model, De Graaf et al. (2015, 2017). In this, we will again be more explicit that our work addresses *the computational challenges need to be overcome if the resolution of this model is increased*.
See line 248-258 'The application... questioned'.
- Steady-state model evaluation:*
 - We will add extra curves for our GLOBGM to Figure 12b showing the errors for sedimentary basins without karst, sedimentary basins and karst and non-sedimentary basins.
For this purpose, we added Figure A1 and put this in the Appendix.
 - We will mask out the karst areas in the steady-state global maps in Figure 14a.
Change made to Figure 15a (former Figure 14a).
 - We will change the legend of in Figure 14a to allow for groundwater levels and heads above the surface.
Change made to the legend of Figure 15a.
 - We will add a separate figure to Figure 14 showing the heads in the confined aquifers, and mask out the Karst areas.
For this purpose, we added Figure A2 to the Appendix.
- Transient model evaluation:*



- 4.1. We will mask out the karst areas for the global maps of Figure 14b and Figure 14c.
Change made for Figure 15b and Figure 15c (former Figure 14b and Figure 14c).
- 4.2. We will change the legend of Figure 14c for showing both positive and negative trends.
Change made to Figure 15c.
- 4.3. We will add a supplemental document explaining the filtering of transient well locations in more detail.
We added a new document to the supplemental.
5. We will investigate the possibilities for comparing with GRACE data for this version of our GLOBGM, version 1.0, or an upcoming version.
We added the GRACE analysis to our manuscript. See section 2.4.3 and 3.3.3, Figure 14, and conclusion line 702 'Monthly and multi-year...'
6. We will add text to Section 2.1 for better explaining the purpose of sorting for the global domain decomposition.
See line 128-130, 'Furthermore... require parallelization'.
Furthermore, in this Section, we will add text to improve the connection of the example of Figure 2 to the actual global domain decomposition being used.
See line 213-216, 'The outline situation... Australia model'.
7. In Section 2.3.1, we will add text to emphasize better the relationship between the "Model Workflow" and the "Node Selection Workflow".
See line 317-318 'Figure 3b... model i'.
8. We will include the typographical/syntactical suggestions and corrections.
These minor changes were made throughout the entire manuscript.

We hope that our changes in our manuscript are adequate and will provide a good starting point for a third reviewer. Please let me know if you have any questions or more clarification is required.

On behalf of all authors,

With kind regards,

Jarno Verkaik