

Response to Editor and Reviewers

Dear Felicity McCormack,

thank you for your comments. We have submitted a next revised version of our manuscript and explicitly incorporate your comments and those of Reviewer 1. Below we summarize the responses to your comments and the reviewer's comments. The original comments are in black and all our responses are highlighted with blue color.

Response to Editor

- L8: "... optimal trade-off between the cost function terms, resulting in smooth L-curves." → "... optimal trade-off between the cost function terms that result in smooth L-curves."

We have changed this accordingly in the revised manuscript.

- L10: "curves" → "L-curves"

Done.

- L44: I'm not sure what "... in the most realistic sense" means here? Do you mean "... in realistic settings"?

Yes, thanks for the comment. We have rephrased it as "realistic settings".

- L49: "It is therefore desirable to resemble the subglacial water pressure on a more realistic and physical basis...". Consider citing papers by Dow, Flowers, Werner, etc. here, who have made substantive contributions to the development of subglacial hydrology models towards this aim. Also Ehrenfeucht et al. (2024; <https://doi.org/10.1029/2024GL111386>), which describes whole-Antarctic subglacial hydrology model outputs using GlaDS.

That is a good point. We have added the citations mentioned to the new version.

- L79: numerical instability?

Yes, we have clarified this in the revised version.

- L93: "physical-based" → "physically-based"

Done.

- L230: Could you add a sentence describing why you don't use a logarithmic misfit term in the cost function equation (5), as per other studies (e.g., Morlighem et al., 2013)? This could be helpful for other modellers.

We have already discussed this topic in the discussion, but have added the following sentence in this section:

"We restrict our cost function to an absolute misfit term and opt against using a logarithmic misfit, as applied by Morlighem et al. (2013), since we do not perform a rheological inversion (see Sect. 4 for details)."

- Figure 7: update the font size of axis labels in panels b-i to be approximately the same as that of the main text

We have changed the size of the axis accordingly.

- L625: "...a reduced skin drag. Indicating, that..." → "...a reduced skin drag, indicating that..."
Done.

- A general revision of the Conclusion section for improved clarity would be good. E.g., L659-660: "The L-curve analysis taught us..." → "We find that ill-shaped L-curves with many outliers are most likely the result of inconsistencies in the model setup that should be addressed." There are also some incomplete sentences to reword (e.g., L663 starting with "Overall, ...")

Thank you for pointing this out. We have edited the sentences mentioned and reworded some other parts of the conclusion.

General things to check:

- An overall check for grammar throughout the manuscript would be good. E.g., checking commas to delete (e.g., end of L63; L70 "examine both,"; L82 "point out,"; L86 "invert for both,"; etc.); prepositions (L119: "...on a manageable" → "...to a manageable"); and conjugations (e.g., L201-202 30% of the domain is frozen to the bed)

We have checked the grammar of the manuscript as well as commas, prepositions and conjugations throughout the text.

- Check parentheses in citations. E.g., L95 should be (CUAS-MPI; Beyer et al., 2018; Fischler et al., 2023). Similar elsewhere.

We have checked the parentheses and changed them in the revised version.

Response to Reviewer 1

Line 93: "physically based"

Done.

Line 178: I'd suggest removing "geometry data like" and "as well as"

Done.

Line 202: "is frozen"

Done.

Line 225: "as the target"

Done.

Line 296: "exhibits"

Done.

Line 494: If you're going to specify "modeled surface velocities, vs" this should probably be done the first time they're referred to in the sentence.

That is a good point, we have edited it in the revised version.

Line 549: Presumably should be "(Table 1, column eight)"

Done.

Line 572: “along with that of” ... “demonstrates”
Done.

Line 658-9: “We conclude ... smooth ones” This sentence is not very clear, and could do with rewording

Thanks for the remark. We have reformulated this sentence as follows:

“We developed a strategy to handle poorly shaped L-curves when weighting the regularization term and achieved six well-defined, smooth curves.”

Line 663 “Overall, we highlight the importance...”
Done, but we have edited the complete sentence.