

Response to the Reviewers

May 14, 2026

Response to the Editor

Dear Editor, thank you for your encouraging comments. We have addressed your comments in greater detail as follows:

In addition, I would like to ask you to make reference to the bed topography map from the quantile regression forest (Palmer et al., 2025). This gives credit to this work. Please add it to the discussion with a brief qualitative statement on comparability/differences (you could add Fig. 2 from your rebuttal as a Suppl. Figure).

Response: As suggested, we have made a brief sentence in the discussion, referencing the work by Palmer et al., 2025. After discussion with the other co-authors, we have included a qualitative statement comparing these two bed topography maps, as well as the figure, in the Appendix as we felt it would break the flow of our discussion section.

Response to the Reviewer

The authors have done a thorough job addressing my comments. I particularly appreciate the new validation section.

Response: We'd like to thank the reviewer for the encouraging comment.

Regarding the authors' final point that the work is technically difficult for the adjoint method, I would like to draw their attention to Perego et al. (2014), which in fact did exactly this (simultaneous inference of thickness and basal sliding coefficient using both conservation of mass and conservation of momentum) with the adjoint method using a 3D momentum balance equation (first-order accurate approximation to the Stokes equations). The authors may consider mentioning this around the sentence: "It should be noted here that solving such a problem (i.e., coupling mass balance and stress balance) using the classical adjoint method, while theoretically possible, is technically difficult... a two-dimensional problem is considerably more involved..."

Perego, Mauro, Stephen Price, and Georg Stadler. "Optimal initial conditions for coupling ice sheet models to Earth system models." *Journal of Geophysical Research: Earth Surface* 119, no. 9 (2014): 1894-1917.

Response: As suggested, we have made reference to this work in our discussion of the classical adjoint method in our manuscript.