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Geoscientific Model Development Discussions

Interactive comment on "ICESHEET 1.0: A program to produce paleo-ice sheet models with minimal assumptions" *by* E. J. Gowan et al.

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Most recent scientific work in modeling past ice sheets has been aimed at a simple or a complex endmember. The former includes whole-ice-sheet simple flowline modeling and the "ice-cream scoop" approach of the ICE-nG models, in which ice volume is "scooped" from the ocean and placed on the map in a way that is semi-arbitrary but fits the GIA constraints. The latter includes all attempts to use time-evolving ice-dynamics models.

Gowan et al. present work that is sorely needed, that obeys the physics without overfitting the geological constraints. I am very enthusiastic about this work, and see this as a necessary way forward. More specifically, I think this work embodies the null hypothesis: ice sheets in the past behave as physics dictates. Modeling them in an

equilibrium state should be the zeroth- or first-order work that forms the basis for any more complex investigation, and has significant scientific value in and of itself.

A few minor comments follow.

- Elevation: E should become z_s (z-surface) or something with z in it – E to me is Young's modulus, erosion, ... while z is a field vertical positions. Same goes with B, would be more intuitive to have z_b. Thus the equations with $E - B$ would become $z_s - z_b$, and this meaning would become immediately apparent to me.
- Line 66 – no comma needed
- p and q: once again, for readability, I would suggest avoiding variables like q that already mean something to glaciologists. Maybe some consecutive Greek letters or other ones from our standard alphabet would work. I don't mean to be a stickler about this – it's just that this makes the difference to me between being able to understand what you're doing after a skim, and after a close reading, and I think that anything that you do to increase the at-a-glance readability will increase the paper's impact.
- Your steps in working through the model are good. How about a flowchart to accompany this? I find these very useful, and use a program called yEd, which is pretty quick.
- Nice examples, especially illustrative of the importance of basal shear stress inputs.
- Software repository location: I would suggest that it could be useful to also provide the software on a non-personal website. This should increase its visibility and ensure its future availability. Some researchers like archives that have a doi, and GMD is in support of this. I personally use GitHub for everything, which

is nice because it allows others to follow changes to one's source code and/or check it out and modify it and suggest changes.

Overall, this work is elegant in its simplicity, and I look forward to seeing additional applications.

– Andy

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