Review of Seroussi et al. (2023): Insights on the vulnerability of Antarctic glaciers from the ISMIP6 ice sheet model ensemble and associated uncertainty

Summary
This paper uses the ISMIP6 ensemble of simulations to investigate the sources of uncertainty in predictions of dynamic mass loss in Antarctica, identifying those glaciers most vulnerable to dynamic changes and where most uncertainty in these predictions is coming from, both at a glacier and an ice-sheet-wide scale. As a result, the authors identify that Thwaites, Pine Island, Totten and Moscow University glaciers are the most potentially vulnerable ice masses in Antarctica, and that, generally speaking, the choice of ice-flow model is by far the largest source of uncertainty (as opposed to climate scenario, and how the climate and ice models interact) in Antarctic predictions, in contrast to those for mountain glaciers where the climate scenario dominates. Though for some glaciers (chiefly those in the Ross Sea), the climate scenario becomes dominant in the second half of the century owing to wide divergences in predicted ocean temperatures. The authors therefore conclude that the community should continue to focus on improving ice-flow models to better capture observations in order to reduce uncertainty in Antarctic mass loss predictions.

The paper is well-written and structured, with clear figures. I do not have any major concerns that require addressing, but there are a number of smaller points that could be improved to aid clarity in some places. Overall, however, this is a very good modelling paper that provides a very useful insight into which glaciers in Antarctica are most likely to suffer substantial dynamic change in the coming decades, as well as pointing the way forward to making better predictions in future.

Samuel

Major points

- None

Minor points

- p.3, l.38: ‘unlike that which is observed’ – the current formulation with ‘what’ reads a bit too informal
- p.3, l.49: ‘in the overall’
- p.4, l.56: ‘in the overall’ – as above, one has a role in something, not to something.
- p.4, l.71: ‘that which is done’
- p.4, l.72: Why only a few of the ice-flow models? I can come up with several reasons, and I imagine the correct one is ‘time constraints’ or ‘modelling constraints’, but providing a reason here would be helpful and would make the sentence read better.
- p.5, l.93: ‘ice flow models’? As written, the sentence doesn’t make sense, but I’m unsure if the authors are saying ‘the trend in these specific ice flow models used in this study’ or ‘the trend in ice flow modelling generally’. Please clarify.
- p.5, l.95: Do the authors a) expect these potential non-linearities to be substantial on the timescale of this paper and b) do they see any signs of them occurring in the results?
- p.6, l.102: ‘their driving stress’ if the authors are referring to the glaciers mentioned earlier in the sentence or ‘the ice sheet’s driving stress’ if the authors are referring back to the AIS in the previous sentence (and is what I think the authors mean, but I can’t be sure).
- p.9, l.179: ‘relative to other glaciers’
- p.9, l.180: ‘that which is shown in Fig. 4’. Using ‘observed’ is perhaps slightly confusing when there are no observations involved.
- p.9, l.182: Similarly to the above, it’s difficult to say ISMIP6 ‘observed’ anything; consider using a different word (‘that which was shown’ would perhaps be best)
- p.9, l.196: I think ‘similar to previous studies on mountain glaciers...or firn models’ reads better
- p.9, l.199: ‘Consistent with’
- p.10, l.213: ‘associated with’
- p.10, l.263: ‘the carbon emission scenario for’
- p.13, l.308: ‘neural network emulators’

- p.13, l.326: ‘that best fit observations from a large ensemble’
- Figure 2: Might it be possible to put a legend on the graph showing which colour corresponds to which simulation? Might make the figure more informative and would also fill the considerable white space at top left.
- Figure 4: Why are the glaciers in this particular order? Is it by size, contribution to mass loss or something else? This is also a different order to that given in the text in section 2.4, which the text implies (it seems to me to do so) is the order by mass loss? Please clarify.
- Figure 5: Could be worth labelling the glaciers on the inset map, just so readers don’t have to check back to Figure 4 to remind themselves which one’s which, if they’re not familiar with their locations
- Figure 6: Caption, ‘associated with’, and ‘as a proportion of the total variance’ (?)
- Figure 8: Caption, ‘Relative contribution...to the total variance’ (?)
- Figure 9: Caption, ‘associated with’, ‘Relative contribution...to the total variance’