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The Cryosphere Discussions

Interactive comment on "The role of history and strength of the oceanic forcing in sea-level projections from Antarctica with the Parallel Ice Sheet Model" *by* Ronja Reese et al.

Anonymous Referee #2

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Summary

In *The role of history and strength of the oceanic forcing in sea-level projection from Antarctica with the Parallel Ice Sheet Model*, Reese et al. present the results of applying a suite of numerical experiments associated with both the ISMIP6 and LARMIP-2 model intercomparisons to the parallel ice sheet model. The key findings of this paper are that 1) the inclusion of a century-scale climate history leads to a significantly different mass loss trajectory for all of the experiments included in ISMIP6 (in particular, a climate history leads to greater mass loss), and 2) that the mechanism for parameterizing sub-shelf melting matters alot, and that choosing between two different methods

leads to an order of magnitude difference in century scale sea-level predictions.

General comments

Overall, I find the paper to be well-written and very interesting. The scientific quality is high, and the conclusions presented will be useful for those trying to hone in on areas of remaining uncertainty when prognosticating with regard to Antarctica. One overarching comment is that the experiments that are applied should be described more fully: because this paper deals with numerical experiments drawn from two other works (the main ISMIP6 forcing paper and the LARMIP-2 paper, one of which is still in review), it would be helpful to briefly state the assumptions and differences between them (to aid in intercomparing the intercomparisons, as it were). My remaining comments are on a line-by-line basis, and may be found below.

Specific comments

L80 A description of the mechanism for creating the ensemble, as well as the scoring method, would be appropriate here. Additionally, a discussion of the degree to which the optimal ensemble member actually matched observations would help in determining how seriously the reader should take the predictions included in this work.

L86 Add "forcing" after "historic".

L89 Please add a citation for NorESM1-M.

L89–90 Please describe how the climate constants were selected for 1850–1949.

L90-91 I don't understand what this "new climatology" is. Please describe in more depth what this sentence means.

L91 "resprective" -> "respective"

L93 "that" -> "which"

L97-97 The constants C and γ_T need units specified.

L99–100 The decision to depart from observations for the Amundsen Sea due to a qualitatively undesireable model behavior merits some additional consideration. Why is lowereing the temperature necessary? Does this imply that the ocean model is doing something wrong, or that the ice sheet model is doing something wrong? What are the ramifications of this, and how much faith should we have in C and γ_T under this alteration?

L107 "We here exemplify ..." is a weird sentence that can probably be removed.

L114 The two configurations are similar in ice thickness, volume, and speed, but how about in trend? This is hinted at, but should probably be specified more explicitly.

L115–119 This whole paragraph is a bit unclear. What does "these" refer to in the third sentence? What is "drift in the initial configuration"? What is an "increase in ocean forcing"?

L124 An increase in mass balance would typically imply a lower mass loss rate, but I don't think that's what is meant here. Try to be more explicit about the signs of the figures being reported.

L125–126 I don't understand this sentence. How is "more realistic" defined?

Table 2 I think that there is a typo here: the text says ISMIP6, but should read LARMIP-2, unless I am gravely misunderstanding something.

L209 I would like to see a more specific description of how the step-forcing experiments mentioned here were performed and analyzed; as it stands, the reader is left to extrapolate from Fig. 6 how these numbers were derived.

Sec. 4.3 This paragraph seems somewhat underdeveloped, given that the role of historic trajectory is one of the key points of the paper (it's in the title!). Is there a strong trend baked into each simulation? Is there a way to analyze whether the historic model hits a tipping point that the pseudo-steady model doesn't? There must be a reason behind why this difference exists.

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