

Interactive comment on “Comparing ice discharge through West Antarctic Gateways: Weddell vs. Amundsen Sea warming” by M. A. Martin et al.

Anonymous Referee #2

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1. General Comments

My review is in the line of the first reviewer. While I also appreciate the conciseness of the paper, clarifications and additional discussions are required. In a journal like The Cryosphere, we can anticipate that most of the readership of this paper will have at least some knowledge on ice flow modelling and will be also interested by the technical aspects of the paper. Thus, I think that the technical parts presented in the Appendix should be included in the main text and expended.

My main concern is that, looking at Figure 7, the projected SLR seems to decrease with the mesh resolution. SLR and Rate of SLR is halved when the grid size is decreased from 5km to 2.5km for the Amundsen sector. Looking at Durand and Pattyn (2015) in open discussion, this result could be the sign that the grounding line retreat is forced

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by the melt prescribed at the grounding line and not by internal ice dynamics. As the results for the Weddell-Sea are not shown for the grid resolution of 2.5km (which is still a coarse grid resolution to capture grounding line dynamics according to the MISMIP intercomparison results), I am not totally convinced that the difference between the two sectors is really physical and will persist if the grid size is further reduced.

2. Specific comments

As mentioned above the Appendix should be moved to the main text to clarify the experimental design. In the main text we only learn that 22 parameter combinations are tested, but we don't know what are the parameters. It's only in the Appendix that we learn that there is 3 parameters (Fw, m and Essa). I think that it could be useful here to give the equations where these parameters appear and discussed with more detailed their role in the model.

The choice of the parameters range is not really discussed and it is really not clear how many combinations are tested for each grid resolution. It is never clear in the Figures if the results are the results for one combination of the 3 parameters (and which one), the ensemble mean, or the “representative ensemble members” mean?

We understand that the 22 parameters are those that give the best match to observed grounding-line position, but the procedure to evaluate this “best match” is not described. The computation of the basal melt rates is only very briefly described but as this is the external forcing studied in the paper, this is a key point. However we read in Appendix A2 that it “roughly adapt” to changing shelf depth and that it's “not particularly realistic”. More attention should be devoted to the description of this implementation and to the discussion of the assumptions and their potential effect.

P1709, l1 to l14; discussion on the mesh resolution and uncertainty associated with model parameters: I agree that there is a large uncertainty associated with the model parameter choice and that most of the paper discuss this point. However, even if the results should not be understood as projections, they are used to conclude that

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the Weddel-Sea sector is more sensitive to ocean warming than the Amundsen-Sea sector. As mentioned in my general comments I'm not totally convinced that this result is really robust as I would expect some kind of convergence of the results when the mesh size is decreased; which is not the case here when the grid size is decreased from 5km to 2.5km.

3. Technical comments

p1706, l8: "At the same time, regional ocean projections show much stronger warm-water intrusion into ice-shelf cavities in the Weddell Sea compared to the observed Amundsen warming"; Is that projections for next century? What is the status for present day? I think this is what confused the 1rst reviewer, the Amundsen-Sea sector is actually changing because warming as started while warming is "projected" for Weddel sea sector? This needs to be clarified.

P1708, l14, "22 parameter combinations": As mentioned above describe the parameters, the sampling etc.. in the text and not in an Appendix.

P1708, l24, "representative ensemble members": In don't clearly understand from the appendix how many members are chosen as representative and the values of the parameters (The value for one representative member are given, is there more representative members?)

P1710, l15, "representative ensemble members": Idem, are the results a mean of the members or is there only 1 representative member?

P1714, l7-8:give more details on the climatic input, i.e. representative of present day?

Fig. 1: Is the ratio H/H_f from model results or data? Grey lines are hardly visible.

Fig. 9 : The discussion on the choice of the representative members should be moved to the text and detailed.

References:

Durand, G. and Pattyn, F. (2015) Reducing uncertainties in projections of Antarctic ice mass loss, The Cryosphere Discuss., 9, 2625-2654

Interactive comment on The Cryosphere Discuss., 9, 1705, 2015.

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