

Interactive comment on “Sensitivity of the Weddell Sea sector ice streams to sub-shelf melting and surface accumulation” by A. P. Wright et al.

Anonymous Referee #2

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The following is a review of “Sensitivity of the Weddell Sea sector ice streams to sub-shelf melting and surface accumulation” By A.P. Wright and others.

This manuscript is a brief communication that describes a suite of ice sheet model experiments, designed to test the sensitivity of the large ice streams feeding the Filchner-Ronne Ice Shelf. This study focuses on sensitivities to changes in basal melting and surface mass balance. The BISICLES ice sheet model is initialized with present-day observations of the West Antarctic basin in question, and a 2000-year reference run is presented as the control experiment. Sensitivity experiments included perturbations to basal melt, both in proximity to and away from the grounding line, as well as shifts in accumulation rate. The authors present how these changes affect the grounding line locations, spatial ice thicknesses, and total ice volume of eight different ice streams.

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They find that two ice streams are particularly sensitive to basal melting, while five others are extremely insensitive. The last ice stream exhibits threshold-triggered retreat once basal melt becomes large. The authors note that the ice stream behavior cannot only be predicted through characterization basal topography. Instead, results highlight the need to correctly characterize both the ice stream trough and the location of ice rises, which can significantly increase stability. Additionally, the authors note that a substantial increase in surface mass balance could help to counteract the effects of modest increase in grounding line melt, but is not able to reverse retreat.

This paper is well written and clearly explains the methods used as well as acknowledgement of study's limitations. The authors also make convincing arguments in defense of their assumptions and modeling concessions. The results are interesting and highlight the need for better observations of the bedrock topography, which serves to constrain the large ice streams of West Antarctica in a variety of ways. Therefore, I recommend this paper for publication in The Cryosphere.

Additionally, I have a few comments/suggestions for the authors:

Page 5479, lines 7-10: Please include some references here to support the statements in this paragraph.

Page 5481, line 13 (also Page 5485, line 6): Please add some justification or explanation for the use of 2000 year- long simulations.

Page 5483, line 3: What are the time-steps of your simulations? Yearly?

Page 5483, line 16: It would be helpful to add a figures illustrating the mesh and highlighting refined area.

Page 5487, line 15: This is the only place where Fig. 7 is mentioned in the results. Overall, a description of the results presented in Fig. 7 is lacking, and it is only the threshold behavior of Evans is mentioned. This figure is quite rich with information but it can be a little confusing to digest at first. More guidance for the reader would be

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helpful, especially in the results section. Doing so would be more effective, since figure is used as a key reference in parts of the discussion.

Page 5487, line 25: found it most convenient “to” apply a uniform shift

Page 5493, line 15: Is it possible to make some statements about how these results might extend to the rest of the West Antarctic Ice Sheet, or maybe other specific ice streams? Or perhaps about how these results could not extend to other locations in the WAIS? Would it make sense to characterize other ice streams, based on key parameters (like outlet narrowing) for predictability? Or are we still far from being able to do something like that? A short discussion on this would add to the broad impact of the findings presented here.

Also, adding a few sentences to discuss possible next steps would be quite valuable to the manuscript. In particular, what could be done (e.g. additional experiments/observations) to nail down the different behaviors of the various Filchner-Ronne ice streams?

Interactive comment on The Cryosphere Discuss., 7, 5475, 2013.