

Interactive comment on “Velocity response of Petermann Glacier, northwest Greenland to past and future calving events” by Emily A. Hill et al.

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Summary: Within the past decade, there have been two very large calving events from the floating ice tongue of Petermann Glacier in NW Greenland. Although the size of the calving events were quite large in terms of aerial extent, they had only a minor influence on ice flow across the grounding line. In this paper, the authors use observations from before and after the 2010 and 2012 calving events to solve for the boundary conditions (both basal and lateral) and viscosity of the glacier in a numerical ice flow model. They then use the observationally-constrained model to simulate the response of the glacier to future calving events of comparable aerial extent. They find that the sensitivity of the glacier to terminus change progressively increases as the terminus retreats towards the grounding line. The increase in sensitivity is due to the

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increase in both ice thickness and stiffness towards the grounding line, which lead to a greater reduction in buttressing as the terminus retreats inland.

Comments: The paper is well written and I see no flaws in the methodology or the interpretation of the results. The exploration of lateral boundary conditions is thorough and is clearly very important for the accuracy of the (past and) future simulations.

My only somewhat major comment is in regard to clarity in the presentation of the future calving simulations. The results are presented as the nearly instantaneous response of the glacier to the prescribed calving. I have no problem with this analysis but it is not clear whether the calving events are essentially prescribed as one massive calving event of progressively larger size or if there is a relaxation period in between subsequent events. If they are prescribed one immediately after the other, then the results of the sensitivity tests certainly represent the high end-member response of the glacier to calving because you essentially simulate larger and larger calving events with no time for adjustment of the glacier geometry. I feel like this should be made more clear throughout the text.

I did not find any glaring typos or places where the text required notable revisions. There were a few instances of tense-switching in the methods, so I recommend checking that you consistently use past tense. I will note, however, that the presentation of the discharge across the grounding line in terms of sea level equivalent should be in mm per year (or mm a⁻¹, whatever your preference) since you are talking about a rate and not the cumulative contribution over a set time.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-162>, 2018.