

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-327

Anonymous Referee #1

Referee comment on "Shear-margin melting causes stronger transient ice discharge than ice-stream melting in idealized simulations" by Johannes Feldmann et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-327-RC1>, 2021

The focus of this paper is on the sea-level rise response from localized melting on regions of a buttressing ice shelf. The melting is applied either at the grounding line or along the lateral edges where the topography increases and the downstream flow is slower (Figures 2 & 3), i.e. the shear margins. The difference between the effects of additional melting at the grounding line versus melting below the ice shelf shear margins is notable. And it make sense from a force balance perspective, thinning the shear margin lowers the buttressing balance and the ice stream will accelerate. Similarly, if we considered a unbuttressed ice shelf with a single pinning point, it would be clear that melting at the pinning point would affect the flow more than melting at the grounding line. Although it is an intuitive result with few actionable consequences, I would tepidly support publication in The Cryosphere.

Additional thoughts:

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the force balance argument described above doesn't appear in the text and the description of the difference between the grounding line and shear margin melting is too thin.

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I find the 'three dimension' description of the simulations as misleading, since SIA/SSA hybrid can have three-components but is still depth integrated.

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the second sentence in the abstract is missing a comma before `the melting'.

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what is solid-ice? I would replace this with 'grounded' both in the abstract, introduction, and anywhere. Right? Solid, as opposed to what?

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it seems like the SM1 is nearly as effective at instigating ice flux as SM2, yet the text in the second paragraph on page 5 is confusing as compared to Figure 4.

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lastly, it seems like the authors have discovered for themselves why shear margins are important. Yet I know that others have worked on shear margins, such as Lhermitte et al (2020). I suggest a clearer connection to the existing literature.

S. Lhermitte, S. Sun, C. Shuman, B. Wouters, F. Pattyn, J. Wuite, E. Berthier, and T. Nagler. Damage accelerates ice shelf instability and mass loss in Amundsen Sea Embayment. PNAS, 117(40):24735–24741, 2020