The Cryosphere Discussions

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Comment on tc-2021-327

Anonymous Referee #3

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-RC3, 2021

The manuscript "Shear-margin melting causes stronger transient ice discharge than ice-stream melting according to idealized simulations" by Feldmann et al. investigates a relatively straightforward question: where does melting of ice shelves matter most? A lot of previous work has focused on the along-flow direction when addressing this question, while the authors focus on the across-stream direction. They apply localised melt either directly at the grounding line or in the shear margins. Maybe unsurprisingly they find that persistent melting matters most where the ice is slowest, which is in the shear margins of an ice shelf in their experiments.

The paper builds heavily on Reese et al. (2018) and is similar to Zhang et al (2020) and thus not overly novel in its approach. Nevertheless, I think it is worth pointing out that spatial variation in melting matters and to try to identify regions where melting is most influential. My main points of criticisms are:

- I think a more systematic investigation involving more locations would have greatly benefitted the paper and would have allowed a more systematic analysis of the role of distributed melt.
- The findings of the paper are really quite straightforward, and I don't see the need for 8 figures in the main text plus an additional 5 in the appendix to convey the results. Figures 1, 3, 4 and subsets of figures 5 and 6 would in my opinion suffice.
- Ice stream shear margins are interesting for many authors because they are regions of enhanced warming with implications for ice flow and stability of ice shelves. I think this could be mentioned in the text.
- The paper title is a bit misleading -- being familiar with the large body of literature on ice stream shear margins, I didn't expect the paper to solely focus on isothermal ice shelf margins.

The paper is well-written, but somewhat selective (not to say negligent) in its discussion

of existing literature. Relevant studies worth mentioning include (just to name a few)

- Alley KE, Scambos TA, Alley RB, Holschuh N. Troughs developed in ice-stream shear margins precondition ice shelves for ocean-driven breakup. Science advances. 2019 Oct 1;5(10):eaax2215.
- Alley KE, Scambos TA, Siegfried MR, Fricker HA. Impacts of warm water on Antarctic ice shelf stability through basal channel formation. Nature Geoscience. 2016 Apr;9(4):290-3.
- Hunter P, Meyer C, Minchew B, Haseloff M, Rempel A. Thermal controls on ice stream shear margins. Journal of Glaciology. Cambridge University Press; 2021;67(263):435–49.