**Review of Nolan et al. (2026): Modulation of glacier surge cycles on decadal to centennial timescales by intrinsic thermal-structure variability**

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This paper presents a series of model experiments with a thermo-mechanically coupled ice flow model. The work investigates the response of the thermal structure of small polythermal glaciers to strong increases in ice velocity akin to glacier surges. The paper evaluates the impact of and recovery from individual surge events as well as the broader impact of cyclical ice velocities and (very) long term thermodynamic feedbacks. I think this is a great paper that describes a very interesting, and somewhat niche, aspect of glacier surging. The writing is clear and concise throughout, and the figures are well made. I only have minor comments that I have listed below with reference to the line numbers in the pre-print.

## 1 Minor comments

- **Fig. 1** and **ll. 178-193:** I understand the logic of using surface forcings available for Kaskawulsh glacier, and I appreciate that there is a mention that Kaskawulsh is representative of the wider region. I wonder if the authors expect the specific conditions on RGI60-01.16732 to also be represented well by the data from Kaskawulsh? I am not super familiar with the particular climate but I imagine these small polythermal glaciers can sit in cirques with surface conditions that are different than the regional average. Since it seems that most spin up runs yield similar thermal structures this is probably not super important, but it might be nice to make a mention of it.

- **l.259:** I might have missed this, but with the zero sliding for cold beds condition, does the entirety of the bed briefly become temperate during simulated surges? Or does the toe of the glacier just not undergo basal sliding at all?

- **ll.359-364:** I think the result that surging behavior results in smaller glaciers could be hedged a bit more: surging results in smaller glaciers in the model, but it seems like this might only be the case because surges happen on a timer in the model, regardless of mass increase in the reservoir zone.

- **l.526:** In **the** Yukon (?)

- **ll.478-490:** It could be worth discussing whether assigning surge as a thickness threshold rather than a set time would still yield an overall smaller and colder glacier as well. I am also curious what motivated the choice to set surges at specific times rather than at a threshold in mass, it seems like the second approach would also be worth pursuing.

- **ll.524:** What is meant exactly by "fundamentally unchanged"? Are there maximum/minimum lengths of the temperate bed outside of which the oscillation would not (re) emerge?

- **ll.533-551:** I think that the comparison with the ice stream activation stagnation cycle is very interesting but I was a little confused by the first part of this paragraph (roughly until l.540). The text mentions the absence of a link between Heinrich events and climatic/oceanic cycles, but doesn't really link that to the mechanism modeled here. I think this paragraph could be shortened and focused a bit more on the comparison with ice-stream cycles. Are there any other examples where secondary oscillations emerge as a consequence of primary oscillations?

- **ll.577-580:** If I understand correctly,this section carefully hints at the link between internal thermomechanical feedbacks and the examples of polythermal glaciers seemingly "shrinking" and "cooling" outside of the surge envelope (which before was ascribed to changing climate). I understand that this might be too speculative, but do the authors think that the "secondary" oscillation could in turn affect individual "primary" surge cycles?