

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-222

Anonymous Referee #1

Referee comment on "Towards modelling of corrugation ridges at ice-sheet grounding lines" by Kelly A. Hogan et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2022-222-RC1>, 2022

General Comments

Hogan et al present a first modelling study aimed at understanding periodic seafloor features (corrugation ridges) that have been imaged proximal to rapidly retreating grounding lines. These features are intriguing and perhaps significant if they can be used as a diagnostic of the speed of retreat. This study provides a context within which these features can now be interpreted. The manuscript is well presented and referenced with ample discussion placing the work in a wider context. An example of the thoroughness of this contribution is quantification of the uncertainty in effective slope introduced by uncertainty in ice thickness gradient close to the grounding zone. This is helpful, as the region of enhanced surface gradient just upstream of grounding zones is often overlooked. In general, the modelling approach is presented as a first effort, and limitations are openly discussed in a useful way. The supplementary material is useful, and the animations provide additional insight.

Specific Comments

These specific comments are minor and intended to help link this study to what we observe at grounding zones.

An omission I noted, which is not a major concern, was the role of englacial sediment delivery, which is then delivered to the grounding zone ocean cavity by subglacial melt, over a length scale partly determined by the debris-rich ice thickness and the ice velocity. I would suggest this mechanism is acknowledged in the introduction, and then need not be addressed further. As it is I believe this mechanism is first mentioned in the Results and Discussion on Line 344. Some explicit statement on the influence that additional accommodation space generated by melt in the grounding zone ocean cavity would also help connect this modelling study to the real system.

I also think an upfront statement on the impact of the assumption of the constant 6 m retreat rate is inserted in Materials and Methods (around Line 76, 101) to allay any fears of circularity in the results.

Technical Comments

The manuscript is very well presented and requires very few technical corrections. As a reviewer I appreciate this.

L71 ‘...due to basal melt.’ suggest change to ‘due to an increase in basal melt.’ as basal melt could be in steady state.

L107 expected some mention of debris delivery by basal melt not being addressed around here.

L295 ...which perhaps supports dynamic thinning... This is an interesting point that might be lost on first reading. Suggest ‘...which perhaps supports widespread dynamic thinning...’

L363 'therefor'

L407 'lift-off off'

In closing, I thank the authors for their interesting and well-presented study.