

Impact of tides on calving patterns at Kronebreen, Svalbard - insights from 3D ice dynamical modelling: Review of revised manuscript

Changes implemented by the authors in response to the first round of reviews have resulted in a much-improved paper. The text is much clearer, and the distinction between model and glacier behaviour is carefully maintained. I have only a couple of points where I believe a little further clarification is needed. These are:

Line 225: With regard to the T_{SP} and T_{CD} simulations, it is unclear what was actually changed in the model set-ups. How was the impact of crevasse depth and sea-pressure isolated in the two runs? This should be described briefly in the text and in a bit more length in the Appendix.

Line 396: With regard to the lack of correlation between T_{SP} and calving events, there should be some discussion here about the absence of elastic strain in the model. The model prescribes calving on the basis of crevasse propagation, which is predicted from the stresses in the ice. These stresses arise from deformations, which pull or push on the ice. On tidal timescales, viscous processes are too slow for these stresses to vary significantly in response to fluctuations in back-pressure – changes in pressure at the ice front simply cannot be transmitted fast enough by viscous flow to be ‘felt’ by ice upglacier. (This point could be investigated by the authors by comparing modelled stresses at high vs. low tides.) On the other hand, elastic response is much faster, allowing rapid transmission of back-pressure variations to potential crevasse locations. So, I think that the lack of correlation between T_{SP} and calving events reflects the fact that variations in sea pressure (on the timescales of interest) actually have no effect on the glacier stress regime (in a purely viscous model), and hence have no impact on predicted crevasse depth or calving. In other words, the results likely reflect a missing process in the model rather than actual calving mechanisms. A few words should be added to the text to highlight this point.

Line 416 (and 421): It is stated that: “When the undercuts are largest, there is also the greatest propensity for calving via the promotion of basal crevassing.” Why should this be the case? Undercuts promote forward bending of the upper part of the glacier (less support at the base), which should promote surface crevassing and suppress basal crevassing. Modify these statements or provide better justification.

In addition, I spotted two typos:

Line 109: reference to Fig. 2 needed here.

Line 351: ‘where’ should be ‘whether’