Manuscript Review

Ice Shelf Calving due to Shear Stresses: Observing the Response of Brunt Ice Shelf and Halloween Crack to Iceberg Calving using ICESat-2 Laser Altimetry, Satellite Imagery, and Ice Flow Models

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Summary:
In this significantly revised manuscript, Morris et al. present (and validate against a suite of other observational techniques) their new method for measuring Antarctic rift widths and opening rates using ICESat-2 in a case study of the Halloween Crack on the Brunt Ice Shelf. The modelling component of this manuscript has been greatly expanded, and now includes an analysis of the stress fields in the ice shelf prior to, at and after the calving of the A-74 iceberg. From the new analysis, the authors identify an important role for horizontal shear stresses in the observed rift propagation and eventual tabular calving. This leads them to make suggestions on how to extend existing ice-shelf calving laws to include these shear stresses, which is a valuable contribution to the ongoing development of calving laws in the modelling community.

Overall Comments:
I thank the authors for their thorough response to my previous review comments. I found the description of the algorithm in the methods section to be much clearer in the revised manuscript. And I am really pleased to see that the authors have expanded the modelling component of their manuscript and appreciate the additional work this must have required. The rationale for the modelling component is now very clear, and the results provide new insight into rift propagation and calving mechanisms, which is a great additional result from the observational data you have generated.
I suggest that the manuscript be published after a couple of clarifications, and some very minor technical corrections.

Minor/Technical Comments:

L5: suggest 'rift development', rather than 'rift propagation, widening, calving, and stabilization'.

L8: suggest removing reference to 'inboard rift' as it is not used anywhere else in the manuscript and seems unnecessary here.

L61: you could include something extra here to emphasise the new things that paper does compared to the last version, e.g. 'proposes first steps to include shear stresses in commonly used ice sheet calving laws based on the findings of our model analysis'.

Figure 1: inset box is labelled 5f, but it should be 4f (as in the caption)

L185: why choose 5 m/a for uniform error? Based on your own exploration of the data? Or another paper that used this method? Would be good to see that explained here.

L199: …importance 'of' various factors control'ing' rift…

L207: this is the only part of the methods section – the model boundary conditions – that I think could be slightly clearer. So along the boundaries you specify (MIR, BIS/SWIT divide, grounding zone) you apply Dirichlet boundary conditions? If so, it clears up another question I had about how you simulate the buttressing provided by MIR if the domain of the model is drawn to exclude MIR itself – you prescribe the ice velocity at the MIR boundary?

L480: … HC opening rate ~~provide~~ consistently …

L482: … evolution of 'the' system of …

L485: Why 'Halloween Crack' not HC here?