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Interactive comment on "Ice shelf rift propagation: stability, three dimensional effects, and the role of marginal weakening" *by* Bradley Paul Lipovsky

Anonymous Referee #1

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General comments:

This is an extremely timely and creative paper that approaches a physical process that many glaciologists would be timid to approach in such a straightforward manner. Bravo!

The manuscript is well written, and I have only indicated a few suggestions as for improvements. (One place where I was confused was caused by not realizing the nature of how the solutions were derived, numerically using Equations 6, 7 and 8, apparently, as stated in the appendix. I didn't at first notice a reference to the appendix in the text.... after searching for it, I see it is referenced on page 7. It may be that the main body of the text needs a more forthright statement about what is done to produce the results, and a "louder" statement of what Appendix A is about would be helpful to some readers.)

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I think it is important to state somewhere at the outset and also in regard to future research that the fern-structure of the ice shelf may have additional bearing on the problem. In this case, the "touching of the top" is by weak, crushable firn. Also parts of the ice shelf that are in snow accumulation areas will have rift tops that are being actively filled with new material. Dealing with this is far beyond the scope of the present paper, but it worth identifying as a factor in future investigation.

I am very impressed with the fact that observations, specifically (1) the absence of seismicity at rift tips, (2) the failure of a wave-forced propagation of a Nascent rift, and (3) the view of the compressive arch by Doake, are so nicely explained by the simple analysis of the theory presented. This, to me, is a great success and one which suggests that this approach may be what breaks any "log jam" over how rifting on ice shelves is to be pursued in the future.

Specific comments:

Around line 30 of page 2. I wonder if a citation to a paper by Sanderson would be appropriate. He thought about ice-shelf margins. Journal of Glaciology, V22, 1979.

Is equation 2 the bending moment due to the stress balance at the ice front that leads to a bending moment? Just a comment would suffice.

In the discussion along with Figure 1, it may be useful to point the reader to observational studies of rift walls: e.g., Scambos, T., Ross, R., Haran, T., Bauer, R., Ainley, D., Seo, K., . . . MacAyeal, D. (2013). A camera and multisensor automated station design for polar physical and biological systems monitoring: AMIGOS. Journal of Glaciology, 59(214), 303-314. doi:10.3189/2013JoG12J170 Note figure 8 in that paper.

In describing the model, I think it is important to state whether a firn layer is going to be treated or not. Also, although a minor point: I wonder if it is worth mentioning that brine-infiltration, horizontally along the bottom of the firn where it is permeable and where there is an ice front or rift wall might introduce secondary effects on rift wall

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bending moments etc..

page 9 just below line 185. f is given to 4 significant digits. I wonder if this could be considered misleading. I also note that the Young's modulus that is used in the study is expressed as if it were very accurately known. My understanding is that relative sizes are more likely to be significant in terms of what readers take away from the comparison t this point in the paper. Perhaps that should be stated.

Figure 5, and some of the preceding figures. Do these results present the solution of Equations 6 7 and 8? I'm confused as to the specific process required to generate the curves and 2-d plot of displacement and other factors. A simple summary (before the results are presented) that describes how the model is implemented would be helpful to other researchers. Oh Dear! I see that this is all explained in the Appendix. (I should have noticed!) But, if my confusion (missing the reference to the appendix) can be of service in improving the exposition, let it so be.

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