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Interactive comment on "Brief Communication: Newly developing rift in Larsen C Ice Shelf presents significant risk to stability" *by* D. Jansen et al.

C. C. Walker (Referee)

catcolwa@umich.edu

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Using MODIS and LandSat imagery, Jansen and co-authors monitor and report upon the propagation of a rift in the Larsen C Ice Shelf that grew rapidly during 2014 after having been mostly stagnant/stable before that year with its rift tip lying in/near a future zone likely filled with marine ice. The authors then discuss two possible directions for future propagation, likely calving scenarios, and the associated adjustment of the strain field at the ice front, enabling discussion of future stability. This is a neat and important observation that will be interesting to monitor going forward.

The paper highlights the very recent development on Larsen C ice shelf and thus I

can understand why it's been submitted so quickly after the observation! However, while the observation and possible calving scenarios are interesting and noteworthy, the rigorousness with which the event(s) are placed into context, analyzed, and detailed is somewhat lacking. With a few fixes, I think this manuscript will be ready for prime time. In order for significant conclusions to be drawn from this work at this stage, though, it is my feeling that some of this analysis needs to be undertaken in a more rigorous manner. Mostly, I think at this point the authors just need to add more detail to further our understanding of rift propagation and ice shelf dynamics near the front.

It would be helpful, perhaps coming from my specific point of view, to have a table or list of the observed propagation rates for the rift in recent years so that it's obvious that the rate of propagation increased dramatically. While it's clear from the author's finding that the rift had a large increase in rifting rate, it would be interesting to be able to see the change in rate as it crossed the Joerg Peninsula suture zone and approached the Trail Inlet flow unit. Otherwise all the reader knows about the large change in rift propagation rate is that it covered approx. 20 km in 8 months (or 2.5 km yr-1 between August 2014 and January 2015). How fast is this when compared to other years (as far back as the imagery allows)? What is the background rifting rate? Did it grow rapidly at any other time since its initiation or is this the first time in its history that it has exhibited a large jump in size? Related to this point, how do other rifts behave that are nearby this rift? Have any of those rifts, which appear to be similar in structure, exhibited this large jump behavior in their past before becoming more stagnant? Is this observation reminiscent of any other rift propagation events on other ice shelves?

P. 863, L. 3: Expand on this? What is the usual pattern? Are there no other instances of rifts passing through suture zones?

P. 863, L. 15-22: More description is necessary with regard to the use of the imagery to monitor the rift. How was the MODIS imagery used? Specifically, how was the near-real-time data used to monitor the general propagation and likely future path of the rift? Was the additional length of the rift wide enough to be visible in MODIS imagery?

While the authors state that Landsat data at high spatial resolution was used to assess the rift length in all images unobscured by clouds between Nov. 2010 and January 2015, how many images exactly were used? What was the temporal resolution of the cloud-free/useable images? Did smaller-timescale changes occur? Perhaps more helpful here than a full-on description (it might make for slightly wordy paragraph), perhaps just a table of the Landsat/MODIS images used would be fine. Additionally, again perhaps from my own point of view, but it would be helpful to understand how the changes between Landsat 7 and 8 might have affected the measurements since both were used in the study. How was the starting point of Nov. 2010 selected? Since the rift was first observed prior to 2010, why was it deemed not relevant to track its propagation back to its earliest observation? This probably won't change the overall outcome of this particular paper, but in general if you want to discuss changes in the behavior of a rift, why not start at the beginning? The the reasoning behind starting in 2010 (rather than its earliest observation) isn't clear.

P. 863, L. 26- P. 864, L. 1: How were the brightness and contrast controlled? Were there limits set for detectability? What imagery software was used? This may have been mentioned elsewhere, but it should be included here in this section regarding satellite observations.

P. 864, L. 5-6: How do you differentiate between surface features and basal crevasses? Was radar used to determine the orientation of the basal crevasses?

P. 864, L. 8-11: Could you expand on the determination of the two Scenarios? Are there any other scenarios? Why are these the most likely? Here it would be relevant to discuss, perhaps, previous calving patterns of Larsen C. These scenarios are described as if they are test cases, but perhaps with more explanation of how they were determined, it would be more clear as to why these were chosen as the two likely scenarios.

P. 865, L. 10-22: Because this is a paper reporting the recent development of a rift, I

would expect a longer results section describing the rift activity and history, placing the current development into context. This paragraph highlights the point that I wanted to make above - it would greatly improve the manuscript as an observation paper to describe the actual observations in detail, rather than just giving a few quantitative values (e.g., 40 km yr-1 widening rate or 20 km in 8 months. . . what are these when placed in context?). Specifically in Line 11, what does 'modestly' mean? What observation led you to the conclusion that the rift 'previously appeared to resist transverse fractures'? This isn't clear. In Line 12, what quantitatively constitutes "dramatically"? Overall this section and the entire manuscript needs to be more focused on quantitative values - while the qualitative observation of it growth and the numerical modeling results are an interesting snapshot, it would be relevant to present these observations and modeling results in the context of quantitative observations.

P. 866: It would be great to enhance the discussion of the numerical model results as it appears to yield very interesting results! With such a model, many different scenarios could be investigated and discussed. Especially, though, it would be great to know more about the set up for the scenarios and the outcomes. Can/does the model show a change in velocity after calving in Scenario I/II/both? Is there any scenario where the velocity of the flow did not change? How does the stress around the rift itself appear? Does it change? Thinking about it from a non-modeling perspective, I would expect the rift to alter the stress field. Does it have any effect on the outcome in Scenario I or II?

P. 866, L. 22-24: Here it would be relevant to have a table or list of the rate per year. This would highlight the observed change in rate nicely, in addition to exhibit what is meant by "grown intermittently". I think a table of values for both rift length and rift width would be a great addition.

P. 866-867: Perhaps it is outside the scope of this manuscript (likely so), but the subject has me wondering, do the authors have a feeling for why this sudden increase in rift propagation rate occurred or why the rift suddenly jumped across a suture zone? This isn't covered much in the paper as it stands now, and it would be interesting to possibly

understand a little bit more about possible reasons for this sudden change, if any.

Figure 2: Though it might make the figure unwieldy, it would be neat to see the appearance of this region in Nov. 2010 in contrast to this image, so the reader could observe changes not only in the length/shape of the rift in question but also its neighbors. Also, would it be possible to label propagation rates on the plot? Additionally, I think the Dec 2012 label should be Dec 2013?

Interactive comment on The Cryosphere Discuss., 9, 861, 2015.