The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-86-RC1, 2017

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "Spatial and temporal variability of water-filled crevasse hydrologic states along the shear margins of Jakobshavn Isbrae, Greenland" *by* Casey A. Joseph and Derrick J. Lampkin

Anonymous Referee #1

Received and published: 3 August 2017

This paper explores potential relationships between the presence or absence of water-filled crevasse groups along the Jakobshavn glacier, and (1) air temperatures, (2) strain rates at the ice sheet surface, and (3) calving front position. No clear relationship is found with these three quantities, although hints of signals may be present that the authors pursue.

The novel contribution of this paper is, then, the dataset for the presence or absence of ponded water for the seven crevasse groups studied. This dataset was begun by Lampkin et al (2013) for the year 2007, and here has been extended from 2000 to 2015.

Printer-friendly version

Discussion paper

Indeed, the authors state that their objective is the collection of this binary dataset, which is the most comprehensive dataset available for this topic (Section 1.1). Yet the data are not fully presented. For instance, instead of plotting a time series of “full” / “drained” for each crevasse group, the authors plot histograms and box-and-whisker plots of monthly averages, which obscure the data by overly summarizing it. While this does not seem like an egregious violation of an openly-sharing data philosophy that The Cryosphere may have, it does feel like the authors are holding their cards unnecessarily close, which makes it difficult to engage with the material and evaluate the hypotheses presented. There is some value in histograms and statistical plots, but these should be presented alongside a full plot of the dataset, not instead of it.

For instance, the paper might be substantially improved with the addition of a few time series of “full” / “drained”, with time series of the other variables (air temperature, strain rate, and calving front position) superimposed. This is approximately done in Figure 5, but because the data are limited to yearly totals or averages, a limited amount of information can be gleaned. Repeating the analyses in more detail and presenting them in full detail is a primary recommendation.

Another considerable shortcoming within this work is an immature treatment of event detection. At several points, the authors rightly declare the likely conflict between the sparsity of observations in the early part of the study (2008 and before) and the lower number of drainage events observed then. Figure 2a shows the considerable range in number observations over time, and this is valuable. Yet the authors still speculate on the possible causes (e.g. increased air temperatures, Section 4.3) of the apparent increase in drainage rate since 2006, and note the apparent decrease in the movement of the calving front over time (Section 4.5). This was irresponsible, given the limitations of the drainage dataset. I recommend assessing whether the apparent increase in the number of drainage events in recent years is real, following analytical techniques from any upper-level statistics text.

Finally, the recent paper by Everett et al (2016) is missing from this manuscript. That

work studied a very similar phenomenon on Helheim and was able to make a conclusion about what drives the drainage of water-filled crevasses on that glacier. Consideration and comparison of Jakobshavn to that system could add some good science here, but at the very least, needs to be included as it is the only other group, to my knowledge, studying this phenomenon.

For these reasons, I do not recommend publication at this time. With more work, the authors should be able to continue the analysis and complete their presentation of their dataset to create a future manuscript on this topic potentially worthy of publication in The Cryosphere.

Specific points

P1 L17 and elsewhere Strain rates of 1.2 /second are very high, more like a putty or a lava flow than a glacier. The correct unit is probably /year, this should be checked.

P3 L7 Google Earth is not a satellite

P3 L8 Some elaboration on how the 7 data sources "offset the relative performance limitations" of each other is required. As far as I can tell, it just results in a denser time series.

P3 L20 The NSIDC velocity dataset used here has approximately 11-day temporal resolution for Jakobshavn, yet only yearly strain rates are obtained and presented. This puzzled me greatly. Certainly much more can be learned with the level of detail available in this dataset. Why was the choice to analyze only on a yearly level made? This should be explained.

P4 L1 More detail is needed in the methods for identification. Is the method for detection of "filled" or "drained" automated or manual? What are the thresholds? Are any "in-between" states observed, and how would they be classified?

P4 L11 These data are posted at 100 meter resolution, yet the crevassed areas appear to be considerably larger than that. How are the strain rate data interpolated and/or

smoothed to account for this?

P5 L16 “multi-drain event” should be defined

P6 L28 How is the calving front tracked? (Data source, analysis techniques, presentation of data.) I was surprised to see a very smooth curve for calving front position Figure 6, as usually they are very jagged.

P7 L11 The discussion section should be better organized (it is currently one 60-line paragraph!) and extent the specific results into general conclusions. The literature review on hydrofracture does not belong here. This section was very difficult to follow and needs a lot of work.

Figure 1 Adding velocity contours or elevation contours would give a better sense of where the crevasse groups are located within the glacier system. The scale bar is too small and the color is very hard to read.

Figure 3 could be combined into Figure 2a, or better yet the y-axis here could be the percentage of time that a crevasse group was filled or drained.

Figure 4 Are the pattern groups identified here meaningful or discussed elsewhere in the manuscript?

Figure 5 This shows that 2012 was one of the coolest years on record. I am skeptical of this because 2012 is well known as a very big melt year.

Figure 6 Why is the calving front position so smooth? This cannot be correct (see comment above) and is not explained.

References

Everett et al, 2016. Annual down-glacier drainage of lakes and water-filled crevasses at Helheim Glacier, southeast Greenland. Journal of Geophysical Research

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-86, 2017.