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Interactive comment on "Characterizing supraglacial lake drainage and freezing on the Greenland Ice Sheet" *by* N. Selmes et al.

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Selmes et al (2013) have completed a thorough and rigorous documentation of the location, size and mode of cessation of Greenland Ice Sheet supraglacial lakes. This paper will be a valuable addition to the rapidly expanding publication list on GIS supraglacial lakes. There are two very recent publications that were likely not published yet at the time of submission that will have to be referenced Howat et al (2013) and Johansson et al (2013). Neither of those studies is as expansive an inventory. Most previous studies have not focused on a comprehensive examination of the mode of drainage or refreezing of supraglacial lakes. This required use of the daily MODIS imagery. The tracking of interannual variation of lake behavior is a simply fascinating aspect as well. The comments below are minor.

Many thanks to Professor Pelto for the review and comments, we have added several references to the papers you suggested, and we have addressed your specific comments below. Our responses are always in italics.

Specific Comments:

483-11: Box and Ski (2007) noted several fast draining lakes that drained several times during the same melt season. Was this observed in your examination, if so, how was this dealt with? This may not be the best location to address this.

We did not observe this phenomenon in our data. We focussed our attention on how a lake ceased to be in our dataset at the end of a melt season which may explain this. However given that we spent a considerable amount of time just with the time series of images we would have thought we would have noticed this if it was at all common. We'd be interested to know if any field observations of this phenomenon exist, and it could form the basis for an interesting paper for someone.

484-13: It is noted that more lakes refroze in 2006 and that was not surprising. Johansson et al (2013) note a specific number of melt days (40 melt days, +-18 days) needed to initiate a lake which would be worth citing here.

Done, also many other references to Johansson's work added elsewhere in the paper.

484-20: At one of the locations where the lack of SE lakes is mentioned, it should be noted the very different width of the ablation zone in that sector as seen in Van den Broeke et al (2009). The combination of the steeper balance gradient and that the southeast has a much higher surface gradient is certainly one reason for this.

Done

485-5: Should provide some quantification in the text of typical lake duration for the various classes from Figure 7 here. Compare these to the duration's of Johansson et al (2013) for their examination of a selected region. The duration should also be compared to Sundal et al (2009) who examined lakes at lower elevations in three study

areas.

Done, we've also generally increased the depth of analysis of the duration data, and the discussion surrounding it, especially with regard to previous work. We've also binned our data using the same elevation bands as both Sundal and Johansson to help put our results in the context of that previous work, with the same bands applied for the other parts of the ice sheet as well.

486-29: Should it be noted that fractures would be restricted in zones of compressive stress?

Done, however both Krawczynski et al. (2009) and Doyle et al. (2013) found that lake drainage could occur in a compressive stress regime. We have clarified this as well.

This deserves more analysis. The sentence is not clear. Howat et al (2013) show a rising trend in the highest elevation of lakes which should be referenced. There Figure is also useful in illustrating the ELA versus these lakes. For Figure 5 what is the median or mean refreezing lakes elevation versus the ELA. Howat et al (2013) used the highest 5% of the lakes to find maximum elevation of lakes. However, your study can provide a different measure that may have value that is the elevation above which say 90% of the lakes refreeze.

We've made an effort to place our paper in the context of Howat's work and we've also considerably expanded both the results and discussion sections referring to the differences in elevation between lake types. We have put our results in the context of the ELAs reported in Howat's paper in our discussion.

488-19: Local lakes that drain in a similar time frame, if they do not share the same fracture system, could be in the same stress environment experiencing the same weather conditions leading to fracture development and propagation.

We've included this in our discussion, thank you.

Figure 5: Contours need to be labelled the mean ELA should also be identified

Done.

Doyle, S. H., Hubbard, A. L., Dow, C. F., Jones, G. A., Fitzpatrick, A., Gusmeroli, A., Kulessa, B., Lindback, K., Pettersson, R., and Box, J. E.: Ice tectonic deformation during the rapid in situ drainage of a supraglacial lake on the Greenland Ice Sheet, The Cryosphere, 7, 129–140, 25 doi:10.5194/tc-7-129-2013, 2013.

Krawczynski, M. J., Behn, M. D., Das, S. B., and Joughin, I.: Constraints on the lake volume required for hydro-fracture through ice sheets, Geophys. Res. Lett., 36, L10501, doi:10.1029/2008GL036765, 2009.

Interactive comment on The Cryosphere Discuss., 7, 475, 2013.