The Cryosphere Discuss., 7, C279–C282, 2013
www.the-cryosphere-discuss.net/7/C279/2013/

The Cryosphere Discussions

Interactive comment on "Influence of supraglacial lakes and ice-sheet geometry on seasonal ice-flow variability" *by* I. Joughin et al.

M. Pelto

mauri.pelto@nichols.edu

Received and published: 7 April 2013

The comments below are suggestions for adding value to what will be a fine paper. Joughin et al (2013) provide a spatially important data set on glacier velocity during two years on a Greenland outlet glacier. The data set provides a unique perspective compared to the temporally rich, spatially poor data sets. The data sets value is in its ability to address two key questions from this perspective. 1) Sundal et al. (2011) posed a central question is melt-induced speed-up of Greenland ice sheet offset by efficient subglacial drainage? 2) How does the seasonal progression of velocity vary with co-alignment or non-alignment of bed and surface gradients? The lack of attention to the first question is a significant issue that needs to be addressed. The authors focus more attention on the enhanced flow, versus the late melt season slowdown.

The significant late summer flow reduction that has been observed by Sundal et al. (2011), Bartholomew et al (2010), Sole et al (2011), Ahlstrom et al (2013). This data set provides an opportunity to compare the net velocity effect of each. The analysis here avoids contrasting the magnitude of the enhanced speed up and the following slow do. To what degree do they offset? Sole et al (2011) note that after GIS outlet glacier ice motion increased above background for up to 2 months, that ice flow at all sites decreased to below background. The second question is relatively well addressed.

This paper suffers from organizational confusion with the results and methods mixed together as well as the results and discussion. The first page (1104) of results is all methods for example, whereas the last paragraph that begins on 1105 is all results.

1103-17: Equally as notable as enhancements is the sharp flow reduction that has been observed Sundal et al. (2010), Bartholomew et al (2010), Sole et al (2011),Ahlstrom et al (2013).

1105-27: The drainage speed coloration is hard to see in Figure 2. Should provide better quantification of the number of lakes that drain quickly versus those that do not. How many drained fast both in 2009 and 2010?

Figure 2: Contains an impressive amount of data on lake size, the number of streams that end in moulins versus crevasses etc. A table that quantify pond area, duration and type would be informative.

1106-22: This annual minimum is what percent below the peak flow?

1107-10: A graph of the change in velocity with time at specific points such as GPS North and South would be useful to better illustrate the temporal changes, such as the series of figures in Ahlstrøm et al. (2013) for GPS locations on specific glaciers.

1107-29: In comparing the enhanced flow early melt season flow to the later melt season reductions, to what extent do they offset?

1108-19: Is this explanation of more widespread impact more pronounced where the

surface and bedrock gradient are not aligned?

1109-1: This is data descriptive and should be in results.

1110-5: Does any of the data allow quantification of this difference of maintaining higher basal water pressures, such as a reduced rate of velocity reduction after the peak?

1110-13: Though locations where surface water is routed transverse to ice flow can be seen in Figure 2, a figure focusing on identifying such regions would be of value.

1110-16: Where bedrock and surface gradients are aligned is the period of enhanced flow prolonged or does it end earlier? Is the period of reduced flow different? This is a key observation of this paper that is unique. The varied impact of velocity response with the different relationship of surface and bedrock gradient relationship and should be explored in more quantitative detail.

Ahlstrøm, A. P., Andersen, S. B., Andersen, M. L., Machguth, H., Nick, F. M., Joughin, I., Reijmer, C. H., van de Wal, R. S. W., Merryman Boncori, J. P., Box, J. E., Citterio, M., van As, D., Fausto, R. S., and Hubbard, A.: Seasonal velocities of eight major marine-terminating outlet glaciers of the Greenland ice sheet from continuous in situ GPS instruments, Earth Syst. Sci. Data Discuss., 6, 27-57, doi:10.5194/essdd-6-27-2013, 2013

Bartholomew, I., Nienow, P., Mair, D., Hubbard, A., King, M. A., and Sole, A.: Seasonal evolution of subglacial drainage and acceleration in a Greenland outlet glacier, Nat. Geosci., 3, 408–411, doi:10.1038/Ngeo863, 2010.

Sole, A. J., D. W. F. Mair, P. W. Nienow, I. D. Bartholomew, M. A. King, M. J. Burke, and I. Joughin(2011), Seasonal speedup of a Greenland marine-terminating outlet glacier forced by surface melt–induced changes in subglacial hydrology, J. Geophys. Res., 116, F03014, doi:10.1029/2010JF001948.

Sundal, A. V., Shepherd, A., Nienow, P., Hanna, E., Palmer, S., and Huybrechts, P.:

Meltinduced speed-up of Greenland ice sheet offset by efficient subglacial drainage, Nature, 469, 521–524, doi:10.1038/Nature09740, 2011.

Interactive comment on The Cryosphere Discuss., 7, 1101, 2013.