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The Cryosphere Discussions

Interactive comment on "Reduced glacier sliding caused by persistent drainage from a subglacial lake" *by* E. Magnússon et al.

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Magnússon et al. (2009) provide a unique and important data set that provides key insights into the connection between glacier velocity and subglacial drainage networks for an ice cap outlet glacier. In this case the variable hydrology is the result of the changing activity of the Grímsvötn Volcano. The following comments are mainly a series of questions that would further illuminate and likely implicate the role of subglacial drainage in the observed velocity reduction.

566-5 and Figure 3: The velocity rate on transect I remains low for the entire study period versus during the pre- jökulhlaup period;however, the velocity is consistently increasing. Does this signal an evolution of tunnel drainage system back towards a distributed drainage system? If so how long will this take? For transect II velocities

returned to pre- jökulhlaup values by 2000. Does this reflect a quicker transition in sub-glacial drainage, or that less of a distributed drainage system existed in this region initially? If the former is true is the quicker transition due to greater ice velocities and ice thicknesses?

567-8: Is there any discharge estimates for the outlet stream or is this braided system to difficult to monitor?

569-1: Winter conductivity provides a fingerprint for leakage conditions, are any values available for pre-1996 when a different subglacial drainage network existed? I would like to see more conductivity data if it is available.

Figure 5: Shows water accumulation rates in Grímsvötn. A table or figure is needed that focuses on the leakage rate determined for the same time periods, not just the accumulation rate. The leakage rate is the key focus of the paper.

Magnússon et al., (2005) indicate a large ice balance transfer between 1986 and 1998 into the region of 1500-1300 m from further upglacier, as determined by surface elevation changes. This suggests enhanced flow in the upper region of the glacier prior to and or during the jökulhlaup period. Is this important to the following velocity reduction at transect I and the shortened duration of velocity reduction at transect II? Is the reduced surface elevation gradient that resulted important? Since 1998 how has the surface elevation evolved? If it is a slow thickening is this not would be expected do to reduce velocities and a tunnel drainage system?

In January 1997 ice flow observed to flow into the Gjalp Cauldron at 0.08 m/day-0.25 m/day (Gudmundsson, 1997) Is this a local short term phenomenon that does not impact the longer term velocity reduction on transect I?

Gudmundsson (1997) and Aldsdorf and Smith (1999) identify velocities not altered regionally across the ice cap by the Gjalp event. Were these studies to broadly focused on overall ice cap velocities to note the significant declines? Gudmundsson (1997)

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also note the development of the tunnel drainage network did not induce widespread sliding during the eruption phase. Clarify that it is this same system that has remained developed in the upper reach of the glacier.

Interactive comment on The Cryosphere Discuss., 3, 561, 2009.