Geophysical Research Abstracts
Vol. 18, EGU2016-2838, 2016
EGU General Assembly 2016

Modeling of subglacial water pressure on Russell glacier, toward a better understanding of the relation between meltwater availability and ice dynamics.

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Basal sliding is the main control on outlet glaciers velocity. This sliding is mainly driven by the water pressure at the base of the glaciers. The ongoing increase in surface melt of the Greenland Ice Sheet warrants an examination of its impact on basal water pressure and in turn on basal sliding. Here, we examine the case of Russell glacier, West Greenland, where a remarkably extensive set of observations have been gathered. These observations suggest that the increase in runoff has no impact on the annual velocity on the lower part of the drainage basin, but yield an acceleration of ice flow above the Equilibrium Line Altitude (ELA). It is believed that this two distinct behaviours are due to different evolutions of the subglacial draining system during and after the melt season. We use here a high-resolution new generation subglacial hydrological model forced by reconstructed surface runoff for the period 2008 to 2012 to investigate the possible causes of these distinct behaviours. The model results confirm the existence of two distinct behaviours of the subglacial water pressure, an increase in the mean annual water pressure at high elevation and a stagnation of these same mean annual pressures below the ELA. The increase in meltwater at the lower elevation leads to a more developed efficient drainage system and the overall steadiness of the annual velocities, but, at higher elevation the drainage system remains mainly inefficient and is therefore strongly sensitive to the increase in meltwater availability.