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Long term evolution of the subglacial water pressure on Russell glacier, a modelling approach.

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Basal sliding is the main control on land terminating 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. Our recently published study (de Fleurian et. al. 2016) is pointing to the fact that two different hydrological regimes exist under this glacier. Near the front of the glacier, the development of an efficient drainage system allows the water pressure to drop quickly at the end of summer and yields a stagnation of its annual-mean value. Conversely, further upglacier, the lack of an efficient drainage system leads to an increase of the mean annual water pressure throughout the years. This study left the question of the long term evolution of the subglacial hydrological system under a warmer climate. To answer this question we present here the results of longer simulations where runoff forcing is derived from a simple Positive Degree Day scheme scaled on the IPCC climatic scenarios. To get further insight from our subglacial hydrological model, we investigate the impact of the varying water pressure on modelled surface velocities.

Reference:
de Fleurian, B., M. Morlighem, H. Seroussi, E. Rignot, M. R. van den Broecke, P. Kuipers Munneke, J. Mouginot, C. J. P. P. Smeets, and A. J. Tedstone (2016), A modeling study of the effect of runoff variability on the effective pressure beneath Russell Glacier, West Greenland, J. Geophys. Res. Earth Surf., 121, 1834–1848, doi:10.1002/2016JF003842.