Local-scale modelling of a rapid lake drainage event on the Russell Glacier, SW Greenland

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The subglacial hydrological system of the Greenland Ice Sheet is affected during the summer melt season by inputs from moulins and from rapid lake drainage events. Such water inputs can directly cause variations in ice dynamics by lubricating the ice-bed interface. It is not yet clear how the basal hydrological drainage system responds to the sudden ingress of large volumes of meltwater, particularly for areas of the inland ice sheet. Knowledge of subglacial drainage system development is necessary if we are to predict the response of the ice sheet to increased basal water influx in a warming climate.

The aim of this study is to examine the subglacial hydrological development in the vicinity of a rapidly draining lake using a local-scale model (on the range of several km). Inputs to the model are calculated using field data gathered in summer 2010 from a field site located ~70 km from the ice margin of Russell Glacier, SW Greenland. Model inputs presented here include the lake drainage rate calculated from pressure transducer data and lake bathymetry measurements; basal topography from active seismic surveys; and subglacial material characteristics from amplitude vs. angle (AVA) seismic reflection analysis of a nearby subglacial basin site. Results demonstrate that lake drainage occurred in 1 hr 45 minutes with a maximum drainage rate of 3186.7 $m^3 s^{-1}$. AVA analysis reveals the presence of wet basal sediment underlying the ice sheet in areas near the lake drainage site. Initial model outputs are presented and the directions of future modelling of this lake drainage event are discussed.