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# Modelling the Evolution of Subglacial Hydraulic Pressures of Ice Sheets

**M. R. Karatay**, S. Zatsepin, N. R. J. Hulton

School of GeoSciences, University of Edinburgh (Nick.Hulton@ed.ac.uk)

The aim of the research is to better understand ice sheet evolution dynamics. One of the least understood components of glaciology are basal conditions, specifically a function which relates basal shear stress to basal thermodynamics and effective pressure. We provide predictions of basal water pressure under ice sheets as a consequence of basal and surface melt inputs. Our aim is to produce a model that will predict seasonal variability in the basal pressure field over appropriate spatial scales but which is tractable for long time integrations such that it can be coupled to large-scale thermodynamical ice sheet codes.

We describe subglacial meltwater dynamics using Darcy's type of flow in poro-elastic mediums with prescribed specific bulk permeability and poro-elastic compressibility. We solve the coupled water flux and pressure equations of poro-elastic theory numerically using a Crank-Nicolson scheme over a Cartesian grid with dimensionless governing equations. Model boundary conditions are ice thickness and bed-elevations from which glaciostatic pressure can be derived and the edge of the ice sheet is at atmospheric pressure. Inputs are the spatially and temporally variable meltwater discharges. Model outputs is the subglacial meltwater physical pattern, including water pressure and effective pressure distributions under the ice sheet.

With constant melt rates, the model predicts equilibrium pressure distributions. Numerical results agree well with analytical cases for simple 2D along-flowline models. The model also resolves seasonal input fluctuations and the consequent variations in basal hydraulic pressure. When driven with a truncated sinusoidal melt rate signal, the model predicts a lagged response in the meltwater and effective pressure field whose magnitude is dependent on the melt volumes.