Thermo-mechanically coupled, prognostic Simulations of Midtre Lovénbreen with a full Stokes model

Thomas Zwinger (1) and John C. Moore (2,3,4)

(1) CSC - IT Center for Science Ltd., Espoo, Finland (thomas.zwinger@csc.fi, +358 9-457 2302), (2) Arctic Centre, University of Lapland, Rovaniemi, Finland, (3) Thule Institute, University of Oulu, Oulu, Finland, (4) College of Global Change and Earth System Science, Beijing Normal University, China

Midtre Lovénbreen, Svalbard is an Arctic glacier with an extensive data set of geophysical measurements available spanning several decades. On the basis of these excellent observation records we set up a model for the digital elevation model (DEM) from the year 1977 in order to get diagnostic results with the full Stokes FEM code Elmer/Ice. The effect of superimposed ice formation as a contribution to the energy budget of the glacier is accounted for by the model. Motivated by the occurrence of pronounced anomalies of the velocity field in under determined parts of the DEM, a prognostic (transient) simulation forced by an averaged mass balance and surface temperature distribution with an integration time of 53 years starting from the diagnostic results was set up. The fact that the unphysical velocities were quickly damped out by an adaption of the free surface within the first timesteps of this prognostic run, leads to the conclusion that simulations based on DEM geometry are very sensitive to errors, which are present even in this well studied glacier. This presents certain obstacles with respect to the spin-up of simulations that start from DEM's.