Abstract

Storglaciären, a polythermal glacier in Lappland, northern Sweden, is a particulary well suited glacier for all types of model and process studies thanks to a wealth of available data.

The content of liquid water in temperate ice is important for the flow of glaciers as well as for the stability of the thermal layering in polythermal glaciers (Pettersson et al., 2004). One of four possible sources for liquid water is melting due to strain heating. In this diploma thesis, strain heating in the temperate layer of Storglaciären is calculated. Following this, the water content due to strain heating is assessed along the cold-temperate transition surface. A mean value of $0.0006\,\mathrm{kg_w/kg}$ in the proximity of three thermistor strings is presented which complies with a rough estimate of $0.001\,\mathrm{kg_w/kg}$ by Pettersson et al. (2004) for the same region.

A second order ice flow model was used to calculate velocity fields. The results yield much higher velocities throughout the entire glacier compared to first order model results. A dependence of the rate factor on the numerical order is assumed. Additionally, the zero surface traction boundary condition was reproduced worse. A hidden error in the program code is suspected. Due to the need for a velocity field as close to observed surface data as possible, an novel approach was chosen: The rate factor was allowed to vary in longitudinal direction. The model was tuned in a way such that it reproduces surface velocities in close agreement with prescribed surface velocities. Flow lines were calculated and the melt water production due to strain heating assessed.

Tests with an alternative basal velocity boundary condition suggest the existence of a temperate, but dry zone within the glacier.