Present-day simulations of Vestfonna ice-cap (Svalbard) with Shallow-Ice and Full-Stokes models

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Svalbard is an archipelago in the Arctic Ocean. Nordaustlandet is the second largest island in the archipelago. The island has two major ice-caps: Austfonna and Vestfonna. These ice-caps on Nordaustlandet represent one of the largest ice-covered areas in the Eurasian Arctic.

In the current project we focus on a present-day simulation of the Vestfonna ice-cap. In this case the Vestfonna and Austfonna ice-caps can easily be modeled separately since the two ice-caps are currently not connected. In a latter step once the dynamics of these ice-caps is better understood, prognostic simulations over the last 120 ka including both ice-caps together will be conducted.

Our main goals are to compare different types of ice-models (Shallow-Ice and Full Stokes models) as well as to gain a better understanding of the occurrence of basal sliding.

Even though low temperatures and low balance gradients generally result in low flow rates on the glaciers of Svalbard, the Vestfonna ice-cap is characterized by fast-flow regions (velocities over $100 \frac{m}{yr}$). The importance of sliding in these regions is shown and a Weertman sliding law is adjusted to reproduce the present-day velocities as obtained from measurements.

In this first step regions where sliding is important are identified from surface characteristics like crevasses with the help of satellite or air-photos. Then, this purely geometrical definition of sliding regions, will be extended to a criteria based on ice-temperature or water-content for prognostic simulations.

The models used are a Full Stokes Finite Element Model (Elmer) as well as a Shallow-Ice approximation model (Sicopolis). Both model outputs as well as present-day measurements will be compared.

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References:
Elmer: http://www.csc.fi/english/pages/elmer
Sicopolis: http://sicopolis.greveweb.net/ (Ralf Greve)
Kinnvika: http://www.kinnvika.net/