Geophysical Research Abstracts
Vol. 16, EGU2014-2325-1, 2014
EGU General Assembly 2014

Climate sensitivity of Abrahamsenbreen (northern Spitsbergen)

Johannes Oerlemans and Ward Van Pelt
Utrecht University, IMAU, Utrecht, Netherlands (j.oerlemans@uu.nl)

The climate sensitivity of Abrahamsenbreen, a 20 km long surge-type glacier in northern Spitsbergen, is studied with a simple glacier model. A scheme to describe the surges is included, which makes it possible to account for the effect of surges on the total mass budget of the glacier. A climate reconstruction back to 1300 AD, based on ice-core data from Lomonosovfonna and climate records from Longyearbyen, is used to drive the model. The model is calibrated by requesting that it produces the correct late-Holocene maximum glacier length and simulates the observed magnitude of the 1978-surge.
We make a comparison of the glacier evolution with and without regular surges. The main effect of a surge is to lower the mean surface elevation and to increase the ablation area, thereby causing a negative perturbation of the mass budget. When the surging mechanism is switched off, long-term mean glacier length increases by typically 10%.
Abrahamsenbreen is strongly out of balance with the current climate. If climatic conditions will remain as they were for the period 1989-2010, the glacier will ultimately shrink to a length of 8 km (but this will take hundreds of years). For a climate change scenario involving a 2 m per year rise of the equilibrium line from now onwards, we predict that in the year 2100 Abrahamsenbreen will be about 14 km long.
Because of the very small bed slope, Abrahamsenbreen is sensitive to small perturbations in the equilibrium-line altitude E. For a decrease of E of only 60 m, the glacier would steadily grow into the Woodfjorddalen until after 2000 years it would reach the Woodfjord and calving could slow down the advance.
Our study once more underlines the extreme sensitivity of the large and gently sloping Svalbard glaciers to climate change.