Geophysical Research Abstracts
Vol. 19, EGU2017-7246, 2017
EGU General Assembly 2017

Present-day dynamics and future evolution of the world's northernmost ice cap, Hans Tausen Iskappe (Greenland)

Harry Zekollari (1,2), Philippe Huybrechts (1), Brice Noël (3), Willem Jan van de Berg (3), and Michiel R. van den Broeke (3)

(1) Earth System Science & Departement Geografie, Vrije Universiteit Brussel, Brussels, Belgium (Harry.Zekollari@vub.be), (2) Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zürich, Zurich, Switzerland, (3) Institute for Marine and Atmospheric research Utrecht, University of Utrecht, Utrecht, the Netherlands

In this study the dynamics of Hans Tausen Iskappe (western Peary Land, Greenland) are investigated with a coupled ice flow – mass balance model. Precipitation is obtained from the Regional Climate Model RACMO 2.3 and the surface mass balance is calculated from a Positive Degree-Day runoff/retention model, for which the input parameters are derived from field observations. For the ice flow a 3-D higher-order thermo-mechanical model is used, which is run at a 250 m resolution. Under 1961-1990 climatic conditions a steady state ice cap is obtained that is overall similar in geometry to the present-day ice cap. Ice thickness, temperature and flow velocity in the interior agree well with observations. For the outlet glaciers a reasonable agreement with temperature and ice thickness measurements can only be obtained with an additional heat source related to infiltrating meltwater.

The simulations indicate that the SMB-elevation feedback has a major effect on the ice cap response time and stability. This causes the southern part of the ice cap to be extremely sensitive to a change in climatic conditions and leads to thresholds in the ice cap evolution. Under constant 2005-2014 climatic conditions the entire southern part of the ice cap cannot be sustained and the ice cap loses about 80% of its present-day volume. The future projected loss of surrounding permanent sea-ice and corresponding potential sharp precipitation increase may however lead to an attenuation of the retreat and even potential stabilization of the ice cap for a warming of up to 2-3°C. In a warmer and wetter climate the ice margin will retreat while the interior is projected to grow, leading to a steeper ice cap, in line with the present-day observed trends. For intermediate (+4°C) and high warming scenarios (+8°C) the ice cap is projected to disappear respectively around 2400 and 2200 A.D., almost irrespective of the projected precipitation regime and the simulated present-day geometry.