SVALGLAC - The Netherlands

Report of Dutch activities on Svalbard, and related work, 2012.

Carleen Reijmer[1], Ward van Pelt[1], Veijo Pohjola[2], Rickard Petterson[2], Jack Kohler[3], Jon Ove Hagen[4], Thorben Dunse[4]

[1] Institute for Marine and Atmospheric research Utrecht (IMAU), Department of Physics and Astronomy, Science Faculty, Utrecht University, The Netherlands.
[2] Department of Earth Sciences, Uppsala University, Sweden.
[3] Norwegian Polar Institute (NPI), Tromsø, Norway.
[4] Department of Geosciences, Faculty of Mathematics and Natural Sciences, University of Oslo, Norway

The Dutch activities on Svalbard are part of ongoing research, which started in spring 2006 as part of the IPY initiative *the dynamic response of Arctic glaciers to global warming* (GLACIODYN). All activities are in cooperation with international partners. The key contacts are listed above.

From 9 to 22 April 2012 a team from IMAU, Uppsala University, and the Geological Survey of Denmark and Greenland (Geus), Denmark, carried out fieldwork on Nordenskiöldbreen, Svalbard. The fieldwork existed of replacing the IMAU GPS instruments that measure stake locations year round from which time series of glacier velocity can be derived. The stake locations were also measured with DGPS instruments for precision annual velocity determination and the stake height for the annual mass balance. The two GPSs located closest to the front were replaced by one Argos transmitting GPS. Since 2009 an Automatic Weather Station (AWS) is located on the central flow line of the glacier. The AWS was visited and data collected. Some repairs were carried out to remove problems related to moisture in the system during the melt season.

Other activities that were carried out on Nordenskiöldbreen were kinematic DGPS observations, high frequency snow radar profiling in order to determine surface height changes and accumulation patterns, deep radar measurements to improve the bedrock topography, snow pit observations of temperature, density and moisture content, ice core drilling in order to measure snow temperature and filming the layering in the core. Logistics consisted of transport of personnel and equipment by snowmobile and camp was made in a cabin close to the glacier front.

Other activities on Svalbard that included Dutch involvement where the replacement of Argos GPS on Kronebreen by NPI and the replacement of Argos GPS on Austfonna by University of Oslo. Especially the observations on the Austfona glacier Basin no3 are very interesting since they indicate the onset of a glacier surge (see Fig. 1).

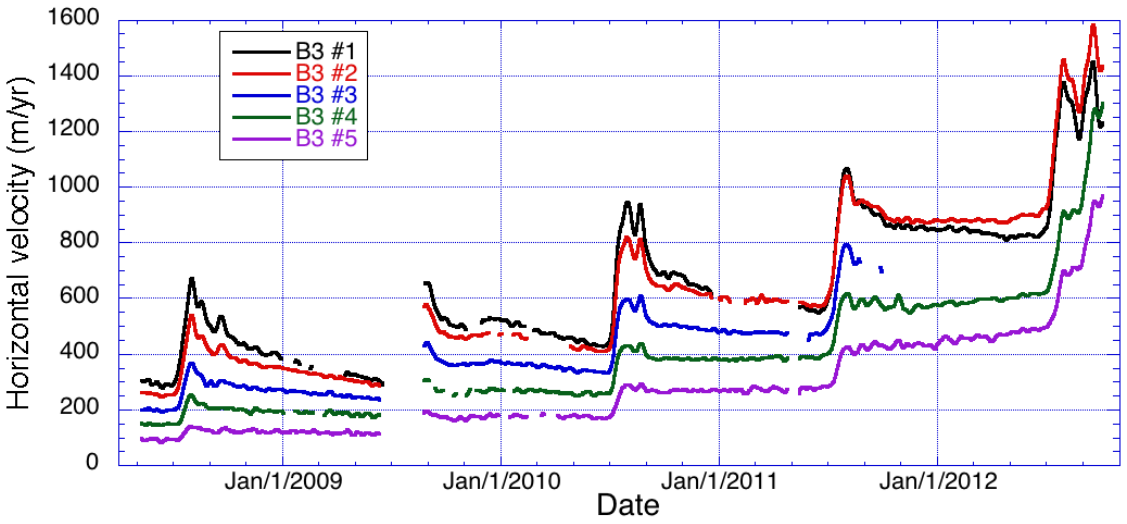


Figure 1. Flow velocities along the central flow line of Basin No3, Svalbard. Flow velocities are derived from displacement of 10 day filtered GPS positions and computed velocities.

Analyses of all data included calculating velocities from the GPS observations for Austfonna, Kronebreen and Nordenskiöldbreen as illustrated in Figure 1 for Basin No3 on Austfonna, calculation of annual mass balances for Nordenskiöldbreen, applying an energy balance model to the AWS data on Nordenskiöldbreen. The AWS data has also been used in validation studies for satellite products (MODIS) and regional Climate model output (WRF). A related project using the bedrock data of Nordenskiöldbreen as validation is the study in which a dynamical ice flow model (PISM) is used to determine bedrock topography based on surface elevation maps. Preliminary (unpublished) results of this study are illustrated in Figure 2.

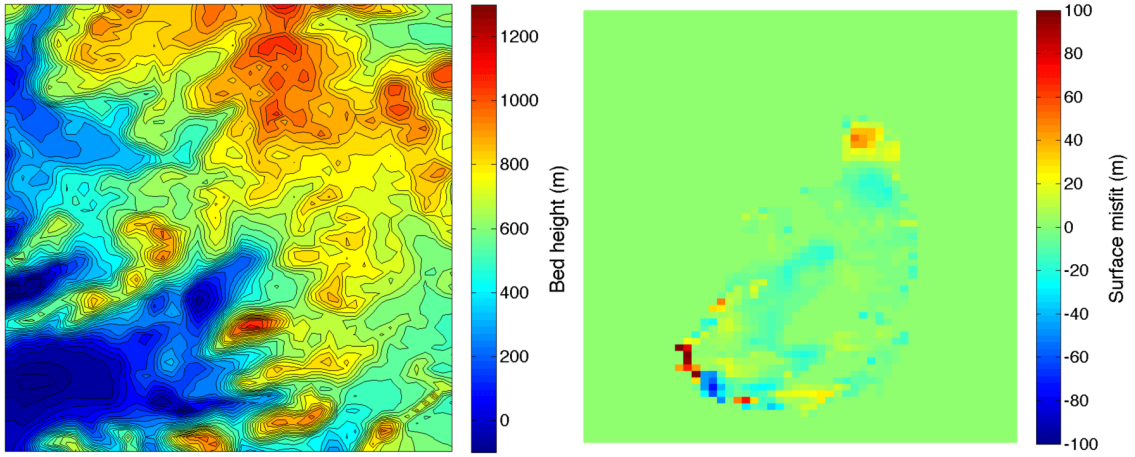


Figure 2. Bedrock topography of Nordenskiöldbreen as derived using a DEM and a dynamical flow model, PISM (left). Misfit between PISM calculated surface topography and the initial used DEM (right).

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Carlsson-Claremar, B., F. Obleitner, C. Reijmer, V. Pohjola, A. Waxegård, F. Karner, A. Rutgersson, 2012. Applying a mesoscale atmospheric model to Svalbard glaciers. Advances in Meteorology, 2012, doi:10.1155/2012/321649.

Dunse, T., T.V. Schuler, J.O. Hagen, and C.H. Reijmer, 2012. Seasonal speed-up of two outlet glaciers of Austfonna, Svalbard, inferred from continuous GPS measurements. The Cryosphere, 6, 453-466, doi:10.5194/tc-6-453-2012.
Van Pelt, W.J.J., J. Oerlemans, C.H. Reijmer, V.A. Pohjola, R. Petterson, J.H. van Angelen, 2012. Simulating melt, runoff and refreezing on Nordenskiöldbreen, Svalbard, using a coupled snow and energy balance model. The Cryosphere, 6, 641-659.
Østby, T.I., T.V. Schuler, J.O. Hagen, C.H. Reijmer and R. Hock, 2013. Parameter uncertainty, refreezing and surface energy balance modelling at Austfonna ice cap, Svalbard, over 2004-2008. Ann. Glaciol., 54(63A), in print.

Conference abstracts

Dunse, T., T.V. Schuler, J.O. Hagen, C. Reijmer. Seasonal and interannual velocity variations of two outlet glaciers of Austfonna, Svalbard, inferred by continuous GPS measurements. Workshop on the Dynamics and Mass Budget of Arctic Glaciers & the IASC Network on Arctic Glaciology, Zieleniec, Poland, 10-13 January 2012.
Dunse, T., A. Kääb, C. Nuth, G. Moholdt, T.V. Schuler, J.O. Hagen, C. Reijmer. Surge initiation or meltwater induced acceleration? Observations of a marine-terminating outlet glacier of Austfonna, Svalbard. International Symposium on Glaciers and ice sheets in a warming climate, University of Alaska Fairbanks, Alaska, USA, 24 - 29 June 2012.
Dunse, T., A. Kääb, C. Nuth, G. Moholdt, T.V. Schuler, J.O. Hagen, C. Reijmer. Surge activity and meltwater induced acceleration of a marine-terminating outlet glacier of Austfonna, Svalbard, and implication for the ice cap's mass balance. Tidewater Glaciers Workshop 2012, r/v Horyzont, Longyearbyen, Hornsund, Ny Ålesund, Svalbard, 26-31 August 2012.
Dunse, T., A. Kääb, T. Schellenberger, C. Nuth, T.V. Schuler, J.O. Hagen, C. Reijmer. Surge activity and meltwater induced acceleration of a marine-terminating outlet glacier of Austfonna, Svalbard, and implication for the ice cap's mass balance. IGS Nordic Branch Meeting 2012, Stockholm, Sweden, 25-27 October 2012.
Reijmer, C.H., V. Pohjola and W.J.J. van Pelt. 5 Years of mass balance and velocity observations on Nordenskiöldbreen, Svalbard. Workshop on the Dynamics and Mass Budget of Arctic Glaciers & the IASC Network on Arctic Glaciology, Zieleniec, Poland, 10-13 January 2012.