

On the mass balance of Austfonna Ice Cap, Svalbard.

HAGEN J.O.¹, EIKEN T.¹, LOE E.¹, MELVOLD K.¹ and TAURISANO A.²

¹*Department of Geosciences, Faculty of Mathematics and Natural Sciences, University of Oslo, P.O. Box 1047 Blindern, 0316 Oslo, Norway.*

²*Norwegian Polar Institute, Polar Environmental Centre, N-9296 Tromsø, Norway*

Austfonna is a large Arctic ice cap of 8,200km² in the Svalbard archipelago. The ice cap is centered at 79.5 deg N, 25 deg E with elevation ranging from 0 to 800 m a.s.l. In connection to a CalVal-project for the new satellite CryoSat that will be launched by the European Space Agency in 2005 a series of investigations on the ice cap was started in spring 2004.

No direct measurements of the surface mass balance of the ice cap have ever been carried out. Net mass balance estimates have been done from shallow cores and detections of reference horizons from the Chernobyl fallout from 1986 [1]. Ground-based investigations of the snow accumulation distribution have been carried out by Ground Penetrating Radar profiles in 1999 and 2004. There are strong gradients in the snow accumulation across the ice cap with highest accumulation in the southern and eastern part of the ice cap. The winter accumulation varied between only about 200 mm to 800 mm water equivalents. Ground based differential GPS profiles across the ice cap have also been done in 1999 and 2004. In addition repeated laser profiles were carried out by NASA in 1996 and 2002 [2]. These surface altitude profiles indicate a thickening of the upper central part of the ice cap and a peripheral thinning. The net balance derived from shallow cores indicate, however, a balance close to zero. The different data sets of elevation changes, ground-based GPS and airborne laser, show same trends but different numbers. However, surface altitude changes alone must be used with care to assess the mass balance. The dynamics – i.e. the ice flux and the emergence or submergence velocity must be known. Many glaciers are not in dynamical balance with the current mass balance like surge type glaciers or glaciers with long response times.

References

- [1] Hagen, J.O., K. Melvold, F. Pinglot and J. A. Dowdeswell, 2003: On the net mass balance of the glaciers and ice caps in Svalbard, Norwegian Arctic. *Arctic, Antarctic, and Alpine Research*, 35(2), 264-270.
- [2] Bamber, J. L., W. Krabill, V. Raper and J. A. Dowdeswell (2004). Anomalous recent growth of part of a large Arctic ice cap: Austfonna, Svalbard. *Geophys. Res. Lett.* 31(12): doi:10.1029/2004GL019667.