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MASS BALANCE AND DYNAMICS OF AUSTFONNA ICE CAP, SVALBARD

Jon Ove Hagen (*Department of geosciences, University of Oslo, Norway*)

Thorben Dunse (*Department of geosciences, University of Oslo, Norway*)

Trond Eiken (*Department of geosciences, University of Oslo, Norway*)

Jack Kohler (*Norwegian Polar Institute, Norway*)

Geir Moholdt (*Norwegian Polar Institute, Norway*)

Thomas Vikhamar Schuler (*Department of geosciences, University of Oslo, Norway*)

Torbjorn Ostby (*Department of geosciences, University of Oslo, Norway*)

joh@geo.uio.no

The Austfonna ice cap (~7800 km²) in Svalbard is one of the largest ice caps in the Arctic. Studies have been conducted on 1) Surface mass balance 2) Elevation changes and 3) Dynamics; surge and calving.

The surface mass balance on Austfonna measured by glaciological method shows a slightly negative mean balance for the period 2004-2012. The interannual variability is large. The calving is important and gives 2.5 Gt/yr, or ca. 1/3 of the total ablation. The overall mass balance of the ice cap is thus negative, by ca. 3 Gt/yr or -0.4 m/yr w.eq.

The elevation changes on Austfonna derived from ground-based GPS, airborne lidar and ICESat data show a clear pattern of thickening in the interior of ca. 0.5 m/yr, and a thinning closer to the coast of 1-2 m/yr, indicating a large dynamic instability. The geodetic mass balance calculated from this elevation change data fits well to the direct measured on the surface.

Many outlets are of surge-type and a recent surge in Basin 3 resulted in a temporary tripling of the calving loss from the entire ice cap with c. 4.4 Gt calving loss from the basin during one year from May 2012 to May 2013. This has strong temporary implications for the mass balance of the ice cap. The development of the surge was monitored by continuous GPS since spring 2008 and showed a stepwise velocity change. We indicate that the surge development is enhanced by cryo-hydrological warming, processes also relevant for the ice sheet outlets.