Dynamic mass loss of North West Greenland

Morten Langer Andersen (1), Signe B. Andersen (1), Andreas P. Ahlstrøm (1), Lars Stenseng (2), Henriette Skourup (2), Steen S. Kristensen (2), Rene Forsberg (2), and Ian Joughin (3)

(1) Geological Survery of Denmark and Greenland, Copenhagen, Denmark, (2) Technical University of Denmark, DTU Space, Copenhagen, Denmark, (3) University of Washington, Polar Science Center, Seattle, USA

The Greenland Ice Sheet is losing mass at an accelerated pace. Presently, the mass loss is distributed approximately equally between loss in the form of surface melt (surface mass balance, SMB) and solid ice discharge (iceberg calving, D) along the margins. Detailed studies of the spatial distribution of D help us understand the mechanisms controlling this portion of the mass loss. As part of the PROMICE project, repeated airborne LIDAR and radar surveys were carried out along the entire margin of the Greenland ice sheet in the years 2007 and 2011, providing bed and surface elevation profiles. Using these profiles, we establish a flux gate along the flight path, passing through six North West Greenland drainage basins. With the ice thickness known we then estimate the solid mass flux passing through the flux gate in 2007 and 2011. To obtain a depth-averaged flow speed, the observed surface flow speeds were adjusted with respect to several different flow regimes defined by the ratio of a SAR-derived surface velocity to ice thickness and driving stress. To isolate D (i.e., the contribution to sea level rise from solid ice discharge at the coasts), SMB values for the areas between the gate and the grounding lines in the basins were obtained from a regional climate model. We compare the calculated mass losses between the two years integrated over the entire study area, but also on a basin-by-basin level to investigate internal redistribution of mass between the basins over time.