

Establishing mass balance observation at Austre Grønfjordbreen, Nordenskjöld land, Svalbard

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The Arctic archipelago Svalbard consists of a vast glacierized area which contributes significantly to the sea level rise outside of Greenland and Antarctica due to recent warming. The glaciers of Svalbard have already experienced an unprecedented increase in average summer temperatures, melt periods, and rainfall in late autumn and early summer.

Glaciers of the Nordenskjöld land were the subject of glaciological studies conducted through the Soviet scientific program at the Institute of Geography RAS, Moscow starting in the 1960s. However, with the collapse of the Soviet Union glaciological monitoring was stopped in the late 1980s. It was resumed in 2003 with direct observations of winter accumulation and summer melt at a number of glaciers in Nordenskjöld land. However, until now snow pit and stake data were inconsistent and were reported randomly.

Recent efforts by the Institute of Geography RAS have been aimed at establishing mass balance observation at Austre Grønfjordbreen (7 km²) located 16 km south of Barentsburg. Starting from 2014 observations have included a new ablation stake network of 15 stakes measured biannually, two automatic weather stations located at the glacier tongue and at the accumulation area, and annual high resolution GPR surveys of snow thickness together with snow pit measurements repeated every spring. Special attention has been paid to the evaluation of refreezing ice and superimposed ice distribution. Active layer (10 m) borehole temperatures are measured annually at stake locations. The obtained mass balance gradients are compared with the geodetic mass balance changes in 1990-2005 and recent Arctic DEM data. Additionally glacier bedrock, polythermal structure and surface topography maps have been completed using GPR data and DGPS measurements. All available satellite imagery has been used to reconstruct the snowline elevation changes from 1986 to 2016. Remarkably almost a total absence of accumulation area has been registered in recent years. Current plans are to apply a spatially distributed mass balance model to seasonal mass balance surveys.