Svalbard glaciers, mass balance and dynamics.

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Abstract

The most recent inventory of Svalbard glaciers show reduced ice masses and gives an area of 33 775 km^2 of glaciers covering 57% of the total land area of the archipelago. At present, 68% of the glacierized area of Svalbard drains through tidewater glaciers that have a total terminus width of ~ 740 km. The glacierized area over the entire archipelago has decreased by an average of 80 km^2 a^{-1} over the past ~30 yr, representing a reduction of 7 %.

Mass balance monitoring were started by the Norwegian Polar Institute in 1967 at two small glaciers in Kongsfjorden, North-West Spitsbergen. These have been extended to larger glaciers in the same region since 1986 and since 1988 Hansbreen in South Spitsbergen has been monitored. The mass balance time series are among the longest continuous data series from the Arctic. However, they cover only a small fraction (~2%) of the total glaciated area. The time-series show no clear trend and no recent increased melt-rate can be detected. The larger glaciers are in general more positive, since their accumulation areas are both higher and larger than the smaller glaciers. On all glaciers, summer ablation is more variable than winter accumulation, thus summer temperatures provide most of the control on the net balance.

Geodetic mass balance over entire Svalbard has been obtained by analysing the Ice, Cloud, and land Elevation Satellite (ICESat) data from 2003-2009. This shows that most glacier regions in Svalbard have experienced low-elevation thinning combined with high-elevation balance or thickening. The largest ice losses have occurred in the west and south, while northeastern Spitsbergen and the Austfonna ice cap have gained mass. The geodetic mass balance (excluding calving front retreat or advance) of Svalbard's glaciers was estimated to be -4.3±1.4 Gt/yr, corresponding to an area-averaged water equivalent balance of -0.12±0.04 m w.eq./yr .

Many glaciers are of surge-type and surges may alter the are/altitude distribution and for calving glaciers give a temporary increased mass loss. A recent surge in Basin 3 on Austfonna 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.