Monitoring of heat exchanges in the snowpack of Foxfonna glacier, Spitzbergen, Svalbard

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Popular Description

Refreezing of meltwater in snow and firn is known to have a major impact on the mass and energy budget of glaciers. In the Arctic, it is sometimes the primary accumulation process of some glaciers. It is a major heating process, as the refreezing of 1g of water releases enough latent heat to raise the temperature of 160g of snow by 1°C.

Superimposed Ice is a layer of ice formed by the percolation of meltwater onto the sub-zero temperature glacier ice. The meltwater can percolate and transfer heat deep into the snow and the firn cover, and even reach the glacier ice surface, where the refreezing removes some of the cold content of the ice by latent release. As a fraction of the meltwater remains captured in the snow, this process may buffer the sea level rise caused by the increased glacier melt. The processes of meltwater storage in firn and the impact of refreezing on firn-covered glaciers have been investigated on the Greenland ice sheet. On Svalbard, climate change promotes the disappearance of firn on glaciers. Gaining further knowledge about superimposed ice and the refreezing processes on a firn-free glacier is crucial for understanding and predicting the future of Arctic glaciers.

This thesis aims to monitor the heat exchanges through the snowpack on the firn-free Foxfonna glacier, Spitzbergen, Svalbard, over the melting season May-July 2021. Weather data were gathered, for multiple reasons. First, to link the weather conditions to the observed snow processes. Second, to model the snowmelt. The modelled results were compared with field data. The evolution of the snow processes as it melts was assessed by making snow pits and measuring temperature and density. The snow and the weather data reveals that the weather and snow conditions were not appropriate for the SI formation.