Project acronym: SNAP

Project title: Snow Accumulation Patterns on Hardangerjøkulen Ice Cap, using Geophysical Methods

Project leader: Emma Pierce, University of Leeds, UK

Discipline: Earth Sciences & Environment

Station(s): Finse Alpine Research Centre (Norway)

The project consisted of geophysical surveys on Norway's Hardangerjøkulen Ice Cap. Hardangerjøkulen snow accumulation has been the focus of recent studies researching the evolving supply of ice cap meltwater to the local hydrological system under warming climate conditions. Such predictions assume that the balance between snow accumulation and melt can be predicted with regional meteorological trends over Hardangerjøkulen, but recent geophysical surveys indicate a more complex distribution. In particular, ground penetrating radar (GPR) data acquired in 2017 show areas of Hardangjøkulen where snow may be preserved between successive summers, resulting in firn formation.

Accurate forecasts of meltwater supply require characterisation of both the consistency of snow distribution between years, and where firn is actively forming. A campaign of further geophysical surveys is proposed along targeted profiles on Hardangerjøkulen, to provide modelling initiatives with an mass balance record of unprecedented spatial detail and accuracy.

Our geophysical surveys are a combined application of GPR, repeating observations made in 2017, and novel seismic "full waveform inversion" methods. A GPR system will be towed behind a snowmobile, with data acquired along ~100 km line profiles over the Hardangerjøkulen ice cap. Where these reveal significant firn accumulation, seismic methods will be deployed to characterise the snow/firn density structure, itself validated against snow pit data. Data will be supplied to climate models currently under development with Norwegian project partners. Our project will be based at Finse Alpine Research Centre in April/May 2018.

The specific project objectives for the field work include imageing the varying patterns of snow accumulation across Hardangerjokulen through the use of seismic surveys and GPR. Establish field sites that provide seismic data that is suitable for the use of FWI for a successive field season in 2019.