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DISSERTATION TITLE: *Subglacial Hydrology and Subglacial Processes*

Vann har stor innvirkning på en isbres dynamikk. Raske variasjoner i breens bevegelser kan forekomme ved endringer av hydrologiske forhold både på, i og under breen. Vår forståelse av det subglasiale dreneringssystemet er basert på få observasjoner, ofte målt i korte tidsperioder fra overflaten på breen. I denne doktorgradsavhandlingen har to tiår med subglasiale målinger av trykket mellom berggrunn og is hele 200 meter under isen blitt analysert. Analysene fra det Svartisen Subglasiale Laboratorium i Nord-Norge viser at endringer i vanndreneringen under breen skaper flere typer av mekaniske prosesser mellom breen og underlaget.

Exploratory science: Understanding the response of the glacier bed by direct subglacial observations.

Scientists have a good understanding of processes at the glacier surface, but know comparatively nothing about what happens at the glacier base. What if you could actually go study under the ice?

In this thesis, PhD student Pierre-Marie Lefeuvre investigates the glacier response from a unique facility located below 200 metre of ice in a hydropower rock tunnel: the Svartisen Subglacial Laboratory. His research reveals that monitoring the subglacial hydrology and pressure from the glacier bed is like studying a negative image of water pressure measured in boreholes drilled from the surface. A statistical analysis of a 20-year pressure record shows that parts of the glacier hydrological system respond in opposite manner to meltwater input, even when they are a few metres apart of each other. The combination of observations and modelling of the glacier identifies that the ice itself causes the opposite response. The ice actually transfers pressure from subglacial water channels to the surrounding glacier bed, a mechanism called Load Transfer that has been widely overlooked. This Load Transfer is nevertheless crucial to understand as it explains the propagation of pressurisation from water channels to the whole glacier bed and affects the basal friction and so ice flow. This is not accounted for in glacier models, although it is thought to cause seasonal variations in dynamics of the Greenland ice sheet.

As the climate warms thus increasing meltwater input to the glacier bed, this thesis helps understand better the dynamic response of glaciers and ice-sheets to climate change.

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