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Assessing glacier-permafrost coupling from scratch: Thermokarst processes in an ice-cored moraine, Snøhetta, Dovrefjell, Norway

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Albeit often located in the same area and climatic zone, phenomena regarding permafrost and glaciers are often studied separately. Various landforms, however, express a clear interaction of these regimes, such as ice-cored moraines. Being of glacial origin, ice-cored moraines constitute a permafrost environment. Reworking by periglacial processes is often directed both by glacial meltwater impacts and freeze-thaw dynamics.

Aiming to seek a coupling element in a glacial-periglacial landscape, surface- and near-surface hydrology was considered along a basin featuring a polythermal glacier, a glacier lake and an ice-cored moraine complex at the north-eastern flank of the Snøhetta massif, Dovrefjell, South Norway. This study provides insight from very first field observations including a snapshot of spatial variability of stable oxygen isotopes as tracers along meltwater pathways combined with short-term observations of glacier lake dynamics by remote sensing.

First results suggest a periodical drainage of the lake along preferential subsurface pathways, with subsequent thermal erosion of the ice-core and the development of thermokarst structures within the moraine. This constitutes a spatially heterogeneous pattern and a division of the moraine complex in a stable, eastern part and a degrading, western part. Whether the ice-cored moraine provides a barrier or a pathway to meltwater exiting the glacier, is both determined by dynamics and patterns of glacial discharge and active layer depth within the moraine, suggesting a two-fold threshold for lake drainage.

The ice-cored moraine therefore provides an intriguing example of studying the transient glacier-permafrost interface in a changing climate.