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Towards a better understanding of rock wall thermal regime and stability in Norway

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Hazardous rock fall events caused by slope failure have drawn attention towards the physical processes that affect slope stability of rock walls. The stability of a slope is determined by the interplay between driving and resisting forces acting on the site. A typical scenario is a gravity driving force that is counteracted by friction and cohesion forces. The nature of these forces is dependent on a complex interaction between a range of factors, amongst them topography, rock mass quality and hydrology. Steep topography increases the gravitational driving force, while factors such as water pressure and discontinuities in the rock mass decrease the resisting forces. Hence, slope instabilities evolve in time and space and is dependent upon a range of factors influencing each other through feedback processes.

During the past century, the number of slope failures in the European Alps have increased, leading to an increasing focus on degrading permafrost as a possible factor for slope failure. Degrading permafrost might influence both the driving shear stresses and the resisting shear forces in frozen rock faces, causing changes in the force balance of the bedrock. Though degrading permafrost is considered to have an impact on the stability of rock slopes, the physical processes behind the causality are not fully understood.

For the Scandinavian mountains, a possible relationship between permafrost and rock slope stability is poorly investigated and understood. Many unstable rock faces have been mapped and some are surveyed, and in several locations temperature loggers monitor the ground thermal regime in steep slopes. It is evident that many unstable rock faces are situated in or close to the zone of mountain permafrost.

This project tries to contribute to the understanding of rock wall stability with respect to the influence of ground thermal regime and changing climatic conditions. A first goal of this study is to gain a better understanding of the sensitivity of the thermal regime in a rock slope. The presentations introduces a 2D finite element model used to investigate the sensitivity of the thermal regime. The results have been compared with data from data loggers for validation.