

Excursion of the Swiss Young Geomorphologists (SGmS)

Rock stability and the preservation of technical and tourist facilities at the Jungfraujoch

Challenges around infrastructures in a rapidly changing glacial
and periglacial environment

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The Young Geomorphologists' 2024 spring excursion took place at the Jungfrauoch, located in the Bernese Alps and known for its mountain rack railway arriving at 3454 m a.s.l., giving an entry point to a spectacular UNESCO World Heritage alpine landscape. The excursion was attended by 14 participants from the universities of Fribourg, Lausanne, Basel, and ETHZ. During this one-day excursion at the Jungfrauoch, we addressed some of the main issues related to the monitoring and maintenance of infrastructure built in high mountain environments with Dr. Pierre Dalban, geological engineer from GEOTEST AG, who gave us insights from the practical and technical perspective of working in high mountain environments. We also discussed the dynamics of mountain permafrost from a scientific perspective, including the challenges of data acquisition and monitoring in steep permafrost rock slope with Dr. Samuel Weber, scientific collaborator from SLF.

The excursion started at the "panorama point", where the weather hampered the group to profit from the panoramic view of the surrounding landscape (Fig. 1). Nevertheless, we discussed the shrinkage of the glacierized areas and its impact on the tourist infrastructures such as the maintenance and longevity of this facility.

Despite the difficult weather conditions encountered at the Jungfrauoch, we were able to see the mitigation measures in place, such as wire safety nets against rock falls at the *Aletsch-Ausgang* (title figure; Aletsch exit side). In the *Rundgang Stollen* (inside gallery), many anchors were placed to maintain rock stability and to preserve the technical and tourist facilities. Temperature loggers are also installed in this gallery and allow to monitor rock face temperature evolution.

Techniques to understand the processes and dynamics occurring in steep bedrock mountain permafrost were also addressed. For instance, the application of acoustic and micro seismic approaches allow to improve the understanding of frost cracking and rock slope movement, which can be used for early warning systems. Examples were given for the Matterhorn (Fig. 2).

Organisers

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Figure 1: Explanations on the impacts of glacier shrinkage on the infrastructures at the Jungfrauoch.



Figure 2: Explanations on the processes occurring in steep bedrock permafrost based on observations at the Matterhorn.