Continuous monitoring of electrical resistivity tomography in steep unstable Rock Walls – Insights from the MOREXPERT Project, Kitzsteinhorn (3.203 m), Austria

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ERT has been demonstrated as a powerful tool for monthly changes in permafrost rock walls. However, stability applications require high temporal resolution of changes in rock faces such as days and hours. Here, we investigate the feasibility of ERT in a steep rock wall to continuously monitor stability-relevant changes.

The investigated rock slope is a north-facing back wall of a glacial cirque and is underlain by permafrost.Over the last decades it has been affected by intense glacier retreat at the base and the complete loss of its ice cover. Several observed rock fall events indicate slope instabilities in the investigation area. The ERT profile is situated at an altitude between 2.965 and 3.017 m. It is 72 m in length and has an electrode spacing of 2 m. Stainless steel rock anchors were drilled into the bedrock (calcareous mica-schist) to ensure firm electrode-rock contact. Data acquisition runs fully automatic and is controlled via remote access.

Temperature data from shallow boreholes (0.8 m deep) located along the profile line is used to check the plausibility of measured near-surface resistivities. Data sets are recorded at four hour intervals which allows for quality checks of redundant measurements. Four hours is assumed to be the minimum interval at which changes greater than the measurement noise become evident and can be considered as a quasi-continuous monitoring. ERT data describes the seasonal development of the active layer very well but also demonstrates the influence of water flow along geological discontinuities and their influence on the ground thermal conditions.

Here we show, how ERT can be used to quasi continuously monitor changes in sensitive and unstable rock wall permafrost.