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Case study: Long-term permafrost evolution at the Schilthorn monitoring site, Swiss Alps, using electrical resistivity tomography (ERT) monitoring

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Permanently frozen ground is a very sensitive climate change indicator. A better understanding of mountain permafrost degradation implies a temporal and spatial permafrost distribution monitoring, which is of major importance regarding high mountain slope stability.

ERT is broadly applied in the context of permafrost. Subsurface resistivity temporal variations depend on temperature and pores content (ice, water or air). Several orders of magnitude discriminate the electrical resistivity of ice and water, allowing a distinction between frozen and unfrozen ground.

We focus this study on the Schilthorn permafrost monitoring site (Swiss Alps), which includes a 17-year discontinuous resistivity dataset, as well as temperature ground truth data available from 2 boreholes. Both apparent resistivity and inverted specific resistivity are analysed in space and time. A special effort dedicates to temporal resistivity changes comparison between different depth levels: from shallow (active layer) to deeper levels (permanently frozen ground). The effects of the 2003 and 2015 summer heatwaves are investigated in detail in comparison with in-situ air and ground temperatures at several depths.