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A database integrating the electrical resistivity data of Switzerland for mountain permafrost spatio-temporal characterisation

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In permafrost research, geoelectrical surveys are increasingly used to detect the presence and extent of permafrost and to characterise the stratigraphy and material composition of permanently frozen terrain. When repeated, the resulting temporal changes in electrical resistivity can be related to changes in ground temperature and ice content, and therefore also to ground ice loss over time. However, for financial and logistical reasons, only a few continuous electrical resistivity tomography (ERT) monitoring installations on permafrost exist worldwide. An alternative approach is manual but regularly repeated ERT measurements, such as - besides other examples - in the context of the Swiss Permafrost Monitoring Network (PERMOS, 2023). In contrast, there are many permafrost sites (estimated to be over 500 in Switzerland) where single ERT measurements have been performed in the past. In the context of atmospheric warming, these historical datasets can serve as a baseline for analysing current changes in ground ice content in permafrost regions and the associated challenges to mountain slope stability.

In this contribution, we present the analysis of the Swiss datasets, which are integrated in the International Database of Geoelectrical Surveys on Permafrost (IDGSP), led by the International Permafrost Association (IPA) Action Group of the same name. Before this initiative, geoelectrical datasets (mainly ERT) were not included in a common and dedicated database. Since the launch of

the IPA Action Group in 2021, a database has been designed and set up (using PostgreSQL), numerous metadata and data have been collected and homogenised, and public access via a searchable web map is available (https://resibase.unifr.ch). We present the strategy developed for consistent filtering, processing, and inversion for this extensive dataset. In this contribution, we analyse both spatial and temporal variations in surveys conducted at various Swiss mountain sites.

The overall goal is to establish a complete database of electrical measurements on permafrost in Switzerland, including all historical measurements. The data are re-processed with the newly developed filtering and inversion routines and made available to the public to facilitate the repetition of measurements in the context of permafrost degradation, geotechnical studies of permafrost stability, hydrological studies in the context of natural hazards and water availability from thawing permafrost environments, and to serve as a baseline dataset for permafrost distribution and modelling.

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