

The Cryosphere Discuss., community comment CC1
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Comment on tc-2022-207

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Community comment on "Identifying mountain permafrost degradation by repeating historical electrical resistivity tomography (ERT) measurements" by Johannes Buckel et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-207-CC1>, 2022

Seminal historical resistivity soundings on mountain permafrost

The interesting paper by Buckel et al. points to early electrical resistivity soundings in the Swiss Alps. Correct reference should thereby be made to Fisch et al. (1978; publicly available via ResearchGate). These early measurements constitute the first reported electrical resistivity soundings on viscous creep features in ice-rich mountain permafrost usually called rock glaciers, providing ground-breaking insights already at that time.

On behalf of the Grande Dixence power scheme, long profiles were measured by Werner Fisch, father and son, in the region of Prafleuri (1950s) and Kintole (1960) but only reported in a science context roughly two decades later. At Prafleuri, a deep excavation in ice-supersaturated frozen materials was also carried out, and specific profiles were measured at Kintole on top as well as underneath buried surface ice (cf. Figures 14 and 15 with text comments in Haerberli (1985)). The following were key results from these unique historical soundings and observations:

- Perennially frozen talus/debris in rock glaciers is very rich in ice with visible occurrences of excess ice.
- Such frozen materials have electrical resistivities in the medium to high $k\Omega m$ range.
- These resistivity values are clearly different from values in the high $M\Omega m$ -range measured elsewhere in ice of glaciers with a temperate/wet firn-ice metamorphosis.
- Usually thin debris-covered remains of small glaciers or ice patches can be embedded on top of much thicker masses of perennially frozen materials.

In the meantime, a large and steadily increasing number of geophysical soundings and drillings confirmed and continue to confirm these early findings. It is a special merit of the submitted paper to point to early sources of our knowledge and understanding.

References:

Fisch, W. sen., Fisch, W. jun. and Haerberli, W.: Electrical D.C. resistivity soundings with long profiles on rock glaciers and moraines in the Alps of Switzerland, *Zeitschrift für Gletscherkunde und Glazialgeologie* 13 (1/2), 239-260, 1978.

Haeberli, W.: Creep of mountain permafrost: internal structure and flow of Alpine rock glaciers. Mitteilung VAW/ETHZ 74, 1985.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2022-207/tc-2022-207-CC1-supplement.pdf>