New multi-phase thermo-geophysical model: Validate ERT-monitoring & assess permafrost evolution in alpine rock walls (Zugspitze, German/Austrian Alps)

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ERT setup to monitor permafrost change

Study-site: Zugspitze (German/Austrian Alps)

Here, multi-year (2007-today) monthly field dataset to evaluate:

(i) How well the ERT record in steep permafrost rock walls be matched with a thermal model?
(ii) How is permafrost affected by environmental factors in natural rock walls?

Yearly mean ERT-data (2016 vs. 2019)

$\Delta T = -0.7 \, ^\circ C$

Krautblatter et al., 2010

Schroeder et al., in prep.
Strategy to model thermal regime

**Input**

1. Meteorological data
   - Topographic data

2. Astronomical & meteorological parameters


4. (Non-)Turbulent heat fluxes

5. Ground surface temperature
   - Heat conduction + local influences

**Spatial-temporal thermal permafrost regime**

**Calculations**

Coupled thermo-geophysical model for conductive heat transfer in steep rock-wall permafrost/frozen rock, affected by seasonality & long-term climate change

**Preliminary model results**

Excerpt of main ERT-area

\[ \Delta T_{\text{ERT vs Model}} = 0.3 \, ^\circ \text{C} \]

Schroeder et al., in prep.
Thermal-spatial permafrost change can be acquired via ERT & reproduced by model

- We can reproduce natural rock temperatures in steep bedrock permafrost with ERT derived temperatures!

- We prove the applicability of the laboratory derived resistivity-temperature relationship for natural rock walls!

- We can validate ERT-measurements via a local high-resolution thermal heat flux model in steep bedrock permafrost!
References
