



## **Estimated ice and water contents from geophysical measurements, and their relationships to resistivity, seismic velocity and temperature in permafrost regions**

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In this study we apply the so-called 4-phase model (4PM) to several geophysical field measurements at permafrost sites in the Swiss Alps. The 4-phase model provides estimates of the volumetric fractions of subsurface ice, water and air content from tomographic electrical and seismic images. Porosity has usually to be prescribed.

The 4-phase model has so far only been tested at few study sites, often with high subsurface ice contents, such as rock glaciers and ice-cored moraines (Hauck et al. 2008, 2010). In this contribution we want to present a thorough sensitivity analysis of the model using resistivity and seismic P-wave velocities from a number of different surveys, as well as coinciding ground temperatures from boreholes. Where available, the model results will be compared with ground truth data of ice and water contents.

Finally, the reliability of estimations of the temporal evolution of subsurface ice and water contents will be analysed using time-lapse geophysical data and borehole temperature data.

### References:

Hauck, C., Böttcher, M. and Maurer, H. (2010): A new model for quantifying subsurface ice content based on geophysical data sets. *The Cryosphere Discuss.* 4, 787-821.

Hauck, C., Bach, M., Hilbich, C. (2008): A 4-phase model to quantify subsurface ice and water content in permafrost regions based on geophysical data sets. *Proceedings Ninth International Conference on Permafrost*, Fairbanks, Vol. 1, Kane D.L. and Hinkel K.M. (eds), Institute of Northern Engineering, University of Alaska Fairbanks, 675-680.