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# Time-lapse Seismic Tomography for Permafrost Monitoring at the Crest of Hoher Sonnblick (3106 m, Hohe Tauern, Austria)

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In the alpine realm the cryosphere (glaciers and permafrost) belongs to those areas which are most intensively affected by climatic change. As the retreat of glaciers since the Little Ice Age is clearly visible and well documented the distribution, thickness and ice volume of alpine permafrost is just sparsely known. This study focuses on the documentation of permafrost in the rock mass of the crest of Hoher Sonnblick and its reaction on climate change based on measurements of rock temperature and geophysical parameters.

The seismic tomography was conducted on a 2D-profile (120 m) crossing three 20 m deep boreholes at an interval of about 30 m. Seismic signals generated at the surface with a hammer were registered on 15 borehole geophones. From 2008 to 2009 four seismic data sets were collected in the months July and September. Rock temperatures were recorded continuously along various depths in the boreholes since 2008. The active layer has a depth of up to 60 cm. During summer significant short-term variations ($\sim$ 0.5°C within 2 months) were observed into depths of 8 m, whereas rock temperatures in 20 m depth remain almost constant at about -2.7°C. We observed a change in seismic wavefield and data quality depending on the measurement period. Compared to the measurements in July, while the active layer remains particularly frozen, the data recorded in September show a better data quality and the seismic wavefield arrives delayed. The P-wave travel time differences can be related to thawing processes within the active layer (< 1 m). First results from a tomographic inversion indicate lower compressional velocity (< 4000 m/s) down to 8 m depth. This region is interpreted as loosening zone (weathered & jointed bedrock) and correlates with the region of short-term rock temperature variation. Thus we assume that thawing and melting processes are controlled by a strong heat transfer (e.g. percolation). Below this depth the P-wave travel time differences did not indicate strong variations of the frozen rock/fissure system.