



2.5. CryoGeoLab: multi-scale geophysical characterization of permafrost at the Hoher Sonnblick

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Abstract: The Hoher Sonnblick summit, nestled within the Austrian Alps, provides a distinctive setting for permafrost research. Our project CryoGeoLab is dedicated to an in-depth investigation of permafrost distribution and evolution at this site, through the application of geophysical methods to achieve high spatio-temporal resolution. Specifically, we employ the Spectral Induced Polarization (SIP) and Seismic Refraction Tomography (SRT) methods with the following objectives: (1) Recent SIP investigations in the laboratory and other permafrost sites have unveiled large contrasts in the frequency-dependence of resistivity and polarization between frozen and unfrozen sediments and rock samples. We aim to extend the relation between the frequency-dependence of resistivity and polarization to the field-scale, enabling the estimation of ground ice content. (2) Continue the collection of SIP monitoring data along a profile in the southwestern part of the Hoher Sonnblick summit, started in 2015 and recorded yearly. Such long monitoring data set facilitates the exploration of seasonal variations in subsurface thawing and freezing processes, as well as the long-term permafrost evolution. (3) Further develop the petrophysical joint inversion of SIP and SRT monitoring data to quantitatively assess subsurface hydrogeological properties, including ice content and porosity. By including polarization properties we expect to refine the underlying petrophysical model, facilitating a more precise characterization of permafrost distribution. Activities planned within the CryoGeoLab project are based on recent studies published by the TU Wien Research Unit of Geophysics and exploit the extensive geophysical data set spanning more than 6 years. Preliminary results obtained for existing and recently collected data show the immense value of integrating geophysical methods across different scales for the characterization of alpine permafrost. Accordingly, the CryoGeoLab project will serve as a cornerstone for continued exploration and evaluation of permafrost dynamics at Hoher





Sonnblick, offering crucial insights with direct relevance to climate change research in mountain ecosystems.

