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Recognition of the varying permafrost conditions in the SW Svalbard by multiple geophysical methods

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In recent years, rapid climatic changes and their impact are widely visible and recognizable around the world. The Atlantic sector of the Arctic is the place of the strongest observed changes. As a result, such changes are already destabilizing the arctic systems including the glaciers and the permafrost that strongly affects the Arctic's physical and biological systems.

In the presented work, we applied multiple geophysical methods and tools, to recognize horizontal and vertical distribution as well as ongoing changes in the seasonally and perennially frozen ground. The study site, located near the Polish Polar Station in the Hornsund (Svalbard), is unique due to its location between sea-shore and mountainous ridges and close presence of the retreating Hans Glacier. Such an environment allows for conducting research encompassing various dynamical cryospheric, geological and other environmental processes. The monitoring of the ground temperature variations in the several boreholes, with detailed ERT, GPR and MASW modeling, allow for recognition and analyses of the active layer spatial variability and the permafrost changes in this area. The seismic recognition, based on the dense 2D seismic reflection and refraction methods, allows for the direct comparisons between observations conducted during the summer and winter seasons. Results obtained by those methods are directly targeted to visualize not only the active layer thickness but also the permafrost which until today is unknown in the area of Southern Spitsbergen. Additionally, the comparison of the data-set quality between two seasons allowed to select the best conditions for future data acquisition. The recognition of vertical and horizontal changes of the permafrost as well as the active layer depth provided unique information about the thermal ground conditions.

Obtained results, gives us the opportunity for explanation of seasonal changes which were observed, measured, and modeled. This information allows for better understanding of the geophysical processes responsible for the cryospheric and geological processes occurring in the study site, and further better estimation of the climate change impacts on the environment SW Spitsbergen.

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