



Seismic surveys test on Innerhytta Pingo, Adventdalen, Svalbard Islands

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We present the preliminary results of an experimental full-wave seismic survey test conducted on the Innerhytta a Pingo, located in the Adventdalen, Svalbard Islands, Norway. Several seismic surveys were adopted in order to study a Pingo inner structure, from classical reflection/refraction arrays to seismic tomography and surface waves analysis. The aim of the project IMPERVIA, funded by Italian PNRA, was the evaluation of the permafrost characteristics beneath this open-system Pingo by the use of seismic investigation, evaluating the best practice in terms of logistic deployment. The survey was done in April-May 2014: we collected 3 seismic lines with different spacing between receivers (from 2.5m to 5m), for a total length of more than 1 km. We collected data with different vertical geophones (with natural frequency of 4.5 Hz and 14 Hz) as well as with a seismic snow-streamer. We tested different seismic sources (hammer, seismic gun, fire crackers and heavy weight drop), and we verified accurately geophone coupling in order to evaluate the different responses. In such peculiar conditions we noted as fire-crackers allow the best signal to noise ratio for refraction/reflection surveys. To ensure the best geophones coupling with the frozen soil, we dug snow pits, to remove the snow-cover effect. On the other hand, for the surface wave methods, the very high velocity of the permafrost strongly limits the generation of long wavelengths both with these explosive sources as with the common sledgehammer. The only source capable of generating low frequencies was a heavy drop weight system, which allows to analyze surface wave dispersion below 10 Hz. Preliminary data analysis results evidence marked velocity inversions and strong velocity contrasts in depth. The combined use of surface and body waves highlights the presence of a heterogeneous soil deposit level beneath a thick layer of permafrost. This is the level that hosts the water circulation from depth controlling the Pingo structure evolution.