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Analysis of seismic noise recorded by temporary seismic array near the Pyhäsalmi underground mine in Finland

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The Pyhäsalmi mine is an underground copper and zinc mine located in central Finland. It is one of the oldest and deepest underground mines in Europe, in which ore is excavated from the depth of about 1450 m. Due to the large amount of heavy machinery, the mine itself is a source of strong seismic and acoustic noise. This continuous noise creates a problem for high-resolution active source seismic experiments. That is why in out study we investigated the opportunity to use this seismic noise for studying structure of the uppermost crust. For this we installed 24 3-component DSU-SA MEMS seismic sensors with the autonomous RAUD eX data acquisition units produced by Sercel Ltd. along a 10 km long line crossing the mine area. The array recorded continuous seismic data from 29.10.2013 to 1.11.2013 with the sampling rate of 500 sps. The continuous data for the period 5 days were processed in several steps including single station data analysis, pre-filtering and time-domain stacking. The processed data set was used to estimate empirical Green's functions (EGF) between pairs of stations in the frequency band of 1-100 Hz. We developed our own procedure of stacking EGF in time-domain and, as a result, we were able to extract not only Rayleigh, but also refracted P-waves. Finally, we calculated surface wave dispersion curves and solved inversion problems for surface waves and refracted waves. In our paper we concentrate mainly on details of our data processing routine and its influence on quality of results of EGF extraction. The study is a part of SEISLAB project funded by he European Regional Development Fund (ERDF), Council of Oulu region (Finland) and Pyhäsalmi Mine Oy.