



Ambient noise shallow imaging of Boliden Tara Mines (Ireland)

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Boliden Tara mine, located in eastern Ireland in the surroundings of Navan village is one of the largest lead-zinc mines in Europe and its operation will continue into the foreseeable future. We investigate the feasibility of using passive seismic as an imaging tool for further exploration at the mine focusing the research on the small area in the vicinity of the main orebody.

The study area sits on Carboniferous rocks, mainly carbonaceous formations, characterized by an horst-like complex with a major fault running toward South West of Ireland

In this study, we apply the cross-correlation techniques to both local anthropogenic and regional generated seismic noise in the 1-7 Hz band. The noise sources that we record vary from high-frequency mining and traffic activities to low-frequency Atlantic Ocean and the Irish Sea generated noise.

From June 2017 to July 2018 we deployed twenty-one broadband seismic stations with a maximum aperture of 7 km at South-West of the mine site. After the data collection and the standard pre-processing steps, we applied the cross-correlation in the frequency domain. Despite the predictable absence of spatial homogenous noise sources we have obtained a large number of consistent cross-correlograms showing a high signal-to-noise ratio which can be used to extract the surface waves.

Then, following the dispersion analysis that provided us the group travel times we apply a fast marching method and a Bayesian analysis to generate frequency dependent velocity maps, 1D Vs profiles for each station and a 3D shear-wave velocity variation model down to 1km depth. The inversion results show laterally and vertically distributed velocity variations that we interpret by using the borehole constrained local geological model and with the support of active surveys and sonic logging data.

Finally, we corroborate our study with 3D full wavefield numerical simulations, used a benchmark against real seismic noise dataset and for comparison with the actual noise sources distribution. The overall aim is to assess the performance of ambient noise methodology in a shallow environment that is already well constrained using other observations.