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Apparent changes in seismic wave velocity related to microseism noise source variations

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Currently there is a strong interest of using cross correlation of ambient noise for imaging of the subsurface or monitoring of various geological settings where we expect rapid changes (e.g. reservoirs or volcanoes). Through cross correlation retrieved Green's function is usually used to calculate seismic velocities of the subsurface. The assumption of this method is that the wavefields which are correlated must be diffuse. That means that the ambient noise sources are uniformly distributed around the receivers or the scattering in the medium is high enough to mitigate any source directivity. The location of the sources is usually unknown and it can change in time. These temporal and spatial variations of the microseism noise sources may lead to changes in the retrieved Green's functions. The changed Green's functions will then cause apparent changes in the calculated seismic velocity.
We track the spatial and temporal distribution of the noise sources using seismic arrays, located in Ireland. It is a good location in which to study these effects, as it is tectonically very quiet and is relatively close to large microseism noise sources in the North Atlantic, allowing a quantification of noise source heterogeneity.
Temporal variations in seismic wave velocity are calculated using data recorded in Ireland. The results are compared to the variations in microseism source locations. We also explore the minimum noise trace length required in Ireland for the Green's functions to converge. We quantify the degree to which apparent velocity variations using direct arrivals are caused by changes in the sources and assess if and at what frequencies the scattering of the medium in Ireland is high enough to homogenise the coda wavefield.