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3D subsurface modeling at Limburg using multimodal surface waves

Limburg, a region located in the cross-border area between The Netherlands, Belgium, and Germany is the Euregio-Meuse-Rhine candidate site for hosting the Einstein Telescope. Recent studies to investigate the site's subsurface suitability for hosting Einstein Telescope has seen several boreholes being drilled and deployment of arrays of geophones on the surface. In this study we present a 3D subsurface model up to depths of 500 meters which was estimated by making use of vertical component of ambient seismic noise data on the surface. Continuous seismic noise recordings for a period of 3 weeks were used to perform seismic interferometry which yields the empirical Green's function between station pairs. The phase of the estimated Green's functions was further used to perform Rayleigh-wave tomography, thereby obtaining a 2D distribution of phase and group velocities in the frequency band 1.5 –5.0 Hz. The estimated phase and group velocities for every tomographic grid were then converted to a depth-dependent S-wave velocity model. Besides the Rayleigh wave fundamental model, the first overtone is also used to increase the accuracy of the estimated velocity model. Results show a good match between the estimated 3D model and the boreholes located in the region of study. An accurate 3D velocity model is important for reliable estimation of Newtonian noise as well for deciding the suitability of the underground to host the vertices of the Einstein Telescope.

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