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Seismic array measurements in the Italian candidate site for the Einstein Telescope, the third-generation gravitational wave detector

The characterization of local seismic noise is of paramount importance for evaluating candidate locations for hosting the Einstein Telescope (ET), the third-generation gravitational wave detector. Three temporary seismic arrays were installed at the Italian candidate site for ET, each with different geometrical layouts, recording durations, and total numbers of stations. Here, we provide an overview on the noise characteristics and its azimuthal distribution, obtained through beamforming analysis. Moreover, we leverage the noise recordings to extract (i) Rayleigh wave dispersion curves using FK-analysis, which are then inverted to obtain a one-dimensional, shear-wave velocity model of the subsurface and (ii) HVSR spectra across all arrays' stations. The recordings confirm the exceptionally low level of seismic noise approaching Peterson's New Low Noise Model for frequencies >1 Hz. The arrays allowed to reliably reconstruct the seismic wavefield in the 10-20 Hz range, showing an almost azimuthally homogeneous noise source distribution, with slowness values between 0.4 and 0.5 s/km. The inversion of dispersion curves in the same frequency range highlighted a rather homogeneous, high-velocity terrain ($V_S=2-3$ km/s) in the first 100 m. The flat HVSR spectra across all arrays excludes the presence of a resonant, low-velocity layer at shallow depth.

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