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SUPPLEMENTAL MATERIAL FOR

INTEGRATING THE FXLAND NETWORK INTO THE REAL-TIME EARTHQUAKE SURVEILLANCE AND MONITORING SYSTEM OF ITALY

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Table S1. OBS coordinates – Deployment January 2022-August 2022.

Station	Latitude (°)	Longitude (°)	Depth (m)
SG01A	37.4939	15.2539	1320
SG07A	37.5728	15.2917	1118
SG08A	37.6818	15.3566	1584
SG05A	37.4680	15.4478	2051
SG11A	37.7316	15.6834	1654
SG12A	37.7233	15.8735	1672
SG14A	37.5212	16.0571	2045
SG16A	37.5191	15.7026	2239
SG18A	37.3357	15.4096	2126
SG19A	37.3346	15.5433	2223
SG21A	37.3343	15.9051	2550
SG24A	37.1554	15.9196	2901.5
SG25A	37.1534	15.7368	2452
SG27A	37.1489	15.4271	2104
SG28A	36.9725	15.7554	2518
BB03A	37.4760	15.3388	1812
BB10A	37.7371	15.4898	1558
BB13A	37.7158	16.0516	1766
BB26A	37.1514	15.5692	2251
BB30A	37.0624	16.0698	2934
LT02A	37.4266	15.2909	1360
LT04A	37.4229	15.4085	2110
LT06A	37.5380	15.3388	1841
LT15A	37.5083	15.8878	2135
LT17A	37.5164	15.5199	1992
LT20A	37.3230	15.7206	2280
LT22A	37.3330	16.0627	1902
LT23A	37.1573	16.0679	2693
LT29A	37.0213	15.9306	3076

Table S2. OBS coordinates – Redeployment September 2022-August 2023.

Station	Latitude (°)	Longitude(°)	Depth (m)
BB17B	37.5164	15.5197	1951
BB03B	37.4764	15.3391	1771
BB10B	37.7369	15.4904	1525
BB15B	37.5078	15.8875	2099
BB26B	37.1514	15.5695	2190
LT29B	37.0213	15.9304	3076
LT06B	37.5379	15.3387	1804
LT02B	37.4266	15.2909	1330
LT04B	37.4224	15.4039	2110
LT20B	37.3217	15.7203	2236
LT22B	37.3328	16.0630	2880

Station-specific Power Spectral Density (PSD) analysis of the FXLand network

The Power Spectral Density (PSD) analyses presented in this supplementary material refer to the vertical component of the FXLand temporary stations and are based on Probabilistic Power Spectral Density (PPSD) estimates computed over the period 25 June-4 July 2022.

Across the FXLand network, the PPSD curves consistently show elevated noise levels at high frequencies, reflecting the predominantly urban and coastal setting of the stations.

At lower frequencies (f < 1 Hz), differences in absolute noise levels are observed among stations equipped with identical sensors, pointing to a significant influence of local conditions on the recorded noise characteristics.

At very low frequencies (f < 0.1 Hz), variations in the level and stability of the noise plateau indicate differences in long-period recording stability, sensor coupling, and environmental conditions.

The analysis aims to document site-specific noise characteristics and to complement the network-level assessment of common noise pattern discussed in Section 3 of the main manuscript.

1J.FX01.HHZ – Siracusa, Ortigia (Trillium Compact 120 s)

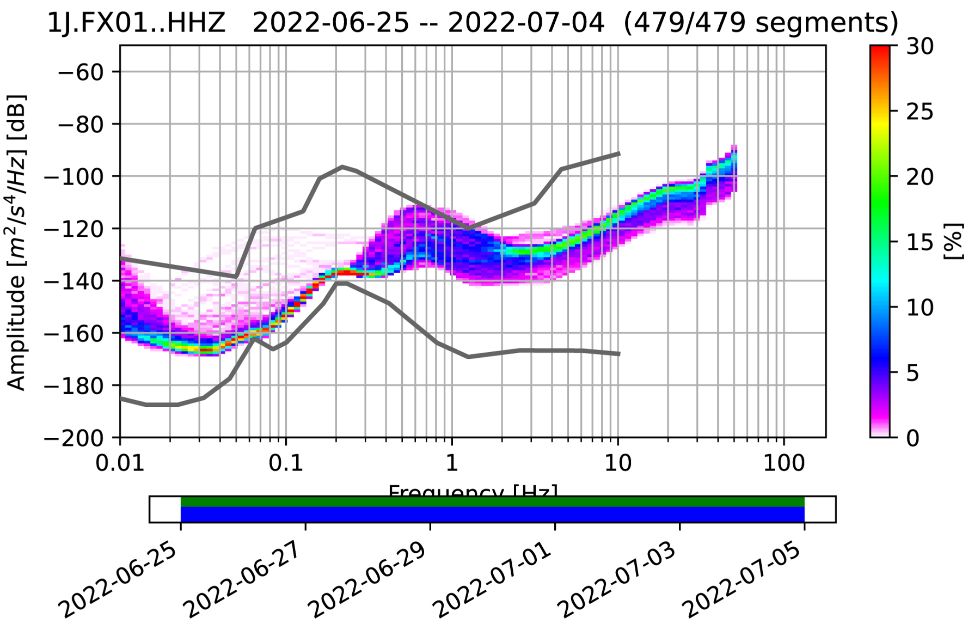

Figure S1. FX01 exhibits elevated noise levels across most of the frequency range, particularly above ∼1 Hz, where PSD values systematically approach the NHNM. This behavior is consistent with the urban coastal setting and with the non-buried installation within the Carabinieri barracks courtyard. At low frequencies (<0.1 Hz), moderate noise levels reflect the combined influence of ocean-generated microseisms and local site effects. Despite high-frequency noise, the PSD curves are stable over time, indicating reliable performance for phase picking of local and regional earthquakes.

1J.FX02.HHZ – Melilli (Trillium Compact 120 s)

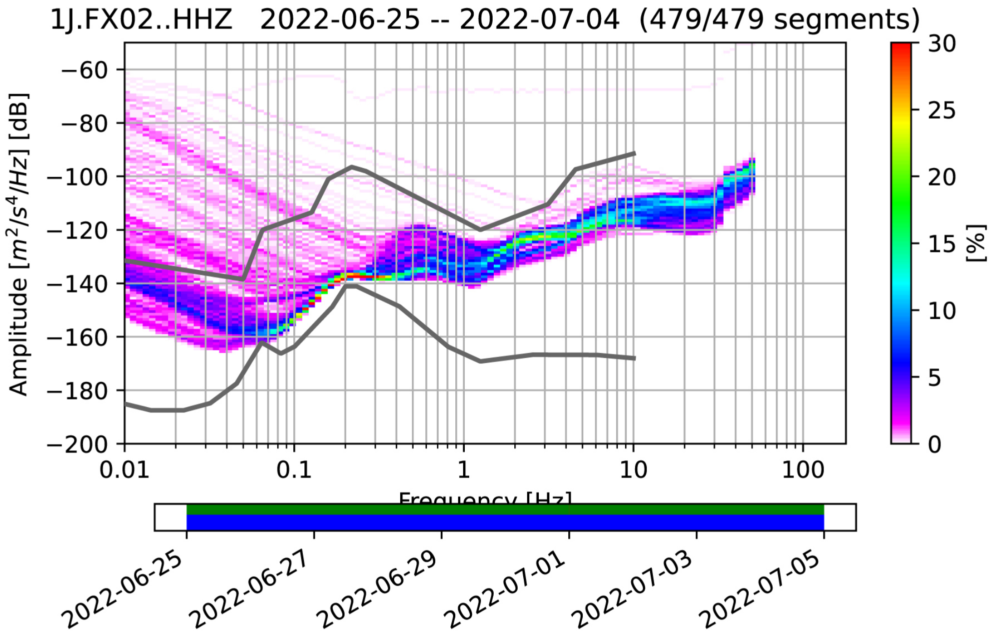

Figure S2. FX02 shows increased noise levels at long periods and a larger dispersion of PSD estimates, suggesting sensitivity to environmental disturbances. The non-buried installation in a basement/garage environment likely affects sensor coupling and long-period performance. At intermediate and high frequencies, noise levels remain elevated but stable, allowing effective detection of impulsive seismic phases despite reduced low-frequency sensitivity.

1J.FX03.HHZ – Lentini (Trillium Compact 120 s)

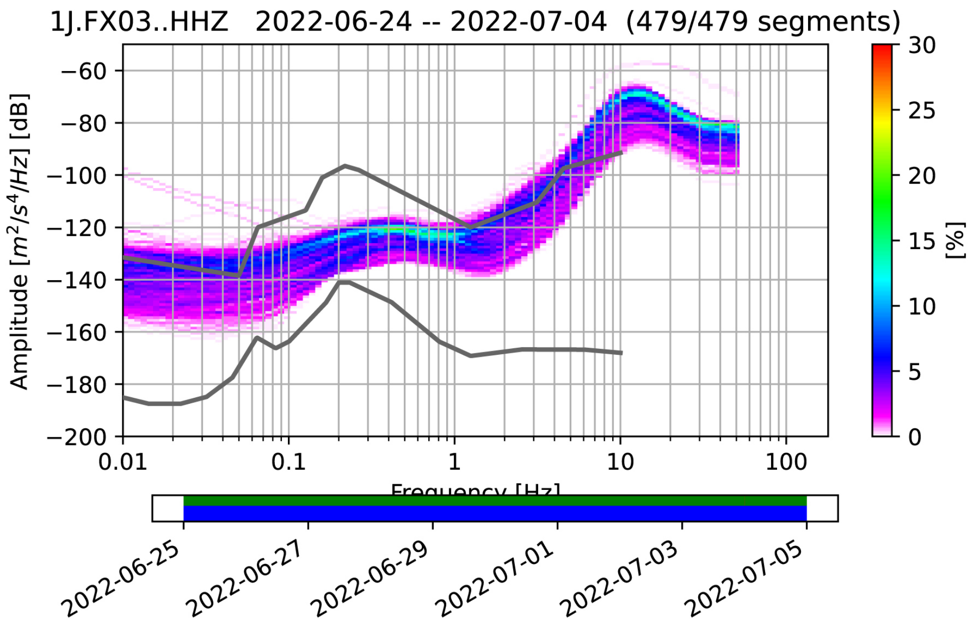

Figure S3. FX03 displays high noise levels at intermediate and high frequencies, locally exceeding the NHNM above ~5-10 Hz. This behavior is attributed to the proximity to a road and to shallow burial in fill soil. At low frequencies, the PSD remains relatively stable, indicating consistent environmental conditions. While high-frequency noise may limit the detection of very small nearby events, the station still provides useful data for moderate local seismicity.

1J.FX04.HHZ – Catania, La Playa (Trillium Compact 120 s)

FX04 shows elevated noise levels across a broad frequency range, with a pronounced increase between 1 and 10 Hz. The coastal urban setting and alluvial substrate likely contribute to both anthropogenic noise and site amplification effects. The buried installation partially mitigates high-frequency noise, but PSD values remain above the NLNM. The station nevertheless provides valuable recordings due to its proximity to offshore seismic sources.

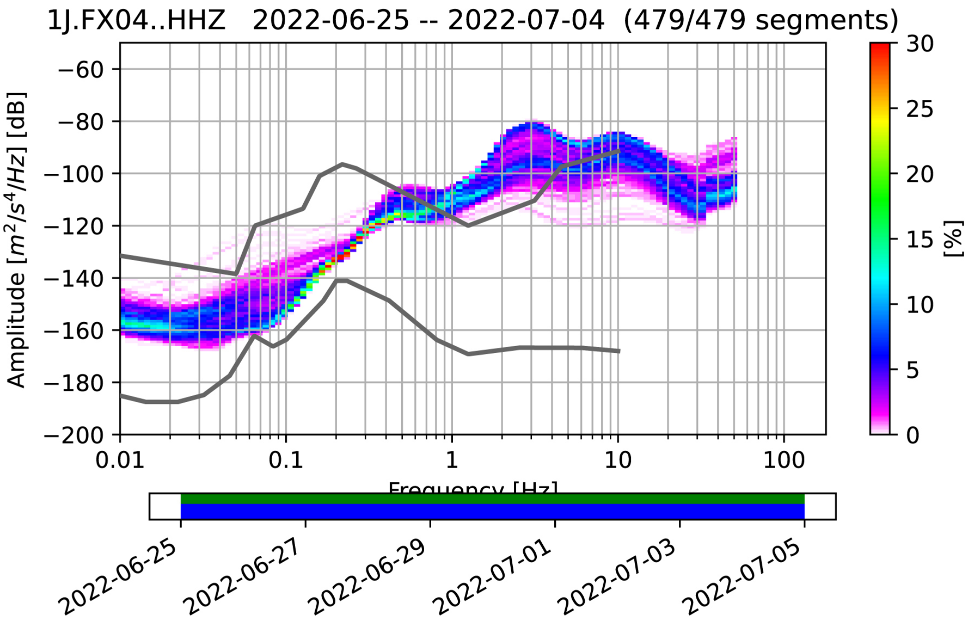

Figure S4. FX04 shows elevated noise levels across a broad frequency range, with a pronounced increase between 1 and 10 Hz. The coastal urban setting and alluvial substrate likely contribute to both anthropogenic noise and site amplification effects. The buried installation partially mitigates high-frequency noise, but PSD values remain above the NLNM. The station nevertheless provides valuable recordings due to its proximity to offshore seismic sources.

1J.FX06.EHZ – Misterbianco (Lennartz LE-3D/5 s)

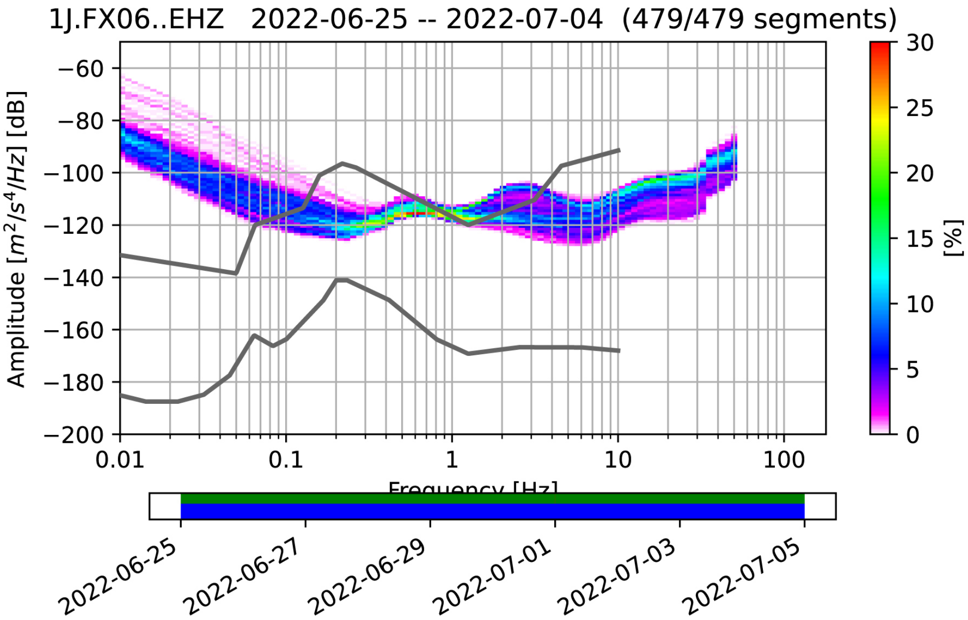

Figure S5. FX06 exhibits spectral characteristics typical of a short-period sensor, with limited sensitivity at long periods and relatively flat PSD levels at higher frequencies. Noise levels above ~1 Hz are generally lower than those observed at several broadband stations. While unsuitable for long-period analyses, the station performs robustly for local earthquake detection.

FX07 – Aci Castello (Trillium Compact 120 s)

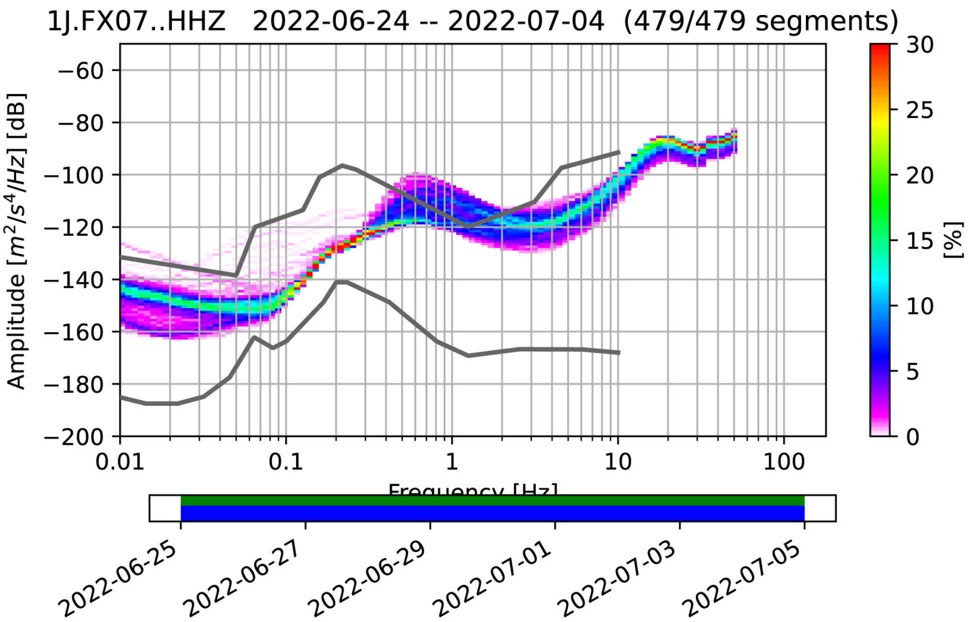

Figure S6. FX07 shows moderately elevated noise levels at high frequencies, with PSD values slightly above the NLNM-NHNM range between 1 and 10 Hz. The indoor, non-buried installation within a boiler room likely contributes to persistent anthropogenic noise. At low frequencies, the spectra are stable and comparable to other coastal stations, supporting reliable phase identification.

1J.FX08.HHZ – Riposto (Trillium Compact 120 s)

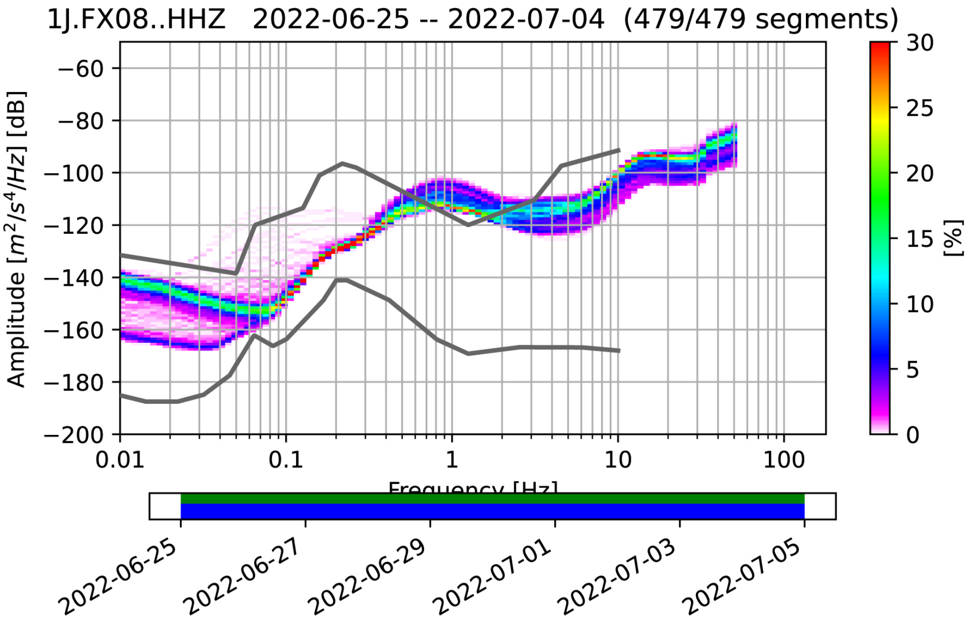

Figure S7. FX08 exhibits elevated noise levels at intermediate and high frequencies and a clear microseismic peak around 0.2-0.3 Hz. The indoor, non-buried installation contributes to increased anthropogenic noise above 1 Hz. Despite these conditions, PSD estimates show limited temporal variability, indicating stable station behavior.

1J.FX09.HHZ – Giardini Naxos (Trillium Compact 120 s)

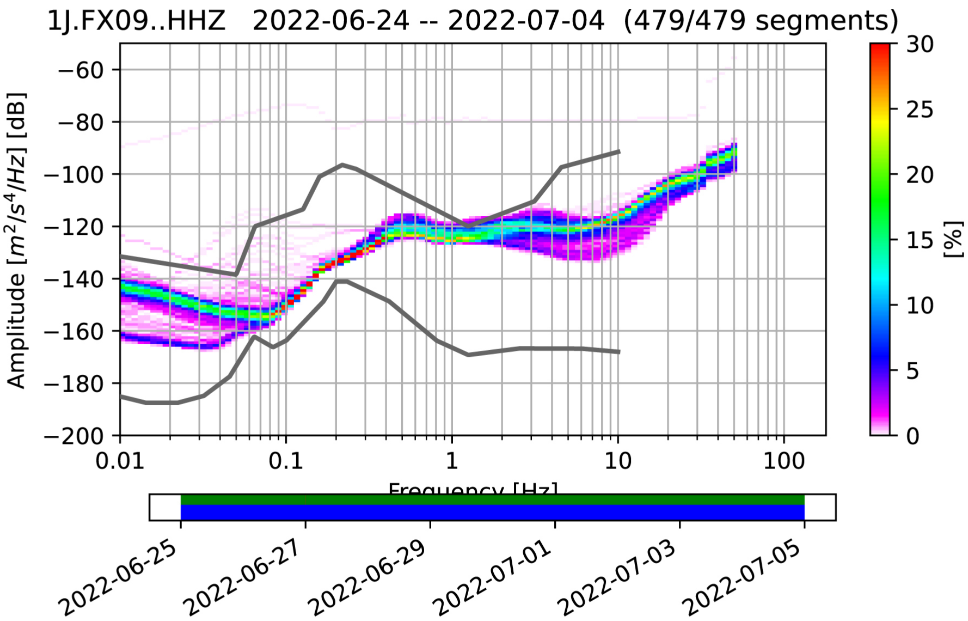

Figure S8. FX09 exhibits moderately elevated noise levels at intermediate and high frequencies, with PSD values generally lying between the NLNM and NHNM above ~1 Hz. The station shows a well-defined microseismic peak in the 0.1-0.3 Hz band, consistent with its coastal location. Compared to other non-buried stations, high-frequency noise is partially mitigated, reflecting the buried installation in fill soil within the Carabinieri barracks garden. At long periods (<0.1 Hz), the PSD approaches the NLNM, indicating satisfactory low-frequency performance of the Trillium Compact 120 s sensor. The PSD curves are stable over time, suggesting good coupling and consistent recording conditions. Overall, FX09 provides reliable broadband data and effectively contributes to phase picking for both coastal and offshore seismicity.

1J.FX10.EHZ – Santa Teresa di Riva (Lennartz LE-3D/5 s)

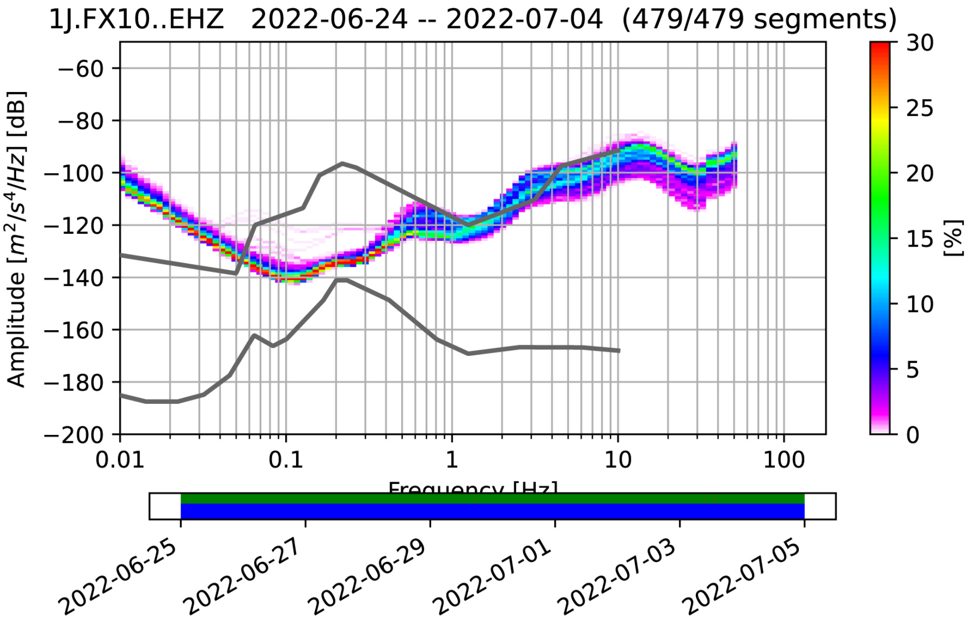

Figure S9. FX10 shows spectral characteristics similar to FX06, reflecting the response of the Lennartz 5s sensor. Noise levels are relatively low at high frequencies, while long-period sensitivity is limited. The PSD curves are stable over time, indicating good coupling and reliable performance for local seismicity in the Messina Strait area.

1J.FX11.HHZ – Santo Stefano Medio (Trillium Compact 120 s)

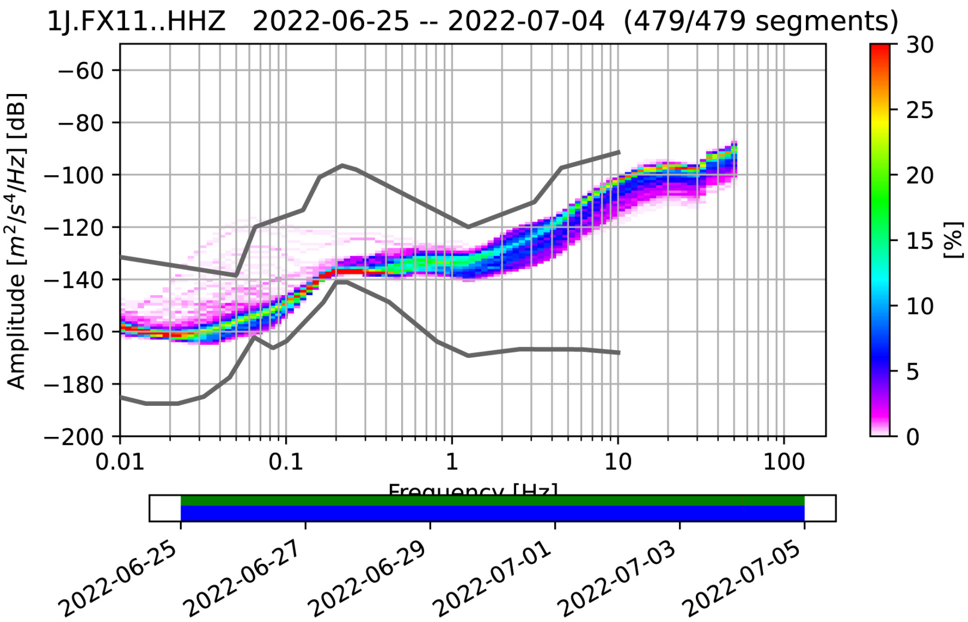

Figure S10. FX11 displays comparatively lower noise levels at frequencies below 1 Hz, with PSD values approaching the NLNM, suggesting relatively favorable site conditions despite the indoor, non-buried installation. High-frequency noise remains elevated but stable, consistent with a semi-urban environment. Overall, FX11 provides good-quality data for both local and regional monitoring.

1J.FX12.HHZ – Cataforio (Sara SS08 – 60 s)

FX12 exhibits moderate noise levels at low frequencies, with PSD values approaching the NLNM below ~0.1 Hz, indicating good long-period performance. At intermediate frequencies, a broad noise increase is observed, likely related to local site conditions and the non-buried courtyard installation. High-frequency noise remains elevated but less dispersed than at several Trillium-equipped stations.

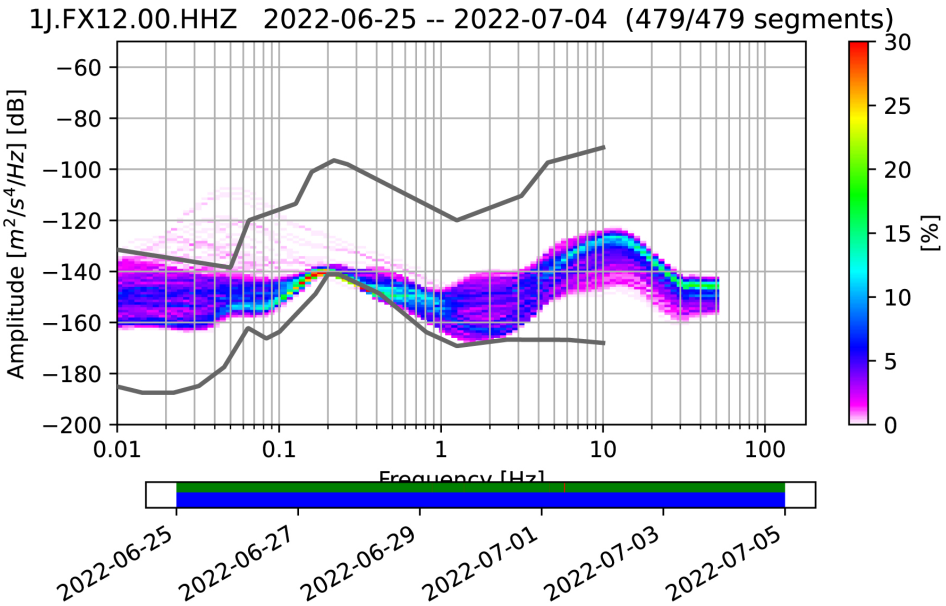

Figure S11. FX12 exhibits moderate noise levels at low frequencies, with PSD values approaching the NLNM below ~0.1 Hz, indicating good long-period performance. At intermediate frequencies, a broad noise increase is observed, likely related to local site conditions and the non-buried courtyard installation. High-frequency noise remains elevated but less dispersed than at several Trillium-equipped stations.

1J.FX13.HHZ – Montebello Jonico (Trillium Compact 120 s)

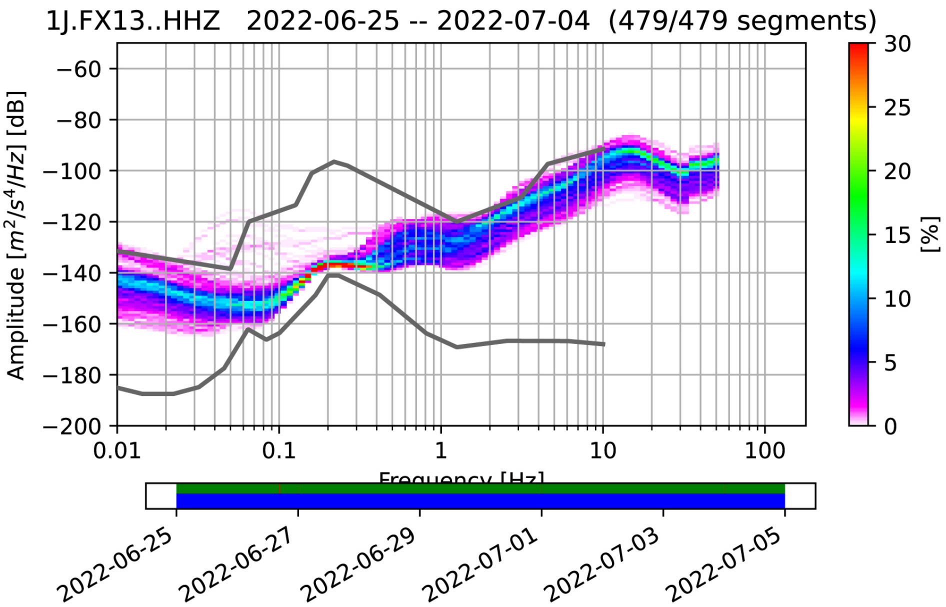

Figure S12. FX13 shows elevated noise levels at high frequencies and moderate noise at long periods. The buried installation contributes to a partial reduction of high-frequency noise compared to non-buried sites. PSD estimates are stable and well clustered, indicating consistent recording conditions suitable for phase picking.

1J.FX14.HHZ – Bova Marina (Sara SS08 – 60 s)

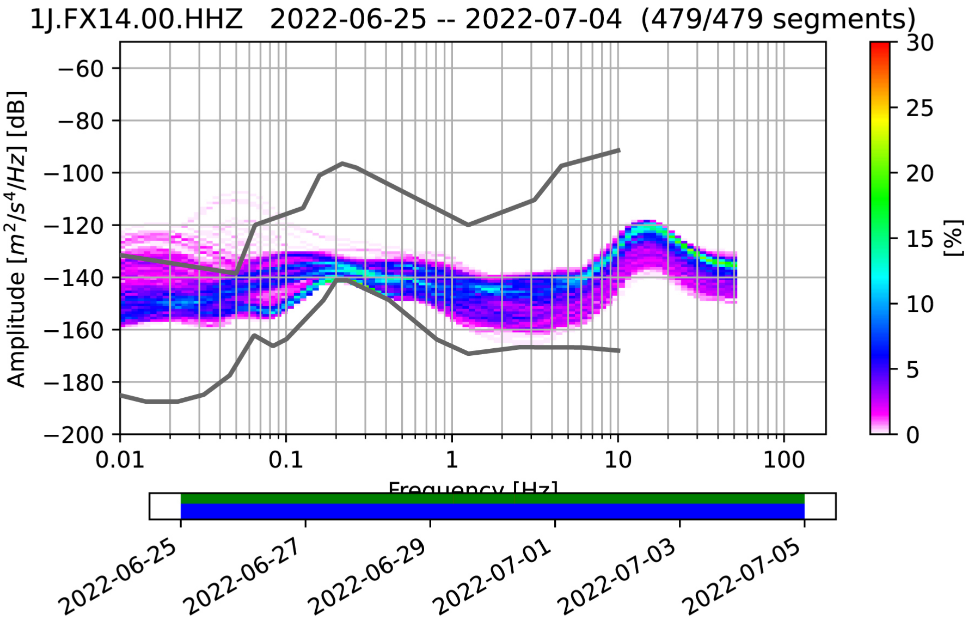

Figure S13. FX14 displays relatively low noise levels at long periods, with PSD values close to the NLNM below ~0.1 Hz, reflecting good sensor performance and site conditions. At higher frequencies, noise increases but remains within the expected range for a non-buried courtyard installation in a coastal urban setting. The station provides stable and reliable broadband recordings.

Reference

Peterson, J. (1993). Observations and modeling of seismic background noise, U. S. Geol. Surv. Open-File Rep., 93-322, doi:10.3133/ofr93322.