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Insights from the DAS analysis of ambient seismic noise recorded off the coast of Sicily

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In November 2023, DAS (Distributed Acoustic Sensing) data were acquired along few fibers of the MEOC cable of the INFN-LNS submarine infrastructure, extending circa 29 km off the coast of Catania; one of these fibers is terminated with a further 6km-long optical fiber layed on the seafloor in the context of the FOCUS-ERC project. In addition another set of measurements were conducted using the INFN-LNS MEOC cable deployed offshore Capo Passero, probing a 200 km loop implemented on a pair of fibers. With almost 2 weeks of recordings, the DAS interrogator captured multiple types of signals from ocean waves to earthquakes and even volcanic tremors linked with an eruption phase of Etna. Here, we investigate in particular the ambient seismic noise associated to the sea state that was recorded on each cable. With the goal to identify and locate noise sources for using passive seismic imaging in the area, there is a need to differentiate seismic noise related to wind waves from other overlapping signals at similar frequencies (e.g. tremors from Etna). First, long-term trends in the DAS data are investigated using spectrograms for specific channels along each cable. In addition to continuous low frequency seismic noise, the data highlight the presence of short-term high frequency (>1Hz) events which also seem connected to the wind wave activity in the area. Taking advantage of the dense spatial sampling of the DAS data, spectral profiles and f-k analysis are applied on shorter time windows over different sections of the cables to decompose both ocean waves and seismic wavefields in more details (e.g. landward vs seaward separation of signals) and better characterize the mechanisms behind those events. Both cables show some differences in the seismic noise wavefield that imply a change in local noise sources but also highlight the influence of site effects from each cable. Whereas the wind waves signature is limited to the shallower sections of the cables, we also observe that microseisms are present over the whole length of each cable, with their energy fluctuating as a function of water depth but also the cable coupling with the seafloor. In particular, along the Capo Passero cable, we observe significant stronger microseisms energy far out at sea.