Characterization of the seismic dynamical state of Ischia Volcanic Island (Italy) through the ICA and the polarization analysis applied to background seismic noise

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We have investigated the seismic dynamical state of Ischia volcanic Island before and after the August 21, 2017 earthquake, by applying classical and innovative techniques to the background seismic noise. First, we searched for the presence of independent signal sources by performing the Independent Component Analysis (ICA). Over 60 days of recordings, from 26 August to 25 October 2017, the application of ICA algorithm successful separated two stable components: IC1, the most energetic and persistent, picked at ~1 Hz; and IC2, concentrated in 3-4 Hz band. The root mean square (RMS) of continuous recordings during three months of the years 2016 and 2017, was estimated in order to investigate coherence properties of the background seismic signal before and after the August 2017 earthquake, for both raw and filtered data in the frequency ranges corresponding to the two ICs. The results show no variations in the patterns. The polarization properties of the same dataset were obtained by applying the covariance matrix method. The polarization parameters were estimated by filtering the signals in the 1-2 and 3-4 Hz frequency bands. The time evolution of the mean values of the polarization pattern does not show any variation during the analysed time intervals. The statistical properties of the polarization pattern were further investigated by analysing the rose plots of the azimuth of the polarization vector.

All the obtained results were interpreted taking into account the existing literature on volcanological, morphological, structural and geochemical studies. IC1 seems conditioned by tectonic and volcanic structures and by the Island morphology. It could be associated with the persistent activity of the hydrothermal system. The signal amplitude of IC2 clearly shows 24h periodicities, likely related to anthropogenic activities.