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A small aperture array for seismic monitoring of Mt. Vesuvius

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A small aperture quadripartite seismic array was installed on the south-east flanks of Mt. Vesuvius, in order to improve the seismic monitoring of this active volcano. The use of the array allows: i) to discriminate natural-source generated signals by artificial-source-generated signals; ii) to detect and track the source of possible Long Period (LP) events; iii) to detect coherent phases in the low frequency noise that may be related to magma movements (tremor insurgence).

The kinematic properties of the seismic signals were retrieved by using two techniques operating in frequency (MUSIC) and time (Zero Lag Cross Correlation) domain. Both methods retrieve the components of the vector slowness from the dominant peak of the slowness spectrum, and hence the apparent velocity and azimuth of the signal. Moreover, we investigate the polarization properties of the signals using the time domain approach based on the estimation of the covariance matrix.

The array greatly helps in locating the seismic signals produced by artificial blasts (both in land and sea), improving the discrimination of possible natural long period (LP) quakes in the background seismicity. The array is also a useful tool for retrieving the kinematic properties of the wavefield associated with volcano-tectonic (VT) earthquakes (more than 99% of the whole natural seismicity) and to all the other transients which are routinely observed (landslides, artificial blasts). The main results obtained during this first year of observation are the absence of correlated phases associated to volcanic tremor and the clear detection of only one LP in the background seismicity since the start of seismic observation at Mt. Vesuvius.