

**Automatic discrimination and fast wavefield decomposition
of Volcano- Tectonic (VT) earthquakes by Independent Component Analysis:
the case study of Campi Flegrei (Italy)**

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A fundamental task in volcano-seismology is the characterization of the source of Volcano- Tectonic (VT) earthquakes; this passes through the discrimination of seismic events from the ambient background noise and the identification of the onset of the main phases, i.e. the body waves.

An automatic procedure based on the Independent Component Analysis (ICA) which successfully performs the blind source separation of convolutive mixtures, has been developed to have a prompt discrimination among the different sources in the seismic signals. Specifically, the ICA is adopted to obtain a clear separation among meteo-marine microseism, anthropogenic noise, and volcano-tectonic activity at Campi Flegrei. A coarse-grained variable, i.e. the frequency associated with the maximum amplitude of the power spectral density of the Independent Components (FMPSDA), is introduced. This parameter is sensitive to the variation in the frequency bands of interest (e.g. that corresponding to the corner frequencies of VT events) and can be used as marker of the insurgence of seismic activity.

In addition, the ICA also provides the wavefield decomposition of VT earthquakes into basic sources which are naturally polarized into the vertical and horizontal planes, thus allowing the identification and separation of the main seismic phases. On this basis, a novel approach, "ICA-based Polarization" (ICAP), which consists in the estimate of the polarization parameters directly from the Independent Components is introduced. The technique is suitable for directly retrieving polarization features of the seismic signals in a single step, avoiding a priori cumbersome segmentation and filtering procedures.

On the basis of the presented results, the application of the ICA to large massive seismic datasets represent an useful tool for fast pre-processing, thus efficiently supporting the volcano monitoring practice.