



Automatic procedure for quasi-real time seismic data processing at Campi Flegrei (Italy)

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The accuracy of automatic procedures for detecting seismic events and locating their sources is influenced by several factors such as errors in picking seismic phases often buried in the high-level ambient noise, network geometry and modelling errors. fundamental objective is the improvement of these procedures by developing accurate algorithms for quasi-real time seismic data processing, easily managed in observatory practice.

Recently a robust automatic procedure has been implemented for detecting, onset picking and identifying signal phases in continuous seismic signal with an application at the seismicity recorded at Campi Flegrei Caldera (Italy) during the 2006 ground uplift (Ciaramella et al. 2011). An Independent Component Analysis based approach for the Blind Source Separation of convolutive mixtures (CICA) has been adopted to obtain a clear separation of low-energy Long Period events (LPs) from the high-level ambient noise allowing to compile a complete seismic catalogue and better quantify the seismic energy release. In this work, we apply CICA at the seismic signal continuously recorded during the entire 2006 at Campi Flegrei. First, we have performed tests on synthetic data in order to improve the reliability and the accuracy of the procedure. The performance test using very noisy synthetic data shows that the method works even in case of very poor quality data characterized by very low signal to noise ratio (SNR). Second, we have improved CICA automatic procedure recovering the information on the amplitudes of the extracted independent components. This is crucial for further analysis, starting from a prompt estimate of magnitude/energy of the highlighted events.

Data used for the present analysis were collected by four broadband three-component seismic stations (ASB2, AMS2, TAGG, BGNG) belonging to the Campi Flegrei seismic monitoring network, managed by the "Istituto Nazionale di Geofisica e Vulcanologia-Osservatorio Vesuviano (INGV-OV)" (see for details Saccorotti et al. [2007]). Specifically, the analyzed time series are the recordings of ground velocity (seismograms) along the three directions of motion (North-South, East-West and Vertical) for each station. We focus the attention not only on the detection of LPs, but also on volcano-tectonic quakes and on the study of the noise itself, including its separation into metemarine, anthropogenic and volcanic (tremor) sources. The extracted waveforms with improved SNR via CICA coupled with automatic phase picking (based on the comparison of short-term average amplitude and long-term average) allow to obtain precise polarization analysis and localizations.