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Seismo-acoustic analysis of the near quarry blasts using Plostina small aperture array

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Seismic and acoustic signals are important to recognize different type of industrial blasting sources in order to discriminate between them and natural earthquakes. We have analyzed the seismic events listed in the Romanian catalogue (Romplus) for the time interval between 2011 and 2012, and occurred in the Dobrogea region, in order to determine detection seismo-acoustic signals of quarry blasts by Plostina array stations. Dobrogea is known as a seismic region characterized by crustal earthquakes with low magnitudes; at the same time, over 40 quarry mines are located in the area, being sources of blasts recorded both with the seismic and infrasound sensors of the Romanian Seismic Network.

Plostina seismo-acoustic array, deployed in the central part of Romania, consists of 7 seismic sites (3C broad-band instruments and accelerometers) collocated with 7 infrasound instruments. The array is particularly used for the seismic monitoring of the local and regional events, as well as for the detection of infrasonic signals produced by various sources. Considering the characteristics of the infrasound sensors (frequency range, dynamic, sensibility), the array proved its efficiency in observing the signals produced by explosions, mine explosion and quarry blasts.

The quarry mines included for this study cover distances of two hundreds of kilometers from the station and routinely generate explosions that are detected as seismic and infrasonic signals with Plostina array. The combined seismo-acoustic analysis uses two types of detectors for signal identification: one, applied for the seismic signal identification, is based on array processing techniques (beamforming and frequency-wave number analysis), while the other one, which is used for infrasound detection and characterization, is the automatic detector DFX-PMCC (Progressive Multi-Channel Correlation Method). Infrasonic waves generated by quarry blasts have frequencies ranging from 0.05 Hz up to at least 6 Hz and amplitudes below 5 Pa. Seismic data analysis shows that the frequency range of the signals are above 2 Hz.

Surface explosions such as quarry blasts are useful sources for checking detection and location efficiency, when seismic measurements are added. The process is crucial for discrimination purposes and for establishing of a set of ground-truth infrasound events. Ground truth information plays a key role in the interpretation of infrasound signals, by including near-field observations from industrial blasts.