Automatic monitoring of crustal seismic activity in Galati region of southeastern Romania using full waveform-based approach

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In September–November 2013 a seismic swarm occurred in Galati region of southeastern Romania. The area was previously known as characterized by low seismic activity along the major crustal faults. During the period of swarm, between September 23rd and November 5th, over 1000 events with the magnitudes (Ml) of 0.2–4.0, located at the depth of 5–10 km, have been detected. Despite the relatively small magnitude, events generated ground motions that were well felt by local people, leading to panic in the area. The proximity of active oil fields caused additional annoyance.

Advanced seismic monitoring in the region started in 2013 with deployment of mobile seismic stations immediately after the beginning of the swarm. Additionally, active seismic measurements were performed in order to characterize the shallow velocity structure at specific sites. Starting from July 2015 new permanents stations were installed in the area marking the beginning of Galati local network development. The routine seismic catalog derived using the acquired data and applying the standard detection and location techniques pointed that area continues to be seismically active, however with low rate of activity and magnitude of events. These made it a perfect study case for development of new advanced schemes for seismic monitoring of the regions with low and complex seismicity aiming on an understanding of the phenomenon underlying the 2013 seismic swarm as well as the current seismic activity in the area.

We developed and automatic monitoring scheme based on the network-based full waveform detection and location method BackTrackBB (Poiata et al. 2016) that exploits the coherency of signals’ statistical features recorded across the seismic network. Once extracted from the flux of continuous data, seismic events are compared against the database of previously detected events using coherency and allowing to identify potential repeaters or multiplets. The earthquake catalog provided by the system starting from 2017 was compared to the routine ROMPLUS catalog of NIEP showing an increase in the number of detected events by the order of 3. We present the details of the implementation and discuss its advantages and drawbacks.