EGU22-5342, updated on 09 Aug 2022
https://doi.org/10.5194/egusphere-egu22-5342
EGU General Assembly 2022

Use of a seismo-acoustic array for local to near-regional quarry blasts monitoring

Daniela Ghica
National Institute for Earth Physics, National Data Center, Bucharest, Romania (daniela@infp.ro)

NIEP operates BURAR-BURARI seismo-acoustic array deployed in northern Romania under a joint effort with AFTAC (USA). Currently, the 6 infrasonic elements are distributed over a 0.7 km aperture, whilst the 9 SP borehole seismometers are distributed over an area of 5 km^2.

Impulsive and short-duration signals, generated by repeating sources confined in certain directions, are frequently detected during daytime both by seismic and infrasonic sensors. As a number of active quarries are located in the local to near-regional distance ranges, we assumed that many of the seismo-acoustic signals, characterized with PMCC algorithm (for infrasound), and with f-k analysis (for seismic), are generated by the surface blasts conducted in these sites.

Two cases are addressed in this study:

(1) The location of the local/near-field source is unknown: An empirical method for identification of near-field quarries, based on associating the seismic signal with the infrasonic arrival, is presented. The method is the most effective in the distance range of fastest infrasonic phases (direct or tropospheric), i.e., within 5 – 50 km of the infrasound array. The shorter distance and impulsive signals, with quite large SNR, indicate the direct waves arrivals. Seismic surface type waves (Rayleigh and Love) are propagating along the Earth surface. Source location is based upon phase identification and characteristics (back azimuth, arrival time and apparent velocity) from both seismic and acoustic data. The seismo-acoustic signals are characterized by short duration (2-4 s on the waveform), high frequency content, stable azimuth, and quite stable trace velocity. Depending on the atmospheric conditions, the method can still be applied to the analysis of more distant events as well.

(2) The location of the local or near-regional source is listed in the updated Romanian seismic catalogue (ROMPLUS): Since artificial blasting can produce seismic and acoustic signals simultaneously, analysis of seismo-acoustic records is applied to discriminate between anthropogenic events and earthquakes. In the distance range of interest (up to 350 km), the infrasonic array records both tropospheric and stratospheric phases. Signals recorded at distances over 200 km show longer duration, travel time analysis indicating stratospheric path. For the most infrasonic arrivals generated by the near-surface blasts, the apparent acoustic speed is close to the sound speed at the array site. The apparent velocity of the seismic phases increases with the epicentral distance. Infrasonic signals detected by BURARI were investigated in order to associate

them with seismic events recorded in the ROMPLUS catalogue, and to identify quarry blasts. Based on the InfraGA 2D ray tracer and NRL-G2S atmospheric models, the ducting conditions towards the station are highlighted in order to explain the recordings. Ray tracing predictions are consistent with the infrasound detections at station for near-regional sources.

Joint analysis of the seismic and acoustic recordings has proven to be a useful tool for identifying and locating quarry blasting sources.

This presentation has been accomplished in the framework of the National Core-Programme MULTIRISC project (contract 31N/2019), PN 19080101.