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Analysis of infrasound and seismic signals recorded from repetitive explosion sources at near-regional distance

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Simultaneous observations of infrasonic and seismic signals recorded with the Romanian seismoacoustic arrays (BURAR, BURARI and IPLOR) are used to forensic tracking the repetitive explosion sources generated by the bombing and shelling taking place in Ukraine since 24 February 2022. Seismo-acoustic signature (signal shape and amplitude, frequency content, energy spectrum) analyzed are characterized by impulsive energetic signals. Events reported in the bulletins provided by IDC/CTBTO are used as reference for associating infrasound and seismic detections of the Romanian arrays. Infrasound signals observed with BURAR seismic array are added to better characterize the type of events in this region. Seismo-acoustic data are analyzed by using processing capabilities of the DTK-GPMCC and DTK-DIVA software embedded in NDC-in-a-Box package.

Infrasonic detections are strongly influenced both by seasonally dependent stratospheric winds and local turbulence-induced pressure fluctuations, i.e., level of wind-generated background noise increases with station altitude. Directions of IPLOR and BURARI infrasonic detections are estimated and the locations are obtained by cross-bearing the derived back azimuths. Deviating effects of zonal cross winds along the propagation path through the atmosphere affect the observed back azimuths: rays which arrive at BURARI are deflected towards the East with approx. 5°, whilst at IPLOR, the azimuthal deviation is negligible (below 1°).

The propagation path of infrasonic signals is analyzed by applying infraGA 2D ray tracer through NRL-G2S atmospheric model. Stratospheric and thermospheric infrasound phases are identified to be observed at BURARI and IPLOR stations.

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