SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

Assessing Romanian infrasound stations performance for tracking repetitive explosive sources generated by military activity at near-regional ranges using IDC bulletins

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INTRODUCTION AND MAIN RESULTS

This presentation shows an analysis focused on the high frequency signals (above 1 Hz) detected by two Romanian infrasound stations mainly from consistent sources related to the intense military activity caused by bombardment and shelling during the Ukraine war. Coherent infrasound signals were automatically associated with events listed in the LEB bulletins provided by IDC/CTBTO.

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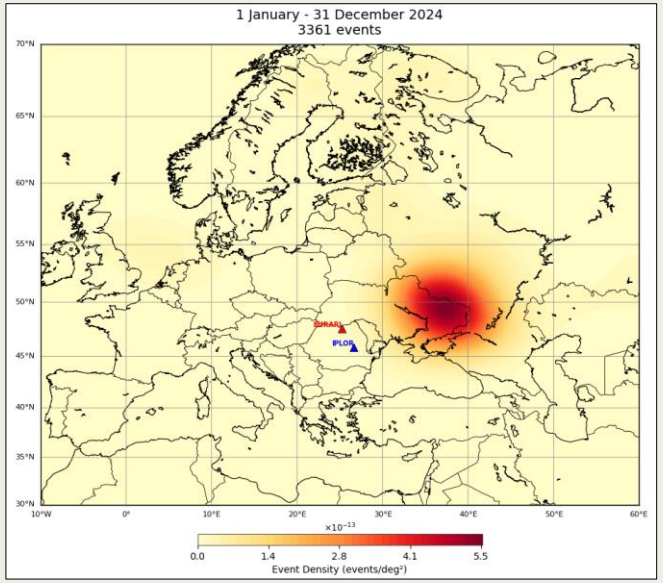
Introduction

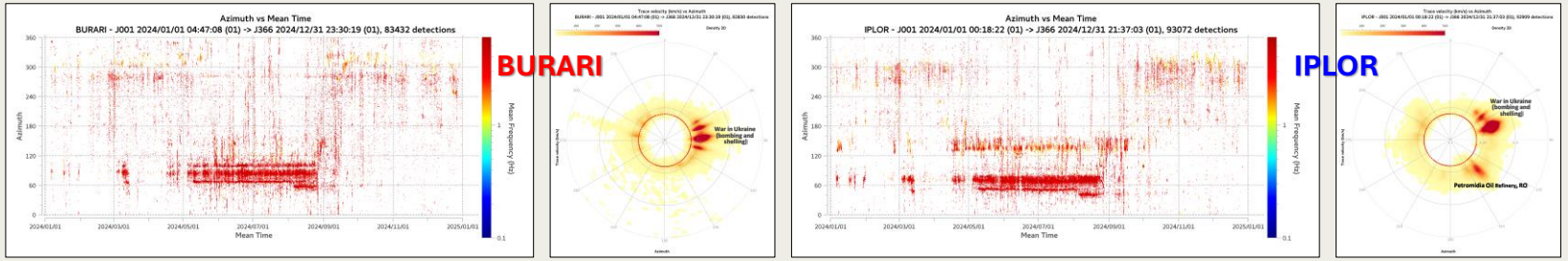
Detection performance of the Romanian infrasound stations BURARI and IPLOR are permanently investigated for relevant recurrent coherent signals. Automatically processing of infrasound data recorded in 2024 shows seasonal behaviour of the station detection performance in correlation with atmospheric dynamics. Numerous and repeated high frequency signals (above 1 Hz) are detected mainly from consistent sources related to the intense military activity caused by bombardment and shelling during Ukraine war. Events listed in LEB bulletins could be related to these sources.



Map showing the density of geographical distribution of the LEB events used in this study

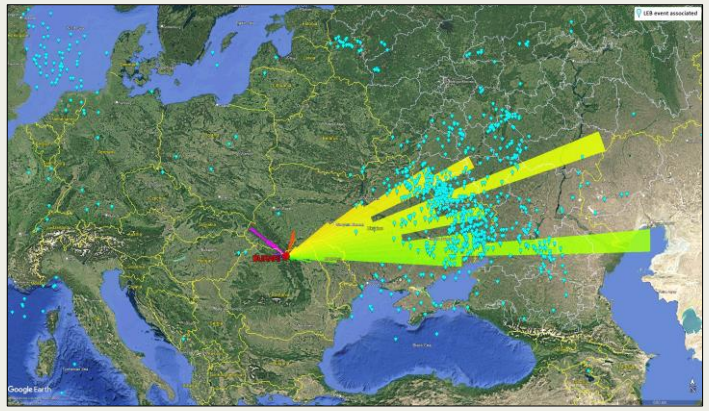
Methods/Results

Infrasound data recorded with Romanian stations BURARI and IPLOR are processed and analysed on routinely basis at NIEP by using capabilities of NDC-in-a-Box, i.e., DTK-PMCC, DTK-GPMCC and DTK-DIVA software.

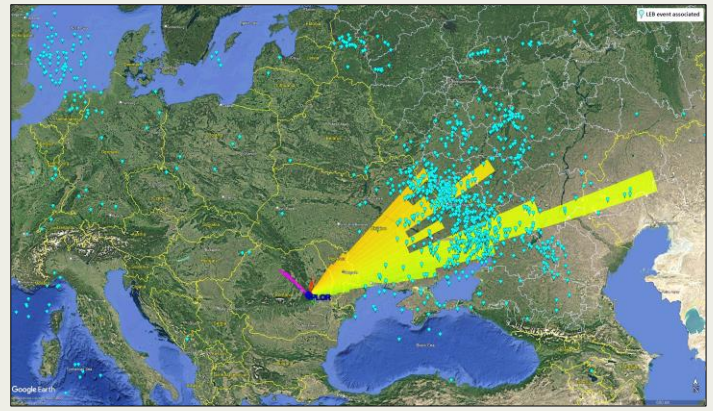


Station detection performance in 2023 (frequency above 1 Hz) for BURARI (left) and IPLOR (right)

The observed and expected values of both backazimuths and arrival times for arrays recordings and LEB events were compared. Expected arrival time was estimated by using an average speed of 0.3 km/s of the sound wave to propagate to arrays straight from the event location. Deviating effects of zonal cross winds along the propagation path through the atmosphere is not considered for the observed backazimuths. Allowed deviations between observed and expected values were considered as ±10 deg for backazimuth and ±10 min for arrival time.



3348 BURARI infrasound detections associated with 881 LEBs (approx. 26% of the LEBs total)



3446 IPLOR infrasound detections associated with 974 LEBs (approx. 29% of the LEBs total)

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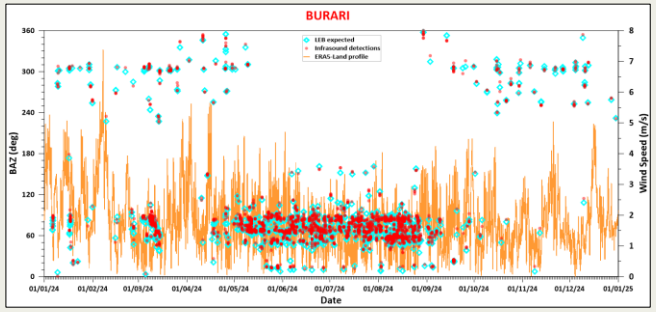
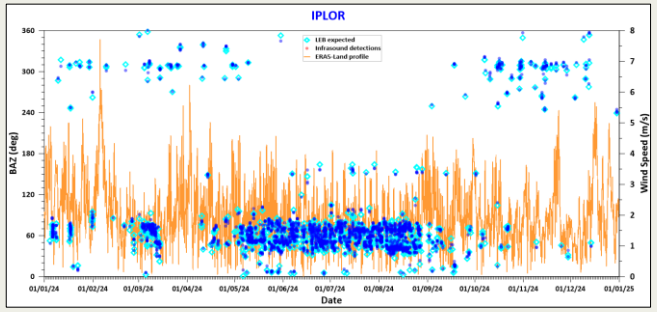
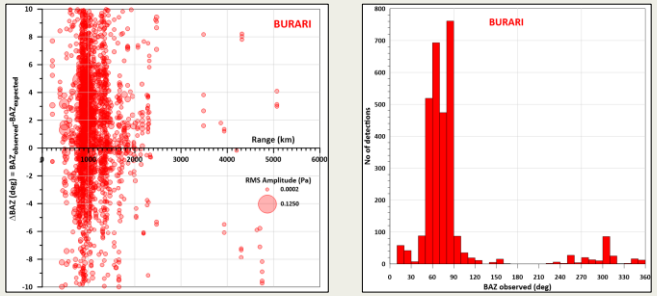
Results (cont.)



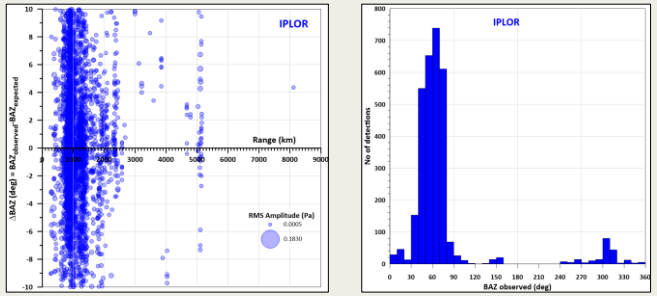
3348 BURARI infrasound detections could be automatically associated with 881 LEBs (approx. 26%)



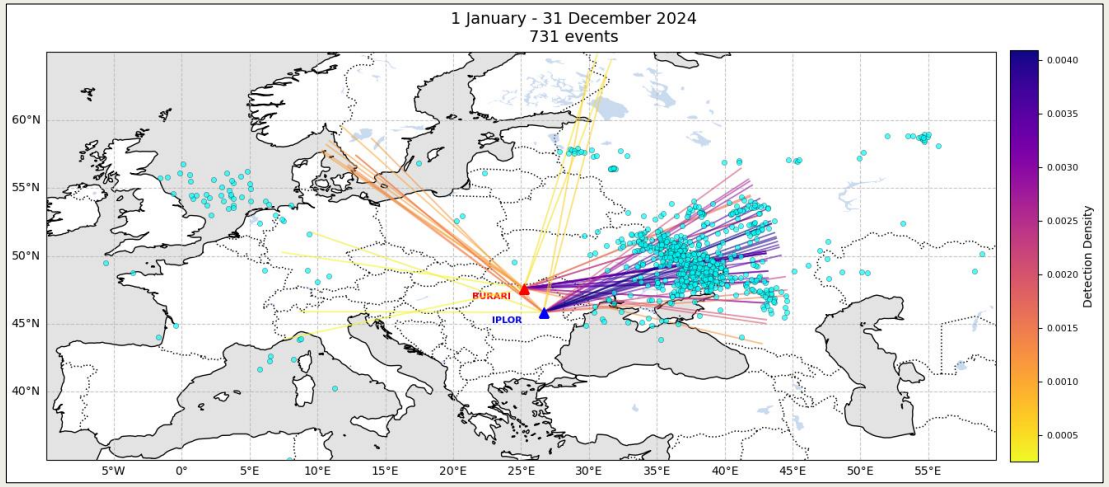
3446 IPLOR infrasound detections could be automatically associated with 974 LEBs (approx. 29%)



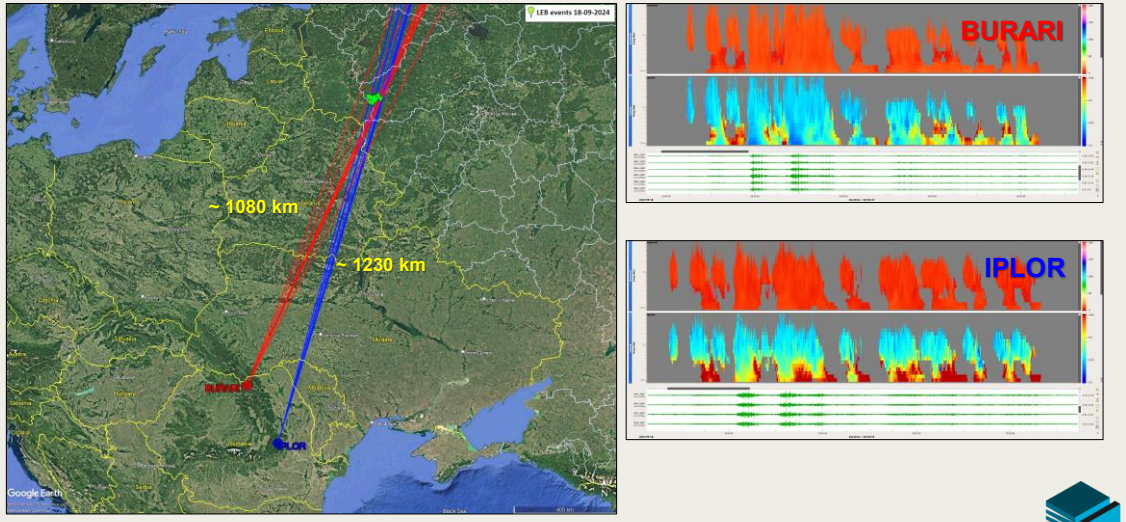
For 90% of LEB associated events, BURARI observed backazimuth values lie between 0 and 120 degrees



For 92% of LEB associated events, IPLOR observed backazimuth values lie between 0 and 120 degrees



731 LEB events could be simultaneously associated to BURARI and IPLOR (observed backazimuth is plotted)



Example of association of infrasonic detections with LEB locations: 18 September 2024, massive series of explosions at Toropets (Russia) ammo depot caused by Ukraine drone attack

Conclusions

Observations of infrasonic signals recorded with BURARI and IPLOR arrays were used to forensic tracking these repetitive explosion sources at regional range

Coherent infrasound signals with frequency above 1 Hz were automatically associated with LEB events provided by IDC/CTBTO

Characteristics of the associated infrasonic signals, i.e., number of detections, backazimuth deviation, RMS amplitude, were analysed

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