Detections at Infrasound Station ISCO

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The continuous monitoring of potential nuclear tests is performed by the Austrian National Data Center (NDC-AT). The Comprehensive Test-Ban Treaty (CTBT) forwards data from a worldwide network of different sensors to all signatory states for verification purposes. One technology used to monitor atmospheric explosions is infrasound. To study its attributes and to understand the behavior of infrasound propagation the Infrasound Array ISCO was installed in 2021 on the premises of the Conrad Observatory. Meanwhile the system was upgraded and continuous data are now collected. An overview of the detection capability and some selected events are presented.

Installed in 2021 the array is part of the Central Eastern European Infrasound Network (CEEIN) which was established in 2018 by Rumania, Czechia, Hungary, Ukraine and Austria (Bondar et al, 2022, https://doi.org/10.1093/gji/ggac066). In 2022 the ISCO array detected infrasound signals from different sources like microbaroms originating from the Atlantic Ocean, local quarry blasts, sonic booms of military aircrafts in the Northern Sea, military activity in Ukraine and infrasound generated by earthquakes. Due to the semi-annual variation of the stratospheric wind direction, the prevailing direction of the signals is changing with time. During winter, signals are mainly received from the East (Ukraine) while sources from the West (military activity in the Northern Sea, microbaroms) are observed during summer. Fig. 1 shows detections station ISCO made during winter (left) and during summer 2022 (right). Yellow dots are locations of known events listed in the analyst-reviewed Late Event Bulletin (LEB) provided by the CTBT International Data Center (IDC).

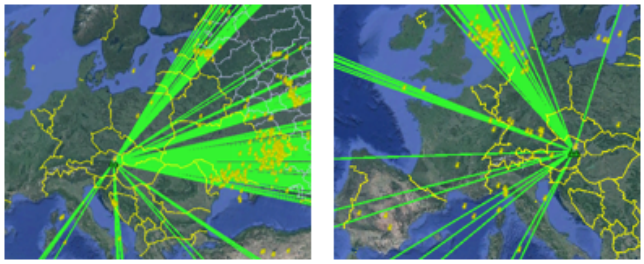

Figure 1: Detections at station ISCO.

Due to the Russian invasion of Ukraine, the array routinely detects signals from Eastern and Southern Ukraine generated by shelling, bombardment and missile attacks. As an example Fig. 2 shows detections caused by an explosion of an ammunition depot near Dzhankoi in Northern Crimea on 16th August 2022 at a distance of approximately 1350 km from the array. Data was processed and analyzed manually by using the dtkGPMCC- and dtkDIVA-Software, developed by CEA/DASE (Commissariat à l'Énergie Atomique/Département analyse, surveillance, environment, France). In the upper part of the panel the detections are color-coded by azimuth and in the middle panel by trace velocity. In the lower panel waveforms are displayed, filtered between 0.5-4 Hz.

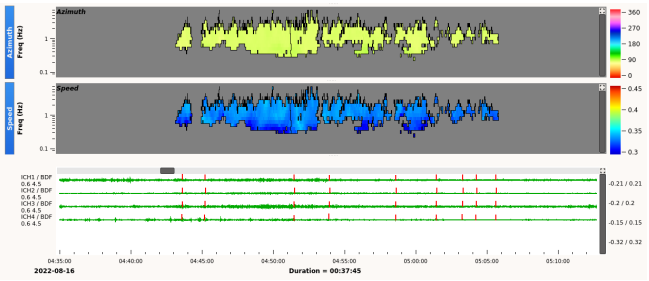

Figure 2: Detection of an explosion in Northern Crimea on 16th August 2022.

Another event of interest occurred on 26th September 2022 close to island Bornholm in the Baltic Sea. Two seismo-acoustic events were caused by explosions of the Nord Stream gas pipeline, which carries natural gas from Russia to Europe. The detection, which is marked with a white frame in Fig. 3, relates to the later explosion at 17:03 UTC. Infrasound signals of the event with a seismic magnitude mb=3.2 were detected around 18:00 UTC at station ISCO. The distance from the array amounts to 800 km.

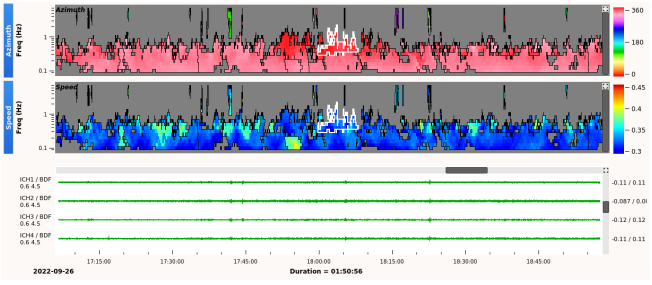

Figure 3: Detection of Nordstream Explosion on 26th September 2022.

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