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Infrasound research at Kola Regional Seismological Centre, Russia

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A small-aperture infrasound array has been installed in Kola Peninsula, Russia 17 km far from the town of Apatity in the year 2000. It comprises 3 Chaparral V microbarographs placed closely to the APA seismic array sensors and equipped with pipe wind reducing filters. The data are digitized at the array site and transmitted in real time to a processing center in Apatity.
To search for infrasound events (arrivals of coherent signals) a beamforming-style detector has been developed. Now it works in near real time. We analyzed the detecting statistics for different frequency bands. Most man-made events are detected in 1-5 Hz band, microbaromes are typically detected in 0.2-1 Hz band. In lower frequencies we record mostly a wind noise.
A data base of samples of infrasound signals of different natures has been collected. It contains recordings of microbaromes, industrial and military explosions, airplane shock waves, infrasound of airplanes, thunders, rocket launches and reentries, bolides etc. The most distant signals we have detected are associated with Kursk Magnetic Anomaly explosions (1700 km far from Apatity).
We implemented an algorithm for association of infrasound signals and preliminary location of infrasound events by several arrays. It was tested with Apatity data together with data of Sweden - Finnish infrasound network operated by the Institute of Space Physics in Umea (Sweden). By agreement with NORSAR we have a real-time access to the data of Norwegian experimental infrasound installation situated in Karasjok (North Norway). Currently our detection and location programs work both with Apatity and Norwegian data. The results are available in Internet.
Finnish militaries routinely destroy out-of-date weapon in autumns at the same compact site in North Finland. This is a great source of repeating infrasound signals of the same magnitude and origin. We recorded several hundreds of such explosions. The signals have been used for testing our location routines. Some factors were observed enabling or disabling first (tropospheric) arrivals of such signals depending on weather conditions. Systematic backazimuth deviations for stratospheric arrivals have been observed caused by strong stratospheric winds.
In 2009 mobile infrasound arrays were developed in KRSC. Each array comprises 3 low-frequency microphones, GPS, digitizer and PC with data acquisition system. Aperture of such arrays is about 250 m, deployment time is less than 1 hour. These arrays are used in experimental work with Roskosmos space agency to search space debris reentering places. In 2012 a wireless version of such mobile array was created. Each acquisition point comprises a microphone, GPS and ADC chips, microcontroller and radio modem to send data to a central unit. This enabled us to increase aperture (up to 500 m) and decrease deployment time.