The program LOS for interactive seismic and infrasonic data processing

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Abstract For many years, the Kola Division of the Geophysical Survey of the Russian Academy of Sciences carries out work on testing and implementation of modern techniques and algorithms for seismic and infrasonic data processing and event location. The KoD staff has developed several original algorithms that appeared to be useful for seismic and infrasonic event location and discrimination. In 2020, the LOS program was created. The most efficient tools for data processing and analysis, event location algorithms have been united in the program. The program also contains a modern mapping system and database. The following tools have been implemented: bandpass and adaptive filtration, polarization analysis and backazimuth computation for 3C stations, computation of backazimuths, and apparent velocities for seismic and infrasonic arrays (beamforming). To analyze records of infrasonic arrays the program has a cross-correlation tool, which enables to observe changes of signal's backazimuths and apparent velocities in time. For seismic event location, the program uses two basic algorithms: minimization of origin time estimation residual and grid search based on generalized beamforming approach. These algorithms can be used in different combinations depending on the location scenario selected by a user. In addition, a new location algorithm based on a presentation of the seismic medium in a form of random graph where vertices correspond to points in the medium and edges are wave paths between the points, has been implemented. It can be useful for locating events in a substantially heterogeneous media, possibly with voids and cavities, as well as for taking into account the relief. This algorithm can be used, in particular, when locating events in mines using local mine seismic networks. The LOS program has been put into the practice of the Kola Division.

Keywords seismology, acoustics, program, signal processing, seismic location, infrasound, infrasonic array.

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