Development of the method for detecting natural frequencies of blocks in seismic noise before small seismic events

Alina Besedina and Dmitry Pavlov
Sadovsky Institute of Geospheres Dynamics of Russian Academy of Sciences, Deformation processes of the Earth crust, Moscow, Russian Federation (besedina.a@gmail.com)

Previous studies of microseismic noise before earthquakes in seismically active regions showed the possibility of detecting the preparation processes of seismic events. This effect manifests itself as decrease of the frequency of natural oscillations before earthquakes. In this work, the method for detecting the natural frequencies of blocks in seismic noise is adapted to a lower hierarchical level. Using known empirical relations for faults with a characteristic length of less than 500-1000 m, the characteristic natural oscillation frequencies that can be used to diagnose a fault zone are estimated. For small seismic events with magnitudes Mw from -2 to -1, we calculated the expected frequencies of natural vibrations of 350-1100 Hz, and for events with Mw from 0 to 1 – below 35 Hz. For analysis, we used the recording data of high-frequency accelerometers at a depth of 300 m from the free surface in the area of the city of Gubkin (Russia) within iron ore deposits. Before small events with an amplitude of more than 0.01 m/s², the intervals of decrease in the spectral centroid in the range of 20-1200 Hz were identified. The minimum values of the spectral centroid obtained on the basis of experimental data are generally in a good agreement with theoretical estimates. This work was supported by RFBR (project # 18-05-00923).