Using the matched filter technique at small aperture seismic array "Mikhnevo"

I.O. Kitov, I.A. Sanina, K.S. Nepeina, N.L. Konstantinovskaya

Institute of Geopheres Dynamics RAS, Moscow, Russia

Abstract. Small-aperture array (SMA) "Mikhnevo" was designed as an instrument for various regional seismic studies, including the creation of detailed catalogue of industrial explosions within the East-European platform. This array includes 12 observation sites arranged in three circles and equipped with short-period seismometers SM3-KV. The Institute of Geospheres Dynamics launched the array in 2004 and it has been detecting up to 1000 industrial blasts per year. The SMA "Mikhnevo" uses beam-forming for array processing. Stacking of individual waveforms reduced to the reference point allows suppressing microseismic noise and improving signal-to-noise ratio (SNR) relative to 3C station. The improved SNR for a given signal is equivalent to a reduced detection threshold – much weaker signals can be detected with beam-forming. In turn, more and more signals from small industrial explosions are detected. Weak signals are difficult to indentify because of higher uncertainty in the estimates of such characteristics as azimuth, slowness, and amplitude. Having the ten-year catalogue of industrial explosions and corresponding archive of raw digital records we apply the waveform cross correlation (matched filter) technique, which has an extremely high relative location accuracy and thus identification capability. We have created a set of master-events with relevant waveform templates for automatic data processing and creation of accurate catalogue of industrial explosions.

Keywords: matched filter, waveform cross correlation, small aperture seismic array, industrial explosion.