THE REDUCTION IN SIGNAL DETECTION THRESHOLD WITH THE METHOD OF WAVEFORM CROSS CORRELATION BY USING A SEISMIC ARRAY OF THREE-COMPONENT SENSORS

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Abstract. The use of waveform cross-correlation allows reducing the amplitude detection threshold of repeating seismic events by a factor of 5 to 10, to improve the accuracy of relative location and seismic magnitude estimate more than by an order of magnitude, and also provides the possibility to reliably identify the source nature. In this study, we demonstrate that in comparison with the sub-array of vertical channels temporary seismic array of three-component sensors (3-C) detects more valid signals with higher mean signal-to-noise ratios (SNR). For this analysis, we used records of repeating blasts from seven quarries that are from 60 km to 350 km distant from the 3-C array center. For each quarry, we selected best waveform templates which provided maximum quantity of valid signals with the largest signal-to-noise ratios. We have directly compared the efficiency of detection and identification of blasts’ signals with the help of complete 3-C array and sub-array consisting of vertical sensors. The results of comparison indicate that the 3-C arrays have considerable advantages over any other types of stations, that is based on the increase of total energy of template and sought signals and also on the specifics of the template waveform due to the three times increase of total length of the template. The growth of the signal-to-noise ratio results in the increasing number of detected seismic signals and specifics of the waveform reduce the rate of false alarms.

Keywords: waveform cross-correlation, seismic array, three-component stations, signal detection, quarry blasts.

References


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