Geophysical Research Abstracts
Vol. 19, EGU2017-5989, 2017
EGU General Assembly 2017

Detection and location of small aftershocks using waveform cross correlation

Ivan Kitov (1,2), Irina Sanina (2), and Sergey Sergeev (2)
(1) PTS CTBTO, Vienna, Austria, (2) Institute for Dynamics of Geospheres, Russian Academy of Sciences, Moscow, Russia

Aftershock sequences of earthquakes with magnitudes 5.0 and lower are difficult to detect and locate by sparse regional networks. Signals from aftershocks with magnitudes 2 to 3 are usually below detection thresholds of standard 3-C seismic stations at near regional distances. For seismic events close in space, the method waveform cross correlation (WCC) allows to reduce detection threshold by at least a unit of magnitude and to improve location precision to a few kilometers. Therefore, the WCC method is directly applicable to weak aftershock sequences. Here, we recover seismic activity after the earthquake near the town of Mariupol (Ukraine) occurred on August 7, 2016. The main shock was detected by many stations of the International monitoring system (IMS), including the closest primary IMS array stations AKASG (6.62 deg.) and BRTR (7.81), as well as 3-C station KBZ (5.00). The International data centre located this event (47.0013N, 37.5427E), estimated its origin time (08:15:4.1 UTC), magnitude (mb=4.5), and depth (6.8 km). This event was also detected by two array stations of the Institute for Dynamics of Geospheres (IDG) of the Russian Academy of Sciences: portable 3-C array RDON (3.28), which is the closest station, and MHVAR (7.96). Using signals from the main shock at five stations as waveform templates, we calculated continuous traces of cross correlation coefficient (CC) from the 7th to the 11th of August. We found that the best templates should include all regional phases, and thus, have the length from 80 s to 180 s. For detection, we used standard STA/LTA method with threshold depending on station. The accuracy of onset time estimation by the STA/LTA detector based on CC-traces is close to one sample, which varies from 0.05 s at BRTR to 0.005 s for RDON and MHVAR. Arrival times of all detected signals were reduced to origin times using the observed travel times from the main shock. Clusters of origin times are considered as event hypotheses in the phase association procedure. As a result, we found 12 aftershocks with magnitudes between 1.5 and 3.5. These small events were detected neither by the IDC nor by the near regional network of the Geophysical Survey of RAS, which has three closest 3-C stations at distances of 2.2 to 3.5 degrees from the studied earthquake. We also applied procedure of relative location and all aftershocks were found within a few km from the main shock.