Accuracy tests of the automatic detection algorithms

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The biggest earthquake (M_L 5.8) since the modern earthquake monitoring in the Korean Peninsula was initiated in 1978 occurred in the southeastern part of Korea on 9 September 2016. After about a year, the most damaging earthquake in Korea occurred near by M_L 5.8 earthquake. Dense temporary broadband networks were installed for the purpose of aftershock monitoring. In order to analyze the Korea Peninsula southeastern earthquake sequence, we developed an algorithm of automatically detecting events, determining the arrival times of seismic phases, and locating the hypocenters of detected events in the sequence. An implementation of the algorithm is consisting of six steps. The first step is the initial declaration of an event in continuous seismic data using a characteristic function which is designed considering the unique background noise characteristics of the study region. The second is the automatic determination of P-wave arrival time using the normalized squared–envelope function. The third is the application of three-axis rotation using an energy ratio among three-component seismograms of the event. The fourth is the automatic determination of S-wave arrival time. The fifth step is the removal of outliers on the Wadati diagram which plots S-P times against P-wave arrival times. The final step is to determine the hypocenter using the velellipse algorithm. If root-mean-square error (RMSE) of hypocenter inversion has larger than a prescribed threshold, arrival time of the largest RMSE is removed and the hypocenter is re-determined using velellipse. The developed algorithm is applied to the continuous waveform data after mainshocks. Spatial and temporal patterns of the aftershock sequence detected using the automatic analysis algorithm is compared with those of selected events analyzed manually. The results confirmed that the present automatic algorithm is applicable with confidence to the processing of massive data from dense temporary seismic networks which cannot be readily merged into the existing permanent network.