



Local Earthquake Onset Detection Based on Short Time Fourier Transform

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The existence of the large number of seismographs in Iran and necessity of a fast and precise analysis of them motivates the implementation of an automated procedure to analyze the data from these seismographs. In this study we introduce a method of automatic P-phase picking for analyzing local earthquakes in Iran. The proposed algorithm is categorized as a time-frequency domain version of the well-known STA/LTA method, since it investigates the power in a short term window versus the power in a long term window of a time-frequency representation of a seismogram. In the proposed method Short Time Fourier Transform is calculated along the seismic signal using the Gaussian time window. The total power in the selected frequency band is calculated for each time window and the produced time series is regarded as a characteristic function to which STA/LTA picking algorithm is applied and P phase arrival time is determined.

The performance of our method is evaluated using two databases of more than 100 local events and the P-phases detected by the algorithm are compared with those reported in the databases. The first data set included 118 very minor ($2 \leq m_b < 3$) local events which have been selected from aftershocks of the Zarand, February 22, 2005, $m_b = 6.4$ earthquake recorded by the temporary broadband stations installed by International Institute of Earthquake Engineering and Seismology. The second data set consist of 100 very minor local events ($2 \leq m_b < 3$) gathered by the Iranian National Seismic Network (INSN). These earthquakes occurred within the Iranian plateau during 2005 and 2006. The results show that the mean value and standard deviation of time differences between manually and automatically determined onset times are both less than 0.3 s for both data sets. Accordingly the proposed phase picking algorithm can be used to determine P phase onset time automatically on local events recorded at Iranian Plateau, e.g. in aftershock analysis.