Geophysical Research Abstracts
Vol. 14, EGU2012-4450-2, 2012
EGU General Assembly 2012


# Automatic earthquake detection and P- and S- phase picking for local seismic networks

Nasim Karamzadeh (1), Gholam D. Javan (1), and Peter H. Voss (2)

(1) Institute of Earthquake Engineering and Seismology, Seismology Research Center, Tehran, Islamic Republic Of Iran (n.karamzadeh@gmail.com), (2) Geological Survey of Denmark and Greenland-GEUS, Copenhagen, Denmark

Automatic earthquake detection and seismic phase arrival time determination is of great importance in seismology. Huge amount of digital seismic data are recorded by seismic stations every day. Manual processing of these data is a very time consuming and expensive. Hence, using automatic procedure for rapid processing of seismic data, such as event identification and location is essential.
In this study, we have developed a procedure for automatic event detection and phase picking, namely Automatic Earthquake Signal Analyzer (AESA), which is designed to be applied on local seismic networks.
Seismic event are distinct on seismograms as their frequency content and amplitude are different from background noise. So working on time frequency representation of the seismograms is more reasonable than working just in time or frequency domain seismograms. For these reasons, AESA uses short time Fourier transform to inspect seismograms properties in the time and the frequency domain, simultaneously. The event detection algorithm inspects the temporal variation of the signal spectrogram calculated on frequency bands corresponding to the frequency content of local earthquakes. In order to reduce false detection rate, all three components of seismograms are used in event detection procedure. P-phase picker method is similar to event detection method, but it works only on vertical components. For S-phase picking a polarization analysis is done by 2D covariance matrix, using horizontal components spectrograms.
The AESA performs as fallowing steps: First, events are extracted for all available stations of network, using 3 component continuous waveforms. Accordingly, a list of events is generated for every station. After that, events in all or some of stations whose start times fall within the same interval are merged together and announced as a single event. For detected events, P and S phases are picked on available signals. In addition coda duration is determined to obtain a rough estimation of duration magnitude. Events which have been observed in more than 3 stations will go to the location step. All of the determined information is stored in a text file, according to SEISAN, S-file format. So we can use SEISAN software for determining location of events. In addition further analysis of the automatically detected events will be easily done.
We evaluate the AESA; using data recorded on a local network consist of 4 broadband stations. The results of this evaluation show that, the AESA may successfully extract preliminary information of a local network, such as numbers, magnitude and location of recorded events. This information is very valuable, e.g. in a fast analysis of an aftershock sequence.