



Application of a cross correlation-based picking algorithm to an active seismic experiment in Sicily and Aeolian Islands

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The detection of the arrival time of seismic waves or picking is of great importance in many seismology applications. Traditionally, picking has been carried out by human operators. This process is not systematic and relies completely on the expertise and judgment of the analysts. The limitations of manual picking and the increasing amount of data daily stored in the seismic networks worldwide distributed and in active seismic experiments lead to the development of automatic picking algorithms.

Current conventional algorithms work with single signals, such as the “short-term average over long-term average” (STA/LTA) algorithm, autoregressive methods or the recently developed “Adaptive Multiband Picking Algorithm” (AMPA). This work proposes a correlation-based picking algorithm, whose main advantage is the fact of using the information of a set of signals, improving the signal to noise ratio and therefore the picking accuracy. The main advantage of this approach is that the algorithm does not require to set up sophisticated parameters, in contrast to other automatic algorithms.

The accuracy of the conventional STA/LTA algorithm, the recently developed AMPA algorithm, an autoregressive method, and a preliminary version of the cross correlation-based picking algorithm were assessed using a huge data set composed by active seismic signals from experiments in Tenerife Island (January 2007, Spain). The experiment consisted of the deployment of a dense seismic network on Tenerife Island (125 seismometers in total) and the shooting of air-guns around the island with the Spanish oceanographic vessel Hespérides (6459 air shots in total). Only 110937 signals (13.74% of the total) had the signal to noise ratio enough to be manually picked. Results showed that the use of the cross correlation-based picking algorithm significantly increases the number of signals that can be considered in the tomography.

A new active seismic experiment will cover Sicily and Aeolian Islands (TOMO-ETNA MED-SUV.ISES) under the European MED-SUV project. The Spanish oceanographic vessel Sarmiento de Gamboa will shot about 2600 and 4000 air-guns in the Ionian and Tyrrhenian Seas, respectively. The shots will be recorded in 150 seismic stations. Thus, close to 1 million P-waves arrivals will be generated. Since the sources and receivers locations are known and considering that the vessel will travel a small distance between two consecutive shots, a cross correlation-based picking algorithm will be used to obtain the arrival time.