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Automatic processing of seismograms using the new version of the RSNI-Picker software: examples of real-time and off-line analyses

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The growing number of permanent and temporary seismic stations has recently led to a huge amount of available seismic recordings. To take advantage of all the information contained in these data, reliable automatic procedures are increasingly required. In particular, an automatic phase picking engine able to work in a very short time like a seismologist, especially in terms of comparable accurate and reliable phases readings, and able to work without making systematic or subjective biases (e.g., false picks) is becoming of primary importance to take real advantage of the great amount of seismic data.

Inspired by a pioneering work by Sleeman and Van Eck (1999), Spallarossa et al. (2014) recently proposed the RSNI-Picker automatic engine (RSNI stands for the Regional Seismic network of North-western Italy, managed by the University of Genoa) and showed its performances in automatically identifying reliable P- and S-phase arrival times from different seismic datasets. RSNI-Picker obtains P- and S-wave arrival times calculating the AIC function (Akaike Information Criterion; Akaike, 1974), from seismic signal portions selected by an envelope function. The AIC-based module is driven by the use of an a-priori information (i.e. selecting the proper part of the signal) derived from the signal characteristics (i.e. envelope function), at an early stage or from the results of previous iterations (i.e. location residuals).

The new version of RSNI-Picker takes great advantage from the use of the NonLinLoc software (Lomax et al., 2000) with 3D P- and S-wave velocity models in its engine. In fact, during the location phase it is very important the use of a robust and validated velocity model, in order to obtain the best results both for travel-time calculations and correct phase weighting.

Preliminary results show that significant improvements could be achieved both in terms of accuracy and reliability of automatic seismic data processing, and of earthquake locations. RSNI-Picker is currently used as an automatic monitoring system with real-time data by the RSNI seismic network in North-western Italy, but it is also extremely valid with off-line data processing such as the creation of automatic earthquake catalogues (e.g., AlpArray Project data processing) or automatic arrival times datasets for local earthquake tomographic studies (e.g., Trentino region tomography, North-eastern Italy; Scafidi et al., 2016).

References:
- Akaike H.; 1974: Markovian representation of stochastic processes and its application to the analysis of autoregressive moving average process. Annals of the Institute of Statistical Mathematics, Vol. 26, pp. 363-387.
- Lomax A., Virieux J., Volant P. and Berge-Thierry C.; 2000: Probabilistic earthquake location in 3D and layered models: introduction of a Metropolis–Gibbs method and comparison with linear locations. In: Thurber C.H. and Rabinowitz N. (eds), Advances in seismic event location, Kluwer, Amsterdam, pp. 101-134.
- Scafidi D., Spallarossa D., Turino C., Ferretti G., Viganò A.; 2016: Automatic P-and S-Wave Local Earthquake Tomography: Testing Performance of the Automatic Phase-Picker Engine "RSNI-Picker". Bulletin of the Seismological Society of America, Vol. 106, No. 2, pp. 526-536.
- Sleeman R., Van Eck T.; 1999: Robust automatic P-phase picking: an on-line implementation in the analysis of broadband seismogram recordings. Physics of the Earth and Planetary Interiors, Vol. 113, Issues 1-4, pp. 265-275.
- Spallarossa D., Ferretti G., Scafidi D., Turino C. and Pasta M.; 2014: Performance of the RSNI-Picker. Seismological Research Letters, Vol. 85, pp. 1243-1254.