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IMPLEMENTATION OF A NEW PICKING PROCEDURE IN THE ANTELOPE SOFTWARE

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Automatic estimates of earthquake parameters continues to be of considerable interest to the seismological community. In this study we present a new automatic procedure for a quasi real-time location of events. This procedure is a combination of the solid and tested Antelope sotfware written by BRTT, Boulder Real Time Technologies (Figure 1) with a new picking procedure, the AutoPicker (Figure 2) (Turino et al., 2010).

Antelope picking procedure consists on:

a) Prefiltering into different frequency pass bands;
b) Run STA/LTA detectors in one or more channels of the waveform data;
c) Associate event locations by searching over one or more spatial grids for a candidate hypocenter that produces theoretical time moveout (P and S) to each station that most closely matches the observations.

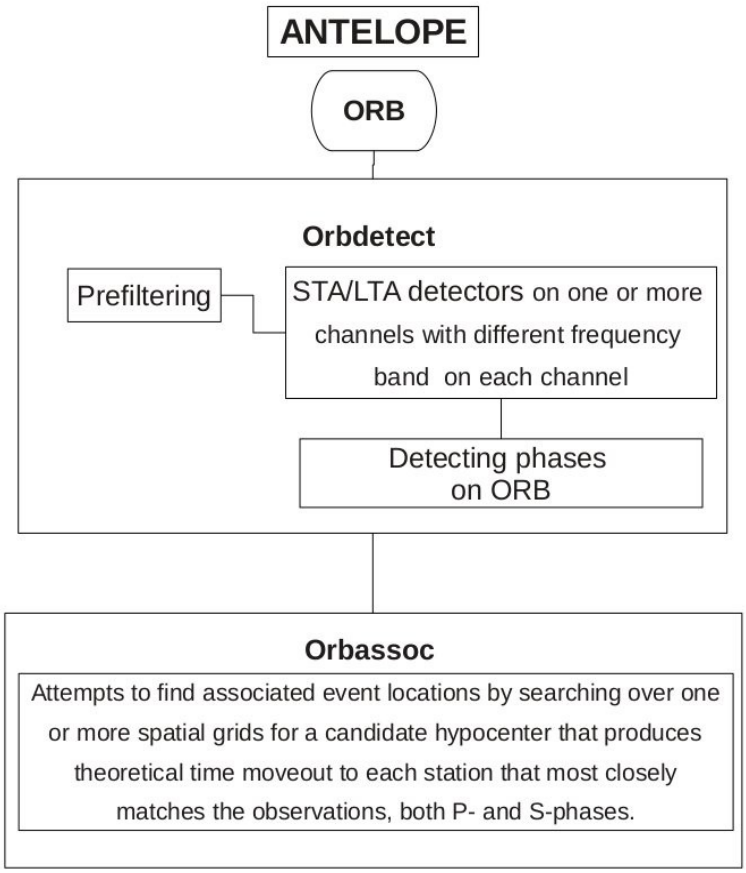

Figure 1. Flow chart of the ANTELOPE P and S wave picking and event location approach

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The main characteristics of the AutoPicker picking algorithm are:
a) Pre-filtering and envelope calculation to prearrange the onset;
b) Preliminary detection of P onset using the AIC based picker;
c) P validation, Signal Variance/Noise Variance analysis sample by sample;
d) Preliminary earthquake location;
e) Detection of S onset adopting the AIC based picker;
f) S/N analysis, S validation;
g) Earthquake location.

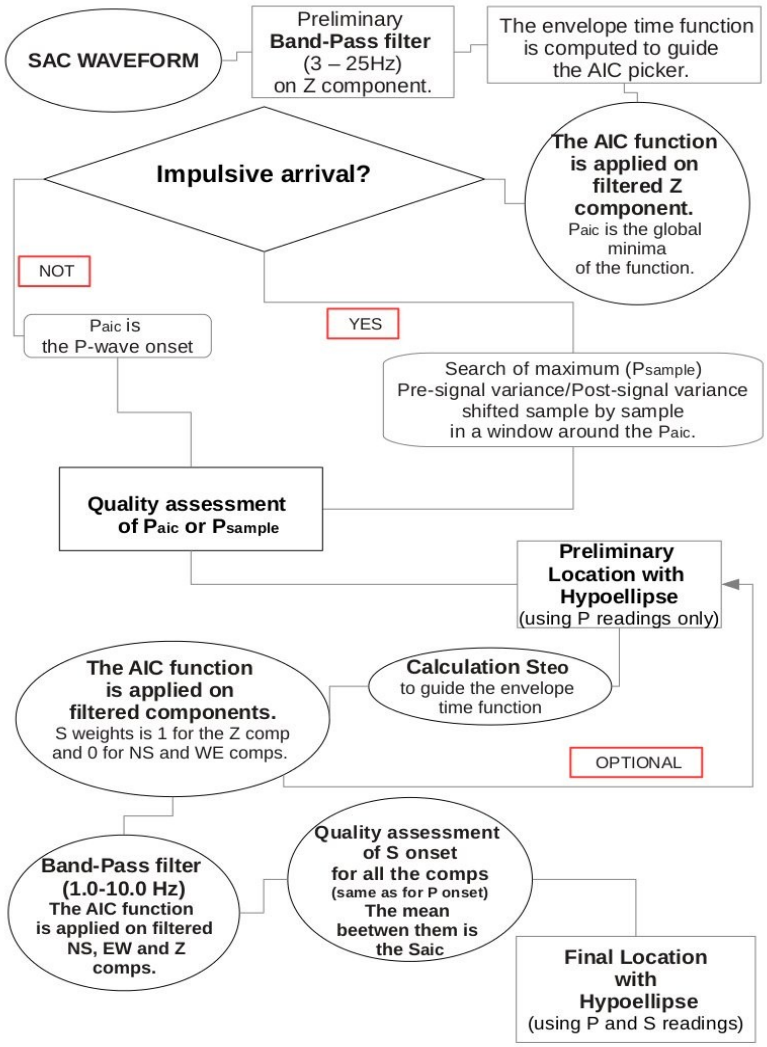

Figure 2. Flow chart of the AUTOPICKER P and S wave picking approach.

We have applied these two automatic procedures to the Emilia sequence occurred in May-June 2012. In this comparison the distribution of the differences between the manual and the two automatic P-onset are comparable. The average values of P differences are similar, but we have to point out that the AutoPicker procedure gives a st.deviation value lower than the Antelope ones and most important it picks the 16% of phases more than the other algoritm. For S-phases the AutoPicker algorithm picks 178 phases with a mean value of 0.09 sec, instead of the 16s of Antelope with a mean value of 3.75 sec. For more than 90% events the epicentral differences of AutoPicker is less than 5 kms, instead of the Antelope differences which are less than 10 kms. For the depth differences the mean values and the distributions of the two procedures are quite similar, even if Antelope locates only 38 of the 44 events studied, despite of the 43 of the AutoPicker.

AutoPicker finds more and preciser phases than Antelope both P- (16% more) and mainly S-phases(90% more); despite that Orbassoc process in Antelope, is able to correctly associate the detections and to find the right location even if with less phases. In this work we illustrate the implementation of the AutoPicker picking procedure in Antelope software. In the final configuration the AutoPicker is used to rilevate the P- and S- phases, and then these P- and S- onset are associated through the use of the Antelope associator and localizator (Figure 3). In particular, after the first location with Antelope, the new procedure read the waveform data and the origin time from the Antelope tables. These informations are transferred to the AutoPicker, which detects and determines the P- and S-onset, those are written in the detection and arrivals table of Antelope. Then Antelope's orbassoc process, using the AutoPicker phases, associates and locates the seismic events.

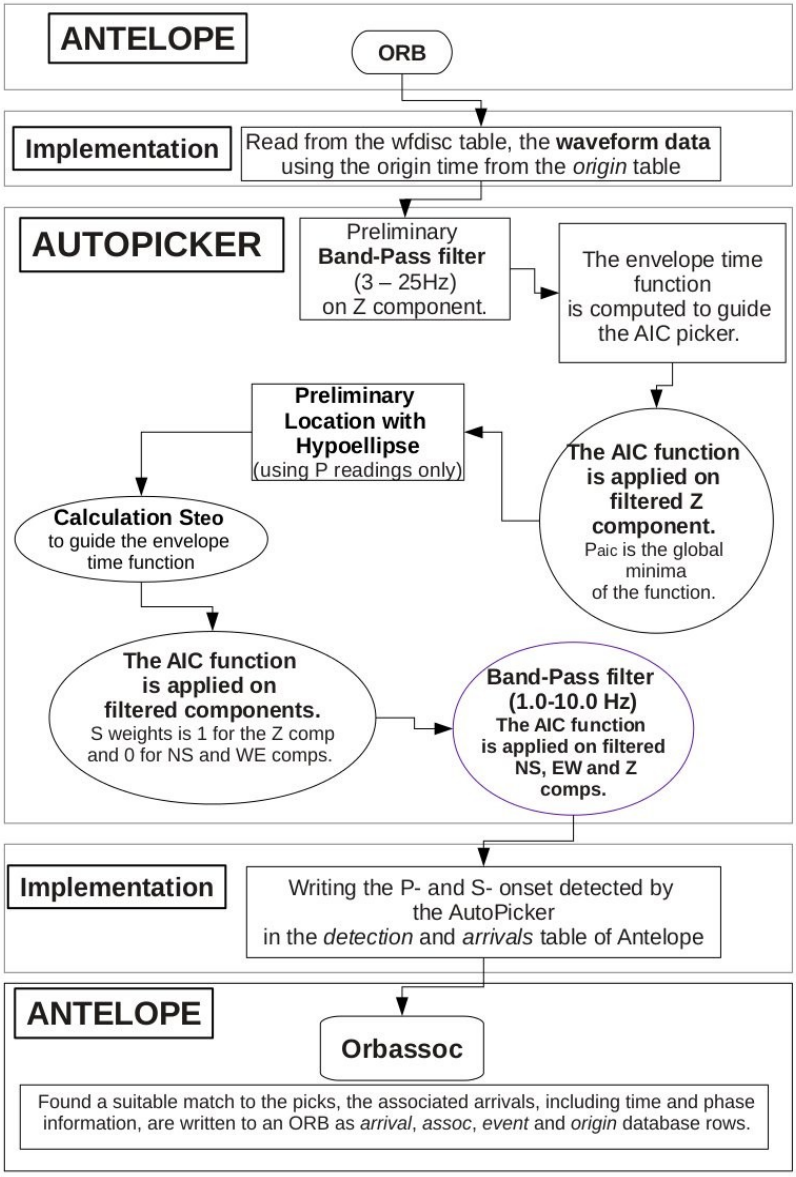

Figure 3. Description of the FINAL implementation of AutoPicker procedure in the Antelope ones.

REFERENCES

Turino C., Morasca P., Ferretti G., Scafidi D., Spallarossa D. (2012) “Reliability of the automatic procedures for locating earthquakes in southwestern Alps and northern Apennines (Italy)” *J Seismol* (2010) 14:393–411.doi:10.1007/s10950-009-9171-1