Geophysical Research Abstracts,
Vol. 11, EGU2009-6165-1, 2009
EGU General Assembly 2009

Denoising seismic data using wavelet methods: a comparison study

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In order to derive onset times, amplitudes or other useful characteristic from a seismogram, the usual denoising procedure involves the use of a linear pass-band filter. This family of filters is zero-phase and is useful according to phase properties but their efficiency is reduced when transients are existing near seismic signals. The alternative solution is the Wiener filter which focuses on the elimination of the mean square error between recorded and expected signal. Its main disadvantage is the assumption that signal and noise are stationary. This assumption does not hold for the seismic signals leading to denoising solutions that does not assume stationarity. Solutions based on Wavelet Transform proved effective for denoising problems across several areas. Here we present recent WT denoising methods (WDM) that will applied later to seismic sequences of Seismological Network of Crete.

Wavelet denoising schemes have proved to be well adapted to several types of signals. For non-stationary signals, such as seismograms, the use of linear and non-linear wavelet denoising methods seems promising. The contribution of this study is a comparison for wavelet denoising methods suitable for seismic signals, which proved from previous studies their superiority against appropriate conventional filtering techniques. The importance of wavelet denoising methods relies on two facts: they recovered the seismic signals having fewer artifacts than conventional filters (for high SNR seismograms) and at the same time they can provide satisfactory representations (for detecting the earthquake's primary arrival) for low SNR seismograms or microearthquakes. The latter is very important for a possible development of an automatic procedure for the regular daily detection of small or non-regional earthquakes especially when the number of the stations is quite big. Initially, their performance is measured over a database of synthetic seismic signals in order to evaluate the better wavelet approach.

Acknowledgements
This work is partially supported by the Greek General Secretariat of Research and Technology in the frame of Crete Regional Project 2000- 2006 (M1.2): "TALOS: An integrated system of seismic hazard monitoring and management in the front of the Hellenic Arc", CRETE PEP_7 (KP_7).