Single station location of small-magnitude seismic events recorded by OBS in the Ionian Sea

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In May 2007, to monitor the seismic processes taking place in the Ionian region, the Centro Nazionale Terremoti, department of INGV, in the frame of the NERIES project (NA6), extended offshore through the deposition of 3 Ocean Bottom Seismometers (OBS) its seismic network. During this experiment the magnitudes of completeness (the magnitude of the smallest events that can be reliably and completely detected by the network) appreciably decreased and the precision of hypocenter estimation of medium-large magnitude earthquakes with epicentres in the Ionian Sea increased. However traveltime-based location methods are inapplicable to many earthquakes recorded only by the OBS's. The most effective and economical methods to locate small-magnitude seismic events recorded by single three-component stations are based on the polarization analysis of broadband seismic data.

The classical polarization analysis assumes that the signal is noise free, nevertheless the 3C recording includes both signal and noise and the polarization analysis is reliable only if the signal to noise ratio is very high. To statistically improve the polarization estimated attributes, we applied a noise correction to the covariance matrix. This correction is based on the assumption that in the selected time-window the noise can be regarded as a stochastic process stationary both in the time and in the space domain.

To locate the earthquake hypocenters we used the back-azimuth and emergence angle of P-phase and Ts-Tp delay time. This parameters were estimated by polarization analysis.

Using the 1D velocity model proposed by de Voogd (1992) for this region of Ionian Sea, we mapped the emersion angle of the seismic ray and the Ts-Tp delay time as functions of epicentral distance and focal depth. We used the punctual estimates of these parameters and the confidence intervals to determine their intersection region. This method defines in the vertical azimuthal plane the area containing the focus position with some probability.

The application of this procedure to about 100 seismic events recorded only by a single OBS, allow to detect low energy seismicity near to the Hyblean-Maltese escarpment.