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Testing continuous earthquake detection and location in Alentejo (South Portugal) by waveform coherency analysis

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In the last decade a permanent seismic network of 30 broadband stations, complemented by dense temporary deployments, covered Portugal. This extraordinary network coverage enables now the computation of a high-resolution image of the seismicity of Portugal, which in turn will shed light on the seismotectonics of Portugal. The large data volumes available cannot be analyzed by traditional time-consuming manual location procedures. In this presentation we show first results on the automatic detection and location of earthquakes occurred in a selected region in the south of Portugal

Our main goal is to implement an automatic earthquake detection and location routine in order to have a tool to quickly process large data sets, while at the same time detecting low magnitude earthquakes (i.e. lowering the detection threshold). We present a modified version of the automatic seismic event location by waveform coherency analysis developed by Grigoli et al. (2013, 2014), designed to perform earthquake detections and locations in continuous data.

The event detection is performed by continuously computing the short-term-average/long-term-average of two different characteristic functions (CFs). For the P phases we used a CF based on the vertical energy trace, while for S phases we used a CF based on the maximum eigenvalue of the instantaneous covariance matrix (Vidale 1991). Seismic event detection and location is obtained by performing waveform coherence analysis scanning different hypocentral coordinates.

We apply this technique to earthquakes in the Alentejo region (South Portugal), taking advantage from a small aperture seismic network installed in the south of Portugal for two years (2010 – 2011) during the DOCTAR experiment. In addition to the good network coverage, the Alentejo region was chosen for its simple tectonic setting and also because the relationship between seismicity, tectonics and local lithospheric structure is intriguing and still poorly understood. Inside the target area the seismicity clusters mainly within two clouds, oriented SE-NW and SW-NE. Should these clusters be seen as the expression of local active faults? Are they associated to lithological transitions? Or do the locations obtained from the previously sparse permanent network have large errors and generate fake clusters?

We present preliminary results from this study, and compare them with manual locations.
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