Earthquake location in Central Mediterranean area by means of pseudo 3D velocity model: a procedure for velocity models optimization

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Accurate earthquakes location is of primary importance for studying the seismicity of a given area.
In this paper we located the seismic events that occurred from 2000 to 2021 in the Central Mediterranean (Sicily and surrounding region), a very complex geodynamical area concerned by the interaction of European and African plates.
In recent years, several authors have proposed 1D P and S velocity models optimized for a specific sector of this area. This studies shows as the accuracy in locating local earthquakes can be improved using well constrained 1D velocity models and stations correction. Minimum 1D velocity models were determined for South-Eastern Sicily (Musumeci et al., 2003), Calabrian Arc (Barberi et al., 2004), Southern Tyrrhenian (Giunta et al., 2004), North-Eastern Sicily (Langer et al., 2007), Aeolian Island (Gambino et al., 2011), Central Sicily (Sgroi et al., 2012), Ionian Sea (D'Alessandro et al., 2016). Moreover, several sectors in our study area, don't have any optimized velocity models.
The study area was divided into a set of homogeneous 1D lithospheric model and a procedure for the simultaneous inversions for the different 1D velocity models was employed. The procedure employed the HYPOINVERSE2000 (Klein, 2002) location programs. The need to relocate earthquakes is linked to the need to minimize the root-mean square travel time residual (RMS), the horizontal location error (ERH) and the depth error (ERZ). We relocated 26197 events recorded by about 300 seismic stations.
As a result, a set of optimized velocity models for the Central Mediterranean area (pseudo 3D model) was obtained. The optimized velocity models were employed in precise and accurate earthquake location to return an unbiased image of the seismicity of Sicily and Central Mediterranean. This pseudo 3D velocity model will be employed in the next future for a better definition of the earthquakes source mechanisms and as initial reference models for accurate 3D tomography.