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3D crustal seismic velocity model for the Gulf of Cadiz and adjacent areas (SW Iberia margin) based on seismic reflection and refraction profiles

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The Atlantic margin of the SW Iberian Peninsula and northern Morocco has been subject of study during the last 30 years. Many seismic reflection and refraction profiles have been carried out offshore, providing detailed information about the crustal structure of the main seafloor tectonic domains in the region, from the South Portuguese Zone and the Gulf of Cadiz to the Abyssal Plains and the Josephine Seamount. The interest to obtain a detailed and realistic velocity model for this area, integrating the available data from these studies, is clear, mainly to improve real-time earthquake hypocentral location and for tsunami and earthquake early warning. Since currently real-time seismic location tools allow the implementation of 3D velocity models, we aim to generate a full 3D crustal model. For this purpose we have reviewed more than 50 profiles obtained in different seismic surveys, from 1980 to 2008. Data from the most relevant and reliable 2D seismic velocity published profiles were retrieved. We first generated a Moho depth map of the studied area (latitude 32ºN - 41ºN and longitude 15ºW - 5ºW) by extracting Moho depths along each digitized profile with a 10 km spacing, and then interpolating this dataset using ordinary kriging method and generating the contour isodepth map. Then, a 3D crustal velocity model has been obtained. Selected vertical sections at different distances along each profile were considered to retrieve P-wave velocity values at each interface in order to reproduce the geometry and the velocity gradient within each layer. A double linear interpolation, both in distance and depth, with sampling rates of 10 km and 1 km respectively, was carried out to generate a (latitude, longitude, depth, velocity) matrix. This database of all the profiles was interpolated to obtain the P-wave velocity distribution map every kilometer of depth. The new 3D velocity model has been integrated in NonLinLoc location program to relocate several representative earthquakes occurred in the area in order to check the reliability of our results. Finally, the new model has been implemented into SeisComP3 software for the location of all the events in this area.