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Tomographic three-dimensional seismic velocity structure of the SW Ibero-Maghrebian region

Youssef Timoulali (1), Mourad Bezzeghoud (2), Bento Caldeira (2), José Fernando Borges (2), and Youssef Hahou (1)

(1) CNRST, Rabat, Morocco, (2) University of Évora, Geophysics Centre of Évora, Department of Physics, Évora, Portugal (mourad@uevora.pt,)

The present tomographic study focuses on SW Ibero-Maghrebian region. To locate the seismic events and find the local velocity structure of epicentral area, the P and S arrivals at 42 stations located at north of Morocco, south of Portugal and Spain are used. The arrival times data used, in this study, were obtained by the "Instituto de Meteorologia" (IM, Lisbon, Portugal), the National Institute of Geophysics (CNRST, Rabat, Morocco) and the "Instituto Geografico Nacional" (IGN, Madrid, Spain) (between 12/1988 and 30/2008). The preliminary estimate of origin times and hypocentral coordinates are determined by the hypocenter 3.2 program. In this study we use a linearized inversion procedure comprising two steps: 1) finding the minimal 1-D model and simultaneous relocation of hypocenters and 2) determination of local velocity structure assuming a continuous velocity field. The earth structure is represented in three dimensions by velocity at discrete points, and velocity at any intervening point is determined by linear interpolation among the surrounding eight grid points. The resolutions tests results indicate that the calculated images give near true structure for the studied region at 15, 30, 45 and 60 km depth. At 5km depth it gives near true structure in the continental region of Portugal, Spain, and Morocco. This study shows that the total crustal thickness varies from 30 to 35 km and contains low-velocity anomalies. A prominent low velocity anomaly that shows a maximum decrease in P-wave velocity of approximately 6 per cent in the Gibraltar region is observed extending down to a depth of approximately 30 km. This low velocity demarcates a small bloc located between Iberia and Nubia plates. The resulting tomographic image has a prominent high velocity anomaly that shows a maximum increase in P-wave velocity of approximately 6 per cent between 45 to 60 km depth beneath South of Portugal and the Golf of Cadiz. High-velocity anomalies could be associated with the location of deep active faults in the uplift and upper crust of South of Portugal. In the Golf of Cadiz, these anomalies could be associated with the seismogenic zone and probably more at the south with the Iberia-Nubia plate boundary.