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New Constraints on Pn-Velocity Structure of the Iranian Plateau

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As a part of Alpine-Himalayan belt system, Iranian plateau is a zone of compressional deformation which holds active and young tectonic structures with different tectonic styles. Despite the different studies in the region, the state of deformation and collision is still under question. In this study we use Pn-tomography technique to map Pn-velocity variations in the upper mantle of the Iranian plateau. The results can be used to deduce valuable information about the large scale tectonic and major geological provinces of the studied area. We analyzed more than 48000 Pn rays from EHB catalog at epicentral distances between 1.8° and 15°. These picks are derived from 667 individual stations and 1618 earthquakes and have an average upper-mantle Pn-velocity of 8.2 km/s. A regularized damped least-squares inversion used to image velocity perturbations in the mantle-lid. The inversion was done with cell size of $2^\circ \times 2^\circ$ and 25 iterations using LSQR algorithm. Various checkerboard tests with different cell-sizes, evaluated the resolution of the model and the reliability of the large-scale structures resolved in the inversion. According to the synthetic tests, only large-scale anomalies (e.g. $1.67^\circ \times 1.67^\circ$) are considered to be resolved and strong horizontal smearing is also observed in the eastern part of the studied area.
Our Pn-velocity model, with high lateral resolution, shows strongly positive anomalies (∼8.5km/sec) in the Zagros belt with a distinct transition between the faster and slower zones nearly along the Main Zagros Thrust (MZT). We interpret this as an evidence for underthrusting the Arabian plateau beneath the Central Iranian micro continent and used it to denote the location of the suture. Negative anomalies occur predominantly beneath NW Iran and eastern Turkey (∼7.9km/sec), suggesting a zone of relatively weak mantle in these regions. In Makran province the SW-NE trending high velocity anomaly in the Pn velocity map, suggests that the slab is dipping shallower westward. We also observe significant transition in velocity across the Kopeh-Dagh region which we used it to mark the boundary between Turan and Central Iran plates. Obtained low velocity anomalies in Alborz, reveals the depleted Mg-rich low density upper mantle in this old continental collision zone. Central and Eastern Iran generally show low Pn values with sparse positive anomalies which can be interpreted as the remnant of the stable upper mantle, underlie the Central Iran micro plate.

Key words: Iranian plateau, Pn velocity, tomography, upper mantle