Geophysical Research Abstracts
Vol. 13, EGU2011-10939, 2011
EGU General Assembly 2011

Anisotropic Pn Tomography of Turkey and Surrounding regions

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We presents an analysis of Pn travel times to determine lateral variations of Pn velocity, anisotropy of uppermost mantle and crustal thickness beneath Turkey and surroundings. From 1999 to 2010, more than 39,500 Pn arrivals are compiled from 700 regional earthquakes and the 690 stations of permanent and temporary networks operated in the study area. We used a regularized least squares inversion to estimate the uppermost mantle parameters. The results reveal significant features that correlate well with the surface geology and the active deformation of the region.

The Pn velocities show very fast and very slow anomalies, reflecting the heterogeneous lithosphereic structure. The average velocity (8.0km/s) determined from the linear fit to Pn travel times is representative of the region. Relatively uniform Pn velocities (8.0km/s) are observed in western Turkey. A transition is apparent from the average Pn velocity of 8.0km/s in the west to lowest (7.5km/s) in the east of central Anatolia. Lowest velocities are mainly observed on eastern Anatolia Plateau and do not appear to cover the entire region but show on three distinct patches with varying magnitudes. The magnitude of low velocities increases along the volcanic chain of the easternmost Anatolia. Large velocity contrasts are sited at subduction and suture zones. High Pn velocities are observed at Hellenides and Dinarites, western Black Sea basin, Mediterranean Basin and Zagros suture.

Pn anisotropy has a maximum amplitude of $\pm$0.6 km/s in the study area. The largest and coherent anisotropic anomalies are observed along the active tectonic zones, i.e. the western Anatolia, Aegean sea, Cyprian arc. Pn anisotropy in Aegean Sea and Greece well correlate with the present tectonic deformation and GPS velocities. In western Anatolia, anisotropy is aligned in N-S direction along the principal strain direction. Along the North Anatolian Fault, the anisotropy directions are E-W, aligned with the fault geometry in the western part while no correlation was observed on the central and eastern parts. Anisotropy in eastern Anatolia is complex and the directions are varying strongly in the region of low Pn velocities. The absence of anisotropy is apparent in an area dominated by volcanism. A significant anisotropic pattern is observed in the region of the Cyprian arc which suggests a mantle lithospheric deformation similar to the clockwise rotation of material observed at the surface.

Largest positive station delays are observed along the southern coast of Anatolia and Dinarites-Hellenides while largest negative stations delays are observed in western Anatolia and Marmara regin. Crustal thicknesses inferred from station delays are consistent with previously reported values. The majority of the stations show very small station residuals in central Anatolia indicating the average crustal thickness of 35$\pm$2 km.