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Crustal and Uppermost Mantle Isotropic and Anisotropic P-wave Velocity Variations Beneath Turkey

Tuna Eken[1], Haibo Wang[2], Zhouchuan Huang[2], Derya Keleş[1], Tulay Kaya-Eken[3], Judith M. Confal[1,4], Ceyhun Erman[1], Seda Yolsal-Çevikbilen[1], Dapeng Zhao[5], and Tuncay Taymaz[1]

[1]Istanbul Technical University (ITU), Department of Geophysical Engineering, Istanbul, Turkey (tuna.eken@gmail.com)
[2]School of Earth Sciences and Engineering, Nanjing University, Nanjing, China
[3]Kandilli Observatory and Earthquake Research Institute, Geodesy Department, Boğaziçi University, Istanbul, Turkey
[4]Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy
[5]Department of Geophysics, Graduate School of Science, Tohoku University, Sendai, Japan

Turkey has been undergoing compressional and extensional tectonics that greatly influences the major surface features following northward plate convergences since the Miocene. Despite increasing efforts in last few decades aiming to elucidate the current architecture of the crust and mantle beneath Turkey, several issues regarding the depth extent of the deformation zones, crust□mantle interaction (e.g., coupling and decoupling) in relation to the deformation, and stress transmission in the lithosphere remain elusive. Inversion of 204,531 P wave arrival times from 8,103 local crustal earthquakes yields high□resolution 3□D P wave isotropic and azimuthal anisotropic velocity models of the crust and uppermost mantle beneath Turkey. Major outcomes of the present work are low□velocity anomalies or velocity contrasts down to the uppermost mantle along the North and East Anatolian Fault Zones. We observe the fast velocity directions (FVDs) of azimuthal anisotropy in the lower crust and uppermost mantle parallel to the regional maximum extensional directions in western Turkey, whereas parallel to the surface structures in the crust and uppermost mantle beneath south-eastern Turkey. Our isotropic/anisotropic images strongly imply vertically coherent deformation between the crust and uppermost mantle in western and south-eastern Turkey. However, in central northern Turkey, the FVDs in the uppermost mantle are oblique to both the FVDs in the lower crust and the maximum shear directions derived from GPS measurements, suggesting that the crust and lithospheric mantle are decoupled.