Geophysical Research Abstracts
Vol. 18, EGU2016-2540, 2016
EGU General Assembly 2016

Upper-Mantle Flow Driven Dynamic Topography in Eastern Anatolia

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Eastern Anatolia is characterized by 2 km plateau uplift -in the last 10 Myrs-, high surface heat flow distribution, shallow Curie-point depth, anomalous gravity field. Seismological observations indicate relatively high Pn and Sn attenuation and significant low seismic velocity anomalies in the region. Moreover, the surface geology is associated predominantly with volcanic rocks in which melt production through mantle upwelling (following lithospheric delamination) has been suggested. It has been long known that the topographic loading in the region cannot be supported by crustal thickness (∼45 km) based on the principle of Airy isostasy. Recent global geodynamic studies carried out for evaluating the post-collisional processes imply that there is an explicit dynamic uplift in Eastern Anatolia and its adjacent regions. In this study we investigate the instantaneous dynamic topography driven by 3-D upper-mantle flow in Eastern Anatolia. For this purpose we conducted numerous thermo-mechanical models using a 2-D Arbitrary Lagrangian Eulerian (ALE) finite element method. The available P-wave tomography data extracted along 10 profiles were used to obtain depth-dependent density anomalies in the region. We present resulting dynamic topography maps and estimated 3D mantle flow velocity vectors along these 2-D cross sections for each profile. The residual topography based on crustal thickness and observed topography was calculated and compared with other independent datasets concerning geological deformation and dynamic topography predictions. The results indicate an upper mantle driven dynamic uplift correlated with the under-compensated characteristic in Eastern Anatolia. We discuss our results combined with 3D mantle flow by considering seismic anisotropy studies in the region. Initial results indicate that high dynamic uplift and the localized low Pn velocities in concurrence with Pn anisotropy structures show nearly spatial coherence in Eastern Anatolia.