3-D density structure of the upper-mantle from gravity inversion constrained by seismic velocity model: A case study of the Mediterranean Sea and surrounding region

Fayez Harash
China University of Geosciences, institute of Geophysics & Geomatics, Geophysics, China (f.harash@cug.edu.cn)

Harash Fayez¹, Chao Chen¹,², Qing Liang¹,², Chenming Tu¹

¹Institute of Geophysics & Geomatics, China University of Geosciences, Wuhan 430074, P.R. China
²Subsurface Multi-Scale Imaging Lab, Institute of Geophysics & Geomatics, China University of Geosciences, Wuhan 430074, P.R. China.

Summary

A 3-D density structure of the lithosphere and upper-mantle beneath the Mediterranean Sea and adjacent region was constructed based on inversion of gravity anomaly constrained by seismic tomography model. In this study, we have removed the terrain and crustal effects from the observed gravity field (EIGEN-6C4), in order to obtain the mantle gravity anomaly which was used to investigate the lithospheric and the upper-mantle density distribution. The 3-D inversion process is constrained by a reference density model estimated from shear-wave velocity model (SL2013sv). Our result shows some characteristics of density distribution in the lithosphere and upper-mantle that might be related to the tectonic signification beneath the Mediterranean Sea and adjacent region. A low-density zone dominates the lithosphere beneath the Mediterranean Sea except the area around Arabia shield and North Anatolian fault belt. A thinner high-density layer appears beneath the southwest of Mediterranean Sea, and it may be related to the older oceanic lithosphere fragments. The high-density anomalies appear below depth of 280 km beneath the Mediterranean Sea and the Turkish Aegean Sea Plate. However, the low-density anomalies appears at the top of the upper-mantle beneath trenches of the southwestern of Mediterranean Sea, the eastern of Aegean Sea, the Red Sea, the Black Sea and the middle of Arabia shield. It may indicate the intensity and origination of tectonic movement referring the deep structure below the Eratosthenes seamount in the Mediterranean Sea. Furthermore, the
convergence region of two low-density anomaly zones may be interpreted as a significant tectonic unit.