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3D Full Seismic Waveform Tomography of NW Turkey and Surroundings

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Northward collision of the Arabian plate with the Eurasian plate, and interaction of the motion between dynamic processes originated from the subduction of the African plate beneath the Aegean generated very complex tectonic structures in the study region. Western Turkey is among one of the most active extensional regions in the world and the study area is mainly located where the extensional Aegean and the right-lateral strike-slip North Anatolian Fault Zone (NAFZ) intersects. Therefore, the tectonic framework of the NW Turkey and the Marmara region is mainly characterized by the transition between the strike-slip tectonics to the extensional tectonics. The Sea of Marmara region has been subjected to several active and passive seismic investigations, nevertheless the accurate knowledge on the heterogeneity in the crust and upper mantle beneath the study area still remains enigmatic. On small-scale tomography problems, seismograms strongly reflect the effects of heterogeneities and the scattering properties of the Earth. Thus, the knowledge of high-resolution seismic imaging with an improved 3D radially anisotropic crustal model of the NW Turkey will enable better localization of earthquakes, identification of faults as well as the improvement of the seismic hazard assessment. For this purpose, we aim to develop 3D radially anisotropic subsurface structure of the Sea of Marmara and NW Turkey crust based on full waveform adjoint tomography method. The earthquake data were principally obtained from the Kandilli Observatory and Earthquake Research Institute (KOERI) and Earthquake Research Center (AFAD-DAD) database. In addition to this, some of the seismic waveform data extracted from the Hellenic Unified Seismic Network (HUSN) stations that are located within our study region were also used in this study. We have selected and simulated waveforms of earthquakes with magnitudes $4.0 \leq \mathrm{Mw} \leq 6.7$ occurred in the period between 2007-2014 to determine the 3D velocity model in the vicinity of the NW Turkey. In total, 2985 three-component regional seismograms from 95 events were used. SES3D algorithm developed by Fichtner et al. (2009) was used to compute synthetic seismograms using the Spectral Elements Method (SEM) for regional wave propagation. Velocity perturbations to the initial 3D Earth model of the study region have been implemented from the multi-scale seismic tomography study of Fichtner et al. (2013). The differences between observed and synthetic waveforms determined using time-frequency misfits (Fichtner et al., 2008) and the conjugate gradient iterative matrix approach is used to minimize data misfit. Our objectives are to improve understandings on previously unresolved shallow and deep features of NW Turkey in contribution with the next generation 3D Earth model by future work of this study.