High-resolution seismic images of the crust and mantle beneath regions of complex surface geological structures are necessary to gain insights on the underlying geodynamical processes. One such region embodying various plate boundary motions and intraplate deformations is the Middle East, and consequently the region is prone to significant seismic activity. Hence a tomographic investigation using a more recent and reliable data set is vital in understanding the ongoing complicated deformation process driven by the African, Arabian and Eurasian plates. The purpose of our study is to retrieve a detailed model of the crust and mantle beneath the Middle Eastern region using teleseismic P arrival times from the ISC-EHB bulletin (Engdahl et al., 1998).

Starting with AK135 as the reference model we invert for tomographic models of compressional wavespeed perturbations down to lower mantle depths in an area bounded by longitudes 22E–66E and latitudes 8N–48N. The data set used in this study consists of regionally observed P-phase arrival times from over 1000 global events from 1996–2016 culminating in a larger dataset than other similar studies. Selection of a reliable data, ray tracing, preconditioning and inversion steps are carried out using the BD-soft software suite (https://www.geoazur.fr/GLOBALSEIS/Soft.html).

Preliminary inversion results are consistent with the previous regional tomographic studies. In checkerboard tests, cell sizes as low as $\sim 2.8^\circ \times 2.8^\circ$ ( $\sim 240 \times 240$ km at surface) are generally well recovered down to a 1000 km depth beneath the Anatolian plateau where we currently have the densest coverage. Additionally the Caucasus region and northern parts of the Iranian plateau shows good recovery of $\pm 4$% Vp perturbation amplitudes at depths $\sim 70 – 135$ km. There is fair recovery for a minimum cell size of $\sim 2.8^\circ \times 2.8^\circ$ beneath the Iranian Plateau, Zagros mountain region, Persian gulf, and northeast Iraq, along with quite good recovery of cell amplitudes towards the Anatolian-Caucasus region at depth ranges 380 – 430 km, 650 – 700 km, and around 950 km. Tomographic inversions unveil a low P velocity zone stretching from the Afar region to Sinai Peninsula consistent with S wave velocity observations of a similar feature by Chang and van der Lee 2011.

We are able to further improve coverage especially down to lithospheric depths within the Arabian peninsula using first arrival times measured from waveform data collected from regional
networks. Addition of first arrival time delays from waveforms highlights a prominent low velocity in the tomographic inversions beneath the volcanic fields of western Saudi Arabia. Our ultimate goal is to perform full-waveform inversion of the region constrained by the constructed P-wave model.