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Variation of the Moho depth along the Shooshtar-Damavad profile (Iran) using P receiver functions

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The convergence between the Arabian and Eurasian Plates resulted in the extension of the Alborz mountains belt in north and the Zagros mountains belt in west-southwest of Iran and the different deformation zones with the various distribution of seismicity and local topography, which make geological structure interpretations difficult for Iran plateau. Detecting Moho depth and crustal thickness could be of great help to understand the dynamics of predominate tectonics which is the main objective of this study. P receiver function technique was used in this work as a popular method to estimate the crustal thickness and detect the upper mantle discontinuities under a seismic station. We computed receiver functions for 9 permanent broad band seismic stations of the International Institute of Earthquake Engineering and Seismology (IIEES), which had been installed along an arbitrary profile from Shoshtar station to Damvand station in the limited region between 32.10˚-35.63˚N and 48.801˚-51.97˚E. All stations were equipped with Güralp CMG3T seismometers. The teleseismic events in epicentral distances between 30˚-90˚ with magnitude larger than 5.5 (mb) and clear P onset with high signal to noise ratio, which recorded in a time period between 2006 and 2010, were selected. We applied observed backazimuth and incident angles for calculating P receiver functions. About 120 P receiver functions were obtained for each station. We increased the signal to noise ratio by stacking after moveout correction for a reference slowness of 6.4 s/deg, which corresponds to an epicentral distance of 67˚.

Due to the different deformation zones existed along the profile, our results could show significant variations of the Moho depth beneath the Iranian plateau. The depth of the crustal discontinuities as well as the Moho was estimated by calculating the time difference in the arrival of the converted Ps phase relative to the direct P wave. For depth estimation we used the IASP91 reference model. The estimated Moho depth beneath the Shoshtar station in the Zagros fold and thrust belt (ZFTB) is estimated to be 48 km, which increases to a depth of about 60 km in the Sanandaj-Sirjan metamorphic zone (SSZ). Furthermore, the Moho depth decreases to around 46 km beneath the GHVR station located in the central domain of Iran. Our P receiver functions obtained from stations located in the Central Alborz display an average crustal thickness of about 52 km. A local crustal thickening of about 67 km is observed beneath the DAMV station located near the Damavand volcano. The Zhu and Kanamori method was also done for determining the crustal thickness (H) and Vp/Vs ratio by using the arrival times of the crustal multiples.