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Seismic discontinuities of the western Alborz by analysis of receiver functions and surface waves dispersion

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Extended Abstract

Summary

Crustal velocity structure in the Western Alborz have been investigated using joint inversion of receiver functions and Rayleigh wave group velocity dispersion curves. To determine the receiver functions, time domain iterative deconvolution and teleseismic events, which are recorded at five broadband seismic stations of the Iranian Seismological Center (IRSC), were used. The fundamental mode Rayleigh wave group velocity dispersion curves were provided by the study on the structure of crust and upper mantle of the Iranian Plateau. The results show that the average thickness of the crust in the southern margin of the Caspian Sea beneath of the CSN1 and RST1 stations is 38 km. Toward south, the depth of Moho increases up to 52, 54 and 50 km beneath the QALM, QCNT and QSDN stations. The low thickness of the crust in the southern shore of the Caspian Sea indicates that the Caspian crust is thin. Moreover, the moderate thickness of the crust in western Alborz, which is not in balance with its elevation, indicates the lack of root in Alborz.

Introduction

Iran is located in one of the seismically active areas of the world. Alborz structural zone as an active belt extends from Talesh Mountains in northwest of Iran to Kopehdagh Mountains in northeast of Iran.The aim of this research is to study the crustal structure of the Western Alborz. In spite of several researches carried out on the Central Alborz crustal structure, very little is known about the structure and thickness of the crust beneath the Western Alborz.

Methodology and Approaches

Receiver functions are the response of the local earth structure to the near-vertical arrival of P waves under a three-component seismogram and are susceptible to shear wave velocity contrasts. The depth-velocity trade-off in receiver function causes non-uniqueness in the inverse problem. However, by incorporating information of absolute shear wave from dispersion estimates and joint inversion of these two datasets, this shortcoming can be compromised. To determine the receiver functions, we have used iterative deconvolution in time domain proposed by Ligorria and Ammon (1999). Five years teleseismic events with magnitudes more than 5.0 which are recorded at five stations of the Caspian, Rasht, Alamut, Center and Sirdan located in the Western Alborz have been processed. The fundamental mode of the Rayleigh wave group velocity dispersion curves have been provided by the study of Rahimi et al. (2014) on the structure of crust and upper mantle of the Iranian Plateau for the period interval of 10-100 seconds. Joint inversion of two independent datasets has been made by considering appropriate combined weighting parameter obtained from the program developed by Herrmann and Ammon (2003). Minimizing standard error between the real and predicted data is the criterion for getting the desired final mode close to earth real model.

Results and Conclusions

The results show that the average crust thickness in the southern margin of the Caspian Sea beneath the CSN1 and RST1 stations is 38 km. Toward south, the depth of Moho increases up to 52, 54 and 50 km beneath the QALM, QCNT and QSDN stations. The low thickness of the crust in the southern shore of the Caspian Sea indicates that the Caspian crust is also thin. Furthermore, the moderate thickness of the crust in the western Alborz, which is not in balance with its elevation, indicates the lack of root in Alborz.