LITHOSPHERIC STRUCTURE OF NORTH ZAGROS USING JOINT INVERSION OF RECEIVER FUNCTION AND SURFACE WAVE DISPERSION

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The Zagros mountain belt, situated on the northern margin of the Arabian plate, is one of the youngest continental collision belts. This belt was formed by collision between the Arabian plate and the central Iranian micro-continent. In this study, we used data from 20 temporary seismological stations installed on a 400 km long profile from May to November 2003. The trend of profile is N58°E across northern Zagros and a part of central-Iran micro-continent. The stations are part of Zagros03 profile (Paul et al., 2010) operated by International Institute of Earthquake Engineering and Seismology (IIEES) in collaboration with CNRS - Université Joseph Fourier, France.

We studied the crustal and upper mantle structures, beneath the profile by analysis of P wave receiver functions and Rayleigh wave phase velocity dispersion. Joint inversion of Rayleigh wave phase velocity dispersion and receiver functions have been used to estimate the crust and upper mantle structure at 20 seismic stations in Zagros.

Receiver functions are time-series computed from three-component body-wave seismograms and are sensitive to the earth structure near the receiver station. They are composed of P to S-wave conversions because of wave velocity differences in discontinuous structures under the stations and crust reverberation. These converted waves are isolated by deconvolving the vertical component of a teleseismic P-wave record from its radial component.

For each event, a 120s time-window centered at the direct P arrival is selected and used for the calculation of the PRF. Receiver functions are determined using the iterative deconvolution method of Ligorria and Ammon (1999). The Gaussian smoothing factor of 1 is equivalent of the application of a 0.5 Hz low pass filter to the seismograms. The dataset of acceptable receiver functions were arranged with increasing theoretical back-azimuth.

Surface waves arise from the presence (boundary conditions) of the stress free surface of the Earth's and in presence of layering, they are dispersed. They provide valuable information on the absolute S-wave velocity (Vs) but are relatively insensitive to sharp vertical velocity contrasts. On the other hand, receiver functions are sensitive to S-wave velocity contrasts, which give rise to converted phases, but allows for substantial trade-off between the depth and velocity above an impedance change. Combining both kinds of signals in a joint inversion bridges the resolution gaps associated with each individual data set.

We used to jointly invert the stacked receiver function and surface wave dispersion data. We employ the program joint96 which is available in the software package "Computer Program in Seismology" (Herrmann and Ammon, 2003).

The damped least square method (Menke, 1989) is used to invert the two data sets for a S-wave velocity model. This method is a common regularization method, which searches for the "simplest" model that fits the data within the limits of its variance (Menke, 1989; Ammon et al., 1990). The procedure used for the joint inversion is based on the linearization of a non-linear inversion problem. Based on this fact, the final model is dependent on the initial model. The drawbacks intrinsic in such problems can be minimized by considering reliable starting models obtained from other studies. The initial models used in this study are taken from Rahimi et al. (2014).

In this study, we try to calculate crust and upper mantle structure in north Zagros using joint inversion of receiver function and surface wave dispersions. Receiver functions are calculated using teleseismic events of magnitude greater than

5.5, located between 30◦ and 95◦ epicentral distances. The fundamental mode Rayleigh-wave group velocities are extracted from the tomographic study conducted by Rahimi et al. (2014).

The inversion is operated by the program joint96. The 1D velocity models resolved by joint inversion are juxtaposed and a 2D velocity model is obtained. The 2D model reveals a thick lithosphere ~160 km beneath Zagros which is thickened to 240 km beneath Sanandaj-Sirjan Zone and Urumieh-Dokhtar magmatic arc.

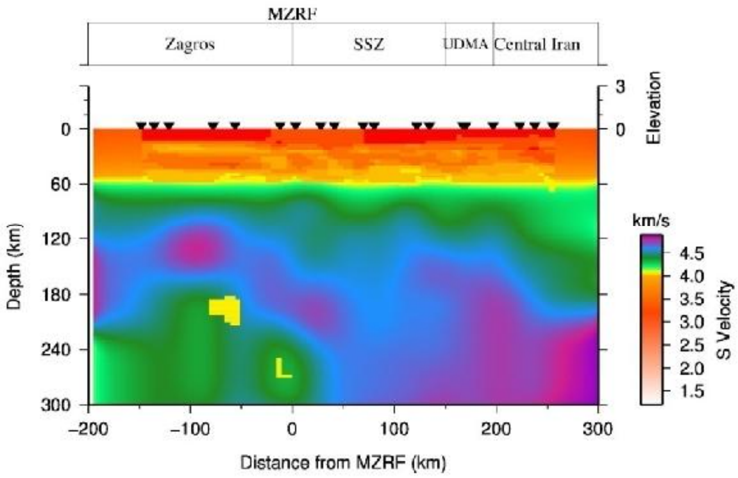

Figure 1. 2-D absolute S- wave velocity model obtained for lithosphere beneath the seismic profile. This model is made from juxtaposed of 20 1-D models with 300km depth

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