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ACRUSTAL SCALE IMAGING ACROSS THE ARABIA-EURASIA COLLISION ZONE

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Continental collision along the Zagros suture occurred due to convergence of the Arabian plate and the Eurasia (Figure 1) initiated at ~35 Ma (e.g., Mouthereau et al., 2012, and references therein) with the main phase at ~27 Ma (e.g., Madanipour et al., 2013; Egan et al., 2009). Here, we study the crustal structure by focusing on both the geometry and the changes in anisotropic properties of the crust across the China-Iran profile (triangles in Figure 1).

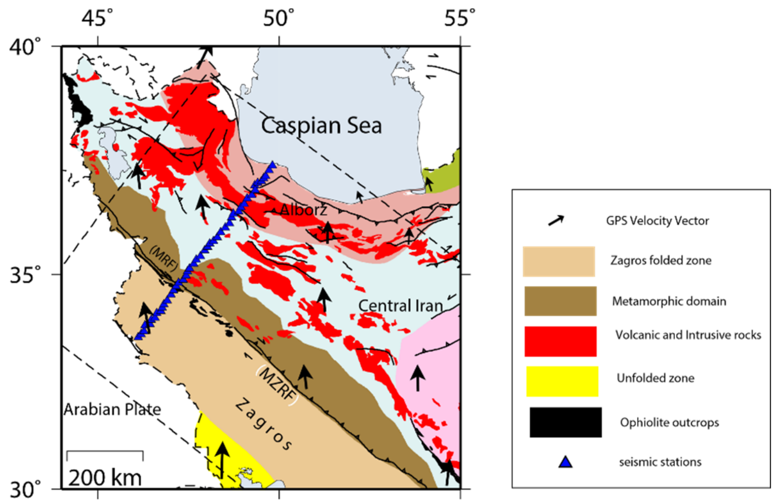

Figure 1. Study area; region covered by seismic stations (blue triangles) along a line. Solid lines represent the active faults (Hessami et al., 2003). MZRF: main Zagros reverse fault, MRF: main recent fault.

In this work, our main objective is to recognize dipping interfaces and/or anisotropic layers (subsurface structures) at crustal depth. With that aim, we implement the harmonic decomposition method is based on the derivation of the back azimuthal harmonics of a Preceiver function data set as a function of the incoming P- wavefield direction (Girardin and Farra, 1998; Farra and Vinnik, 2000). The preference of this technique over classical RF analysis is making interpretation easier, by separating the constant azimuth term from the azimuth dependence term (3-D features). The harmonic analysis separates the contributions of the isotropic part of the structure below the seismic station and puts it in the k=0; and also the harmonics analysis separates the contribution of 3D structures (i.e. anisotropy with plunging symmetry axis and dipping interfaces) and puts them on the first-order (k = 1) components, these two actually generating a two-lobed variation (360°) with back-azimuth; the second components of the harmonics (k = 2) shows an anisotropy with horizontal axis, as regards a four-lobed variation (180°) is associated with the presence of anisotropy with a symmetry axis in the horizontal direction (Bianchi et al., 2008, 2010). We used data from CIGSIP (China-Iran Geological Geophysical Survey in the Iranian Plateau) temporary linear array of broadband seismic stations installed in NW Iran (Figure 1).

Looking at the isotropic component of the harmonics (k=0) along the seismic profile (Figure 2), we can find a continuous feature (marked by red dashed line) between delay time of 1 s and 4 s. Clear negative pulses at increasing delay time continuously delineate a northeast dipping feature (Figure 2), the possible signature of a low-strength shear zone between the underthrusting and overriding continents. The effects of such dipping layer is observable as dipping linear negative pulse in both N-S and E-W k=1 harmonics highlighted by colored stripe in Figure 3. Larger negative amplitudes in the N-S component (in highlighted stripe) in comparison with those highlighted pulses at the E-W component and similar amplitude polarities are consistent with the N10^{o}E directed convergence in the Zagros collision zone (Khorrami et al., 2019). Our results present a clearer image of crustal thickness (marked by black solid line) too.

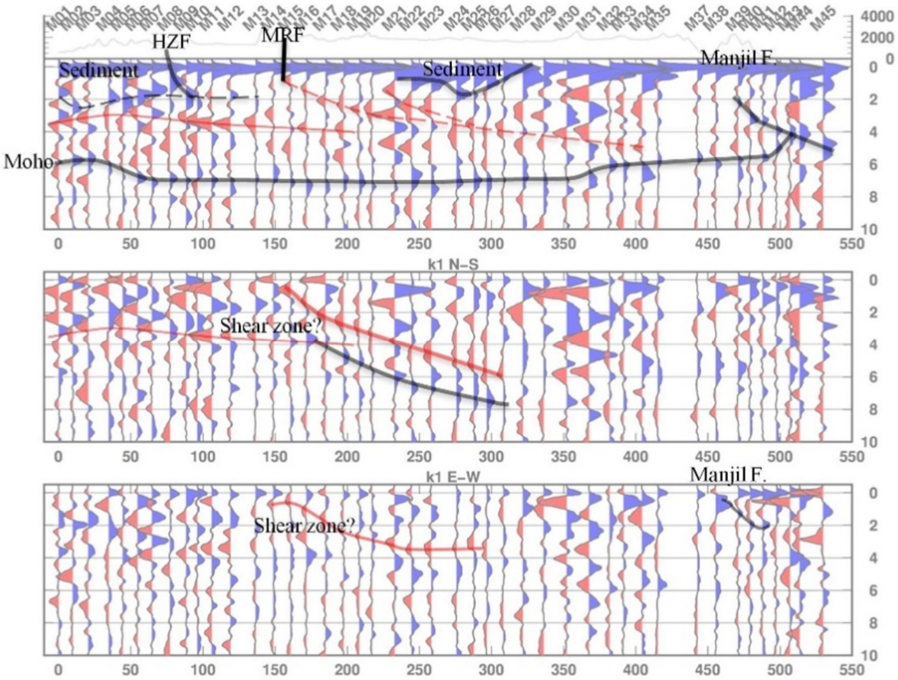

Figure 2. Receiver function data set along 45 seismic stations, displayed as constant (k=0), cos φ (N–S) and sin φ (E–W) back-azimuth harmonics. Blue and red pulses indicate positive and negative amplitudes, respectively.

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