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Site Transfer Functions of Three-Component Ground Motion in Western Turkey

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Because of high seismicity accommodating crustal deformation and deep graben structures, on which have, urbanized and industrialized large cities in western Turkey, the importance of site-specific seismic hazard assessments becomes more crucial. Characterizing source, site and path effects is important for both assessing the seismic hazard in a specific region and generation of the building codes/or renewing previous ones. In this study, we evaluated three-component recordings for micro- and moderate-size earthquakes with local magnitudes ranging between 2.0 and 5.6. This dataset is used for site transfer function estimations, utilizing two different spectral ratio approaches 'Standard Spectral Ratio-(SSR)' and 'Horizontal to Vertical Spectral Ratio-(HVSR)' and a 'Generalized Inversion Technique-(GIT)' to highlight site-specific seismic hazard potential of deep basin structures of the region.

Obtained transfer functions revealed that the sites located near the basin edges are characterized by broader HVSR curves. Broad HVSR peaks could be attributed to the complexity of wave propagation related to significant 2D/3D velocity variations at the sediment–bedrock interface near the basin edges. Comparison of HVSR and SSR estimates for the sites located on the grabens showed that SSR estimates give larger values at lower frequencies which could be attributed to lateral variations in regional velocity and attenuation values caused by basin geometry and edge effects. However, large amplitude values of vertical component GIT site transfer functions were observed at varying frequency ranges for some of the stations. These results imply that vertical component of ground motion is not amplification free. Contamination of HVSR site transfer function estimates at different frequency bands could be related to complexities in the wave field caused by deep or shallow heterogeneities in the region such as differences in the basin geometries, fracturing and fluid saturation along different propagation paths. The results also show that, even if the site is located on a horst, the presence of weathered zones near the surface could cause moderate frequency dependent site effects.