

A Study on the site transfer functions of the downhole arrays at Istanbul

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Seismic hazard studies in the Marmara region have revealed that unbroken segments of the North Anatolian Fault in the Marmara Sea have the potential of producing an $M=7.0+$ earthquake. This poses a great threat to the cities around the Marmara Sea, especially Istanbul, with a population of over 15 million. Hence, the subject site amplification has been of interest for the research society working on seismic risk mitigation. In the past a large number of studies have been performed to calculate the predominant frequency distribution of the Istanbul using earthquake and ambient noise recordings of dense strong motion network at Istanbul. V_s30 distribution of the city has been revealed by analyses of geotechnical investigations. In addition to that Kandilli Observatory and Earthquake Research Institute (KOERI) operates seismic downhole arrays at three different locations in the west side of Istanbul, namely at Atakoy, Fatih and Zeytinburnu. All three downhole arrays have different subsoil and topographical conditions. KOERI also operates an earthquake early warning and rapid response network, which some of the stations is situated on engineering bedrock. In this study estimation of site transfer functions at downhole arrays were investigated based on eight earthquake data recorded both at downhole arrays and at the outcrop stations of the earthquake early warning and rapid response network. Amplifications were determined (a) using the motion at surface and at the base of the downhole arrays and (b) using the motion at surface and outcrop motion. Differences and causes of the differences between these two evaluations were studied. Furthermore, the empirical relationships proposed in the literature for the estimation of spectral amplifications were applied to investigate their differences from the actual field values obtained. Since, Atakoy array was widely studied and reported in the literature, the study mainly focused on the Fatih and Zeytinburnu arrays.