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SPECTRAL STUDIES OF EARTHQUAKES IN IZMIR

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ABSTRACT

This study concerns the results with obtained from IzmirNET local strong-motion network installed in Izmir metropolitan city. 16 strong-motion stations perform four main geological units. The aim of the project Polat et al. (2009) was using with the strong ground motion data to find out the propagation and site characteristics of Quaternary sediments that underlay the Izmir metropolitan area, and are thought to create large site amplification and seismic hazard. These data were observed to characterize the properties of the soils underlying the city to design appropriate earthquake-resistant structures for the region. We also considered the distinctive effects of local topography, soil type variation and azimuthal dependency.

Keywords: acceleration, spectral ratio, earthquake spectrum

INTRODUCTION

Local soil characteristics are the most important factors for reducing the damage of earthquake. At the same distance from the earthquake source, but with different soil properties regions shows different responses to earthquake motion. Therefore many methods to analyze the dynamic behavior of the ground have been developed and have been implemented by many researchers. Two approaches are investigated for the effects of local soil. These are Standard Spectral Ratio (SSR - reference station method) and Horizontal Vertical Spectral Ratio (H/V) method (Gok et al, 2012).

S-wave of selected earthquakes has been chosen according to azimuthal distribution for each site and then their spectrums were computed. These stations have been divided by the reference station which was chosen as MNV and then, geometric mean of spectral ratio of selected events was illustrated as graphic for each station. Different amplifications were obtained regarding the soil characteristics and mapped for different frequencies (Gok et al, 2012).

Spectrums of the accelerograms for each site, for different events in wide range azimuthal distribution, were computed. Site characteristics have been detected by using Standard Spectral Ratio (SSR) and Horizontal to Vertical spectral ratio (H/V).

We also analyzed the chosen earthquakes to compare the spectrums. The spectral analysis of waveforms from moderate and weak earthquakes in the Izmir and its surrounding areas allows of the foreshocks of forthcoming strong events and seismic shocks. This method widely is used by various researchers to prevent seismic hazards Aptekman et al (1989); Ishida and Kanamori (1980); and

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Utsu (1980). Based on significant frequency anomalies observed from earthquakes, the methods investigated that can be applied to identify medium and short term seismological precursory effects. Differences between waveforms of earthquakes are based on their spectral characteristics. Some accelerograms are dominated by higher frequencies, whereas lower-frequency waveforms are characteristic of ordinary weak earthquakes (Ishida and Kanamori 1980; Utsu 1980).

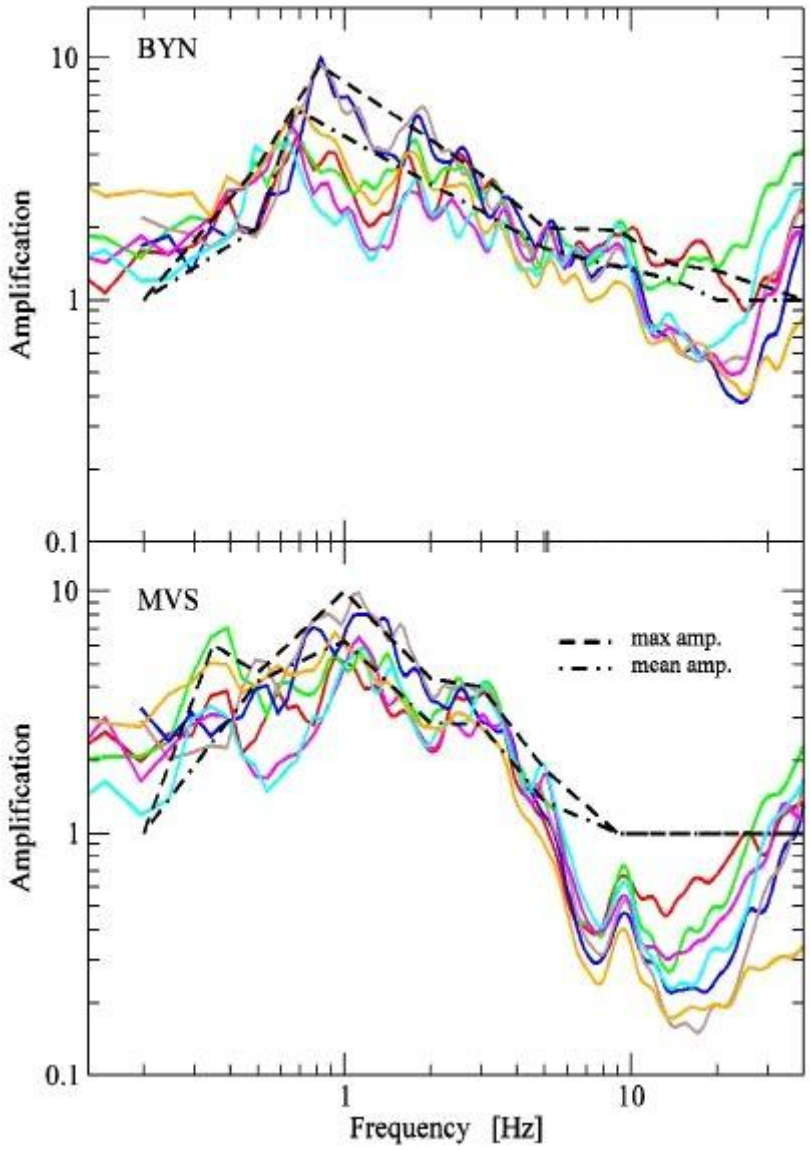

Figure 1. Horizontal amplification estimates at sites BYN and MVS using earthquake data (Gok et al, 2014). The different curves show average amplification determined from SSR relative to station MNV.

Similar results are given for two other stations, BYN and MVS, also on Quaternary alluvium, in Fig. 1.We observe again a good agreement among all amplification estimates. Results in this figure suggest that sediment thicknesses are considerably larger on the north coast of Izmir bay. Maximum average amplification is observed for the results, a factor of 10 at about 1 Hz. Again, Fig. 1 shows the simplified average (mean amp.) and envelope amplification (max amp.) functions. Amplitudes of the simplified functions tend to unity at low and high frequencies and are meant to represent average amplification for all the different techniques used (mean amp.) or an upper estimate of the average local amplification (max amp.). These simplified functions will be used to predict ground motion at each of IzmirNET sites.

CONCLUSION

Site amplification factor was found equal or greater than 6.0 for a dominant frequency interval between 0.6 – 1.5 Hz on alluvial deposits observed mostly around the Izmir Gulf. Results indicate that the local soil effects can considerably change with the geological effects. SSR amplification value was also detected at 1.0 Hz fundamental frequency for MVS station. Bigger frequencies and less amplification were also detected for limestones and flat spectrum as expected at andesitic volcanic units. The results of the H/V method show generally compatible with the SSR method. Analyzed site characteristic shows good correlation with the geological formations as well as expected ground deformation in the city.

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