

論文 / 著書情報  
Article / Book Information

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著者(和文)	KARAGOZOZLEM
Author(English)	Ozlem Karagoz
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種別(和文)	論文要旨
Type(English)	Summary

## 論文要旨

THESIS SUMMARY

専攻 : Department of	Environmental Science and Technology	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 Doctor of	(Philosophy)
学生氏名 : Student's Name	KARAGOZ Ozlem		指導教員 (主) : Academic Advisor(main)	山中 浩明	
			指導教員 (副) : Academic Advisor(sub)	海江田 秀志	

### 要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words )

The most important key to assessing of earthquake hazard is the prediction of ground motion that is controlled by source, path and site effects. It is essential that characterizing earthquake source, the effect of the propagation path from source to the seismic or engineering bedrock, and amplification of shallow soil structures are defined as accurate as possible to close the real ones in simulation studies to predict and mitigate the damage of a future earthquake in a broadband frequency range. Among them, local geological and soil conditions (site effects) have sometimes played a principal role on damage of buildings due to the essential characteristics such as amplitude, frequency content, and duration of strong ground motions.

In this study, the characteristic of ground motions was investigated using 1D simulation of past two earthquakes in the western Marmara Region. First, the S-wave velocity structures of shallow sedimentary layers down to the engineering bedrock were explored by applying short-period microtremor array measurements on the different geological units in Tekirdag and surrounding area. The observed Rayleigh wave phase velocities were between ~90 and 930 m/s in a frequency range from 2 to 30 Hz. The S-wave structures of the shallow soil in Tekirdag city center and coastal area were deduced. The top layers of sites located on the sandstone, claystone, and siltstone units had velocities of ~200 m/s. One of significant result of the study was clearly identification of the S-wave velocities and thickness of the alluvial creek beds in coastal area. The observed phase velocities change due to the thickness of alluvium and shapes of them were similar. The engineering bedrock velocities in the study area ranged from 700 to 930 m/s. The site amplifications, predominant frequencies, and site classifications according to the AVs30 values were also determined to be a proxy for future microzonation studies in Tekirdag and surroundings. The results indicate that Tekirdag city center and the northern parts have amplifications from 3 to 6 with fundamental frequency range of 2-3 and 4-6 Hz, respectively. Most of the sites located on claystone, sandstone and siltstone units in Tekirdag had predominant frequencies higher than 2 Hz. The fundamental frequency range in Tekirdag was 1-10 Hz while the predominant frequency range was 1-16 Hz. The relationship equations for AVs30-slope and AVs30-amplification were proposed for future usage in site response prediction studies.

The second part of this study is to determinate 1D deep velocity structures from the engineering bedrock to Moho beneath the 12 strong ground motion stations in different azimuthal directions by comparing theoretical surface wave group velocity dispersion curves with the observed ones of the 2014 Gokceada mainshock' seismograms. This approach is provided to determine effectively the S-wave velocities and thickness of the layers in the upper 4-5 km part of the crust. The tuned models have deeper layer interfaces depths than the initial model defined from previous studies. The engineering bedrock thicknesses are found thicker than the initial model.

The third part of this study is to validate the integrated 1D crustal velocity structures from the surface to Moho and to model ground motions of the latest moderate 2014 Gokceada mainshock in the region. Its broadband (0.1-10 Hz) ground motions were simulated with a characterized source model and the 1D shallow and deep subsurface structures. The characterized source model of the earthquake was defined utilizing the slip distribution from analysis of teleseismic data (Pinar, 2014) and the strong ground motion recipe (Irikura and Miyake, 2011). It consisted of one asperity area and background area to predict low and high frequencies, respectively. The seismogram on the engineering bedrock of each sub-fault was calculated with the discrete wavenumber method. The linear approximation of the site amplification was used in the frequency domain to estimate surface ground motions.

The results indicate that the defined asperity area in the source model is sufficient to generate high frequency synthetic ground motions of the 2014 Gokceada earthquake. The importance of a proper 1D deep velocity structure beneath engineering bedrock to simulate low frequencies is emphasized. The synthetic arrival times of the body and surface waves are similar to the observations because the subsurface models

have been constructed from the surface wave group velocity dispersion analyses. The S-wave velocity structure of the shallow soils was also included into the models to obtain the effects of the complete 1D crustal velocity structure from the surface to Moho. The local site effects were mostly successfully generated on the synthetic high frequency seismograms. It is clear that the 1D simulation cannot generate sufficient results at special sites where on a thick sediment basin with low seismic velocity or at large epicentral distances (i. e. >150 km).

The final part of the study is investigation of ground motions of the destructive historical 1912 Murefte (Mw 7.3) earthquake ground motions in the region. The characterized source model was defined using previous studies. Two source models with two and three asperities were examined. The 1D simulation for the characterized source models were performed using the 1D velocity structure at the strong motion sites. The characteristic source model with three asperities is much appropriate for the 1912 Murefte earthquake because the intensity differences are minimum at the sites. The estimated near-fault strong ground motions indicate that characteristics of the spectral accelerations change according to the site location respect to the location of fault and asperities. The amplitudes of the spectral acceleration of the sites are higher than the limits of the Turkish Building Code (2007).

The broadband 1D simulation of the past two earthquakes were succeeded to estimate the response of the 1D deep velocity structures from the engineering bedrock to Moho and to generate the high frequency ground motions including the local site effects. The results of this study can be used for more reliable estimation of scenario earthquake simulations and seismic hazard evaluation in the Marmara Region.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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