Estimation of the 3-D bedrock structure using the microtremors andgravity surveies.

Saori Yamaguchi[1]; Hitoshi Morikawa[2]; Kimitoshi Sakai[3]; Atsushi Nozu[4]; Masao Komazawa[5]

[1] TITech; [2] Dep. of Built Environment, Tokyo Inst. of Tech.; [3] Dept. of Civil Eng., Tokyo Tech.; [4] PARI; [5] GSJ/AIST

1.Introduction

The area around Shimizu, Japan is located near the predicted sources area of the Tokai Earthquake which will be occurred in near future. However, we do not have enough information about the ground structure to estimate the strong ground motions in this area. Thus, we will try to determine the three-dimensional bedrock structure using the microtremors and gravity. The preliminary results of the gravity surcey have been shown in the previous report by Yamaguchi et al(2004).The results from the microtremor survey are added and a model of the ground structure is preposed.

2.Observations

The observations have been carried out in the area around shimizu and the Miho Peninsula during June and July, 2004. The microtremors are observed at 19 sites, considering to apply the 2sSPAC method (Morikawa et al, 2004) to estimate the phase velocity. Three arrays are available for this analysis: Array-A is located in the downtown of Shimizu and Array-B and -C in the Miho Peninsula. The slow-code is recorded with the waveforms of microtremors to insure the simultaneousness of the records.

The gravity is observed at 60sites. A reference site is set in the downtown of Shimizu and the absolute value of the gravity is determined as 979730.913mGal at this site by the comparison from the value at Shizuoka meteorological observatory. Using this result, the gravities around the area are determined relatively.

We used the moving-coil-type seismometer with predominat period of 2seconds for the observation of the microtremors and automatic gravity meter(Syntrex CG-3M) for the gravity. The positions of the sites is determined by the differential observations of GPS and their errors are less than 1m horizontal and vertical position.

3.Results

After some correction of the instrumetal properties, the horizontal/vertical spectral rations(H/V) are calculated. Furthermore, the phase velocities are estimated by 2sSPAC method.

To analyze the gravity data, we use the date from the CD-ROM(Japan Geological Survey, 2000) and GH-97(Japan Geological Survey, 1999) with our data. After some correction of the data such as topological correction etc., the Bouguer anomaly is obtained with assumed density 2.5t/m3.

4.Discussion

From the dispersion curves obtained from the microtremors, we estimate the velocity structures under the Array-A and -B:

Array-A(downtown of Shimizu)

	Vp(m/s)	Vs(m/s)	density(t/m3)	thickness(m)
1	1900	900	2.1	570
2	3400	2000	2.3	1500
3	5000	3000	2.5	

Array-B(the Miho Peninsula)

	Vp(m/s)	Vs(m/s)	density(t/m3)	thickness(m)
1	1800	400	1.8	100
2	1900	900	2.1	670
3	3400	2000	2.3	1500
4	5000	3000	2.5	

The depth to the bedrock(Vs=2000m/s) are 570m at Array-A and 770m at Array-B. Furthermore, the H/V of the observed data agrees with the analytical eliptisie of the Rayleigh waves calculated from the above model. From this, we can say that the proposed models are appropiate.

Using the distribution of the Bouguer anomaly without the trend for large area, the three-dimensional bedrock structure is estimated under the assumption of two-layered medium: the sediment and bedrock. In this calsulation, we used 2.1t/m3 for the density of the sediments and the models of the ground structure at the Array-A and -B as the sontrol points. The estimated the gravity basement shows the steep sloop in the south-western area of the downtown of Shimizu and the deep dip under the Miho Peninsula.

5.Conclusions

We determined the 3-D model of the bedrock structure under the Shimizu area. This model shows some distinctive structures.