Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SSS016-P14 Room: Convention Hall Time: May 24 17:15-18:45

Estimation of deep ground structure around Kurikoma, Miyagi using microtremor and gravity surveys

Masachika Tanigawa[1*], Hitoshi Morikawa[1], Hiroko Matsuo[1]

[1]Tokyo Institute of Technology

1. Introduction

Iwate-Miyagi nairiku earthquake of M7.2 has occurred on June 14 2008. The source region was Kurikoma area where is located about 100 kilometers northwest of Sendai, Japan. After the earthquake, the discriminative behaviour of tombstone has been observed near the source.
For example, most of tombstones in Hozo-ji temple fell down in a similar way. On the other hand, in Kongo-ji temple, where is just 5 kilometers away from Hozo-ji temple, type of their behaviours were quite different from those at Hozoji-temple.
These behaviours have many possible causes: source effects, path effects, local site effects, and so on. To understand the reasons, Morikawa et al. (2009) have focused on site effects, especially shallow ground structure. They suggest that not shallow structure but large scale factors such as deep structure or source property might contribute to discriminatory behaviour of tombstones.
In this study, we would like to focus on deep structures to know the behaviour of tombstones. For this purpose, microtremor and gravity surveys were carried out around Kurikoma area.

2. Observations and Results

To know the velocity structure of shear wave, we carried out observation of microtremor array during September 2009. We used moving-coil-type velocity seismometers (natural period 2 sec), and digital recorders (24 bit resolution and 800 Hz sampling rate) with GPS clock and analog gained filter. The observed data are synchronized by the GPS clock, and recorded through low pass filter with cut off frequency of 10 Hz.
Before the observation, a step response of the pendulum is recorded to perform the correction of instrumental characteristics during the process of analysis. The observation duration is more than 30 min.
For analysis, we apply the Spatial Auto-Correlation (SPAC) Method (Aki,1990), and phase velocities are estimated.
Moreover, we compute the spectral ratio of a horizontal component to a vertical one (H/V).
To obtain the three-dimensional ground structure accurately, we carried out the relative gravity measurement around Kurikoma area (38°47'N - 38°54'N, 140°50'E - 141°03'E ; 15 km NS x 19 km EW) during December 2009.
For the observation, Type G gravimeter by LaCoste & Romberg (S/N G911) was used to measure the gravity values. To determine the accurate positions of the observation, sites, the differential survey with the GPS was performed. Errors on positions were less than 1 m.
We have obtained 146 absolute values of the gravity. After some data corrections (Komazawa,1998) the Bouguer anomaly can be obtained using the assumed density, 2.4 t/m^3. On the basis of Bouguer anomaly and the velocity structure obtained from microtremor survey, we estimate a three-dimensional shape of the bedrock surface under the assumption of two-layered medium.

We found the deep sediments with valley-like shape under Hozo-ji temple: its strike directs from north to south and its width is about 5 km in east to west.
Hozo-ji temple is located on the steep slope of the bedrock. This suggests that three-dimensional shape of the bedrock contribute possibly to the behaviour of tombstones.

3. Conclusions and Future Developments

We have carried out microtremor array and gravity surveys around Kurikoma area, Japan. We estimated the phase velocities and velocity structures using microtremor data. Furthermore, three-dimensional shape of the bedrock is obtained from Bouguer anomaly.
For the detailed discussions of the earthquake ground motions, we will introduce ground motions of after shocks observed around the target area and perform some numerical simulations.

References:

Komazawa,M.(1998),"Gravity Survey", handbook of Exploration Geophysics, Vol.4, Society of Exploration Geophysicists of Japan, 431-471