Relation between ground vibration characteristics of strong motion seismograph networks and gravity anomalies

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1. Introduction

Dense strong-motion seismograph-networks such as K-net and Kik-net have functioned to provide a great number of seismic data, from which we can derive site-specific information. However, the distribution of the sites is still sparse when we want to use the data for microzoning of an area aiming at strong motion prediction. For this, we should develop a suitable method to interpolate the wave field between the sites. As gravity data reflect the subsurface structure, the gravity anomalies are expected useful for this purpose. As the first step, we examine the relation between ground vibration characteristics at sites and gravity anomalies.

2. Data and Analysis

Strong motion data from K-net, Kik-net and CEORKA(The Committee of Earthquake Observation and Research in the Kansai Area) were used. As the measures for ground vibration characteristics at sites, we used the residuals of observations from mean attenuation relations in JMA intensities(Ij) and peak ground velocities(PGV). We used 14 events including the 2000 West Tottori Prefecture Earthquake of M7.3 and 2001 Geiyo Earthquake of M6.4. All the events were felt in the Kinki district. First, we calculate attenuation relations for PGVs in various frequency bands and Ij for each event. Frequency bands are from 0.13Hz to 0.5, 1.0, 2.0 and 10Hz. Then we can obtain the mean residuals at sites, although the fluctuation of the residuals is very large. In addition, we evaluate horizontal-to-vertical spectral ratio(H/V) with 40s interval for S- and surface-wave portion.

We select an area covering parts of eastern Osaka basin, Nara basin and Kyoto basin as a test field. In the area, Bouguer anomaly, obtained with reduction density of 2.3g/cm**3, shows the regional trend of low anomaly from Osaka Bay to Lake Biwa reflecting deep structure. In order to see shallow structure, we use residual anomalies of high-pass filtering. The filtering was achieved with upward-continuation technique (continuation height = 2km), so that we can see mainly the structure shallower than about 1km. Gravity anomalies are given at mesh points of 0.5km interval, and the values of anomaly at given sites were obtained as the mean at nearby mesh points within a given radius, R (=0.5km).

3. Result and Discussion

Roughly speaking, the longer peak-period of H/V, and the positive residuals in PGVs and Ij correspond to the negative gravity anomalies, that is, to the area with thick soil deposits. The correlation of PGVs to the gravity anomaly depends on the frequency bands. Contrary to expectation, the correlation is better for the higher frequency bands. This means that, PGV of higher frequency(shorter wave length) reflects the structure beneath the site and PGV of lower frequency(longer wave length), wider area around the site than that of radius R. In order to obtain useful information on the relation, we should make wave-length analysis both for seismic data and gravity anomalies.