Earthquake observation in a basement rock by accelerometer with 1 kHz sampling

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It is important for strong-motion prediction to evaluate the characteristics in high-frequency range. An observational limit of frequency is usually 20 or 30 Hz for 100 Hz sampling system in consideration of ant-aliasing filter. So, we must use higher-frequency sampling for evaluation of high-frequency characteristics. But over 200Hz sampling system is not usual for strong ground motion observation.

We used the accelerometer in basement rock in depth of 285 m at Kumakura observatory in Furudono-machi, Fukushima prefecture, Japan. The boring core shows that rock density is 2.9 g/cm3, P-wave velocity is 6.6 km/sec, and S-wave velocity is 3.7 km/sec at the depth of sensor position. The sensor can observe 2000gal, and the frequency response of the sensor is flat from DC to 400 Hz. The sampling rate of the present system is 100 Hz. We connected the branch off output of the accelerometer to the high-sampling logger [GPL-1] and have observed with 1 kHz sampling from June 2005.

Twelve events were observed from June to December 2005. The epicenters are distributed from Kanto to Miyagi-Ken-Oki area. JMA magnitude (Mj) of these events is from 4.4 to 7.2 and epicenter distance is from about 40 to 200 km. No near fault large event have been observed.

The significant peaks in high-frequency range of Fourier spectra are at 50, 100, 150, 200 Hz. These peaks are considered as the frequency of power supply cable and its higher mode. We made Fourier spectral of pre-event part to check noise level. The spectral level in high frequency range from 1 to 500 Hz are under 0.005 gal∗sec. If the spectral level of seismic signal were over this level, we can discuss the characteristics in this frequency band. The spectra of observed earthquake data show higher than noise level up to 100 Hz beside the power supply noise. The fmax of Fourier spectra of observed data was located at between 5 and 10 Hz and decay characteristics of spectra in over 50 Hz show steeper than fˆ-2.