S146-012 **Room: 302** **Time: May 27 15:00-15:15**

Attenuation relations of three-component ground motions for P-wave, S-wave, and all duration of crustal earthquakes

Toshimi Satoh[1]

[1] Institute of Technology, Shimizu Corp.

In the recent statistical Green's function method, strong motions for P wave as well as S wave can be predicted. However, the validity of the Green's function or predicted ground motions for P wave has been rarely verified using observed records. Previous empirical attenuation relations of ground motions were constructed using all duration or S wave of strong motion records and so we can not compare the Green's function or predicted ground motions for P wave with attenuation relations. Therefore attenuation relations of three-component ground motions for P wave, S wave, and all duration of crustal earthquakes are constructed in this study.

Data are selected from strong motion records of crustal earthquakes observed by NIED (K-NET and KiK-net stations) and CEORKA from January, 1995 to April, 2007. The data ranged in moment magnitude Mw from 5.0 to 6.9. The fault distance ranged from 2 to 200 km. The total of 1755 station-event pairs of 34 events occurred in west Japan from Niigata prefecture were selected.

The following simple attenuation function is used in this study.

$\log_{10}$Y=aMw+g-bX-$\log_{10}$(X+d$10^{0.5Mw}$)+cJ

where Y is either PGA, PGV or 5 % damped acceleration response spectrum of radial, transverse, and vertical components for P wave, S wave, and all duration records. This function is used for data when X is shorter than Xr. When X is longer than Xr, $\log_{10}$(X+d$10^{0.5Mw}$) is replaced to $\log_{10}\{$(XXr)$^{0.5}$+d$10^{0.5Mw}\}$. The fault type parameter g applies only to reverse faulting and oblique faulting earthquakes and is zero to strike faulting earthquakes. The site class parameter cJ is categorized into engineering bedrock with S wave velocity of about 700 m/s, site class I (rock), site class II (hard soil), and site class III (soft soil).

The estimated Xr for PGA, PGV, response spectrum are 60 km, 70 km, and 60 km, respectively. The Qs calculated from the parameter b for S wave and all duration was represented as Qs=110$f^{0.8}$ for three components. On the other hand, Qp has different value for each component, but tends to be the same value as the period is shorter. The Qp for transverse component is largest among three components maybe due to scattering effects by inhomogeneous media. The three-component attenuation relation of PGA for P wave approaches each other as the distance is longer, although the PGA of vertical component is largest and the transverse component is smallest in the close distance. The parameter g of PGA is larger than zero for all cases. This means that PGAs of reverse faulting and oblique faulting earthquakes are larger than those of strike faulting earthquakes in average. The parameter g of response spectrum is smaller than zero only for transverse component in a period longer than 0.3 second. This result can be interpreted by radiation pattern and directivity effects.

The PGA and response spectrum for all duration with Mw6.6 (X=10km) predicted by this model are similar to those predicted by Abrahamson and Silva(1997) and are little larger than those predicted by previous attenuation relations derived using records in Japan. The vertical-to-horizontal ratio of response spectra for S wave with Mw6.6 and X=10 km at site class II is about one in the period range 0.07 to 0.1 seconds. On the same condition at the engineering bedrock, the vertical-to-horizontal ratio is larger than 0.5 for periods shorter than 0.2 second and longer than 1 second. On the same condition at the engineering bedrock, the vertical-to-transverse ratio for P wave is larger than two for a period longer than 0.1 second.

Strong motion records observed by NIED and CEORKA are used. The fault mechanisms by NIED and hypocenter information by JMA are also used. This research was supported by the Ministry of Education, Science, Sports and Culture, Grant-in-Aid for Scientific Research(C),17560527.