Oral | Symbol S (Solid Earth Sciences) | S-SS Seismology

[S-SS23_1PM2]Strong Ground Motion and Earthquake Disaster

Convener:*Kentaro Motoki(Kobori Research Complex), Chair:Kentaro Motoki(Kobori Research Complex)
Thu. May 1, 2014 4:15 PM - 5:45 PM 211 (2F)
Strong ground motion has social impacts as it induces earthquake disasters. We solicit contribution on any seismological topics related to strong ground motion that includes, but are not limited to, source processes, wave propagation, and site effects. We also welcome contribution on earthquake related disaster mitigation.

5:00 PM - 5:15 PM

[SSS23-P17_PG]Stochastic green function considering 3-D Qs structure-Predicting ground motion of the 2011 Tohoku Earthquake-

3-min talk in an oral session

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Keywords:3D attenuation structure, Stochastic green function, Qs, 2011 Tohoku earthquake, Depth dependence, Strong ground motion prediction

We have developed a method to simulate strong ground motions by combining the stochastic green function (SGF) and 3-D attenuation effects. The calculation procedures of our method are as follows. (1) To give Source spectra for sub-fault events.(2) To calculate basement spectra considering 3-D Qs structure.(3) To calculate ground surface spectra by multiplication of the site factors to basement spectra.(4) To make time history of ground motions using ground surface spectra and envelope function (Boore, 1983).(5) To create main shock ground motion by superimposing the ground motions from sub-fault events considering lapse time: ex. fault ruptures. (Kamae et al.,1991)In this study, we reproduced strong motions of the 2011 Tohoku Earthquake (M9) by using this method. The fault plane of the 2011 Tohoku Earthquake was divided into 10*10*10 element faults planes, and seismic moment of Mo=4E+25 Nm and stress drop 25 MPa are given to the elements uniformly. Target sites to evaluate are ground surfaces of the K-NET and the KiK-net observation stations. The 3-D Qs model and site amplification factors estimated by Nakamura (2009) were used in this study. To show validity of this method, we compared calculation results by using the 3-D Qs model with by a uniform Qs model; $Qs=100f^{1.00}$.The standard deviation of the logarithmic residual of PGA from the 3-D Qs model is 0.224 and that from the uniform Qs model is 0.231 for the stations with PGA>100Gal and the values are 0.253 and 0.360 respectively for the stations with PGA>1Gal. The difference was more significant for longer epicenter distance area. The response spectra calculated from the uniform Qs model are underestimated in the long distance areas, ex. Kinki and Hokkaido, whereas the response spectra using the 3-D Qs model were well reproduced the observed ones. Seismic wave spreads in deeper part for longer distance travels without attenuating. It is necessary to consider the three-dimensional Qs structure in evaluating the ground motion distribution in a broad area.We tried to use the complex source model with SMGA. The model with five SMGA segments (Kurahashi and Irikura, 2011)) was adopted for calculation. The waveforms calculated from the uniform source model are like spindle shape generally, but the waveforms from the SMGA model are divided into several wave groups of the corresponding to individual SMGA especially for observation points close to the source. The SMGA model could explain well the observed record shape.