

## Effects of random number on strong ground motion prediction

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Random time series is used instead of empirical Green function in stochastic Green function method for strong ground motion prediction. The theoretical spectral amplitude of random time series is flat throughout all frequency range. However, a random time series with finite sample length fluctuates from the theoretical one, which reflects to fluctuation of source model spectral amplitude to be assumed in the calculation. The difference of random time series of Green function leads to difference in source spectral amplitude. For the same source spectral amplitude, the intensity scale varies only within +/- 0.1 for different random time series. We have previously reported that the difference of source spectral amplitude is the main cause of wide varieties of predicted amplitude of JMA intensity scale, peak ground velocity or peak ground acceleration.

Random number is also widely used to realize fluctuation of rupture times and/or rake angles of fault displacement in stochastic Green function method or empirical Green function method. These fluctuations also give rise to varieties of predicted amplitude of JMA intensity scale or other peak ground motions. The relationship between these fluctuations and the predicted amplitudes of calculated ground motion has not been sufficiently investigated. Random time series used in Green function relates to difference of source spectral amplitude, or to the difference of assumed earthquake nature. The fluctuation of rupture time from that according to average rupture propagation velocity or fluctuation of rake angle from that according to average stress field is realistic for any earthquake source spectrum and thus the statistical effects must be considered.

This paper reports the effects of fluctuation in rupture time or rake angle of fault displacement on strong ground motion prediction. We discuss the results for the Tokai earthquake model of the Central Disaster Management Council.

Fluctuation of rupture time at sub-fault is given by a series of uniform random number, whose range is half the width divided by average rupture velocity. Fluctuation of rake angle is given by a series of uniform random number whose range is 30 degrees. Difference of strong ground motion amplitude due to fluctuation of rupture time is larger for farther points from the fault. The range of variation in JMA intensity is 1.0 at most. The variation of JMA intensity is larger for smaller sub-fault. The effect of fluctuation of rake angle of fault displacement is smaller than that of rupture time fluctuation. The effect is larger for nearer points from the fault. The variation of JMA intensity scale is up to 0.5 at most.

The fluctuations of rupture time and of rake angle of fault displacement are taken into account for strong ground motion prediction in a series of studies under the Central Disaster Management Council. To avoid an accidental deviation from average by choosing a particular series of random number, strong ground motion calculation was done for 100 cases of rupture time fluctuation from different random number series, and the average was taken as a final predicted value. The effect of fluctuation of rake angle was similarly processed.

It is important to understand the variety of strong ground motion prediction due to difference of random number used in the calculation.