Green's function for strong ground motion prediction over a wide area with a high density

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Stochastic Green's function method has been widely employed for strong ground motion prediction. The method is useful when the prediction is carried out with a high density over a wide area. However, it applies the same waveforms to various observation sites with different paths and different site characteristics, though many observations show the waveforms are quite different.

In order for the strong ground motion prediction to be appropriate, it is required for the predicted waveforms to reflect the path effects and the site characteristics. We need velocity structures beneath the base rock in wide area for path effects, precise shallow structures for site characteristics, and a new type of Green's function. The deep structure of P wave, S wave and medium density has been modeled by using geotechnical data. The shallow layer models have been studied by using borehole data and geomorphology data.

Next step is to correlate the structure characteristics and waveforms. We investigated the characteristics of observed waveforms to find that the waveforms are approximated as the Boore's function form of wave envelope. The parameters of wave envelope are obtained by analyzing observation waveform data for various frequency bands from 0.125 to 32Hz. The parameters correlate well with the characteristic period of ground at each site, which is related to the deep structure at the site. This shows that the Green's function should be calculated according to the characteristic period of the site.

We carried out strong ground motion prediction by using the new Green's function. The result shows that the larger amplitudes and longer codas are successfully reproduced at sites in the plains or valleys compared to hard rock sites.