High frequency Radiation of Crustal Earthquakes

High frequency Radiation of Crustal earthquakes from Non-linear Inversion: The role of Stress Drop and fmax

# Pulido Nelson[1]
Nelson Pulido[1]

[1] 地震防災フロンティア研究センター防災科研
[1] Earthquake Disaster Mitigation Research Center (NIED)

Several studies in the past have calculated the high frequency radiation of large earthquakes from inversion of acceleration envelopes of near-fault ground motion. Some of these studies locate the radiation of high frequency near boundaries of large slip regions (Kakehi et. al. 1996, 1997; Nakahara 1999, 2002), while others locate the high frequency radiation corresponding with regions of large slip (Zeng et. al. 1993; Hartzell et. al 1996). Most of these studies have traditionally determined the spatial variation of a high frequency index which does not have an absolute value, and is a measure of the relative stress drop between the mainshock and the aftershock for every subfault.

In the present study we investigate the high frequency radiation from the source by directly inverting for the stress drop of the mainshock at every subfault, and the maximum frequency fmax, which have been identified to adequately represent the flat level of ground motion acceleration spectra and its decay at large frequencies. To achieve this purpose we calculate a stochastic high frequency Green ’ s function (Boore 2003), by including a frequency dependent radiation pattern model (Pulido et. al. 2002), and using a convolution technique to obtain the ground motion at a particular site from a finite fault (Irikura 1986).

I use a Genetic Algorithm approach to invert for the stress drop distribution, the rupture velocity, rise time, fmax, the high frequency decay for frequencies larger than fmax, and the site effects. I evaluate the fitness of the inversion by comparing the observed and simulated RMS acceleration envelopes, as well as the acceleration response spectra of the waveforms. I use the acceleration response spectra as part of the inversion objective function in order to constraint the fitting of the simulated waveforms not only in the time domain (envelopes), but also in the frequency domain (response spectra). The frequency range of our inversion is from 1 to 15H.

I have applied the above methodology to study the high frequency radiation during the 1999 Kocaeli earthquake (Turkey), and the 2000 Western Tottori prefecture (Japan). The contribution of the different model parameters to the high frequency radiation from the source, and its influence to the high-frequency near-fault ground motion are discussed.