# Influence of the Rupture Source Parameters on the Broadband Frequency Strong Ground Motion

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We studied the contribution of the rupture source parameters into the broadband frequency strong ground motion in the vicinity of the fault. We performed a broadband frequency (0.1 to 10 Hz) strong ground motion simulation of the Tottori earthquake by using an asperity model determined from the final slip distribution of the source. To study the real contribution of the source we used KiK-net borehole data to minimize the site effect. We made a parametric study of the source parameters that have the largest influence on the broadband frequency ground motion, and found a model that optimised the fitting with the observations. The size and rupture velocity of asperities controls the velocity while the stress drop and rise time controls the acceleration.

The purpose of our present research is to study the contribution of the rupture source parameters like rise time, stress drop, rupture velocity and size of asperities, into the broadband frequency strong ground motion in the vicinity of the fault.

For that purpose we performed a broadband frequency (0.1 to 10 Hz) strong ground motion simulation of the Tottori earthquake by using an asperity model determined from the final slip distribution of the source (Iwata 2000). The simulation is divided into two frequency ranges: low frequency (.1 to 1 Hz) and high frequency (1 to 10 Hz). The low frequency ground motion is calculated from an asperity model using a Discrete Wave Number method (Bouchon 1981), and a flat-layered velocity structure. The high frequency part uses the summation technique of the empirical Green's function method (Irikura 1986), and a synthetic aftershock waveform, which was calculated stochastically to follow an omega square model of the source and a regional attenuation of Q for the epicentral region (Kamae, Irikura and Pitarka1998, Boore 1983). We obtained a preferred "broadband frequency source model" by optimising the fitting of the observed and simulated velocity and acceleration in frequency and time domain in a forward modelling procedure.

Since we wanted to study the real contribution of the source into the ground motion we decided to only use borehole data from KiK-net in order to minimize the site effect, and avoid mapping into the estimated rupture source parameters the effects of the shallow structure. We used 5 KiK-net borehole strong motion records (100m depth) around the fault, at epicentral distances below 30 km. By using the asperity model obtained before, we made a parametric study of the source parameters that have the largest influence on the broadband frequency ground motion characteristics, and found a model that optimised the fitting with the observations. We found in general that the size and rupture velocity of asperities controls the velocity waveforms while the stress drop and rise time of asperities controls the acceleration waveforms. The values of rise time obtained are smaller that the ones determined from the kinematic inversion.

We used the obtained "broadband frequency source model" to calculate the strong ground motion distribution around the fault, and calculated the spatial distribution of the acceleration response spectra for different periods. This could give an idea about the real effect of the source into the ground motion and response of different kind of building structures.

References

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