Earthquake Scaling and Development of Hybrid Method Toward Strong Ground Motion Prediction in Taiwan

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ABSTRACT

For the demand of engineering, the broadband strong ground motions which consider the reliability and earthquake physical characters have been provided for earthquake resistant design of important building structures. However, the high frequency portion (> 1 Hz) of strong ground motions in the near field was restricted by the insufficient resolution of velocity structure. Using the small events as Green's functions (i.e. empirical Green's function (EGF) method) can resolve the problem of lack of precise velocity structure to replace the path effect evaluation. If the EGF is not available, a stochastic Green's function (SGF) method can be employed. Through characterizing the slip models derived from the waveform inversion, we directly extract the parameters needed for the ground motion prediction in the EGF method or the SGF method. The slip models had been investigated from Taiwan dense strong motion and global teleseismic data. In addition, the low frequency (< 1 Hz) can obtained numerically by the Frequency-Wavenumber (FK) method. Thus, broadband frequency strong ground motion can be calculation by a hybrid method that combining a deterministic FK method for the low frequency simulation and the EGF or SGF method for high frequency simulation. Characterizing the definitive source parameters from the empirical scaling study can provide directly to the ground motion simulation. To give the ground motion prediction for a scenario earthquake, we compiled the earthquake scaling relationship from the inverted finite-fault models of moderate to large earthquakes in Taiwan. The studies show the significant involvement of the seismogenic depth to the development of rupture width. In addition to that, several earthquake from blind fault show distinct large stress drop, which yield regional high PGA. According to the developing scaling relationship and the possible high stress drops for earthquake from blind faults, we further deploy the hybrid method mentioned above to give the simulation of the strong motion in displacement, velocity and acceleration. We now give this exercise to the high stress drop event, and the events, which might have potential seismic hazard to a specific site to give further estimation on seismic hazard evaluation.