Characteristics of high frequency ground motions in the Maule region (Chile), obtained from aftershocks of the 2010 Mw 8.8 earthquakes

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ABSTRACT

The Mw 8.8 Maule earthquake occurred off the coast of central Chile on 2010 February 27, and was followed by hundreds of aftershocks. In this study, we modeled 172 aftershocks recorded by more than 100 temporary broadband stations deployed between March 2010 and January 2011. Each of these earthquakes is characterized by a well-determined hypocentral location and well-constrained focal mechanism and moment magnitudes in the range M 3.7 to 6.2. Most of these earthquakes are characterized by shallow, eastward-dipping, thrust-type focal mechanisms consistent with faulting at or near the plate interface, where the Nazca plate is subducting beneath the South America plate at approximately 74 mm/yr. This study provides a unique opportunity to quantify high-frequency earthquake ground motion in a subduction zone due to the quality and quantity of observations in the frequency and distance range of 0.2-30 Hz and 40-500 km, respectively. The analysis was done using a two-step modeling procedure. A regression is performed to characterize source duration and excitation, source-receiver distance dependence, and station site effects. A point source forward model is then constructed in terms of geometrical spreading, duration, site effects and source scaling to match the regression results. This procedure provides the necessary point source parameters for stochastic finite-fault modeling of peak ground motions for future earthquakes in this subduction zone.

REFERENCES


CONCLUSIONS

• For the first time a subduction earthquakes data set was used in our ground motion analysis;
• We completely calibrated the excitation and attenuation of the ground motion in Central Chile;
• It is evident that a constant stress drop cannot be use to fit the excitation term at all magnitudes;
• The parameters found in this study will be use to obtain accurate predictions of ground motion in this specific subduction zone.