Geophysical Research Abstracts
Vol. 13, EGU2011-3088, 2011
EGU General Assembly 2011

Stochastic finite-fault ground-motion simulation and source characterization of the 4 April 2010 (Mw 7.2), El Mayor-Cucapah earthquake.

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The 4 April 2010 El Mayor-Cucapah earthquake, caused severe damage in Mexico to the infrastructure and the agricultural sector. The main aim of the present work consists in the source characterization, determination of the slip distribution and the simulation of strong-ground motion records in Mexico. We characterized the seismic source by implementing the EGF technique using four aftershocks recorded at regional distances. The slip distribution was obtained by inverting teleseismic records. Based on the result of the slip inversion, we obtained a magnitude Mw of 7.2. Stochastic finite-fault simulation with the dynamic corner frequency approach was used to simulate the acceleration time histories and the amplitude Fourier spectra. We compared stochastic simulations with observations to validate source, path and site parameters. The site effects were determined with the H/V technique. Our results showed that the total rupture duration of the mainshock is about 52-60 sec. Using spectral division at regional distances to identify subevents, we found that the mainshock consists of two or three subevents. This result is also supported by the observations made to near-fault strong-ground records showing acceleration peaks at some stations. Based on the teleseismic inversion, we determined the slip distribution, which shows two asperities. We interpret the slip distribution as follows: 1) the rupture nucleates near the hypocenter, breaking bilaterally the first asperity. 2) the rupture stops in the southeastern part but it propagates in the northwest direction, breaking unilaterally the large asperity. We found that the stochastic finite-fault simulations using a stress drop of 40 bars and a pulsing area of 30% reproduce reasonably well the observed PGA and the amplitude Fourier spectra at frequencies of engineering interest (0.1-20 Hz). The discrepancies between the simulations and the observations could be mainly due to source complexities and inadequate representation of the local site amplifications.