Geophysical Research Abstracts, Vol. 7, 07196, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07196

Ground motion simulations for a M=7.5 scenario earthquake in the Marmara Sea and implications for the city of Istanbul, Turkey.

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Following the disastrous earthquakes in Izmit and Düzce along the North Anatolian Fault in 1999, the earthquake hazard in the Istanbul area became a great concern. In this study we simulate the strong-ground motion in the Marmara Sea region with special emphasis in Istanbul. Simulations are based on an earthquake scenario in the Marmara Sea using a multiasperity source model that involves the combined rupture of the North Anatolian fault segments beneath the Marmara Sea. In the simulation of the strong ground motion, we use a hybrid model combining a deterministic simulation of the low frequencies (0.1-1.0 Hz) with a semi-stochastic simulation of the high frequencies (1.0-10.0 Hz) using empirical Green's functions. We apply a high-frequency radiation model which uses a smooth transition between non-spherical to spherical wave radiation as the frequency increases. Computation at each frequency range is performed separately and the total ground motion is combined in the time domain. We calculate several earthquake scenarios corresponding to different hypocenter locations and source parameters and obtain information on the sensitivity of ground motion to these parameters. This will help us to select the most critical scenario earthquake for the Istanbul region. Computations are performed for both a regular grid and for the recording sites of the recently installed Istanbul Earthquake Early Warning and Rapid Response system. The latter computations are compared to recorded ground motions.