SIMULAÇÕES DE MOVIMENTOS FORTES E AVALIAÇÃO DA INFLUÊNCIA DOS PARÂMETROS DO MODELO POR COMPARAÇÃO DAS FORMAS DE ONDA

STRON GGROUND MOTION SIMULATIONS AND ASSESMENT OF INFLUENCE OF MODEL PARAMETERS ON WAVEFORMS

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SUMMARY

Modeling near-field ground motion is an important and useful tool of modern seismology. It helps in studies of seismic events and mitigation of seismic hazards. Several approaches are widely used to obtain synthetic ground motion for a finite earthquake source. In our work we use a finite difference algorithm, developed for 3D structures and kinematic source model, to compute near-field ground motions from a real moderate event with pre-existing slip distribution model. Lately, synthetic seismograms are quantitatively compared with observed waveforms from near-field seismic stations in order to justify created model. Furthermore, we independently changed several source parameters (rupture velocity, source dimension and geometry), and structure (velocity model) in order to evaluate their influence on the waveforms. We applied quantitative misfit criteria, based on wavelet transform, for the comparison of seismograms.

Resumo

We applied finite-difference method and algorithm for ground motion synthesis based on it – 2D/3D elastic finite-difference wave propagation code E3D (Larsen & Schultz, 1995) – for simulation of strong ground motions produced by the Alum Rock earthquake ($M_w = 5.4$) that occurred near the junction of the Hayward and Calaveras faults in the San Francisco Bay, California, on October 31, 2007. We used existing slip distribution for this event obtained through inversion in the Berkeley Seismological Laboratory that was available in the report [1] and detailed 1D velocity model of the San Francisco Bay region that was adapted for 3D media [2] as input parameters of the model in simulations of long-period waveforms for three channels of six broad-band stations located in the immediate vicinity from the epicenter of the event. Results of simulations were quantitatively compared with observed waveforms using MatLab code that we developed. This technique, on wavelet transform based, allows to compare seismograms in terms of envelope (amplitude) and phase misfits in time-frequency domain. It could be applied for various tasks when quantitative comparison of waveforms is required (for example, in source inversion). Eventually, we studied importance of some parameters of the model involved in waveform synthesis. To this were calculated waveforms, using models where, separately and independently, were modified the parameters: – dip angle, strike angle, length of the fault plane, rupture velocity, and velocity model. Later, we quantitatively compared these waveforms with originally obtained and draw some important conclusions about their influence on the waveforms. It helped us realize the significance of their appropriate and thoughtful usage in input models.

Reference

[1] – Hellweg, M., A. Chung, D. Dreger, A. Kim and J. Boatwright (2007).Mapping the Rupture of the $M_w 5.4$ Alum Rock Earthquake, report of the Berkeley Seismological Laboratory

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[3] – Kristekova, M., Kristek, J., Moczo, P., Day, S.M., (2006). Misfit criteria for quantitative comparison of seismograms, Bull. Seism. Soc. Am. 96(5), 1836–1850