Geophysical Research Abstracts
Vol. 15, EGU2013-8725, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Broadband Near-Field Ground Motion Simulations in 3D Scattering Media

Walter Imperatori (1) and Martin Mai (2)
(1) Kaust, Saudi Arabia (walter.imperatori@kaust.edu.sa), (2) Kaust, Saudi Arabia (martin.mai@kaust.edu.sa)

The heterogeneous nature of Earth's crust is manifested in the scattering of propagating seismic waves. In recent years, different techniques have been developed to include such phenomenon in broadband ground-motion calculations, either considering scattering as a semi-stochastic or pure stochastic process. In this study, we simulate broadband (0-10 Hz) ground motions using a 3D finite-difference wave propagation solver using several 3D media characterized by Von Karman correlation functions with different correlation lengths and standard deviation values. Our goal is to investigate scattering characteristics and its influence on the seismic wave-field at short and intermediate distances from the source in terms of ground motion parameters. We also examine other relevant scattering-related phenomena, such as the loss of radiation pattern and the directivity breakdown. We first simulate broadband ground motions for a point-source characterized by a classic omega-squared spectrum model. Fault finiteness is then introduced by means of a Haskell-type source model presenting both sub-shear and super-shear rupture speed. Results indicate that scattering plays an important role in ground motion even at short distances from the source, where source effects are thought to be dominating. In particular, peak ground motion parameters can be affected even at relatively low frequencies, implying that earthquake ground-motion simulations should include scattering also for PGV calculations. At the same time, we find a gradual loss of the source signature in the 2-5 Hz frequency range, together with a distortion of the Mach cones in case of super-shear rupture. For more complex source models and truly heterogeneous Earth, these effects may occur even at lower frequencies. Our simulations suggest that Von Karman correlation functions with correlation length between several hundred meters and few kilometers, Hurst exponent around 0.3 and standard deviation in the 5-10% range reproduce the available observations, although an unambiguous random-media characterization of the Earth crust in the distance range currently cannot be achieved