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Ground motions simulations for the city of Thessaloniki, Greece, using a 3-D Finite-Difference wave propagation method

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A 3D Finite-Difference (FD) wave propagation technique is employed for the study of the ground motion characteristics in the Thessaloniki metropolitan area. For this reason, three different earthquake scenarios are employed, assuming two different focal mechanisms for each scenario, following the well known faulting patterns of the area. Moreover, two different 3D velocity models for the shallow velocity structure beneath Thessaloniki are used, based on the study of Anastasiadis et al. (2001).

Full 3-dimensional synthetic velocity waveforms have been produced using a computer code that implements a 3D - 4^{th} order staggered-grid velocity-stress finite-difference scheme (Moczo et al., 2002). The complete synthetic waveforms (time series and frequency content) for 20 positions spread in the metropolitan area of Thessaloniki are used for studying strong motion properties. The frequency content of the synthetic waveforms is compared using H/V and SSR techniques with the results from Lachet et al. (1996), Triantafyllidis et al. (2004) and Panou (2006). Moreover snapshots of the wave propagation on the free surface were produced for visual inspection of ground motion propagation in the area of Thessaloniki.

Results show a good agreement between the empirical and synthetic H/V and SSR results, both in frequency and amplitude terms. However, a strong dependence of the local site-effects on the source properties (azimuth, distance, fault-plane solution) is also found, indicating the complexity of the 3-D soil response in different excitations. The wave propagation snapshots depict several interesting aspects of the ground motion properties and wave propagation pattern for the metropolitan area of Thessaloniki. Necessary modifications and limitations of the existing 3D models used and possible future developments and modifications of the modeling approach are also examined.