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Stochastic strong ground motion simulations for the intermediate-depth historical earthquakes

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We model the macroseismic damage distribution of four important historical intermediate-depth earthquakes of the south Aegean subduction zone, namely the 1926 (M=7.7) destructive Rhodes earthquake, the anomalous spatial pattern 1964 Athens (M=6.0) and 2002 Milos (=5.8) earthquakes, and the 1956 (M=6.9) Amorgos aftershock. All earthquakes were simulated using the stochastic finite-fault modelling approach of Motazedian and Atkinson (2005), as adapted by Boore (2009). Observed macroseismic data for these events were collected from published macroseismic database (Papazachos et al., 1997), and compared with the obtained stochastic seismic motions, which were appropriately converted to macroseismic intensity (Modified Mercalli scale, IMM). To obtain the conversions, we have examined the correlation between macroseismic intensities and the main peak measures of seismic motions (PGA and PGV) for intermediate depth earthquakes, and propose the use of the relations of Wald et al. (1999) appropriately modified for the Modified Mercalli scale adopted in Greece. The attenuation parameters for simulations were adopted from Skarlatoudis et al. (2013) and are based on the regression analysis results of response spectra. In order to account for site-effects on the observed seismic motions, a new VS30 map for southern Aegean subduction zone was created, using topographic slope proxies (Wald and Allen, 2007). Site amplification functions for each soil class were adopted from Klimis et al. (1999), while the kappa values were constrained from the analysis of the EGELADOS network data from Ventouzi et al. (2013). The stress-parameter values were based on simulations performed with the EXSIM code for several ranges of stress parameters values and by comparing the results with the available Fourier spectra of intermediate-depth earthquakes. The fault characteristics were constrained using the focal mechanisms either collected from published sources or using the main faulting types from Kkallas et al. (2013). The results obtained in the present study show a very good correlation between historical (macroseismic) information and the obtained stochastic motions, while this agreement is also confirmed by the comparison of the synthetic PGA values with the ground motion prediction equations (GMPE) of Skarlatoudis et al. (2013).