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Joint interpretation of macroseismic and strong motion data for recent large shallow mainshocks of the Aegean area using a Monte Carlo optimization of finite-fault stochastic simulations

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The study of strong historical and early instrumental earthquakes is based almost exclusively on the use of their macroseismic data, which usually constrain the area that has suffered the heaviest damage. In the recent decades, strong-motion data have been also employed for the same purpose. We present a stochastic simulation approach to jointly model macroseismic and strong motion data for selected shallow strong (**M**≥6.0) earthquakes that occurred in the broader Aegean region between 1978 and 1995. For the simulations we employed the finite-fault stochastic simulation method, as realized by the EXSIM algorithm. We calibrated several parameters for the stochastic simulation modeling using a priori published information (e.g., moment magnitude, stress parameter). Other rupture zone information were collected from published works, such as fault plane solutions, relocated seismicity, etc. A Monte Carlo approach was adopted to perform a parametric search for the stress parameter and the modelling both independently and jointly the available macroseismic data and the strong motion instrumental recordings. The validity and the reliability of this semi-automated simulation approach was examined, to test if this method could be applied either in a fully automated manner, or for the study of the source properties of historical earthquakes. The results suggest that a joint-misfit minimization from the simultaneous simulation of macroseismic and strong motion data is a feasible target, that can be potentially employed for the simulation of older events, for which a limited number of instrumental data is often available. In general, a good agreement of the spatial distribution of the original and modeled macroseismic intensities is observed, showing that can reliably reconstruct the main features of the damage distribution for strong shallow mainshocks in the Aegean area using the proposed joint interpretation approach.