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ORIGINAL RESEARCH PAPER

High-frequency maximum observable shaking map of Italy from fault sources

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Abstract We present a strategy for obtaining fault-based maximum observable shaking (MOS) maps, which represent an innovative concept for assessing deterministic seismic ground motion at a regional scale. Our approach uses the fault sources supplied for Italy by the Database of Individual Seismogenic Sources, and particularly by its composite seismogenic sources (CSS), a spatially continuous simplified 3-D representation of a fault system. For each CSS, we consider the associated Typical Fault, i.e., the portion of the corresponding CSS that can generate the maximum credible earthquake. We then compute the high-frequency (1–50 Hz) ground shaking for a rupture model derived from its associated maximum credible earthquake. As the Typical Fault floats within its CSS to occupy all possible positions of the rupture, the high-frequency shaking is updated in the area surrounding the fault, and the maximum from that scenario is extracted and displayed on a map. The final high-frequency MOS map of Italy is then obtained by merging 8,859 individual scenario-simulations, from which the ground shaking parameters have been extracted. To explore the internal consistency of our calculations and validate the results of the procedure we compare our results (1) with predictions based on the Next Generation Attenuation ground-motion equations for an earthquake of M_w 7.1, (2) with the predictions of the official Italian seismic hazard map, and (3) with macroseismic intensities included in the DBMI04 Italian database. We then examine the uncertainties and analyse the variability of ground motion for different fault geometries and slip distributions.

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