Geophysical Research Abstracts, Vol. 9, 06480, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06480

Seismotectonics and seismic hazard in Southeast Spain: implications for seismic engineering

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Southeast Spain is located in the northeaster sector of the diffuse Iberian-African plate contact: the Eastern Betic Cordillera. The tectonic pattern of this area is composed of several major fault systems (L>50 km) and a dense network of secondary faults (L<20 km). Seismic activity is moderate and distributed throughout the area. Hence, apparent epicentre alignments are rarely observed. Recent studies point out that frequent small-to-moderate earthquakes (M<5.5) are generated by the secondary fault network, while large but infrequent earthquakes (M>5.5) are controlled by a few major active faults. This particular seismotectonic setting has important implications for seismic hazard and seismic engineering in the area at different return periods. In this study we present a probabilistic seismic hazard analysis including both specific major active faults and seismic zones. Results for the 475-year return period, usually adopted in earthquake-resistant provisions, are obtained. Hazard disaggregation at selected sites for target ground motions corresponding to the 475-year return period shows that the largest hazard contribution is due to small-magnitude events, located at short epicentral distances. These controlling earthquakes correspond to the events that small active faults, widely observed in the area, are capable of generating. The design spectrum that reproduces those ground motions the best is the Eurocode-8 type 2 spectrum. Consequently, its adequateness for earthquake-resistant design of normal-importance buildings in SE Spain is underlined. For structures of special importance, such as lifelines and critical structures, whose design is based on ground motions corresponding to longer return periods, the contribution of major faults, capable of generating moderate earthquakes, is the largest.