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Use of the ESI-07 Scale for generation of seismic scenarios in Spain: from ancient earthquakes to future simulated shake exercises

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Abstract

The combination of macroseismic data-points from the environmental earthquake effects (ESI-07) and building damage (EMS-98), leads to the refinement of seismic scenarios for instrumental and historical earthquakes. In particular, seismic information from Earthquake Environmental Effects (EEEs) allows to multiply, sometimes by ten (x 10), the number of macroseismic data-points, especially in non-populated zones, which allows improving identification of historic to ancient epicentres located away from old urban areas. In Spain, the 2nd edition of the Catalogue of Earthquake Environmental Effects (to be published in 2019 by the Geological Survey of Spain, IGME) provides hybrid EMS-ESI macroseismic maps for most of the strong historical and instrumental earthquakes with intensities \geq VIII EMS-98 (c. 70 events). In most of the cases (especially after the 17th Century), the incorporation of multiple ESI-07 macroseismic data resulted in a better identification of both: (1) the probable seismic sources; and (2) the participation of secondary earthquake geological effects in the resulting damage scenarios. In this contribution we present data on the AD 1764 Estubeny (Valencia) and the AD 1862 Huércal-Overa (Almería) earthquakes occurred in different sectors of the Spanish Betic Cordillera, the more seismically active zone of the Iberian Peninsula. The obtained macroseismic scenarios are converted in seismic acceleration (PGA) maps on the basis of standard ground motion prediction equations (GMPE) and specific algorithms for seismic amplification. On the other hand, routines learned from the generation of seismic scenarios (ShakeMaps) developed for instrumental and historical earthquake in Spain have been implemented for the generation of earthquake simulation exercises. The collaboration among the Salamanca University (USAL), the Geological Survey of Spain (IGME) and the "Unidad Militar de Emergencias" (UME) of the Spanish Army, leads to the generation of future earthquake scenarios by means of the lessons learned of ancient earthquakes applying methodologies similar to those used by the USGS ShakeMap Program. Recent "earthquake drills" in densely populated areas of the Guadalquivir basin (Sevilla, 2016) and the Lorca-Alhama de Murcia Fault (Librilla, 2018), were based on seismic scenarios provided by the USAL and managed by the IGME, considering the highest emergency levels considered in Spain (Level 3). The main goal of this research is the generation of scientific maps to be used by civil and military authorities during the management of natural disasters as earthquakes, giving a real vision about what we can expect during large earthquakes (\geq 6.0 Mw) affecting wide areas within Spain. Research funded by the MINECO-FEDER Spanish research projects CGL2015-67169-P (QTETC-SPAIN-USAL)