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Probabilistic Seismic Hazard Assessment of the Chiapas State (SE Mexico)

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The Chiapas State, in southeastern Mexico, is a very active seismic region due to the interaction of three tectonic plates: Northamerica, Cocos and Caribe. We present a probabilistic seismic hazard assessment (PSHA) specifically performed to evaluate seismic hazard in the Chiapas state. The PSHA was based on a composited seismic catalogue homogenized to Mw and was used a logic tree procedure for the consideration of different seismogenic source models and ground motion prediction equations (GMPEs). The results were obtained in terms of peak ground acceleration as well as spectral accelerations. The earthquake catalogue was compiled from the International Seismological Center and the Servicio Sismológico Nacional de México sources. Two different seismogenic source zones (SSZ) models were devised based on a revision of the tectonics of the region and the available geomorphological and geological maps. The SSZ were finally defined by the analysis of geophysical data, resulting two main different SSZ models. The Gutenberg-Richter parameters for each SSZ were calculated from the declustered and homogenized catalogue, while the maximum expected earthquake was assessed from both the catalogue and geological criteria. Several worldwide and regional GMPEs for subduction and crustal zones were revised. For each SSZ model we considered four possible combinations of GMPEs. Finally, hazard was calculated in terms of PGA and SA for 500-, 1000-, and 2500-years return periods for each branch of the logic tree using the CRISIS2007 software. The final hazard maps represent the mean values obtained from the two seismogenic and four attenuation models considered in the logic tree. For the three return periods analyzed, the maps locate the most hazardous areas in the Chiapas Central Pacific Zone, the Pacific Coastal Plain and in the Motagua and Polochic Fault Zone; intermediate hazard values in the Chiapas Batholith Zone and in the Strike-Slip Faults Province. The hazard decreases towards the northeast across the Reverse Faults Province and up to Yucatan Platform, where the lowest values are reached. We also produced uniform hazard spectra (UHS) for the three main cities of Chiapas. Tapachula city presents the highest spectral accelerations, while Tuxtla Gutierrez and San Cristobal de las Casas cities show similar values. We conclude that seismic hazard in Chiapas is chiefly controlled by the subduction of the Cocos beneath Northamerica and Caribe tectonic plates, that makes the coastal areas the most hazardous. Additionally, the Motagua and Polochic Fault Zones are also important, increasing the hazard particularly in southeastern Chiapas.