Confirmation of the probabilistic seismic hazard assessment by the Taiwan Earthquake Model through comparison with strong ground motion observations

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To confirm the probabilistic hazard assessment proposed by the Taiwan Earthquake Model (TEM), we compared it with the strong ground motion observations. We accessed the Taiwan Strong Motion Instrumentation Program (TSMIP) database and reported the maximum ground shaking of each strong-motion station. Comparing the TSMIP observations and the TEM hazard model reveals similar spatial patterns. However, some records indicate significantly higher shaking levels than the model does due to the occurrence of some large events, for example, the 1999 Mw7.6 Chi-Chi earthquake. Such discrepancies cannot be explained by model parameter uncertainties but by unexpected events in the given short observation period. We have confirmed that although each seismogenic structure in Taiwan is unlikely to rupture within a short period, the summarized earthquake potentials from all the structures are significant. Additionally, we discuss the impacts of some model parameters, including epistemic uncertainties of source parameters, truncation of standard deviation for ground motion prediction equations, the Gutenberg-Richter law for area source, and the time-dependent seismicity rate model. The outcomes of this study provide not only crucial information for urban planning on a city scale and building code legislation on a national scale, but also suggestions for the next generation of probabilistic seismic hazard assessment for Taiwan as well as other regions.