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Probabilistic Tsunami Hazard Assessment for Local and Regional Seismic Sources Along the Pacific Coast of Central America

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Historical data indicate that the Middle America subduction zone represents the primary tsunamigenic source that affects the Central American coastal areas. In recent years, the tsunami potential in the region has mainly been assessed using maximum credible earthquakes or historical events showing moderate tsunami potential. However, such deterministic scenarios are not provided with their adequate probability of occurrence. In this study, earthquake rates have been combined with tsunami numerical modeling in order to assess probabilistic tsunami hazard posed by local and regional seismic sources. The common conceptual framework for the probabilistic seismic hazard assessment has been adapted to estimate the probabilities of exceeding certain tsunami amplitudes along the Central American Pacific coast. The study area encompasses seismic sources related to the Central America, Colombia and Ecuador subduction zones. In addition to the classical subduction inter-plate events, this study also incorporates sources at the outer rise, within the Caribbean crust as well as intraslab sources. The study yields conclusive remarks showing that the highest hazard is posed to northwestern Costa Rica, El Salvador and the Nicaraguan coast, southern Colombia and northern Ecuador. In most of the region it is 50 to 80% likely that the tsunami heights will exceed 2 m for the 500 year time exposure (T). The lowest hazard appears to be in the inner part of the Fonseca Gulf, Honduras. We also show the large dependence of PTHA on model assumptions. While the approach taken in this study represents a thorough step forward in tsunami hazard assessment in the region, we also highlight that the integration of all possible uncertainties will be necessary to generate rigorous hazard models required for risk planning.