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Site-Specific Characterization of Earthquake Ground Motions: Papua New Guinea Case Study

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A seismic hazard analysis was conducted for a site in Papua New Guinea which is located in a seismically-active region that experiences frequent large earthquakes generated by crustal and subduction sources. A suite of ground motion prediction equations (GMPEs) was developed for each source type (crustal, interface and in-slab) using the scaled-backbone approach. To this end, a ground-motion database consisting of events of 4.0<Mw<8.0 was compiled from available local and regional monitoring stations. Ground motions were classified based on the source type and converted to a common reference site condition. The site-corrected motions were compared against alternative GMPEs to examine residual trends between observed and predicted amplitudes. A backbone model that represents the best estimate of the median ground motions for each source type was selected. The backbone models were then adjusted to the median of the ground motions observed at the study site.

The epistemic uncertainty in median predictions was modeled using a logic-tree approach, where the distribution of potential median predictions is approximated by a lower, central and upper model. The central model is represented by the site-adjusted backbone model; it was scaled to define the lower and upper branches. The scaling factor was determined considering: (i) the standard deviation in median prediction of alternative GMPEs; and (ii) epistemic uncertainties recommended in other studies. The available data were insufficient to model aleatory variability with confidence; therefore, the standard deviation of observed motions in data-rich regions is used for guidance. Two alternative aleatory variability models (ergodic and single-station sigma) adopted from other studies are recommended.