Common form ground-motion models for crustal earthquakes and partially-ergodic hazard calculations in New Zealand

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A key aspect of seismic hazard assessment is the prediction of the ground motion distribution from seismic sources. The prediction can either be made using an empirical ground-motion model, sometimes referred to as a ground-motion prediction equation, or using semi-physical, semi-empirical ground-motion simulations. The choice of technique, and model within each technique, often has a very large effect on the results, which renders the final hazard results uncertain. This type of uncertainty is often referred to as epistemic uncertainty. Accounting for epistemic uncertainty involves combining the outputs from all technically defensible models. Seismic hazard assessment in New Zealand has historically suffered from an insufficient number of available, technically-defensible models, which has prevented the epistemic uncertainty from being robustly quantified. This study derives suites of nonredundant median models for shallow crustal earthquakes that are designed to capture the full space of technically defensible models for seismic hazard assessment. With the plausible model space adequately covered, well-performing models based on current evidence can receive higher weights. Model suites and weights are derived specifically for Auckland, Wellington and Christchurch, as well as a generic model suite for wider application. Ground-motion standard deviation models are derived using New Zealand data, and guided at large magnitudes by global data where the New Zealand dataset is too sparse. Uniform seismic hazard spectra are calculated using these model suites for rock sites in Auckland, Wellington and Christchurch. Partially-ergodic uniform hazard spectra are also calculated using the model suites for twelve locations in Wellington and Christchurch.

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