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A Test of a Strong Ground Motion ìPredictionî Method for the 7 September 1999, Mw 5.9 Athens Earthquake

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We test a method to "predict" the range of ground-motion hazard for a fixed-magnitude earthquake along a specific fault or within a specific source volume, and we demonstrate how to incorporate this into probabilistic seismic hazard analyses (PSHA). We modeled ground motion with empirical Green's functions. We tested our method with the 7 September 1999, Mw 5.9 Athens earthquake. We (1) developed constraints on rupture variables based on prior knowledge of the region; (2) ran a sufficient number of scenario earthquakes to span the variability in ground motion; (3) found that our distribution includes what actually occurred and is realistically narrow; and (4) determined that one of our models generates records that matches observed time histories well. We also synthesized strong-motion records in high-damage areas for which strong-motion records from the earthquake do not exist. We then developed a demonstration PSHA for the Athens area utilizing synthesized ground motion rather than traditional attenuation relations. We synthesized 500 earthquakes distributed throughout the source zone likely to have Mw 6.0 earthquakes near Athens. We assumed an average return period of 1,000 years for this magnitude earthquake, thereby having simulated a catalog of ground motion for a period of 500,000 years. The distribution of traditional ground-motion variables of peak acceleration or spectral ordinates then becomes the actual record from which we develop hazard curves in the form of the annual probability of exceedance of the variable of interest. *This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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