

Seismic Hazard Evaluation Using Markov Chains

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Seismic hazard, here defined as the occurrence probability of one or more earthquakes in a specific geographic area which includes several seismogenic regions within given time and magnitude intervals, is determined from a statistical analysis of seismicity reported in catalogues, through the application of Markov Chains. Our new method includes the procedures for hazard estimation and for evaluation of both confidence and results, including comparison with null hypotheses of memory-less uniform or Poissonian seismicity occurrence.

The method is applied to the area of Japan; data from the ISC catalogue for 36 years are analyzed considering four seismogenic regions, magnitudes ≥ 5.5 , and a 0.1 yr time interval. The method's "predictive" performance (i.e. estimated probability values at which new, as yet unconsidered, transitions actually occur, and transition occurrence with high estimated probabilities) appears to be quite good, although its assessment is based on very few data, since there is barely enough data to obtain reasonably robust hazard estimates. However, "postdictive" (evaluating the occurrence of transitions already used for the estimates) performance yields excellent results with negligible probabilities of being random.