A Probabilistic Approach towards Earthquake Hazard Assessment using Two First Order Markov Models in Northeastern India

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The occurrence of earthquakes is characterized by extreme randomness. They are of a highly stochastic nature in both the spatial and the temporal domain. As a result, very little progress has been achieved so far in accurate prediction of future earthquakes, both spatially and temporally. In this paper, a probabilistic analysis of earthquakes of a seismically active region is carried out in the temporal domain. Two First Order Markov Models have been used in Northeastern India; The first one is for the probability estimation of at least one major earthquake striking the area under consideration within a definite span of time in the future. The second model is used to evaluate the likelihood of occurrences of earthquakes falling in different magnitude ranges. Both the models are Markovian in nature and model the occurrences of earthquakes as a first-order Markov process. While the first model predicts the long-term risks of the region of experiencing at least one major earthquake, the second model predicts the immediate short-term risks. Earthquake catalogs for NE Indian region are prepared from various sources like USGS, ISC catalogs, IMD, Harvard Seismology, Chandra 1992, Bapat et.al 1996. The geology, tectonic setup and the seismicity of the area are used to classify the study region into four seismotectonic polygons. Zone 1 comprises the Arakan-Yoma mountain ranges, Zone 2 the Himalayan Zone, Zone 3 is the Shillong Plateau and Zone 4 is the Bay of Bengal. The two models are applied to each of these zones and their seismic hazards are estimated.

Key Words: Probabilistic approach 1; Source zones 2; Seismic Hazard Assessment 3; Markov Model 4; Return period 5; Northeast India 6.