ABSTRACT

Natural hazards, particularly earthquakes usually occur without warning. Although the occurrence of earthquake is inevitable, the reduction of social and economic setback during earthquake can be achieved through a comprehensive assessment of seismic hazard and risk reduction. The present study region, Northeastern (NE) India, is known for its high level of seismicity and complex tectonic features. The seismic zonation map of India has demarcated the NE India as Zone V and Global Seismic Hazard Assessment has estimated high seismic risk in this region with peak ground acceleration of 0.35g-0.4g. This region has experienced 20 large earthquakes ($M_w > 7.0$) since 1897, including two great earthquakes of magnitude M_w 8.1 in 1897 and M_w 8.5 in 1950. Due to these earthquakes, NE region has experienced loss of life and property, severe building collapse and intense ground shaking. Moreover the rapid urbanization, increasing population density, the loss of human live and properties due to recent past devastating earthquakes, demand research studies on seismic hazard assessment and risk analysis. For the present study, a reliable, homogeneous and complete earthquake catalogue with a cutoff moment magnitude $M_w \geq 3.0$ for NE region is prepared covering the period from 1897 to 2009, which is the essential input parameter to estimate seismic hazard assessment. Pattern Informatics (PI) and Relative Intensity (RI) methods are applied for earthquake forecasting and seismic hazard assessment. Both the PI and RI methods are performed for a grid size of 0.2° × 0.2° with cutoff magnitude $M_w \geq 3$ during the time period from t_0=1897 to t_3=2009. The results obtained from the PI method are evaluated using relative operating characteristic (ROC) diagram. The hotspots or the possible site for future earthquakes include 39 boxes out of the 2750 boxes considered for NE region. Further, the NE region is divided in to three zones namely Zone 1: Arakan-Yoma Zone (AYZ), Zone 2: Himalayan Zone (HZ) and Zone 3: Shillong Plateau Zone (SPZ) based on seismicity and tectonics. Energy blocked in these regions is calculated to estimate the maximum magnitudes (M_{max}). The M_{max} obtained for source zones are 8.2 for AYZ, 8.6 for HZ, and 8.7 for SPZ. Two first order Markov models have been used in the above source zones in the temporal domain to compute the seismic hazard analysis. The result depicts that AYZ is the most prone to experiencing large earthquakes among all the three zones in the near future. In the present study, the relative movements in NE India is estimated from the Interferometric Synthetic Aperture Radar (InSAR) image and correlated with the continuous recorded Global Positioning System (GPS) data obtained from the NE GPS network. The InSAR is prepared to find out the relative movements of the particular region and quite well correlates with GPS findings. This InSAR result suggests continuous relative movements in NE region and hence accumulation strain which will be responsible for future earthquakes.

Key words: seismic hazard analysis, $M_{max,}$ pattern informatics, relative intensity, relative operating characteristic diagram, Markov model, InSAR and NE India.