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GIS and Remote Sensing Approach in Earthquake Hazard Assessment and Monitoring: A Case Study in the Momase Region of Papua New Guinea

Authors : Tingneyuc Sekac, Sujoy Kumar Jana, Indrajit Pal, Dilip Kumar Pal

Abstract : Tectonism induced Tsunami, landslide, ground shaking leading to liquefaction, infrastructure collapse, conflagration are the common earthquake hazards that are experienced worldwide. Apart from human casualty, the damage to built-up infrastructures like roads, bridges, buildings and other properties are the collateral episodes. The appropriate planning must precede with a view to safeguarding people's welfare, infrastructures and other properties at a site based on proper evaluation and assessments of the potential level of earthquake hazard. The information or output results can be used as a tool that can assist in minimizing risk from earthquakes and also can foster appropriate construction design and formulation of building codes at a particular site. Different disciplines adopt different approaches in assessing and monitoring earthquake hazard throughout the world. For the present study, GIS and Remote Sensing potentials were utilized to evaluate and assess earthquake hazards of the study region. Subsurface geology and geomorphology were the common features or factors that were assessed and integrated within GIS environment coupling with seismicity data layers like; Peak Ground Acceleration (PGA), historical earthquake magnitude and earthquake depth to evaluate and prepare liquefaction potential zones (LPZ) culminating in earthquake hazard zonation of our study sites. The liquefaction can eventuate in the aftermath of severe ground shaking with amenable site soil condition, geology and geomorphology. The latter site conditions or the wave propagation media were assessed to identify the potential zones. The precept has been that during any earthquake event the seismic wave is generated and propagates from earthquake focus to the surface. As it propagates, it passes through certain geological or geomorphological and specific soil features, where these features according to their strength/stiffness/moisture content, aggravates or attenuates the strength of wave propagation to the surface. Accordingly, the resulting intensity of shaking may or may not culminate in the collapse of built-up infrastructures. For the case of earthquake hazard zonation, the overall assessment was carried out through integrating seismicity data layers with LPZ. Multi-criteria Evaluation (MCE) with Saaty's Analytical Hierarchy Process (AHP) was adopted for this study. It is a GIS technology that involves integration of several factors (thematic layers) that can have a potential contribution to liquefaction triggered by earthquake hazard. The factors are to be weighted and ranked in the order of their contribution to earthquake induced liquefaction. The weightage and ranking assigned to each factor are to be normalized with AHP technique. The spatial analysis tools i.e., Raster calculator, reclassify, overlay analysis in ArcGIS 10 software were mainly employed in the study. The final output of LPZ and Earthquake hazard zones were reclassified to 'Very high', 'High', 'Moderate', 'Low' and 'Very Low' to indicate levels of hazard within a study region.

Keywords : hazard micro-zonation, liquefaction, multi criteria evaluation, tectonism
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