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Application of earth observation datasets and Analytic Hierarchy Process in the mapping of Landslide hazard zones of Manipur, India

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Landslides problems are one of the major natural hazards in the mountainous region. Every year due to the increase in anthropogenic factors and changing climate, the problem of landslides is increasing, which leads to huge loss of property and life. Landslide is a common and regular phenomenon in most of the northeastern states of India. However, in recent past years, Manipur has experienced several landslides including mudslides during the rainy season. Manipur is a geologically young and geodynamically active area with many streams flowing parallel to fault lines. As a first step toward hazard management, a landslide susceptibility map is the prime necessity of the region. In this study, we have prepared a landslide hazard map of the state using freely available earth observations datasets and multi-criteria decision making technique, i.e., Analytic Hierarchy Process (AHP). For this purpose, lithology, rainfall, slope, aspect, relative relief, Topographic Wetness Index, and distance from road, river and fault were used as the parameters in AHP based on the understanding of their influence towards landslide in that region. The hazard map is classified into four hazard zones: Very High, High, Moderate, and Low. About 40% of the state falls under very high and high hazard zone, and the hilly regions such as Senapati and Chandel district are more susceptible to the landslide. Among the factors, slope and rainfall have a more significant contribution towards landslide hazard. It is also observed that areas nearer to NH-39 that lies in the fault zones i.e., Mao is also susceptible to high hazard. The landslide susceptibility map gives an first-hand impression for future land use planning and hazard mitigation purpose.