

Rainfall-Induced Landslide Hazard Analysis Using TRIGRS Model: An Investigation of 2014 Malin Slide, Maharashtra, India

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The Western Ghats region of India and its neighbouring areas are highly susceptible to rainfall-triggered landslides due to the regional geography, extreme rainfall, and anthropologic intervention like excavation for construction activities etc. Every year in monsoon season, Maharashtra faces a massive loss of properties and life due to rainfall triggered landslides. In the monsoon of 2021, Pune and Konkan divisions in Maharashtra have witnessed severe rainfalls that triggered many landslides, which cause nearly 200 deaths and massive loss of properties. Thus, it is necessary to model an accurate early prediction system to mitigate such natural hazards. In this study, we have analyzed the efficiency of the transient rainfall infiltration and grid-based regional slope-stability (TRIGRS) model in predicting the location and timing of landslides. The case study selected for this analysis is a destructive rainfall-induced landslide triggered at Malin near Mumbai in July 2014, which resulted in 160 deaths, including the burial of an entire village under the debris. The TRIGRS is a widely applied model to analyze the effect of rainfall on pore water pressure fluctuations and related variation in factors of safety. It uses an infinite slope model to estimate the change in the factor of safety for every pixel. The model input data requires topographic properties (slope and elevation), soil layer thickness, material properties, initial water-table depth, and rainfall characteristics (intensity and duration). The preliminary analysis of rainfall data indicated that the study area was affected by 3-days intense rainfall prior to the landslide event. The TRIGRS model results show that the factor of safety of the Malin slope decreases with the increasing rainfall intensity and duration. The present study suggests that this model can also be used at large scale areas to prepare an active early warning system for landslide events.

Keywords: Landslide; Rainfall; TRIGRS; Natural hazard; Maharastra