CHAPTER 21

GEOLOGY

Doctoral Theses

01. THOMAS (Juby)
Modified Physically Based Slope Stability Model and Enhanced Hydrologic Parameters for Prediction of Rainfall-induced Landslides.
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Abstract

The current study investigates into the modelling of distribution and initiation timing of rainfall-induced shallow landslides, with special reference to hydrological aspects of the terrain utilizing TRIGRS (Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability), a dynamic physically based slope stability model over a catchment region in the central Himalayas. The model has been optimised for hydro-geomechanical parameters. It has been found that the TRIGRS with optimised hydro-geomechanical parameters models the initiation timing and distribution of rainfall-induced shallow landslides with better accuracy as compared to the default TRIGRS. In addition, it is found that terrain heterogeneity, especially the spatial variability of soil hydraulic parameters (SHPs), significantly affect the initiation timing of rainfall-induced shallow landslides. Since the spatial variability of SHPs is a pronounced factor, default TRIGRS v2.1 has been modified into DisTRIGRS v1.0 to accommodate grid-wise variation of SHPs over the selected catchment region in the central Himalayas. Also, as there are no high-resolution grid-wise information of SHPs available in data-poor regions like the Indian Himalayan Region (IHR), a framework to derive SHPs from Earth Observation (EO) datasets over large catchment regions has been developed. Initiation timing and spatial distribution of rainfall-induced shallow landslides have been modelled in the DisTRIGRS, and validated against the landslides that occurred in the study area in the last two decades. DisTRIGRS' outputs show better agreement with the spatial patterns and timing of observed landslides in the study area. The study leads to advancing the prediction of rainfall-induced shallow landslides through a modified model with enhanced SHPs dataset. DisTRIGRS can be utilized for having a prior information about 'when' and 'where' the landslides will occur during and after a storm event and can be a useful tool to policymakers and authorities to formulate effective mitigation strategies.

Contents