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Landslide forecasting in the Eastern Himalayas by Fracture Induced Electromagnetic Radiation (FEMR) Technique

Dip Das and Jyotirmoy Mallik
Indian Institute of Science Education and Research Bhopal, Bhopal, India (dip18@iiserb.ac.in)

The Himalayas being an actively deforming terrain with steep hillslopes and significant rainfall is highly susceptible to landslide hazards. The fractured nature of the rocks, steep river bank and moderate to steep road cut-slope provide added risk to the slope failure vulnerability. Landslides are generally triggered after substantial downpours during monsoon resulting in significant economic loss and casualties. Thus, an Early Warning System (EWS) is an absolute necessity. Our study explores the potential of geogenic Fracture Induced Electromagnetic Radiation (FEMR) technique for landslide forecasting. The FEMR technique is getting increasingly popular amongst geoscientists due to its ability to determine the zones of enhanced stress accumulation enabling it to be an effective precursor to a mass failure episode. This method is cost-effective and quick compared to other conventional rock mechanical studies. In the Eastern Himalayas, slopes get reactivated causing recurrent landslide episodes. The slope failure is generally guided by tensile rapture followed by shear sliding (TRSS) mechanism. We acquired high-resolution FEMR linear profiles along the landslide planes with a portable instrument called ANGEL-M. Additionally, soil strength tests and numerical modelling were carried out to complement FEMR results. We concluded that the most severe deep landslides could be correlated to very high FEMR amplitudes whereas very low FEMR amplitude often corresponds to a lack of failure. Moderate FEMR amplitudes, however, are related to shallow-intermediate landslide occurrences. We further recommend that the FEMR technique can be utilized by moderately skilled surveyors from local municipalities as a pre-monsoon landslide forecasting methodology and mitigation strategies can be planned in advance.