

Modelling of debris flows starting from shallow landslides in the Kathmandu area, central Nepal

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The occurrence of shallow landslides is very common in the Lesser Himalaya of central Nepal during Monsoon rainstorms. Many shallow slides have converted into debris flows causing extensive damages and fatalities in the Kathmandu area. The most recent events took place in 1993 and 2002. Even though the landslide susceptibility in the area has been studied, no attempts to predict the motion and travel distance of future debris flows were yet published. The present study is seen as an initiative to fill this gap by combining different modelling techniques.

A detailed landslide inventory is available for the area. Debris flows in Mohoria (Makwanpur District) and Matatirtha (Kathmandu District) are used for model calibration and validation. The following modelling strategy is applied:

(1) Development and validation of empirical relationships for the travel distance of debris flows on the basis of average slope angle, onset depth and volume and flow path properties. In a second step, application of the relationships to possible future events.

(2) Application of physically-based models for debris flow motion (DAN and RAMMS): back-calculation with historical events and simulation of possible future events.

The model results correspond well to the field observations. Comparison of the results from the different models enables a robust characterization of possible future debris flows in terms of flow parameters, travel distance and impact area, as an important input for risk mitigation.