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Reliability analysis and risk assessment on debris-flow inundation area

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Hydrogeological parameters used to evaluate debris flows usually exist uncertainty. The uncertainty of the hydrogeological parameters should be considered in evaluating debris flow mobilization and developing the risk-assessment system of debris flows. Generally, the discharge of debris flows (Qd) can be estimated according to the relationship between discharge of the debris flow and runoff (Qw), i.e. Qd = k Qw. k is related to the volume concentration of debris flow and it has high uncertainty. The value of k could be up to 40 for landslides induced debris flows. In this study, the uncertainty of the parameters and the reliability of discharge of debris flow were analyzed. The FLO-2D software was used to analyze the maximum flow velocity, maximum flow depth and inundation area. The inundation area and potential hazard map at various reliability probabilities were presented. The vulnerability of the debris-flow affected area was also analyzed and it was combined with the hazard map to develop the risk assessment model of debris flow with the reliability concept. Finally, the proposed model was applied to a case study of debris flow gully in northern Taiwan. The proposed method analyzed the potential hazards in the debris flow gully and divided the affected area into three risk zones. Results of this study can provide a reference for debris-flow hazard mitigation in the area.