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Prospects and limitations for determining the parameters in physical-based regional landslide susceptibility model using back analysis technique

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Landslide susceptibility analysis is crucial from viewpoint of hazard mitigation. Statistical and deterministic approaches are frequently adopted for landslide susceptibility analysis. Based on physical models, deterministic approaches are superior to the statistical approaches for they fully take the mechanical mechanisms into account. However, it is difficult to input the appropriate mechanical parameters (including strength and hydraulic) in a deterministic model. Back analysis is a promising way to calibrate the required parameters though few researches have paid attention to evaluate the performance of back analysis approach. This research use hypothetical cases (100 cells) to investigate the prospects and limitations for estimating the parameters of a deterministic model by using back-analysis approach. Based on the assigned hydraulic and strength parameters, the corresponding safety factor and landslide inventory (cell with safety factor less than 1), as well as the depth of ground water table for each cell, were calculated using a deterministic model, TRIGRS. The landslide inventory derived from the forward calculation is then used to back-calculate the pre-assigned parameters. Two scenarios of back analysis approaches were examined in this research. The results reveal that the non-uniqueness of back-analyzed hydraulic and strength parameters is detrimental to the performance if only the landslide inventory is utilized to back-calculate the parameters. However, the performance of back-calculation will be improved if the spatial and temporal variation of ground water table is used to calibrate the hydraulic parameters first. Thereafter, the multiple landslide inventories are hopefully helpful to soothe the non-uniqueness on back-calculating the hydraulic and strength parameters for a deterministic landslide susceptibility analysis in regional scale.