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A GIS-based susceptibility map for landslides at the Franconian Alb, Germany

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In general, slopes of cuesta scarps like the Franconian Alb are highly prone to slide activity due to susceptible geological and geomorphological conditions. The geological setting with alternating permeable and non-permeable bedrock results in the characteristic cuesta landforms of almost flat backslopes and steeper front slopes. Furthermore, this bipartite structure leads to a strong disposition for mass movements.

The slopes of the study area near the town of Ebermannstadt are affected by different types of mass movements, such as topples, slides, lateral spreads and flows, either in single or in combined occurrence. In the years 1625, 1957, 1961 and 1979, four large landslides took place in the area of Ebermannstadt, reaching close to the town limits and causing major destructions to traffic facilities. In the study area, slopes are covered by debris and slide masses, thus they are prone to remobilization and further mass movements.

In order to assess hazardous areas, a GIS-based susceptibility modelling was generated for the study area. The susceptibtibility modeling was processed with the slope stability model SINMAP (Stability Index Mapping), developed by TARBOTON (1997) and PACK et al. (1999). As SINMAP was particularly designed to model shallow translational slides, it should be well designed for describing the conditions of the study area in a sufficient way. SINMAP is based on the "infinite slope stability model" by HAMMONT et al. (1992) and MONTGOMERY & DIETRICH (1994), which focuses on the relation of stabilizing (cohesiveness, friction angle) and destabilizing (gravitation) factors on a plain surface. By adding a slope gradient, as well as soil mechanical and climatical data, indices of slope stabilities are calculated.

For a more detailed modeling of the slope conditions, SINMAP computes different "calibration regions", which merge similar parameters of soil, land-use, vegetation, and geology. Due to the fact that vegetation, land-use, and soils only show minor differences on the slopes of the study area and therefore have no significant impact on the slope stability in the applied modeling, geology becomes the most important input factor. Therefore, first calculations are based on the main geological units drawn in the geological map, such as limestone, clay, sandstone and debris. However, the results obtained were not sufficient, as several areas of known instability were calculated as rather stable slope areas. This was due to an underrepresentation of debris and slide masses in the geological map and the models' calculation. In order to improve the modeling process, geological standard units were further differentiated, with the debris cover and its soil mechanical parameters considered in greater detail. These adjustments not only led to significantly improved modeling results in the study area, but also create a more realistic basis for SINMAP calculations in all cuesta landscapes.

HAMMONT, C., HALL, D., MILLER, S., SWETIK, P. (1992): Level I Stability Analysis (LISA) Documentation for version 2.0. General Technical report INT-285, USDA Forest Service Intermountain Research Station 190p.

MONTGOMERY, D. R. & DIETRICH, W. E. (1994): A physically based model for the topographic control on shallow landsliding. Water Resources Research 30/4, p 1153-1171.

PACK, R. T., TARBOTON, D. G. & GOODWIN, C.N. (1999): SINMAP – A Stability Index Approach to Terrain Stability Hazard Mapping, User's Manual. Forest Renewal B.C., 65p.

TARBOTON, G.D. (1997): A new method for the determination of flow directions and upslope areas in grid digital elevation models. Water Resources Research 33/2, p 309-319.