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Spatially-distributed landslide susceptibility assessment in the Mucone catchment, Calabria, Italy

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In the valley of the Mucone River (Sila Massif, southern Italy) highly weathered Palaeozoic crystalline rocks crop out, ranging from residual soils to moderately weathered rocks. Because of the rugged topography and the abundance of weathered deposits, mass movements affect the great majority of the catchments. The most common instability phenomena are given by rotational and translational slides, with subordinate rockfalls on steep to near vertical slopes. Debris-flow and debris avalanche scars occur at the upper-middle reaches of many catchments. Most of the flow-like movements show a surficial surface of rupture, which suggested to analyse the landslide susceptibility in the catchment basin of the Mucone River through a physically-based model. To this aim the SINMAP code (Pack and Tarboton, 1998) was adopted to explain and eventually predict the spatial distribution of shallow soil slips identified in the Mucone basin. SINMAP works as an extension of ArcView GIS software, allowing to compute the Stability Index (SI) on a pixel by pixel base. As known, SINMAP combines a mechanistic infinite slope stability model with a steady-state hydrological model. Hence, a Mohr-Coulomb criterion is applied on each cell and the hydrological model accounts for its saturation. SI values, defined as the probability that a location is stable assuming uniform distributions of parameters over their uncertainty ranges, are used to classify the studied territory in six stability classes. Three scenarios (A, B, C) were simulated, given by different rainfall events, in turn related to some of the landslides surveyed in the basin, and by and different values of soil hydraulic transmissivity. The scenario B seems to be the best fit for the overall instability conditions of the weathered terrains of the Mucone basin, being characterized by rainfall values corresponding to the mean of the max monthly values over a 50-year time span.