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Probabilistic rainfall thresholds for shallow landslide triggering

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Rainfall thresholds for shallow landslide triggering are useful technical tools in managing hazardous conditions deriving by exceptional rainfall events. Existing thresholds usually divide hydrological conditions in two ranges (landslides and no landslides) without assigning any level of probability. In order to define rainfall thresholds with different triggering probability, we developed two different approaches. A statistical approach allows to reclassify the rainfall events into “landslide” and “non-landslide” events and to define the group membership probability (i.e., the triggering probability). A physically-based model approach incorporates the variability and uncertainty of hydrological parameters that are responsible for landslide triggering, and thus allows to trace rainfall thresholds with different triggering probabilities. Physically-based rainfall thresholds are traced using a simple pore-pressure diffusion model, that is valid under certain rainfall intensities and hydrological conditions. As a consequence, the physically-based thresholds are suitable for local scale problems, differently from most of the empirical relationships already available in the literature. Moreover, it is possible to associate a temporal probability (i.e., a recurrence time) to the rainfall events responsible for thresholds, thus defining a temporal triggering probability. Examples have been prepared for a study area located in the Italian Central Alps (Valsassina).