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Probabilistic classification of local rainfall-thresholds for landslide triggering

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A procedure is formulated for the probabilistic classification of an empirical threshold model for rainfall-triggered landslides. The threshold model $t(\Theta)$ with a set of parameters Θ, integrates rainfall intensity I, duration D and n-day antecedent precipitation A_n. The probabilistic classification based on this model is the solution of an inverse problem under a Bayesian theoretical framework. This approach allows for identifying, characterizing and propagating the uncertainty encapsulated on the evidence use for the calibration of the classification model. The use of the Bayesian paradigm results in the integration of the joint probability distribution of the model parameters. From the parameters' joint probability distribution, it is then possible to assess the correlation between the model parameters and to populate likely realizations of threshold curves, so that a smooth probability threshold definition can be obtained, as opposed to deterministic optimal threshold curves. A case study is discussed where observations are provided for a dataset of $I - D - A_n$ records considering both landslide-triggering and non-triggering rainfall events. A fundamental application of this exercise, is the potential probabilistic definition of alert levels in the context of early-warning systems.