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A bayesian approach to determine the rainfall thresholds for shallow landslides triggering

M.L.V Martina (1), **S. Pignone** (2), M. Pizziolo (3) and E. Todini (1)

(1) Dipartimento di Scienze della Terra Università di Bologna, (2) Arpa Servizio IdroMeteorologico Regione Emilia-Romagna, (3) Servizio Geologico Sismico e dei Suoli Regione Emilia-Romagna

The relationship between rainfall and landslides aimed at the definition of landslide-triggering rainfall thresholds have been studied by several researchers both according to a physically based approach and to more statistically based approach. Generally a threshold is defined as the minimum or maximum level needed for a process to take place or a state to change. In this work, the rainfall thresholds are defined as the critical value of the combination of two controlling variables: a variable describing the magnitude of the rainfall event (e.g. rainfall intensity, total rainfall volume of the event) which trigger landslides and another variable describing the antecedent conditions at the rainfall event (e.g. cumulate antecedent rainfall and soil moisture) We used a statistical Bayesian approach in order to estimate the rainfall thresholds by choosing a critical value for the exceedance probability of the landslides given the two controlling variables. The study is based on the available data of the Emilia-Romagna for the landslides occurred in the last 70 years in the North Apennines. The joint probability distribution function of the controlling variables conditional to a landslide does not show indication of critical threshold as it has been shown by previous works. We think that is not the correct way to analyze the data. As a matter of fact the comparison of the marginal and conditional pdfs of the controlling variables shows evident differences. By applying the Bayes's theorem, it has been possible to estimate the probability of a landslides event conditional to the controlling variables and confirm the intuitive dependence of the shallow landslides from the triggering factors.