



Temporal clustering of rainfall for landslides detection

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Landslides are impactful and complex natural hazards, causing important damages in vulnerable areas. They can be related to several pre-existing conditions and triggering factors. The former are variables that do not directly cause the event but that increase its likelihood in the presence of a triggering variable. Example of the former are the slope or the aspect, of the latter precipitation, earthquakes, snowmelt, or human disturbances. Among the triggering factors the most important is rainfall. Usually deep-seated movement, characterized by a slip surface deeper than 1.5 m, are related to repeated moderate precipitation episodes while shallow landslides, characterized by a slip surface less deep than 1.5 m, to single and more intense episodes. Landslide detection is usually performed with the use of precipitation thresholds, either process-based or empirical ones. Here we introduce a new methodology to detect landslides based on temporal clustering of precipitation. Temporal clustering is a particular typology of compound event falling inside the category of temporal compounding events and it is defined as the occurrence of multiple events of the same type in close succession. The new method is compared with the use of empirical rainfall thresholds considering as case study two landslide inventories in the Lisbon region, Portugal. The method shows a better sensitivity with respect to empirical rainfall thresholds and a performance in terms of precision variable depending on the site. In general, the detection of deep landslides is better than of shallow landslide. The method requires only precipitation data and the selection of a precipitation quantile to identify events and it could help to improve the detection of rainfall-triggered landslides.