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Frequency-area distribution of earthquake-induced landslides

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It is a widely held view that a power-law relation is valid for the frequency-area distribution (FAD) of medium and large landslides. Discovering the physical explanations behind the power-law distribution of landslides can provide valuable information to quantify triggered landslide events and as a consequence to understand the relation between landslide causes and impacts in terms of environmental settings of landslide affected area. In previous studies, the probability of landslide size was utilized for this quantification and the developed parameter was called a landslide magnitude (mL). The FAD's of several landslide inventories were modelled and theoretical curves were established to identify the mL for any landslide inventory. In the observed landslide inventories, a divergence from the power-law distribution was recognized for the small landslides, referred to as the rollover, and this feature was taken into account in the established model. However, these analyses are based on a relatively limited number of inventories, each with a different triggering mechanism. Existing definition of the mL include some subjectivity, since it is based on a visual comparison between the theoretical curves and the FAD of the medium and large landslides. Additionally, the existing definition of mL introduces uncertainty due to the ambiguity in both the physical explanation of the rollover and its functional form. In this study, we focus on earthquake-induced landslides (EQIL) and aim to provide a rigorous method to estimate the mL and total landslide area of EQIL. We have gathered 28 EQIL inventories from around the globe. Using these inventories, we have evaluated existing explanations of the rollover and propose an alternative explanation given the new data. Next, we propose a method to define the EQIL FAD curves and mL. We utilize the total landslide areas obtained from inventories to compare them with our estimations and to validate our methodology. The results show that we calculate landslide magnitudes more accurately than previous methods. We are currently developing a model for predicting the magnitude of EQIL and therefore the total landslide area for a given earthquake that could be applied to real-time methods.