Characterization of rainfall events that triggered landslides in different regions in Japan

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During the last decades, Japan has experienced several rainfall events, that induced hundreds to thousands of shallow landslides over large areas. For example, the 2017 July northern Kyushu torrential rainfall (> 500 mm / 24h) caused more than 1,500 shallow landslides widespread over 430 km^2. Landslide-triggering rainfall episodes may have a unique pattern that never experienced before in the region. Rainfall intensity-duration (ID) and accumulated rainfall-duration (ED) thresholds are often modeled for predicting the temporal occurrence of landslides. Such classical methods, define the rainfall conditions that must be reached or exceeded for the triggering of landslides, are subjective and affected by multiple uncertainties. Here, we studied the pattern of various rainfall events that triggered widespread landslides in different regions in the Japanese archipelago. We attempt at discriminating between experienced (non-triggering) and non-experienced (triggering or may-triggering) rainfall events by considering multiple minimum duration for rainfall interruption (MDRI). Hourly rainfall data (1976 ˜ 2019) were obtained from selected rain gauges that represent different landslide events. Multiple MDRIs were tested for separating the rainfall records of each station into statistically independent storm events. Then, the ID threshold representing the upper limit of non-triggering rainfall events was computed. So far, our results showed that landslide-triggering rainfall events do not necessarily exhibit the highest record of average rainfall intensity, cumulative rainfall, or maximum hourly rainfall. The ID plots, developed using different MDRI, showed that the landslide-triggering rainfall events are generally characterized by high average rainfall intensity and long duration. The ID thresholds of non-triggering rainfall events were influenced by the choice of MDRI. Considering both the maximum hourly rainfall and ID threshold may improve the discrimination between experienced and non-experienced rainfall events. Our preliminary findings will help in following-up on the present research.

Keywords: Landslide-triggering rainfall, Rainfall ID thresholds, MDRI