

Rainfall conditions and magnitude of landslides in Taiwan

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This study analyzed 172 landslides in Taiwan during 2006-2012. These landslides were compiled from the reports of the Soil and Water Conservation Bureau of Taiwan. The area of each landslide was mapped and calculated using FORMOSA-II images. The volume and depth were also calculated according to the empirical formula. Comparing the landslide size with rainfall conditions interpolated from data for surrounding rain gauges, this study found that deep landslides usually occurred due to long duration and moderate intensity rainfall, whereas shallow landslides occurred due to short duration and high intensity rainfall. This observation is consistent with some previous studies and is ascribable to the fact that deep landslides need a high ground water level caused by a prolonged rainfall. Concerning the area of landslides, their frequency-area distribution correlates well with a power-law relation having an exponent of -1.1 , over the range $6.3 \times 10^2 \text{ m}^2 < A_L < 3.1 \times 10^6 \text{ m}^2$. The slope of the power-law relation for Taiwan is lower than those for other areas around the world. It indicates that for the same total area or total number of landslides, the proportion of large landslides will be higher in Taiwan than in other areas. This study also proposed a landslide-event magnitude scale $m_L = \log V_a$, where V_a is the average volume of landslides associated with an event. The average m_L for all landslides during 2006-2012 was estimated to be $= 6.4$. In conclusion, the power-law relation of frequency-area distribution is valid for recognizing characteristics of landslides in a specific area and the magnitude scale can be used to assess historical landslide events.

Keywords: landslides, rainfall, frequency-area, power-law, magnitude