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Empirically Based Rainfall Threshold for Landslides Occurrence in Peninsular Malaysia
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Abstract
Empirical rainfall thresholds for the purpose of shallow landslide forecasting are proposed for Peninsular Malaysia where numerous slope failures are reported due to the intense rainfall in conjunction with the humid tropical climate. Thirty-seven cases of landslide-triggering-rainfall were selected from 1993 to 2018 to identify the correlation between rainfall and shallow landslide through the analysis of specific rainfall events. The derived rainfall parameters were applied to establish two rainfall thresholds of (Imean-D) and (Imax-D) via practical methods. For the identical range of event duration 1 < D < 263 h, the (Imean-D) threshold formula was expressed as I = 17.5 D−0.722, while the (Imax-D) threshold was defined as I = 37.8 D−0.114. Both thresholds performed different functionalities with a primary goal of predicting shallow landslides. When both (Imean-D) and (Imax-D) thresholds were compared with the thresholds proposed by various studies worldwide, both dominated the upper positions. More rainfall is required for land sliding due to the high thickness of the Malaysian soil that is associated with the abundant tropical downpour. From the perspective of the antecedent, the period of prolonged precipitation or short heavy rainfall from 1 to 10 days can result in shallow landslides for Peninsular Malaysia. In the context of geology, the igneous rock type of granite has the highest susceptibility to the shallow landslide at 65%, despite other rock types of sedimentary and metamorphic. The threshold validation depicted all True Positive events for the (Imax-D) threshold, and one Negative False event for the (Imean-D) threshold. The (Imean-D) threshold was revised to acquire the new value, but it needed to deal with the possibility of False Alarm and the (Imax-D) threshold seemed to be more credible to represent the rainfall-induced shallow landslide threshold for Peninsular Malaysia. © 2021, Korean Society of Civil Engineers.

Author Keywords
Early warning system; Empirical correlation; Landslide; Peninsular Malaysia; Rainfall intensity-duration threshold; Rainfall threshold

Index Keywords
Igneous rocks, Landslides, Metamorphic rocks, Sedimentary rocks, Tropics; Heavy rainfall, Humid tropical climates, Intense rainfalls, Practical method, Rainfall event, Rainfall thresholds, Rainfall-induced, Shallow landslide; Rain

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