Title: Spatiotemporal regional modeling of rainfall-induced slope failure in Hulu Kelang, Malaysia

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Abstract: This study demonstrated the use of transient rainfall infiltration and grid-based regional slope stability analysis model incorporated with spatial rainfall distribution model for regional mapping of rainfall-induced slope failures in a slope failure-prone area in Malaysia, namely Hulu Kelang. Infinite slope analysis was incorporated into the improved model to compute the pore water pressure and slope stability of the region. Digital terrain maps, spatial rainfall distributions, soil profiles, groundwater table, and soil properties were input into the model. The results showed that the slope failures in the study area can be grouped into shallow failures (<4 m) and sub-shallow failures (4–8 m). Most of the shallow slope failures (<4 m) were triggered by the northeast monsoon while the NE monsoon that characterized by more prolonged and intense rainfalls. Spatial temporal distributions of shallow and sub shallow slope failures predicted using the improved model showed reasonably good comparison with the historical slope failure regions. Monsoon events have affected slope stability by reduction in matric suction, complete loss of matric suction, and development of positive pore water pressure (PWP). Computation for the effects of rainfall infiltration on PWP response and consequent effects on slope stability is enhanced by the spatial rainfall distribution model. The pore water pressure response to monsoon rainfall is a function of rainfall duration, the rate of infiltration, groundwater depth, soil thickness, and slope inclination. The amount of the local daily rainfall is not the only factor affecting slope stability. The prolonged antecedent rainfall could have a role to play in building up the slope failure mechanism.