Article

Susceptibility Assessments of Landslides in Hulu Kelang Area Using a Geographic Information System-Based Prediction Model

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Abstract: This study was conducted to estimate the susceptibility of landslides on a test site in Malaysia (Hulu Kelang area). A Geographic Information system (GIS)-based physical model named YS-Slope, which integrates a mechanistic infinite slope stability method and the geo-hydrological model was applied to calculate the safety factor of the test site. Input data, slopes, soil-depth, elevations, soil properties and plant covers were constructed as GIS datasets. The factor of safety of shallow landslides along the wetting front and deep-seated landslides at the bottom of the groundwater were estimated to compare with the analysis results of the existing model and actual landslides in 2008. According to the results of the study, shallow landslides mainly occurred in the central area which has many historical landslides, while deep-seated landslides were predominant in the east side of the study area. A ROC analysis was conducted and it is shown that the prediction result at the end of the northeast monsoon for shallow landslides showed relatively high accuracy compared with other predictions.

Keywords: landslide susceptibility; rainfall-induced landslide; physical model; groundwater flow

1. Introduction

A landslide is one of the most serious disasters that can occur in an urban area but since there is no clear solution yet, landslides are causing damage to lives and properties. Recently, various studies have been carried out to reduce damages caused by landslides and to increase the sustainability of urban areas including several studies on safety and economic feasibility against landslides [1]. Wang et al. (2015) conducted a susceptibility assessment of landslides in Boaxing Catchment, Sichuan, China, based on a Geographical Information System (GIS) and an Area Under Receiver operating Characteristic Curve (AUC) [2]. Zhou et al. (2016) integrated the subjective weight and objective weight for regional landslides susceptibility analysis based on GIS [3]. Additionally, a study on cost of damage and effect of adaptation to landslides by considering climate change was conducted to relate landslides with climate change [4]. Hulu Kelang has reported 28 major landslides from 1990 to 2011 and is very vulnerable to landslides in Malaysia [5]. Malaysia region is temperately situated in the monsoon zone that is generally hot and humid with heavy rainfall events in rainy seasons and landslides in Malaysia occur usually during the rainy seasons.

Landslides susceptibility assessments can generally be categorized into four groups: landslides inventory, statistical, heuristic and deterministic methods [6–15]. The inventory method is one of the