地工技術，第129期（2011年9月）第77-88頁
Sino-Geotechnics, No.129 (Sep.,2011) pp.77-88

集水區降雨促崩潛勢分析

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摘　要

本文研擬一套結合定率模式與最佳化技術之廣域降雨促崩潛勢分析方法，藉以預測集水區內降雨誘發岩屑崩滑之發生時間、規模及空間分布。模式考量地文及水文因子於空間與時間之分布變異，透過評估降雨入滲導致暫態地下水壓上升進而對坡地穩定性所造成之影響。另結合GIS技術，將傳統單一邊坡穩定分析拓展至整個集水區範圍，同時預測集水區內所有邊坡單元在特定降雨條件下之崩塌潛勢、時機及範圍。由於定率模式之成效取決於參數能否取得及其代表性，本文將最佳化技術納入定率模式，並透過多次颱風事件之山崩目錄進行最佳化模式率定與驗證，除提升模式之正確性及準確度外，更可大幅縮短率定時間。實務應用上，本方法除能評估降雨促崩潛勢與時機外，後續可進一步結合氣象雨量即時與預報資料，擴展成山崩預警系統，可供相關單位後續於預警準則及保全對策擬訂時參考。

關鍵字：山崩、岩屑崩滑、山崩潛勢、定率法、最佳化。

Regional Landslide Potential Analysis Using a Deterministic Dynamic Model Integrated with Optimization Techniques

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Abstract

This paper presents an effective method that integrated the GIS-based deterministic dynamic model with the optimization technique to estimate the regional rainfall-induced landslide potential. The deterministic dynamic model, TRIGRS, couples an infinite-slope stability analysis with a one-dimensional analytical solution for rainfall infiltration. To improve the obtainment of representative parameter values of deterministic model, the optimization techniques were creatively applied for model calibration and verification accroding to the typhoon event-based landslide inventories. The calibrated and verified model can predict the triggered time, the scale, and the spatial distribution of shallow landslides by considering the spatial and temporal variabilities of hydro-geological parameters and rainfall intensities. Using the Morakot typhoon event as an example, the model successfully predicted the initiation locations of landslides in the mountain area of Kao-Ping River watershed. Our preliminary results could be regarded as a good reference to the authority for landslide hazard mitigation and risk management.

Key Words：Landslide, Shallow Landslide, Landslide Potential, Deterministic Method, Optimization.

一、前　言

近年來全球氣候異常，水文極端現象明顯，再加上台灣先天具有地形陡峻、地質複雜且豪雨集中等特性，故每逢暴雨侵襲便常釀成規模不等的坡地災害，嚴重危害流域中、下游民眾生命財產安全。以 2009 年 8 月侵台的莫拉克颱風為例，強大的雨勢不僅在南台灣沿海鄉鎮造成嚴重的水患，更在流域中、上游山區誘發 2 萬餘個大小