

應用崩塌與土石流整合模式於坡地災害之研究

陳毅青¹ 沈哲緯² 鍾佩蓉³ 邱昱嘉⁴ 吳映昕⁵ 姜壽浩⁶

¹臺灣大學水工試驗所博士後研究員

²財團法人中興工程顧問社防災科技研究中心副研究員

³財團法人中興工程顧問社防災科技研究中心專案計畫助理研究員

⁴臺灣大學水工試驗所專案計畫助理研究員

⁵臺灣大學土木工程學系博士候選人

⁶美國加州大學柏克萊分校地球與行星科學系博士後研究員

摘要

本近年來台灣災害類型大多屬於崩塌與土石流同時發生的複合型災害，但目前對於複合型災害的研究仍然相當缺乏。本研究利用崩塌體積-面積法估算崩塌體積，結合Debris 2D二為土石流模式，稱之為整合崩塌體積估算與 Debris 2D模擬，以台南市南化區玉山里的羌黃坑地區，並且測試崩塌料源、模式參數與數值地形模型與崩塌位置對於土石流模擬之敏感度。結果顯示莫拉克颱風於羌黃坑地區產生崩塌體積共計15,099 m³，土石流影響範圍與實際觀測範圍相當符合，並且模擬結果在青山宮後方之土石流流深為3.2 m，與野外觀測的3~4公尺相當符合。而敏感度分析顯示土石流影響範圍受到崩塌體積、數值高程模型與料源位置影響甚鉅，而降伏應力則對較不敏感。最後，本研究建議結合經驗統計式的崩塌潛勢、崩塌體積-面積式與Debris 2D，並且以時間性的發生機率為基礎，評估複合型土砂災害風險。

關鍵字：崩塌、土石流、整合模式、Debris 2D、複合型災害、羌黃坑地區。

Applying Landslide and Debris-flow Integrated model for Assessing Hillslope Hazards

Yi-Chin Chen¹, Che-Wei Shen², Pei-Jung Chung³, Yu-Jia Chiu⁴, Ying-Hsin Wu⁵, Shou-Hao Chiang⁶

¹ Postdoctoral Research Fellow, Hydrotech Research Institute, NTU., Taiwan

² Associate Researcher, Disaster Prevention Technology Research Center, Sinotech Engineering Consultants, Inc., Taiwan

³ Assistant Researcher, Disaster Prevention Technology Research Center, Sinotech Engineering Consultants, Inc., Taiwan

⁴ Project-Appointed Associate Research Fellow, Hydrotech Research Institute, NTU., Taiwan

⁵ PH. D. candidate, Department of Civil Engineering, National Taiwan University, Taiwan

⁶ Postdoctoral Research Fellow, Earth & Planetary Science, University of California at Berkeley, USA

ABSTRACT

The composed hazards, landslides and debris-flows happened continuously, were triggered frequently in recent year in Taiwan. However, the studies focused on this issue were still few. In this study, we combined the landslide volume-area relation and Debris-2D model to simulate the landslide and debris-flow hazards in the Qianhuangkeng village, and made the sensitive analysis of the landslide volume, model parameters, DEMs, and landslide location. The results show that the typhoon Morakot triggered 15,099 m³ of landslide volume. The simulated affected areas of debris-flow were well consistent with the observed area. And the simulated deposited depths were 3.2 m, corresponding to the observed depths of 3~4 m near the Chin-Shan temple. Sensitive analysis shows the landslide volume, DEMs, and landslide location are critical factors influenced on debris-flow simulation, rather than yield stress. Finally, we suggested that the applying of integrated model, combining landslide susceptibility, estimation of landslide volume, and debris-flow simulation, and the basis of temporal probability can help assessing risk of the composed hazards.

Keywords: Landslide, Debris-flow, Debris 2D, composed hazards, Qianhuangkeng village.