計畫摘要

中文摘要

臺灣本島係由歐亞板塊和菲律賓海板塊相互擠壓成形。造就出陡峻之地形與脆弱多變之地質環境。近年由於全球氣候異常，頻繁颱風、豪雨事件及地震活動，受災範圍與程度均遠較過去為烈，導致山崩與土石流等地質災害頻傳。因此，如何有效掌握山崩事件之破壞機制與影響範圍，以提供災損評估及作為防災減災之參考，實為今日防災工作上的一項重要課題。雖然導致山崩事件的因素甚多，但降雨是公認誘發山崩的顯著因子之一。一般而言，降雨入滲會導致淺層土壤含水量與基質吸力改變、單位重增加或抗剪強度下降，長期浸潤時則可能造成地層材料弱化或岩層潛變行為，進而導致坡地產生不同類型之地質災害。山崩災害之破壞機制與影響範圍會受地形、地質、地下水位(壓)變化、地層參數等條件而異。因此，場址地質及水文特性之調查、現地監測、數值模型建置及模擬實為釐清破壞機制所不可或缺的重要工作。

爰此，本計畫共分 5 年，逐年挑選不同場址執行。106 年度計畫執行場址編號為 D160 之茶山潛在大規模崩塌地、107 年度計畫執行場址編號為 D008 之車心崙潛在大規模崩塌地、108 年度計畫執行場址編號為 D007 之梵梵潛在大規模崩塌地。今年度(109)計畫場址選擇位於臺東鄉海端鄉霧鹿潛在崩塌地。為能釐清坡地淺層不飽和土體及深層重力變形之破壞機制，本計畫主要工作項目包含：（一）坡地場址地質調查、（二）三維水文地質模型建立及驗證、（三）三度空間坡地活動性評估系統建置、（四）動態水文條件下之破壞力學分析、（五）梵梵場址持續觀測及回饋分析等。預期透過本計畫於坡地場址之水文地質調查、觀測及數值模擬成果，可整合空間分布之水力條件、變形行為及破壞模式，以探討及驗證坡面淺層破壞與深層滑動之可能情境及模式。

關鍵詞：水文地質調查、地下水、坡地觀測、變形機制

ABSTRACT

Taiwan is located at an active mountain belt resulted from the oblique collision between the northern Luzon arc and the Asian continental margin. The inherent complexity of geological background leads numerous discontinuities embedded into rock masses and relatively steep hillslope. Recently, the high seismicity in Taiwan and frequent storm events due to the global warning and/or climate change resulted the catastrophic geohazards, including landslide and debris flow. Thus, a better understanding of failure mechanisms and impact area of geohazards would be helpful for hazard mitigation and assessment. Several factors can trigger the landslide event. Rainfall is one of the most important triggering factors for landslides. In general, the precipiration infiltration could result in changing the suction and the moisture of soil, increasing the unit weight of soil, and reducing the shear strength of soil for the shallow colluvium. Long-term infiltration may also result in weakening or creeping of slope formation material. Combined effects of the geological and topographical conditions, the groundwater pressure change corresponding to rainfall infiltration, and the physical and mechanical parameters of slope formation casue the landslide occurred with the different failure mechanisms. Futher detailed site investigation, monitoring and numerical modeling using the state-of-the-art technology is needed for active landslide area to clarify the how the change of hydrologic conditions during heavy rainfall can cause the failure of landslides.

This study is aimed to better understand the mechanism of triggering landslide hazards so that casualties and property damages can hopefully be reduced in the occurrence probability of natural disasters in the future through the appropriate disaster prevention planning we proposed. The project is a 5-year integrated study and the site investigation in the past years focuses on the Chashan, the Chexinlun and the Fanfan potential large-scale landslides (D160, D008, D007), respectively. The Wulu potential large-scale landslide is selected as the case study site in 2020 year. The work scopes of the project contain: (1) hydrogeological investigations; (2) establishment and verification of the three-dimensional (3D) hydrogeological model; (3) deployment of 3D monitoring system for understanding slope activity; (4) deformation mechanism analysis under dynamic hydrological condition; (5) continuation observation and refined analysis of Fanfan site. We expected that the complex phenomenon between the stability of landslides and hydrogeological conditions could be revealed and clarified through the detailed study on the hydrogeological investigation, observation and the numerical simulation.

KEYWORDS: hydrogeological investigation, groundwater, slope observation, deformation mechanism