

## 山崩活動性評估與防災應用(2/4)

### Landslide Activity Assessment and Disaster Prevention Application(2/4)

受到極端氣候及颱風豪雨的影響，近年來山崩及土石流災害不斷，因此本計畫將分年分區更新全國坡地環境地質資料庫，並以防災導向進行不同類型山崩潛勢分析評估，以提供坡地防災基礎資料，及全國災害管理資訊平台防災應用。主要目標包括：進行全台山崩潛勢評估模式更新，研發山崩雨量門檻模式、加強全尺度山崩活動性觀測技術發展。本計畫將研發應用前瞻觀測技術，除針對鄰近聚落的潛在大規模崩塌地區，進行自動化觀測，並研發廣域的動態即時雨量山崩雨量門檻模式，配合展示及防災操作介面，提升坡地災害的警戒效能。

配合「行政院災害防救應用科技方案」第3期研發課題，並延續前期(104~107年)計畫的執行成果，本計畫為4年期(108~111)之中長程計畫，主要包含2項細部計畫：(1)降雨誘發山崩動態警戒模式與調查技術研發應用；(2)山崩調查觀測技術精進與應用。各細部計畫摘要分列於後。

細部計畫 1：

## 降雨誘發山崩動態警戒模式與調查技術研發應用(1/4)

### The study of rainfall-induced landslide dynamic warning system and innovative landslide investigation approach (1/4)

主管單位：經濟部中央地質調查所

李璟芳<sup>1</sup> 黃春銘<sup>1</sup> 黃韋凱<sup>1</sup> 陸安<sup>1</sup> 林錫宏<sup>2</sup>

Lee, Ching-Fang<sup>1</sup> Huang, Chuen-Ming<sup>1</sup> Huang, Wei-Kai<sup>1</sup> Lu, An<sup>1</sup>

Lin, Hsi-Hung<sup>2</sup>

<sup>1</sup>財團法人中興工程顧問社防災科技研究中心

<sup>2</sup>經濟部中央地質調查所環境與工程地質組

#### 摘要

本計畫配合「行政院災害防救應用科技方案」第3期研發課題，與地調所108-111年度「山崩潛勢評估與觀測技術防災應用」計畫，並延續前期(104-107年)計畫的執行成果，進行全臺環境地質資料更新及山崩潛勢調查分析，持續研發防災導向的區域性降雨引致山崩潛勢分析模式與精進、光達地貌之岩體滑動區判釋及研發多元遙測尺度於山崩災害調查技術，加強防災整合資訊平台與政府整體災害防救科技，以有效提升政府防災決策資訊效能。

本計畫於期末階段已完成高山區之岩性組合圖及岩體強度分級圖，亦重新分析北北基與屏東縣之斜坡單元山崩潛勢。各尺度之山崩調查技術，已選擇測區進行試驗，了解各方法之適用性，以便後續手冊編撰。同時也蒐集了30筆山崩災害案例，其中有11個案例進行現地調查，並進行各案例之降雨特性分析。

**關鍵詞：**山崩潛勢、坡地災害警戒雨量、山崩調查技術、防災預警資訊平台

## **Abstract**

For this reason, government agencies commit to improving the efficiency of disaster mitigation in recent years. Based on results from the previous project, this project aims to improve the rainfall threshold and susceptibility of rainfall-induced landslide, update environmental geological maps and establish multiple-stage remote sensing landslide survey approach for disaster mitigation during rainfall period. Furthermore, the analysis of the project will contribute to upgrading the national-wide environmental geologic map and provide competent authority to make decisions reducing the geohazard risk.

In the final-stage, this project has initially completed the lithologic combination map of the high mountain area and the rock mass strength classification map, and also constructed the attribute data of each slope unit within the year(2020). The landslide investigation techniques of various scales have selected the study area to conduct experiments to understand the applicability of each method for the subsequent manual compilation. Meanwhile, 30 cases of landslide disasters were collected, and the rainfall characteristics of each case were analyzed.

**Keywords:** landslide susceptibility, rainfall threshold, landslide survey technique, early warning information system

細部計畫 2：

## 山崩調查觀測技術精進與應用(2/4)

### Application of Innovative Technology for Landslide Investigation and Observation 2020 (2/4)

主管單位：經濟部中央地質調查所

陳昭維<sup>1</sup>      呂家豪<sup>1</sup>      林錫宏<sup>2</sup>      朱偉嘉<sup>2</sup>  
Chen, Chao-Wei<sup>1</sup>    Lu, Jia-Hao<sup>1</sup>      Lin, Hsi-Hung<sup>2</sup>      Chu, Wei-Chia<sup>2</sup>

<sup>1</sup>青山工程顧問股份有限公司

<sup>2</sup>經濟部中央地質調查所

#### 摘要

較大規模的潛在山崩地區，往往具有特殊的地質條件，進而構成不同的山崩機制，並可能伴隨不同的邊坡滑動變形特性及行為，如老崩塌地、順向坡地區等。但在豪大雨條件作用下，均可能誘發邊坡發生或再次發生滑動，引致嚴重災害，如南投縣廬山溫泉北坡及嘉義縣油車寮地區等，均屬於老崩塌地再次滑動現象。故面對近期尚未發生較大規模山崩災害之潛在山崩地區，除透過現場調查瞭解其山崩機制外，亦須配合適當的活動性觀測技術，輔以掌握坡地的環境地質狀況及潛在山崩活動特性，避免邊坡災害無預警發生。

經濟部中央地質調查所於前期計畫中，已完成 31 處潛在山崩地區之基礎調查工作，發現部分潛在山崩地區，於近期活動性相對較高，有必要持續觀測，供警戒防災參考。此外，經濟部中央地質調查所於前期計畫中，持續引進或改良更先進的調查、觀測技術，以提昇現有調查觀測技術水準，工作成果豐碩。由於近期國、內外相關調查、活動性觀測及物聯網技術不斷發展中，本計畫將進行相關技術的資料蒐集、研發及應用，以持續提昇整體防災應變能量。整體計畫包括四大部分：1.潛在山崩地區調查、活動性觀測及地質安全評估、2.多尺度遙測技術應用於潛在山崩地區地表變形探討研究、3.前瞻地中調查觀測與物聯網之技術研發防災應用及 4.山崩活動性觀測成果智慧應用推廣及國內外技術交流。

**關鍵詞：**潛在山崩地區、地質調查、孔內探測、活動性觀測技術、物聯網

## **Abstract**

Large-scale potential landslide areas often have special geological conditions, which in turn constitute different landslide mechanisms, and may be accompanied by different slope sliding deformation characteristics and behaviors, such as ancient landslide area or dip slope area. However, these large-scale potential landslide areas all may happen sliding induced by the heavy rain conditions, resulting serious disasters, such as the northern slope of Lushan Hot Spring in Nantou County and the Youcheliao area in Chiayi County, all of which belong to the phenomenon of re-sliding in the ancient landslide area. Therefore, in the face of potential landslides where large-scale landslides have not occurred in the near future, in addition to understand the landslide mechanism through in-situ investigations, it is also necessary to cooperate with appropriate active observation techniques to study the environmental geological conditions of slopes and the characteristics of potential landslide activities to avoid unwarranted slope disasters.

The Central Geological Survey of the Ministry of Economic Affairs has completed 31 basic investigation and observation works of potential landslide areas in previous plan. It has discovered some of the potential landslide areas recently show relatively high activity, and thus it is necessary to continue observation for disaster prevention. In addition, the Central Geological Survey of the Ministry of Economic Affairs continued to introduce or improve advanced investigation and observation techniques in the past, which expect to improve the existing survey and observation technology standards and achieved fruitful results. Due to the recent development of investigations and active observation technologies and Internet of Things technologies, the project will continue to collect, develop and apply relevant technologies to enhance the overall disaster prevention and response energy. The objects of overall plan include: (1) Potential landslide area survey, active observation and geological safety assessment. (2) Multi-scale remote sensing technology applied to potential surface landslide deformation research. (3) The research, development and disaster application of prospective survey and observation and Internet of Things technology (4) Smart application and promotion of landslide activity observation results and technical exchanges at home and abroad.

**Keywords : Potential landslide area, geological survey, borehole test, activity observation technology, internet of things**