全球暖化程度 2°C 及 4°C 新店溪崩塌衝擊趨勢

Trends of Landslide Impacts in Xindian River Watershed under Global Warming Levels of 2°C and 4°C

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摘　要

受氣候變遷影響，未來臺灣地區可能面臨強颱頻率提升且降雨強度增強。極端降雨事件可能引發更多的崩塌及土石流，加劇坡地災害的發生。為預防重大災害帶來的損失，需預先瞭解氣候變遷可能帶來的崩塌衝擊，以提前針對高風險區擬定調適策略。因應國家氣候變遷調適應用情境，本研究應用 TCCIP 計畫產製之 AR5 動力降尺度全球暖化程度 1°C 作為基期，2°C 及 4°C 作為未來評估情境，以各時期颱風事件資料搭配 TRIGRS 模式模擬崩塌衝擊及其變化趨勢。本研究以新店溪集水區為例，先透過集水區崩塌率瞭解整體崩塌變化趨勢，再以崩塌發生機率評估各斜坡單元可能發生崩塌的頻度變化。在全球暖化程度 1°C 下，集水區崩塌率之中位數為 0.73%，2°C 及 4°C 下則分別為 0.67%及 0.94%，4°C 情境下崩塌衝擊有較顯著的增加趨勢。相較全球暖化程度 1°C，在 2°C 及 4°C 下各斜坡單元的崩塌發生機率提升幅度最多達 29%及 39%，提升幅度較多之區域主要分布在中上游，對於未來機率提升較多之區域應提前思索適當的調適策略。本研究之方法及結果可供相關單位作為在氣候變遷坡地衝擊評估及調適區位分析的參考。

關鍵詞：氣候變遷，全球暖化程度，坡地衝擊，動力降尺度，崩塌率，崩塌發生機率

Abstract

Due to climate change, Taiwan is expected to experience increased frequency of strong typhoons and intensified rainfall in the future. Extreme rainfall events may trigger more landslides and debris flows, exacerbating slope disasters. To prevent major disasters, it is crucial to proactively understand the potential impacts of climate change on landslides and develop adaptation strategies in advance for high risk areas. In response to the national climate change adaptation scenarios, this study utilizes the AR5 dynamically downscaled global warming levels of 1°C as the baseline and 2°C and 4°C as future assessment scenarios from the TCCIP project. Typhoon event data from different periods are combined with the TRIGRS model to

simulate landslide impacts and their changing trends. In this study, the Xindian River watershed is taken as a case study. Initially, the overall trend of landslides is understood through landslide area ratio. Subsequently, the landslide probability is assessed to evaluate the frequency changes in potential landslide events across different slope units. Under global warming levels of 1°C, the median landslide area ratio in the watershed is 0.73%. This rate decreases slightly to 0.67% at 2°C and increases to 0.94% at 4°C. The scenario with 4°C warming shows a more significant upward trend in landslide impacts. Comparing to a global warming level of 1°C, the landslide probabilities across slope units increase significantly by up to 29% and 39% under 2°C and 4°C warming scenarios, respectively. The regions experiencing the greatest increases are predominantly located in the middle to upper reaches of the watershed. The overall research methodology and results can serve as a reference for relevant agencies in assessing climate change impacts on slopes and conducting location-specific adaptation analyses.

Keywords：climate change, global warming level, impact, dynamical downscaling, landslide area ratio, landslide probability