應用多時域雷達干涉技術偵測台灣北部大崙山邊坡之潛移行為

Detecting the slow-moving movement of the Dalun mountain area in northern Taiwan by the MTInSAR technique

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摘　要

由合成孔徑雷達(synthetic aperture radar, SAR)衛星所拍攝之影像具有不受天候日照影響、低成本、大範圍、長時間及固定時間提供觀測數據的優點，透過多時域雷達干涉技術(multitemporal SAR interferometry, MTInSAR)的分析，可以獲得長時間之地表變形資訊。華梵大學建校於台灣北部大崙山的西南邊坡，屬於一砂頁岩互層之順向坡，自 1990 年代開始便有潛移現象，因此，本研究透過 Sentinel-1A/B 衛星所提供之免費資源，蒐集了 2019-2021 年升軌 163 張及降軌 177 張 C 波段之合成孔徑雷達影像，進行邊坡活動性與位移特性之監測與探討。分析成果顯示在校區內部有明顯的潛移現象，並透過升軌與降軌的分析成果，在假設南北方向變動為零的前提下，進行東西方向與垂直方向的速度場解算，可見在崩塌體的冠部有下陷、址部有隆起的情況，並從時間序列的分析中，可監測到颱風豪雨事件所造成的較明顯滑動現象。此研究成果呈現了 MTInSAR 技術具有偵測潛移型山崩的活動性與位移特性上的能力。

關鍵詞：合成孔徑雷達，多時域雷達干涉技術，潛移型山崩

Abstract

Images derived from synthetic aperture radar (SAR) satellites have the advantages of about unaffected by weather and day or night, low cost, large-scale, long period and providing observation data in fixed time interval. The surface displacement information in a long period can be calculated and analyzed by the multitemporal SAR interferometry (MTInSAR) technique. The Huafan University campus was founded on the southwestern slope of the Dalun Mountain in northern Taiwan. It is a dip slope with interbedded sand and shale. The slow-moving phenomenon has been observed since 1990s. Therefore, this study applied 163 ascending and 177 descending free C-band SAR images from Sentinel-1A/B during

2019-2021 to monitor and analyze the activity and displacement characteristic of this slow-moving landslide. Our result shows that there exist continuous slow-moving phenomenon in the campus. Under the assumption that the north-south direction displacement is zero, the E-W and vertical velocity filed can be calculated based on the ascending and descending results. The subsidence and uplift phenomenon can be found on the upper and bottom part of the sliding blocks, respectively. And from the analysis of the time series, the significant sliding phenomenon caused by the typhoon events can be detected. The results of this study show the ability of MTInSAR technique to detect the activity and displacement characteristics of slow-moving landslides.

Keywords: synthetic aperture radar (SAR)，multitemporal SAR interferometry (MTInSAR)，slow-moving landslide