火炎山土石流之地貌變遷與流動型態分析

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摘　要　本文以三義火炎山一號坑雙聲監測系統配合即時影像與雨量觀測資料，針對不同土石流流動形態與地聲訊號間之關係，將該集水區內之土石流分為黏性土石流與稀性水石流兩類。本文主要探討 2013/5/22 降雨引起之土石流事件，並以多時序光達掃瞄產製之高程數值地形，判釋災後渠道內土石流波峰、粒徑組成及自然堤特徵。監測分析顯示誘發次聲之因素主要為風、雨聲，其特徵頻率為 5Hz 以下。由頻譜分析得知地表逕流與土石流訊號分析得知地聲訊號反應較次聲良好，地表逕流主頻分佈較土石流頻譜略高，本次事件地表逕流頻譜特性介於 30-45Hz；土石流頻譜特性則在 10-32Hz 間。最後藉由地聲訊號之振動強度與土石流流量、流深所建立之關係，以研判火炎山土石流流動類型與規模。

關鍵詞：土石流、火炎山、地貌變遷、自然堤、地聲訊號。

The Landscape Variations and Flow Patterns of Debris Flows at Houyenshan, Miaoli, Taiwan

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ABSTRACT Debris flows running from mountainous gullies are often with destructive high velocities, large buried depth and great number of coarse particles and may cause serious slope disasters. By analyzing the geophone, acoustic systems, real-time CCD images and the rainfall data in the gully 1 catchment at Houyenshan, Miaoli, one can classify the debris flow into two different flow patterns such as viscous debris flow and diluted debris flow based on their flow characteristics. This paper studies the rainfall-induced debris-flow event on May 22, 2013. The multi-temporal digital elevation model produced by airborne and terrestrial LiDAR was also adopted to map the location of wave surge, size distribution, and nature levées after debris flow events. The current infrasound signals are mainly influenced by winds and rain noises, whose characteristic frequencies are less than 5Hz. Frequency distribution of surface runoff is higher than that of debris-flow events. The frequency spectrum of surface runoffs are 30 to 45Hz, while the frequency spectrum of debris flows are 10 to 32Hz.

Key Words : Debris flow, Houyenshan, landscape variation, natural levées, geophone signals..

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