

地震儀應用於土石流監測之研究

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摘要 當土石流發生時，大量礫石摩擦與撞擊河床造成明顯之地表震動，又可稱為地聲。一般常用的土石流地聲量測儀器為地聲檢知器 (geophone)，受限於其量測頻寬，傳統定義土石流地聲之頻率範圍約為 10 - 150 Hz。然而，低頻震波在地表中傳遞時具有不易衰減之特性，監測 10 Hz 以下之低頻地聲則有助於提前測得土石流。本研究引進由國內自行研發的 ES-1 寬頻地震儀，在水土保持局位於南投縣信義鄉神木村之觀測站建置土石流低頻地聲監測系統。本研究透過短時傅立葉轉換 (STFT) 分析土石流訊號，發現土石流前端波湧確實能產生 2 - 10 Hz 之低頻地聲，此外，監測低頻地聲可提前測得土石流之發生，也可測得溪水因降雨所導致的流量增強趨勢。由此可知，地震儀於防災應用上可擴大土石流監測之時間與空間縱深，長期觀測資料可作為土石流相關研究之資料庫。

關鍵詞：地震儀、ES-1、土石流、地聲、地表震動。

Monitoring Debris Flows by Using A Newly Developed Seismometer

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ABSTRACT The ground vibrations produced by the collision and friction of boulders with riverbed are the characteristics for monitoring debris flows. Conventionally, the frequency of the ground vibration of debris flow is 10 - 150 Hz, which is restricted by the frequency range of the ordinary geophone. However, the low frequencies of seismic waves correspond to a lower attenuation. Debris flows probably can be detected earlier by the measurement on lower frequencies if the ground vibrations of debris flows contain lower frequency waves. A newly developed seismometer, ES-1, was demonstrated in this study for monitoring debris flows. The system was deployed along the Ai-Yu-Zi creek at Shen-Mu village, Nantou County. Short Time Fourier Transform (STFT) were performed to analyze the ground vibration signals. The results showed that the front surge of debris flows can produce the vibrations of lower frequency about 2 - 10 Hz. Furthermore, ES-1 has higher sensitivity and lower system-noise than geophone. In conclusion, Low Frequency Ground Vibration Monitoring System could not only extend the time of emergency disaster response but also enlarge the knowledge of debris-flow disaster prevention.

Key Words: debris flow, ES-1, Low Frequency Ground Vibration Monitoring System.

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