

土石流運動時之次聲特性監測及分析

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摘 要 天然災害如火山爆發、地震、山崩及土石流等，在產生過程中皆帶有低於人類聽覺範圍之次聲信號（即頻率低於 20Hz 的聲波）。次聲的頻率較低於一般地聲，故具有能量遞減慢及較高的地面反射性。次聲信號之特性與滑坡或土石流之內部組成及山坡地質條件有關，必須就地域特性進行比對及驗證，方能確定次聲信號與土石流動事件之關聯性。本文分析了蔣家溝土石流之次聲特性，當土石流流量小於 500 cms 時，次聲之尖峰頻率約在 6 Hz；而隨土石流流量增加其尖峰頻率有遞減的趨勢。鑒於台灣山區崩塌及土石流頻繁，屢屢造成交通中斷、道路破壞及人民生命與財產的損失，本文並建立台灣本土性之坡地災害次聲監測系統，即藉由靈敏之次聲訊號感應器、資料分析處理器及訊號處理系統，能接收經由大氣傳播之次聲信號來即時監控土石流及滑坡之發生，並發出預警訊息，以達到減低損失、防治災情的功能。

關鍵詞：土石流、次聲、監測系統。

Infrasound Monitoring and Analysis of Debris-Flow Movement

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ABSTRACT Naturally occurring infrasounds are produced by volcanic eruptions, earthquakes, landslides and debris flows. Infrasound covers the inaudible acoustic spectrum below 20 Hz, which results from the compressibility of the air. Infrasound propagates to large distances in the atmosphere at the speed of sound by the low adsorption in the air and the high reflectivity of the ground. The infrasonic signals induced by landslides and debris flows are related to the magnitude and composition of the failure zone as well as the slope areas. In order to establish the monitoring system for the slope hazards in Taiwan, we explore the infrasonic signals of landslides and debris flows by experiments and field study. The peak frequency of infrasounds is about 6Hz when the debris flow discharges are less than 500 cm. While the peak frequency is decreasing with the increasing discharge of debris flows. The monitoring system includes sensitive infrasonic transducers, a data logger and signal processors. With spectrum analysis, this infrasonic system can be implemented with the warning system in the potential debris flow areas.

Key Words: debris flow, infrasound, monitoring system.

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