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Using the seismic signals to study the coseismic landslide

Yi-Han Wu (1), Wei-An Chao (2), and Zheng-Yi Feng (1)

(1) Department of Soil and Water Conservation, National Chung Hsing University, Taichung, Taiwan, 40227 (jim87ho@gmail.com), (2) Department of Civil Engineering, National Chiao Tung University, Hsinchu, Taiwan, 30010 (vvnchao@nctu.edu.tw)

The seismic signals generated by the mass sliding could be completely recorded by seismic stations nearby. However, for the coseismic landslide events, the seismic signals of landslide significantly affected by the ground motion generated by the earthquake, then causing analysis of coseismic landslide signals to be challenge. Thus, a standard approach is needed to isolate the landslide signals embedded in earthquake ground motion. In this study, we developed the ATM (Amplitude Tracking Method) approach, which can identity the moving direction of landslide mass by using the ratio of filtered (0.02-0.1Hz) peak amplitude in horizontal (radial and transverse) component from each station with different source-to-station azimuth. The ATM has been verified by a series of synthetic test and successfully applied to Xiaolin landslide occurred during Typhoon Morakot. For a case study of the coseismic landslide events such as the Tsaoling landslide trigged by the M_w7.6 Chichi earthquake, previous studies have shown that the ground acceleration signals at time window ranging from 32.5 to 37.5 seconds recorded by closest strong motion station (station name: CHY080) (starting from original time of Chichi earthquake: UTC 1999/09/20 17:47:02) is corresponding to Tsaoling landslide. In a case of coseismic landslide, the landslide movement direction can be roughly estimated by ATM, which is consistent with filed observation. Then, we further conduct a series of forward waveform modeling to understand different contributions in seismic signals between earthquake and landslide. Our study demonstrated that a combination of ATM and waveform modeling could identify the seismic signals caused by coseismic landslide. An available coseismic landslide signal facilitates the seismological understanding of landslide source parameters, such as source location, runout distance and event size.

Key words: ATM (Amplitude Tracking Method), coseismic landslide, forward waveform modeling