

A comparison between the acoustic signals and seismic signals generated during a dam-break test

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Natural events, such as landslide, sediment transport, flooding, etc., usually release energy to produce acoustic waves and seismic waves. Acoustic wave is transmitted through air and seismic wave is transmitted through geologic structure. Therefore, the characteristics of acoustic waves and the seismic waves induced by these events should be different. This study focus on the differences in the acoustic signals and seismic signals during a dam-break test performed by the authors. We built a model dam and slope in a creek for the test. We filled the dam with water and caused it to overflow. The overflow water caused the downward erosion of the dam. The flood due to the dam-break eroded the toe of the model slope causing the slope to collapse locally. We set up microphones to collect acoustic signals and installed accelerometers to collect vertical seismic signals generated by the flood and collapse events during the test. During the test we also used unmanned aerial vehicle (UAV) to continuously take photos for the collapsed areas for making the digital surface model (DSM) of the slope to analyze the volumes of the collapsed materials. We used Hilbert-Huang Transform (HHT) to obtain the time-frequency spectra for the acoustic signals and seismic signals. From the spectra, we compared the energy and frequency content of the two kinds of signals and their differences. The results show that the acoustic signal showing earlier indication of overtopping than that of the seismic signal. In addition, the acoustic and seismic signals generated during the flood can correspond to each other. The collapse events of the slope during the flood can be investigated also by examining the time-frequency spectrum of the seismic signal. Usually the signals of the collapse events can be distinguished from the flooding signals.

Keywords: dam break, landslide, slope, acoustic signal, seismic signal, flood