Seismic monitoring of landslides and debris flows in the Chenyoulan River catchment, Taiwan

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Landslides and debris flows are an integral part of the sediment routing system in limit landscapes, mobilising sediment and causing significant risk to human life and economic activities. Present methods to monitor these processes lack either the spatial or temporal resolution to truly examine the spatio-temporal pattern of landsliding at a catchment scale. Broadband seismology has the potential to satisfy both requirements, permitting continuous monitoring over length scales of >25km. During the 2010 typhoon season (June to October), a seismic array of 10 intermediate band and 4 short period seismometers has been deployed in the catchment of the Chenyoulan River in central west Taiwan to monitor the ensemble of surface processes (landslides, debris flows, sediment transport, etc.). We have developed a semi-automated method to detect and locate landslides using seismological techniques and spectral analysis from seismometer data, and applied it to determine the location and timing of geomorphic activity. Synthetic tests indicate that it should be possible to locate geomorphic processes with a good degree of precision, even with relatively large errors (<0.5s) in the detected arrival times. However, errors in locating real events are found to be significantly greater, principally due to difficulties correlating complex signals with low amplitude. Nevertheless, a number of small landslide and debris flow events have been located successfully, according to verification with high resolution satellite imagery, highlighting the promise of broadband seismology in comprehensive, and potentially near-real time monitoring of surface processes.