Geophysical Research Abstracts
Vol. 21, EGU2019-6276, 2019
EGU General Assembly 2019

Geomorphic Change Detected by Multi-Temporal LiDAR DEMs and a Possible Precursor for Repeated Tasoling Landslide

Yu-Chung Hsieh (1), Yu-Chang Chan (2), Mien-Ming Chen (1), and Li-Yuan Fei (1)

(1) Central Geological Survey, Ministry of Economic Affairs, Environmental & Engineering Geology Division, New Taipei City, Taiwan (hsiehyc@moeacgs.gov.tw), (2) Institute of Earth Sciences, Academia Sinica

Catastrophic landslides often cause serious disasters, and such incidents are often the focus of our attention. The well-known Tasoling Landslides occurred repeatedly, which were triggered by earthquakes, typhoons, and torrential rains in 1862, 1898, 1941, 1942, 1951, 1979, and 1999. Among these, the landslides in 1862, 1941, and 1999 were triggered by earthquakes. The Tsaoling area geologically belongs to a dip-slope terrain in interbedded Pliocene sandstone, mudstone, and shales. The volume of the rock debris accumulated from previous landslide events was about 0.026 - 0.126 km3 , which formed a landslide dam with a height of 70-170 m and blocked the Qingshui river. The sudden failures of these landslide dams often resulted in additional catastrophes in the downstream areas, three of which occurred years after the landslide event.
With the progress of surveying technology, high-resolution DEMs data could be used for important topics, such as landslides and geomorphic change. In this study, we presented multi-temporal remote sensing datasets for geomorphic changes in the Tsaoling landslide area before and after the Chichi earthquake and provided an effective DEM analysis technique to better estimate volume changes and surface movements. We found that multi-temporal data comparison could show the geomorphic changes of the Tsaoling landslide area directly at different times by using aerial photogrammetry and LiDAR DEM analysis. The observed results of geomorphic changes in the shorter period of 1- 3 years from 2011 to 2012, 2012 to 2016, 2016 to 2017 and over a long period time of about 9 years from 2002 to 2011, including the location of the landslide accumulation area, the change of cliff retreat , and the volume change of the debris after the landslide event. By means of terrain profile comparison, elevation change calculation and Particle image velocimetry (PIV) analysis from image and DEM data during 2016-2017, we found some surface displacement located in the lower half of the Tsaoling landslide area and distributed in the Chinshui shale area. Within the range of about 80 hectares, there was a clear trend of surface displacement, indicating that this range of the Tsaoling area may have slipped, which was similar to the scale as the 1942 landslide event. This study shows that the integrated use of aerial photogrammetry and LiDAR DEM data analysis method with multi-temporal topographic data collection and field surveys in the landslide area, and could resolve the surface changes and possible impacts of this large landslide and river geomorphological changes in the future.