

Aerial Photogrammetry-Based Techniques to Rebuild the 30-Years Landform Changes of a Landslide-Dominated Watershed in Taiwan

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Abstract : Taiwan is an island characterized by an active tectonics and high erosion rates. Monitoring the dynamic landscape of Taiwan is an important issue for disaster mitigation, geomorphological research, and watershed management. Long-term and high spatiotemporal landform data is essential for quantifying and simulating the geomorphological processes and developing warning systems. Recently, the advances in unmanned aerial vehicle (UAV) and computational photogrammetry technology have provided an effective way to rebuild and monitor the topography changes in high spatio-temporal resolutions. This study rebuilds the 30-years landform change in the Aiyuzi watershed in 1986-2017 by using the aerial photogrammetry-based techniques. The Aiyuzi watershed, located in central Taiwan and has an area of 3.99 Km², is famous for its frequent landslide and debris flow disasters. This study took the aerial photos by using UAV and collected multi-temporal historical, stereo photographs, taken by the Aerial Survey Office of Taiwan's Forestry Bureau. To rebuild the orthoimages and digital surface models (DSMs), Pix4DMapper, a photogrammetry software, was used. Furthermore, to control model accuracy, a set of ground control points was surveyed by using eGPS. The results show that the generated DSMs have the ground sampling distance (GSD) of ~10 cm and ~0.3 cm from the UAV's and historical photographs, respectively, and vertical error of ~1 m. By comparing the DSMs, there are many deep-seated landslides (with depth over 20 m) occurred on the upstream in the Aiyuzi watershed. Even though a large amount of sediment is delivered from the landslides, the steep main channel has sufficient capacity to transport sediment from the channel and to erode the river bed to ~20 m in depth. Most sediments are transported to the outlet of watershed and deposits on the downstream channel. This case study shows that UAV and photogrammetry technology are useful for topography change monitoring effectively.

Keywords : aerial photogrammetry, landslide, landform change, Taiwan

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