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Mapping and monitoring of sediment budgets and river change by means of UAS multi-scale, high-resolution imageries

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Due to the high seismicity and high annual rainfall, numerous landslides triggered every year and severe impacts affect the island Taiwan. Global warming and sea-level rise with increasing frequency and magnitude of storms and typhoons has resulted in an increase of natural hazards, and strong impacts on human life. A consequence of a change of the rainfall regime, increase of intensity and in a reduction of the duration of the events may have dramatic impacts. Heavy rainfall precipitations are one of the major triggering factors for landslides. Typhoon Morakot in 2009 brought extreme and long-time rainfall, and caused severe disasters. After 2009, numerous debris and sediment deposition increased greatly due to the severe landslides in upstream area. Detail morphological records may able to reveal the environment changes. This kind of analysis is based on the concept of DEM of difference (DoD) to evaluate the sediment budgets during climate and geo-hazard events. The aerial photographs generated digital surface models (DSMs) before and after Typhoon Morakot, and the subsequent multi-periods of imageries is thus been conducted in this study.

In recent years, the remote sensing technology improves rapidly, providing a wide range of image, essential and precious information. In order quantify the hazards in different time; we try to integrate several technologies, especially by unmanned aircraft system (UAS), to decipher the consequence and the potential hazard, and the social impact. In order to monitoring the sediment budget of the study area, we integrates several methods, including, 1) Remote-sensing images gathered by UAS and by aerial photos taken in different periods; 2) field in-situ geologic investigation; 3) Differential GPS, RTK GPS in-site geomatic measurements; 4) Construct the DTMs before and after landslide, as well as the subsequent periods using UAS and aerial photos.

We finally acquired 7 DEMs, prior to post-events, from 2009-2015. The precision of the dataset been verified firstly. The migration of the debris is well defined from DEMs and been calculated. The sediment budgets are thus been evaluated. The riverbed migration is affect both by natural sediment deposition and by human activities. The profile of the riverbed is blocked mainly in the midstream area. One-half of the debris still rested on the mid- to upstream, and in the up-slope. To the end, the UAS and the methodology used in this study is been adjusted and is capable to apply to other region for hazard monitoring, mitigation and planning.