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Variations of topographic feature of a Major Typhoon

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In August 2009, in Taiwan, Typhoon Morakot with a maximum rainfall of over 2,900 mm, induced over 23,000 landslides in mountainous area throughout southern Taiwan. One large scale deep-seated landslide, the Hsiaolin landslide, with an area of about 250 ha, buried the entire village causing 397 casualties, the disappearance of 53 people, and the destruction of over 100 houses (Lin et al., 2011; Tsou et al., 2011). The LiDAR-derived 2m resolution DEMs before and after Typhoon Morakot was utilized in this study to perform the relation between slope and contributing area. Montgomery and Foufoula-Georgiou (1993) suggested a partitioning of the landscape into drainage and slope regimes that include hillslopes (Region A), unchanneled valleys (Region B), debris flow-dominated channels (Region C), and alluvial channels (Region D). The comparison of slope-area relationship of Hsiaolin village before and after Typhoon Morakot indicates, no matter pre or post typhoon, the slope?area figure shows four regions with different scaling responses. However, there are remarkable for the significantly variation of scaling pattern in slope-area diagram after the deep-seated landslide. Sediment mass produced by deep-seated landslide with approximately 2.7x107 m3 (Wu et al., 2011) depleted from hillslope, nearly 90m deepest failure depth resulted in outward extend of upstream catchment boundary. Huge amount of sediment mass was transported downward also formed significant deposition in debris flow channel and alluvial channel, respectively. These phenomenon also reflects in slope-area graph, contributing area at parting between Region I and Region II migrate from 20 m2 to 50 m2, that means hillslope length become longer due to outward development of upstream catchment boundary. The local slope in debris flow channel (Region C) and alluvial channel (Region D) both become gentler after this catastrophic landslide. The analysis only after an intense event, really represent a strategic tool for a directly quantification of the processes that affected and significantly changed the earth surface.

Keywords: DTM, High resolution topography, LiDAR, Slope?area relation