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## Redistribution of landslide debris through episodic heavy rainfall events as revealed by multi-period Lidar DEMs

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Landslides are commonly triggered by heavy rainfall events, but how the loose landslide debris is redistributed through time and how fast the landslide scars are healed by vegetation are not well and precisely documented. Due to recent advances in airborne Lidar-derived digital elevation models, we are able to obtain precise DEMs at different time periods and analyze the redistribution of landslide debris that was once difficult to measure because of relatively minor elevation changes. Three periods of Lidar-derived DEMs were used to analyze a drainage basin that was affected by a heavy rainfall event and generated several landslide deposits and scars within the drainage basin in Taiwan. We selected a single drainage basin to better constrain the source of landslide debris for subsequent observations of landslide debris removal. How the landslide debris is transported and redistributed remains an important topic for understanding debris removal and evaluating post-landslide hazards in downstream areas. The multi-period high-resolution Lidar DEMs give the necessary accuracy to calculate small but significant volume changes that were not easily detectable from previous measuring techniques. Our results show that the landslide debris redistributed most effectively during later large rainfall events, and the landslide materials are minimally redistributed during small rainfall events. Areas without existing landslides were also insignificantly affected in terms of volume change even during large rainfall events. The standard deviation of elevations in the drainage basin is used to show how the topography was changed due to heavy rainfall events within the drainage basin. The concept of surface roughness may be useful to characterize the dissipation of landslide debris because the roughness values become lower during the debris redistribution process. The redistribution of landslide debris over the observed years suggests that the dissipation of landslide debris is mainly affected by episodic heavy rainfall events and the landslide scars recover relatively quickly for smaller affected landslide regions.