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Sedimentation and Landslides in Gao-Ping Hsi Catchment after the 2009 Typhoon Morakot in Taiwan

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The hilly Western Foothill of Taiwan Island is highly prone to landslides, especially during typhoon season in the summer. The 2009 Typhoon Morakot resulted in tremendous amount of landslides along the Gao-Ping Hsi catchment of central Taiwan. The impact of this typhoon is more severe than other typhoons due to its long duration of touchdown. It not only induced large number and large scale landslides, but also significantly changed the river morphology. This study investigated the correlation of catchment sedimentation and landslides before and after the 2009 Typhoon Morakot. The Gao-Ping Hsi is a major river in southern Taiwan, with 171km in length, 3257km2 in drainage area, and elevation from about 3000m to the sea level. In order to consider the flow discharge and sediment discharge in different sub-watersheds, especially in the upstream, this study divides the Gao-Ping Hsi catchment to three sub-catchments, the Laonong sub-catchment (I), Chishan sub-catchment (II), and Ailiao sub-catchment (III). Analyses were performed for each sub-catchment with discussions. The study comprises two major parts, i.e. catchment sedimentation and correlation with landslides. The former part includes field, satellite image and DTM calculation results, and the later part includes analysis on the correlation between the landslides and catchment sedimentation. In order to investigate the temporal behavior of the sedimentation after the 2009 Typhoon Morakot, the measurement and the analysis were performed during 2010.

Our findings indicate, huge amount of new sediments were generated in the whole river systems due to the extremely heavy rain of Typhoon Morakot. It is closely related to the number and scale of landslides in the upstream area. Since, this event induced large amount of newly generated and reactivated landslides, the geo-morphology in the catchment was changed dramatically. On the other hand, the analyses on the sedimentation transportation suggest that huge amount of sediments are still in the mid to upstream of the river system. The study also reveals that the river system is still in the unstable phase and prone to the secondary hazards, like debris flows, landslides, and flooding. The study on the temporal behavior of sedimentation 1 year after Morakot suggests that the sediment generation reduces and limited in the upstream areas as the landslide areas are reduced. On the other hand, the sediment accumulation is limited at the downstream areas. However, there are still treamendous amount of sediments in the river banks that possess hazard potential and need to be treated. A conceptual model is also developed to investigate the control factors on the correlation of sedimentation and landslides. This case study could provide experiences of the sustained landslide investigation and sediment estimation to regard as the reference of catchment management.