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Landslide events in Tsaoling and their effect on sediment flux distributions,Taiwan

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In the climatic and geodynamic context of Taiwan, with large annual rainfall and strong deformation and uplift, the erosion processes are very active. The evaluation of the erosion rates plays an important role for both the study of the mountain building and related geological processes and the natural hazard mitigation purposes. Frequent earthquakes affect the stability of mountain slopes, and landslides favour river erosion of disrupted masses. As for many rivers in Taiwan, large changes in water discharge occur with time, as a function of variable rainfall and typhoon occurrence. This highly irregular flow regime has caused severe damage and human losses. To understand the potential of landslide and position of potential landslide area is important for protection of the property and life and people, which helps to improve the land use management in the hazardous area. On September 21 1999, a catastrophic earthquake occurred in the mountainous Tsaoling area in Central-Western Taiwan, at epicentral distance of about 35 km. Chi-Chi earthquake (ML=7.3) triggered two huge landslides at Jiufengerhshan and Tsaoling, Killing 39 and 29 persons, respectively. We focus on the Tsaoling landslide, form the point of view of historical landslide event, the occurrence of successive landslides in the Tsaoling area during the last century. Historical catastrophic dip slope failures have repeatedly occurred, triggered by heavy rainfalls, as in 1942, 1951 and 1979, or by destructive earthquake. The catastrophic of Chi-Chi earthquake which mobilized about 0.125 km3 of rock and soil that slide across Chingshui River and created a 5-km-long dam. To understand the impact of earthquake induced landslide on short-lived sediment budgets and suspended sediment transported in the Chingshui River. In this study, we analyzed the rapid topographical changes during the 7 years following the event, with deep incision of the landslide mass by the Chingshui River. Erosion rates have been estimated for the interval 1958-2009 from measurements of river suspended-sediment discharge over 5 stations in the mountain regions. We quantify the sediment transfer in the rivers running from high mountains to the sea, and hence the erosion rate, by combining large numbers of water discharge data with smaller numbers of sediment content data. Our observations from the Chingshui River near Tsaoling indicate that despite upstream sediment accumulation resulting from landslide damming, landslides undoubtedly facilitate erosion, because disrupted landslide masses are quickly eroded. The study of the Tsaoling landslide suggests that the probability for further major landslide events is high, which deserves consideration in terms of natural hazard mitigation.