Preservation and transportation of landslide deposits under multiple timescales in the Taiwan orogenic belt

Chan-Mao Chen[#], J. Bruce H. Shyu[†], Hsiu-Kuo Tsui[*]

Department of Geosciences, National Taiwan University, Taipei 106, Taiwan

#Corresponding author: r05224214@ntu.edu.tw +Presenter

†Co-author: jbhs@ntu.edu.tw

*Co-author: alan498235002@gmail.com

Landslide is one of the most important surface processes along active orogenic belts. However, the evolution of landslide deposits has not yet been fully understood. To obtain further insight into this, we observed decadal and millennial timescale transportation and preservation of landslide deposits at several sites in Taiwan, which is an active orogenic belt with numerous landslide events.

More than 9,000 landslides had been triggered within thirty days after the 1999 Chi-Chi earthquake in central Taiwan. Using the DEMs and satellite images obtained from different periods and augmented by field investigations, we compared two largest landslides and analyzed the state of preservation of their deposits. We found that one landslide's deposit in the river channel has lost more than one third of the total volume since 1999. On the contrary, the other landslide's deposit that is sitting on the hillslope and far from any major river channel has not yet been significantly transported. These observations demonstrate a close relationship between landslide deposit storage and the connectivity of landslides with the fluvial network.

In millennial timescale, many large debris-flow fan terrace systems are present along the Laonong River in southern Taiwan, with their ages span the Holocene. We reconstructed the original shape of eight terrace systems with a 5-m resolution DEM and calculated the transported and remaining amount of these terraces. The results show that at least 70-90% of the total deposit volume may have been moved away since these debris-flow fans were deposited. The percentage of transported or remaining deposit appears to be independent of time in this timescale. Our results would provide important constraints on the fate of landslide deposits, as well as the roles they play in the sediment transportation, carbon cycle, and mass balances of active orogenic belts around the world.

Keywords: landslide deposit; surface processes; sediment storage; active orogenic belt; Taiwan