Geophysical Research Abstracts, Vol. 7, 06563, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06563

On the response of the fluvial system to extensive earthquake-triggered landslides

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Extensive landslide activity is a common consequence of large-scale earthquake events in high mountain areas. The actual triggering of slope failure is a highly complex process that involves a range of parameters, including the properties of the seismic waves (frequency, amplitude, duration, etc); the properties of the rock mass and its associated discontinuities; the depth of superficial deposits and their properties; the slope morphology; the pore pressure variations; and interactions between the seismic wave and the topography. It is clear that this complex behaviour results in highly heterogeneous distributions of landslide activity in any affected area. The landslides so-triggered are a particularly efficient mechanism by which sediment is released from the hillslope system into the fluvial channel. Thus, it is clear that the nature of sediment delivery by a fluvial system in a seismically-active mountain system is probably highly dependent upon the nature of recent earthquake events and their interactions with the topography. In this paper, we examine the response of the Tachia catchment in western Taiwan to the 1999 Chi-Chi earthquake. In this area a very high density of landslides was induced by the earthquake event. This has resulted in a very large increase in sediment discharge through the fluvial system. Furthermore, the subsequent rainfall events associated with the passage of typhoons across the study area has led to a significant increase in the land area affected by landslides, and as a result four years after the earthquake event the sediment production rate was still increasing. It is clear that the initial high density of landslide occurrence was the result of a particular set of interactions between the earthquake waves and the topography in this valley. This set of interactions is now having a profound impact upon the efficiency and behaviour of the river.