Geophysical Research Abstracts
Vol. 14, EGU2012-6937-2, 2012
EGU General Assembly 2012

Characteristics of earthquake-induced landslides and differences compared to storm-induced landslides

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Landslides triggered by the Chi-Chi earthquake, as re-mapped from high resolution SPOT images just before the quake and after the quake, are studied and compared to landslides triggered by some typhoon storm events in Taiwan. Several landslide controlling factors are statistically analyzed and compared. This includes slope gradient, slope height (SH), total slope height (TSH), relative slope height (RSH), and others. RSH is defined as SH divided by TSH, and is a measure to indicate a location is close to the toe of a slope (RSH=0) or near the ridge top (RSH=1). A high resolution of DEM was used in the terrain analysis to produce slope gradient, RSH and other derived data. The DEM is of 5mx5m grid in origin and was made by aerial photogrammetry. It is checked and smoothed a little and reduced to 10mx10m grid for following analyses. The results show that slope gradient always is a very important factor controlling the occurrence of landslides, but there is difference in distribution of occurrence frequency between the two. Storm-induced shallow landslides most occurred at slope gradient from 20 degrees to 44 degrees and shows a mode about 33 degrees. Earthquake-induced landslides most occurred at slope gradient from 20 degrees to 54 degrees and shows a mode about 42 degrees for shallow landslide and rock falls. There are fewer occurrences of rock falls in a storm event than that in an earthquake event for a specific region. The results also show that RSH is a very significant factor controlling the location of landslides. Storm-induced shallow landslides most occurred at lower RSH and closer to the river, whereas earthquake-induced landslides occurred at higher RSH and closer to the ridge. In summary, the earthquake-induced landslides are mostly located at a steeper and longer slope and at a higher position of the slope as compared to the storm-induced shallow landslides, and this implies that topographic amplification play a very important role in the earthquake-induced landslides, especially for those regions where ground motion exceeds 250 gals. The relatively less occurrence of coseismic landslides during the 2011 magnitude 9.0 Tohoku Earthquake may be because there are less steep and long slopes in northeastern Japan where meizoseismal area locates.