Geophysical Research Abstracts,
Vol. 11, EGU2009-304-1, 2009
EGU General Assembly 2009

Numerical Methods in Earthquake-Triggered Landslides: A Case Study from Amasya-Turkey

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It is often difficult to analyze dynamic landsliding mechanisms using field observations or geomorphologic features alone because of the mutual interaction of complex individual factors. These include lithology, structure, geomorphology, topography, and human presence. Limit equilibrium basis may be sufficient to analyze structurally controlled failures for simple landslides. However, while dealing with more complex failure mechanisms including sets of discontinuities, numerical methods are typically more suitable. Here we attempt to identify the role of earthquake shaking on the failure mechanisms of a rock slide.

We created a database including 170 large landslides (>20 Mm3) with a variety of mechanisms and triggers, from the worldwide literature with dates of occurrence during the 20th and 21st centuries. The database includes large rock slides (>20 Mm3) triggered by earthquakes. Finally, 30 earthquake-induced landslides that occurred in rock slopes were used for inventory studies. The database can identify potential correlations between parameters that could indicate the potential for landsliding to occur during seismic events. For instance, we compare the volume of the landslide with distance to epicenter or slope aspect.

This study also presents data from the Kaledag Mountain, located in the city of Amasya in North Anatolia. It is bounded by North Anatolia Fault Zone, an active tectonic structure of Turkey. The mountain itself is a rock slope, and may slide during an earthquake event of unknown magnitude. Due to its hazardous nature and the unknown potential for movement during an earthquake, we modeled this slope with Universal Distinct Element Code (UDEC), a discontinuum method, to get a better understanding of the complex coseismic slope instability problems. The results is a model of the mechanism of failure under an earthquake shaking that may be of use to geological engineers seeking to understand the mechanisms of landslide potential during large earthquake events.