Geophysical Research Abstracts, Vol. 8, 00311, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00311

Feasible methods for landslide spatial prediction, taking into account the source and the runout zones; example from NW Nicaragua after Hurricane Mitch

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Hurricane Mitch, in October 1998, triggered a large number of landslides (mainly debris flows) in Honduras and Nicaragua, resulting in a high death toll and considerable property damage. In order to explore the potential application of relatively simple and affordable spatial prediction models for landslide hazard mapping in developing countries, we focused our study on a region in NW Nicaragua, one of the most severely hit places during the Mitch event.

With aerial photography interpretation and a detailed field work, a landslide map at 1:10.000 scale, in a GIS environment, has been obtained. In this map the terrain failure zones are distinguished from the areas within the reach of the mobilized materials. Also, in the study area, we dispose of several thematic maps which contain a set of terrain factors and a DEM with 20m of pixel size.

Firstly we develop a methodology based in a comparative analysis between the terrain failures caused by hurricane Mitch and a selection of 5 terrain factors which, in our expert opinion, contribute to the terrain failure. Using GIS tools we combine the thematic maps corresponding to these 5 instability factors, to obtain a Terrain Units Map. Then, this map is combined with the terrain failures map in an attempt to calculate the failure zones density in each terrain unit. The obtained density values represent the land propensity to failure and allow us to obtain a Terrain Failure Susceptibility Map.

In order to estimate the prone areas to be affected by the path or deposition of the

mobilized materials, we consider the fact that under intense rainfall events, debris flows tend to travel long distances following the maximum slope and merging with the drainage network. Using GIS tools we generate automatically flow lines following the maximum slope in the DEM starting from the areas considered highly prone to failure in the Terrain Failure Susceptibility Map. The areas crossed by the flow lines correspond to the runout susceptible areas.

The union of the Terrain Failure Susceptibility Map and the Runout Susceptibility Map enables us to obtain a spatial prediction for landslides, which could help in landslide risk mitigation through implementation of non-structural measures, such as land planning or emergency measures.