Comparing Stability Index MAPping (SINMAP) Landslide Susceptibility Models in the Río La Carbonera, Southeast Flank of Pico de Orizaba Volcano, Mexico

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Abstract : In volcanic environments, landslides and debris flows occur continually along stream systems of large stratovolcanoes. This is the case on Pico de Orizaba volcano, the highest mountain in Mexico. The volcano has a great potential to impact and damage human settlements and economic activities by landslides. People living along the lower valleys of Pico de Orizaba volcano are in continuous hazard by the coalescence of upstream landslide sediments that increased the destructive power of debris flows. These debris flows not only produce floods, but also cause the loss of lives and property. Although the importance of assessing such process, there is few landslide inventory maps and landslide susceptibility assessment. As a result in México, no landslide susceptibility models assessment has been conducted to evaluate advantage and disadvantage of models. In this study, a comprehensive study of landslide susceptibility models assessment using GIS technology is carried out on the SE flank of Pico de Orizaba volcano. A detailed multi-temporal landslide inventory map in the watershed is used as framework for the quantitative comparison of two landslide susceptibility maps. The maps are created based on 1) the Stability Index MAPping (SINMAP) model by using default geotechnical parameters and 2) by using findings of volcanic soils geotechnical proprieties obtained in the field. SINMAP combines the factor of safety derived from the infinite slope stability model with the theory of a hydrologic model to produce the susceptibility map. It has been claimed that SINMAP analysis is reasonably successful in defining areas that intuitively appear to be susceptible to landsliding in regions with sparse information. The validations of the resulting susceptibility maps are performed by comparing them with the inventory map under LOGISNET system which provides tools to compare by using a histogram and a contingency table. Results of the experiment allow for establishing how the individual models predict the landslide location, advantages, and limitations. The results also show that although the model tends to improve with the use of calibrated field data, the landslide susceptibility map does not perfectly represent existing landslides.

Keywords : GIS, landslide, modeling, LOGISNET, SINMAP
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