

DEVELOPMENT OF A METHOD FOR MULTI-SCALE LANDSLIDE RISK ASSESSMENT IN CUBA.

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Abstract: *This paper presents a summary of the method and the results of landslide risk assessment carried out in Cuba as a contribution to the system of multi-hazard risk assessment by the Civil Defence authorities. The method is developed at four different scales, national, provincial, municipal and local, each with specific objectives. At the national level a landslide risk index was generated, using a semi-quantitative model with 10 indicator maps using spatial multi-criteria evaluation techniques in a GIS system. Each indicator was standardized according to its contribution to hazard and vulnerability. The indicators were weighted using direct, pairwise comparison and rank ordering weighting methods and weights were combined to obtain the final landslide risk index map. The results were analysed per physiographic region and administrative units at provincial and municipal levels. The hazard assessment at the provincial scale follows a method for combined heuristic and statistical landslide susceptibility assessment, its conversion into hazard, and the combination with elements at risk data for vulnerability and risk assessment. The method is tested in Guantánamo province. For the susceptibility analysis 12 factors maps were considered: geomorphology, geology, soil, landuse, slope, aspect, internal relief, drainage density, road distance, fault distance, maximum daily rainfall and peak ground acceleration. Five different landslide types were analyzed separately (small slides, debrisflows, rockfalls, large rockslides and topples). The susceptibility maps were converted into hazard maps, using the event probability, spatial probability and temporal probability. Semi-quantitative risk assessment was done by applying the risk equation in which the hazard probability is multiplied with the number of exposed elements at risk and their vulnerabilities. At the municipal scale a detailed geomorphological mapping formed the basis of the landslide susceptibility assessment. A heuristic model was applied to a municipality of San Antonio del Sur in Eastern Cuba. The study is based on a terrain mapping units (TMU) map, generated at 1:50,000 scale by interpretation of aerial photos and satellite images and field data. Information describing 603 terrain units was collected in a database. Landslide areas were mapped in greater detail to classify the different failure types and parts. The different landforms and the causative factors for landslides were analyzed and used to develop the heuristic model. The model is based on weights assigned by expert judgment and organized in a number of components such as slope angle, internal relief, slope shape, geological formation, active faults, distance to drainage, distance to springs, geomorphological subunits and existing landslide zones. At the local level, digital photogrammetry and geophysical surveys were used to characterize the volume and failure mechanism of the Jagüeyes landslide. In order to improve the temporal probability information for Cuba, the generation of a national landslide inventory database is essential.*