

Approach for analyzing landslide and torrential flow hazard conditions in relation to landscape evolution in the northern Colombian Andes

Karolina Naranjo Bedoya¹, Edier Aristizábal¹, Daniel Hölbling², John García¹, Asaf Aguilar¹, David Ortiz¹

¹ Departamento de Geociencias y Medio Ambiente, Universidad Nacional de Colombia, Medellín Colombia

² Department of Geoinformatics – Z GIS, University of Salzburg, Salzburg, Austria, daniel.hoelbling@sbg.ac.at

Colombia is an equatorial country located in the northwestern corner of South America with characteristic and complex climatic and geologic settings, which contribute to a great diversity of landforms in the Colombian Andes. 65% of the Colombian population is concentrated in this mountainous terrain, where landslides and torrential flows are common. These natural hazards led to several tragic events over time. Their occurrence is favored by a very dynamic landscape made up of weak and highly weathered materials and affected by tectonic stress. In this study, we aim to gain a better understanding of morphometric control on the occurrence of landslides and torrential flows through process geomorphology and information derived from Digital Elevation Models (DEMs). Several morphometric indices related to drainage network, basin geometry, drainage texture, relief characteristics, asymmetry factor and others were calculated over 168 drainage basins in the northern Colombian Andes. We used quantitative geomorphology to find patterns of anomalies associated with landscape evolution and the occurrence of landslides and torrential flows. Understanding morphodynamics from morphogenesis is important to assess landslide and torrential flow hazard conditions in relation to landscape characteristics and evolution, to support hazard assessment, and consequently to reduce human and economic losses.

Keywords: Landslide, torrential flow, morphometric indices, mountainous terrains.