



The occurrence of Landslides in Guarumales, Ecuador

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The Ecuadorian Andes landscape has been shaped by a variety of factors ranging from plate movement to the construction of hydropower dams. Hydropower is a relatively new electricity generation alternative for Ecuador, and the potential for landslides along the slopes of the reservoir behind the dam provide new challenges in planning and mitigation. Recognizing the potential hazard, we studied the landslide occurrence in the Mazar and Daniel Palacios reservoirs and their surroundings in south-east Ecuador. One of the landslides threatening the electricity generation is the Guarumales landslide, which is located 8 kilometers away from the Daniel Palacios dam, across its powerhouse. The main objective of this study is to characterize the Guarumales landslide by studying the relationship between the characteristics of the landslide such as geology and slope, and triggering factors such as rainfall and groundwater fluctuations. Besides the detailed geological information coming from 12 cores reaching up to 100 m, we collected rainfall, evaporation, groundwater levels and surficial displacements. Interpretation of the geology shows a complicated system of colluvium deposits on the slope that reach up to 100 m. The matrix of these slope deposits is formed by a combination of sand, clay, and limestone surrounding boulders sometimes as big as 50 m in diameter; a lot of material appears highly weathered. Weaker layers indicate the presence of a slip surface between the schist bedrock and the colluvium, while the presence of water results in clayey-rusty layers. A water balance of the sub-basin was computed and the relationship between rainfall, groundwater levels, and surficial movement was studied statistically, showing that rainfall results in a lagged response of groundwater and an acceleration of surficial movement. These findings will serve as a starting point for future studies of landslide occurrence within the colluvium in the landslides across the Mazar and Daniel Palacios reservoirs.