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THEORETICAL ASPECTS UNDERNEATH DIFFERENT LANDSLIDE PREDICTION MODELS: HOW DO THEY CONSIDER GEOMORPHOLOGY?

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ABSTRACT

Landslides are major processes controlling landscape evolution, especially in tropical environments, where thick talus and colluvial deposits are observed filling bedrock topographic hollows. Besides their geomorphological meaning, they also represent a enormous danger to man when soil-mantled steep hillslopes are densely occupied in urban areas. Although a lot of effort has already been made towards a better understanding of the conditioning factors controlling landslide initiation at a specific site (hillslope scale), it is urgent to improve our ability in predicting landslide instability in larger areas (drainage basin scale), where positive and negative feedbacks between the hillslope and the channel segments play a major role. Modeling hillslope stability, of course, is not an easy task, especially when dealing with large drainage basin. Consequently, different approaches have been proposed to generate landslide susceptibility maps. Empirical models, generally based on terrain characteristics and/or rainfall intensity and duration, although important, do not improve our understanding on how these hydrological processes trigger hillslope failure. Besides, this class of models does not allow us respond to questions like *where* and *when* will they happen? Physically-based process-oriented mathematical models, usually combined with GIS tools, on the other hand, try to mimic the complex interplay between topography, geology, hydrology and land use in defining landslide location and timing. In this study, we discuss how different landslide susceptibility models consider geomorphology in their analysis. At this point, models like SHALSTAB, TRIGRS, SINMAP, SMORPH, dSLAM, FLO-2D, among others, were investigated and applied to a variety of places in southeastern Brazil. The results were validated by comparing the sites predicted as unstable by them with the actual location of landslide scars mapped in the field. Part of the differences observed in their results may be ascribed to the way geomorphological attributes are incorporated by them. Although our ability to predict *where* landslides might occur in a certain landscape has greatly improved in the last decades, we still have a long way towards being able to define *when* they will take place. In order to achieve this condition fully process-based models must be developed and soil pore-water pressures continuously monitored.

Keywords: landslide prediction; mathematical modeling; geomorphological parameters