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Mass Movement Hazard Assessment Model in Slope Profile: the Humid Tropics Example

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The central aim of this work is to assess the spatial behaviour of critical depths for slope stability and the behaviour of their correlated variables in the soil-regolith transition along slope profiles over granite, migmatite and mica-schist parent materials in an humid tropical environment. In this way, we had making measures of shear strength for residual soils and regolith materials with soil "Cohron Sheargraph" apparatus and evaluated the shear stress tension behaviour at soil-regolith boundary along slope profiles, in each referred lithology. In the limit equilibrium approach applied here we adapt the infinite slope model for slope analysis in whole slope profile by means of finite element solution like in Fellenius or Bishop methods. In our case, we assume that the potential rupture surface occurs at soil-regolith or soil-rock boundary in slope material. For each slice, the factor of safety was calculated considering the value of shear strength (cohesion and friction) of material, soil-regolith boundary depth, soil moisture level content, slope gradient, top of subsurface flow gradient, apparent soil bulk density. The correlations showed the relative weight of cohesion, internal friction angle, apparent bulk density of soil materials and slope gradient variables with respect to the evaluation of critical depth behaviour for different simulated soil moisture content levels at slope profile scale. Some important results refer to the central role of behaviour of soil bulk-density variable along slope profile during soil evolution and in present day, because the intense clay production, mainly Kaolinite and Gibbsite at B and C-horizons, in the humid tropical environment. An increase in soil clay content produce a fall of friction angle and bulk density of material, particularly when some montmorillonite or illite clay are present. We have observed too at threshold conditions, that a slight change in soil bulk-density value may disturb drastically the equilibrium of stress-strength tensions at potential rupture surface with its consequent loss of stability and increase of landslide event production risk.