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Relief unity emulator and slope stability simulator applied to mass movement occurrence analysis in slope evolution

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This work refers to a part of my "Fellow" thesis "Geomorphosynthesis and Geomorphocinematic applied to slope stability and evolution" (Colangelo, 2007). Relief unity emulator (rue) is a device that permits to synthesize a slope unity by means of a single generatrix profile that determine the initial conditions for application of a set of a geotechnical, hydrological and morphological models. This initial profile is considered in equilibrium with original environmental conditions, and operates in an integrated manner with these models. The aim is to induce a boundary condition on initial profile and produce a new profile: a threshold profile. For this manner and by iterations we generate a set of new profiles that represents, each one, a meta-stable profile, or a descending profile. The evolution of these profiles is in according with the central geomorphologycal concepts of slope retreat, base level change and head retreat. This set of "descending profiles" will be now sliced at topographic equivalent points, that will linked for describe a "topographic equivalence line". The crossing of this kind of isolines with descending profiles composes a 3D slope unity. This descending slope unity is represented by a mesh built for the crossing of these new slope profiles with the topographic equivalence lines and, the result is a four-dimensional meta-stable object integrated to the slope stability simulator (sss). This composite "rue-sss" device operates with 10 main models and 16 variables. The models describe effective stress, shearing resistance, soil saturation level behavior, potential rupture surface depth, critical depth, potential rupture surface critical gradient, critical soil saturation level, top of percolation flow gradient and unit weight of soil. Of this manner, is possible to evaluate effective friction angles and cohesion, critical soil saturation levels, critical gradients for potential rupture surfaces, neutral stress, shear strength, shear stress, effective stress, water retention factor, vegetation canopy unit weight and height. All these considering variables were calculated for each cell in the synthetic slope system, that is defined laterally by crossing of equivalence topographic belt with inter-profile space and, vertically by soil surface and potential rupture surface, that may be soil-regolith or regolith-rock transition. Therefore, with this device is possible, from a single generatrix profile, to design infinity of slope evolution ways by means of definition of boundary value of the models. When in the "potential rupture surface" is produced an "effective potential rupture surface", factor of safety less than unity, the soil fails and the slope stability simulator generate a mass movement prototype. A number of interesting and verisimilar 3D mass movement digital experiments may be performed for an inferred neogenic slope evolution time scale.