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# Concepts of Self-Organized Criticality for modeling triggering of shallow landslides

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The triggering of shallow landslides in steep hillslopes is attributed not only to hydrologic conditions (rainfall intensity and duration, initial water content) but also to heterogeneity of the hillslope and heterogeneous stress fields. Depending on variations of bedrock and surface topology, soil properties and root reinforcement, it is plausible that the mechanical load is not distributed homogeneously across the hillslope but may overcome the stabilizing forces only at a few positions. The load destabilized at these positions must be redistributed to neighboring zones. In course of such redistribution the additional load may be accommodated or may destabilize other zones and initiate a cascade of failure culminating in the release of a large portion of the hillslope. To analyze the role of local failure and its propagation across the hillslope we used a model based on concepts of Self-Organized Criticality. The hillslope is discretized to cells with properties reflecting measured soil type, bedrock and surface levels. Cells are connected by mechanical bonds that represent the stabilizing mechanical forces. Rainfall water is redistributed according to the spatial pattern of infiltration capacity and flows downwards along the surface or bedrock profile. With increasing water content the load is enhanced and bonds are weakened. When the load becomes higher than the shear strength at the bedrock and lateral mechanical bonds, these bonds fail and the load is redistributed to neighbored cells. The load distribution and propagation of failure was analyzed for various hillslope geometries and properties. We modeled different mechanical behaviors of the stabilizing bonds taking into account water content-dependent constitutive behavior and mechanical forces. The hypotheses deduced from this modeling concept will be tested in field sites instrumented with

acoustic sensors to measure the occurrence and propagation of local failure.