

## **Self-Organized Criticality modelling of the onset of rapid landslides on hillslopes.**

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The predictability of extreme and hazardous landslides on steep hillslopes is hampered by inconsistent response to similar rainfall and hydrological conditions. Radically different system response from stable to unstable states, and the characteristics of unstable hillslope are cast in the framework of Self-Organized Criticality (SOC). Each element on the hillslope may be either in a stable or unstable state, and the interaction between large numbers of such elements defines the stability of the entire system. The soil elements on a hillslope are assigned with randomly distributed properties (water content, soil type, vegetation, mechanical strength). We then determine the frequency of events with a certain runoff and landslide as a function of soil type, vegetation pattern and initial water content. For that purpose, we coupled the mechanical strength of an element with its neighbors with hydrologic conditions on the hillslope in which higher water content increases an elements mass and weakens soil strength. The model provides statistical description of failure events, magnitudes of released mass, and locations of high failure probability for a given hillslope scenario. The proposed SOC framework enables systematic evaluation of connections between hydrologic conditions and triggering mechanisms for landslides.