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Modeling and Simulation of Self-Organized Criticality in Landslides

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The paper elaborates on an avalanche-like dynamic model for catastrophic landslides introducing the effect of water diffusion along the failure plane. The main idea lies on the assumption that the stochastic nature of water diffusion along the failure plane results in a dynamic decrease in time of the shear strength for the entire rock mass parallel to this plane. To this end, a single stochastic constitutive equation is proposed, modeling external and internal stresses, spatial interactions between neighborhood sites as well as water diffusion, which are shown to reproduce correctly experimental observations. Indeed, simulations of a discrete automaton were performed, in order to study the model dynamics. It is demonstrated that the model exhibits features of self-organized critical behavior and solves the reported discrepancy between simulations outcomes and experimental data for the corresponding power law exponent.
Keywords: Catastrophic landslides, Water diffusion, Discrete automaton, Self-Organized Criticality.