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Cumulative effects of hydro-mechanical loading history on triggering of rainfall induced shallow landslides

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Infiltrating water during rainfall events reduce soil strength and add mechanical load that may progressively deform and fracture a soil mantle, leading to abrupt and sometimes catastrophic mass release. Such events depend on loading history, and accumulation of local weak regions play an important role in hydrologic landslide triggering. Accounting for such pre-existing mechanical flaws is important for realistic modeling of landslides. We employed the fiber bundle formalism to represent hydro-mechanical interactions, forming progressive failures and their impact on hillslope response in subsequent (rainfall) loading events.
The model was applied for a few small sub-catchments in Swiss Prealps where detailed landslide inventories were obtained following an intense rainfall event in summer 2002. We considered 'virtual sensors' at various locations to monitor precursor events accumulating across several hydrologic perturbations to anticipate time and location of simulated failure (landslide) from statistics of precursor events. The outcome of this study would help to explore (more realistically) the potential of developing early warning systems for shallow landslides.