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Process scale and key parameters for hydromechanical triggering of shallow landslides in vegetated slopes

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Processes and parameters controlling the triggering of shallow landslides occur at different spatial and temporal scales. For example plant's effect on stability of a hillslope is manifested at scales ranging from the reinforcement of an individual aggregate, soil anchoring within tree root zone, and affecting mechanical forces at interfaces between forest, meadow and bare soil. To improve understanding of the role of plants in landslides, a suite of hydromechanical processes must be described at the various spatial and temporal scales (e.g., intense rainfall events vs. slow soil formatting processes). We identify different spatial and temporal scales associated with hydrological triggering of shallow landslides within vegetated slopes, and highlight existing knowledge gaps. We propose several new approaches for analyses of structured-rooted soil, considering different combination of soil texture, structure, quantity, size and architecture of roots, and water content dynamics. These provide the inputs for a tentative framework for conditions conducive to triggering of shallow landslide in vegetated slopes. The proposed framework is based on considering basal and lateral cohesion within the hillslope that may act in different ways resulting in different behaviors depending on geometrical and scale issues. The root-soil association, and potential root failure prior and during landslides would be suitable for implementation within a self-organized criticality model (SOC), and future research would focus on the description and quantification of the effect of vegetation on the mechanical status of a hillslope and identifying conditions for mechanical failure.