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Catchment scale hydro-mechanical modeling of shallow landslides: dynamics and spatial distribution

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Rapid shallow landslides are often associated with intense hydrologic loading (rainfall, snow melt) and concurrent weakening of soil strength in the process. To simulate loading and failure patterns at catchment scale we built a hydro-mechanical model considering soil cover on hexagonal grid of mechanically and hydrologically interfacing soil columns. A high resolution digital elevation model was used to represent surface topography and soil depth distribution deduced from balance between soil erosion and production module. The hydrologic module calculates temporal and spatial water distribution accounting for infiltration capacity, surface runoff and routing, water flow within soil matrix and along soil/bedrock interface. By including force balance and load redistribution for each soil column, temporal (and spatial) evolution of loading patterns for entire catchments was computed with provisions for local failures and possible propagation up to landslide initiation. The model was tested with two event based landslide inventories from the foothills of the Swiss Alps with rainfall patterns deduced from radar precipitation data. The two events differed in intensity and duration and triggered landslides in different small catchments in the same region characterized by similar geomorphology. Tests are underway to reproduce different loading patterns in the small catchments for the two rainfall events and observed vs. modeled failure patterns will be compared considering both position and size of triggered landslides. Unknown spatial heterogeneities within the catchments limit point-wise predictability, these issues will be discussed in the comparisons.