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Saturation and drainage of soils at the hillslope scale and implications for landslide triggering

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Saturation and drainage of soils at the hillslope scale show dynamic behaviour and vary widely at different sites depending on the efficiency of preferential flow and on how this flow is initiated. Observations at different hillslopes in Switzerland during sprinkling experiments revealed that saturation may start at the topsoil and spread downwards as a wetting front. However, saturation may start from below when infiltrating water bypasses the soil matrix into deep soil layers through vertical preferential flow paths. Lateral preferential flow can drain the soil continuously and thus delay or prevent saturation. Spatially variable soil properties, topography and precipitation characteristics define these flows.

Slope failure may be triggered by saturation of the ground which leads to increase of weight and decrease of frictional resistance. Therefore, the saturation and drainage characteristics of a slope may exert a major control on the prevention or triggering as well as the shape of its failure. The influence of such hillslope hydrological processes on landslide triggering will be discussed for different experimental slopes where the in-situ infiltration characteristics were evaluated by application of combined sprinkling and dye tracer experiments. Moreover, reasons for the prevention of slope failure during a major landslide triggering experiment in North-East Switzerland in autumn 2008 will be presented.