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Improving the representation of hydrological processes in landslide modelling

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Abstract
Hydrology is an important aspect of landslide and debris flow assessment. Precipitation and snowmelt water infiltration, leading to local pore water pressure increase and/or matric suction decrease, is amongst the most common triggers of landslides. Fundamental knowledge about underlying processes affecting this infiltration process, such as macropore and fissure flow, water repellency, soil structure, soil-plant-atmosphere interactions, as well as about the effects of land use practices (e.g., deforestation, terracing, grazing, etc.), has strongly improved in the last decade or so, with a clear focus on more detailed knowledge of hydrological process dynamics. Although hydrology research field is very strongly linked to natural hazards like landslides and debris flows, this improved hydrological knowledge has found its way into the landslide community rather modestly. Especially the incorporation of hydrological processes into large scale models is still incomplete and their application to landslide prediction limited. The landslide research tends to be more focused on novel methods to include spatial data and on the practical applicability of e.g. landslide triggering modelling and statistical analyses for regional hazard and risk assessment. The in depth hydrological process understanding needs to be incorporated in our technical predictions in natural hazards in order to improve the reliability of Early Warning Systems, mitigation works and landslide zonation. This contribution aims to present an overview of innovative hydrological research applied to landslide studies to improve the understanding of the spatio-temporal patterns of slope movement mechanisms induced by precipitation. This work discusses the representation of hydrological processes in landslide modelling in order to increase our process understanding and, consequently, to improve the reliability of landslide hazard and risk assessment. An overview will be given that covers all scales of hydrological landslide research and gives insight in how novel hydrological concepts can be included in landslide modelling organized along an increasing complexity of the hydrological conceptualization, from including internal heterogeneity, to novel implementation of boundary conditions and to conceptualize large fissures in landslide hydrological modelling. At the same time the contributions range from regional to hillslope scale.