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Investigating and predicting landslides using a rainfall runoff model in Norway

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Landslides are amongst the most destructive natural hazards, causing damage to infrastructures, such as roads, railroads and houses, and can, in a worst-case scenario, take lives. A better understanding of the triggering processes of landslides are important as it enables us to perform better forecasts, improve mapping of zones with landslide risk and carry out mitigation measures. In this study, a parameter-parsimonious rainfall-runoff model, DDD (Distance Distribution Dynamics), is used to simulate the hydrological conditions for rainfall-induced landslide events. The model estimates the capacity of the subsurface reservoir at different levels of saturation and predicts overland flow. The subsurface in the DDD has a 2-D representation in that it calculates the saturated and unsaturated soil moisture along a hillslope representing the entire catchment in question. In this study, 50 landslide events in 10 catchments in Southern Norway are investigated. Characteristics of the subsurface states, before, during and after the landslide are analysed for the whole catchment and at three points (lower, middle and upper part) of the hillslope. Preliminary results show that the hysteretic loop of storage and discharge follow complex clockwise and anti-clockwise patterns. Anti-clockwise loops occur more frequent, except for the middle part of the hillslope. In the upper part of the hillslope, anti-clockwise loop occur almost exclusively (94 %). Evaluated for the entire catchment, 57 % of the landslide events occurred at maximum saturation, while 77 % of the events occurred at saturation above 80 %. We found the majority of the landslide events to be associated with the rising limb and the top of the hysteretic curve with 64 % and 17 %, respectively. Overland flow was found for 68 % of the events.