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Influence of vegetation, soil and antecedent soil moisture on the variability of surface runoff coefficients at the plot scale in the eastern alps

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Modelling the runoff of a catchment in a high spatial resolution, you need to know the potential of a single plot to generate surface runoff. The portion of surface runoff is highly significant for storm runoff events, accordingly, it mainly forms the hydrograph.
In this study, the influence of vegetation, soil features and antecedent soil moisture on generating surface runoff at the plot scale have been analysed. To achieve an appropriate fit of the plots, a plot sizes between 50 and 400 m^2 were chosen. The rainfall intensities ranged between 10 mm/h and 100 mm/h. Based on 260 rain simulations with a transportable sprinkling instrumentation on representative plots in the eastern Alps (Austria, Italy, Germany), including investigations on land-use, vegetation cover and soil physical characteristics, various soil-vegetation complexes and their surface runoff processes have been be analysed. Additionally, we investigated flow paths, travel distance, infiltration hindrance, flow resistance and overland flow velocity. The soil water status was monitored by using TDR-probes, which had been installed in two profiles within the plot in different depths ranging from 5 cm to 40 cm. For every sprinkling experiment, a surface runoff coefficient was calculated as the ratio between total rainfall amount and surface runoff.
With this substantial dataset, the regression analysis was used to examine the influence of the hydrological key factors as soil, vegetation and initial soil moisture condition on the distribution functions of the surface runoff coefficient. The first results show that the vegetation cover is very important for the surface runoff. If initial soils are covered by alpine or sub-alpine pioneering vegetation surface runoff can be found very scarce. If these initial soils are covered i.e. by subalpine nardus grasslands the surface runoff coefficients range from 0.1 up to 0.8. On the other hand it can be shown that soils with a high bulk density mainly generate very high surface runoff coefficients, independent of the antecedent soil moisture. Cambisols show a great variance of surface runoff coefficients. These results are the basis for the characterisation of different soil-vegetation complexes by their surface runoff coefficient and they also describe the potential surface runoff of a catchment.