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Using rainfall simulations to evaluate variability of surface runoff for different land-use/cover types in Alpine Landscapes

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Alpine areas are highly sensitive to land-use and climate changes which can result in a shift in biodiversity. So far, detailed information on attached processes is still missing. Although surface runoff is known for enhancing wet land slide and erosions we still do not understand the underlying factors. We designed a rainfall simulator for mountain areas in order to (1) assess small-scale differences of surface runoff and (2) get along with water availability. Using tubes and three different types of nozzles (full, half and quarter circle) a rain simulator for the irrigation of $10m^2$ (5m x 2m) was constructed. Sprinkling outside the plot (2m on each side) reduced boundary effects leading to a delay of saturation excess flow. As part of the water was sprinkled on the lateral area outside the study plot, a specific calibration factor was needed in order to obtain the effective water quantity within the measuring plot. Rainfall distribution within the simulated plots is a prerequisite for rainfall simulation and was therefore evaluated and visualized. Irrigated water quantities were automatically registered with a logger connected to a water meter and by changing the water pressure, the rain intensity can be modified from 70 to 100 mm h^{-1}. The runoff water was caught in a cannel and recorded in intervals of 1 minute.

Using the rainfall simulator in a study in the Eastern Alps, Stubai Valley, Austria, surface runoff for heavy rainfall events (return period of 100 years) on different land-use/cover types (pastures, meadows, abandoned land) was investigated. Accompanying soil water content and soil water tension measurements in different soil depths as well as analyses of soil type, soil physical properties and phytomass were used for results' interpretation.

Results revealed significant differences in surface runoff coefficients between investigated land-use/cover types. Moreover, pastures revealed a clear seasonal variability of surface runoff. However, besides methodological aspects, both accompanying analyses and date of rain simulation have to be planned thoroughly to realize the full potential of a rainfall simulator.