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A method for modeling runoff in poorly gauged alpine catchments with respect to different rainfall intensities

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The objective of this paper is to present a methodology for the runoff modeling of poorly gauged basins on the basis of field experiments and terrain based information. The semi-distributed, physically based, continuous model COSERO was used for the modeling of the summer to fall season of differently sized catchments. No snow fall and snow melt modeling was done. Intensive sprinkling experiments with different precipitation intensities were carried out on eight sites in 4 different alpine catchments. The simulated rainfall intensity was 10mm/h over periods of 8-27 hours for the long term low-intensity experiments and 30-100mm/h over periods of 1-2 hours for the short term high-intensity experiments. The soil moisture content, the quantity and the velocity of the surface runoff, and the quantity of the rapid subsurface flow within the top 20cm of the soil were measured simultaneously. Geoelectrical resistivity measurements were carried out in order to get a better understanding of the composition of the soil and of the depth of the bedrock on the investigated sites, and thus of probable preferential flow paths in the top few meters of the soil layer. The soil moisture and its variability were monitored by using Time Domain Reflectometry and Ground Penetrating Radar. Finally, core samples were taken from the irrigation plot and analysed in the laboratory. The results of the sprinkling experiments were used for the development and improvement of runoff coefficient maps and surface roughness maps of the investigated catchments. Particular runoff coefficients for high-intensity and low-intensity precipitation on various land covers were derived. Subsequently, hydrological response units and respective parameters were estimated by incorporating the results of the irrigation experiments and from topographically related data. Vegetation data were used for estimating evapotranspiration, interception, and surface flow generation, while hydrogeological and geomorphological data were used for estimat-

ing the storage properties in the soil layers. The modeling efforts were concentrated on three different spatial scales: One 1.2km^2 hillslope, one 16km^2 catchment, and one 170km^2 catchment were modeled with COSERO. Although the lack of proper analysis methods and investigation tools for soils with a large fraction of coarse grain material was a constraint to the modeling efforts, the sprinkling experiments proved quite useful. The main hydrological processes on the plot scale could be identified and implemented into the model. The modeling results were satisfactory considering the lack of runoff data for proper model validation. Nevertheless the procedure for the generation of the information which was used for the estimation of the model parameters is quite time consuming and will have to be simplified in a consecutive step in order to make the presented method more easily applicable to other poorly gauged and, ultimately, to ungauged catchments.