



A GIS-based numerical model for predicting extreme runoff events in small alpine catchments (SYCOSIM)

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The project deals with the estimation of extreme runoff events in small ungauged alpine catchments. In this context SYCOSIM (System Conditions Simulation Framework) was developed for the data-extensive assessment of the hydrological response to rainstorms and rapid snowmelt. Topographical (DEM), hydrological (stream network), landcover and soil (punctual profiles) parameters, as well as climatic data are required as input. The model framework is characterized as follows: (1) it takes into account the spatial distribution of vegetation and soil properties within the basin; (2) it includes the hydrologically relevant state of the system components vegetation, snow cover and soil at the start of the considered event; and (3) it is fully based on open source software, using a combination of GRASS (GIS), R (statistics), and shell (background code).

SYCOSIM operates in three steps:

(1) Preparing the soil and vegetation parameters: The model includes the possibility to combine existing landcover maps with the results of own mapping efforts. The landcover classes are normalized to predefined hydrological vegetation units, and hydrologically relevant characteristics (summer and winter values for leaf area index and interception capacity) are assigned to each class. Hydrologically relevant soil parameters are interpolated using multiple regression models based on the punctual soil data and GIS layers representing topography and geological substrate. Maps of field capacity, pore volume and hydraulic conductivity were calculated from this information.

(2) Modelling the system status at the starting time of the considered event: The real

capacities of the pools (vegetation, litter, soil) are dynamically modelled in daily steps over a period of several months, based on the seasonally variable interception capacities (vegetation, litter) and the static field capacity (soil). A simple pool system model with precipitation as input and evapotranspiration (HAUDE method), runoff and seepage to groundwater as output is used.

(3) Calculating the runoff for the period of the considered event in hourly steps, based on a simple pool system model: Each pixel is assigned to a segment of the stream network, and the cumulative runoff for each stream segment and each hourly step is calculated and fed into a routing routine through the stream network.

SYCOSIM was tested against measured runoff values. The results provided by the model framework for two alpine test areas (Ruggbach, 6,7 km²; Stampfangerbach, 21,3 km²) will be presented and discussed at the meeting.