Automatic evaluation of runoff processes in mesoscale catchments using soil and topographic data

M. Margreth, P. Schmocker-Fackel, F. Naef, S. Scherrer, Ch. Kaegi

Institute of Hydromechanics and Water Resources Management, ETH Zurich

Precipitation is transformed into runoff either by HOF (Hortonian Overland Flow), SOF (Saturation Overland Flow), SSF (Subsurface Flow) or DP (Deep Percolation). Which process occurs, depends on a number of not easily recognizable parameters. A decision scheme was developed, which allows the determination of the dominant runoff processes on a plot scale. Using this scheme, the different processes areas in a catchment can be mapped. Until now, this methodology has been applied to over 50 catchments, covering a wide range of sizes, topography, geology and flood producing precipitation regimes.

The decision scheme uses parameters like macroporosity or lateral hydraulic conductivity, which are not contained in soilmaps and have to be evaluated in the field. To enable an automated process determination, the decision scheme was adapted to rely only on digitally available data, like soiltypes, grain size distribution or soil depth usable by plants. This allowed the automatic determination of the dominant runoff processes in a GIS by overlapping different layers of geology, slope, soil types, grain size distribution, soil depth usable by plants and applying the modified decision scheme to every cell.

The dominant runoff processes were automatically mapped in several micro- and mesoscale catchments, where a large-scale database (soilmap 1:5'000 and DEM 1:25'000) was available. In comparison with the manually evaluated runoff processes, the automatically determined runoff processes represented the characteristic hydrological behaviour correctly in 50% to 70% of the area. The reasons for the differences between manually and automatically determined runoff processes will be discussed and runoff simulations using the automatically and manually derived maps compared.

As large-scale maps of soil properties (1:5'000 to 1:25'000) exist only in some ar-

eas in Switzerland, a method was developed, to use improved small-scale soilmaps (1:200'000) for an automated determination of dominant runoff processes. In a GIS-application the units of the soilmap were enhanced with information of geology and topography. The potential of this approach also will be discussed.