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Evaluation of dominant runoff processes for large areas with a GIS-based method

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A decision scheme to determine the dominant runoff processes (DRP) on the plot scale was developed and applied in over 50 catchments. Some of the required parameters are contained in soil maps, but properties like lateral conductivity or macroporosity have to be evaluated in the field.

To apply this method to a larger area, the decision scheme had to be adapted to rely only on data, which are available in digital form, like soil depth, soil type, grain size distribution, topography, tile drains and geology. Such a scheme, which could be used automatically in a GIS was developed and calibrated with data from two small catchments in Kanton Zurich situated in the Swiss Plateau.

As a high resolution soil map (1:5'000) and other input data like geology, DEM, land use and tile drains were available, it was possible to apply this process scheme for the whole Kanton Zurich, which extends over an area of 1730 $km^2$with different geology, topography and soils.

The automatically evaluated processes were compared with existing manually derived process maps. Deviations were identified either as deficiencies of the process scheme or as areas, where the runoff formation was too complex to assess it with the available data. The automatically determined DRP represented the same hydrological behaviour in 60% to 80% of the area of the existing process maps. In catchments, where runoff and rainfall are measured, runoff volumes were calculated by subtracting storage volume defined in process map from the rainfall volume and compared with the measured

runoff.

In alpine catchments soil information is often missing. For this region a GIS-based method was developed to derive soil depth, soil type and grain size distribution from geological and topographical information. The derived DRP were compared with existing manually derived process maps. In 75% of the area the runoff intensity agreed reasonably well.

With the presented GIS-based method the distribution of DRP can be identified for large areas, if sufficient information about soils, geology, topography and land use is available. In alpine catchments the soil information can be derived from geology, topography and land use. With such maps, process based rainfall-runoff models can be used in larger catchments.