SPATIAL DISTRIBUTED MODEL APPROACHES TO HYDROLOGIC PROCESSES AND RIVER FLOW FROM MOUNTAINOUS REGIONS

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As a result of the pronounced topography, river basins in mountain regions are characterised by strong 3-dimensional variations of all land-surface characteristics (soil type, soil depth, vegetation) and all meteorological elements (air temperature, precipitation, radiation components, vapor pressure, wind velocity). In the assessment of possible impacts of climate variations on the water flow and water resources, a more physically-based model has to be employed, which takes into account these spatial variabilities.

In the development of a corresponding river basin model for the whole alpine/pre-alpine basin of the river Rhine/Rheinfelden (34,000sq.km.) at first the efforts were focussed on the smaller scales of the sub-basins of the Rietholzbach (3sq.km.) and of the Thur/Andelfingen (1,703sq.km.). These basins are located in the northeastern part of the Swiss part of the Rhine basin and have an elevation ranging from 400m to 2,500masl. A considerable part of the Thur basin is high mountain area, some of it above the tree line, and a greater part of the basin has a distinct snow cover during the winter season.

In the hydrologic distributed modelling, the digital terrain model (DTM) and land-use information as given by a GIS were consequently introduced in two approaches: a) a grid-oriented approach; and b) an approach based on the principle of hydrologic subareas (hydrotopes) with the assumption of similar hydrologic behaviour within the hydrotopes. For the spatial interpolation of the meteorological input variables, various methods were employed. The structure of the model components for snow accumulation and melt, interception, soil water, storage and uptake, evapotranspiration,

runoff generation, and flow routing is described, including a discussion on the assessment of the various parameters with respect to their time dependency.

The results for each of the hydrologic components are discussed with respect to the different subareas and altitudinal zones. Finally, some general conclusions and an outlook on the further endeavours in hydrologic modelling in mountain areas are presented.