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Suitability of rainfall runoff models for the assessment of extreme floods in meso-scale basins

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In water resources management the assessment of high floods is normally based on statistical analysis of discharge time-series. But, since floods with a return period higher than 50 years are very rarely observed the extrapolation of the statistics by using extreme value distributions is very uncertain. Therefore, rainfall-runoff models are applied additionally. But again, due to the lack of measured floods the model validation for extreme conditions is difficult.

In the present study various models with different structure and concept (HBV, modified TOPMODEL, WASIM-ETH, LARSIM and a fuzzy-logic-model) have been applied to three low mountain range basins covering 130 km^2 to 240 km^2 as well as to one 5 km^2 basin. For the latter hydro-meteorological data, soil moisture and suspended sediments have been captured for up to three years. Furthermore, runoff generation processes have been investigated experimentally at the plot scale and an extensive spatial data set exists. The aim of the modelling study was (i) to compare the model's efficiency to simulate floods, (ii) to identify and evaluate the flood controlling model parameters and their suitability for extrapolation and (iii) to simulate scenarios of flood generation that are based on different process perceptions.

The discharge simulations showed that the calibrated values of the flood triggering model parameters are not necessarily valid for extreme rainfall. Under very wet conditions the basins are likely to respond different, e.g. it might be that first if a threshold of soil saturation is exceeded large areas of the basin are contributing to the discharge and the stream network is expanding. Therefore, a use of different parameter sets for different moisture conditions or a coupling of different model concepts is planned.