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Evaluation of reanalysis climate simulations for the prediction of extreme runoff characteristics

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Discharge regimes of river basins are expected to be altered due to possible effects of global warming. For planning and water resources management, it is fundamental to estimate the probability of occurrence of extreme hydrological events such as magnitude and frequency of floods and droughts. So far, it is a matter of debate whether actual Global and Regional Climate Model outputs or their reanalysis products (bias corrected) are able to provide a reasonable estimate of the meteorological variables that are required to force a distributed hydrologic model.

In this study, we will evaluate various climate simulations for their reliability to predict extreme runoff characteristics in three German mesoscale river basins with various sizes and hydro-meteorological conditions: Neckar (12 700 km^2), Bode (3 300 km^2), and Mulde (2 700 km^2). Reanalysis of the global atmosphere and surface conditions were obtained from the European Centre for Medium-Range Weather Forecast (ECMWF) Reanalysis (ERA$-$40) for the period from 1957 to 2002.

These data will be used to force a grid based mesoscale hydrologic model calibrated with past meteorological and discharge observations. Several runoff characteristics will be estimated based on daily discharge simulations and then compared with their corresponding estimates derived from daily streamflow observations. Finally, nonparametric statistical test (e.g. Kolmogorov–Smirnov test) and Tukey's depth function will be employed to test two null hypotheses: 1) Meteorological observations and the reanalysis data are realisations from a common generating process, and 2) The probability of occurrence of extreme runoff characteristics obtained from both data sets is similar.