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Downscaling low flow and drought for Southwest Germany by using atmospheric circulation types based on NCEP- and RCM-SLP data

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In June and August 2003 Europe suffered a drought with extreme low flows in many rivers and an extreme heat wave which caused about 35 000 fatalities and economic losses totalling 13 billion US-$. In France and Germany several nuclear power plants had to reduce their production due to a lack of cooling water and temperatures exceeding the legal limit of 28 °C. It will be shown that droughts and extreme low flows for Southwest Germany in summer are mostly linked to a few special circulation types (CP) like “Ridge of High Pressure over Central Europe (BM)”. The methodology of an objective CP classification based on NCEP-SLP data and time series of daily runoff data for several rivers of Southwest Germany will be described. This classification allows the detection of “critical” CPs which are causing droughts and low flows in the study area. The time series of the frequencies and maximum persistence of the "critical" CPs will be analyzed for the observation period (1958-2007) of the NCEP data and two transient RCM scenario runs. The KNMI RACMO2 model and the MPI REMO model, both driven by the A1b emission scenario of ECHAM5. The results of the statistical analysis of the “critical” CPs will be demonstrated for summer (JJA) and the vegetation period (April-Sept.). A comparison of the results obtained for the observation period (1961-1990) and the scenario runs of 2021-2050 and 2071-2100 will indicate how the risk of extreme low flows and droughts in summer will change for Southwest Germany in the future for the different RCM runs.