



Increased risk of heat waves and dry spells in Southwest Germany linked to non-stationarity of "critical" atmospheric circulation types

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In June and August 2003 Europe suffered an extreme heat wave and dry spell which caused about 35 000 fatalities and economic losses totalling 13 billion US-\$. Even in Southwest Germany the dry spell and high air temperature of up to 40°C caused low flow conditions in many rivers and extremely high temperatures of up to 28°C. 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. A similar heat wave occurred in July 2006 in Southwest Germany. The heat wave and dry periods in summer were mostly linked to the atmospheric circulation type (CP) "Ridge of High Pressure over Central Europe (BM)" combined with a few additional types which can therefore be called "critical" CPs. The results of the time series analysis of the "critical" CPs will be demonstrated for the period 1881-2006. Frequencies and maximum persistence of the "critical" CPs show highly significant increasing trends and step changes for the summer (June - Aug.) and vegetation period (April - Sept.) during the recent three decades. Nonparametric tests of the time series of the "critical" CPs indicate that non-stationarity of the summer frequencies and maximum persistence show a highly significant step change in 1972. In particular, the increasing maximum persistence of the "critical" CPs since 1972 indicates an increased risk of getting more severe heat waves and dry spells in large parts of Western and Central Europe. It will be demonstrated that these results are consistent with the results obtained from GCM and RCM runs for future climate scenarios. The heat waves of June and August 2003 and July 2006 have been the responses of the climate system to an already changed summer climate for large parts of Europe.