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Evolution of extraordinarily low and high temperature, precipitation and runoff periods over Germany since 1950 - A quantile regression approach

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Properly describing temporal changes in the occurrence of extreme high or low temperatures, precipitation and runoff is of key importance for properly assessing the potential local impacts of ongoing climatic changes and estimating possible future trends. Unfortunately, the applicability of traditional extreme value statistics to non-stationary climate data is often restricted by the available amount of data. As a possible alternative, quantile regression techniques allow estimating temporal trends in arbitrary quantiles of the distribution of the corresponding hydro-meteorological observables. Besides the basic linear variant, there are nonparametric approaches available that allow characterizing quantile trends without an explicit prescription of a certain functional form.

In this work, we study observational records of German temperature and precipitation as well as runoff time series obtained using the hydrological model SWIM for the second half of the 20th century. Particularly, we compare trends in very high and low quantiles of the associated probability distribution functions and compare them to the outcome of classical extreme value statistics. Our results allow a detailed characterization of the regional patterns of quantile trends and their temporary increase and decrease.