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Extraordinary long-term trends in temperature extremes across Germany

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Properly evaluating temporal changes in the occurrence of extreme high or low temperatures is of key importance for assessing the potential local impacts of ongoing climatic changes and estimating possible future trends. Notably, 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 observed temperatures.

Here, we report results on the long-term evolution of daily mean, maximum and minimum temperatures across Germany based on station data. The obtained trends in very high and low quantiles reveal an extraordinary increase of high temperature extremes since the 1950s, which significantly exceeds the mean warming. In order to assess the robustness of these results, we compare the trend values for linear and nonlinear (spline-based) quantile trends with those obtained from (linearly) time-dependent extreme value analysis. A detailed analysis of the spatial patterns of trend values suggests the specific importance of urban areas, but also local geographical factors for the emergence of extreme trends in the highest temperatures.