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Trend analysis of Meteorological data in Germany

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It has been widely recognised that precipitation patterns has been changed in Europe over a long period due to mainly climate change. For arriving at reliable predictions of future changes it is important both to characterise the trends in the precipitation patterns in regional scale and to understand the underlying forces such as climate and human. As for Germany, General Climate Model's results showed significant changes in precipitation and temperature. During last decades, there is an impression that a warming trend with summer extremes has affected the country several times; however it is still not clear whether such variations are just outliers or whether they are just part of a long-term trend. This study aims at assessing the presence of linear and non linear trends across Germany. Most previous studies related to changes in hydrological variables have been carried out with a limited number of stations and on a small spatial coverage. In this study, on the contrary, we selected a subset contain at least 90 percent data from a database of 5611 rain gauges and 1113 meteorological stations obtained from the German Meteorological Service (DWD) which also passed various homogenisation tests (e.g. the Alexandersson's Test). The retained sample size was 2700 stations for precipitation and 800 for temperature. The period of analysis was from 1950 to 2010. Mean and maximum daily precipitation; maximum, minimum, and diurnal range of daily temperature were estimated for all selected stations. On this subset, non-parametric test (e.g. Wilcoxon-Mann-Whitney, Mann-Kendall and other bootstrap techniques) were applied to assess the null hypothesis of stationarity in both the mean and variance of a selected series. The field significance based on the false discovery rate approach was applied to evaluate the joint statistical significance of multiple hypothesis tests. The results showed a clear decreasing trend in annual precipitation over north eastern Germany and increasing trend in southern Germany. Currently, underlying driving forces for these changes are under investigation.