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Comparison of climate extremes across various global gridded in situ and reanalysis data sets

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Changes in climate extremes are often monitored with global gridded data sets of climate extremes based on in situ observations or reanalysis data. In this study, we check for consistency in temperature and precipitation extremes between these data sets. We analyse the temporal evolution and spatial patterns of annual extremes of daily values across multiple global gridded data sets of in situ observations and reanalyses to make inferences on the robustness of the obtained results.

While normalised time series generally compare well, absolute values of annual extremes of daily data differ systematically within the different data sets. This is partly related to different computational approaches of calculating the climate extremes.

Extreme temperatures in the different in situ-based data sets strongly agree. The comparison for temperature results from reanalyses shows a more heterogeneous evolution, particularly during the pre-satellite era. The NCEP1 reanalysis in particular is affected by spurious values of maximum temperature which challenges its suitability for the analysis of changes in warm maximum temperature extremes. In terms of both temporal and spatial correlations, the ECMWF reanalyses tend to show greater agreement with the gridded in situ-based data sets than both NCEP and the JRA reanalyses.

Extreme precipitation is characterised by higher temporal and spatial variability than extreme temperatures and there is less agreement between different data sets than for temperature. However, a reasonable agreement between the gridded data sets remains. Precipitation time series of reanalyses show lower agreement but generally still correlate significantly.