Global land-based temperature and precipitation extremes over the past century

Markus G. Donat and Lisa V. Alexander

University of New South Wales, Centre of Excellence for Climate System Science and Climate Change Research Centre, Sydney, Australia (m.donat@unsw.edu.au)

Novel global observational datasets of temperature and precipitation extremes have recently been developed, contributing significantly to the IPCC's Fifth Assessment Report. These datasets substantially extend previous extremes datasets, providing data throughout the past century for some regions. In this study we investigate long-term changes in temperature and precipitation extremes over the past century, and discuss the robustness of results across different observations-based datasets including gridded in situ observations and reanalyses.

All datasets indicate consistent and wide-spread warming trends over much of the globe, as reflected by e.g. increasing numbers of warm days and nights and fewer cold days and nights, higher extreme temperatures and longer warm spell duration. Extreme precipitation indices are characterized by a higher variability than extreme temperatures, and changes are spatially more heterogeneous. However, on a global average there is a tendency towards heavier precipitation and larger areas with significant trends towards wetter conditions than areas with drying trends.

While there is strong agreement between the different observational datasets, larger differences are found for some of the reanalyses results, particularly during the pre-satellite era. A reanalysis covering the entire 20th Century shows good agreement with the gridded in situ observations data sets for the past 70 to 80 years, and even longer in regions with dense observational coverage.

In conclusion, there is high robustness in global changes of observed temperature and precipitation extremes since the middle of the 20th Century across the different datasets. However, some inconsistent trends are found in regions with sparse observational coverage.