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Trends in extreme temperature and precipitation in Muscat, Oman

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Abstract Changes in frequency and intensity of weather events often result in more frequent and intensive disasters such as flash floods and persistent droughts. In Oman, changes in precipitation and temperature have already been detected, although a comprehensive analysis to determine long-term trends is yet to be conducted. We analysed daily precipitation and temperature records in Muscat, the capital city of Oman, mainly focusing on extremes. A set of climate indices, defined in the RClimDex software package, were derived from the longest available daily series (precipitation over the period 1977–2011 and temperature over the period 1986–2011). Results showed significant changes in temperature extremes associated with cooling. Annual maximum value of daily maximum temperature (TX), on average, decreased by 1°C (0.42°C/10 year). Similarly, the annual minimum value of daily minimum temperature (TN) decreased by 1.5°C (0.61°C/10 year), which, on average, cooled at a faster rate than the maximum temperature. Consequently, the annual count of days when TX > 45°C (98th percentile) decreased from 8 to 3, by 5 days. Similarly, the annual count of days when TN < 15°C (2nd percentile) increased from 5 to 15, by 10 days. Annual total precipitation averaged over the period 1977–2011 is 81 mm, which shows a tendency toward wetter conditions with a 6 mm/10 year rate. There is also a significant tendency for stronger precipitation extremes according to many indices. The contribution from very wet days to the annual precipitation totals steadily increases with significance at 75% level. When The General Extreme Value (GEV) probability distribution is fitted to annual maximum 1-day precipitation, the return level of a 10-year return period in 1995–2011 was estimated to be 95 mm. This return level in the recent decade is about 70% higher than the return level for the period of 1977–1994. These results indicate that the long-term wetting signal apparent in total precipitation can be attributed largely to the increases in extreme precipitation in recent decades.

Key words climate change; RClimDex; general extreme value probability distribution; skewness