

Interannual variability of mean and extreme rainfall and relationship with large-scale circulation

Malcolm Haylock



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Abstract

Seven journal publications are presented documenting historical trends and interannual variability of mean and extreme rainfall. The seven studies cover diverse geographical regions including Australia, southeast Asia and the Pacific, Europe and South America. While two of the studies solely present trends in mean and extreme rainfall in recent decades, the remainder seek causes for the observed trends.

The first paper explains the reduction in winter rainfall observed in recent decades in southwest Western Australia. Composites of sea level pressure reveal that during anomalously dry years there was a westward expansion of the continental anticyclone along with an intensification of the trough at higher latitudes, thus confining the rain bearing storms to the south of the continent.

The second paper examines the seasonal dependence of the spatial coherence of Indonesian rainfall, showing that high coherence coincides with a strong relationship with the El Niño – Southern Oscillation phenomenon (ENSO). The third paper extends this work to cover the entire Maritime Continent, showing that the ENSO-affected region is strongly related to large-scale changes in the Pacific-wide ENSO related anomalies of sea surface temperature.

The fourth paper uses several indices of daily extreme rainfall to document whether there has been an observed change in extreme rainfall over Australia and to determine if the results are sensitive to the choice of rainfall indices.

The fifth paper presents results from a southeast Asia and Pacific regional workshop that examined trends in indices of extreme daily rainfall and temperature. While extreme temperatures have increased in recent decades, rainfall trends are more region-dependent. The sixth paper shows extreme rainfall trends from a similar workshop held in South America. A strong regional dependence of the observed trends is shown to be the result of changes in the behaviour of ENSO and a weakening of the continental trough in surface pressure.

The seventh paper relates changes in European winter extreme rainfall to changes in pressure. The large-scale latitude dependent trend is the result of changes in the North Atlantic Oscillation (NAO).

The seven studies show that, despite the expectation that a warmer atmosphere means an enhanced hydrological cycle, mean and extreme rainfall has shown no consistent increase. Moreover, long-term trends in rainfall are dominated by changes in large scale climate signals, such as ENSO and the NAO.

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