

Who is responsible for the winter rainfall decreasing over the southwest Western Australian?

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Previous studies have raised the possibility that the recent decline in winter rainfall over southwest Western Australia (SWWA) is related to the concurrent upward trend in the Southern Hemisphere Annular Mode (SAM). Based on an analysis of 60-year (1948-2007) reanalysis and observed data, we suggest that the apparent inverse relationship between the SAM and SWWA winter rainfall (SWR) is caused by a single extreme year, 1964. We show that both the negative and positive phases of the SAM have little impact on the SWR in the case that data for 1964 are excluded from the analysis. The result indicates that the SAM does not significantly influence the winter rainfall over SWWA. Instead, the variation of the SWR would be more closely linked to the variability in regional circulations. Further, we found that the climate of southwest Australia bears a strong seasonality in the annual cycle and exhibits a monsoon-like atmospheric circulation, which is termed as the southwest Australian circulation (SWAC) for its several distinct features characterizing a monsoonal circulation. It is revealed that the SWAC explains not only a large portion of the interannual variability of SWR, but also the long term drying trend over SWWA. The well-coupled SWAC-SWR relationship seems to be largely independent of the well-known effects of large-scale atmospheric circulations such as the Southern Hemisphere Annular Mode (SAM), El Niño/Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and ENSO Modoki (EM). The result offers qualified support for the argument that the monsoon-like circulation may contribute to the rainfall decline in SWR.