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A possible cause of decreasing summer rainfall in northeast Australia

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The NCEP/NCAR reanalysis and precipitation data from the Australian Bureau of Meteorology are used to analyze variability in rainfall during the austral summer (December–March, DJFM) in northeast Australia (NEA). NEA rainfall shows a marked decrease over the past 50 years, mainly in the austral summer. Our analysis reveals that the summer rainfall decrease in NEA is generally an interdecadal phenomenon. The declining trend has an imprint in the tropical Australian summer monsoon (TASM). Not only does TASM have a phase-to-phase influence on NEA summer rainfall at the interannual scale, it is also closely linked with interdecadal variation in NEA summer rainfall. Thus, the decrease in NEA at the interdecadal scale could be attributed to corresponding variation in TASM. Moreover, the coupled linkage between TASM and NEA summer rainfall appears to be largely independent of El Niño–Southern Oscillation. One possible reason for the interdecadal weakening trend in TASM is a sustained interdecadal warming trend in sea surface temperature (SST) over the Wharton Basin (100°–130°E, 20°–5°S). When the Wharton Basin is in a cold state, anomalous westerlies occur in the lower troposphere in the TASM region, and cyclonic circulation anomalies and rising flows occur in the low and middle troposphere over NEA, which are associated with a strong TASM situation, consequently favoring enhanced rainfall over NEA; the opposite occurs in the case of a warm Wharton Basin. SST over the Wharton Basin has shown a continuous warming trend over the past 60 years, contributing to the weakening of TASM and consequently a decrease in NEA summer rainfall.