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The bi-decadal rainfall cycle, Southern Annular Mode and tropical cyclones over the Limpopo River Basin, southern Africa

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Abstract

The association between bi-decadal rainfall variability over southern Africa and the rainfall contributed by tropical cyclonic systems from the Southwest Indian Ocean (SWIO) provides a potential means towards understanding decadal-scale variability over parts of the region. A multi-decadal period is considered, focusing on the anomalous tropospheric patterns that induced a particularly wet 8-year long sub-period over the Limpopo River Basin. The wet sub-period was also characterized by a larger contribution to rainfall by tropical cyclones and depressions. The findings suggest that a broadening of the Hadley circulation underpinned by an anomalous anticyclonic pattern to the east of southern Africa altered tropospheric steering flow, relative vorticity and moisture contents spatially during the sub-period of 8 years. These circulation modulations induced enhanced potential for tropical systems from the SWIO to cause precipitation over the Limpopo River Basin. The same patterns are also conducive to increasing rainfall over the larger subcontinent, therefore explaining the positive association in the bi-decadal rainfall cycle and rainfall contributed by tropical cyclonic systems from the SWIO. An overview of regional circulation anomlies during alternating near-decadal wet and dry epochs is given. The regional circulation anomalies are also explained in hemispheric context, specifically in relation to the Southern Annular Mode, towards understanding variation over other parts of the Southern Hemisphere at this time scale.