

Potential impact of Weddell sea ice variability in southern African climate

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A potential role of interannual sea ice variability in the Weddell Sea in southern African climate is investigated by conducting data analysis and coupled general circulation model (CGCM) experiments. The Weddell Sea ice exhibits a distinct interannual variability during austral summer when the southern African rainfall experiences most of its annual rainfall. The sea ice concentration (SIC) in the Weddell Sea shows a significant negative correlation with southern African rainfall during early summer (Nov-Jan; Fig. 1). A low SIC anomaly in the Weddell Sea is associated with anticyclonic atmospheric circulation anomalies in the South Atlantic and southern Indian Ocean, which facilitates more moisture advection from the southern Indian Ocean. Composite analysis reveals that the low SIC anomaly in the Weddell Sea is attributed to increased solar radiation and the northwesterly wind anomaly. This low SIC anomaly, in turn, acts to cause warmer skin temperature over 60–70°S and reduce the meridional temperature gradient to the north. This is favoring condition for sustaining the anticyclonic circulation anomaly in the South Atlantic by enhancing the near-surface atmospheric stability. This intriguing association between the SIC and atmospheric circulation anomalies is also simulated in CGCM experiments, e.g. where the interannual sea surface temperature variability in the tropics and midlatitudes is suppressed by the model climatology. These results suggest that the Weddell Sea ice may undergo interannual variation via air-sea-ice interaction in the high latitudes, but have some impact on the overlying atmosphere in the South Atlantic, which is important for the southern African climate.

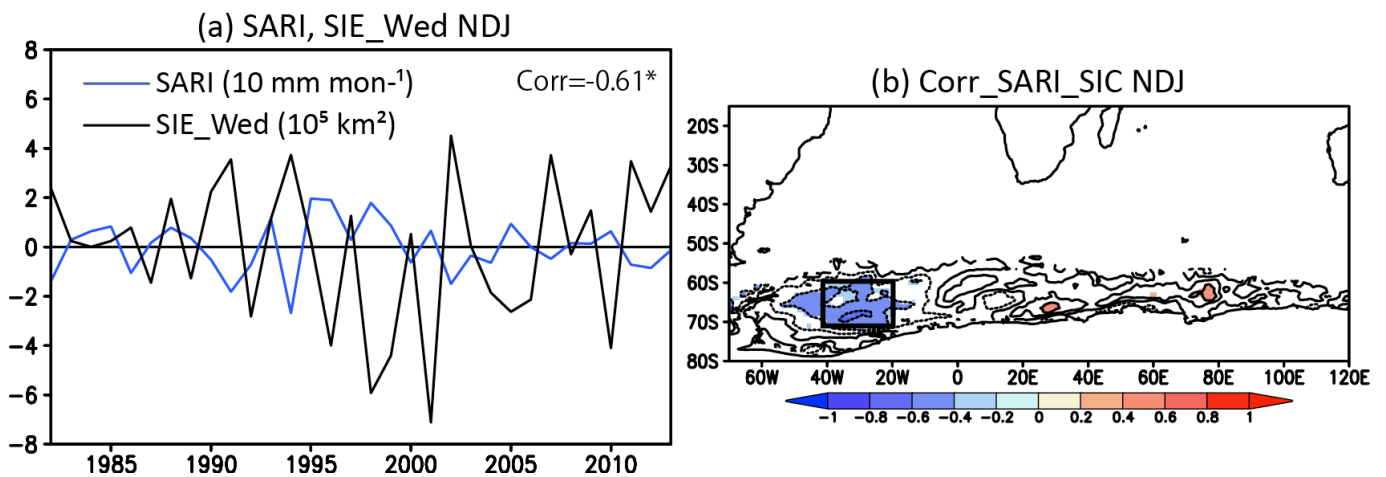


Figure 1. (a) Time series of Nov–Jan mean of the Southern African Rainfall Index (SARI, 10 mm month⁻¹) and the Sea-Ice Extent in the Weddell Sea (SIE_Wed, 10⁵ km²) during the satellite period of 1982–2014. (b) Spatial pattern of correlation coefficient between the Nov–Jan averaged SARI and the SIC.