

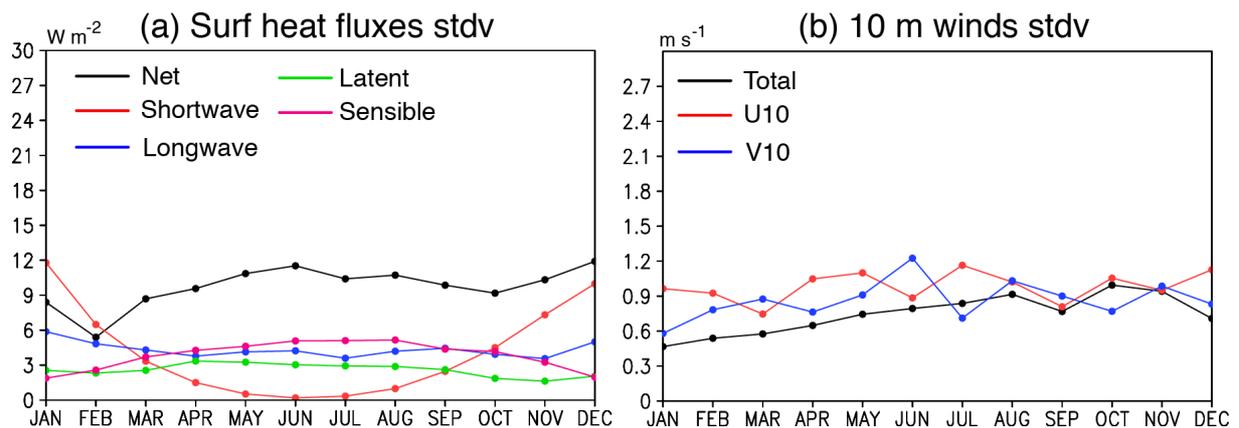
## Role of Weddell Sea ice in South Atlantic atmospheric variability

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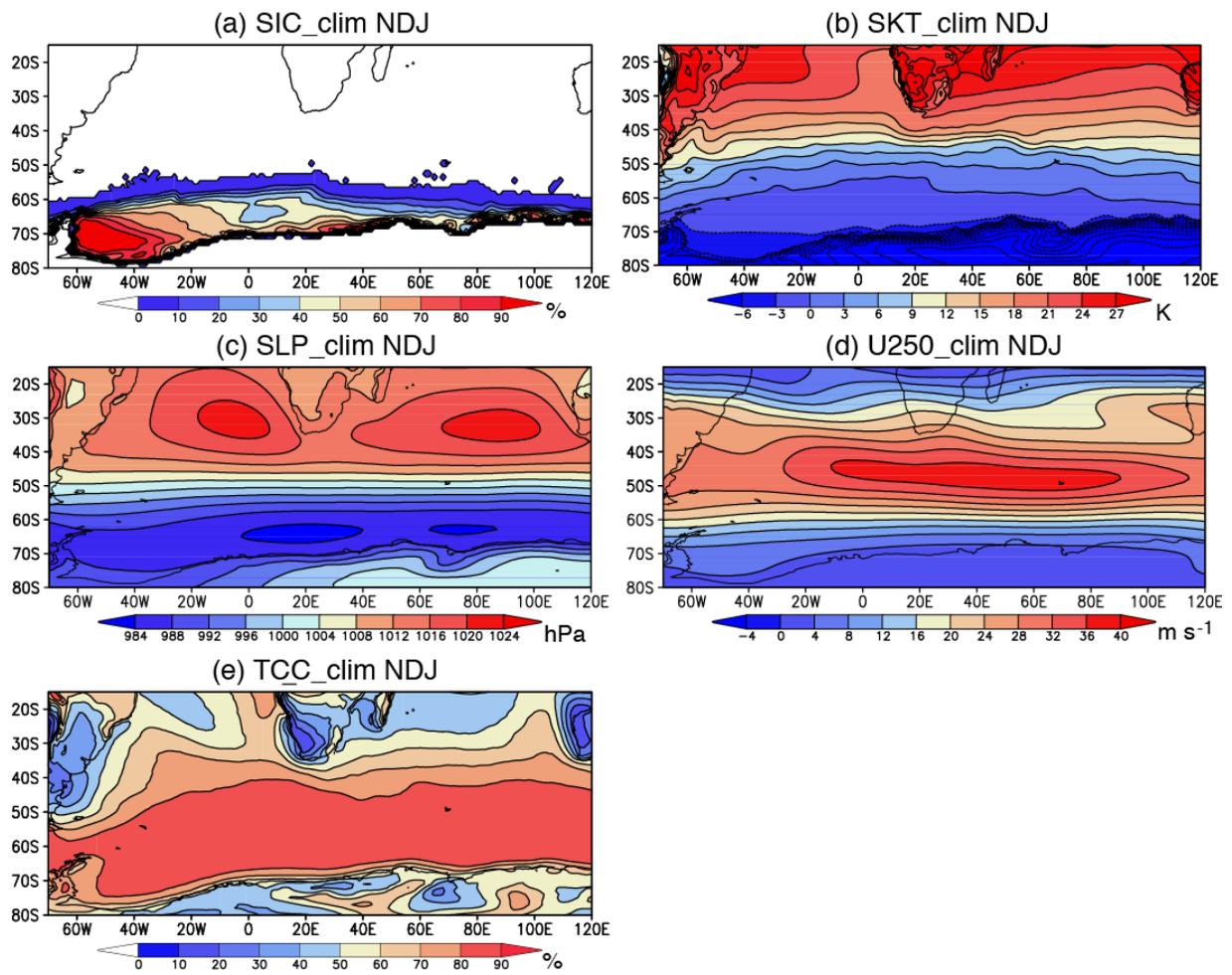
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Climate Research 74: 171–184 (2017)

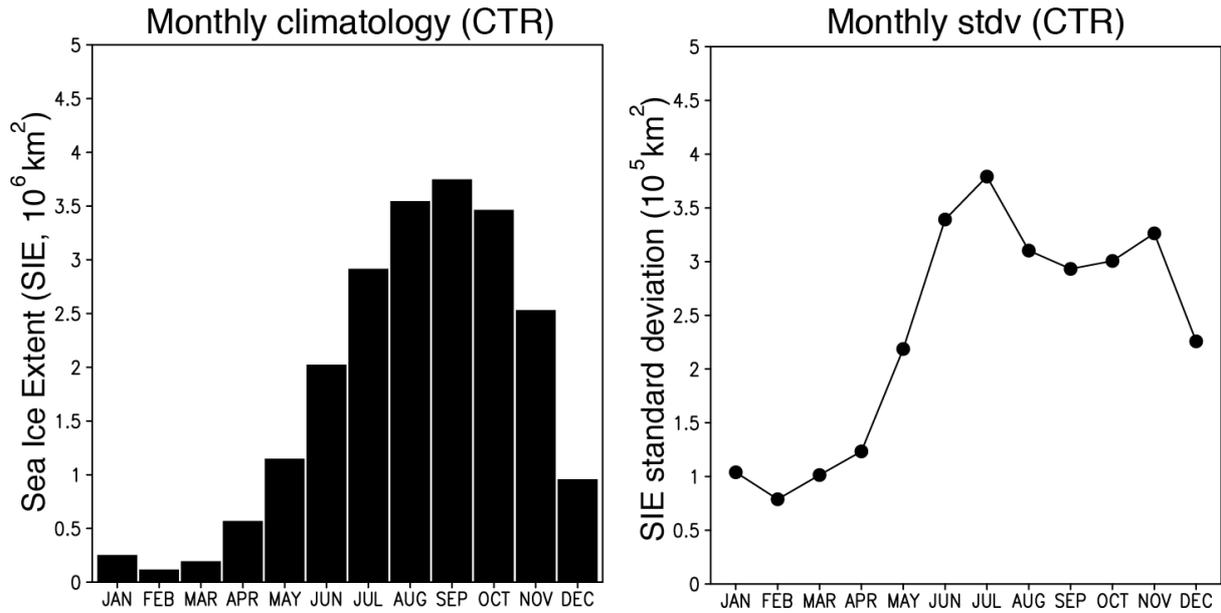
We show the supplementary figure (Fig. S1) to discuss how the two peaks observed in the monthly standard deviation of the sea ice extent in the Weddell Sea (Fig. 1, main article) are related to those in the surface heat fluxes and surface wind speeds in the second paragraph of Section 3.1 (main article). Figure S2 describes spatial patterns of seasonally mean climate variables during Nov-Jan derived from the historical data sets. Figure S3 shows monthly climatology and standard deviation of sea ice extent in the Weddell Sea simulated by the SINTEX-F2 model. Same as in Fig. S2, Figure S4 shows the seasonally mean climate variables derived from the SINTEX-F2 model.



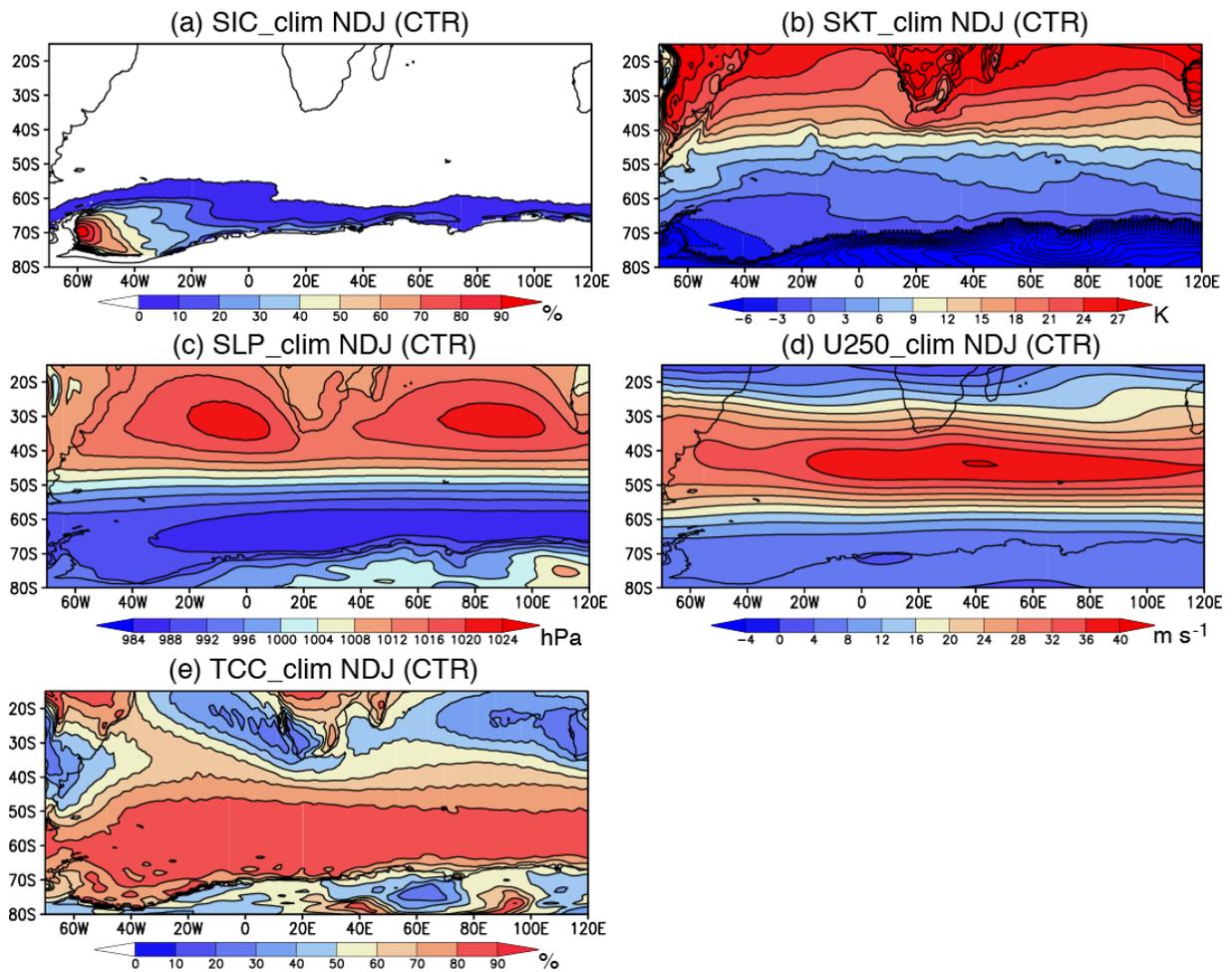
**Figure S1:** (a) monthly standard deviation of the net surface heat flux (black) and its four component, net shortwave radiation (red), net longwave radiation (blue), latent heat flux (green), and sensible heat flux (pink) averaged in the Weddell Sea (20-40°W, 60-70°S; unit  $W m^{-2}$ ). (b) Same as in (a), but for the total wind speed at 10 m (black) and its zonal (U10, red) and meridional (V10, blue) component (unit  $m s^{-1}$ ).



**Figure S2:** Spatial patterns of Nov-Jan mean of (a) the observed sea-ice concentration (SIC, in %), (b) skin temperature (SKT, in K), (c) sea level pressure (SLP, in hPa), (d) zonal wind speed at 250 hPa (U250, in m s<sup>-1</sup>), and (e) total cloud cover (TCC, in %).



**Figure S3:** Same as in Fig. 1, but for the 150-yr outputs of the CTR experiment by SINTEX-F2 model.



**Figure S4:** Same as in Fig. S2, but for the 150-yr outputs of the CTR experiment by SINTEX-F2 model.