

Role of Antarctic Circumpolar Current in decadal climate variability over southern Africa

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Potential sources of decadal climate variability over southern Africa are examined by conducting in-depth analysis of available data sets and coupled general circulation model (CGCM) experiments. The observational data in recent decades show a clear bi-decadal variability in the southern African rainfall with its positive peak during 1999-2000. It is found that the rainfall variability is related to anomalous moisture advection from the southwestern Indian Ocean, where the anomalous sea level pressure (SLP) develops. The SLP anomaly is accompanied by anomalous sea surface temperature (SST), and both the SLP and SST anomalies slowly propagate eastward from the South Atlantic to the southwestern Indian Ocean. The analysis of mixed-layer heat balance reveals that the SST anomaly in the southwestern Indian Ocean is mainly due to eastward advection of the SST anomaly by the Antarctic Circumpolar Current. The eastward propagation of SLP and SST anomalies are also confirmed in the 270-yr outputs of the CGCM control experiment. However, in a sensitivity experiment where the SST anomalies in the South Atlantic are suppressed by constraining model simulations with the model SST climatology, the eastward propagation of the SLP anomaly from the South Atlantic disappears. These results suggest that the local air-sea coupling in the South Atlantic may be important for initiation of the eastward propagation of the SLP anomaly from the South Atlantic to the southwestern Indian Ocean by the Antarctic Circumpolar Current. Although remote influences from the tropical Pacific and Antarctica were widely discussed, this study provides new evidence for the potential associations of regional air-sea interactions and Antarctic Circumpolar Current in the decadal climate variability over southern Africa.

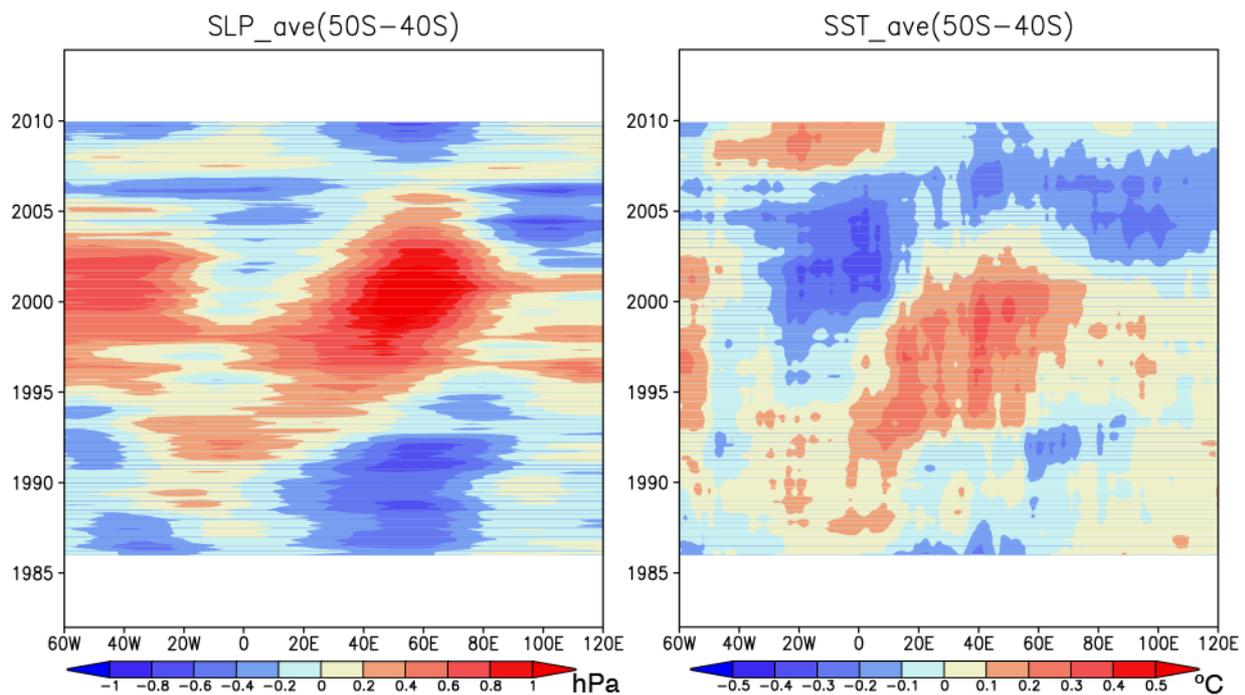


Figure 1: (Left) Time evolution of 8-yr running mean SLP anomaly averaged between 50°S – 40°S as a function of longitude. (Right) Same as in the left panel, but for the SST anomaly. The monthly mean ERA-Interim reanalysis and OISST datasets are used, respectively.

References

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