Decadal climate prediction in the southern Indian Ocean using SINTEX-F2 coupled GCM

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Decadal climate variation in the southern Indian Ocean plays a crucial role in rainfall variability over southern Africa through changes in moisture transport. The rainfall increase over southern Africa has a strong relation with warm sea surface temperature (SST) and high sea level pressure (SLP) anomalies in the Southwest Indian Ocean. Despite many efforts devoted to understanding the physical mechanisms, few studies have examined the decadal climate predictability in the southern Indian Ocean. This study aims at investigating decadal climate predictability in the southern Indian Ocean using a state-of-the-art coupled general circulation model (GCM), called SINTEX-F2. Here we performed 12 ensemble decadal hindcast experiments using different initial conditions with SST-nudging scheme, starting from Mar 1st in each year of 1982-2005.
On decadal timescale, the observed SST anomalies averaged in the Southwest Indian Ocean show positive peak in late 1990s and negative peak in late 2000s. Both positive and negative peaks are well reproduced in the decadal hindcast runs initiated in 1994 and 1999, respectively. Particularly, the decadal hindcast experiments initiated from 1999 successfully capture a distinct phase change from the positive to negative peak. In addition, the spatial patterns of warm SST and high SLP anomalies observed in late 1990s show a clear eastward propagation from the South Atlantic to the southern Indian Ocean along the Antarctic Circumpolar Current. The decadal hindcast experiments initiated in 1994 successfully capture this observed eastward propagation of SST and SLP anomalies from the South Atlantic, indicating an important role of SST anomalies in the South Atlantic. These results suggest that the SINTEX-F2 decadal hindcast experiments, with simple SST-nudging initialization, have reasonable skills in predicting the decadal climate variability of the southern Indian Ocean, important for the southern African climate.

キーワード：十年規模変動、南インド洋、海面水温
Keywords: Decadal variability, Southern Indian Ocean, Sea surface temperature

