

Interannual modulation and its dynamics of the Mesoscale Eddy Variability in the South Eastern Tropical Indian Ocean

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Interannual modulation of the mesoscale eddy activity at the intraseasonal time-scale in the southeastern tropical Indian Ocean (SETIO) and a possible mechanism responsible for the modulation are investigated using the results from a high-resolution oceanic general circulation model (OGCM). The model reproduces reasonably well the observed intraseasonal variability in the SETIO and its interannual modulation. It is shown that the simulated intraseasonal eddies are generated by baroclinic instability. The magnitude of the eddy activity in the SETIO changes year by year. From a composite analysis classified into cases in which significant eddy activity co-occurred with/without Indian Ocean Dipole (SETIO cooling) events, the meridional gradient of the heat content anomaly in the region south of Java Island is enhanced in both cases. This meridional gradient is generated by the negative heat content anomaly off Sumatra and Java in the SETIO cooling case and the positive heat content anomaly along 14S, as well as the weak negative anomaly in the coastal region, in the No-SETIO cooling case. The anomalous positive heat content along 14S in the No-SETIO cooling case is originated from the western tropical Pacific and it takes about half a year to reach the SETIO. These interannual variations in the upper-ocean heat content anomaly modulate the meso-scale eddy activity in the SETIO through enhancement of the baroclinic energy conversion, with the lag of 3 months. The energy budget analysis and the simple stability analysis also confirm this result.

Keywords: Southeastern tropical Indian Ocean, Mesoscale eddy, Indian Ocean Dipole