Abstract

Our studies suggest that the equatorial Indian Ocean Oscillation, which is the atmospheric component of Indian Ocean Dipole, is as important as El Nino and Southern Oscillation for the interannual variation of Indian Summer Monsoon Rainfall. Characteristic features of equatorial Indian Ocean Oscillation are suppression (enhancement) of convection over the eastern (western) equatorial Indian Ocean and easterly (westerly) anomalies of the zonal component of the surface wind over the equatorial region. We find that there is a strong, statistically significant, relationship between large deficits/excess in Indian summer monsoon rainfall and a composite index based on indices of El Nino and Southern Oscillation and equatorial Indian Ocean Oscillation.

We studied the impact of externally introduced atmospheric heating due to the enhanced convection over the western equatorial Indian Ocean, associated with positive equatorial Indian Ocean Oscillation, on the simulation of Indian summer monsoon by an atmospheric general circulation model. We find that convection over the western equatorial Indian Ocean played a critical role in above normal Indian summer monsoon activity in 1994.

We have also studied the triggering and evolution of the positive Indian Ocean dipole events. We suggest that severe cyclones over the Bay of Bengal during April-May, trigger these positive Indian Ocean dipole events. We show that all the positive Indian Ocean dipole events during 1958-2003 are preceded by at least one severe cyclone over the Bay of Bengal during April/May. We show that the severe cyclones over the Bay of Bengal can strengthen upwelling favorable southeasterlies along the Sumatra coast by enhancing pressure gradient across the eastern equatorial Indian Ocean and can suppress convection over the eastern equatorial Indian Ocean. Suppression of convection over the eastern equatorial

Indian Ocean leads to enhancement of convection over the western equatorial Indian Ocean and hence weakening of westerlies along the central equatorial Indian Ocean. This enhances the convergence over western equatorial Indian Ocean and further strengthening of convection over the western equatorial Indian Ocean. This positive feedback between convection and circulation strengthens the anomalous easterlies over the central equatorial Indian Ocean, until the wind becomes easterlies. These surface easterlies trigger eastward propagating, upwelling favorable Kelvin waves in the equatorial Indian Ocean. Together with the coastal upwelling due to anomalous southeasterlies along the Sumatra coast, these Kelvin waves lead to anomalous cooling in the eastern equatorial Indian Ocean and trigger positive Indian Ocean dipole events.