Characteristics of Tropical Indian Ocean during IOD Events

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Introduction

The inter-annual sea surface temperature (SST) anomalies in the Indian Ocean is of the order 0.5°C which is very less as compared to the other ocean like eastern Pacific ocean. Generally the Indian ocean remains warm with maximum SST of 28°C though the inter-annual variation is weak. The large fluctuations in the equatorial Indian Ocean SST anomalies may play significant role in local climate change. Such events are of great importance and are reported recently as Indian Ocean Dipole (Saji *et al.* 1999; Behera et al. 1999). The present study aims at simulation and understanding of such events using a simple 2½ layer basin scale thermodynamic ocean model.

The Model and Results

In the present work 2½ layer thermodynamic ocean model over the region 35 E-115 E, 30 S - 25 N is used which is fully described in McCreary et al.,1993. The model is spun up for 10 years using daily NCEP climatological winds and heat fluxes obtained from ten years mean for the period 1992 to 2001 to reach the steady state. Further the model integration is carried out using inter-annually varying daily surface winds and heat fluxes from 1992 to 2001. The inter-annual variability in the model SST and currents is very well simulated in the equatorial Indian Ocean. The model simulates large fluctuations with cold SST anomalies in the western equatorial Indian ocean and warm SST anomalies in the eastern equatorial Indian ocean during 1992 (negative IOD) and opposite in the year1994 (positive IOD). Figure 1a & 1b shows that the 1994 event is stronger (temperature difference 3°C) than the 1992 event (temperature difference 2°C). The model current field shows that the equatorial jet is absent in 1994 as also reported by Vinaychandran et. al., 1999, but it is present in 1992 event (Fig. 1c &d) with opposite subsurface currents. The cross equatorial flow is found to be weak during 1994. The analyses of the model currents show that the response of this event is not only confined to the equatorial region but also found in the other parts of tropical Indian ocean. The upwelling coastal Kelvin wave during the positive IOD events influence the circulation in the Bay of Bengal (Fig.1f) in the month of September. This strong propagating Kelvin wave along the perimeter of the Bay sets up southward currents along the eastern boundary of the Bay and reflected Rossby wave sets northward currents along the western boundary of the Bay forming an anti-cyclonic circulation in the Bay. During negative IOD event in 1992, the circulation in the Bay of Bengal (Fig. 1e) is similar to the climatological one and remains unaffected.

The subsurface temperature anomalies during the dipole events 1992 and 1994 are compared. It is seen that the subsurface dipole events during both the years is well simulated by the model. (Figure not shown).

References

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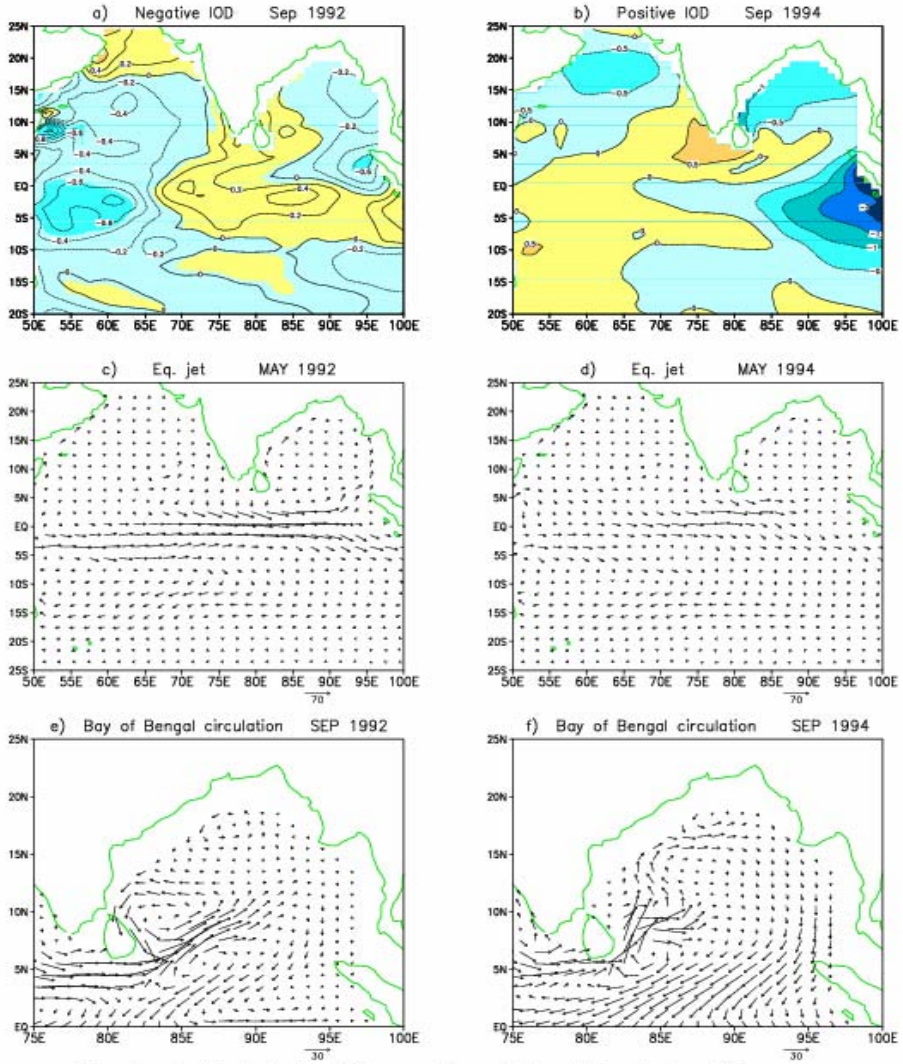

Fig. 1 Model simulated SST anomalies and circulation during IOD events.