ABSTRACT

The Bay of Bengal (Bay) is a less productive tropical ocean with relatively low values of surface layer chlorophyll-a concentration (Chl-a). Temporal evolution of Chl-a in majority of the Bay shows a semiannual cycle with two distinct blooms – summer bloom during summer monsoon and winter bloom during winter monsoon. In this thesis, characteristics of Chl-a winter bloom in the Bay and the governing physical mechanisms are investigated. The winter bloom onset occurred almost simultaneously in most of the Bay during October-November. But the winter bloom peaked slightly earlier in the western Bay compared to the eastern Bay. Consequently, an eastward shift in winter bloom peak is observed. Moreover, the winter bloom in the western Bay is of shorter duration (~1-2 months) while that in the eastern Bay is of longer duration (~3-4 months). Distribution of Chl-a in the surface layer of the ocean is determined by the availability of sunlight and nutrients. Surface mixed layer in the Bay receives sufficient light to sustain photosynthesis throughout the winter bloom period. Hence, it is apparent that the availability of nutrients regulates the Chl-a distribution in the Bay. Surface mixed layer of the Bay receives nutrients through three pathways– influx from subsurface depths, horizontal movement of nutrient-rich water such as river plumes, and atmospheric dust deposition. The influx of nutrients from the subsurface depths are driven by coastal upwelling, Ekman pumping, planetary wave propagation, vertical mixing, mesoscale eddies, and tropical cyclones. Several high intense winter blooms were observed in the Bay during the period September 1997-June 2012. The high intense winter blooms in the Bay are usually confined to three local regions, namely northwestern Bay, southwestern Bay, and the area encompassing eastern and southcentral Bay. The intense blooms in the southwestern Bay, eastern Bay, and southcentral Bay co-occur with anomalies in zonal wind stress occurring in the equatorial Indian Ocean. But, intense blooms in the northwestern Bay are driven by tropical cyclones, offshore movement of river plumes and mesoscale eddies.

Key words: Chlorophyll-a, winter bloom, Bay of Bengal, Indian Ocean Dipole