ABSTRACT

The North Indian Ocean (NIO) shows prominent blooming regions at different parts of the basin under favorable atmospheric and oceanographic conditions. The chlorophyll-a (Chl-a) variability in the basin is significantly affected by different physical mechanisms due to variable natural forcing over the NIO. The variability of Chl-a in NIO is investigated using Regional Ocean Modelling System (ROMS) coupled with Nitrate-Phytoplankton-Zooplankton-Detritus (NPZD) biogeochemical model and satellite observations. The study aims to investigate the role of meteorological and oceanographic parameters on seasonal variability of Chl-a in different regions of NIO during winter and summer monsoons. The study depicts the seasonal Chl-a variability over productive regions in the Arabian Sea (AS), Bay of Bengal (BoB) and Equatorial Indian Ocean (EIO) which are associated with Ekman pumping driven by cyclonic wind stress curl, wind-induced mixing, lateral advection and mesoscale eddies. Subsequently, the thesis analyses the interannual variability of Chl-a in NIO and its relation with Indian Ocean Dipole (IOD) and El-Niño/Southern Oscillation (ENSO) events. The interannual variability of Chl-a over the NIO shows the influence of ENSO and IOD at different locations over the Bay. The individual role of IOD and ENSO on both surface Chl-a and 20 degree isotherm depth (D20) is segregated through partial regression analysis for a period of 25 years (1993-2017). The thesis also examines the influence of meteorological parameters on the Chl-a concentration during the events of a few tropical cyclones in the BoB. While comparing the Chl-a response during the 2006-2007 event with an earlier event 1997-1998 there exists varied Chl-a response across the NIO. Finally, the assessment of the influence of daily forcing of net heat flux and wind stress curl in case of four cyclones Mala, Nilam, Phailin and Hudhud shows that the post-monsoon cyclones have a high concentration of Chl-a, attributed to net heat flux forcing. The investigation of stratification parameter during cyclone in the BoB shows that pre-monsoon cyclone winds are strong enough to break the stratification, while during the post-monsoon season cyclones both winds and negative net heat flux plays an important role in mixing and breaking of upper-ocean stratification.