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A comparative study of chlorophyll-a concentration during different tropical cyclones in the Bay of Bengal based on measurements and model simulations

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Chlorophyll-a (chl-a) pigments derived from ocean color can be used as a tool for estimating phytoplankton distribution in the observed oceanic region. This study aims at providing new insights on the variability of chl-a concentration during the occurrences of different cyclones in the Bay of Bengal (BoB). We consider two tropical cyclones of different intensities observed in the BOB; MALA and NILAM. MALA was a cyclonic storm and was formed on 24 April 2006 and dissipated by 30 April 2006. The wind speed and lowest pressure during the MALA have been recorded as 185–220 Km/h and 950 hp, respectively. Multi-satellite observations are used for chl-a (SeaWiFS, MODIS, OCM-2), winds (QuickSCAT) and sea surface height (SSH) (TOPEX/POSEIDON) analyses in this study. Argo data taken from CORIOLIS (along the cyclone track) are used for temperature and salinity, from which Mixed Layer Depth (MLD), Isothermal Layer Depth (ILD), Barrier Layer Thickness (BLT) is calculated. A case study for MALA cyclone using daily forcing of winds and surface net heat flux in 'Regional Ocean Modeling System' (ROMS) with NPCHLZD (Nitrate, Phytoplankton, Chlorophyll, Zooplankton and Detritus), five components ecosystem model is used for study the chl-a variability during the cyclone. The results show high chl-a concentration along the track as well as in the right side of the track of the cyclone. The daily variations of MLD, BLT, SSH and wind stress curl (WSC) are compared with the daily time series of chl-a for pre-cyclone, during cyclone and post cyclone period. During and after the passage of cyclone average chl-a values increased from 0.2 mg/l to 0.4 mg/l and greater. It shows good agreement with MLD (30–40 m), negligible BLT and strong WSC (4*10-6n/m3). It implies the strong winds has initiated upwelling, which subsequently triggered phytoplankton bloom during and after the cyclonic storm. The cyclone NILAM was formed on 28 October 2012 and dissipated by 1 November 2012, which had a great impact in the southern India. The wind speed during the cyclone was 85-100 km/h and the lowest pressure was about 990 hPa. Before the cyclone the average chl-a concentration was about 0.17 mg/l and it increased to 0.27–29 mg/l during and after its passage over the region. In accordance with high WSC (1.06*10-7n/m3), the barrier layer observed to be disappeared and the MLD extended up to 40 m. Compared to the post-monsoon cyclone NILAM, both the chl-a concentration and WSC are much larger for the pre-monsoon cyclone MALA.