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Biogeochemical response to tropical cyclone Hudhud in the Bay of Bengal using an ocean-biogeochemical coupled model

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It is challenging to study the surface and sub-surface oceanic physical and biogeochemical response in the intense weather conditions like tropical cyclones (TC). Due to limitation of observed subsurface data, most of the studies utilize satellite measured parameters to examine the response of ocean to a passing cyclone. The Bay of Bengal (BoB) is a semi landlocked basin in the northeastern Indian Ocean. The supply of freshwater from rivers and precipitation cause a shallow mixed layer and warmer sea surface temperature leading to cyclogenesis in the BoB. A few studies used in-situ Bio-Argo float which is limited to specified single point location to study oceanic response during the passage of Hudhud cyclone. The genesis of TC Hudhud in the Andaman Sea was on 6 October 2014, later it was intensified as Cyclonic Storm (CS) on 8 October and made landfall near Visakhapatnam on 12 October as an Extremely Severe Cyclonic Storm (ESCS). The TC Hudhud travelled nearly 1600 km in the ocean from genesis to landfall location. Only a few studies carried out on surface and subsurface biogeochemical response during TC Hudhud using Bio-Argo float. There is only one float located on the cyclone track. At that position, the system was a severe cyclonic storm (SCS) around wind speed was 45-55 knots. In the present study, we demonstrate the surface and subsurface bio-physical response along the track from CS to ESCS of TC Hudhud using a fully coupled ecosystem (ocean-biogeochemical) model. The model is configured using Regional Ocean Modeling System (ROMS) coupled with Bio-fennel. The model well captures the variability of surface and subsurface features of biogeochemical and physical parameters like chlorophyll concentration, dissolved oxygen, nutrients and temperature, salinity to compare with Bio-Argo float, and satellite data. Analysis shows that TC Hudhud induced upwelling cause intense water mixing which has a substantial impact on biological processes from depth of oxycline, nutricline to the upper-ocean layer. The model results are further analyzed to understand upper-oceanic physical and biological processes for the pre- and post-cyclone periods and their along-track variations. Model simulation shows changes in subsurface chlorophyll maximum, oxycline, nutricline and chlorophyll blooms with the passage of TC Hudhud in the BoB. The physical and biological processes are discussed to explain the observed and modelled variations in the upper-ocean characteristics.