Impact of intra-seasonal oscillations of Indian summer monsoon on biogeochemical constituents of North Indian Ocean

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Abstract

The instability indices as well as the DWR data are utilized in the present study to estimate the speed of squall associated with thunderstorms during the pre monsoon season over Kolkata (22º 32'N, 88º 20'E), India. The ranges of the selected indices and the Doppler Weather Radar data are estimated using the normal probability distribution function. The statistical skill score analysis is implemented to select the instability indices relevant for estimating the squall speed of thunderstorms over Kolkata. The threshold ranges of the selected indices and the DWR data are used as the inputs while the target output being the squall speed associated with thunderstorms. The method of rough set theory is adopted in this study to identify the best combination of the instability indices and DWR data for estimating the squall speed. The result is validated with the observation.

Objective

The aim is to identify a suitable combination of the threshold ranges of significant instability indices and the Doppler Weather Radar products to forecast the squall speed associated with thunderstorms over Kolkata

DATA

The analysis is carried out with daily data of total chlorophyll (mg/m), mixed layer depth (m), nitrate (nano moles/L), precipitation (mm/day), sea - surface temperature (°C) outgoing long wave radiation (OLR) and wind (m/s). The data of total chlorophyll, mixed layer depth, nitrate are the products of NOBM model collected from Giovanni site. The data of sea surface temperature are taken from NOAA website. The data are taken for the period from 1998 to 2007. The precipitation data is taken from TRMM website. Wind data is collected from NCEP-NCAR.OLR data are collected from NOAA website over Central India (18° – 28° N; 73° – 82° E) and computed the anomaly to identify the active and break phases of ISM

Findings

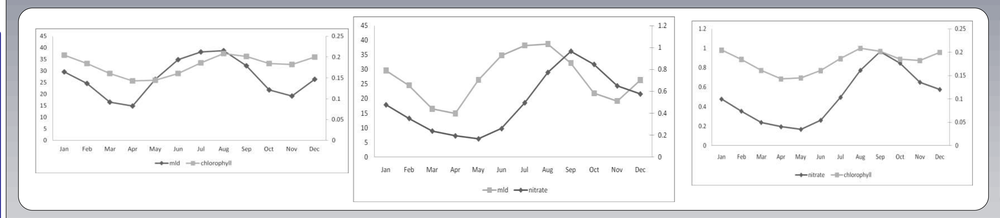

Figure 1 Monthly variation of the biogeochemical parameters; MLD, chlorophyll and nitrate in Bay of Bengal during the period from 1998 to 2007.

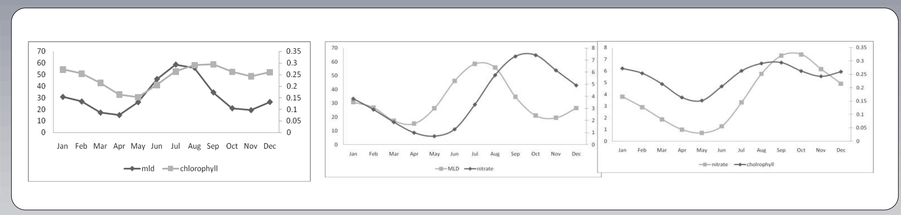

Figure 2 Monthly variation of the biogeochemical parameters; MLD, chlorophyll and nitrate in Arabian Sea during the period from 1998 to 2007.

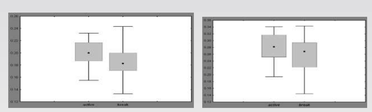

Figure 3 Variability of chlorophyll concentration during active and break phases in (a) Bay of Bengal and (b) Arabian Sea

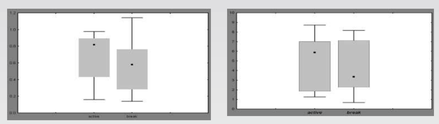

Figure 4 Variability of nitrate concentration during active and break phases in (a) Bay of Bengal and (b) Arabian Sea.

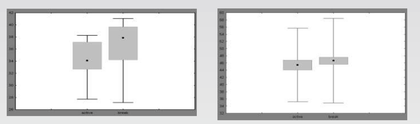

Figure 5 Variability of mixed layer depth during active and break phases in (a) Bay of Bengal and (b) Arabian Sea

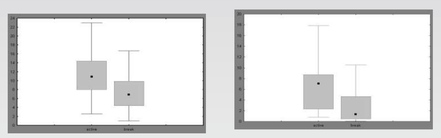

Figure 6 Variability of precipitation during active and break phases (a) Bay of Bengal and (b) Arabian Sea

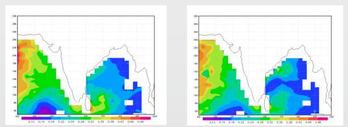

Figure 7 Spatial distribution of ocean surface chlorophyll concentration in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM

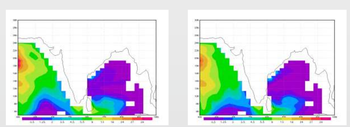

Figure 9 Spatial distribution of mixed layer depth (MLD) in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM.

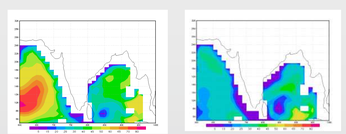

Figure 9 Spatial distribution of mixed layer depth (MLD) in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM.

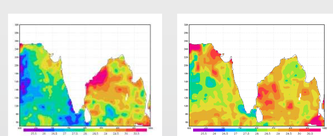

Figure 10 Spatial distribution of sea surface temperature (SST) (°C) in Bay of Bengal and Arabian sea during (a) active and (b) break phases of ISM.

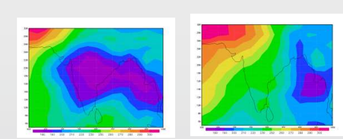

Figure 11 Spatial distribution of outgoing long-wave radiation (OLR, Watt/m²) in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM.

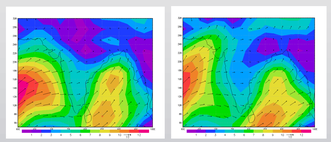

Figure 12 Spatial distribution of surface winds (m/sec) in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM.

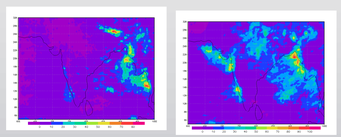

Figure 13 Spatial distribution of precipitation (mm/day) in Bay of Bengal and Arabian Sea during (a) active and (b) break phases of ISM.

Conclusions

The study concludes that upper ocean biology and chemistry significantly differ during the active and break phases of Indian summer monsoon.
An increase in precipitation, strong southwesterly wind and comparatively cold SST in AS and warm SST in BOB might be responsible for deepening of the mixed layer over AS and BOB
The productivity in terms of chlorophyll concentration is higher during active phase.
The SST is also observed to be warmer compared to active phase.
The mixed layer is shallower during break compared to active phase.
Despite the difference is low, comparatively higher nitrate and chlorophyll concentration is obtained in AS during active phase.
Warmer SST is observed in BOB during active than break phase.
Wind is on the other hand, weaker during break phase.
Due to the absence of upwelling in BOB it is free from nutrient as no source of nitrate is available from deeper ocean.
Precipitation is more in active phase as a result of this discharge from the river is also more in BOB.
Physical processes which modulate the intra-seasonal variation of biogeochemical constituent are significantly different in different basins of North Indian Ocean.
Improved data retrieval process of ocean parameter may provide more information.