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Influences of the Indian Ocean Dipole on monsoonal oceanographic features in the Gulf of Thailand based on a 3D hydrodynamic model

Kittipong Phattananuruch[1], Tanuspong Pokavanich[1], Anukul Buranapratheprat[2]

[1]Kasetsart University, Thailand. [2]Burapha University, Thailand

Abstract

Regional atmospheric states were reported to affect the oceanography of the Gulf of Thailand (GOT). Among them, the influences of the Indian Ocean Dipole (IOD) on the GOT oceanography have not been described sufficiently. Delft3D-FLOW model was used to investigate those impacts during the period between 2016-2020 using salinity and temperature condition from HYCOM/NCODA analysis dataset, ECMWF-ERA5 meteorological analysis data and tidal data retrieved from OTIS-TPXO model. Preliminary results revealed the notable influences of the IOD during the southwest monsoon (SWM) and the northeast monsoon (NEM) in terms of water volume transport, salinity and water temperature at times. During the positive IOD phase in SWM 2019, wind speed over the GOT increased, and temperature and salinity at the near surface rose when compared with the conditions during the neutral phase. The increased wind speed enhanced inward flow from the South China Sea (SCS). During the extreme negative phase of IOD in SWM 2016, inward flow from the SCS was promoted, and near surface salinity rose significantly when compared with those during the neutral phase and positive phase. During positive IOD phase in NEM 2020, temperature in the upper GOT and the south of the GOT mouth decrease. Salinity of the entire GOT were higher than those during the neutral phase. Inward flow and outward flow decreased during this season. It can be noted that weaker wind speed over the GOT were observed during both El Niño and positive IOD phase but near surface temperature and salinity distribution patterns were different. Based on three-dimensional hydrodynamic models, this study was able to simulate the inter-annual variability of monsoonal oceanographic features in the GOT. Future works include the investigation of controlling mechanisms over the observed changes, effects of the IOD during the inter-monsoon and analysis with longer periods to reconfirm the findings.

Keywords

3D hydrodynamic model, Indian Ocean Dipole, Gulf of Thailand, monsoonal oceanographic features