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Importance of Cyclone Induced Vertical Mixing: A Case Study on Tropical Cyclones Maarutha and Mora in the Bay of Bengal

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Abstract

Time series measurements from the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) mooring at 15°N, 90°E in the vicinity of the cyclone passage Maarutha and Mora, are used to investigate the upper ocean variability, variations of the cyclone heat potential (CHP) and the importance of cyclone induced vertical mixing (VM) in the Bay of Bengal (BoB) during April-May 2017. Maarutha initially developed on 15th April 2017, intensified on 16th and dissipated at Myanmar on 17th. Mora initially developed on 27th May 2017, intensified on 28-29th and dissipated on 30th May 2017. Shallow mixed-layer depths (MLD), relatively strong stratification and high sea surface temperatures (SST) are obvious during pre-monsoon period in the BoB. The analysis revealed a large SST drop by ~1.53 °C, decrease of surface salinity ~0.19 psu, deepening of MLD and isothermal-layer depth (ILD) by ~18.1 m and ~30.9 m, respectively, due to Maarutha. A similar upper ocean response was observed during Mora. Strong turbulent mixing due to strong winds and currents led to the deepening of MLD and ILD which facilitated the VM (entrainment and vertical diffusion) of colder water. Under the influence of Maarutha and Mora, VM was enhanced by ~95.4 Wm^{-2} and ~220 Wm^{-2} and the associated cooling effect caused for the decrease in CHP by ~22.55 $KJcm^{-2}$ and ~22.29 $KJcm^{-2}$, respectively. Thus, the SST cooling associated with cyclone induced VM tended to inhibit the cyclone intensification itself and emphasized the importance of upper ocean dynamics during the passage of a cyclone. Therefore, the SST-intensity (warming/cooling) feedback and variability of CHP under the influence of VM is of practical importance for BoB cyclones. This brings the necessity of a long-term basin-scale study on the role of upper-ocean dynamics during cyclones in the BoB.

Key words: *Bay of Bengal, Cyclone Heat Potential, SST, Vertical Mixing*

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