Abstract

The thesis attempts to study the Kelvin waves and their effect on upper ocean characteristics of the Bay of Bengal (BoB) using observations, reanalysis datasets and the Regional Ocean Modeling System (ROMS). The first part of the thesis finds employing numerical experiments with a climatological setup of ROMS that the seasonal Kelvin wave signals in the coastal BoB become prominent and realistic with inclusion of river runoff to the model. For example, the second downwelling Kelvin wave (dKW) is prominently recognized in the coastal BoB. The second part explores using Reanalysis data that the interannual variation in the time rate of change of upper ocean heat content (UOHC) in the BoB is correlated to meridional heat transport through its southern boundary. The second upwelling Kelvin wave (uKW) becomes strong and the second dKW is replaced by an uKW in the positive Indian Ocean Dipole (IOD) – El Niño co-occurrence years, resulting in southward heat transport in the eastern bay. The opposite scenario happens during the negative IOD – La Niña co-occurrence years. The UOHC in the BoB shows the presence of quasi-biennial oscillation being prominent during 1994 – 2000. The numerical experiments with an interannual setup of ROMS show that this biennial variation in the BoB is linked with that over the eastern equatorial Indian Ocean UOHC through coastal Kelvin waves. The period 1994 – 2000 witnessed two positive IOD – El Niño, one negative IOD – La Niña co-occurrence years, one negative IOD only, and one La Niña only year. The co-occurrences along with individual occurring ENSO and IOD bring out the quasi-biennial variation prominent in the period. Finally, the thesis examines the characteristics of Kelvin waves during pre-monsoon period of June Indian summer monsoon years, 2009 and 2012, occurred during recent global warming hiatus. It is found that the strength of the first uKW was reduced in these years. *This resulted in lowering the cyclonic EKE by 35% and 50% during April – May of 2009 and 2012 respectively; whereas, cyclonic eddy area is reduced by 18% and 24% respectively.* The reduction in cyclonic eddy activity reduces the upwelling which is reflected in UOHC, thermocline depth, and primary productivity also.

Keywords: Kelvin waves, Upper ocean heat content, Interannual variability, ROMS, Bay of Bengal, River runoff.