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Eddies and their energetics in the Bay of Bengal

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Eddies are integral part of ocean circulation. They play an important role in energy transfer. The surface kinetic energy in eddies can be ten times higher than the energy of the current through which these are generated. Eddies influence the thermodynamic characteristics of the upper-ocean. Oceanic eddies trap and transport hot (cold) water in the core of an anticyclonic (cyclonic) eddy. Therefore, these eddies can modify the thermal structure by the advection of temperature anomalies and its subsequent mixing. Generation of eddies takes place mainly due to the baroclinic instability of the ocean. However, some of the eddies may form due to coastal and bathymetrical geometry. The Bay of Bengal (BoB) is an enclosed basin in the northern Indian Ocean (IO). The BoB exhibits unique physical and dynamical properties due to surplus low-saline waters and shallow mixed layer. It observes seasonal variation of wind and changes in the surface current pattern. Major rivers originating from the Himalayan glaciers drain into the BoB throughout the year with a peak in July-October. The riverine freshwater together with strong post-monsoon (October-November) coastal current generate complex and turbulent surface current pattern with a large number of eddies in the BoB. The wind forcing, coastal currents, and bathymetry make favorable conditions for the generation of eddies in the BoB. In the present study, a numerical ocean model Regional Ocean Modelling System (ROMS) used to simulate the mesoscale eddies in the BoB. The ROMS model uses sigma vertical coordinates which helps in taking account of the effects of coastal and bathymetrical structures on surface circulation and eddy generation. The model results are verified with the available observations. For the detection and tracking of eddies at the surface, both the geometrical and dynamical methods are used. The geometrical method is based on the identification of local minima and maxima of dynamic sea surface height. Whereas, the dynamical method utilizes current turbulences arising from strain or vorticity to identify eddies. Using model simulations, the cyclonic and anticyclonic eddies are identified in the BoB. The life span (time period) and the kinetic energy of individual eddies are calculated. The spatial and temporal distribution of eddies and their energetics in the BoB are discussed. Further, the propagation tracks of individual eddies are estimated.