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Seasonal Variability of the Mixed Layer in the Central Bay of Bengal

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Hydrographic data from NODC and RNODC were used to study the seasonal variability of the mixed layer in the central Bay of Bengal (8oN to 20oN and 87oE to 91oE), while meteorological data from COADS were used to explore atmospheric forcing responsible for the variability. The observed changes in the mixed-layer depth clearly demarcated a distinct north-south regime with 15oN as the limiting latitude. North of this latitude mixed-layer depth remained shallow (∼20 m) for most of the year without showing any appreciable seasonality. Lack of seasonality suggests that the low-salinity water, which is perennially present in the northern Bay, controls the stability and mixed-layer depth. The observed winter freshening is driven by the winter rainfall and associated river discharge, which is advected offshore under the prevailing circulation. The resulting stratification was so strong that even a 4oC cooling in SST during winter was unable to initiate convective mixing. In contrast, the southern region showed a strong semi-annual variability with deep MLD during summer and winter and a shallow MLD during spring and fall intermonsoons. The shallow MLD in spring and fall results from primary and secondary heating associated with increased incoming solar radiation and lighter winds during this period. The deep mixed layer during summer results from two processes: the increased wind forcing and the intrusion of high-salinity waters of Arabian Sea origin. The high winds associated with summer monsoon initiate greater wind-driven mixing, while the intrusion of high-salinity waters erodes the halocline and weakens the upper-layer stratification of the water column and aids in vertical mixing. The deep MLD in the south during winter was driven by wind-mixing when the upper water column was comparatively less stable. The deep MLD between 15o and 17oN during March to May cannot be explained in the context of local atmospheric forcing. We show that this is associated with the propagation of Rossby waves from the eastern Bay.