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Modelling of air-sea interaction and water mass exchanges in the Bay of Bengal and the equatorial Indian Ocean

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Large freshwater fluxes into the Bay of Bengal by rain fall and river discharges result in strong salinity fronts in the vicinity of the equator, where low-salinity Bay of Bengal water encounters high salinity water masses with origin in the western Indian Ocean . The region south and south–east of Sri Lanka is a particularly dynamic region where equatorial jets, equatorial waves and semi-diurnal internal waves interact with low-salinity outflow from the Bay of Bengal to form an eddy-rich environment that affect vertical mixing and air-sea interaction. To investigate these processes, the U. S. Naval Research Laboratory is using two high-resolution coupled models, one of the entire tropical Indian Ocean region that include remote forcing for the region, and a higher resolution local coupled model for the Bay of Bengal area. Daily simulations are produced in operational nowcast modes by both models. Details of the models based on the state-of-the-art Coupled Ocean-Atmosphere Mesoscale Prediction System (COAMPS), which is a fully coupled atmosphere, ocean and wave forecast model including 3D variational data assimilation, will be presented. The simulations are analyzed to understand several of the physical processes and dynamics involved in the water mass exchange between the equatorial Indian Ocean and in the Bay of Bengal on meso-scales and sub-mesoscales. Examples of active processes such as the intrusion and subduction of Arabian Sea water, impact of equatorial waves and jets, the role of barrier layers and internal wave radiation and how it relates to mixing of temperature and salinity will be presented.