ABSTRACT

The Bay of Bengal (BoB) receives a large amount of freshwater from a number of adjacent rivers of the bordering countries. Along with the monsoon precipitation, such river inputs make the northern Bay as the freshest region of the Indian Ocean. This thesis work aims at understanding the impact of rivers on the circulation features and the water mass characteristics of the BoB using a state-of-the-art high resolution ocean state simulation. In order to differentiate the impact of rivers on the BoB, two parallel model simulations are carried out with and without river input. The river input consists of the monthly climatological discharges from the rivers Krishna, Godavari, Mahanadi, Brahmani, Subarnarekha, Hooghly, Ganges-Brahmaputra-Meghna (GBM), Irrawaddy, Sittang and Salween. The river input is specified across the model coastal boundary in the form of a set point sources. A seasonal cycle of salinity is provided at each of the point sources, which is constructed in a conservative approach using the available spatially and temporally sparse synoptic observations.

The model realistically simulates the poleward Western Boundary Current (WBC) with its meandering nature during spring and the equatorward East India Coastal Current (EICC) during autumn, which are consistent with the observations. Strengthening of EICC, and formation of a narrow westward flow at the northern boundary as well as a well organized cyclonic gyre in the head of the Bay during summer monsoon are the important findings in the circulation from the simulation with river input. A substantial improvement in the water mass characteristics of the Bay is found when river input is included. The model simulated surface salinity and density approach towards the climatological values after the inclusion of the river input, while they are still higher than the climatology by 0.57 psu and 0.26 kg/m^3 respectively. However, the river input reduces the domain averaged annual surface salinity and surface density by 0.99 psu and 0.73 kg/m^3 respectively when compared to the non-river simulation. The freshwater from the rivers increases the static stability of the upper 100 m of the Bay. The study reveals that the river input is the dominating factor in formation of the strong near-surface stratification, which was observed from past hydrographic studies, in the northern BoB during summer monsoon and post monsoon. The river water spreads over the BoB in the form of freshwater plume and results in shoaling of mixed layer depth by ~13 m (annual domain average) and formation of thicker barrier layer, which are more realistic.

Keyword: ROMS, river input, point source, stratification, WBC, EICC, MLD, BLT