

1 **High-resolution Simulations for the Bay of Bengal Mean Features:**
2 **Sensitivity to River Input and Wind Forcing**

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ABSTRACT

28 The sensitivity of the Bay of Bengal (BoB) mean features (thermohaline and circulation) to two
29 climatological winds forcing (weaker COADS and stronger QuikSCAT) and two representations
30 of river inputs (river inflow with seasonally varying estuarine salinity or with zero salinity) is
31 investigated, using an eddy resolving ROMS setup. A set of four different simulations (each 15-
32 year long) using the two winds forcing and two river inputs are compared and contrasted. The
33 sensitivities are analyzed in terms the surface circulation, thermohaline structure, freshwater
34 plume dispersion, and the coastal upwelling along the western boundary during late spring/
35 summer. All simulations reproduce the main features of the Bay; however, magnitudes and
36 variabilities depend on forcing conditions. The major mean effects of winds and river inputs are
37 found mostly limited to the upper 50 m of the water column in a domain-average sense, with
38 deeper and stronger influence in the northern BoB. As expected, the stronger QuikSCAT wind-
39 induced enhanced mixing lowers (enhances) the upper ocean temperature (salinity), weakens the
40 near-surface stratification. Moreover, stronger winds enhance eddy activity, strengthen the
41 springtime Western Boundary Current (WBC) and enhance coastal upwelling during spring and
42 summer along the east coast of India. The fresher river input reduces the surface salinity and
43 hence enhances spreading and intensity of the freshwater plume, stratification, and barrier layer;
44 however, its impact on SST is negligible. The lower salinity simulation prefers an eddy-
45 dominant springtime WBC, and enhances the freshness, strength, and southward extent of the
46 autumn East India Coastal Current (EICC) core with plume water inhibition by about 10% over
47 the domain. The stronger QuikSCAT winds during the summer monsoon do not favor the
48 spreading of the freshwater plume but rather reduces its spatial extent due to erosion of the
49 freshwater buildup due to enhanced mixing. The impacts of all four forcing conditions on the
50 vertical thermohaline structure are found to be region specific and are realized differently from
51 northern to southern BoB. In comparison to the COADS simulations, the QuikSCAT winds leads
52 0.2°C lower SST and ~0.3 psu higher SSS. Fresher river inputs reduce the overall surface salinity
53 at the surface by ~0.4 psu towards climatology; however, it significantly underestimates the
54 salinity near the river mouths where the estuarine salinity river inputs simulate more realistic
55 salinity.

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60 **Keywords:** Bay of Bengal, sensitivity study, winds and rivers, stratification and barrier layer,
61 circulation, coastal upwelling