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Impact of 1999 Orissa Cyclone on dynamics and heat budget of the Bay of Bengal

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The impacts of two consecutive strong tropical cyclones (TCs) - 04B and 05B in 1999 - on dynamics and heat budget of the Bay of Bengal (BoB) are examined using Hybrid Coordinate Ocean Model (HYCOM), driven by ERA-Interim surface reanalysis data. A series of experiments are performed in order to isolate the effects of each cyclone and two cyclones as a pair. Lanczos filtering is used to remove TC signals in the individual forcings (i.e., precipitation, radiation, surface temperature, surface humidity, wind stress, and wind speed) in order to assess the TCs effects through different processes. The differences between the simulations with TC signals and without TC signals isolate the TC effects. Due to the slow translation velocity and rapid intensification as both the cyclones approach the seashore of Orissa, India, sea surface temperature (SST) decreases the most near the seashore on the cyclone track, instead of to the right of the track. Mixed layer thickness is largely deepened along the TC tracks except near Ganges river mouth, where fresh river water discharge results in strong stratification. The land-sea contrast introduces evident temperature and humidity diurnal cycle to the BoB, and then increases surface turbulent heat flux (sensible and latent flux) variations by strong TC wind. On the other hand, intraseasonal variability and upcoming cold season after the TC events hamper the recovery of SST to its pre-storm values. The impact of the TCs on turbulent heat flux in the BoB accounts for substantial proportion of its monthly climatologic value. The 05B case alone reduces SST by 1.3 K and introduces ~2.1x10^12 W into the ocean during the period of 2.5 months. Although TC-associated wind speed and wind stress are the most important factors to determine surface turbulent heat flux, the reduced downward solar radiation by the TC clouds significantly decreases the heat pumped into the ocean. Our simulations suggest that two consecutive TCs have less effect on surface turbulent heat budget than the sum of two stand-alone TCs. The preliminary results from one experiment run that adopts artificial Rankine Vortex for 05B wind stress and wind speed, which are significantly underestimated by ERA-Interim reanalysis data, exhibits much stronger SST response. The future work includes model simulations with more realistic TC wind forcings and investigation of gravitational potential energy and kinetic energy variations in the BoB.