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Influence of sea surface roughness on the simulations of Vardah cyclone in the Bay of Bengal using COAWST model

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Tropical cyclone (TC) interacts thermodynamically with the ocean through the interchange of surface fluxes at the air-sea interface. The sustainability and intensification of TC are maintained by the increase in evaporation rate and latent heat flux in the high wind speed regime. Accurate calculation of heat fluxes is important to understand the dynamics of TC. The sea surface roughness is an important parameter that modulates the air-sea heat fluxes. In the present study, we used the coupled ocean-atmosphere-wave-sediment transport (COAWST) model to simulate TC Vardah over the Bay of Bengal during 10th - 15th December 2016. This study focuses on the impact of sea surface roughness on the heat fluxes, track, and intensity of TC Vardah in a coupled modeling framework. Three numerical experiments were performed with different parameterization schemes on the basis of (i) wave age (DGHQ), (ii) wave steepness (TY2001), and (iii) a combination of wave steepness and age (OOST). The coupled model simulations show a reasonable improvement in ocean roughness felt in the atmospheric module that resulted in improved wind intensity estimation and, therefore, generation of wind-waves on the sea surface. Another numerical experiment was explored to examine the effect of dynamic sea-spray on the air-sea heat fluxes. Inter-comparison of model experiments demonstrated differences in air-sea heat fluxes and its influence on the TC characteristics.