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Influence of model horizontal resolutions (1.667 km, 3 km and 5 km) in the prediction of super cyclone Amphan 2020 over the Bay of Bengal

Due to increasing the intensity, life period, and duration of maximum intensity of the intense tropical cyclones over the Bay of Bengal region (Singh et al., 2021). It is a need and scope to improve the forecast accuracy of intense tropical cyclones that made landfall. In this study, the performance of the WRF model was evaluated at different horizontal resolutions of 1.667 km, 3 km, and 5 km to forecast the intensity and structure of the super cyclone Amphan, which developed over the Bay of Bengal region in May 2020. The numerical experiments are carried out with the ARW-WRF model by using double nested domains with fine resolutions of 3 km and 5 km and three nested domains with a fine resolution of 1.667 km under the moving nested option. The initial and lateral boundary conditions for the simulations are derived from available high-resolution (25 km) NCEP operational Global Forecast System (GFS) analysis and forecasted datasets. The best-fit track datasets from the India Meteorological Department (IMD) are used to validate the predicted track, intensity, rapid intensification, and structures of the super cyclone Amphan. Results show that the track, landfall (position and time), and intensity in terms of minimum sea level pressure (MSLP) and maximum surface wind (MSW) of the storm are well predicted using the high-resolution WRF model. The structure of the storm is also compared to available observations in terms of relative humidity, water vapor, maximum reflectivity, and temperature anomalies. Finally, the results demonstrated that increasing horizontal resolution is not only sufficient to improve the forecast of maximum intensity and rapid intensification of the storms and hence needs to parameterize the physical processes at 1.667 km horizontal resolution. It is also expected that using proper data assimilation techniques and microphysical parametrization schemes with more number of cases across the region will provide a better forecast of the storms.

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