Global Warming Influences on Intense Tropical Cyclones in the Arabian Sea: Convection-Permitting Model Experiments

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Climate change and the resulting increase in extreme events are affecting almost all sectors worldwide. This study investigates the effects of a warmer sea surface and atmosphere on intense tropical cyclones (INT TCs) forming over the Arabian Sea (ARB) using a convection-permitting model. The anthropogenic warming 'delta' pattern is obtained by subtracting the natural forcing runs from the all-forcing runs of the CMIP6 models. For the estimation of the effects of TC activity in an environment without human influence, we run the Weather Research and Forecast (WRF) model by removing the delta patterns of SST, relative humidity and air temperature in vertical pressure levels. Three INT TCs – Ockhi (2017), Kyarr (2019) and Maha (2019) – are considered, which formed over the ARB in the post-monsoon season. Results show that the track and intensity of the tropical cyclones are well simulated by the model in all the runs. While comparing the all-forcing (ALL) WRF run with the natural-only forcing (NAT) run, the increased amount of rainfall received in the 500 km radius circle of TCs shows the fingerprint of human influences on TCs. Detailed analysis of pressure velocity and water vapour mixing ratio will be conducted to find the physical mechanisms behind the increased rainfall. The change in the fraction of area experiencing heavy rainfall (>150 mm/6hr) and the cyclone damage potential will be compared between ALL and NAR runs, which are important in terms of the disasters a TC can cause.

Key words: Tropical cyclone, Arabian sea, WRF, climate change