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Impact of the Indian Ocean Basin Mode on Tropical Cyclone Genesis in the North Indian and Western North Pacific Oceans

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This study investigates the diverse influence of the Indian Ocean Basin Mode (IOBM) on tropical cyclone (TC) genesis in the north Indian Ocean (NIO) and western North Pacific (WNP) Ocean. Three types of warm (W1-W3) and cold IOBM (C1-C3) years are identified based on their persistence and connectivity with the Indian Ocean Dipole (IOD) mode. Type 1 is when the IOBM is decayed without conversion to the IOD, and type 2 is the conversion of the IOBM to the IOD with a phase change as a W event converts to a cold IOD or vice versa. Type 3 is a W event transforming into a positive IOD or a C event transforming into a negative IOD. During W1, in the WNP, TC genesis locations shift northward. They are less intense, whereas W3 TCs shift toward the southern WNP, far away from land, and significantly intensify from July to September (JAS). On the other hand, NIO TCs from October to December (OND) during W2 events are more concentrated in the Bay of Bengal (BoB). The W1-associated Genesis Potential Index (GPI) shows enhancement over the southern NIO from April to June (AMJ), extending into the WNP from JAS to OND. Most importantly, there is an increase in TCs south of 10°N in the WNP due to W3 and C2 events modulating vertical wind shear, mid-tropospheric relative humidity, relative vorticity at 850 hPa, and other related physical mechanisms. In contrast, a decrease in TCs south of 10°N in the WNP is caused by mechanisms associated with W2 and C3 events. Overall, changes in the large-scale environmental factors provide the background for the observed TC variation in both ocean basins during three types of IOBMs. This study, therefore, presents a detailed picture of the impact of IOBM events on TC activity over the NIO and WNP.

Key Words: Indian Ocean Basin Mode, north Indian Ocean, western North Pacific, warm and cold IOBM, Genesis Potential Index