

Environmental conditions for tropical cyclone genesis in the Indian Ocean and implications for the MC influences

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This study investigated the seasonal environmental characteristics for tropical cyclone genesis (TCG) over the Indian Ocean during the Cooperative Indian Ocean Experiment on Intraseasonal Variability in the Year 2011 and the Dynamics of the Madden-Julian Oscillation (MJO) (CINDY/DYNAMO) field experiment and compare them with long-term climatological features. It was found that the spatial pattern of an empirical environmental index for TCG over the tropical Indian Ocean in 2011 is very similar to the feature composited over the years with high activity of MJO. The analyses of the contributions from each environmental factor indicated that relative humidity, absolute vorticity, and vertical velocity contribute to generate positive influences on the conditions for TCG in 2011. The influences of La Niña appear only through a shear effect over the Indian Ocean in 2011. Under the influences of active MJO events during the CINDY2011/DYNAMO period, the environmental conditions for TCG over the Indian Ocean are determined more strongly by MJO than by La Niña, through modifications of some environmental properties favorable for TCG. The environmental characteristics during CINDY2011/DYNAMO seem to be quite typical of the MJO active years; in such a case, the influences of El Niño/La Niña would not appear in determining the environmental conditions for TCG over the Indian Ocean. The MJO variation is significantly correlated with the variation of genesis potential index (GPI) for TCG over the northwestern and southwestern parts of the Indian Ocean, while over the northeastern and southeastern parts of the Indian Ocean there is no significant correlation between the GPI variation and the MJO variation. The different features found in the eastern and western parts of the Indian Ocean suggest that the environmental conditions in the eastern part of the Indian Ocean are partly affected by the atmospheric variability induced by the Maritime Continent. The analysis for the CINDY/DYNAMO period is compared with the climatology obtained from the statistical analysis for 33-year period.

Keywords: tropical cyclone, Indian Ocean, Madden-Julian Oscillation