Influence of MJO Activity on the Genesis and Environment of Tropical Cyclones in the Indian Ocean: Climatological Analysis and a Case Study for CINDY2011

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The Madden-Julian Oscillation (MJO) is the most dominant mode of the intra-seasonal variations of the tropic atmosphere. MJO has significant impacts on the weather and climate phenomena not only in the tropics but also in the extra-tropical regions. Moreover the generation and development of tropical cyclones (TCs) can be affected by MJO. The present study focuses on the influences of MJO on TC genesis in the Indian Ocean. We conduct statistical analyses using the 33-years atmospheric re-analysis dataset and a case study for the CINDY2011 period.

In order to conduct statistical analyses we divide the 33 years into MJO active years and MJO non-active years and compare the characteristics between the two categories. We specifically focus on the season of October, November, and December when both MJOs and TCs actively develop. From the comparison, the environmental condition for TC genesis in the active year shows more suitable for the TC genesis than that in the non-active years; the non-active year shows opposite result to the active year.

In the case study for CINDY2011, we compare the environmental condition for TC genesis in the year of 2011 against the conditions of the active years and the La Nina years. In the year of 2011, which is one of the active years, La Nina developed in the year. The comparisons suggest that the environmental condition in CINDY2011 is affected more strongly by MJO than La Nina. However, the other years that are characterized by both an MJO active year and a La Nina year shows different results from 2011. In other words, the environmental condition can be affected more strongly by La Nina than MJO in the years that are categorized both in the MJO active years and the La Nina years. The unique characteristic of the CINDY period (the year of 2011) may be related to the anomalous increased sea surface temperature in the period over the Indian Ocean compared to other La Nina years.