Regional Variability of Precipitation characteristics in Tropical Cyclones over the North Indian Ocean from GPM-DPR measurements

K. Sunil Kumar[1]*, Subrata Kumar Das[1], Sachin M. Deshpande[1], Medha Deshpande[1] and G. Pandithurai[1]

1. Indian Institute of Tropical Meteorology, Ministry of Earth Sciences, Pune 411008, India.

ABSTRACT

Global Precipitation Measurement mission (GPM) satellite carries dual-frequency precipitation radar (DPR) that provides three dimensional structure of precipitating systems with coarser spatial resolution. GPM measurements provide a unique opportunity to examine the microphysical properties of precipitating systems over the ocean, where the precipitation measurements are extremely rare. In this work, GPM products like surface rainfall rate, radar reflectivity factor, storm height, DPR-retrieved mass-weighted mean diameter (D_m), normalized intercept parameter (N_w) of rainfall are used to examine the precipitation characteristics. The precipitation characteristics are investigated in light of Eye Wall (EW), Inner Rain band (IR), Outer Rain band (OR) regions over the North Indian Ocean for 6 years (2014–2019). The observed differences in precipitation features are quantified in light of predominant microphysical processes in different regions of TCs over two oceanic basins Arabian Sea (AS) and Bay of Bengal (BOB). Observation inferred that, the stratiform rainfall dominates than convective rain in IR and OR regions of TCs in NIO. However, such feature is also observed in EW region of TCs that form over BOB. Significant differences between the DSD characteristics are noticed for EW, IR, and OR region within the TCs. The storms are more intense (higher reflectivity), taller characterised by higher rain intensity with bigger Dm and higher Nw in the EW region as compared to the IR and OR regions. A significant amount of raindrop growth/break up is observed in different TC regions and more prominent in the EW region and convective precipitation than other regions and stratiform precipitation. Prominent break up process is observed within 1.5-2.5 km in case of convective rain significantly over BOB. Though the bulk of precipitation features are commonly observed over AS and BOB, EW regions of TCs show distinct features over AS and BOB. The observed variations in the precipitation and DSD characteristics have implications in cloud modelling parameterization schemes over NIO.