Rain Microphysics of Rapid and Slow Intensifying Tropical Cyclones over the North Indian Ocean

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Abstract

This study examines the rain microphysics of tropical cyclones (TCs) that experience rapid intensification (RI) and slow intensification (SI) over the North Indian Ocean (NIO) between 2014 and 2023, with a focus on the Arabian Sea (AS) and Bay of Bengal (BOB). Out of the 114 TCs recorded, 42 underwent intensification, with 22 classified as RI and 20 as SI. The probability density functions (PDFs) of key rain microphysical parameters differ according to intensification mode (RI vs SI) and precipitation type (total, stratiform, and convective). Storm height is found to be slightly greater in RI TCs compared to SI TCs, particularly in convective systems, highlighting the structural differences between the two categories. The contour frequency by altitude diagrams and vertical mean profiles show that RI TCs exhibit higher rain rates (R), stronger reflectivity (Z), larger drop sizes (D_m), and lower drop concentrations (N_w) compared to SI TCs. These findings could be used to improve the ability to predict RI from SI in TCs.

Key words: Tropical Cyclones, Rapid Intensification, Slow Intensification, Rain Microphysics