The Role of Precipitation and Convective Features on Tropical Cyclone Intensification Derived from 16-yr TRMM

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Using Tropical Rainfall Measuring Mission Microwave Imager observations of global tropical cyclones (TCs) from 1998 to 2013, relationships between TC intensification rate and inner-core convective and precipitation parameters are examined by decoupling the dependency of these parameters on TC intensity and that on TC intensification rate. Sixteen TC intensity change-intensity categories are categorized based on the initial intensity and 24-h future intensity change. The results show that the TC inner-core mean rain rate, convective intensity, and stratiform rain occurrence, and axisymmetric index of convective intensity increase significantly with TC intensification rate for each TC intensity category. The symmetry of rain rate and stratiform rainfall occurrence also increase significantly with TC intensification rate for each intensity category, except from slowly intensifying (SI) to rapidly intensifying (RI) group when the initial intensity is major hurricane. The RI major hurricanes have significantly more asymmetric rainfall distribution and distribution of stratiform rainfall occurrence than those of SI major hurricanes. This suggests that asymmetric latent heating from rainfall, especially stratiform rainfall, and its projection onto the azimuthal mean may be important for RI in major hurricanes. For TCs with initial intensity in tropical depression, tropical storm, and major hurricane categories, the RI group has a significantly more asymmetric (symmetric) pattern of shallow precipitation/convection occurrence (deep convection occurrence) in the inner core than the SI group. The inner-core size, as quantified by the radius of maximum azimuthally mean rainfall decreases with both TC intensification rate and TC intensity.