I. Objectives

i. Test hypotheses from previous passive microwave studies (Cecil and Zipser 1998, Sanger 2012, Zagrodnik et al. 2014) that emphasized the importance of areal coverage and symmetry of precipitation and “moderate” convection for tropical cyclone (TC) intensification.

ii. Test the importance of convective bursts (CBs) for rapidly intensifying (RI) TCs.

iii. Compare intensification periods during HS3 campaign with results from Alvey et al. 2015.

II. Data and Methods

This study synthesizes the following datasets to help evaluate the effects of inner core precipitation on intensification:

- Tropical Cyclone Passive Microwave Dataset (TC-PMW) using AMSR-E, TMI, SSM/ISI (1998-2012)
- NHC Best Track for maximum sustained wind and center position information
- Statistical Hurricane Intensity Prediction Scheme (SHIPS) for shear direction

All cases undergoing extra-tropical transition, land interaction, and those overpasses with a fractional coverage less than 100% within 1 degree of the center are removed.

III. Precipitation Properties

(A) Precipitation and “Moderate” Convection

Steady state storms have the lowest frequency of precipitation in all quadrants. As intensification rates increase, precipitation occurrence increases in all quadrants, an indication of greater symmetry.

Symmetrization and occurrence of precipitation (during and prior to onset) increases with increasing intensification rates.

(B) “Strong” Convection

As intensification rates increase, the occurrence of strong convection increases prior to and during intensification. The maximum in frequency also contracts inward (particularly during RI).

IV. Conclusions

The occurrence of inner core precipitation prior to, during, and following the onset (“0 hour”) not only increases with intensification rate in all quadrants, but also the symmetry (measured by the occurrence in the upshear quadrants) distinguishes those that undergo RI (greater symmetry) versus those with slower intensification rates (less symmetry).

As intensification rates increase, the occurrence of “strong” convection (proxy using 85-91 GHz PCT < 190 K) noticeably increases.

The increased precipitation occurrence in the upshear quadrants of RI storms leads to a more symmetric distribution of precipitation initially than SI storms, and reiterates the importance of shear-oriented quadrant-based analyses.

V. Future Work

TC-PMW expanded to Central Pacific, Western Pacific, Indian Ocean, Southern Hemisphere, and 2013-14.

Examine precipitation sensitivity to environmental changes. Analyze outlier cases (i.e. RI with high vertical wind shear, etc.) and Category 3-5 storms with the larger dataset.

Acknowledgements: The authors would like to thank NASA for funding this research.

Mark DeMaria for the SHIPS dataset, and Yongjie Pi for Edouard preimagery.

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Passive Microwave Properties Observed during Tropical Cyclone Intensification

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