C-band Observations During DYNAMO/CINDY2011/AMIE

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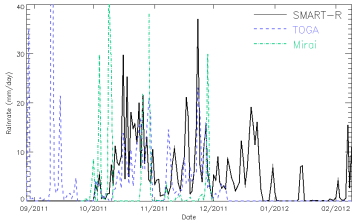
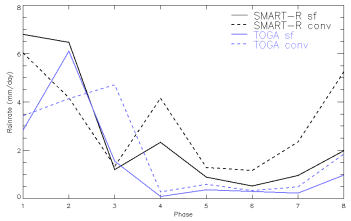
1. Introduction

Five C-band, Doppler radars were deployed during DYNAMO/CINDY2011/AMIE from October 2, 2011 to February 9, 2012 with the overarching goal to better understand the initiation and evolution of the Madden-Julian Oscillation (MJO). The radars were SMART-R on Addu Atoll, TOGA on the Revelle, the Mirai ship-based radar, C-POL in Darwin, and C-SAPR on Manus. This poster aims to highlight the implications of choices made for rain rate and convective-stratiform separation algorithms on the retrieved latent heating profiles at the root of a number of MJO theories.

2. Rain Time Series



- SMART-R, TOGA, and Mirai radar rain retrievals consistent in magnitude but temporal variations due to differences in deployment time + location



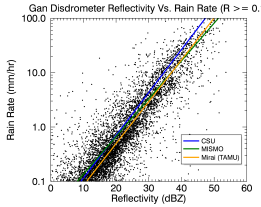
Stratiform rain fraction (%)	Overall	During active MJO
SMART-R	45.7	50.4
TOGA	42.0	53.3

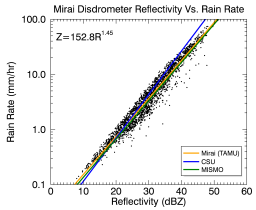
- SMART-R and TOGA MJO rain composites show increasing convective rain during pre-MJO and predominance of stratiform rain in active MJO

3. Algorithm Choices

Higher stratiform rain fractions elevate heating profiles, but are dependent on the rain rate and convective-stratiform retrievals. All of the C-band radars during DYNAMO were single-polarization (except for Darwin's C-POL), so rely on empirical Z-R relations for rain rate estimation and on a texture-based algorithm for convective-stratiform rain type.

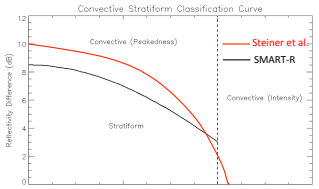
Video and J-W Disdrometer Measurements



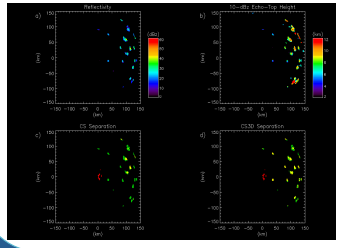


- Video disdrometer on Gan (top) shows more spread than the J-W on Mirai (bottom)
- JW fits: MISMO Z-R ~ Mirai Z-R
- Video fit: CSU Gan Z-R favors larger rain rates at high reflectivity
- Z-R fits are notoriously finicky to assumptions in averaging time, drop counts, rain rate threshold, and instrument type. It is also not clear if more than one Z-R is warranted.

Convective-Stratiform Tuning and Isolated Cells



- SMART-R was tuned to be more convective than Steiner et al. (1995)
- Not necessarily a "right" way to tune because of gray transition from convective to stratiform

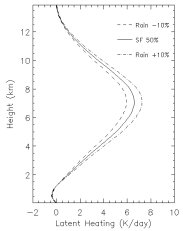


- Steiner et al. misclassifies some shallow, isolated echo as stratiform
- Using echo height information with a separation distance improves shallow, isolated convective classification (Fliegel 2011)

4. Heating Profile Implications

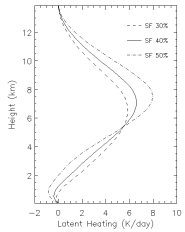
Idealized latent heating (LH) profiles are calculated based on Schumacher et al. (2004) and assume 10% shallow convective rain (although this changes throughout the MJO cycle).

LH Profile Variations Due to Rain Differences



- Rain amount changes affect the magnitude of maximum heating in a linear fashion

LH Profile Variations Due to Conv-Strat Differences



- Assuming the same total rain, convective-stratiform partitioning affects both the magnitude and height of maximum heating

5. Conclusions

The C-band radar array deployed during DYNAMO/CINDY2011/AMIE offers an unprecedented view of the MJO convective spectrum in the Indian Ocean, Maritime Continent, and West Pacific. Because of vagaries in determining Z-R relations and convective-stratiform algorithm tuning, it is recommended to use a reasonable range of values in algorithm retrievals to provide uncertainty bounds on MJO statistics, esp. latent heating profiles which are important in understanding the link between the MJO convection and large-scale circulation.

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