Comparisons of TRMM V6, V7 and Ground-based Polarimetric Radar

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Introduction

Three regions are examined to look at inter-comparisons between TRMM Precipitation Radar Version 6, the recently released Version 7, and observations from ground-based polarimetric radar. Data from the S-Pol radar during two field campaigns, TRMM-LBA in 1999 and NAME in 2004, are analyzed in addition to seven years of monsoon season data from the C-Pol radar in Darwin. The three regions are divided into different regimes based on terrain (NAME and Darwin) or mean wind flow (TRMM LBA and Darwin) in order to understand the influences of microphysical variability.

General Results

- While CFADs match near the surface in many regimes, there are differences at the mid and upper levels
- Version 7 increased mean profiles, bringing some regimes in better agreement with ground observations, but decreasing agreement in others
- There are large differences in V7 near the surface in the NAME domain-WHY?
- TRMM statistics generally have higher reflectivities associated with the same rain rate compared with ground radar. V7 changes little over LBA, while slightly improving in NAME but reducing the likeness in Darwin
- Rain rate histograms in all three regions show a greater frequency of high rain rates compared to TRMM, although V7 made significant improvements especially over land

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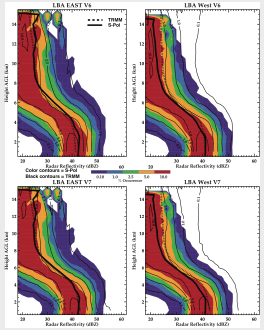
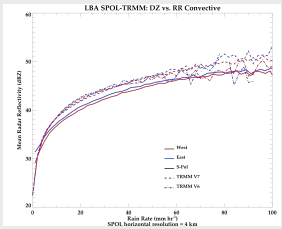
TRMM – LBA Brazil



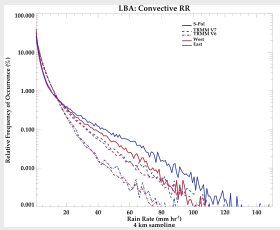
CFADS

- S-Pol and TRMM profiles generally match well, especially during the east regime
- Some differences at the upper levels
- V7 increases the mean profiles, bringing the east regime into better agreement but resulting in TRMM > S-Pol for the west regime



Convective DZ vs. Rain Rate

- For a given rain rate, TRMM reflectivity > S-Pol
- No significant change between V6 and V7

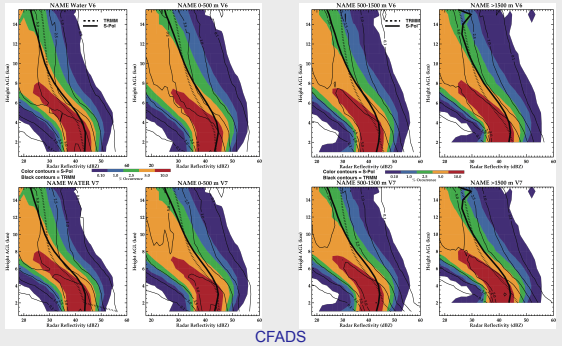


Convective Rain Rate Histograms

- S-Pol: frequent higher rain rates during the east regime
- TRMM: no significant regime variation
- V7 increased frequency of higher rain rates and thus better agreement with S-Pol

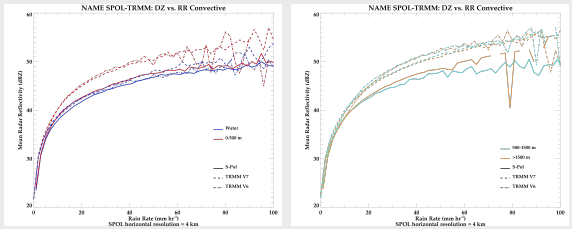
NAME - Mexico

Water 0-500 m | 500-1500 m | > 1500 m



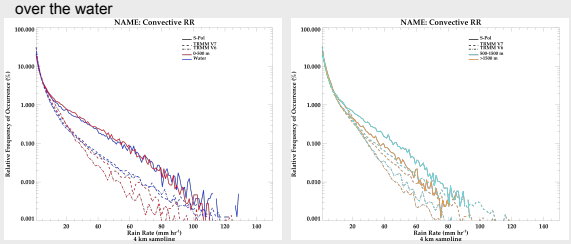
CFADS

- S-Pol and TRMM V6 mean profiles agree at the surface for water and 0-500 m
- Higher terrain TRMM V6 mean reflectivities > S-Pol in the lowest levels
- In the mid-levels, TRMM V6 mean reflectivity < S-Pol; in the upper-levels S-Pol < TRMM V6
- V7 mean profiles have similar characteristics to V6, although some significant problems arise at the low-levels, particularly over the water and 500-1500 m regimes



Convective DZ vs. Rain Rate

- S-Pol: for a given rain rate, reflectivity is higher with increasing terrain
- TRMM: significant difference between water and 0-500 m, with 0-500 m > water
- V7 slightly lowers the reflectivity for a given rain rate compared with V6, except over the water

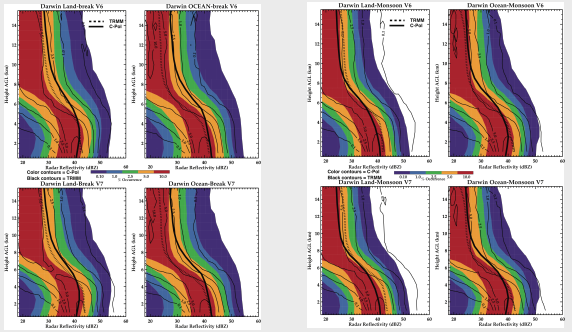


Convective Rain Rate Histograms

- V7 greatly increases the occurrence of higher rain rates over land; no significant change over water
- V7 and S-Pol agree fairly well over 500-1500 m and > 1500 m
- V6 and V7 underestimate the frequency of high rain rates over water, and significantly over 0-500 m

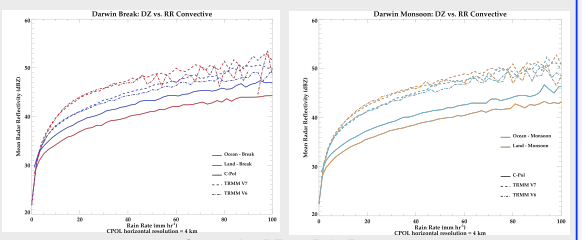
Darwin, Australia

Break | Monsoon



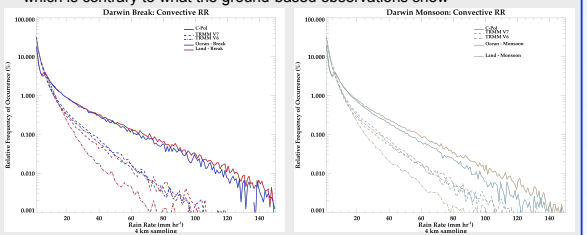
CFADS

- Break is generally more intense than the monsoon periods, and convection over the land stronger than over ocean
- TRMM and C-Pol agree the best during the monsoon and over the ocean
- Large differences near the surface for the land regimes, with TRMM mean reflectivities > C-Pol
- V7 increases the low level mean profiles, resulting in larger differences over land near the surface but better surface agreement for the Ocean-Break regime



Convective DZ vs. Rain Rate

- C-Pol: for a given rain rate, land reflectivities are lower than for ocean
- TRMM: higher reflectivities for a given rain rate for land compared to ocean
- V7 increases the reflectivities for both land and ocean for a given reflectivity, which is contrary to what the ground-based observations show



Convective Rain Rate Histograms

- Version 7 greatly increases the occurrence of higher rain rates over land
- V6 and V7 underestimate the frequency of high rain rates compared with C-Pol
- C-Pol shows the distribution of high rain rates increases during the break period over the monsoon, which is not reflected by either the Version 7 or the Version 6 TRMM rain rate histograms