Evaluation of Radar Derived Surface Rainfall Estimates for Improvement of TRMM Ground Validation Products

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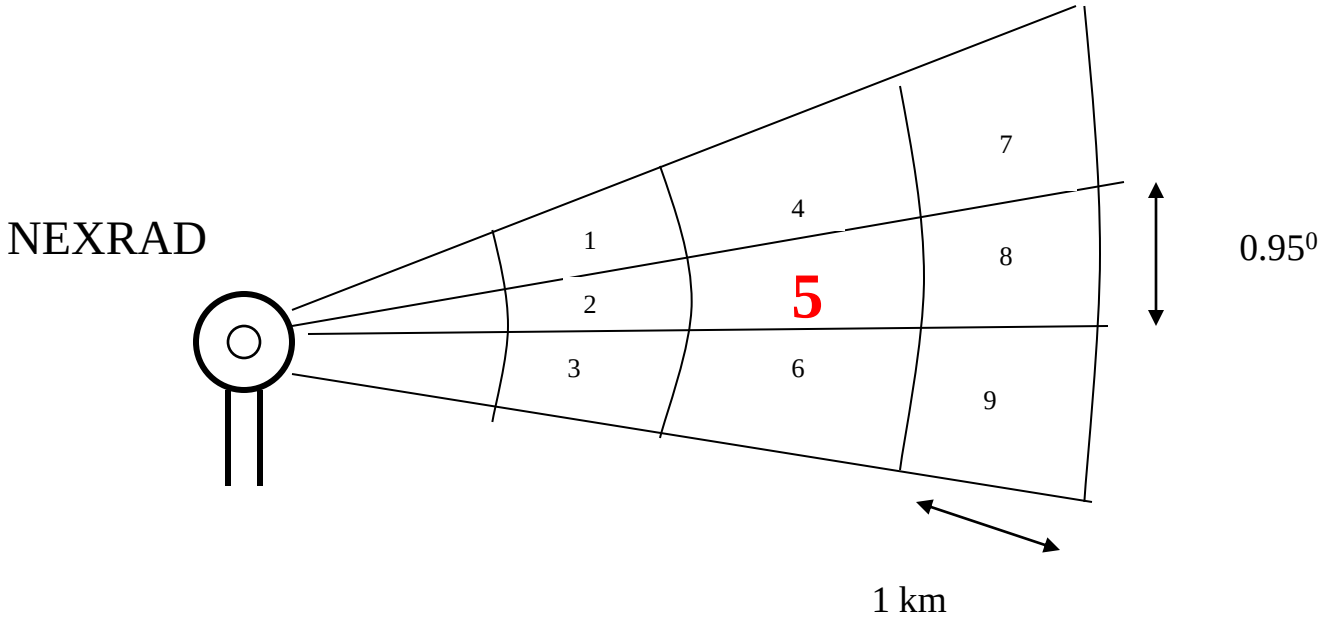
OBJECTIVES

- **Evaluate TRMM Ground Validation techniques using NEXRAD radar data**
  - **Refine procedures for calculating radar to rain gauge accumulation ratio for Melbourne, FL**
    - ***Perform error analysis***
    - ***Evaluate geophysical performance - July 1998***
  - **Evaluate empirical relations for drop terminal velocity and compare UHF profiler reflectivity with impact disdrometer reflectivity**
    - ***suggest suitable relation,***
    - ***study variation of non-dimensional (n.d.)reflectivity with n.d. speeds***

Meteorological Radar



$$Z(mm^6m^{-3}) = \int_0^\infty N(D)D^6dD$$

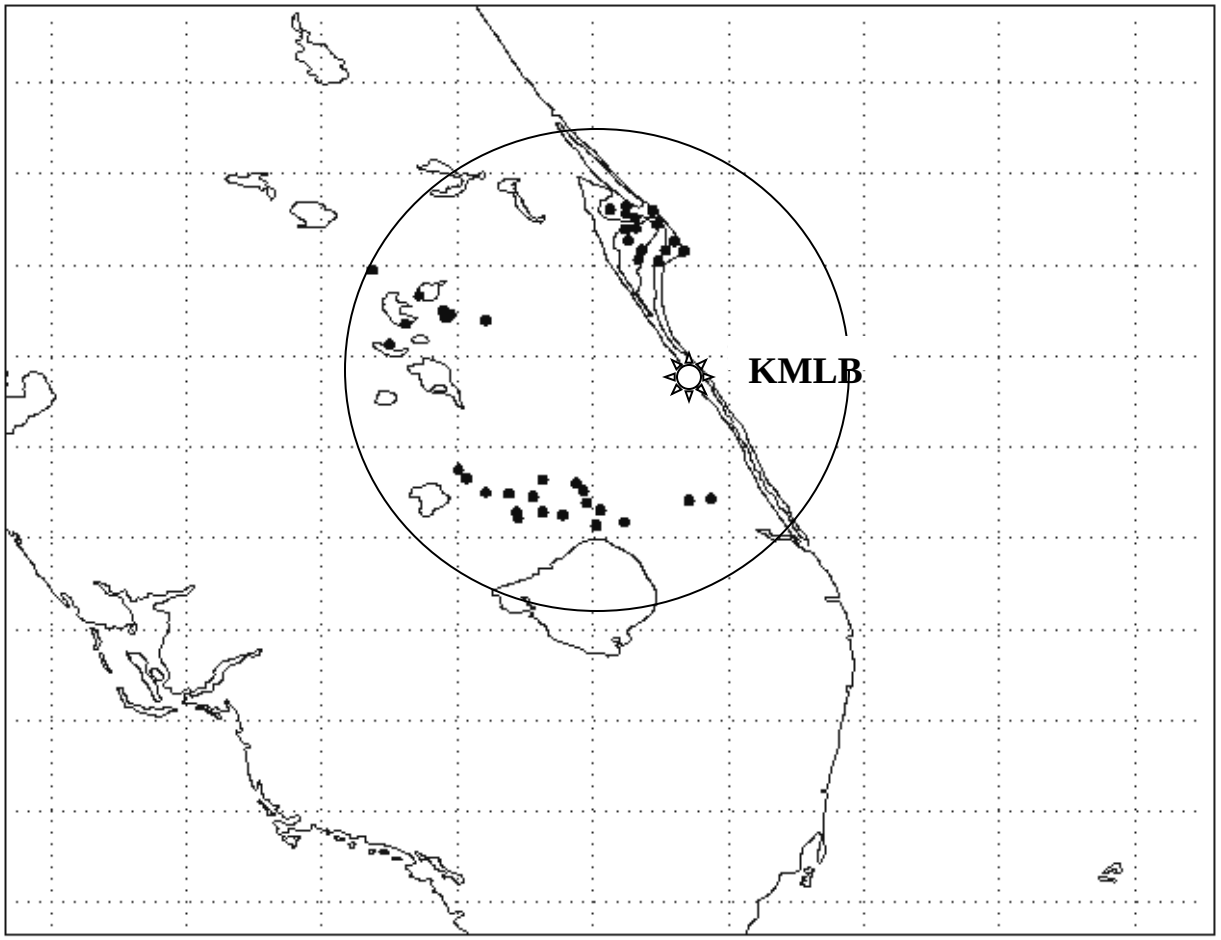
[Z (dBZ)= 10Log$_{10}$Z]

-- Radar operates continuously - typical 7500 volume scans (VOS), approx. 98% useful

-- Radar inoperative: 1,000 - 1,500 minutes/month

Rain Gauges

29.5N, 79W



25.5N, 82.5W

42 of 89 Gauges selected using AQC test

(15 - 99 km range)

SUMMARY OF RESULTS

GV validation using July 1998 Melbourne NEXRAD measurements

- **Combined Z-R developed**
  - ***42 AQC gauge locations and center radar pixel accumulations***
  - ***97 % radar operative and 19.6% time rainfall within radar mask***
- **GVS algorithmic problems discovered**
  - ***extraction procedure and L3 accumulation routine***
- **Software fixed and proper operation verified**

RESULTS - cont.

Improvements in radar/gauge bulk monthly accumulation ratio

- **After *proper extraction*, ratio improves from 0.83 to 0.886 (5.6%)**
- **Sub-setting the *AQC gauge accumulation for radar "down" periods*, bulk ratio becomes 1.018 (radar over-estimation by 1.8%)**
- **Overestimation reduced using CAPPI-PPI *Planar mismatch* for 4.36% yielding bulk ratio of 0.974**
- **Bulk ratio becomes 0.98 after applying *temporal smoothing* (0.64% better)**

Improvements - cont.

- ***Hourly accumulation scheme*** **applied to instantaneous accumulations (rms 0.24 mm), bulk ratio with planar adjustment ~0.952** ***improves to 0.992 after temporal smoothing***
- ***Daily accumulations*** **show larger scatter in the second half of month**
- ***Instantaneous reflectivity*** **rms error ~ 5 - 12 dBZ peak at 80 km**

Improvements - cont.

UHF Profiler reflectivity *compares* well with impact disdrometer (RD-69) reflectivity data while using Best (1950) drop terminal fall speed relation

- **Non-dimensional ratio of UHF Doppler speed to Spectrum width peaks when ratio of Z(UHF) to Z(RD-69) becomes unity**