

Radar Precipitation Totals vs. Rain Gauges

Matt Mosier

Chad Walters

Shawn Marino

Overview

- October 16, 2006 MCS Case
- Used Radar Estimation from the ADRAD
- Compared to selected rain gauge sites
- Related to different z-R criteria

Background

- ADRAD
 - DISH 4.88 m diameter parabolic solid
 - GAIN 40.3 dB
 - HALF POWER BEAMWIDTH 1.52 deg at 2840 MHz
 - FIRST SIDE LOBE LEVEL -22 dB
 - TRANSMITTER:
 - WAVELENGTH 10.56 cm (2840 MHz)
 - PEAK POWER 1 MW
 - PULSE WIDTH 0.8 microsec short, 2 ms long

Background

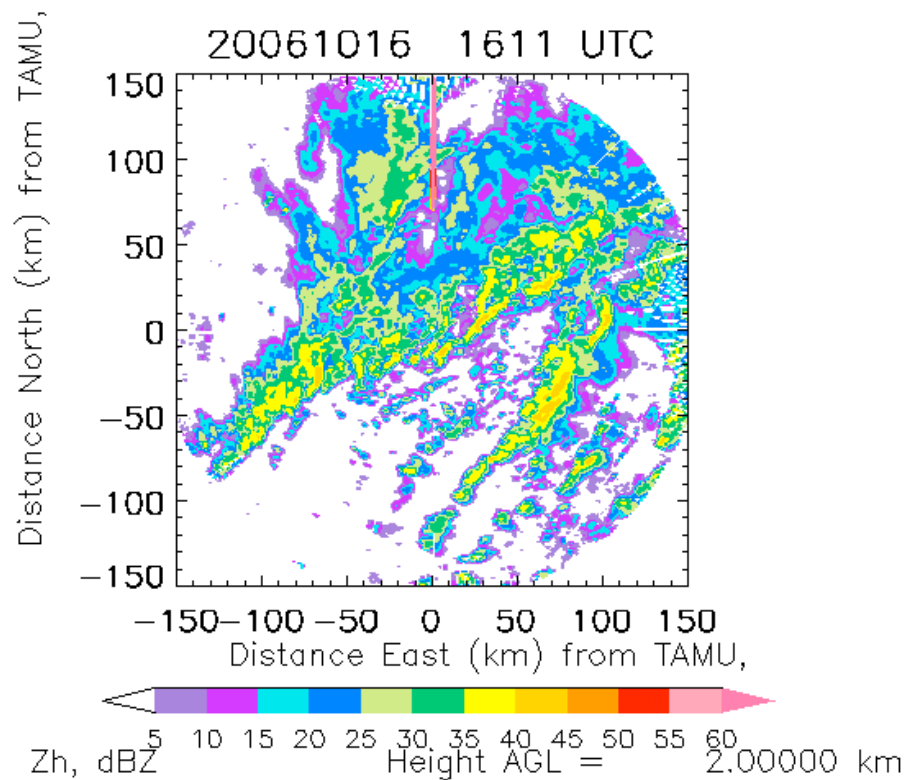
- Rain Gauges
 - LYNT2
 - lat = 30.419444 long= -96.54000
 - SW of radar located near (Davidson Creek near Lyons)
 - HIBT2
 - lat = 31.133889 long= -96.824722
 - NW of radar (Brazos River near Highlands)

Data and Methodology

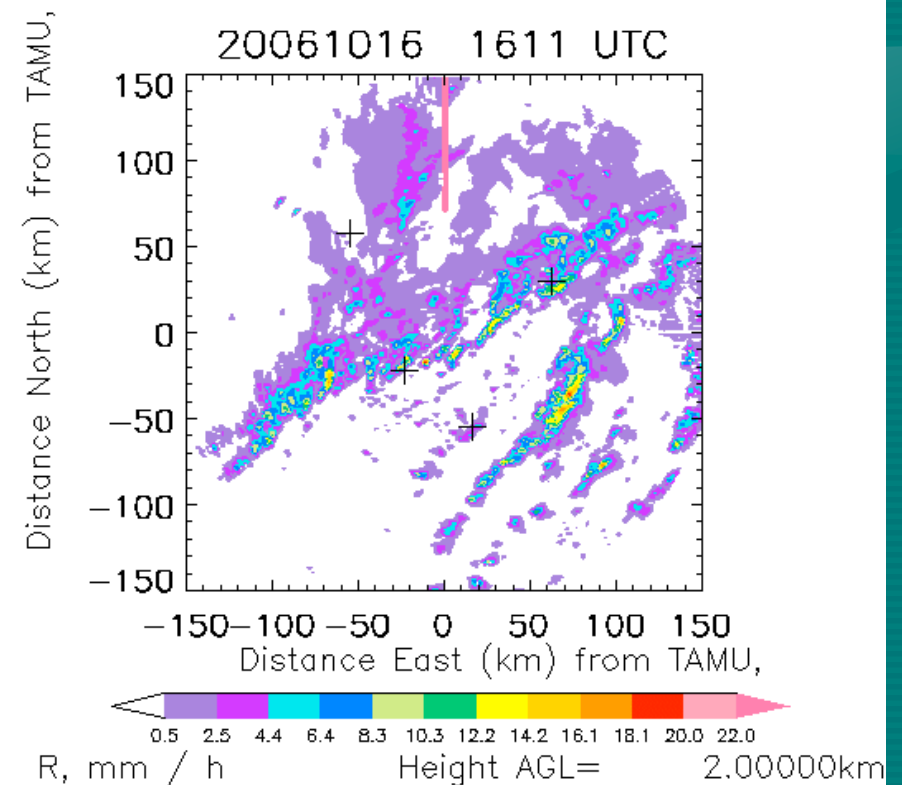
- Used an IDL program to calculate rain rates from radar reflectivity
- Geo-located rain gauges with estimated rain rates
- Plotted reflectivity and rain rates
- Used different z-R relations to compare accuracy of radar estimate rainfall total to rain gauge

Data and Methodology

- Example plot:



dBZ



Marshall-Palmer RR (mm/h)

Results

- LYNT2
 - Rain Gauge Total: 0.16”
 - Radar Estimations
 - Marshall-Palmer: 0.041”
 - WSR-88D Convective: 0.030”
 - WSR-88D Tropical: 0.035”
 - Rain Gauge – Radar Estimates
 - M-P: 0.119” (~ 4 times less)
 - WSR-88D Con.: 0.130” (~5.33 times less)
 - WSR-88D Trop.: 0.125” (~4.57 times less)

Results

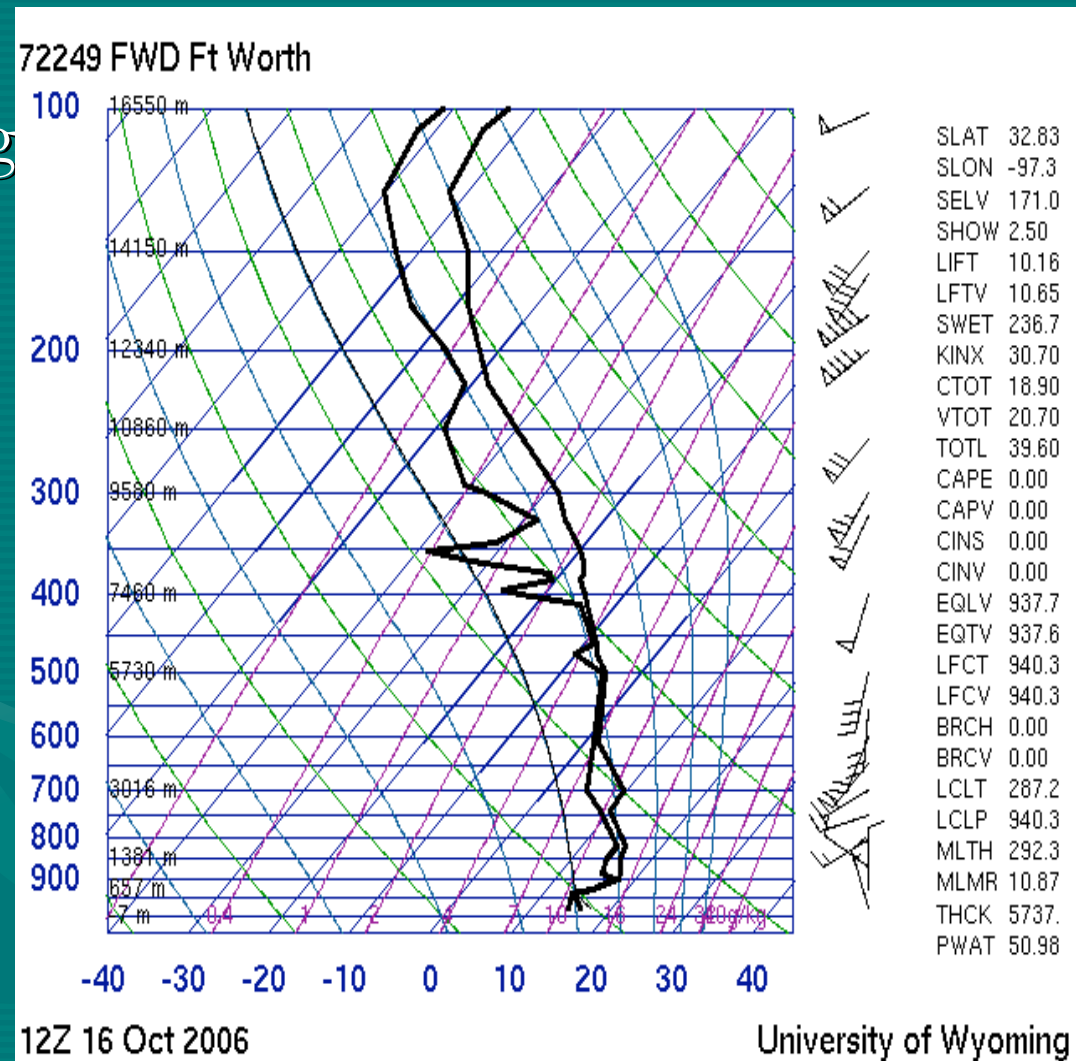
- HIBT2
 - Rain Gauge Total: 0.57”
 - Radar Estimations
 - Marshall-Palmer: 0.129”
 - WSR-88D Convective: 0.105”
 - WSR-88D Tropical: 0.136”
 - Rain Gauge – Radar Estimates
 - M-P: 0.441” (~ 4.42 times less)
 - WSR-88D Con.: 0.465” (~5.43 times less)
 - WSR-88D Trop.: 0.434” (~4.19 times less)

Results

- Possible Reasons for the error in the estimates
 - ADRAD maybe not power calibrated
 - Maybe some attenuation (ADRAD not calibrated)
 - Horizontal winds blowing rain from a distance
 - Incomplete beam filling due to sharp rain rate gradients
 - Stratiform event
 - Small rainfall amounts lead to larger errors

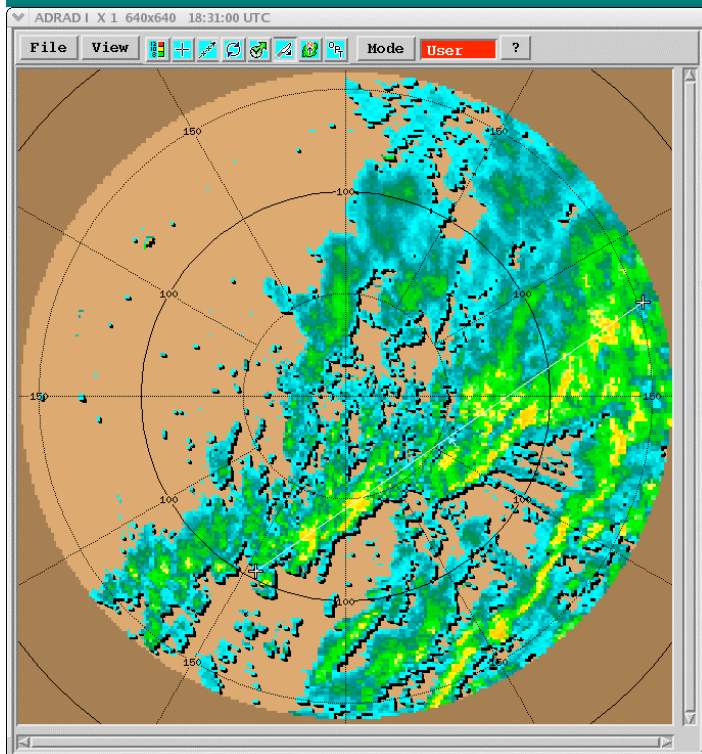
Results

- Winds
 - Relatively strong

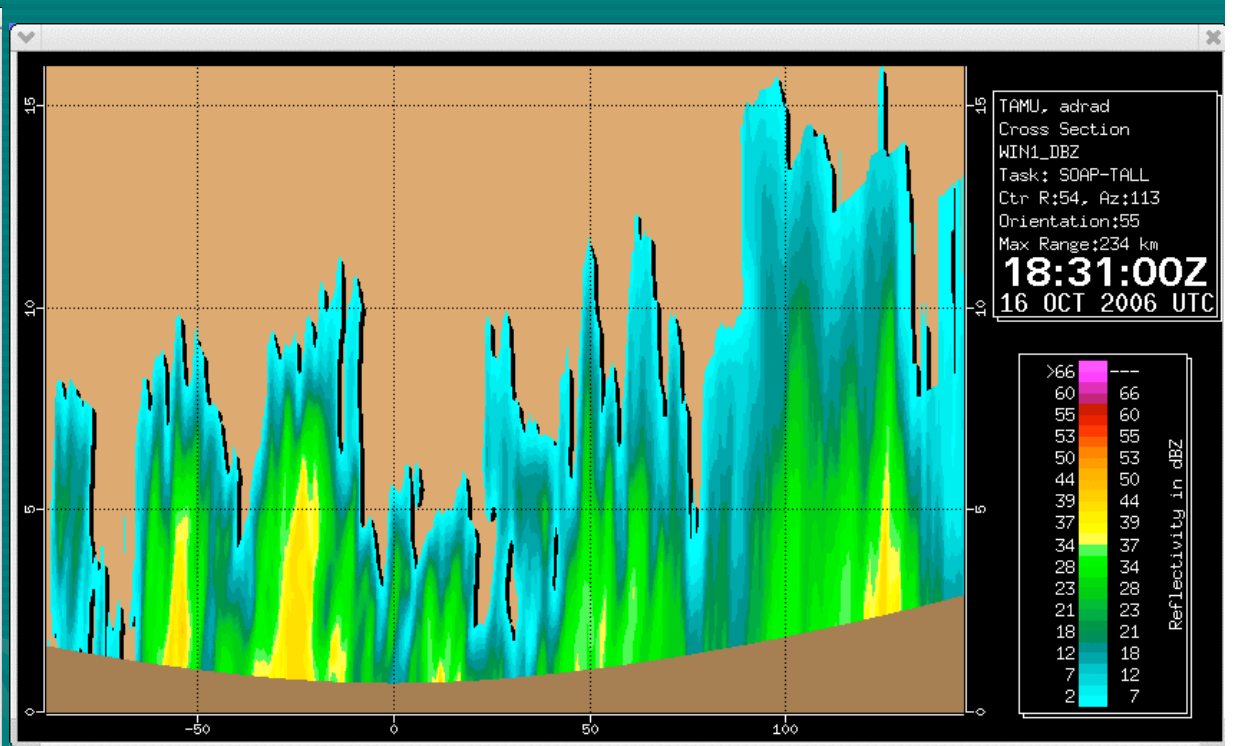


Results

- Stratiform Level



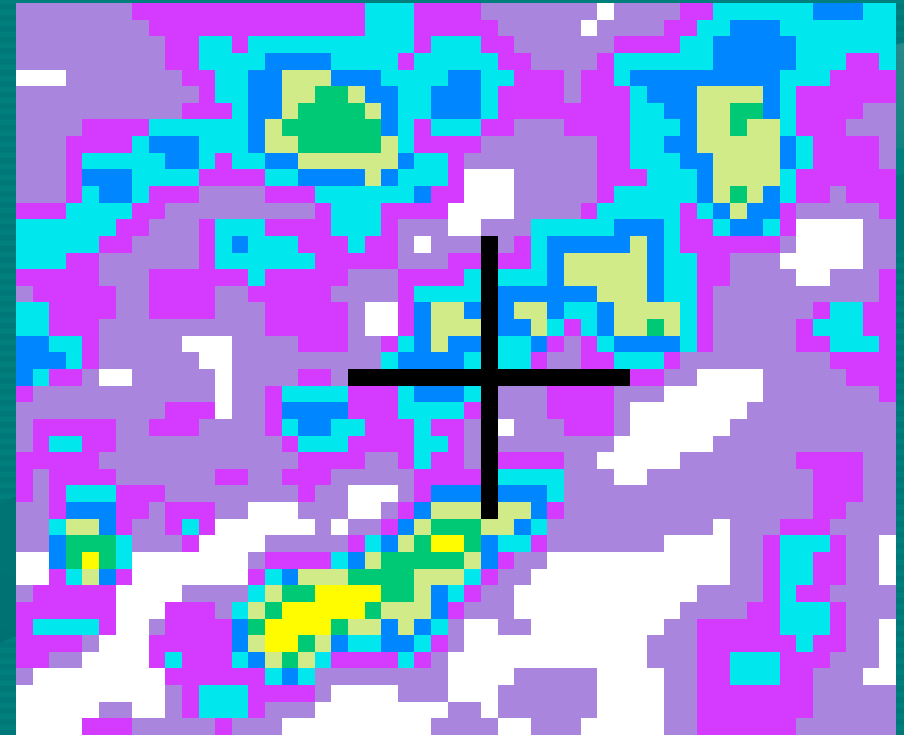
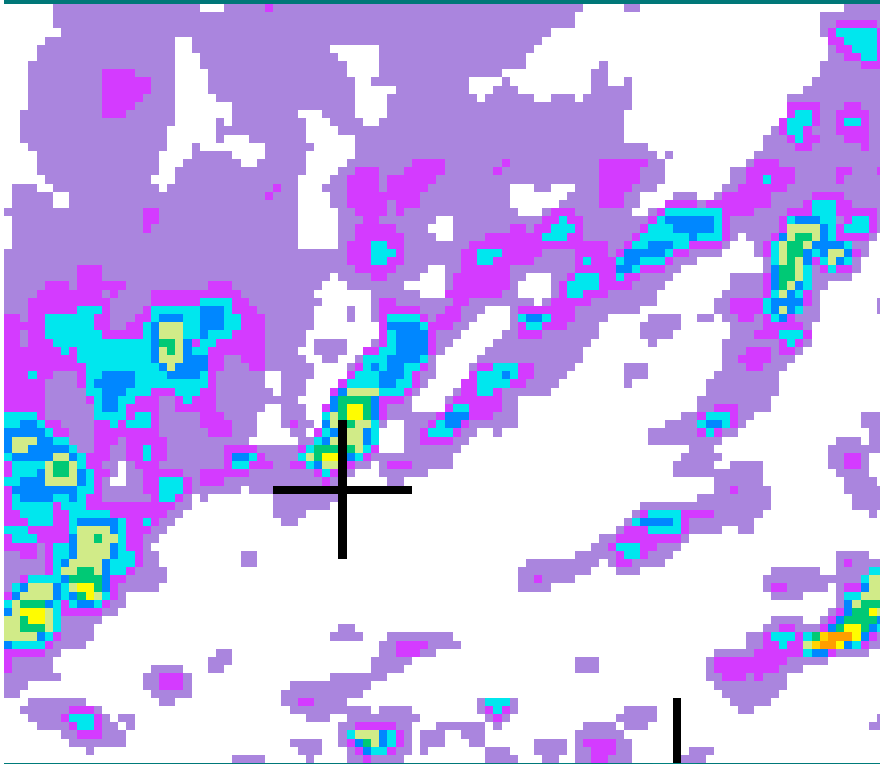
Cut Location



Actual Radar Cut

Results

- Rain Rate Gradients



Two different rain gauges at different times

Conclusion

- Many factors can lead to error
 - Radar Error
 - Gauge Error
 - Calibration Error
- Undetermined z-R relationship
 - No distrometer data
 - Other z_R relationships don't quite fit

