# WET MICROBURST EVENTS OBSERVED WITH PHASED ARRAY RADAR

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## Introduction

- Phased array radar (PAR) can scan the atmosphere much faster than current operational weather radars
- Microbursts are a rapidly evolving form of hazardous weather
- The faster volume scan times of PAR allow for better identification of microburst precursors, providing the opportunity for more timely and accurate prediction of microbursts
- We present here some initial PAR observations of microburst-producing storms in Oklahoma

## Inclusion criteria for storms

- Maximum range from radar limited to 60 km
- Maximum reflectivity of 55 dBZ or higher
- Low-altitude divergence of 0.0025 $s^{-1}$ or higher

## Data cases

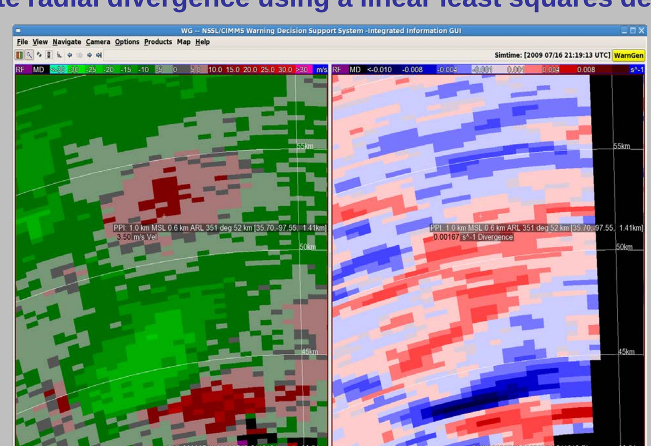
- 25 storms on 8 days from 2007 – 2010 met the inclusion criteria
- 2 storms from April, 3 from June, 5 from July, and 15 from August
- Thermodynamic environment on all days similar to past studies of wet microbursts ($\Delta\theta_e$ > 20 K)

## Parameters analyzed as microburst precursors

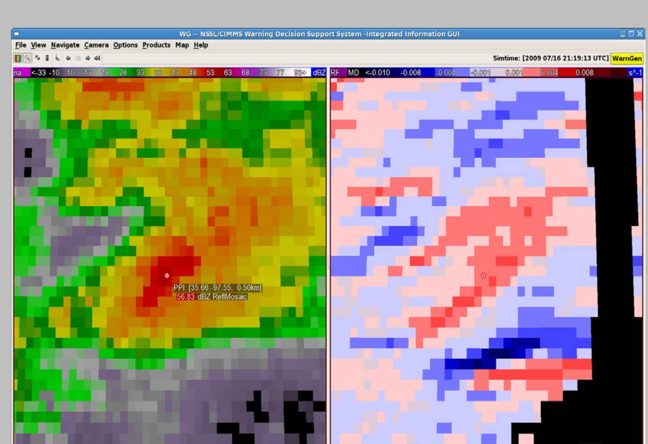
- Parameters are based on the downdraft forcing mechanisms of wet microbursts: precipitation drag and cooling from melting ice (hail)
- First parameter: Vertical extent of precipitation core, measured at the 55, 60 and 65 dBZ reflectivity levels
- Second parameter: Peak mid-altitude (2 – 6 km ARL) convergence associated with a descending precipitation core

## Radar data processing procedures

Calculate radial divergence using a linear least squares derivative



Map reflectivity and divergence data to a 3D latitude-longitude-height grid

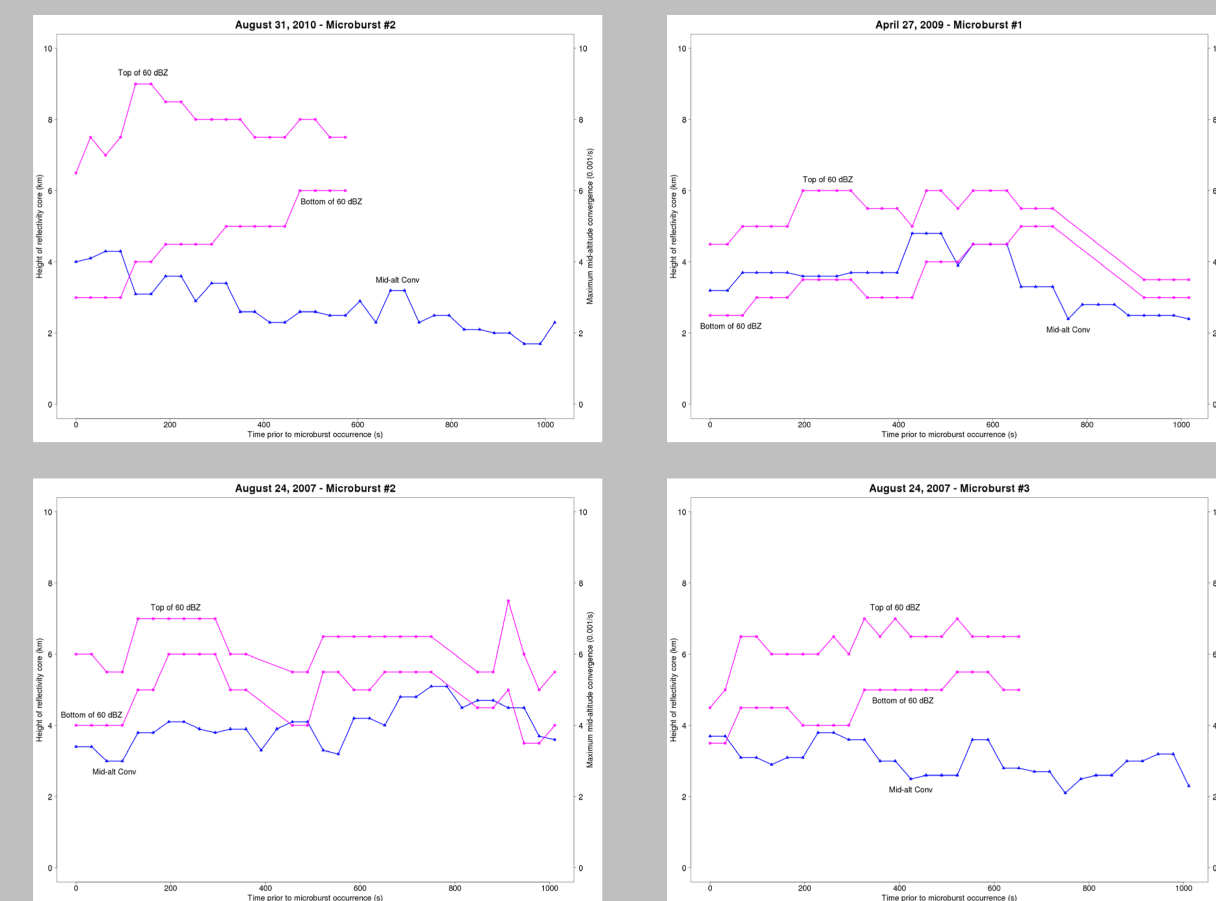


## Results

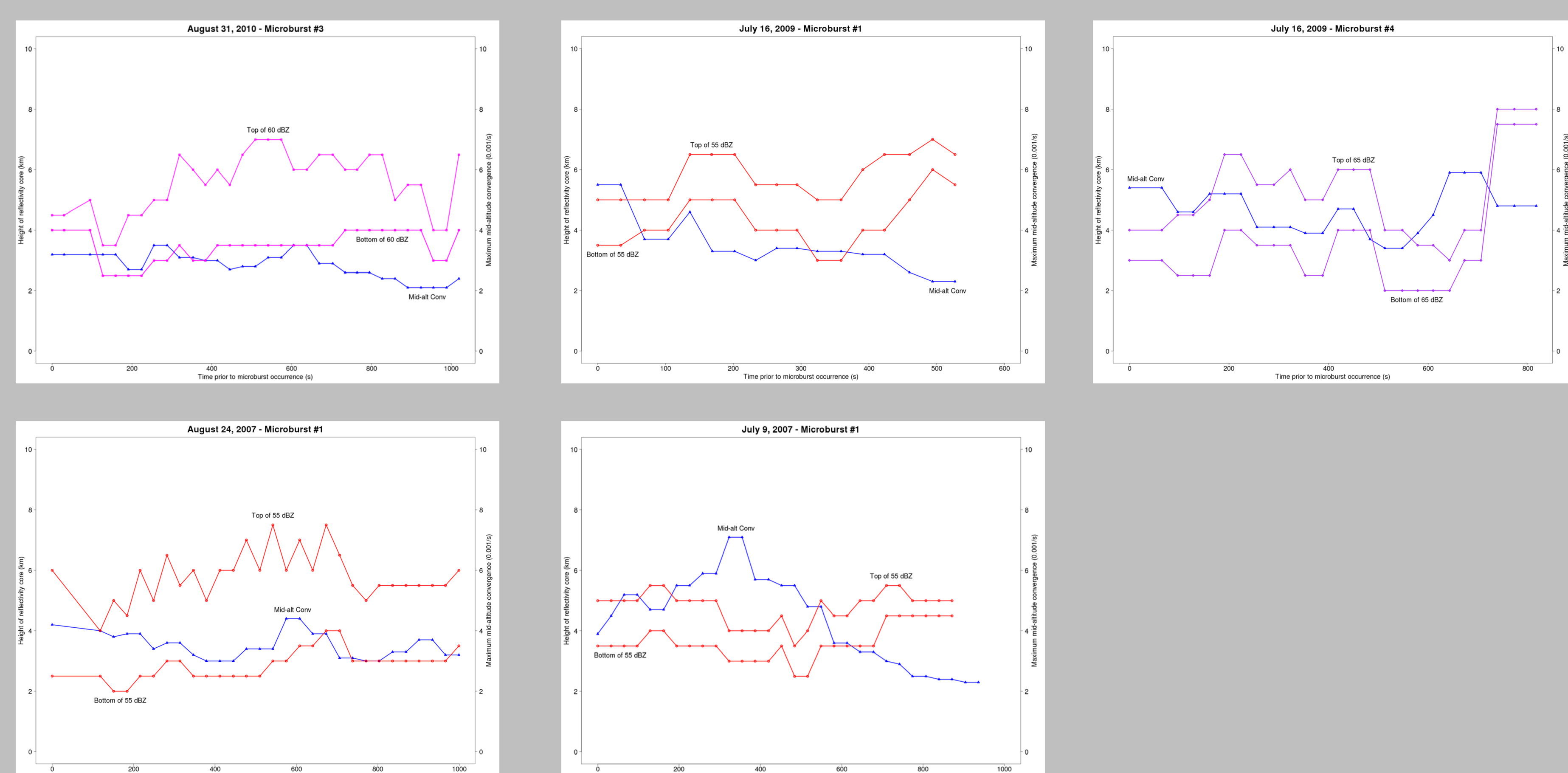
- For each storm, time-series graphs of core base height, core top height and maximum mid-altitude convergence were produced for up to 17 min prior to initial observation of the microburst
- Substantial variations in the magnitude and trend patterns of the parameters was observed, but several distinct groups were apparent
- Groups varied based on the degree that the magnitude and trend patterns of the parameters matched the expected characteristics of microburst-producing storms from past research
- In the plots shown below, the reflectivity value chosen for displaying the precipitation core is the one thought to be most representative of the downdraft forcing mechanisms for the storm

Group 1: Intense, descending core with moderate to strong mid-altitude convergence

Group 2: Intense, descending core with moderate to strong mid-altitude convergence, but core base remains somewhat elevated

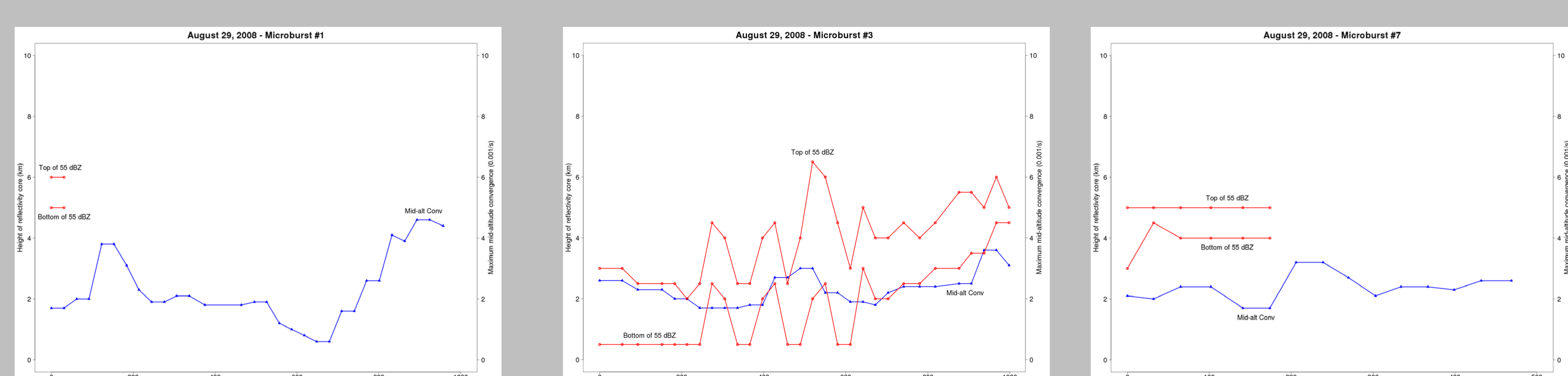


Group 3: Moderate to strong mid-altitude convergence, but without a distinctly descending core



Group 4: Weak mid-altitude convergence

Group 5: Relatively weak core (max Z < 60 dBZ)



## Conclusions

- A majority of storms had all (Group 1; N=9) or most (Group 2; N=4) of the typical precursor characteristics associated with wet microbursts
- Another 20% of the storms (N=5) had moderate to strong mid-altitude convergence and an intense core, but the core did not notably descend (Group 3)
- The remaining 7 storms exhibited weak mid-altitude convergence and/or a relatively weak core (Groups 4 and 5)
- Moderate to strong mid-altitude convergence was the most common feature (20 storms), but there were no consistent patterns in the time trends
- Future project plans include comparing microburst-producing storms with storms that did not produce microbursts, and exploring alternate ways of measuring precursor parameters (e.g., volumetric vs maximum single value)
- The potential benefits of high temporal PAR observations versus the slower update rates of operational weather radars will also be examined