

Meteorological Observations in Support of Dual Polarization Research

Terry Schuur
Weather Radar Research



Motivation



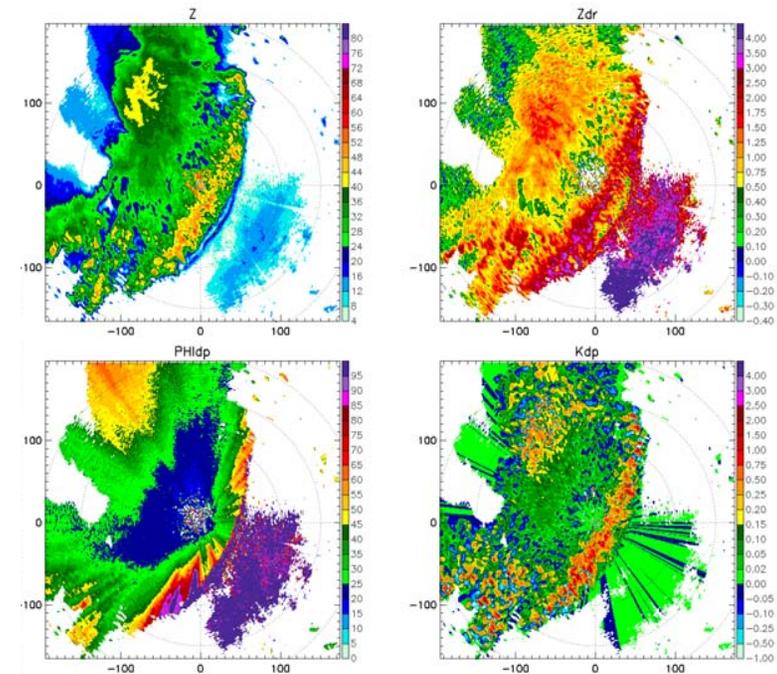
- Support NOAA's mission to provide improved weather and water information by collecting valuable validation datasets to be used in dual-polarization algorithm development.

Success of polarimetric radar research conducted at the NSSL has been contingent upon the availability of data from a vast network of observational facilities located in Oklahoma.

Meteorological Observations Field Facilities



- ✦ Rain gauge networks
 - ✦ Oklahoma Mesonet
 - ✦ USDA Micronet
- ✦ NSSL 2D-Video Disdrometer
- ✦ Kessler Farm Field Laboratory
- ✦ Oklahoma Lightning Mapping Array
- ✦ Volunteer Observation Network

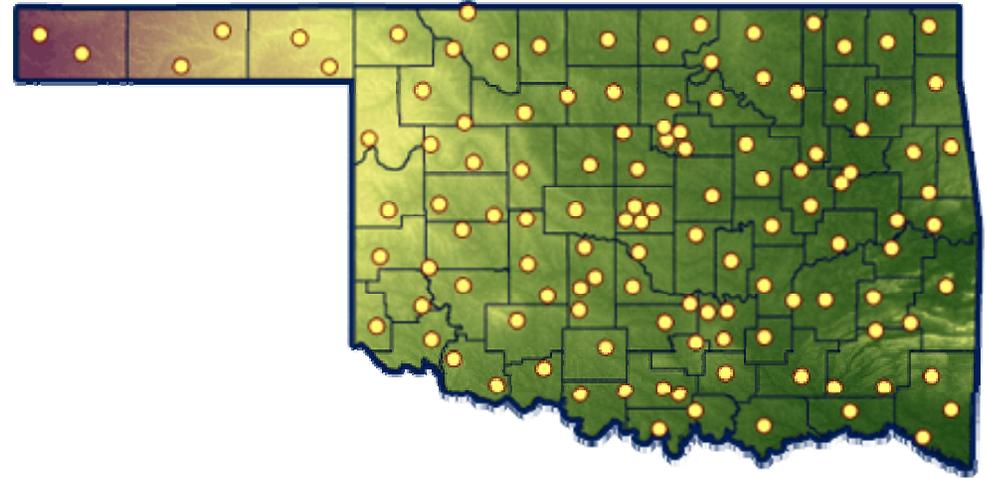


Much of the data critical to the success of polarimetric radar research at the NSSL comes from fixed-site facilities whose collocation with a S-band polarimetric radar are unique to Oklahoma.

Rain Gauge Networks

The Oklahoma Mesonet

- Automated network of 116 remote meteorological stations across Oklahoma.
- Unique in its ability to measure variety of environmental conditions at sites across an area as large as Oklahoma.



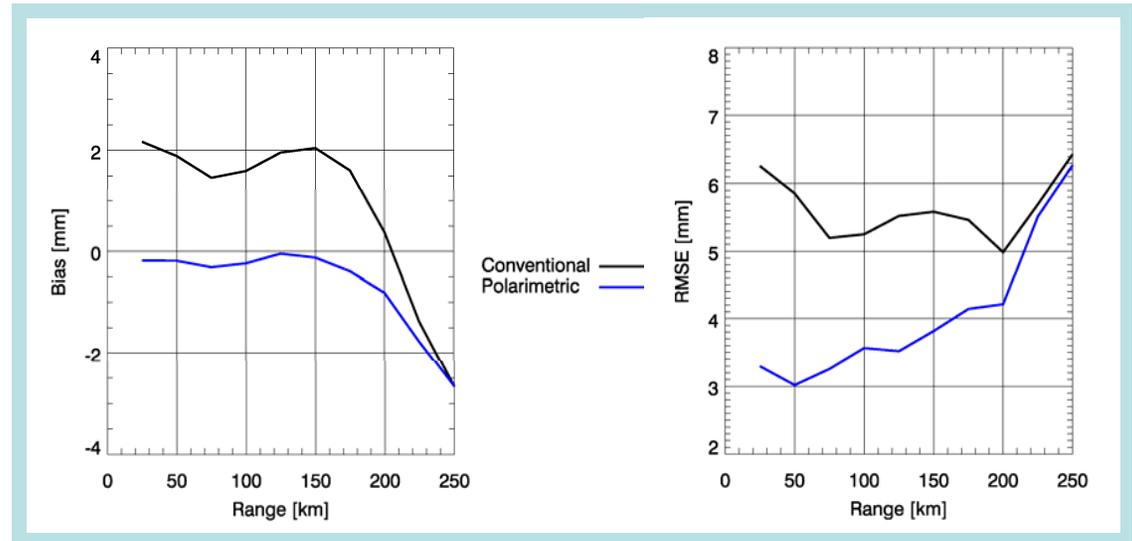
The Oklahoma Mesonet has proven critical to dual-polarization research by:

- Providing 5-minute rainfall data used to develop and test polarimetric rainfall estimation algorithms, especially at large distances from the radar.
- Providing thermodynamic data used to quality control polarimetric hydrometeor classification designations.

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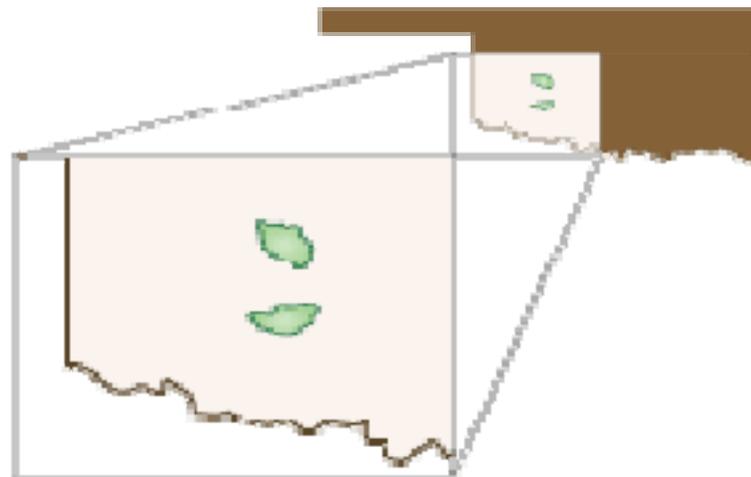
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The Micronet

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- Fort Cobb watershed is also instrumented with 3 US Geological Service discharge stations.



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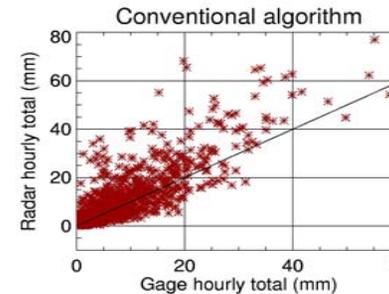
- Little Washita:** Providing high-density (~ 5 km) rainfall data used to develop and test polarimetric rainfall estimation algorithms.
- Fort Cobb:** Providing combined rainfall and stream flow data used to investigate the response of hydrologic models to polarimetric rain estimates.

Rain Gauge Networks

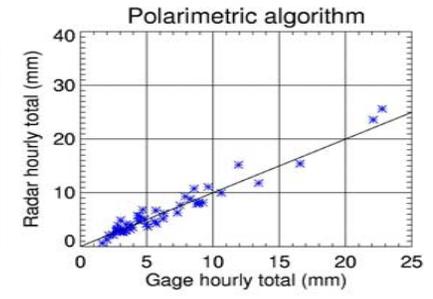
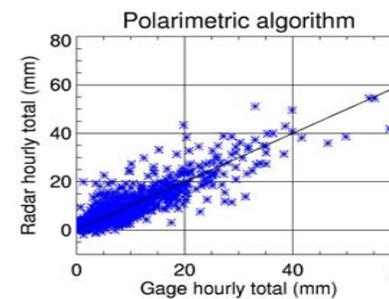
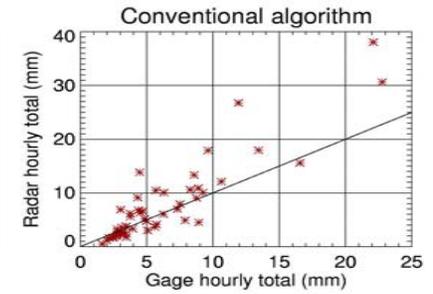
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Point Estimates



Areal Estimates



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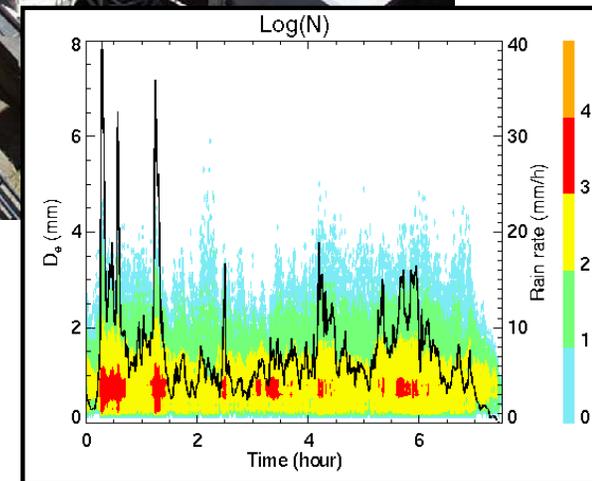
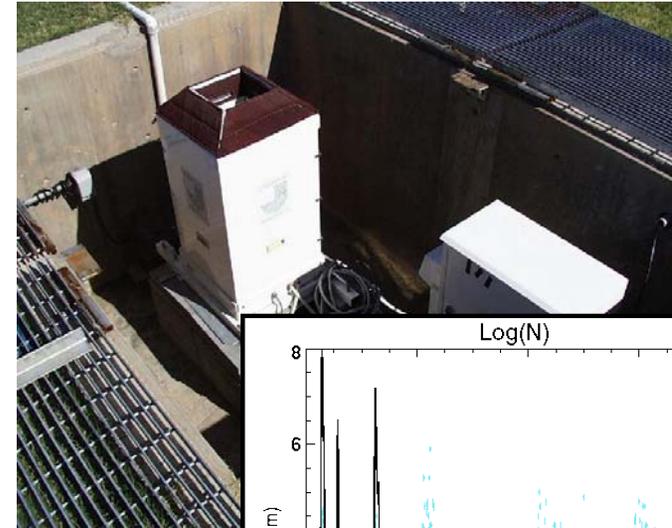
The NSSL 2D-Video Disdrometer

Data Collection Summary:

- Dataset includes over 50,000 one-minute Drop Size Distributions (DSDs) with $R > 0.1$ mm h⁻¹.
- DSD measurements have been made on >300 separate days over an 8 year period.

The NSSL 2DVD has proven critical to dual-polarization research by:

- Providing a large precipitation dataset used to develop dual-polarization precipitation estimation algorithms to be deployed with the polarimetric WSR-88D.
- Providing a large, comprehensive dataset that documents differences in DSD characteristics over a wide variety of seasons and precipitation regimes.



Kessler Farm Field Laboratory (KFFL)

Permanent KFFL Field Facilities:

- WASH Oklahoma Mesonet site
- NOAA 403 MHz and OU 915 MHz wind profilers
- NSSL vertically pointing 24.1 GHz Micro Rain Radar
- OU 2D-Video Disdrometer
- Piconet rain gauge network

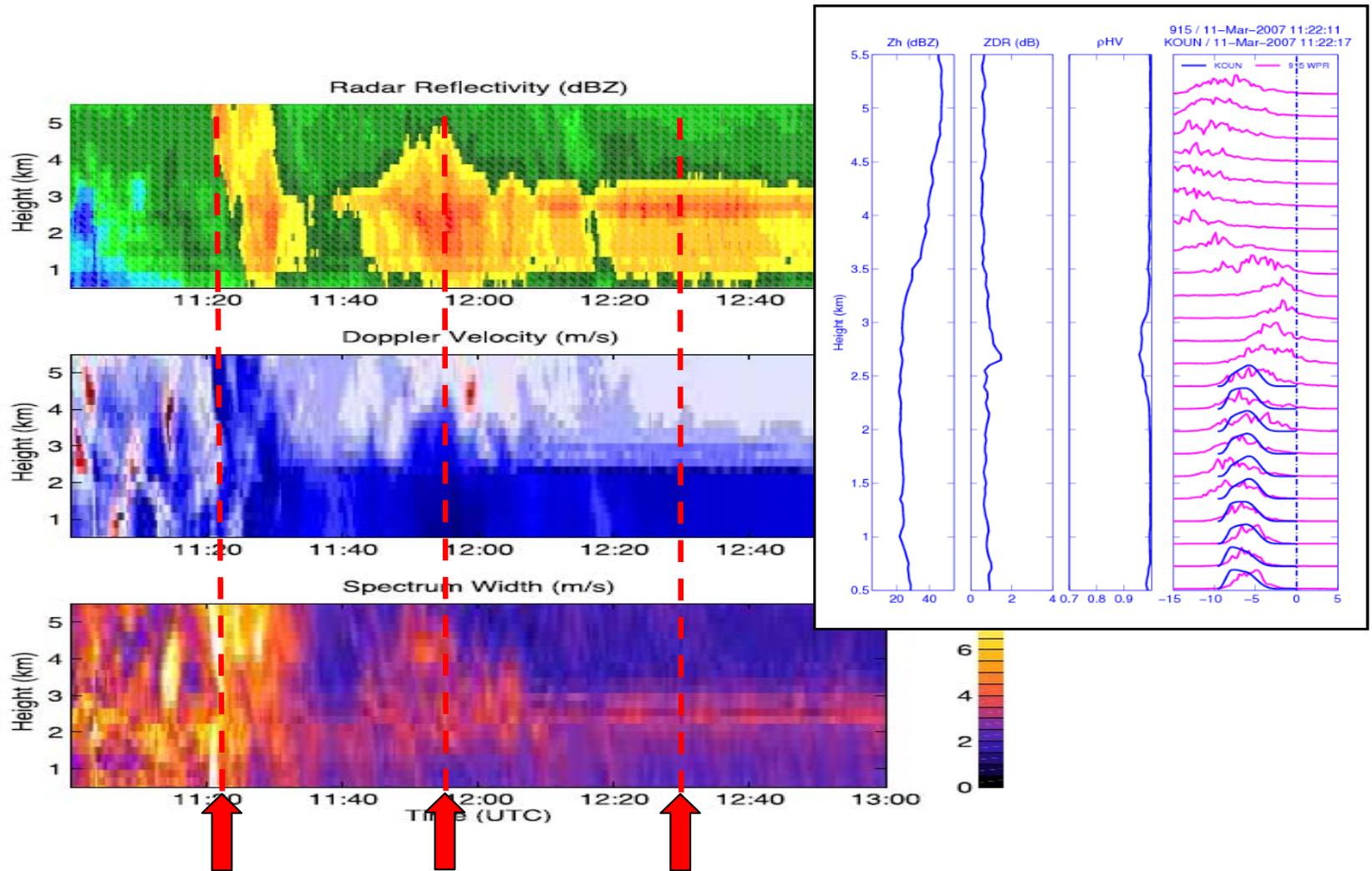


KFFL has proven critical to dual-polarization research by:

- Providing datasets used to better understand the vertical microphysical structure of precipitating clouds, leading to improved polarimetric algorithm performance.



Kessler Farm Field Laboratory



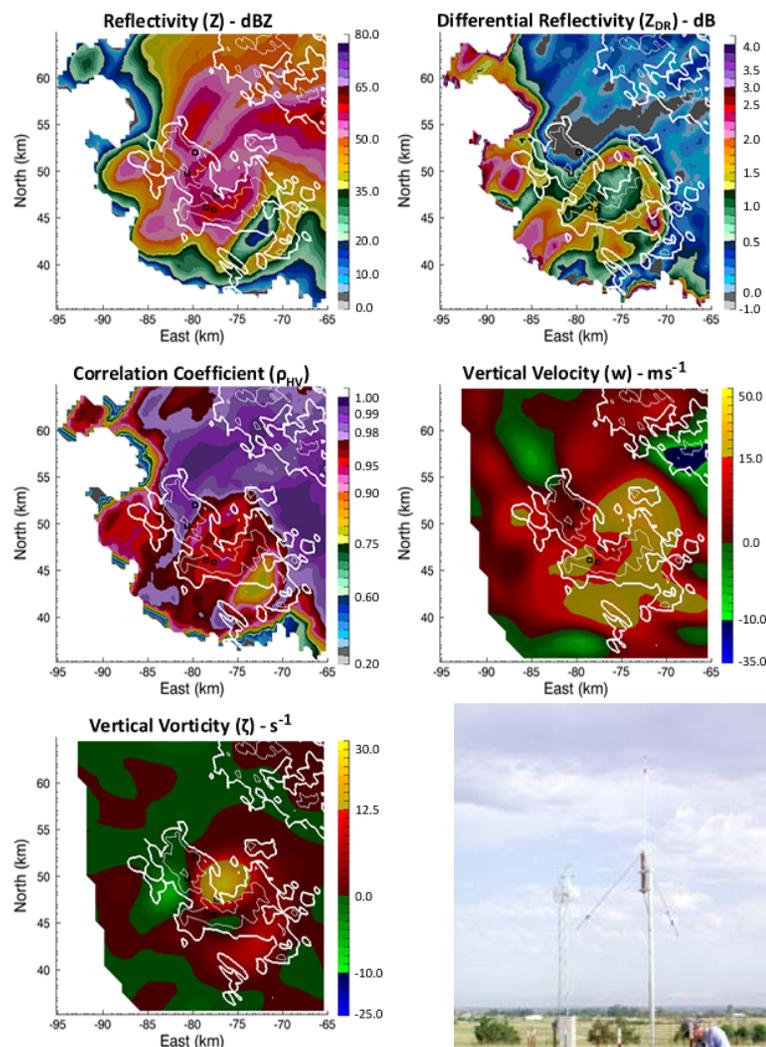
Oklahoma Lightning Mapping Array

The OK-Lightning Mapping Array:

- Consists of 11 stations, all located to the west of the KOUN radar.
- Measures VHF sources emitted by each segment of a lightning flash.
- Accurately measures 3D lightning characteristics to a range of ~100 km from network center.

The Oklahoma Lightning Mapping Array has proven critical to dual-polarization research by:

- Providing 3D lightning signatures used to investigate relationships between electrical, kinematic, and radar-derived microphysical structures.



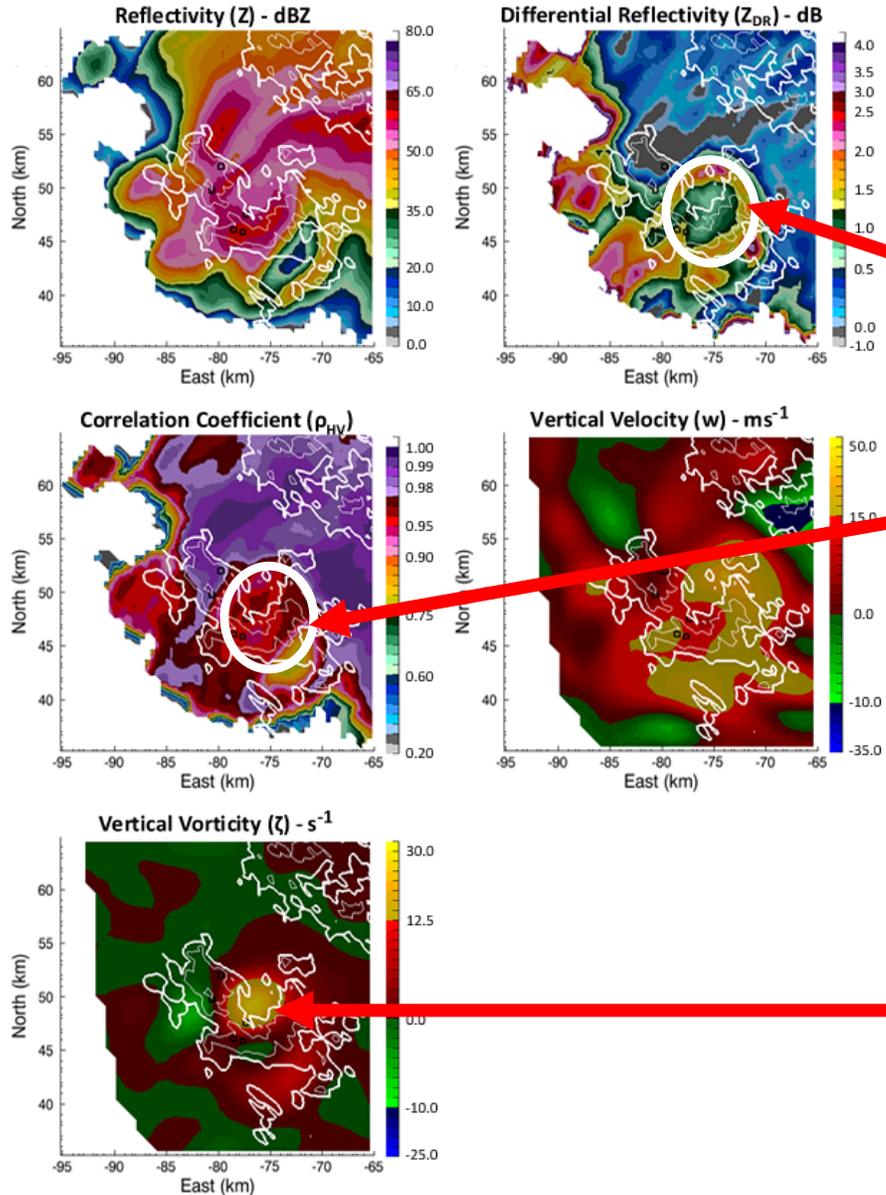


Oklahoma Lightning Mapping Array Tornadic Supercell

Midlevel rings of Z_{DR} and ρ_{HV} formed just prior to a F2 tornado.

Midlevel Z_{DR} and ρ_{HV} rings were visually correlated with a ring in lightning source density, which was centered on the maximum in vorticity.

Z_{DR} , ρ_{HV} , and lightning source density rings dissipated when tornado lifted.



Midlevel rings of Differential Reflectivity (Z_{DR}) and Correlation Coefficient (ρ_{HV})

Vorticity maximum

Volunteer Observation Networks

Winter Precipitation Identification Near the Ground (W-PING)

Hail Size Discrimination Experiment (HaSDEx)

Volunteer Data Collection:

- ✦ Advertised by local television stations and newspapers, NOAA web pages, and schools.
- ✦ Web-based training materials are provided.
- ✦ Volunteers provide observations using a web-based form.
- ✦ Quality controlled by NSSL student employees.



The Volunteer Observation Network has proven critical to dual-polarization research by:

- ✦ Providing valuable validation datasets used to improve the performance of the polarimetric precipitation type classification algorithm.

Summary

Meteorological Observations in support of Dual Polarization Research:

- ✧ Support NOAA's mission to provide improved weather and water information.
- ✧ Critical to the success of NSSL polarimetric radar research by providing valuable validation datasets.
- ✧ Used extensively to develop rainfall estimation and precipitation type classification algorithms to be deployed with the polarimetric WSR-88D.
- ✧ Include data from fixed-site facilities whose collocation with a polarimetric radar are unique to central Oklahoma.
- ✧ Provide an opportunity for NSSL scientists to participate in ongoing collaborations with OU faculty and students.

