

Warn on Forecast and VORTEX2

Dr. Louis J. Wicker
Hazardous Weather Forecasts
& Warnings



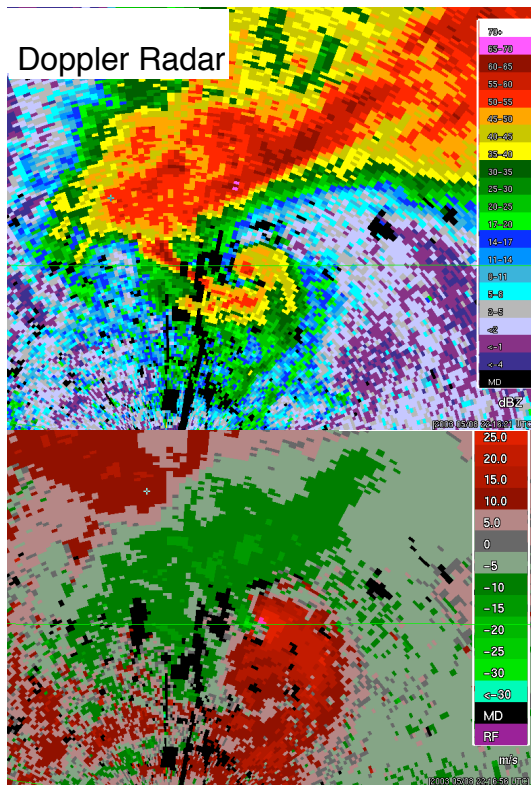


Outline

- Warn on Forecast (WoF)
 - what is it?
 - why do we need it?
- Scientific challenges for WoF
- WoF and VORTEX2

Current Warning Paradigm

Warn on detection of pre-tornadic structures



Human prediction of storm evolution



What is Warn on Forecast?

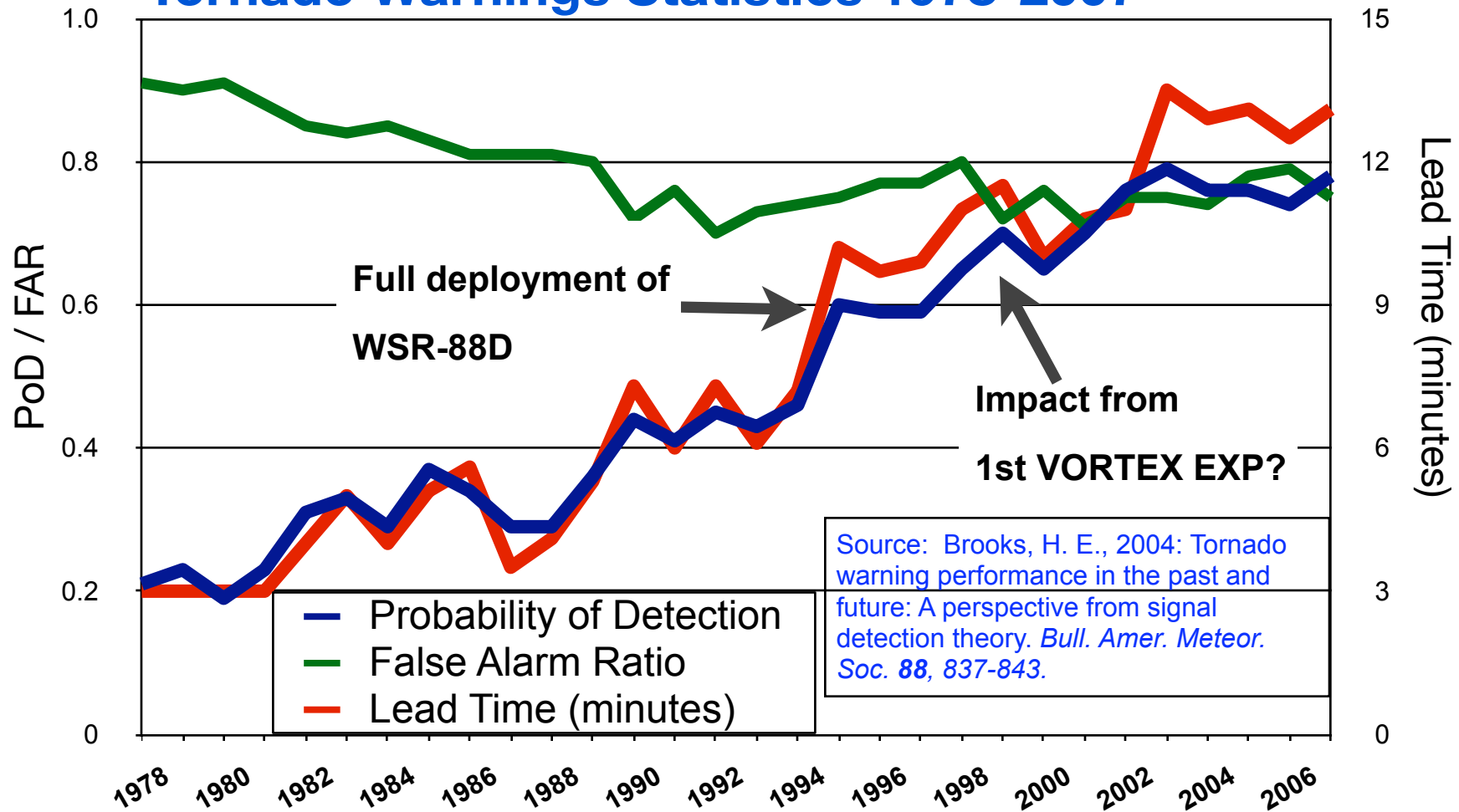
- ▶ NWP for individual convective storms using an ensemble approach
- ▶ High-resolution synthesis of mesoscale, radar-scale, and in situ observational data via 4D data assimilation
- ▶ Provides forecasters with detailed information on the type, severity, and probability of weather threat

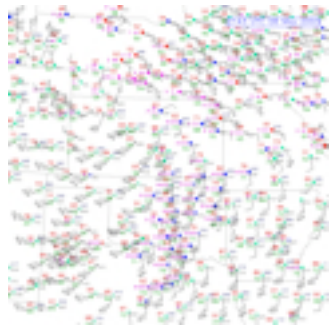
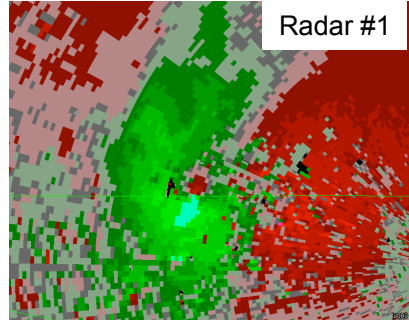
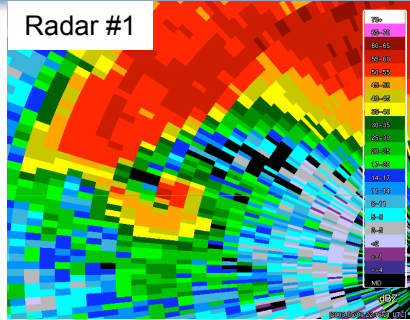
Source: Stensrud *et al.*, 2008: Convective-Scale Warn on Forecast: A Vision for 2020. *Submitted to Bull Amer. Meteor Soc.* Dec. 2008

Why do we need WoF?

Reached the limit of our current technologies?

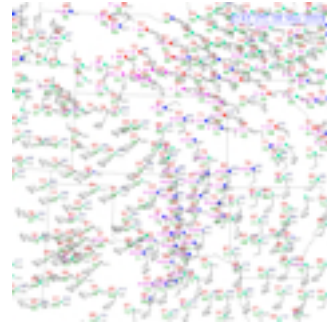
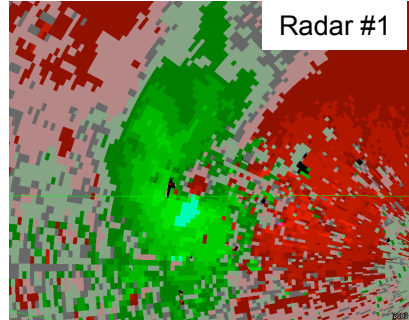
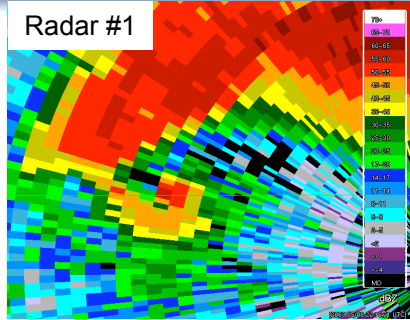
Tornado Warnings Statistics 1978-2007



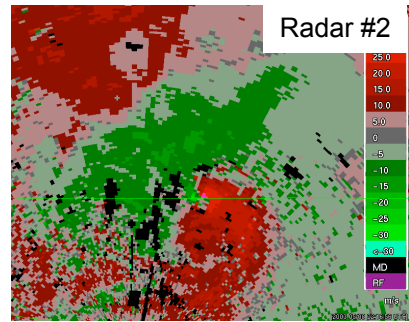
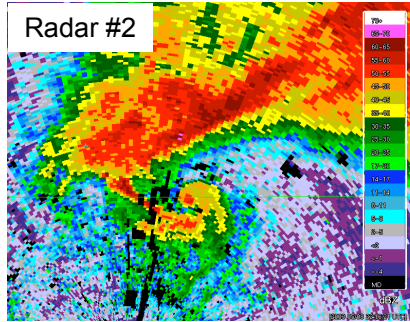
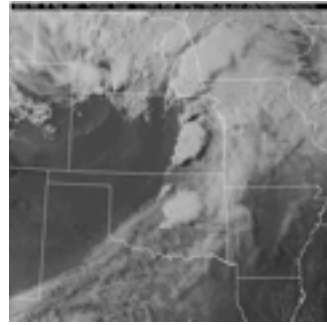


Reached Information Overload?

Okay...standard warning information
input here...



Reached Information Overload?

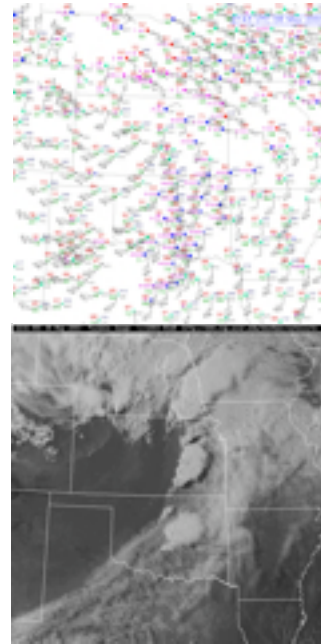
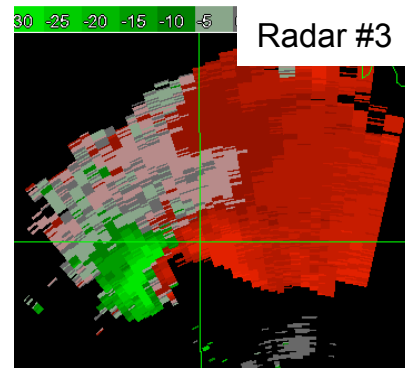
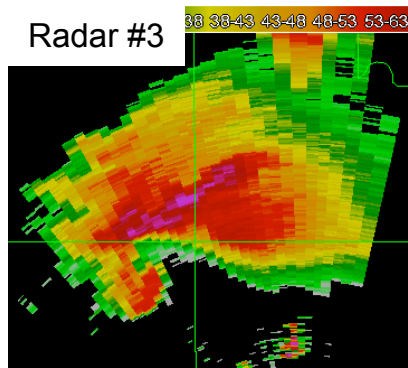
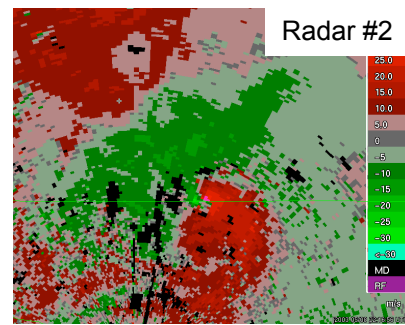
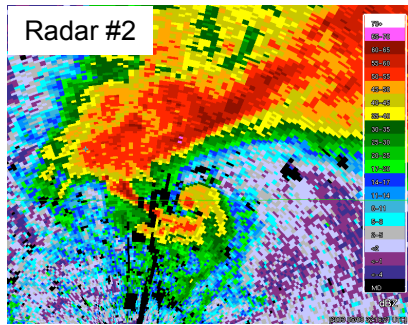
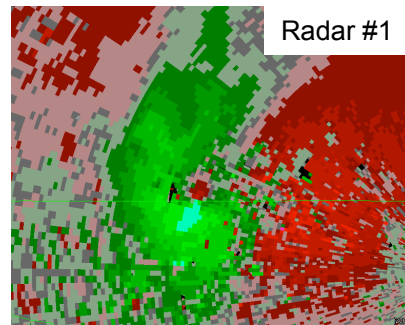
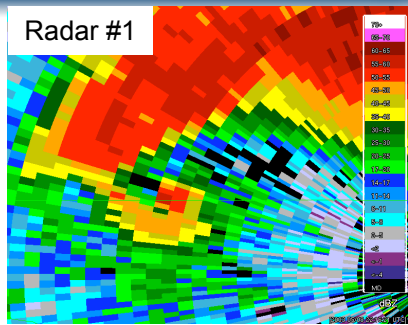


Cool!, hmm...uh, I think....



Information Overload!

NWS
Forecaster



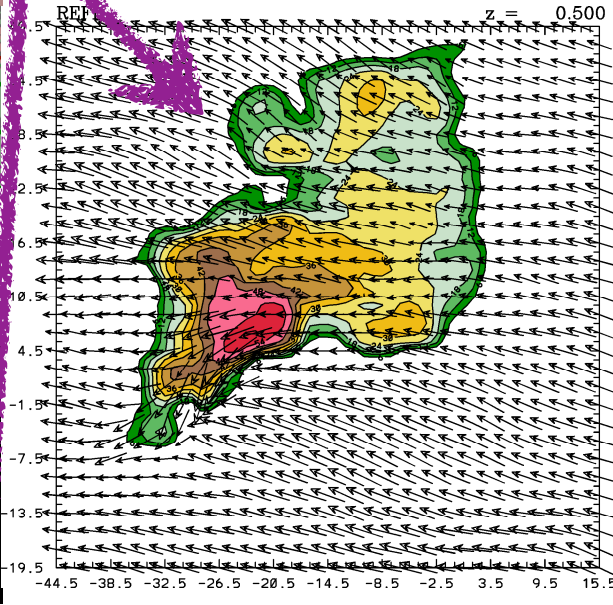
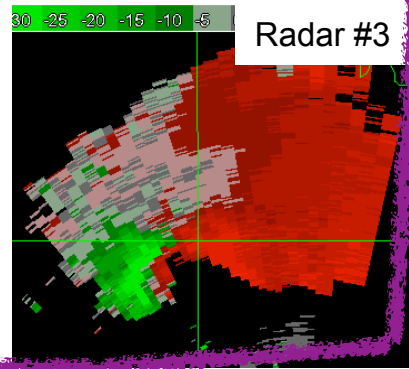
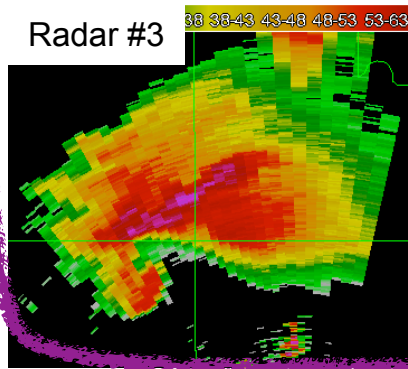
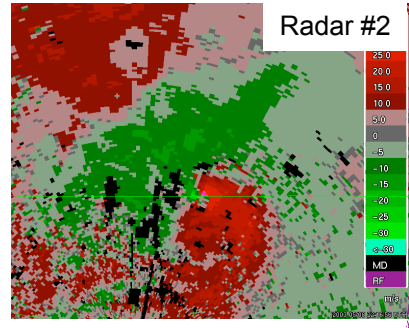
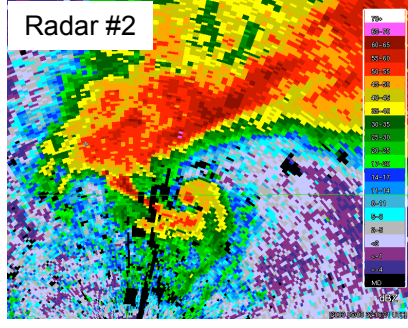
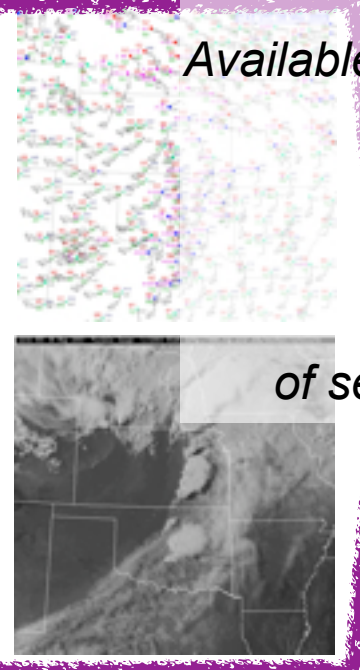
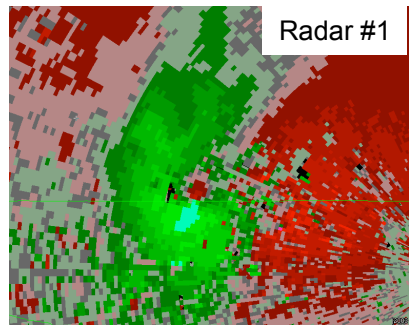
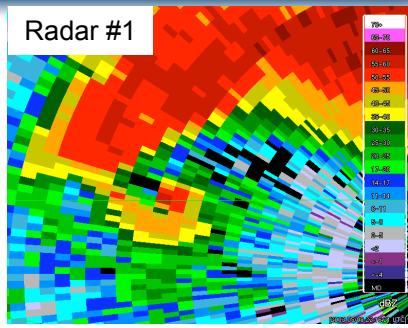
"I've tried to tell Stuart he's over-loading himself with too much information but"



Available data synthesized into a single 3D analysis



Numerical prediction of severe weather can follow



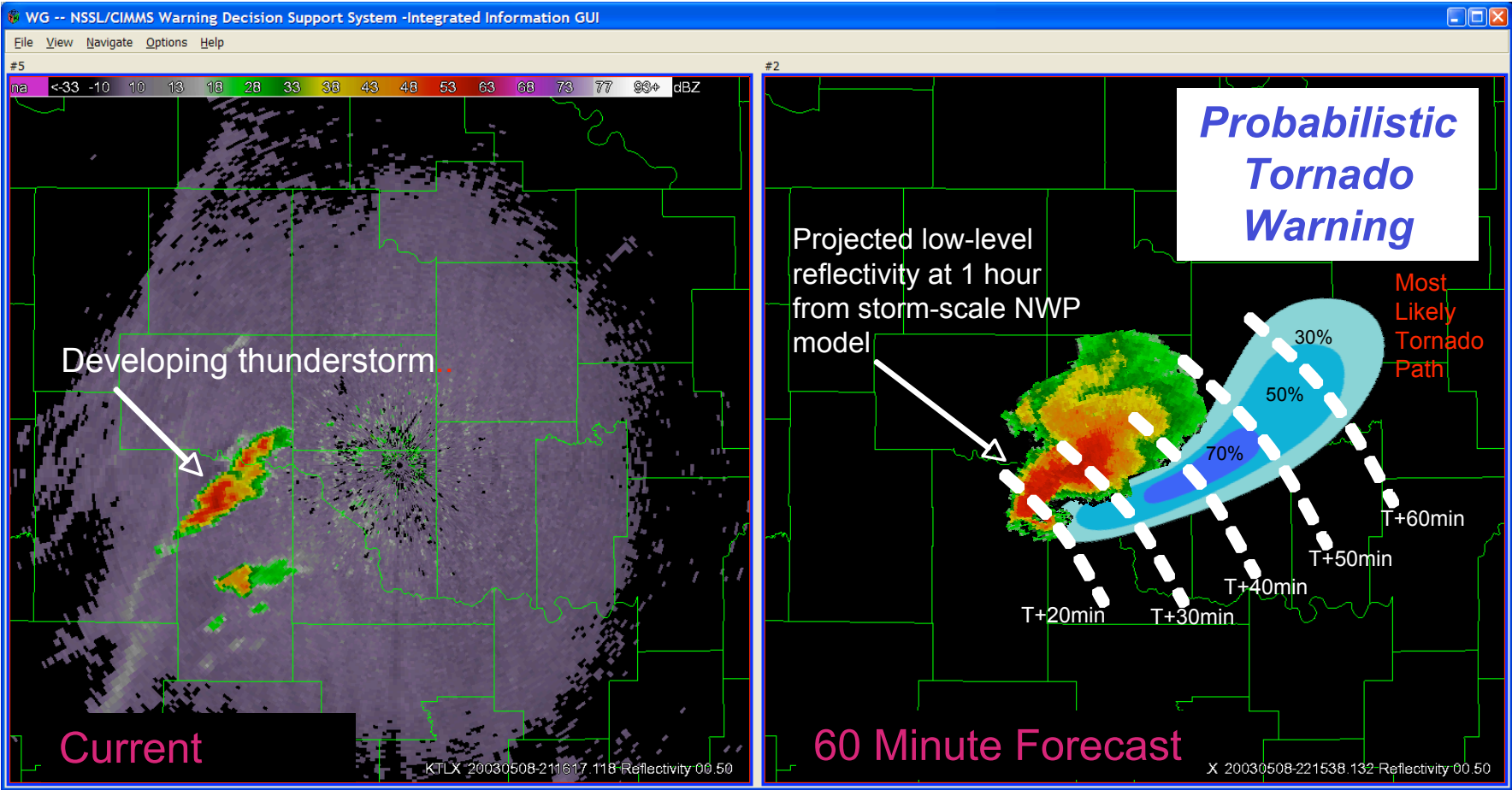
FLUS74 KOUN 082202
AWUOKC

WARNING DECISION
UPDATE
NATIONAL WEATHER
SERVICE NORMAN OK
500 PM CDT THU MAY
8 2003

THIS WARNING
DECISION UPDATE
CONCERNS CENTRAL
OKLAHOMA.

...URGENT...
**STRONG
COVERGENCE
SIGNATURE WITH RFD
AND INFLOW NOW
MOVING INTO
SOUTHWEST METRO
WEST OF MOORE.**
RADAR TRENDS AND
SPOTTER REPORTS
POINT TOWARD VERY
HIGH TORNADO
POTENTIAL...ANDRA

Warn on Forecast: What might it look like?





Warn on Forecast: New Data Sources

④ Surface data

- ④ surface mesonets, micronets, surface vehicle mesonets

④ Polarimetric radar

precipitation type (rain, snow, hail)

data quality control

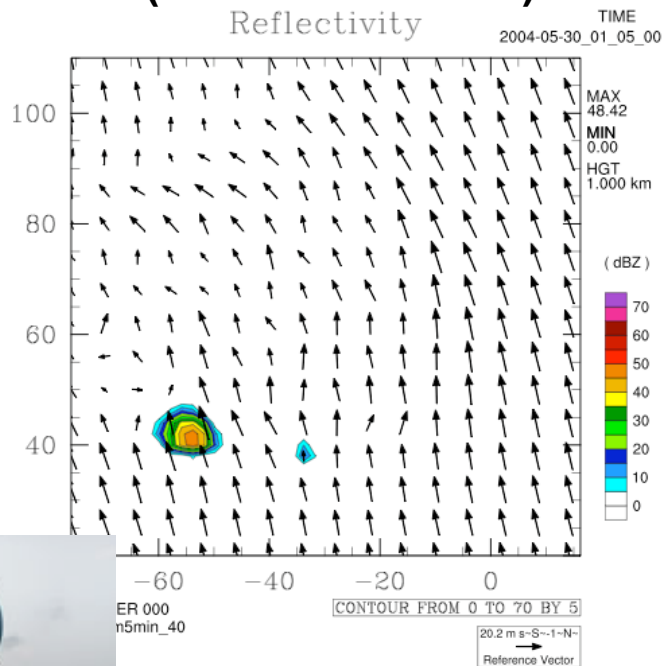
④ Rapid-scan (> 1 minute) radar volumes

- ④ phased-array radar systems



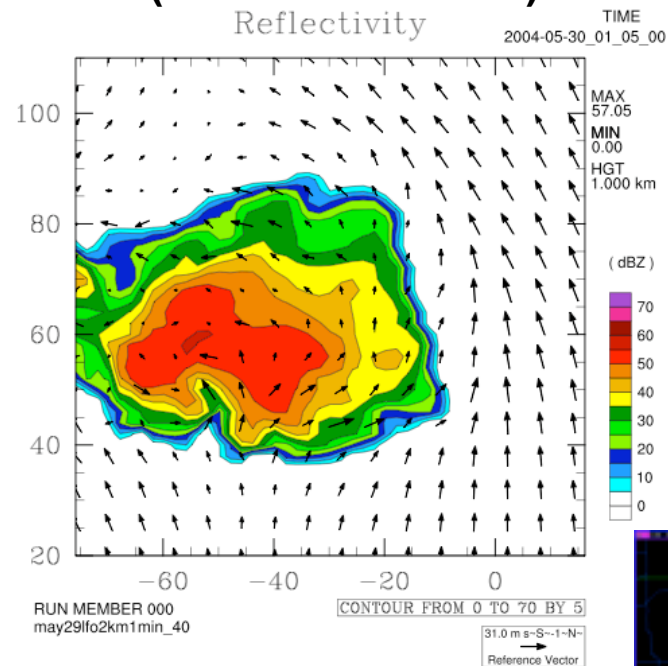
Warn on Forecast: Benefits of Rapid Scanning

Current Scanning Rate (~5 min volumes)

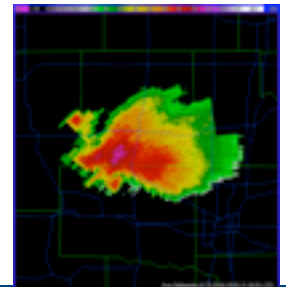


T = 15 min

PAR Scanning Rate (~1 min volumes)



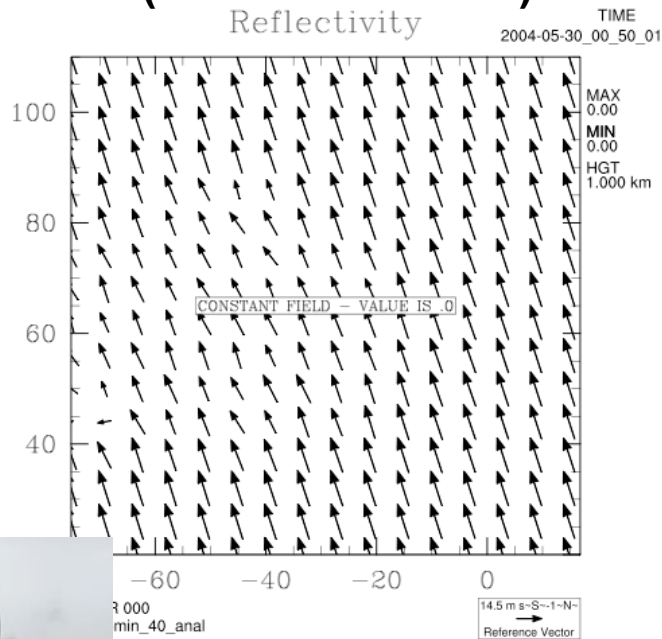
PAR data from 29 May 2004 OKC Supercell





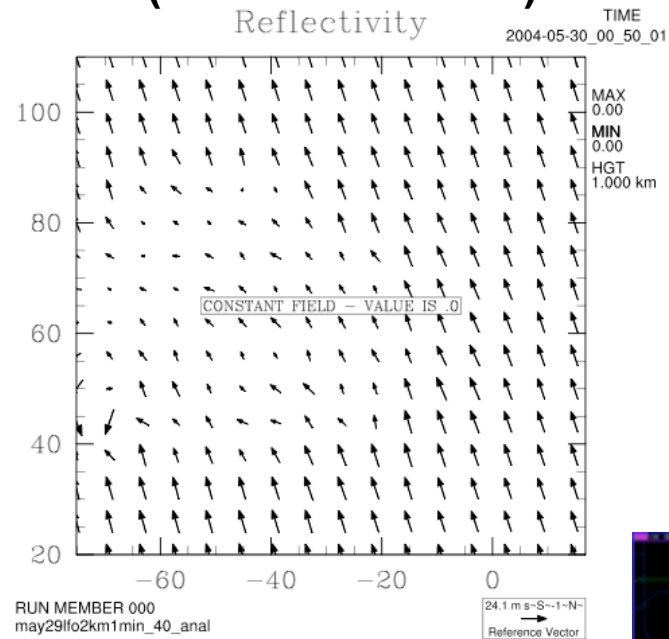
Warn on Forecast: Benefits of Rapid Scanning

Current Scanning Rate (~5 min volumes)

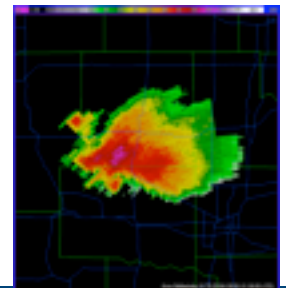


T = 00 min

PAR Scanning Rate (~1 min volumes)



PAR data from 29 May 2004 OKC Supercell





Warn on Forecast Scientific Challenges

Model Error: microphysics

- ⊗ impacts retrieval of unobserved variables
 - ⊗ (e.g., surface temperature, moisture, 3D winds)

Source: Dowell, D. C., F. Zhang, L. J. Wicker, C. Snyder, and N. A. Crook, 2004: Wind and thermodynamic retrievals in the 17 May 1981 Arcadia, Oklahoma supercell: Ensemble Kalman filter experiments. *Mon. Wea. Rev.*, **132**, 1982-2005.

Initial condition uncertainty

- ⊗ *how well do we need to know the mesoscale environment?*



Predictability??

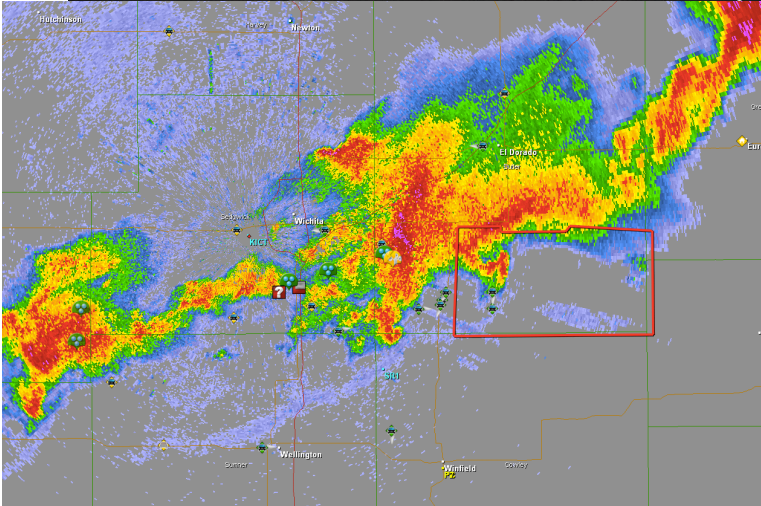


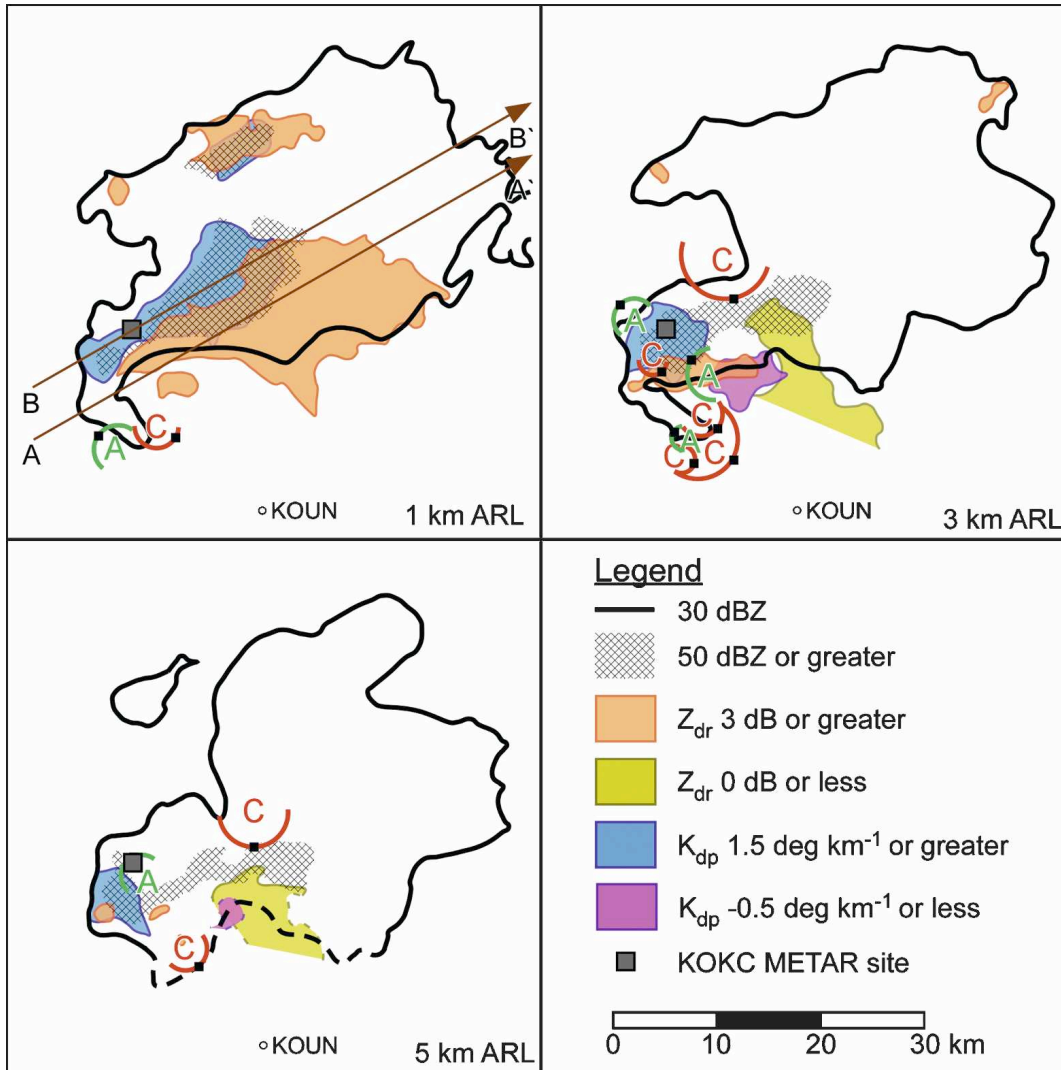
Warn on Forecast:

&

VORTEX #2 2009-2010

Completely mobile data
collection throughout the
southern and central plains





Combining surface data with Doppler and polarimetric radar data to understand microphysical processes

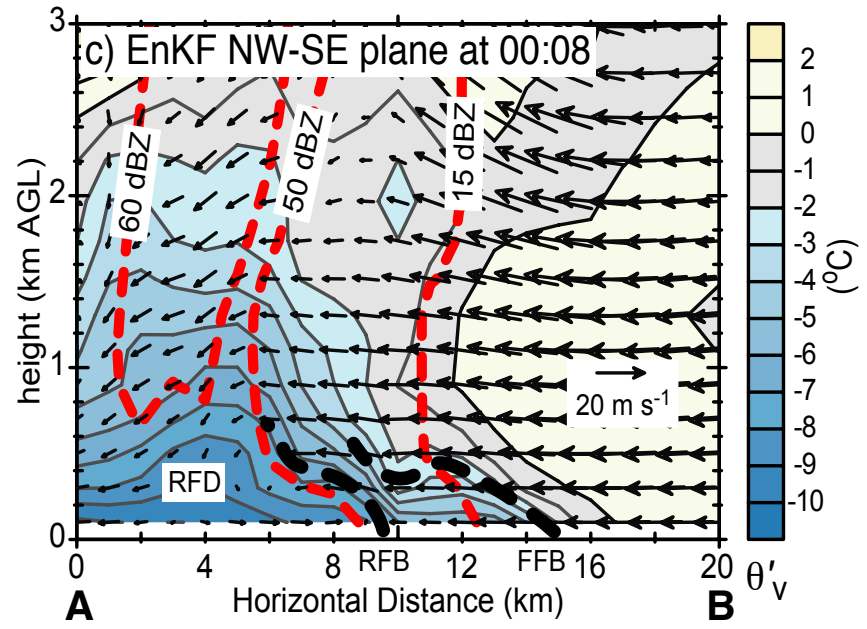
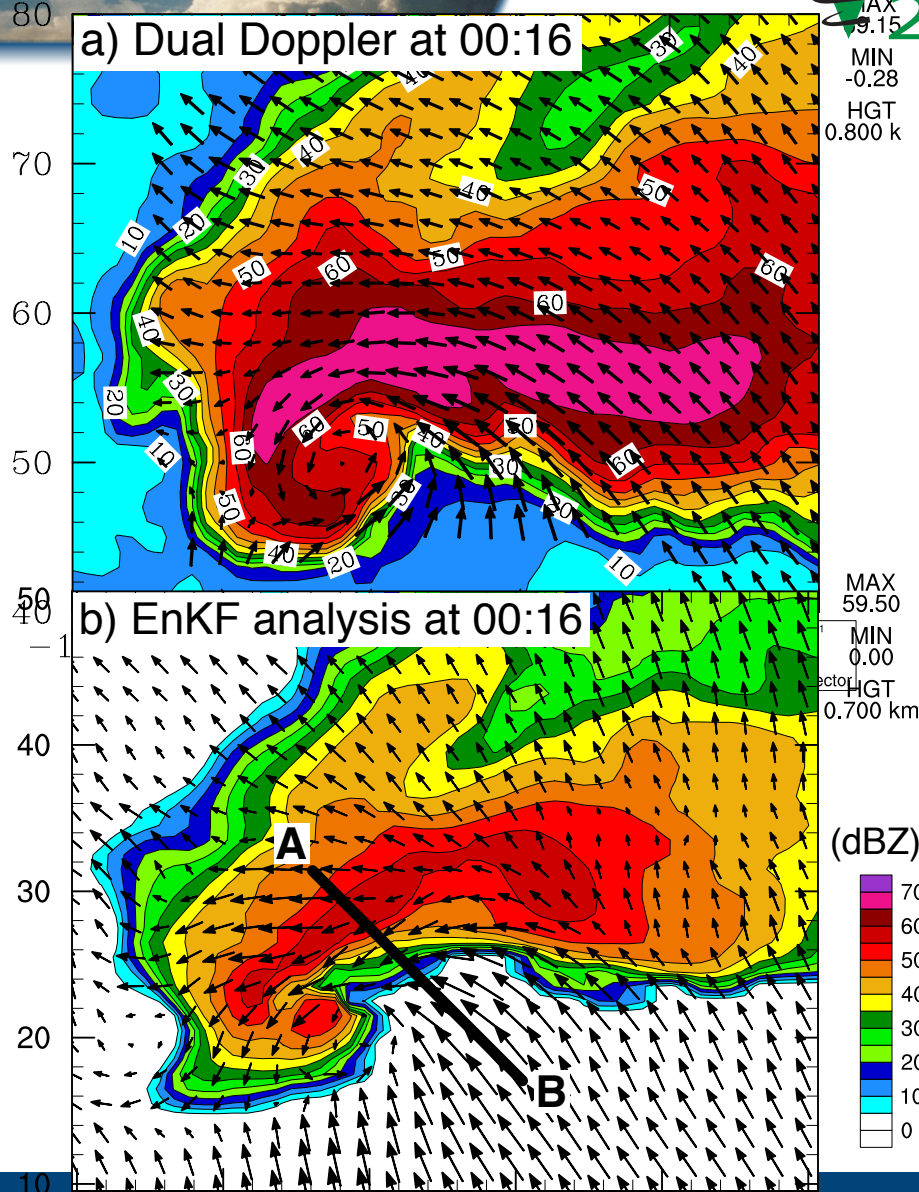
- *their role in tornadogenesis*
- *help improve model*

parameterizations

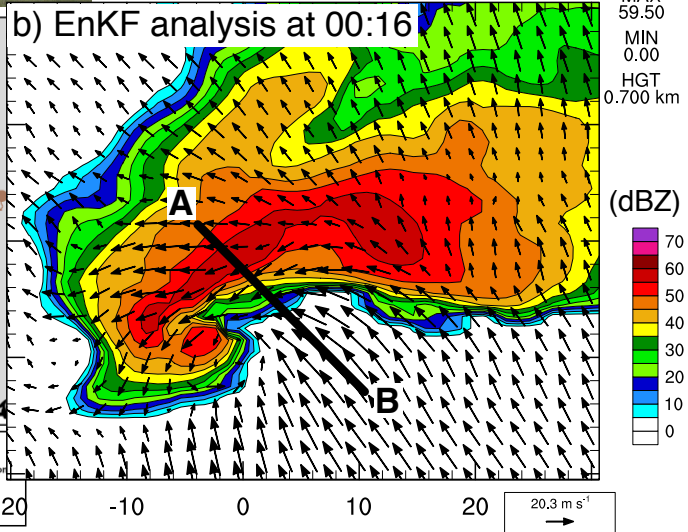
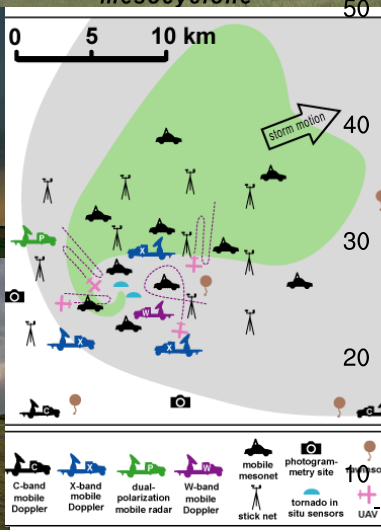
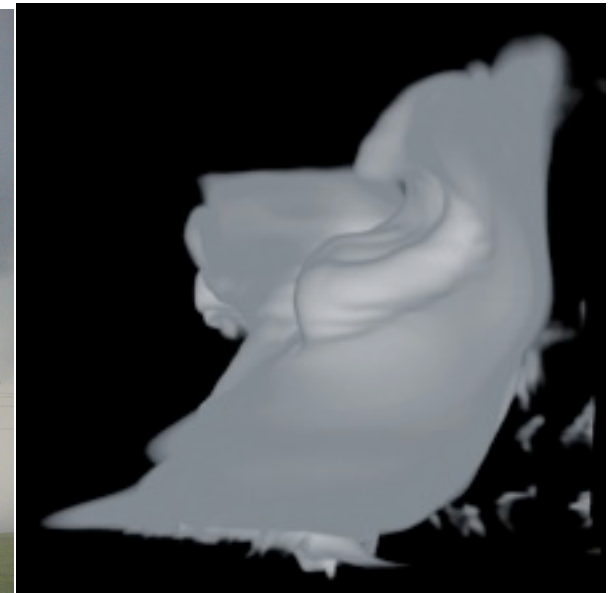
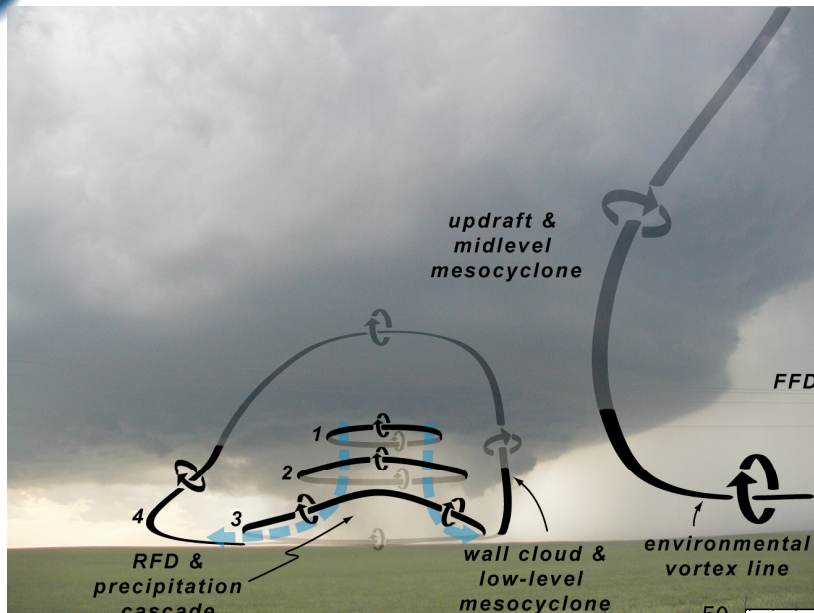
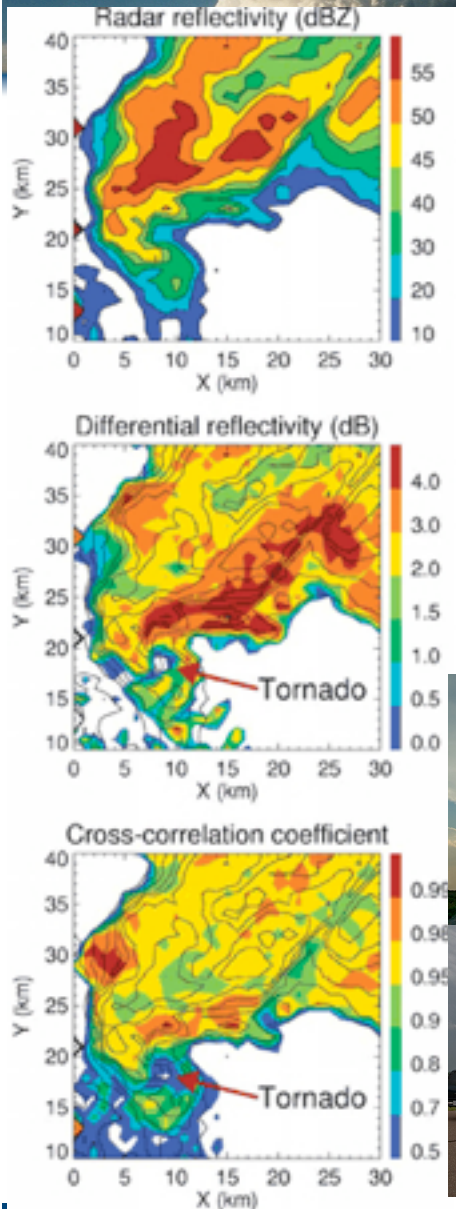
VORTEX and WoF

2009-2010

Understanding environmental sensitivities and predictability through storm-scale analysis, prediction, and VALIDATION



Increasing understanding of fundamental storm processes via observations and numerical simulations lead to *improved warnings*





Summary

⚡ Warn on Forecast

- ⚡ to meet NOAA's Weather and Water warning goals
- ⚡ benefit to hydrology and other sig-wx events
- ⚡ V2: high-resolution data sets and scientific knowledge needed to develop and test WoF

⚡ Partners





The End
Questions?