Investigation of Phased Array Radar Technology to Improve Warnings and Predictability of Hazardous Weather

Pam Heinselman
Weather Radar Research

Why Research PAR Capabilities?

1) Technology new to weather community

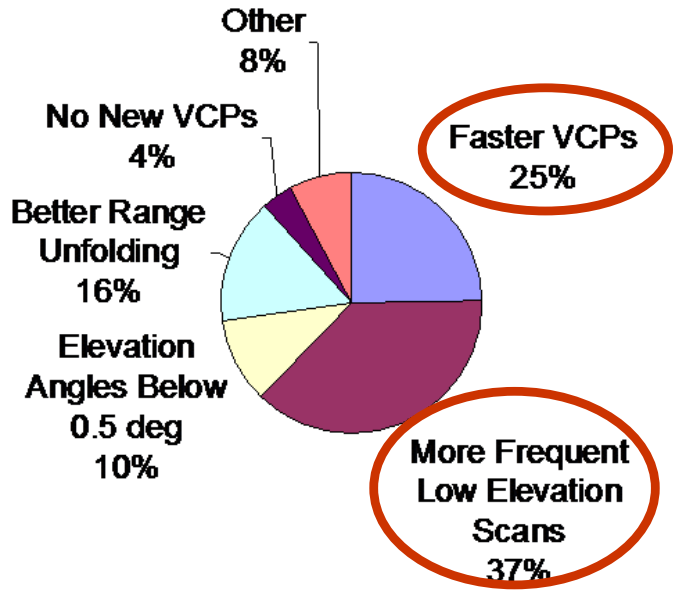
3) NOAA Strategic Plan Objectives

Increase lead-time and accuracy for weather and water warnings and forecasts

Improve predictability of the onset, duration, and impact of hazardous and severe weather

2) Stakeholder needs (N=80)

Which type of scanning improvement do you consider most important?



Goal: Investigate how PAR surveillance capabilities can address these needs

Customers, Partners, Collaborators

Customers

NWS, FAA, DoD
Public
Weather
Enterprise

Key Partners

NOAA and FAA
Univ. Oklahoma
Lockheed Martin &
BCI

Collaborators

NWS
Univ. Oklahoma
Lockheed Martin &
BCI

Accomplishments & Current Research

Rapid updates

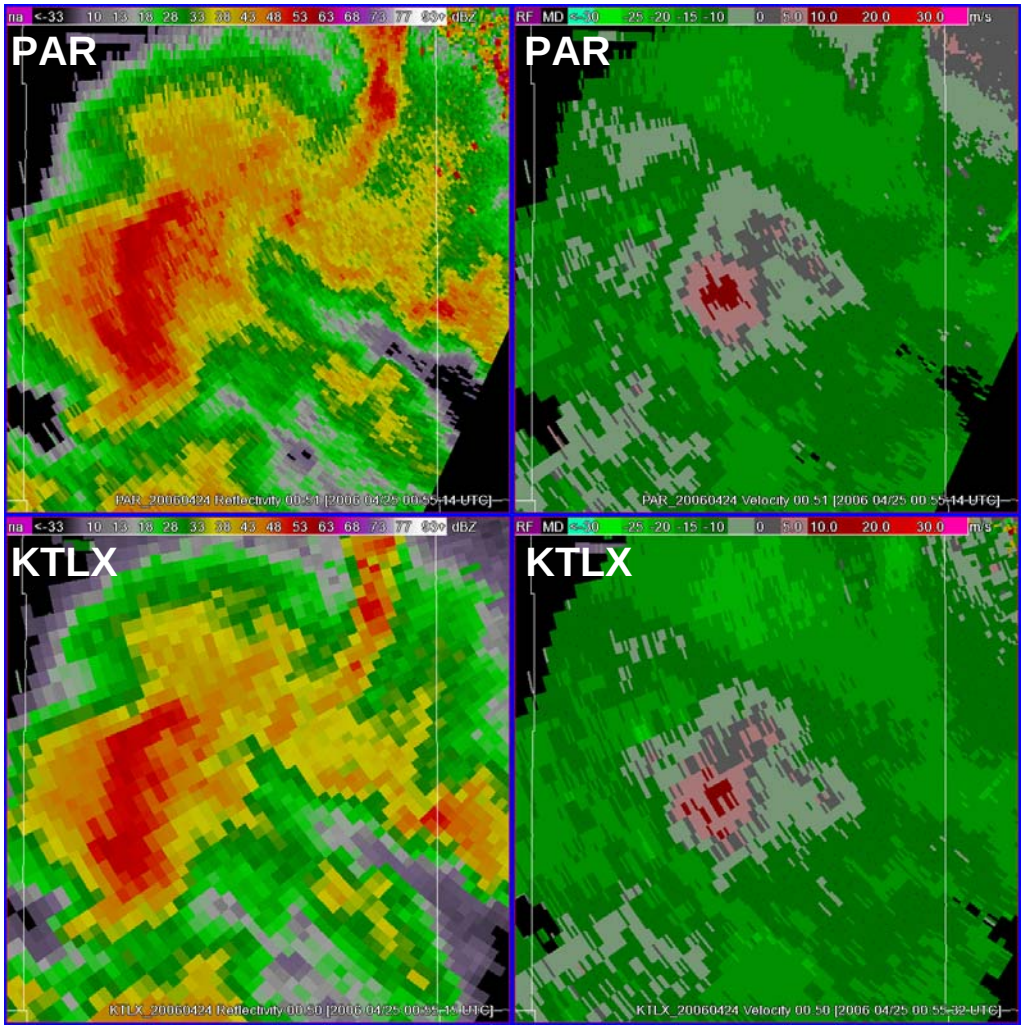
≤1 min Volumetric Scans

29 May 2004 – Present, 48+ Events

15 Supercells: 6 tornadic

13 MCSs: 1 tornadic

13 Pulse storms 7 Scattered storms



Quality

Heinselman, P.L., D.L. Priegnitz, K.L. Manross, T.M. Smith, and R.W. Adams, 2008: **Rapid Sampling of Severe Storms by the National Weather Radar Testbed Phased Array Radar.** *Wea. Forecasting*, **23**, 808–824.

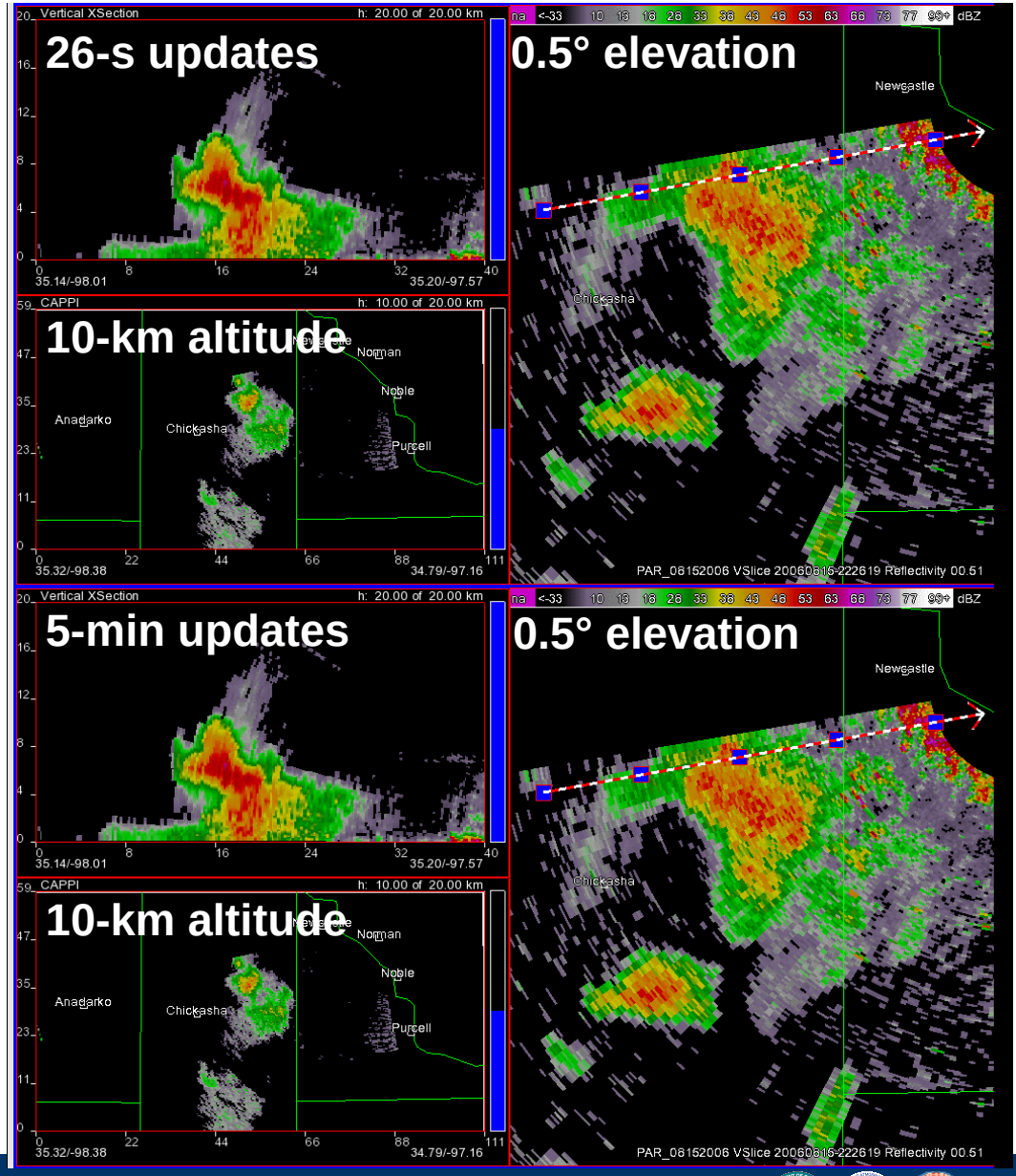
Accomplishments & Current Research

Rapid updates

15 August 2006

PAR reflectivity cross-section
31 elevation scans →

Approximated WSR-88D Reflectivity cross-section
31 elevation scans →



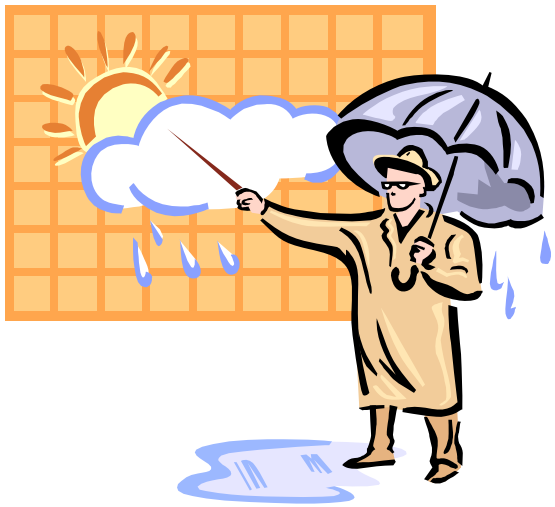
Research Funded by NSF
Examine relationships between hail development and lightning

Current Research

Identifying Strengths and Limitations of Current Radar Systems

Relevance

Understand stakeholder needs in order to assess suitability of PAR as a useful weather radar technology



Who: NWS and Broadcast Meteorologists

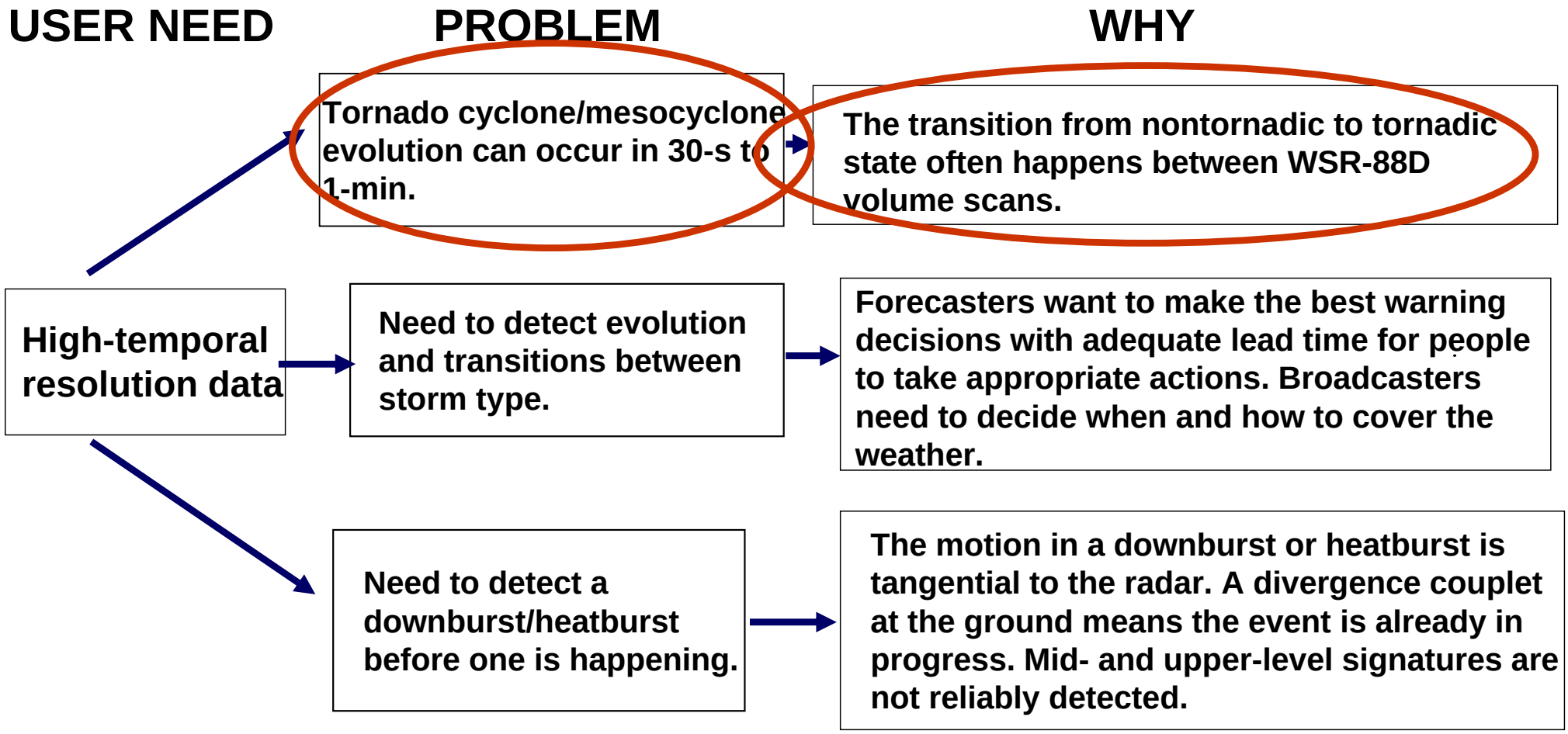
Methodology: Use the critical incident technique to interview radar users.

Critical incident technique: Ask participant to recall critical incidents which illustrate strengths and limitations of radar.

Collaborators: OU PhD Candidate and NWC Research Experience for Undergraduates Student

Current Research

Identifying Strengths and Limitations of Current Radar Systems



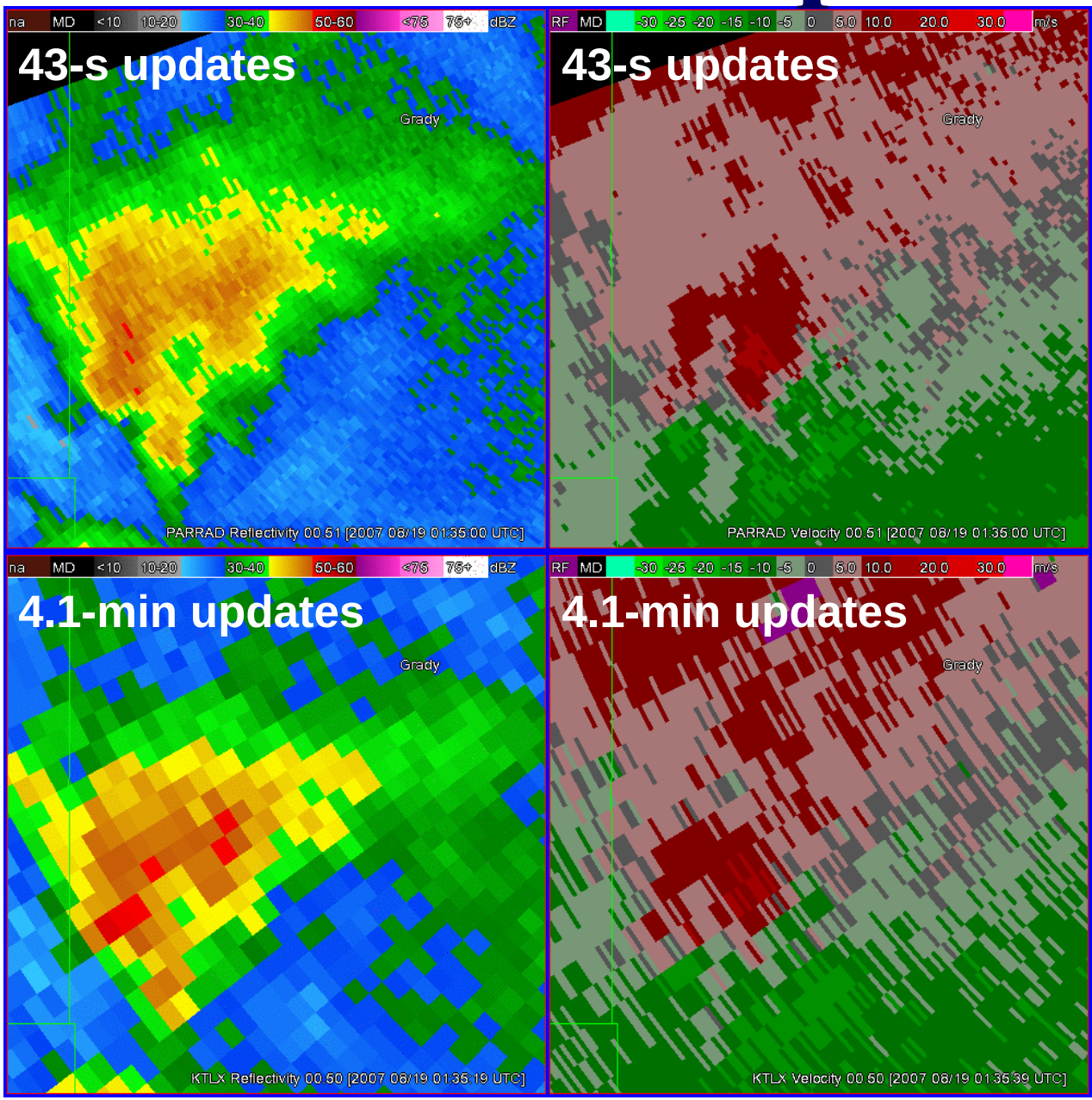
Forecaster Evaluation of a supercell

19 August 2007

PAR
VCP 12
Beam multiplexing
60° sector

0.5° oversampling in azimuth

WSR-88D
VCP 12



Forecaster Evaluation (N=10)

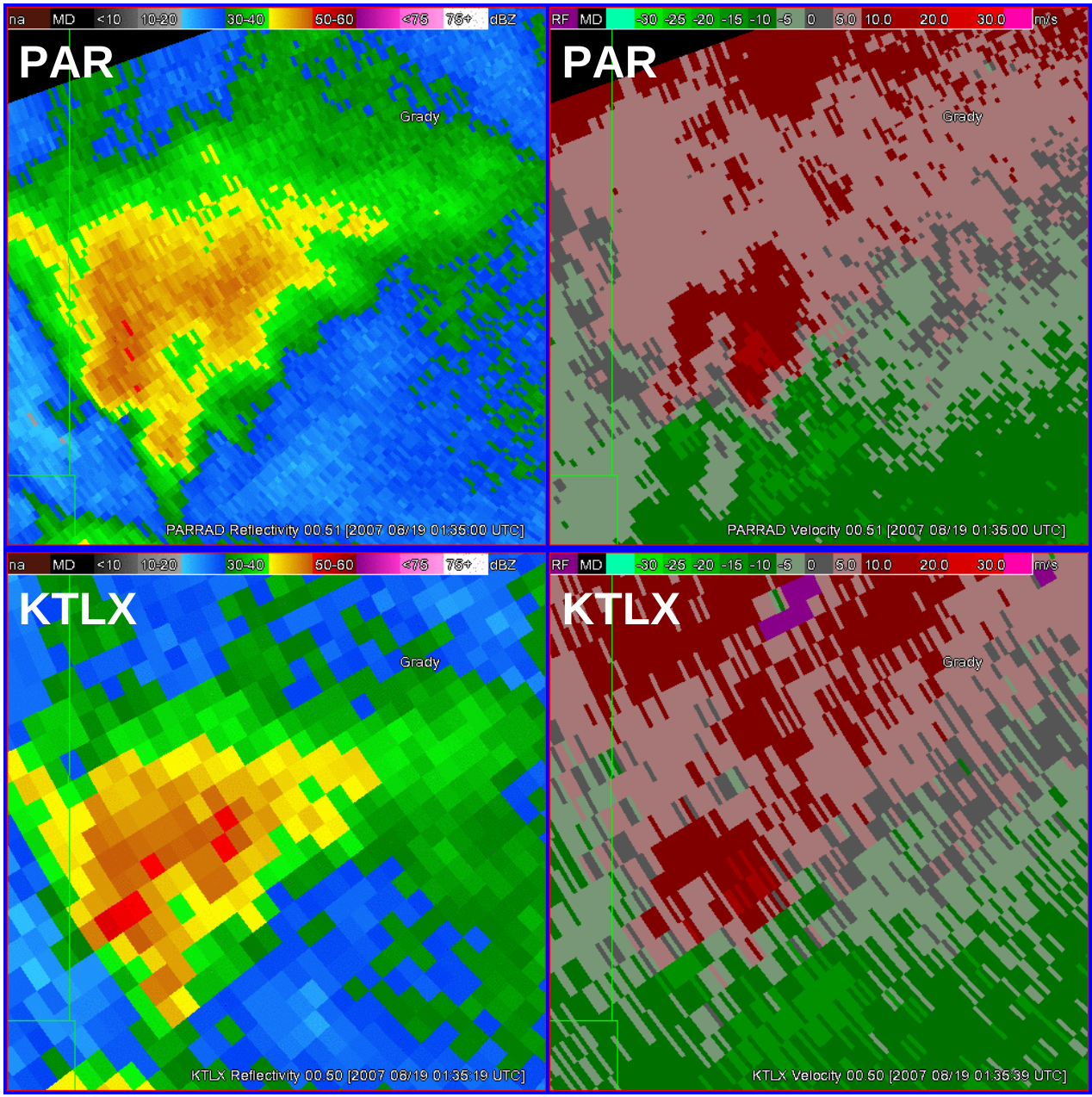
Benefits of Rapid Updates

Quicker analysis of developing circulations

"Rapid updates at the 0.5° tilt were critical in this case; rotation and TVS features were very fast moving and very fast to evolve."

Increased lead time and confidence

"Allowed the tornado warning to be issued 3–4 min before the signature appeared on 88D, and with higher confidence."



Accomplishments & Current Research

Forecaster Evaluation of Rapid Updates

Operational Utility of PAR

Spring 2007/2008: 19 NWS Forecasters, 17 WFOs

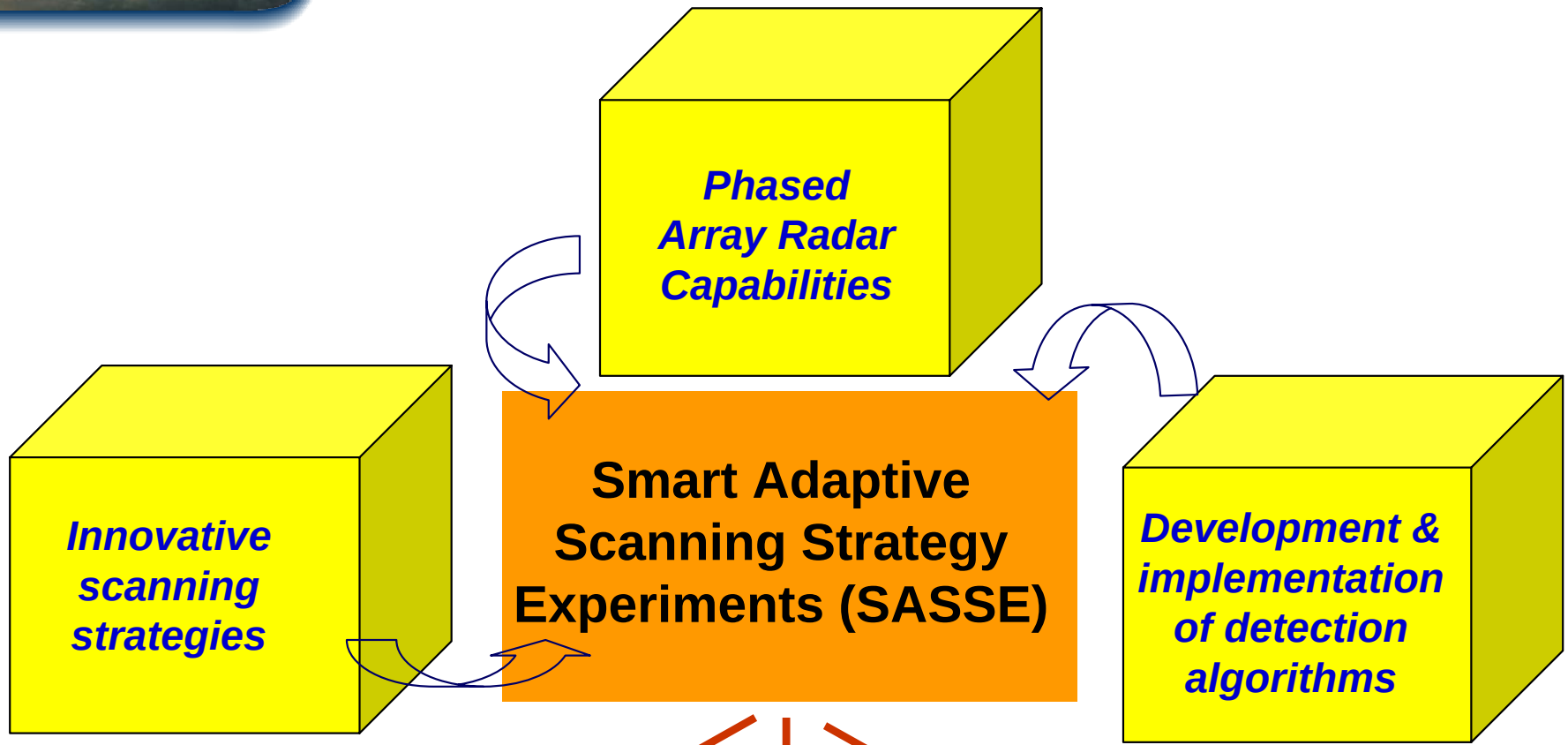
Asked how high-temporal sampling impacted their warning decision-making

1) Improved capability to identify, analyze, and monitor storm processes related to severe weather

2) Few minutes additional lead time

3) Higher confidence in decision-making

Future Directions



Increased lead time & accuracy of weather warnings

Improved predictability of storm evolution

Improved understanding of convective storms

Summary

Goal: Investigate how PAR surveillance capabilities can address users' radar needs and the needs of NOAA

Research efforts are advancing us toward this goal