Poster Showcase
#iaem24

Potential Future Operational Benefit of Phased Array Radar to Improve Decision Support for End Users

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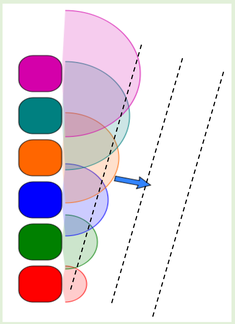
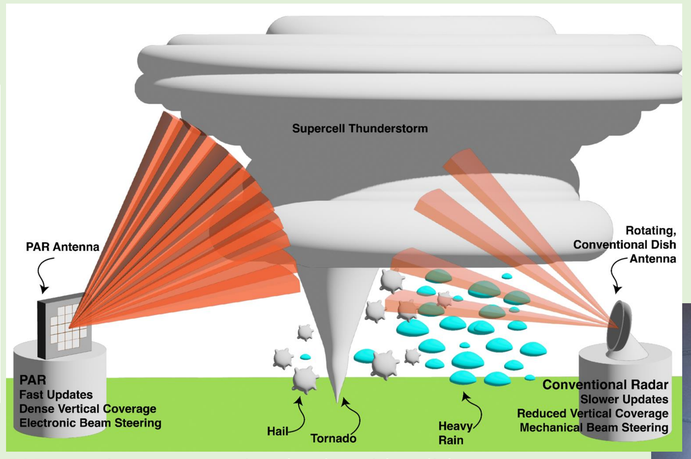
Non-Competitive

What is a phased array radar (PAR) and how does it work?

- Flat panel with many small antennas → electronically steer the radar beam instead of using a dish to mechanically steer the radar beam.
- Electronic beam steering allows for faster updates and more flexibility in scanning weather.
- Get full scan of a storm in 1–2 min or less.

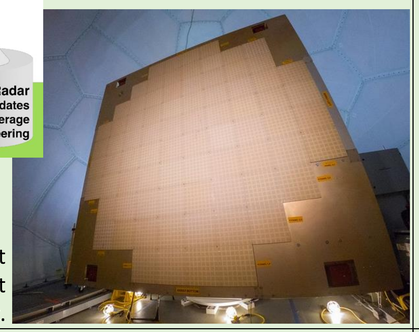


By changing the timing of when the antennas are active, can steer the radar beam in different directions.



PAR scanning vs conventional radar with a dish antenna. PARs can scan storms quicker, more completely, and more precisely.

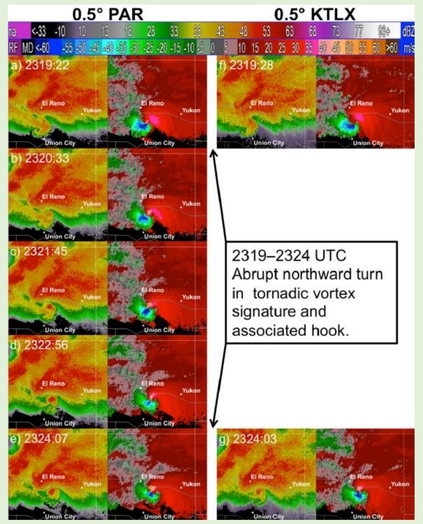
Scan for a video about PARs



Right. The National Severe Storms Laboratory's current dual-pol PAR consists of 4864 small antennas that operate in concert.

How might PARs help National Weather Service forecasters and public safety officials?

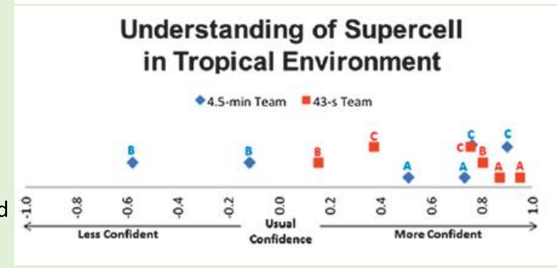
- Faster updates can help with understanding of storm location and motion as well as confidence in severe weather warning decisions.
- A flexible radar allows each storm to be scanned in the most efficient and beneficial way.
- Potential for improvement in algorithm output.



Rapid updates (left column) better captured quick northward turn of a strong tornado than conventional updates (right column).

Tornado Warning Metric	1-min Updates	5-min Updates
Lead Time (min)	12.7	9.0
Prob of Detection	0.78	0.62
False Alarm Rate	0.29	0.44

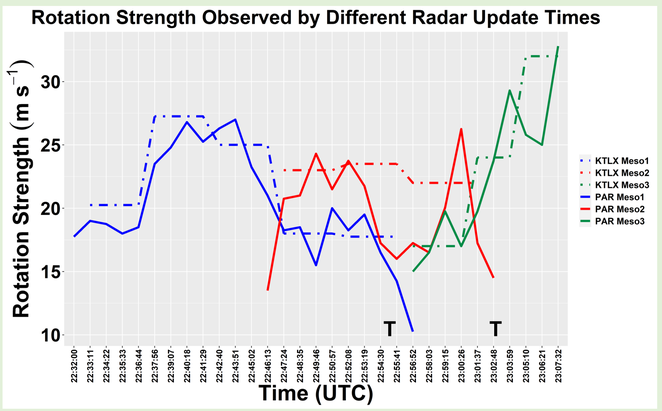
Left: Tornado warning metrics from a PAR Hazardous Weather Testbed experiment.



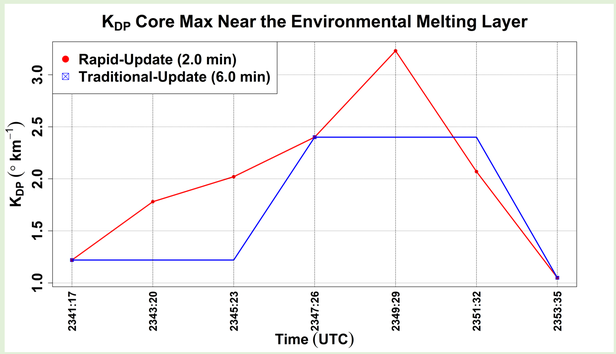
Left: Forecaster confidence during a tropical supercell case in the Hazardous Weather Testbed. Red squares are forecasters using rapid updates, blue diamonds are forecasters using traditional updates. Markers further right indicate higher confidence.

PARs help scientists understand more about storms by providing rapid-update observations.

- More complete and accurate observations of rotation, radar features associated with downbursts, and radar features associated with thunderstorm updrafts.



Observations of rotation in a supercell by a PAR (solid lines) and radar in the current radar network called KTLX (dashed lines). T marks the time of tornado formation.



Observations of a downburst radar feature, called a K_{DP} core, with rapid-update, 2-min data (red line) and traditional-update, 6-min data (blue line)

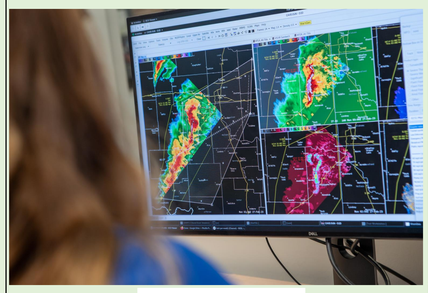
Right: Supercell observed by PAR and current radar network

Right: QLCS observed by PAR and current radar network

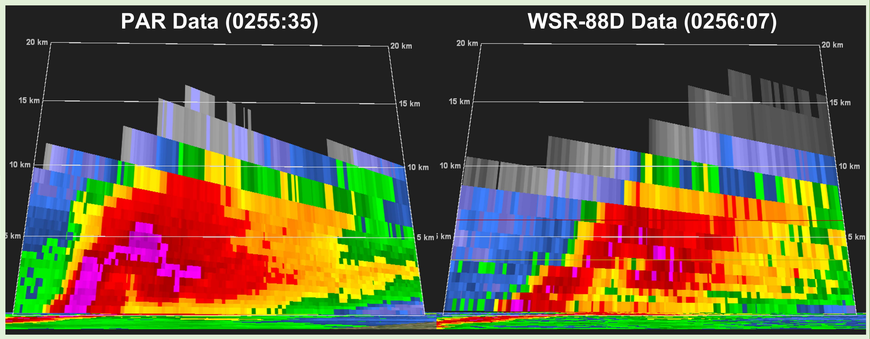
Right: Downburst features observed by PAR and current radar network

What do forecasters think about PARs? Early takeaways from the Hazardous Weather Testbed (HWT).

- Rapid updates are very beneficial → better depict key radar features → better understanding → higher confidence in warnings
- Increased vertical coverage also beneficial. Better depiction of hail cores, descending features, and updraft indicators.
- Increased scanning flexibility likely helpful → The radar you need, when and where you need it.
- Radar beamwidth and velocity data quality is important. Make both as good as possible.



Scan for video about HWT



Faster updates and increased vertical coverage result in a more accurate depiction of storm structure by a PAR (left) and a radar in the current operational network (right). These aspects can increase forecaster warning confidence.