Behind the Curve: FAA and the Low Altitude Weather Radar Coverage Problem

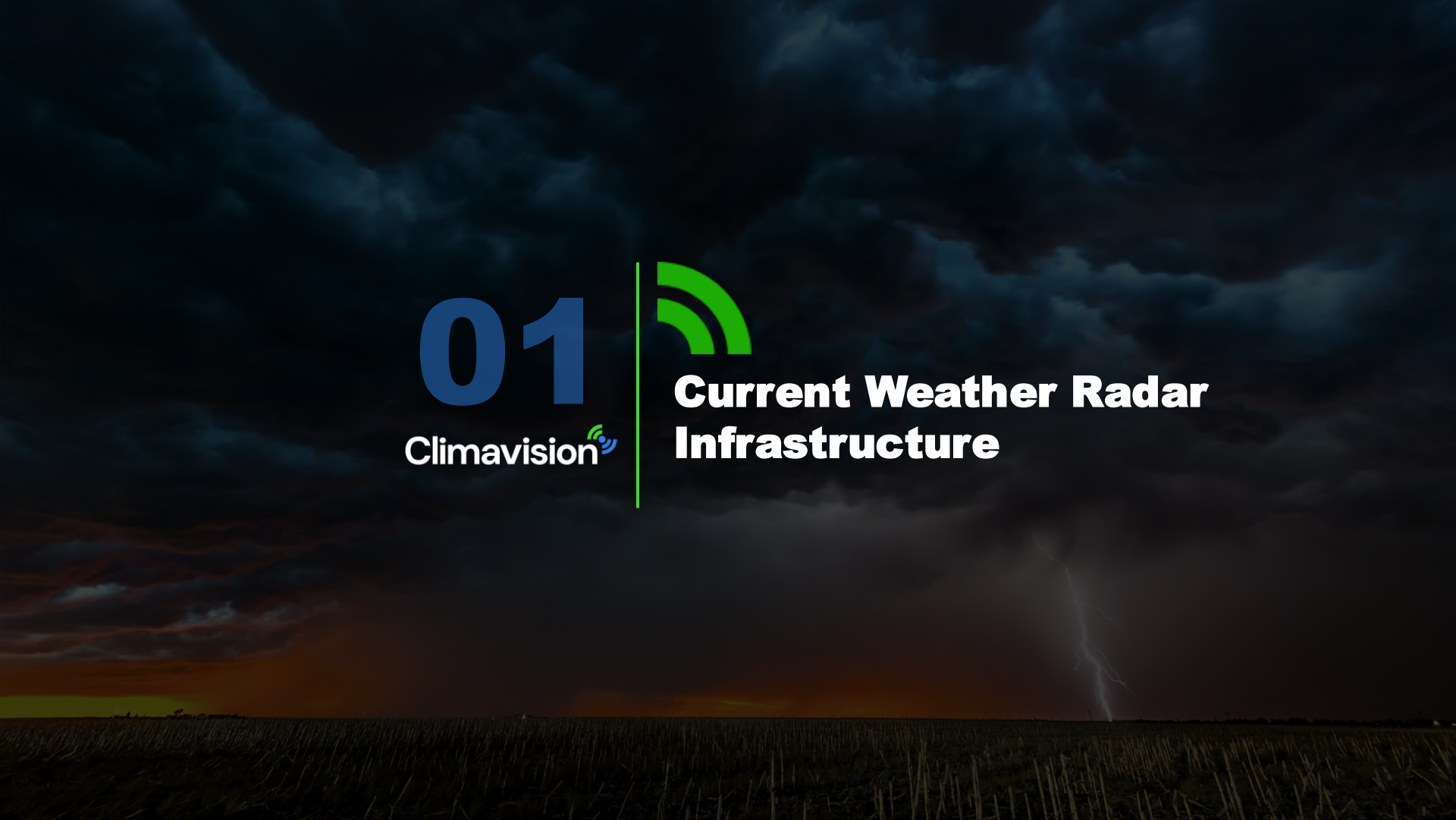
Presenter- Apoorva Bajaj, Public Sector Weather Radar Programs, Climavision

Day 2, Survey of the Weather Radar Landscape

Spring 2026 FPAW Meeting, Stillwater, OK

April 22, 2026

SEE WHAT YOU'VE BEEN MISSING


01
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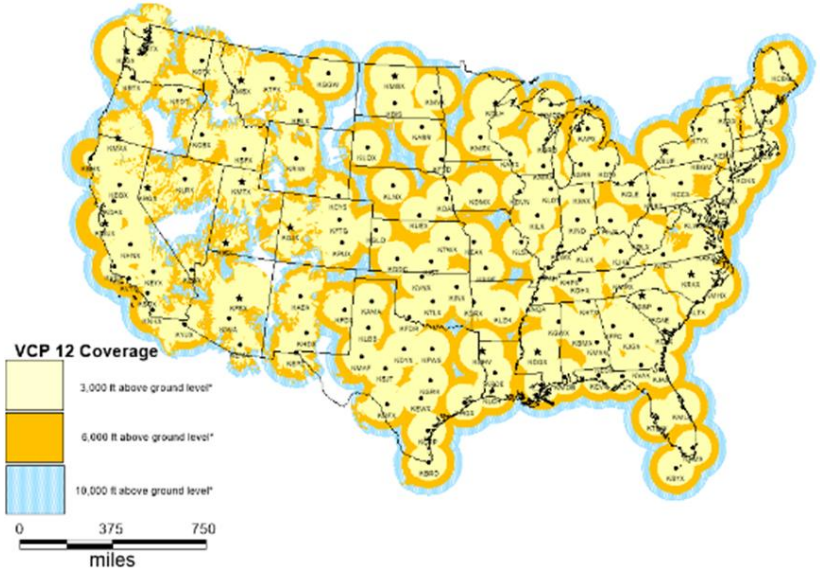
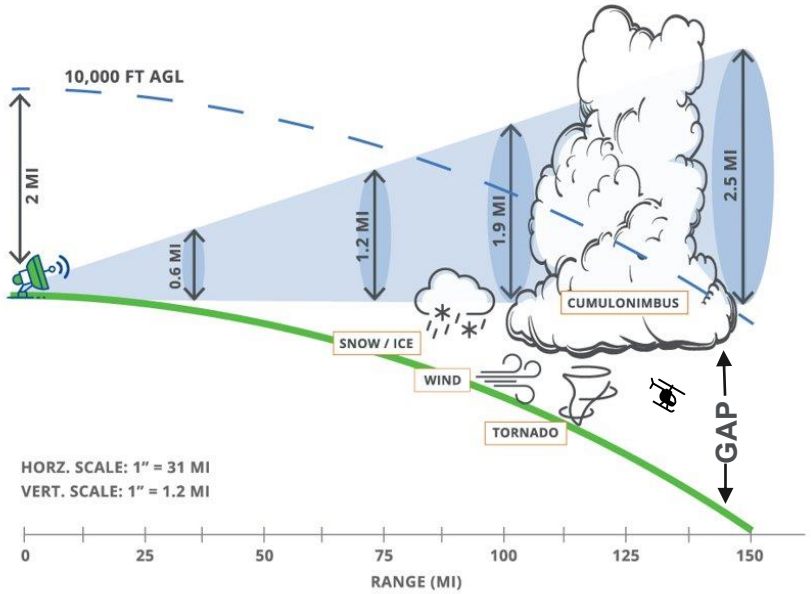
Current Weather Radar Infrastructure

Existing Radar Coverage and Radar Gaps



WSR-88D Radar Coverage (CONUS)



Radar Observation Gaps At Low Altitudes

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Low-altitude Coverage for Aircraft Landing Facilities

Alaska

< 4,000 feet AGL

Existing NEXRAD Network

Existing TDWR Network

Facilities (~11,000)

49%

of facilities do not have low-altitude radar coverage!

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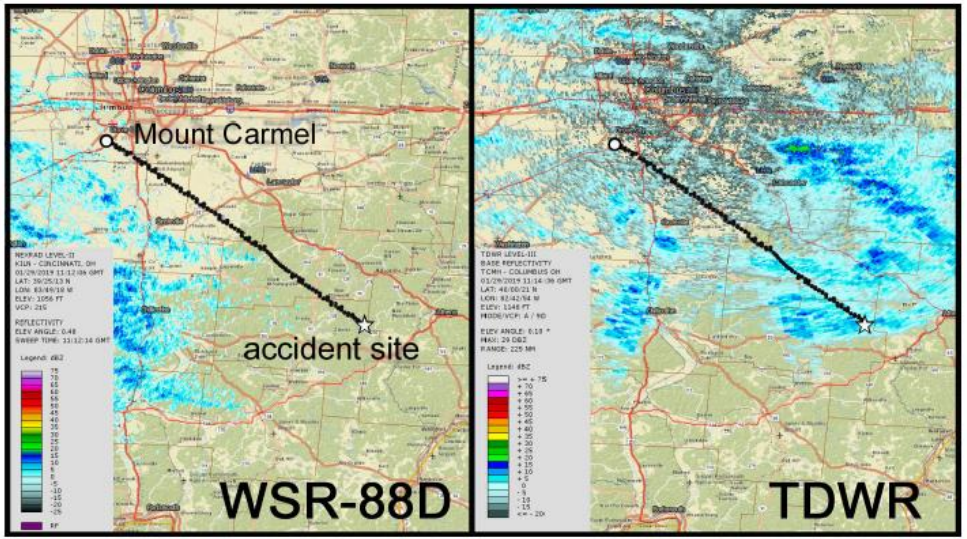
Safety Implications for General Aviation



On Jan. 29, 2019, a Bell 407 helicopter air ambulance operated by Survival Flight crashed near Zaleski, Ohio, killing the pilot, Jennifer Topper, and flight nurses Bradley Haynes and Rachel Cunningham.

- Enroute weather radar not easily available to general aviation and air ambulance services
- EFB applications can have delayed radar imagery
- HEMS Weather Tool uses the MRMS product that does not include TDWRs

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Image Source: Accident Report NTSB/AAR -20/01 Helicopter Air Ambulance Collision with Terrain, January 29, 2019

How to Improve Near-Ground Accuracy

630 NWS forecasters surveyed to assess critical data gaps that impact short-term forecast accuracy.

Ranking	Ranked characteristics	
	Based on mean priority score	Based on highest-priority votes
1	Temperature profile in mixed precipitation	Radar gaps
2	Hydrometeor type in winter	Temperature profile in mixed precipitation
3	Radar gaps	Hydrometeor type in winter
4	Near-storm vertical wind profile	Ground conditions for flooding
5	Ground conditions for flooding	Snow accumulation
6	Snow accumulation	Near-storm vertical wind profile
7	Wind shear of the preconvective environment	Wildfires
8	Wildfires	Nocturnal thunderstorms
9	Nocturnal thunderstorms	Storm damage
10	Storm damage	Wind shear of the preconvective environment

"National Weather Service Data Needs for Short-Term Forecasts and the Role of Unmanned Aircraft in Filling the Gap: Results from a Nationwide Survey", Houston et al, 2021

Weather Radar from an Aviation User Perspective

Major Airports - Well served for windshear, winter and severe weather operations

Commercial Airlines – Well served at airports and en-route

General Aviation – Well served at major airports, not at regional airports and routes

Air Ambulance – Poorly served at hospital helipads and rural corridors

Alaska, Gulf Oil and Gas operations – Poorly served due to lack of coverage

FLIGHT PLAN 2026

UAS Operations/ Package Delivery – Well served in major cities, very poorly served at low-altitudes,

Advanced Air Mobility – Will be supported in urban areas, poorly served for Regional AAM Routes

02

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Flight Path (Where We've Been and Where We're Headed)

Weather Radar Developments

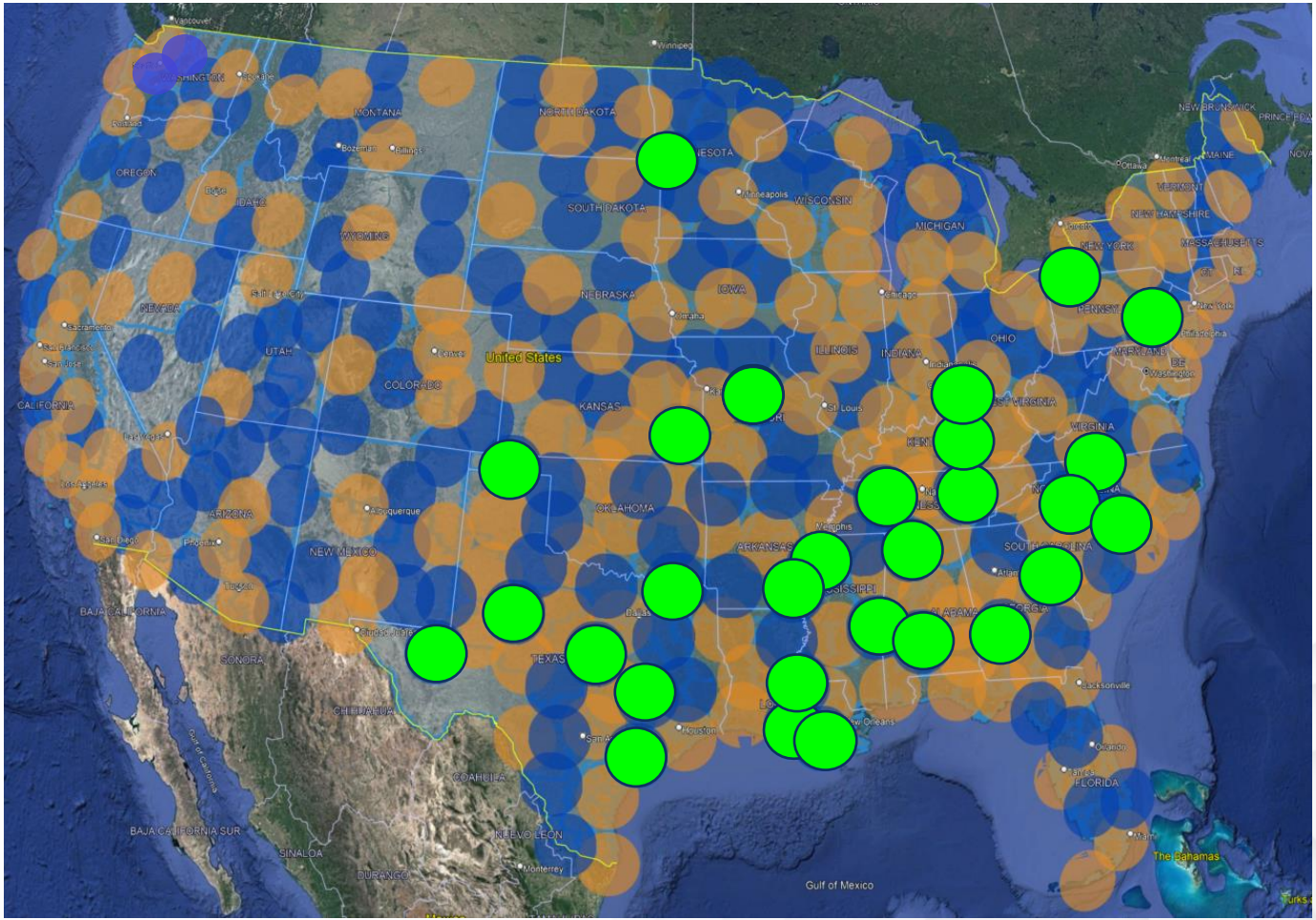
We've come a long way!

Advancements in Radar Technology

- Dual Polarization
- Short-Wavelength Radars
- Solid-State transmitter technology
- Phased Array Radar

Processing and IT Infrastructure

- Networked operations and Data Fusion
- Data Assimilation/ Numerical Weather Prediction
- Compute, APIs, Artificial Intelligence



Operational Fleet & Plan

As of April 1, 2026

- NEXRAD at 4,000ft AGL
- Planned Climavision site
- Operational (29)

"Radar As a Service" (RAAS) Business Model

170-200 new radars across U.S!

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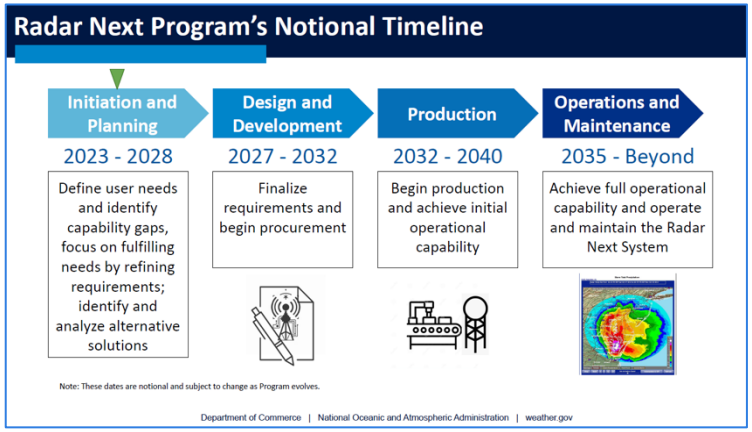
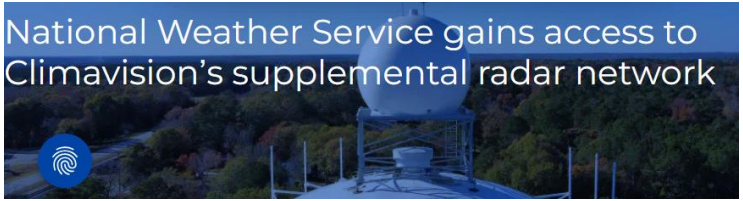
NOAA's Plan for Gap-Filling Weather Radars



Long-Term Planning & Requirements



Commercial Radar Data Buy Program

Broad Agency Announcement: Weather Radar Technology Exploration for the National Weather Service

Funded Research Activities through BAAs

Integration Activities with Private Sector (CRADAs)

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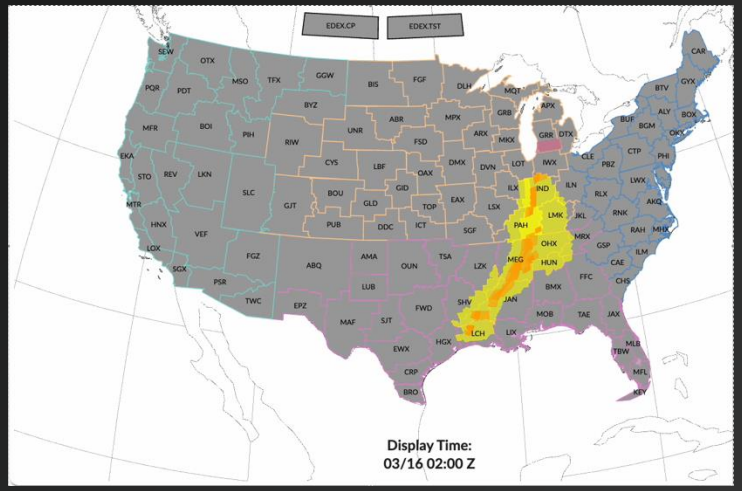
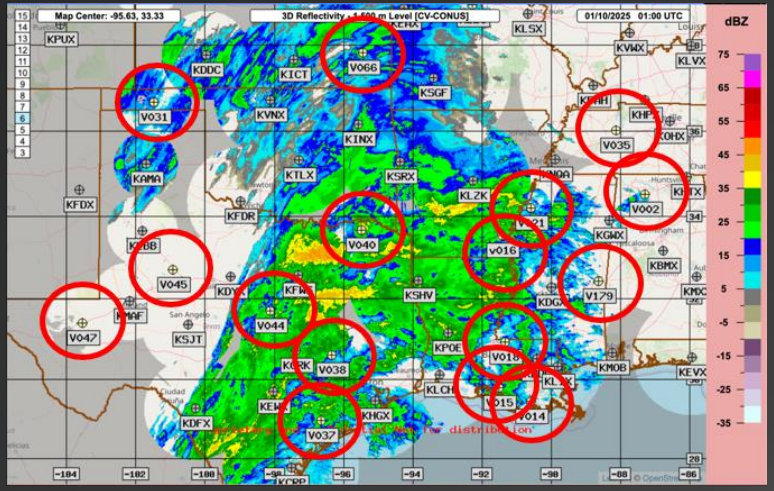
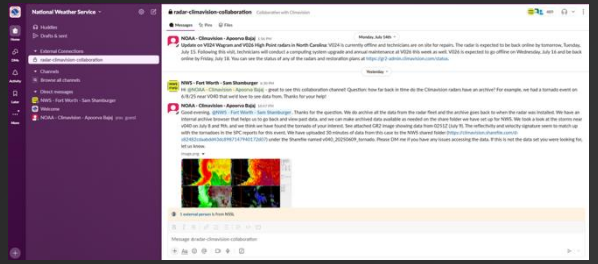
Graphics courtesy – Randall Silver, Radar Next program, April 2026, NOAA TPO, OU-CIWRO, NSSL

Integration of Supplemental Radars







U.S. SENATE COMMITTEE ON COMMERCE, SCIENCE, & TRANSPORTATION
CHAIRMAN TED CRUZ

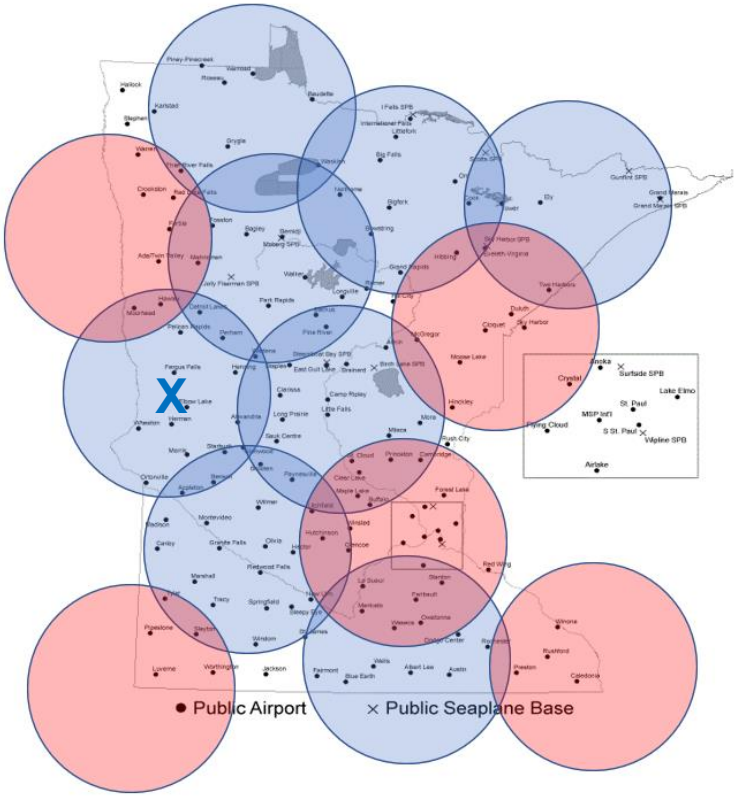
Weather Research and Forecasting Innovation Reauthorization Act of 2026

Graphics courtesy – KBR (NOAA Commercial Data Buy Program), NSSL (Climavision CRADA), NWS

Minnesota Example

Emergency managers hope new radar will fix coverage gaps in Minnesota

The new radar was installed recently atop the water tower in the Grant County town of Wendell, Minnesota, by a private company called Climavision



Red = NEXRAD Blue = Climavision
(< 4,000 feet AGL coverage)

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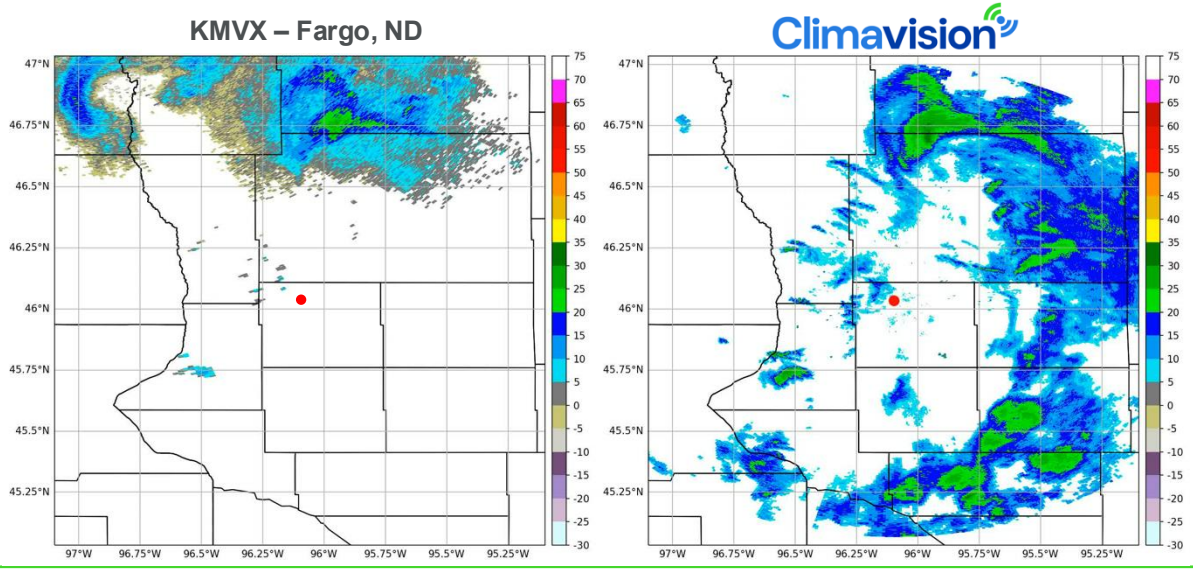
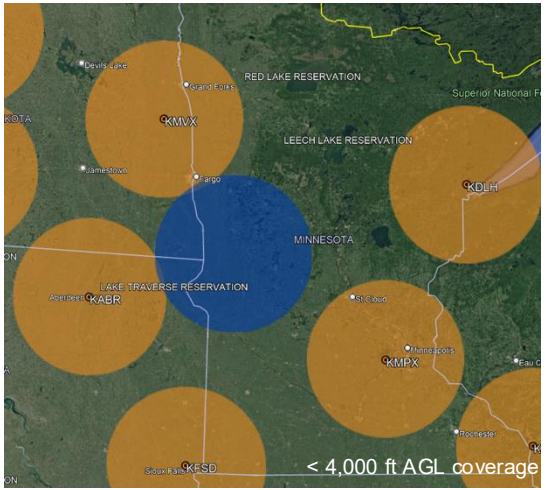
Minnesota Case Study

October 31, 2023

On October 31st, one inch of snow fell near Climavision's first Minnesota radar installation in Grant County, per local weather station reports. As seen in the radar loop below, Climavision's radar detected snow for several hours, while the closest NEXRAD radars missed the majority of the snowfall event. It is important to note that low-level radar coverage in Minnesota is limited, making Climavision radar installations ever important.





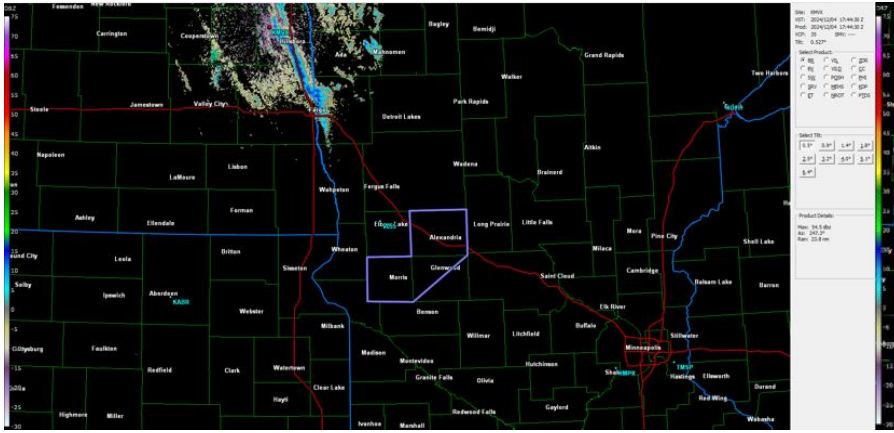
Climavision's radar (blue) in Wendell, MN sits in a prominent weather radar gap. The two closest NEXRAD radars (orange) sit over 100 miles away in North Dakota and South Dakota. The radar beams from KMVX and KABR sit at over 12,000 ft AGL over Wendell.

Usage within the National Weather Service

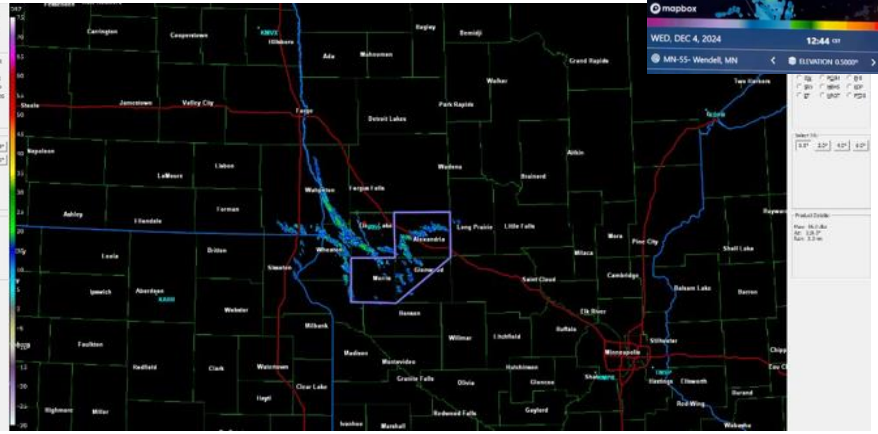
Additional eyes on the skies

Minnesota / North Dakota NWS Offices

*Had access to our radar in West Central Minnesota and issued their first ever **Snow Squall Warning** in December of 2024.*



KMVX – Mayville, ND



V055 – Wendell, MN

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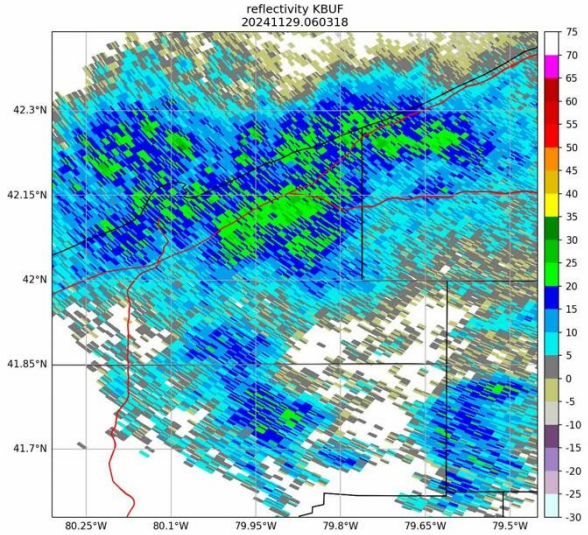
Lake Effect Snow – Erie Region

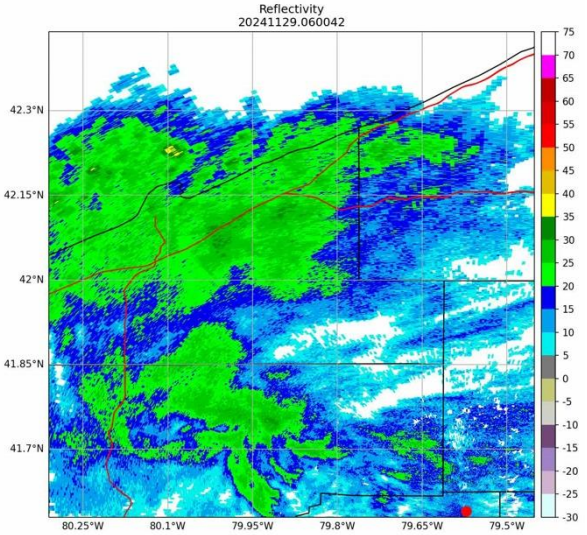
Beginning November 29, 2024

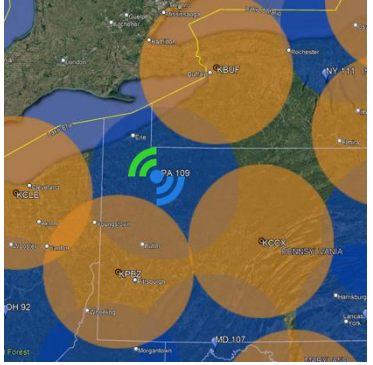
Climavision recently installed a supplemental radar in Pleasantville, PA to fill a low-level gap in observations in the Erie region. When compared to nearby National Weather Service radars (NEXRADs), the supplemental system captured heavier snowfall in certain areas. The high-resolution data captured on the supplemental system showed more clarity around impacted areas.

KBUF – Buffalo, NY NEXRAD



Climavision – Pleasantville, PA





PA109 is located in Pleasantville, PA and provides gap-filling coverage for 60 miles in every direction. Orange circles represent NEXRAD systems out to 4,000ft above the ground. Blue circles represent radar "gaps" and planned or live supplemental Climavision radar sites – areas with diminished coverage beyond the low-level visibility of NEXRAD systems. The nearest NEXRAD radar to Erie is KBUF around ~90 miles away.

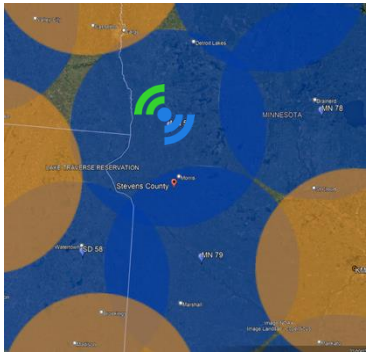
December 10, 2025

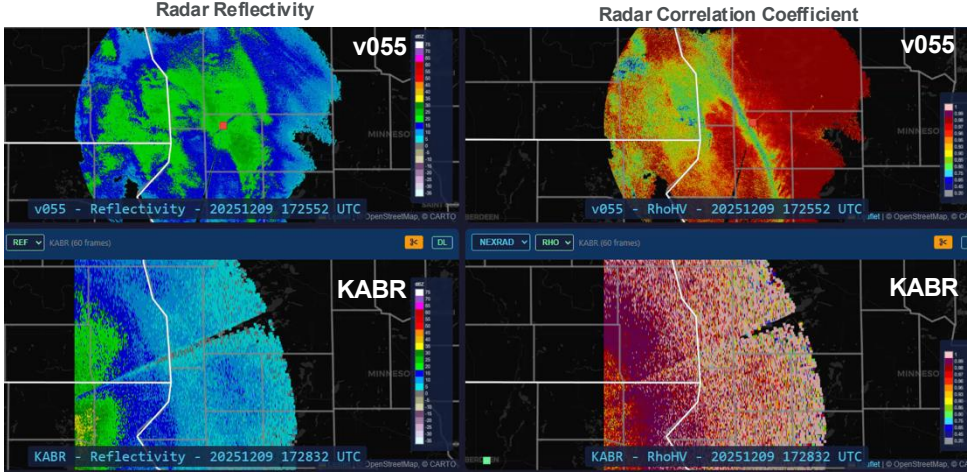
Grant County, MN

Mixed Precipitation

On December 10, 2025, a large weather system brought snow, freezing rain, and rain to areas around Grant County, MN. While not visible on the nearest NEXRAD, a supplemental radar located in a low-level gap showed a clear melting layer– where snow turns to rain or where rain freezes – an important indicator for freezing rain, sleet, or freezing fog. Distinguishing types of precipitation and potential impact areas has important safety and operational implications. A local public works superintendent relied on the supplemental data for hyperlocal insight and noted it helped him plan county plowing and public messaging.

Climavision's radar in Wendell, MN sits in a prominent weather radar gap. The two closest NEXRAD radars sit over 100 miles away in North Dakota and South Dakota. The radar beams from KMVX and KABR sit at over 12,000 ft AGL over Wendell.





Climavision radar data (top) compared to NEXRAD radar data (bottom). Reflectivity is shown on the left, and RhoHV is shown on the right. The melting layer is pinpointed by the cool values (blue, green etc.) on RhoHV. This data was confirmed by ground observations and weather reports.

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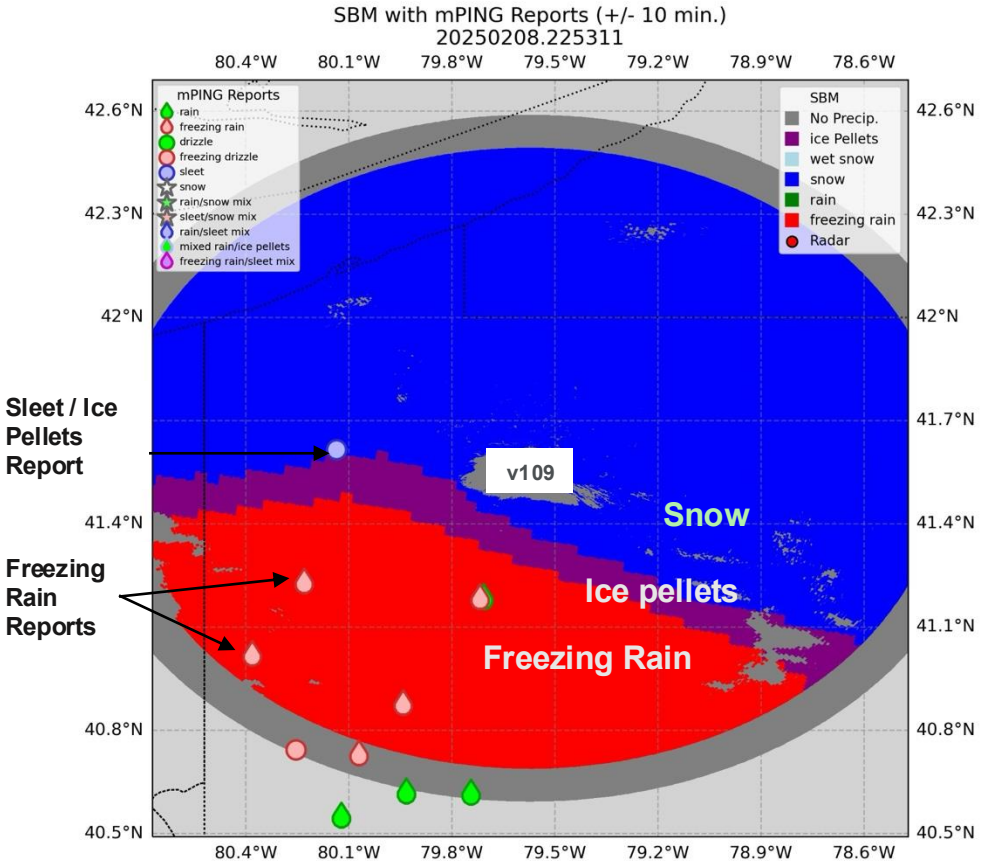
CASE STUDY

Winter Weather – Surface Hydrometeor Classification using Weather Radar

Surface Winter Precipitation Product

- Using a combination of radar data and model data to determine cloud top height, particles sizes, and melting layer (e.g., RDQVP), a Spectral Bin Classifier was developed.
- It is a type of hybrid microphysical/precipitation-classification model (calculating how particles evolve during processes of melting/freezing) that predicts what kind of precipitation will reach the ground (e.g., rain, freezing rain, snow, ice pellets).

Looking closer to the ground with radar allows us to better predict what type of precipitation is making it to the surface, assisting airport operations and landing/take-off decisions.



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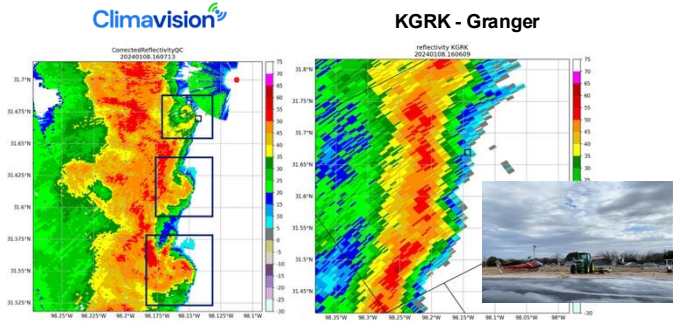
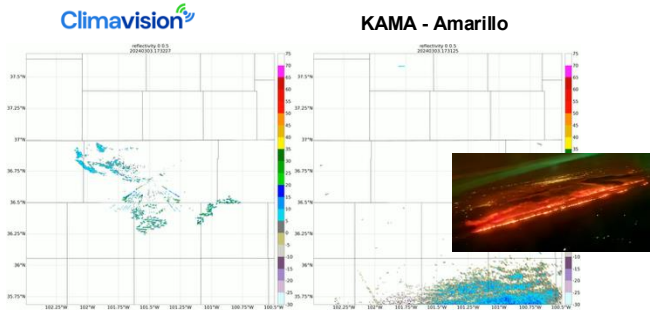
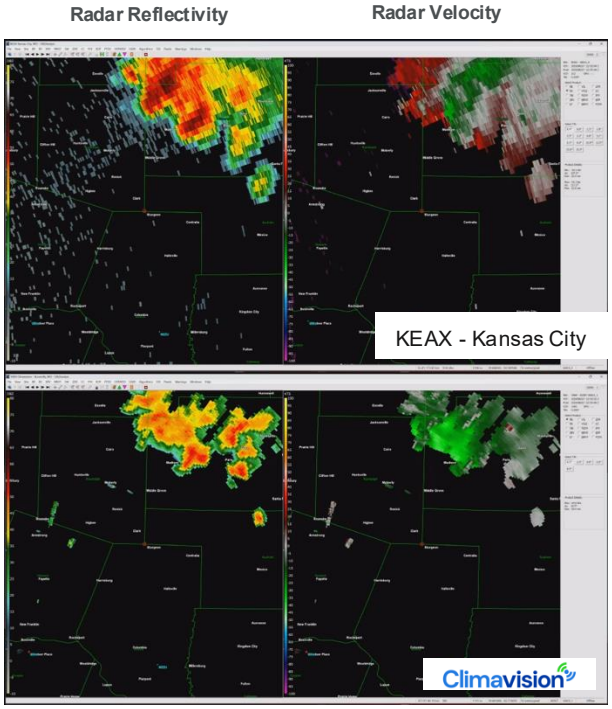
Windstorms, Wildfires, Gust Fronts



Unwarned Wind Event at Hamilton Municipal Airport, January 2024



Tracking smoke from Texas Panhandle Fires, March 2024



Gust Fronts detected in Missouri, August 2024


03
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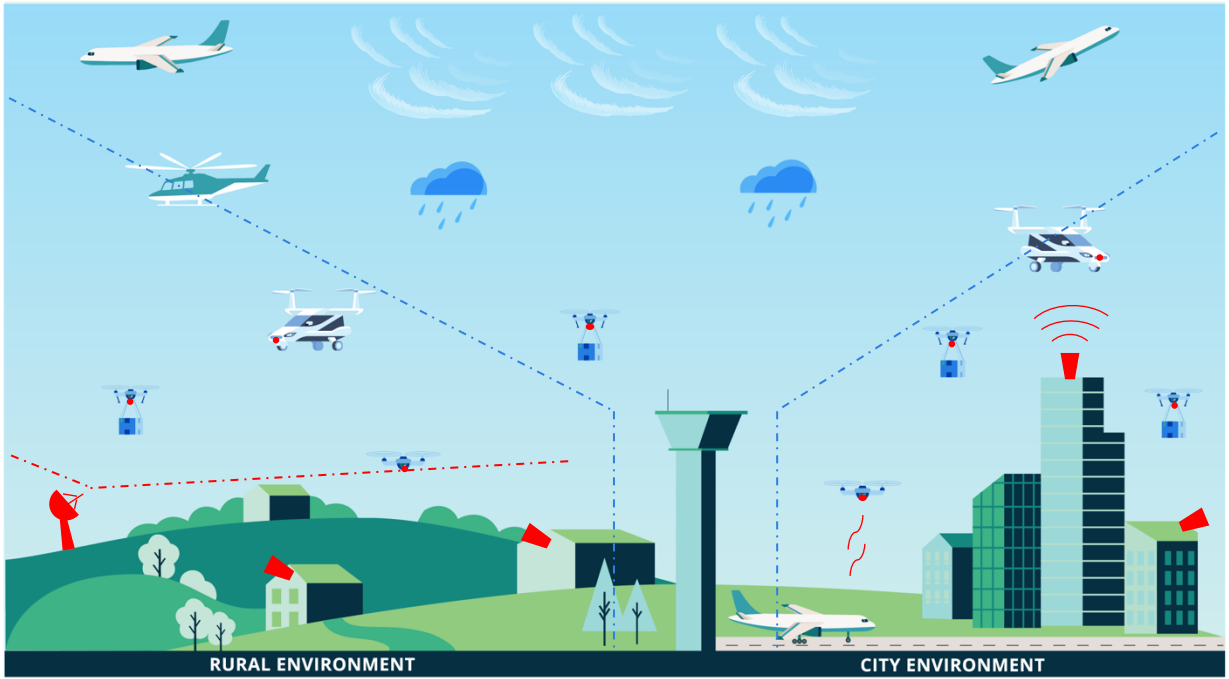
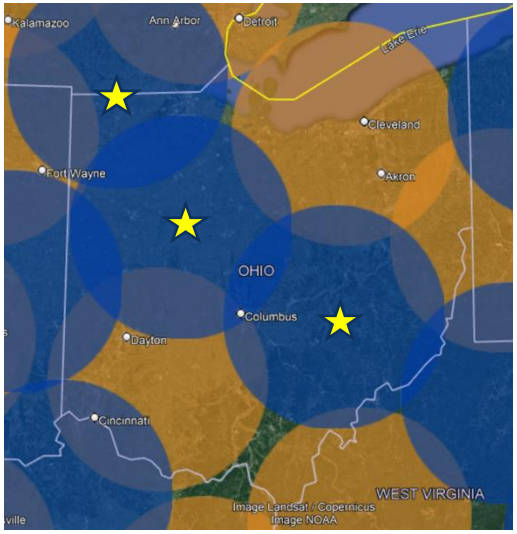
What About FAA?

Low-altitude operations

Weather Radar critical for General Aviation, Helicopter, UAS and AAM

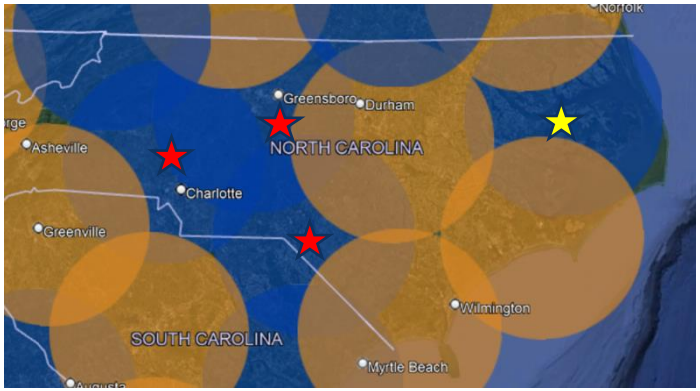


States focusing on Weather Radar Coverage



Ohio

- Operational Climavision Radar
- Planned Climavision Radar

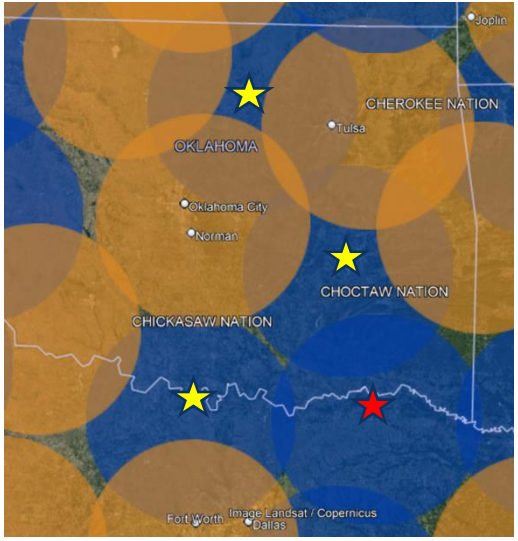


North Carolina

BEYOND

In March 2026, the FAA selected eIPP partners:

Florida Department of Transportation	City of Albuquerque
Utah Department of Transportation	Pennsylvania Department of Transportation
Texas Department of Transportation	North Carolina Department of Transportation
Port Authority of New York and New Jersey	Louisiana Department of Transportation and Development



North Texas & Oklahoma

windmap

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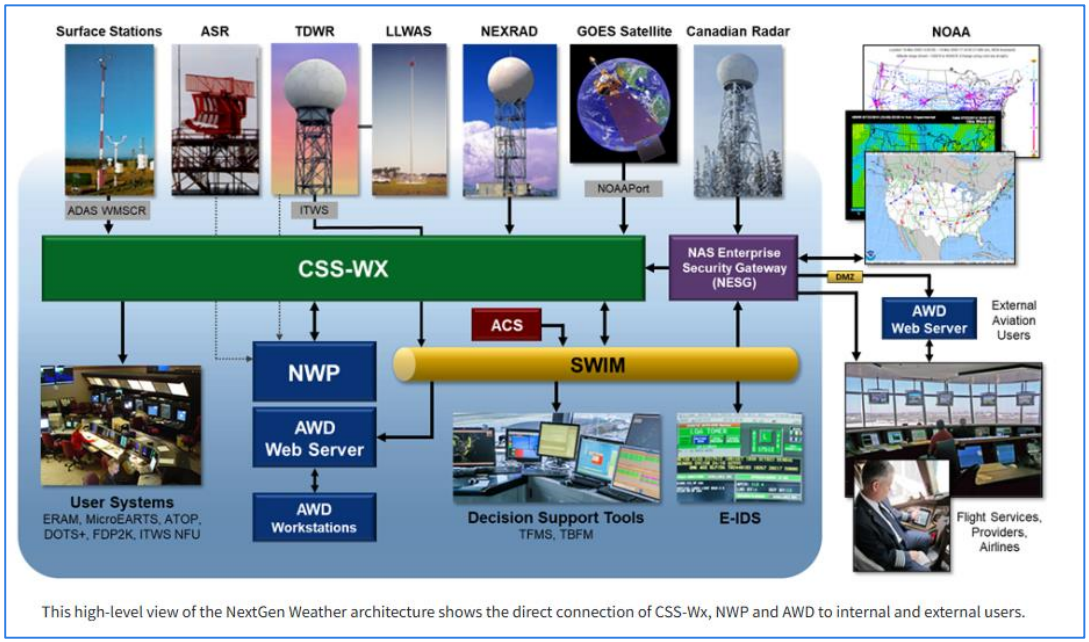
Graphics courtesy – FAA website, NC DOT, NASA ULI Windmap, Texas A&M

FAA - Behind the Curve For Gap-Filling Radars?



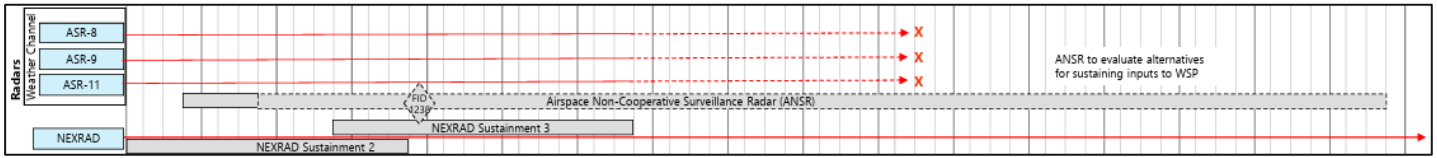
This high-level view of the NextGen Weather architecture shows the direct connection of CSS-Wx, NWP and AWD to internal and external users.

TDWR – No Dual Polarization, only at major airports

ASR Weather – Going away?

Gap-Filling Radar – No Plans Announced

NAS Enterprise Architecture
Infrastructure Roadmaps v19.0
BASELINE



Graphics courtesy – FAA Website

Gap-Filling Weather Radar – Recommendations ('5R's)

Roadmap Activities

- Regular Interface with 3PWP / WIP Radar Service Providers

Requirements

- Specify gap-filling radar as Requirement for NOAA NWS Radar Next Program

Research & Integration Activities

- NSSL MRMS
- NCEP AWC GFA – LA
- FAA NextGen CSS-WX and NWP

Regulatory Environment

- Rules and Guidance for Commercial Radar

Resources

- Commercial Data Buy Program for Radar Data (TDWR, Gap-filling)
- Pilot Projects (e.g eIPP)

Graphics courtesy – FAA Website

Contact

CLIMAVISION.COM

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APOORVA BAJAJ, PUBLIC SECTOR WEATHER RADAR PROGRAMS

APOORVA.BAJAJ@CLIMAVISION.COM

Who is Climavision?

- Since launching in June 2021, we've been focused on one goal: *to close the observation and forecasting gaps* that leave communities and businesses vulnerable, especially during extreme events.
- We aren't doing it alone. Our company is backed by TPG, one of the most respected investment firms in the world. Their support reflects a shared belief: that better weather intelligence is not just a business opportunity, it's a public imperative.
- We are a trusted partner to U.S. Weather Agencies. Most notably, we integrate our radar data with NWS Weather Forecast Offices for real-time operations support.

Climavision

FOUNDED IN

JUNE 2021

TPG

Fort Worth, TX

$100M

STRATEGIC INVESTMENT

Filling Weather Intelligence Gaps

What do we do as a business?

Proprietary Weather Observations

What is happening right now?

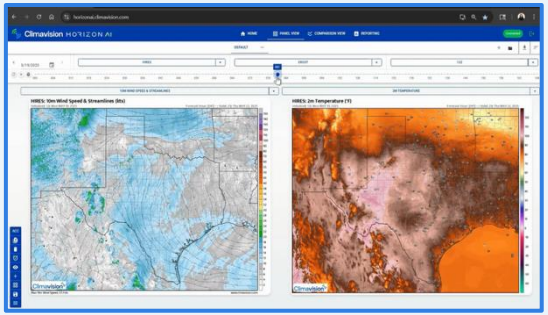
- **Filling low-level blind spots** in the US NEXRAD network - especially critical for tornados, flash flood detection, transportation safety, and rapid-onset events.
- Designed **to integrate with state agency systems** and local platforms for situational awareness and flood response.

Proprietary Forecasting Models

What is going to happen?

Leverage high-resolution observational data sets & AI climate tech to fill blind spots in existing forecasts.

- More precise detail on localized weather events with advanced warnings
- More accurate predictive models over longer time horizons



Climavision is building next-gen weather solutions to fill long-standing gaps and address the challenges of a changing climate.

Use of Weather Radar

Commercial Aviation

Pilots & Dispatchers

Flight planning

En route decisions

Air Traffic Control

Airspace guidance

Airports

Safety of personnel, fleet and infrastructure

Ramp and runway operations

Weather Radar Sources

AVIATION

WSR–88D Network – U.S. wide

S-band, dual polarization

Integrated into forecasts

Long range, coverage limitations

Reaching End of Life

TDWR Network – Major airports

C-band, no dual polarization, higher resolution

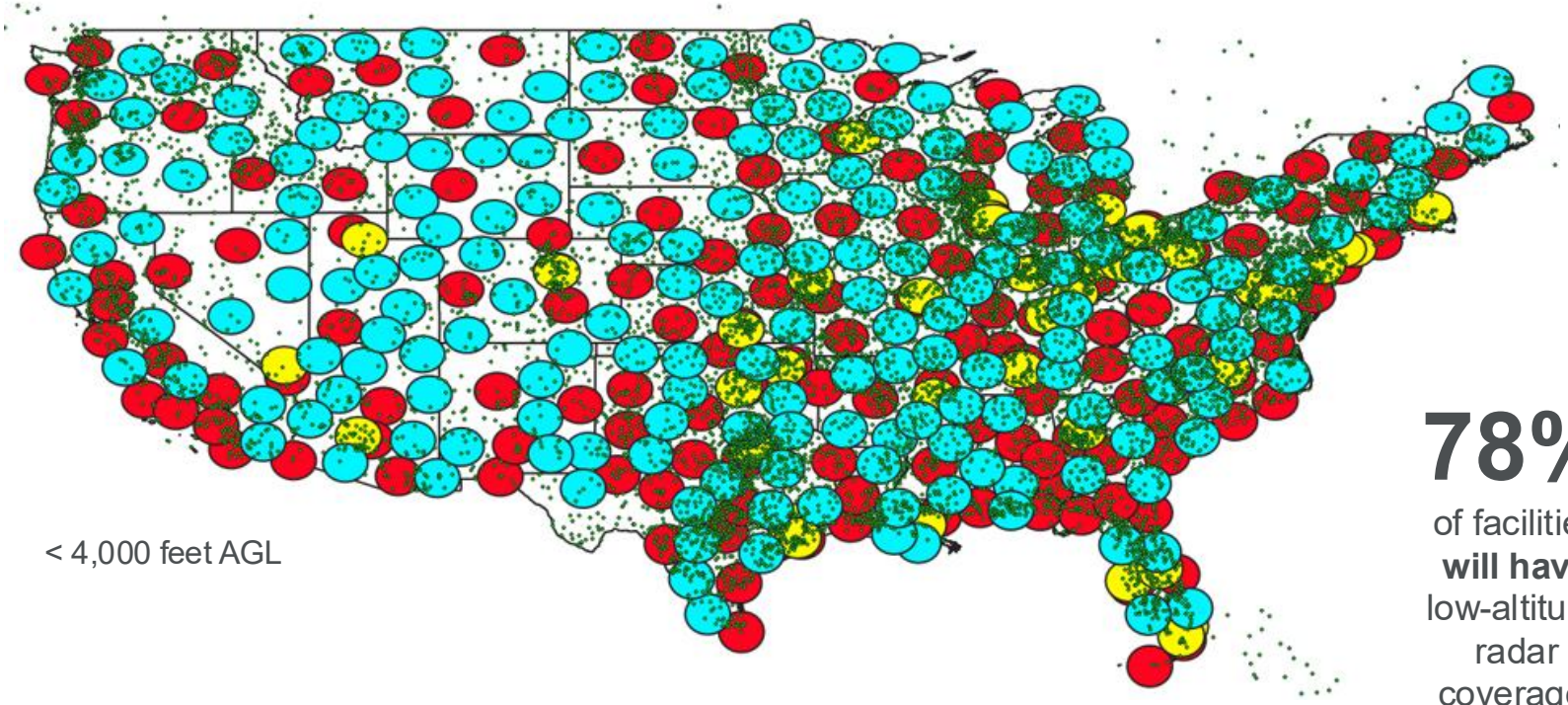
Concentrated in Eastern US

Interference, reaching End of Life, not informing forecasts or GFA-LA

ASR, ARSR – Very limited locations

Weather capability being discontinued

Climavision Supplementary Radar Network



78%

of facilities **will have** low-altitude radar coverage!

200+ radars over next 4 years!

Climavision Radar Network | Existing NEXRAD Network | Existing TDWR Network | Facilities (~11,000)

Climavision

Round-the-Clock Operations

Designed to Keep Radars Online, Minimize Downtime, Maximize Coverage, Capability, Equity, and Continuity

Standard Client SLA – System Restored Within 72 Hours

24/7 Monitoring

- HW monitoring auto scales with network
- Runs 24/7 – alerts at any system “burp”
- Web-based – transportable

Dedicated Science/Tech

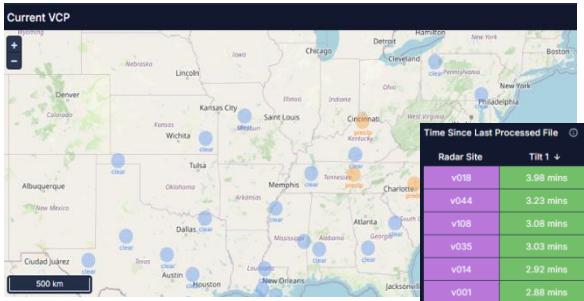
- Cloud-hosted backend
- Ongoing, real-time data quality analysis
- Continuous improvement/innovation

Field Team

- Dedicated field teams ready for deployment within 24-48 hours
- On-call local and regional teams

Spares Depot

- Stocked warehouse of all consumable and critical life components
- On-hand inventory for common, expected, and catastrophic failures
- Designed for quick return to service – 72 hours



Time Since Last Processed File

Radar Site	Tilt 1 ↓	Tilt 2	Tilt 3	Tilt 4	V06.a
v018	3.98 mins	2.80 mins	2 mins	53 s	
v044	3.23 mins	2.18 mins	1.22 mins	7 s	
v108	3.08 mins	2 mins	53 s	10 s	
v035	3.03 mins	1.77 mins	52 s	7 s	
v014	2.92 mins	2.03 mins	55 s	10 s	
v001	2.88 mins	2.02 mins	53 s	4.03 mins	
v040	2.77 mins	1.72 mins	35 s	3.73 mins	
v091	2.67 mins	1.58 mins	40 s	3.58 mins	

Optimized for Winter Weather Observations

- Focus on **low altitudes** – winter storms are shallow
- **Dual Polarization technology** – determine size and shape of hydrometeors
- Transmit at **shorter wavelength (X-band)**
  - **More sensitive to snow** than longer wavelengths (C-, S-band radars)
  - **More accuracy in snow rate measurements** - KDP three times higher at X-band than S-band
  - **Better ground clutter elimination** – cleaner imagery

Climavision

Weather in the NAS (CURRENT)

- **Well understood weather impacts:** Established vehicle designs, robust vehicles
- **Well instrumented:** Airport radars and surface stations, on-board sensors
- **Experienced workforce:** Air traffic controllers, network operations centers, experienced pilots
- **Fully supported:** Government advisories and commercial products

Weather for AAM

- **Poorly understood weather impacts:** New vehicle designs, less weather tolerant
- **Poorly instrumented:** Vastly under-sampled airspace, limited on-board sensor capacity
- **Nascent workforce:** Nontraditional operators, move towards autonomy
- **Limited support:** New air traffic management model, role of advisory products unknown