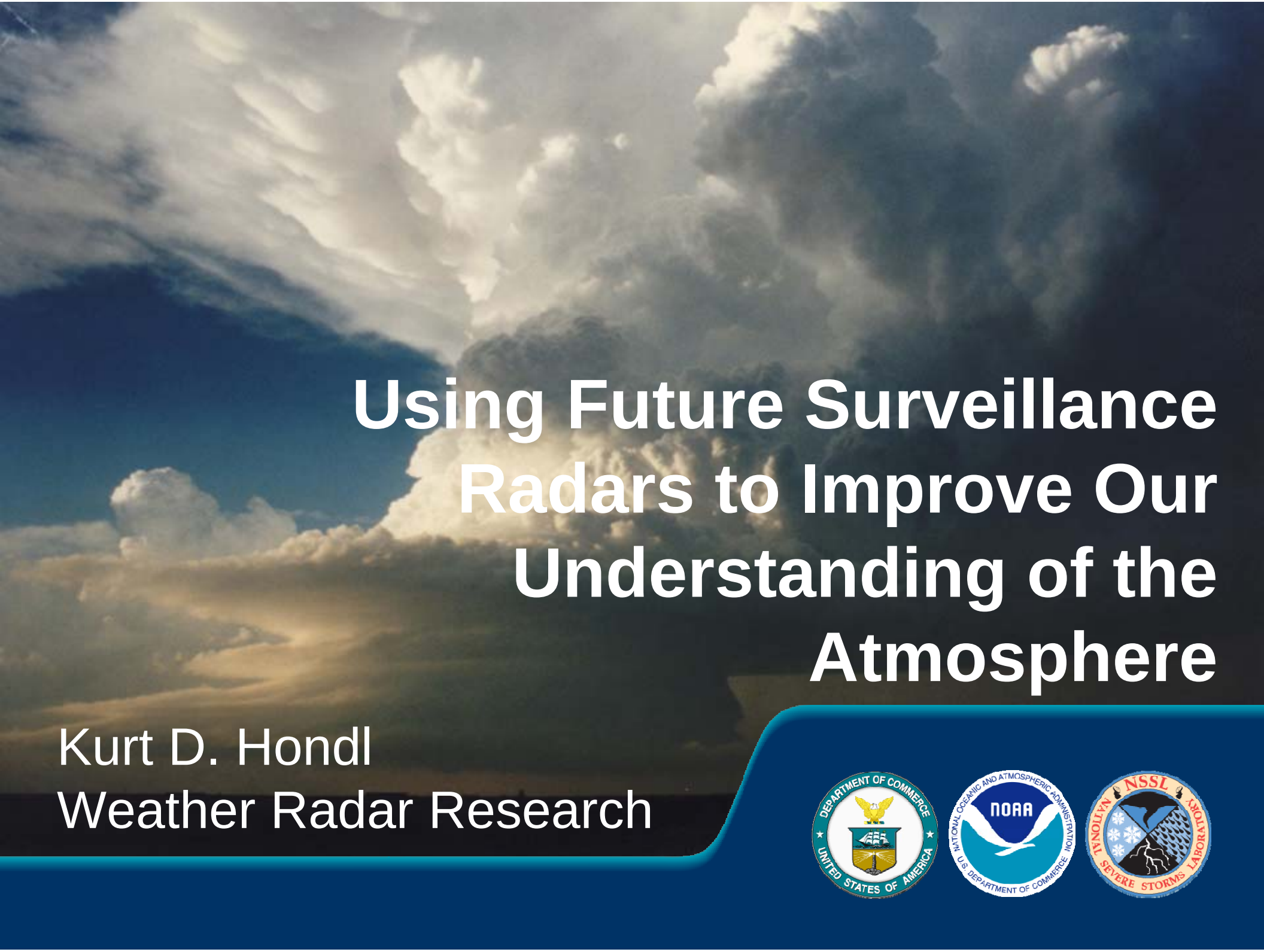
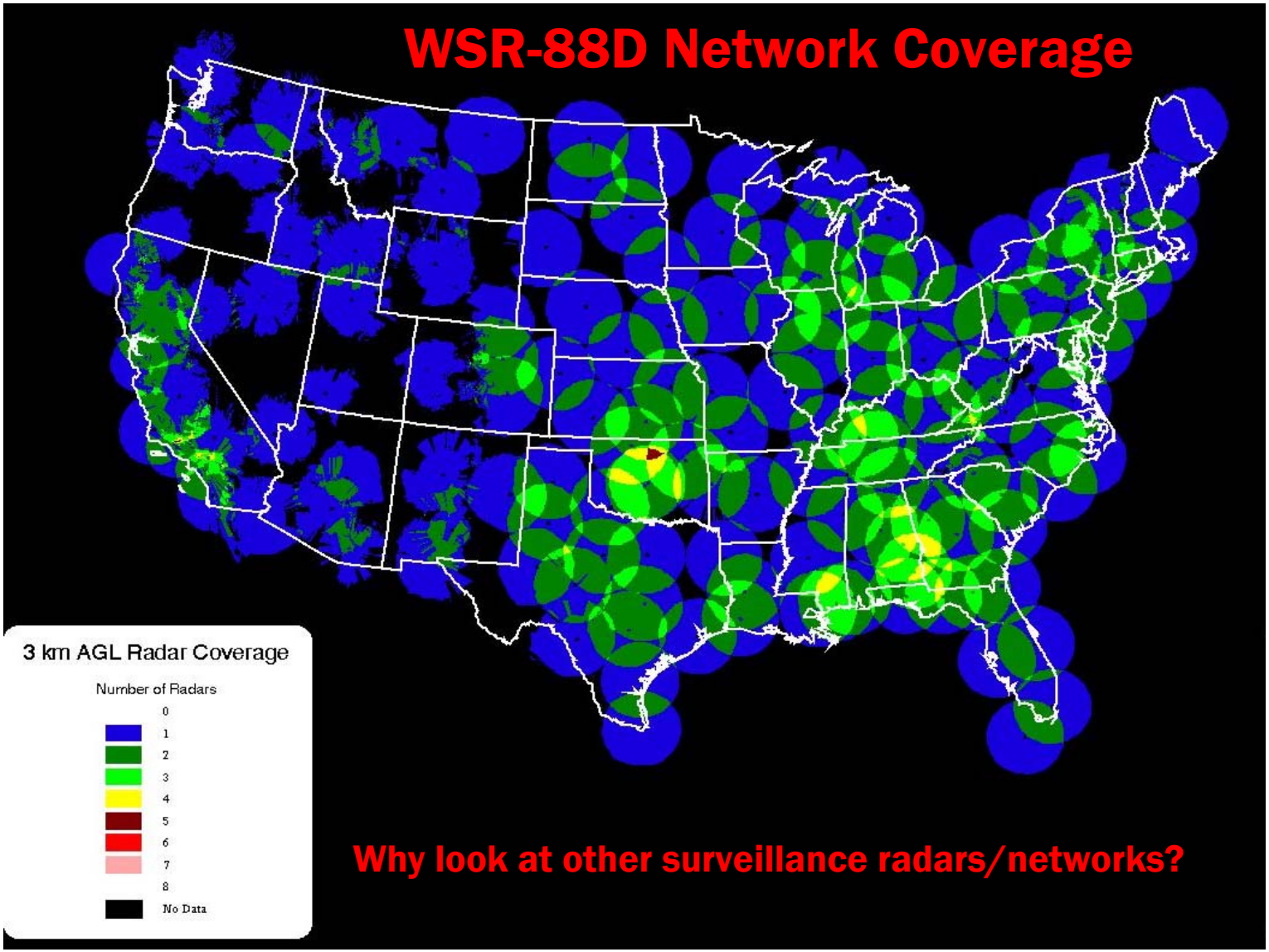


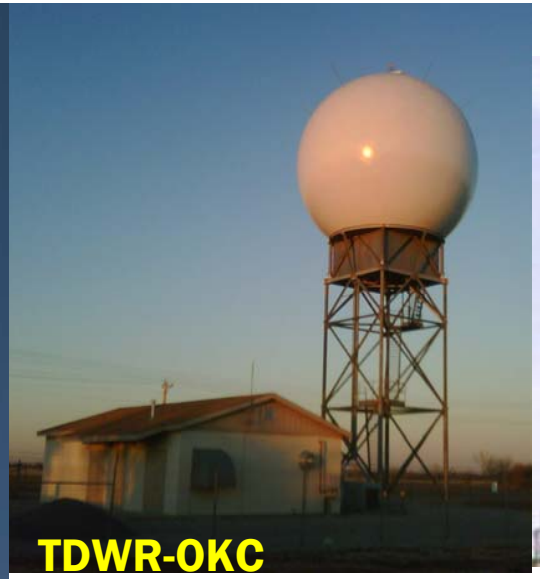
Using Future Surveillance Radars to Improve Our Understanding of the Atmosphere

Kurt D. Hondl
Weather Radar Research

The WSR-88D Network



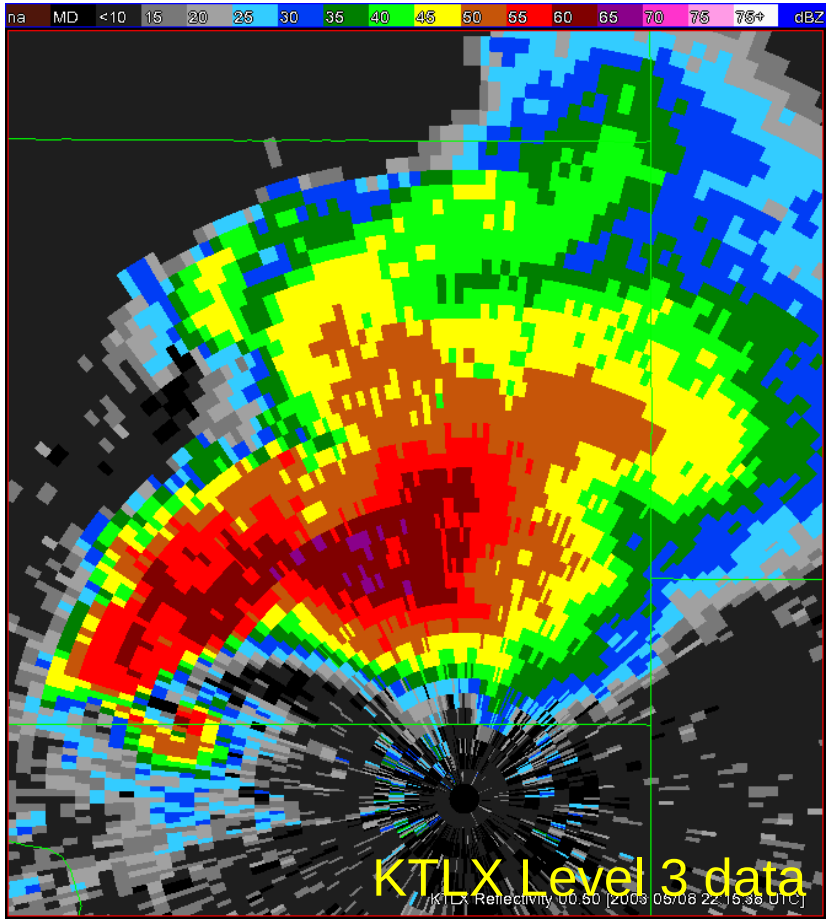
Motivation

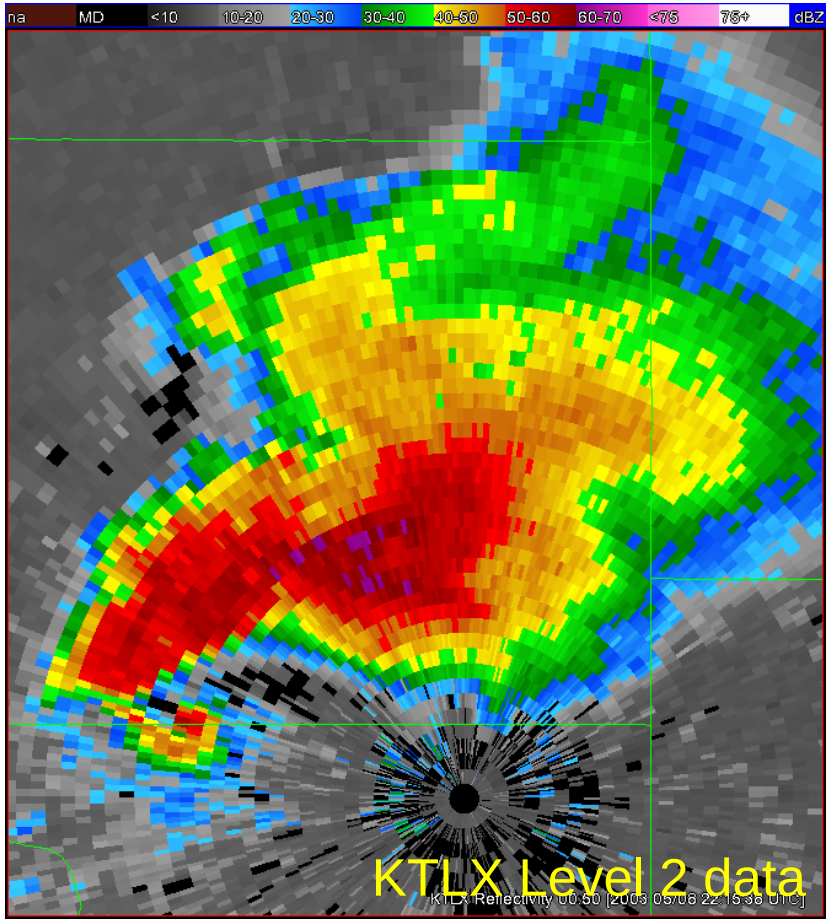


The evaluation of new radar technologies & new complimentary data sources may improve our understanding of the atmosphere and our ability to nowcast/predict severe weather and floods.

Better Resolution Data

NSSL developed the capability to read full-resolution moment data from the WSR-88D and demonstrated the usefulness of full-fidelity data to NWS operations.

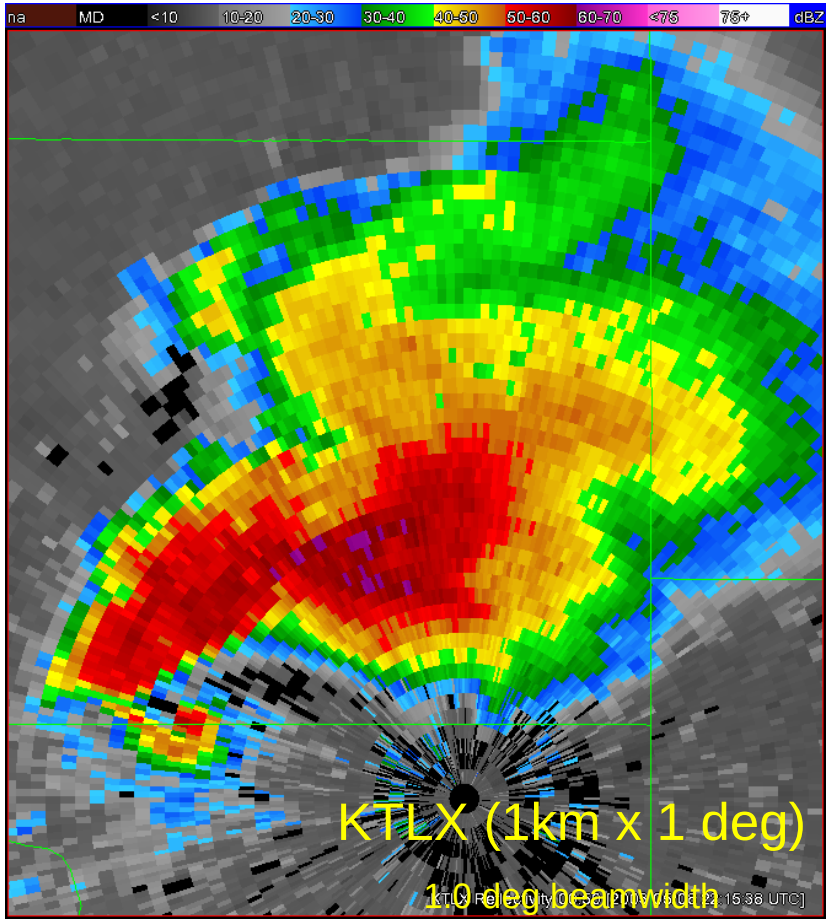


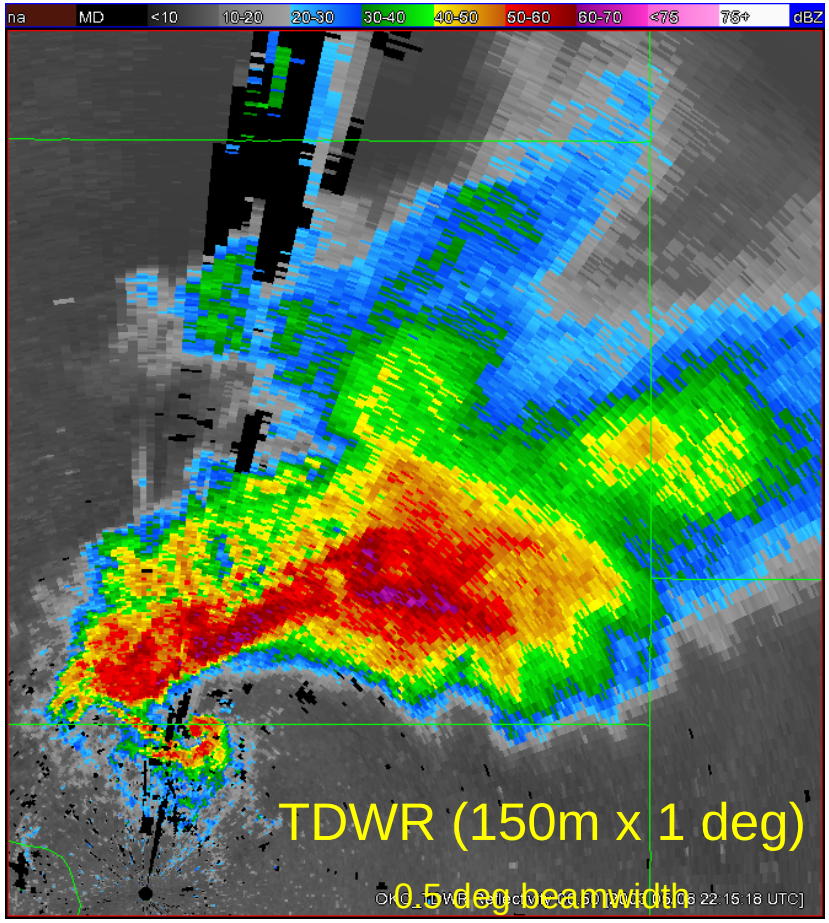


Led to the operational display of "base data" products.

Better Spatial Resolution

Demonstrated usability of TDWR as a backup/auxiliary data source for NWS operations.





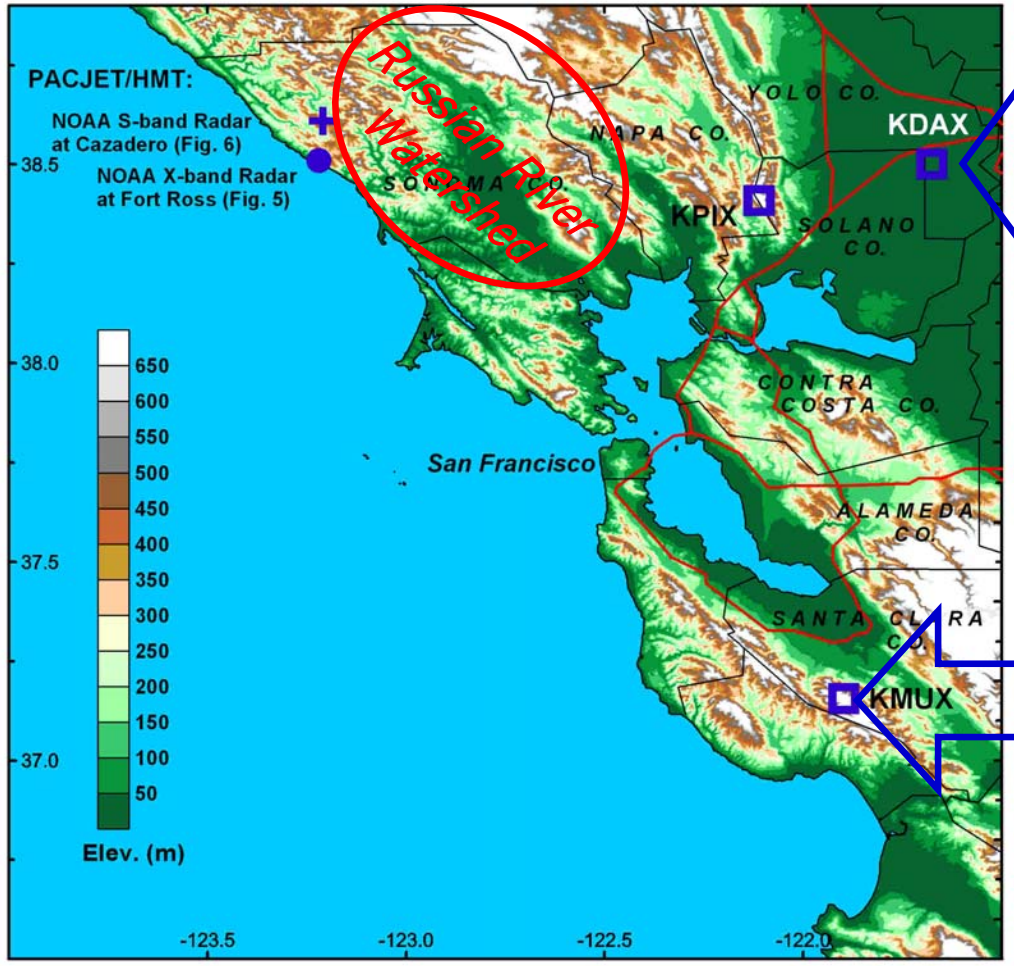
NWS has now installed a Supplemental Product Generator (SPG) to routinely ingest and display TDWR data.

Reduce Terrain Blockage

Monterey NWSFO

Western Region

KPIX TV

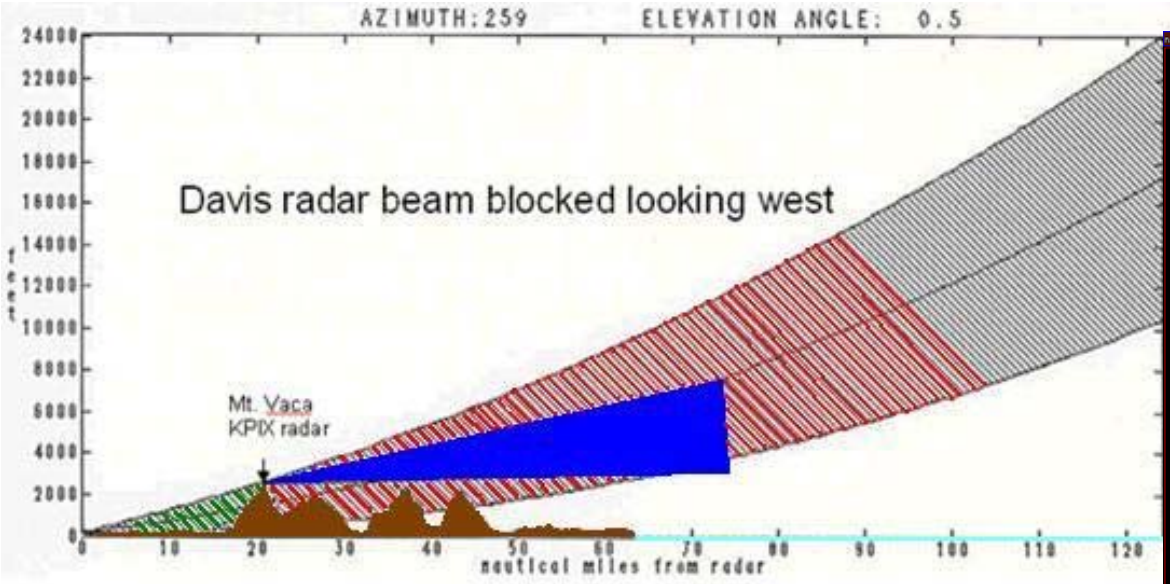


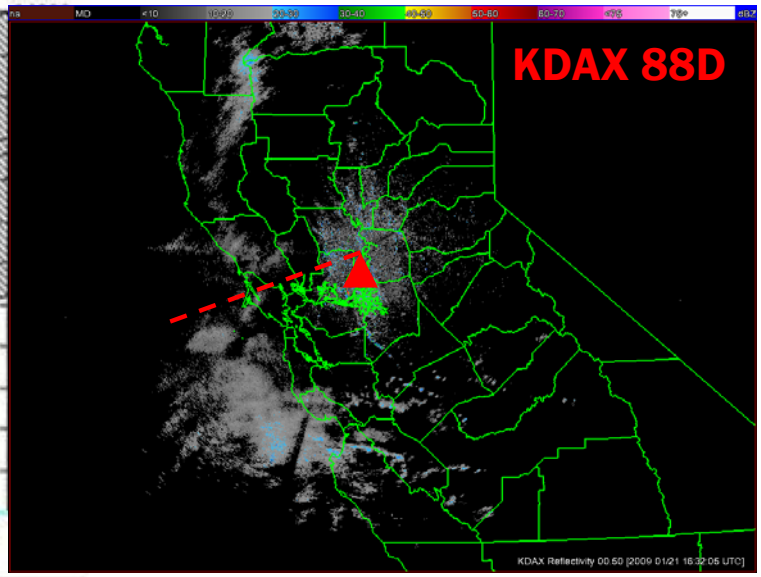
KDAX 88D located In the valley

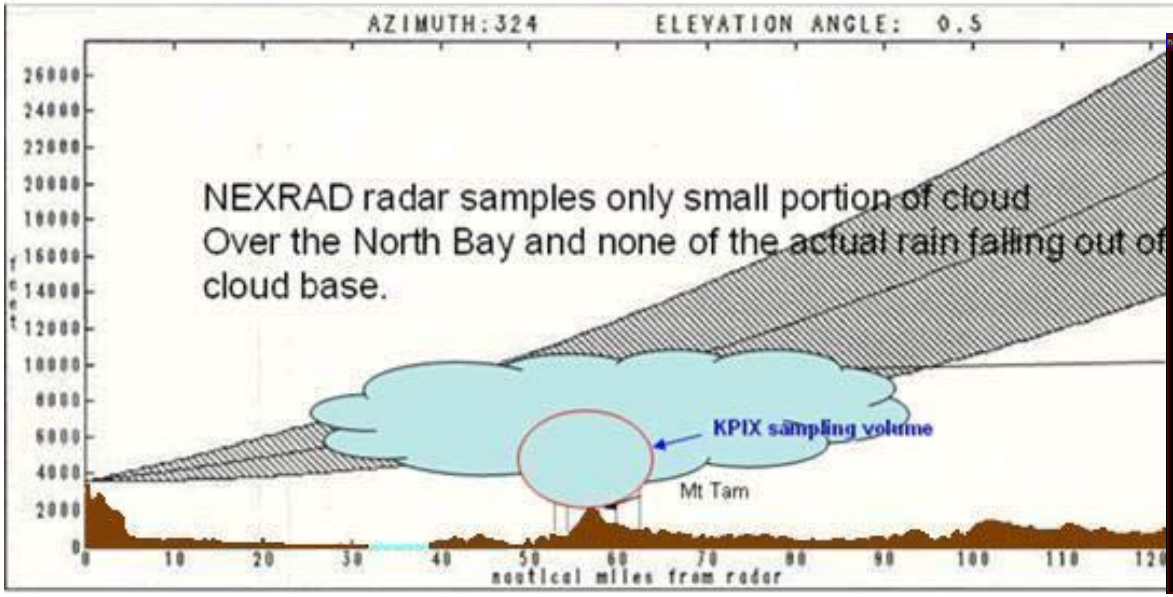
KMUX 88D located On a Mountain

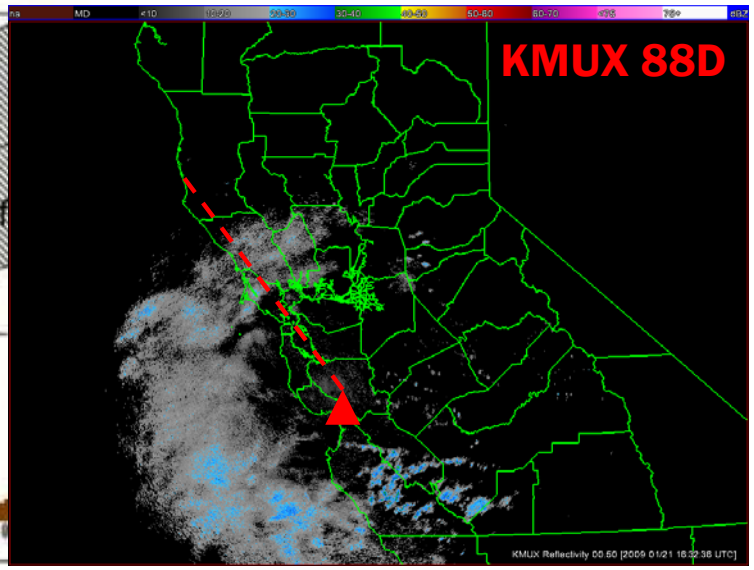
Poor WSR-88D coverage over Russian River watershed (88D radars are either blocked by terrain or overshooting the tops of the terrain-induced precipitation). NWS and KPIX worked together to find an optimal site for the TV radar.

Reduce Terrain Blockage

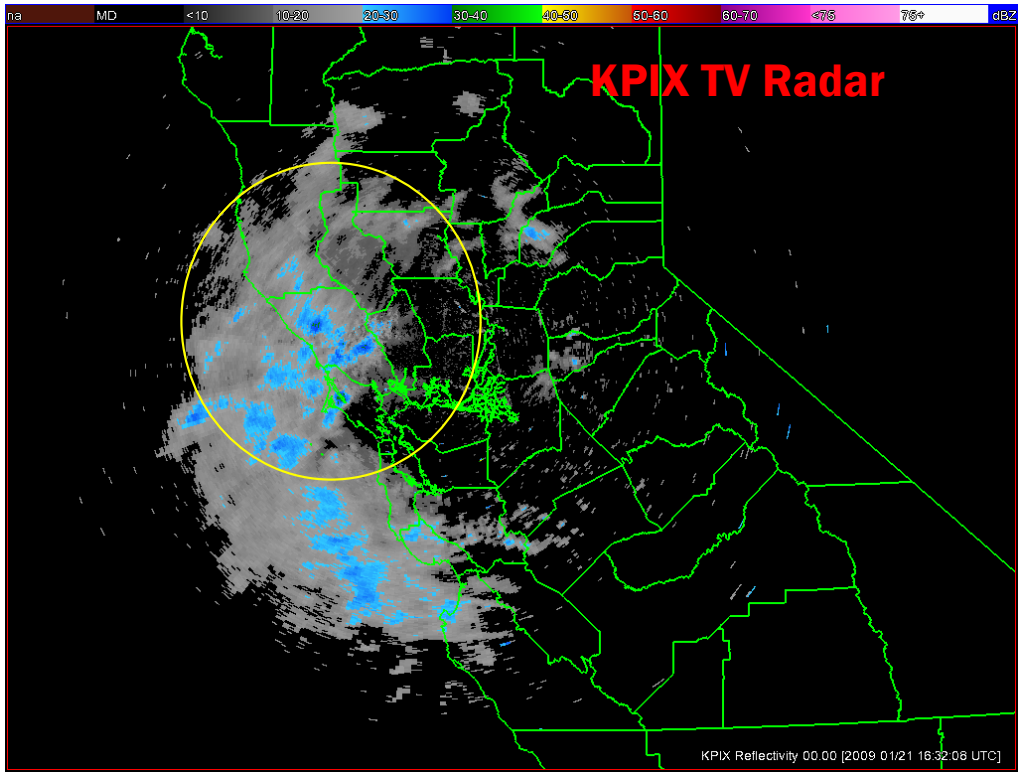


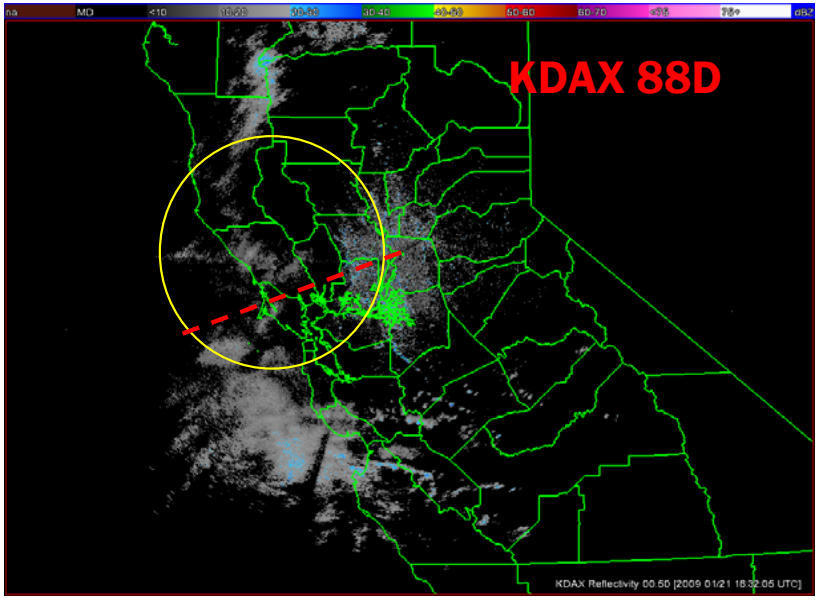


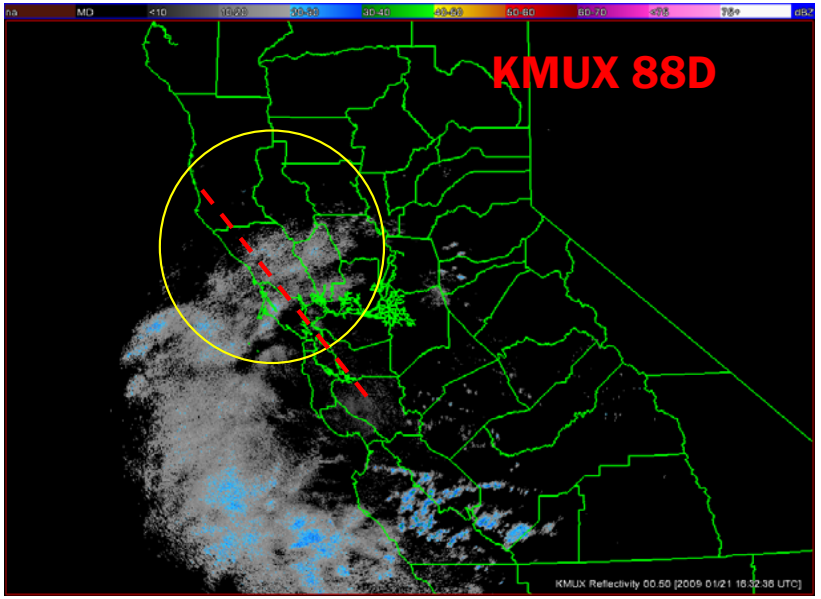




Reduce Terrain Blockage





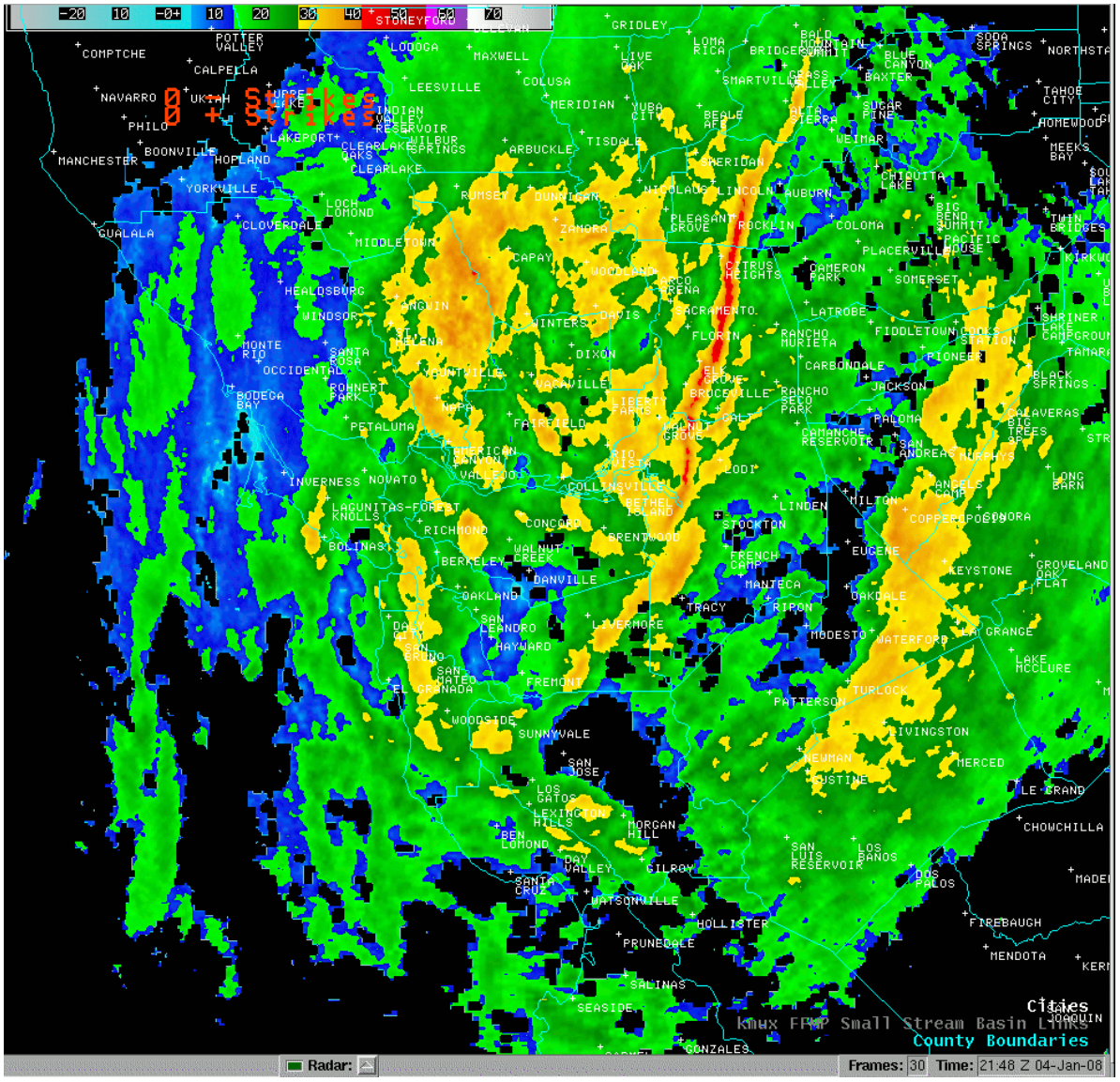


KPIX provides additional coverage over the Russian River watershed which is very important to support operations during heavy rainfall / flooding events.

KPIX Operational Impact

Installed & operational since May 2007

NSSL was asked by NWS to develop a capability to ingest & decode KPIX radar data and retransmit to NWS for use in NWS operations.



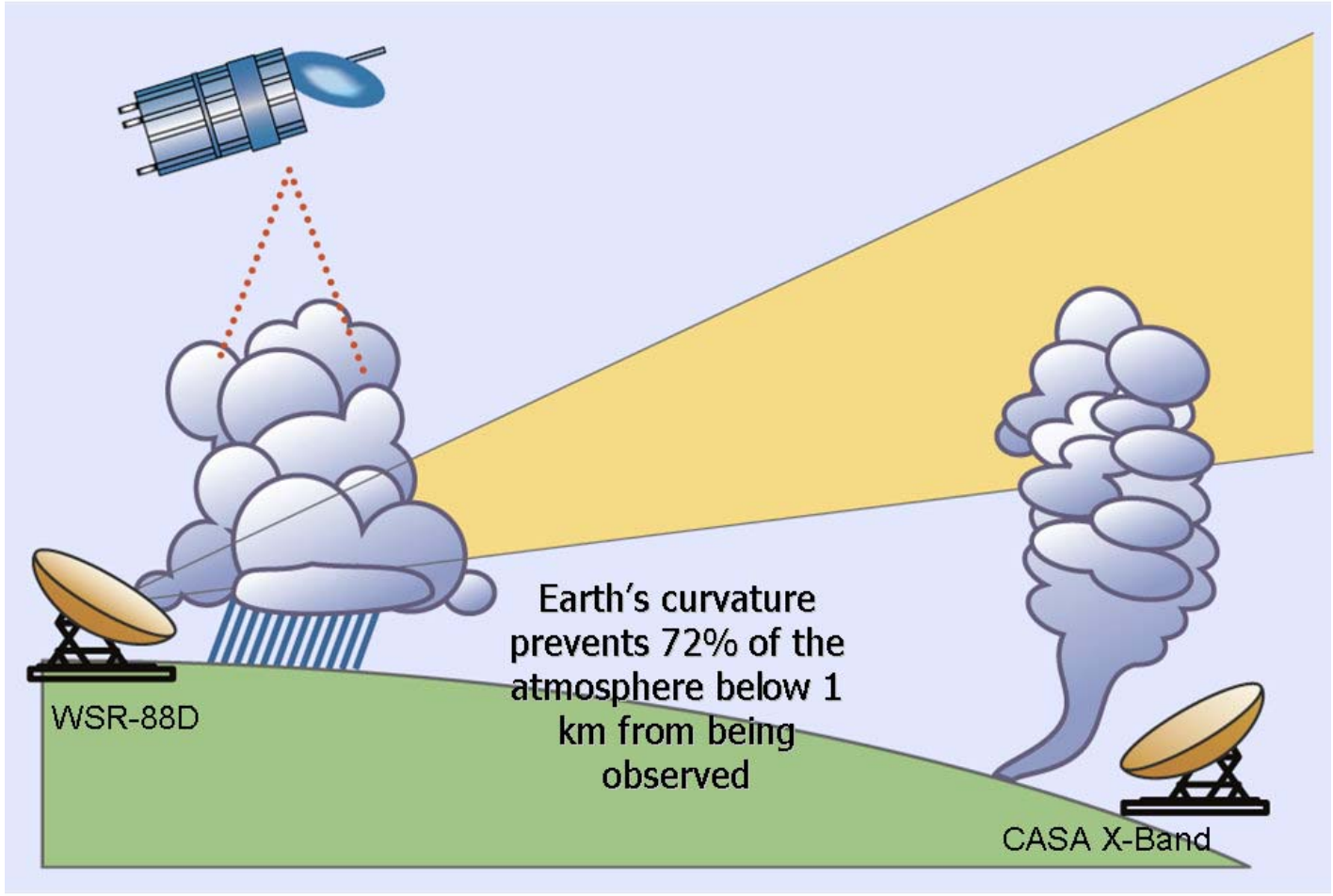
KPIX-TV radar data displayed in the NWS operational AWIPS system

(Surveillance scan is updated every 30 seconds)

Lower Altitude Coverage

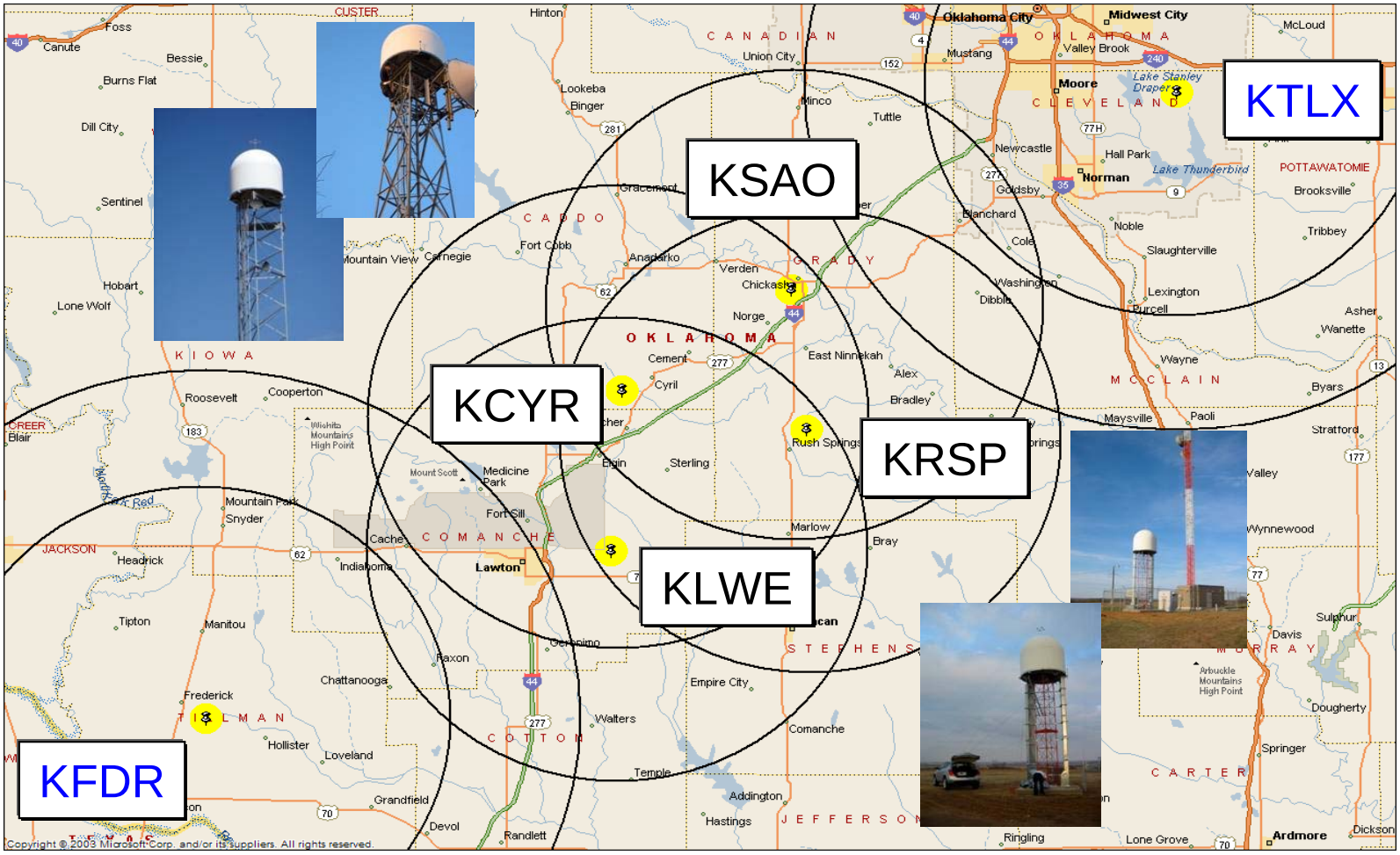
Collaborative Adaptive Sensing of the Atmosphere

A network of inexpensive, collaborative, X-band radars that may be used to fill-in the gap below WSR-88D coverage
(or in other under-sampled regions).

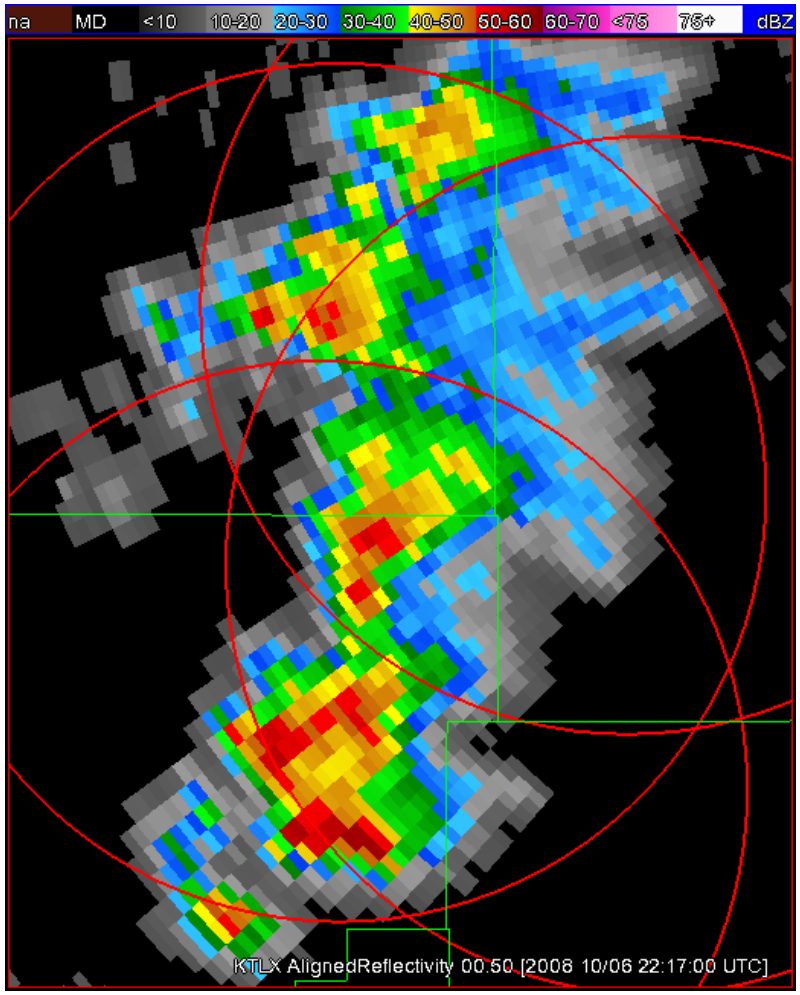


Lower Altitude Coverage

Radar coverage is pretty good in Oklahoma, but what added benefit can come from good temporal and spatial observations near the ground? Boundary layer features are not always well observed by the WSR-88D network.



CASA / WSR-88D Comparison



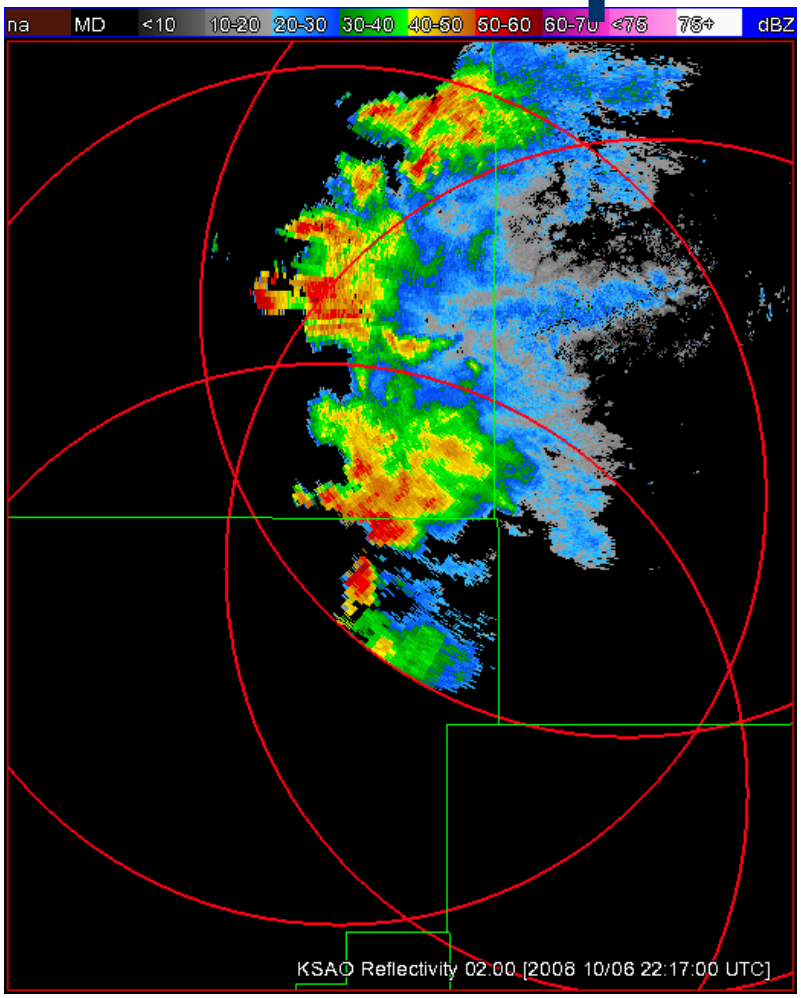
KTLX 88D (Legacy Res)

(S-band)

1000m gate spacing

1.0 deg azimuthal spacing

4 – 6 minute volume update



KSAO CASA

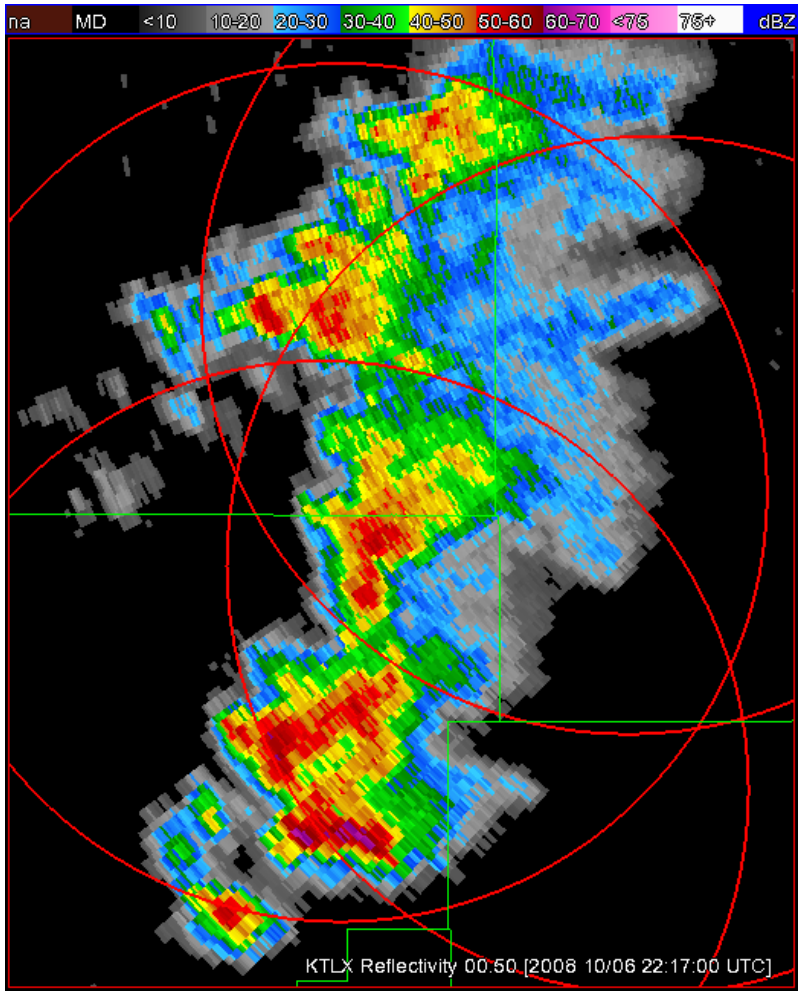
(X-band)

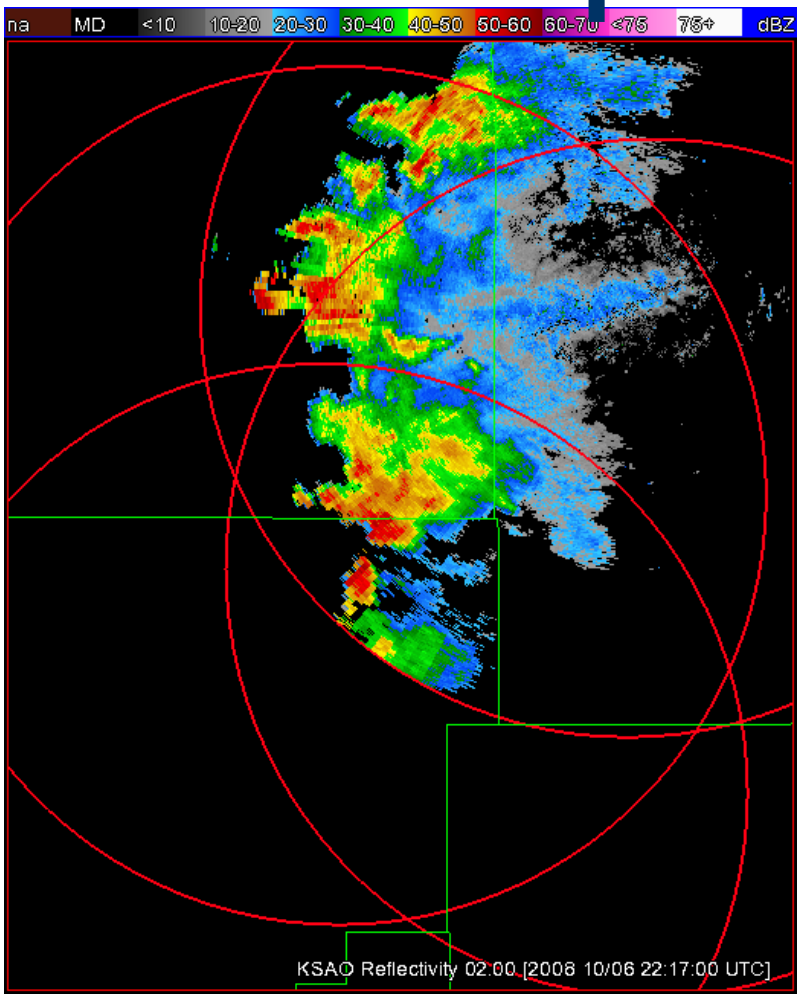
100m gate spacing

1.0 deg azimuthal spacing

1 minute volume update (sector)

CASA / WSR-88D Comparison





KTLX 88D → Super Res ←

(S-band)

250m gate spacing

0.5 deg azimuthal spacing

4 – 6 minute volume update

KSAO CASA

(X-band)

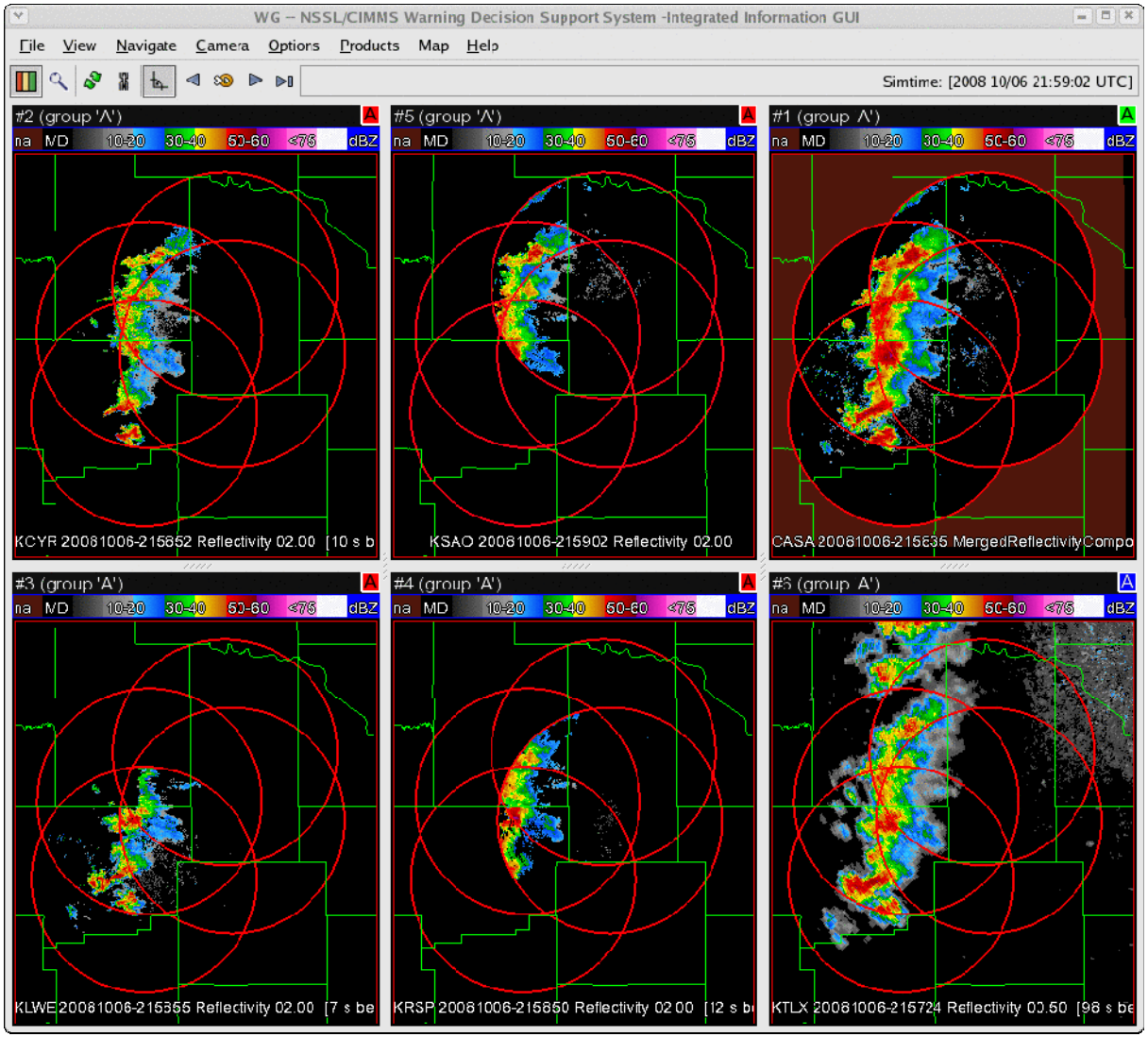
100m gate spacing

1.0 deg azimuthal spacing

1 minute volume update (sector)

Higher Temporal Resolution

Increased Temporal & Spatial Resolution



CASA Radars

100m gate spacing

1.0 deg azimuth

1.8 deg beamwidth

1 minute update

CASA Composite Reflectivity

100m x 100m grid

KTLX 88D

Super-Resolution

250m gate spacing

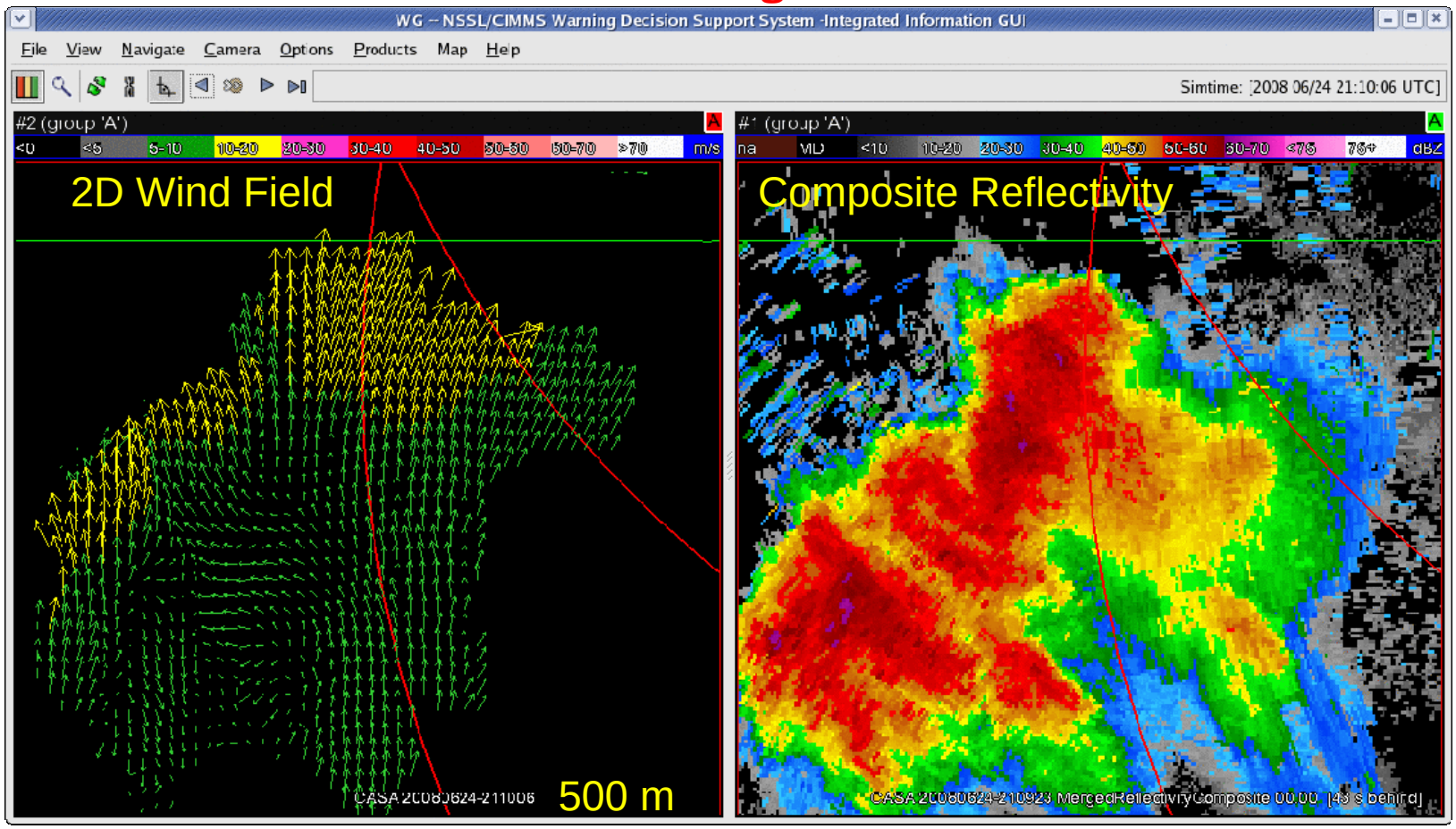
0.5 deg azimuth

1.0 deg beamwidth

4 - 6 minute update

Dense Network Coverage

The synergistic results of high spatial and temporal resolution radars situated close together.



Real-time multi-Doppler 2D wind field produced by NSSL's WDSS-II system.

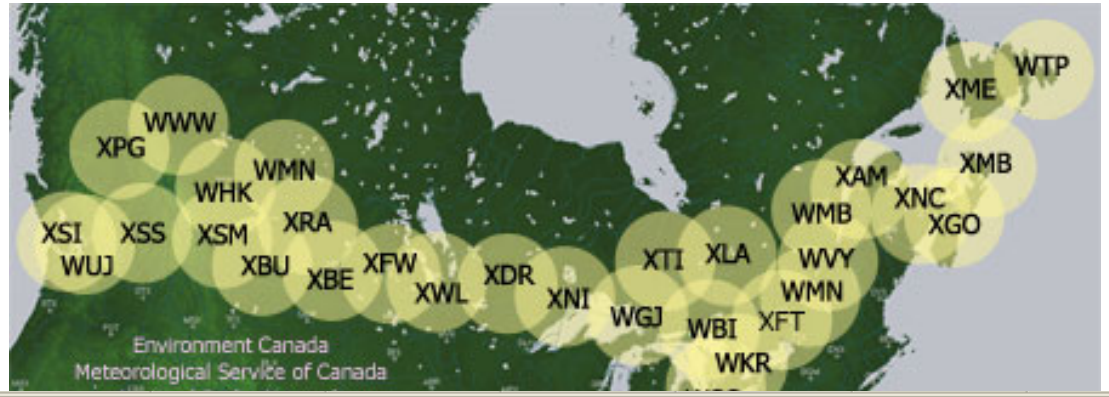
Increased Border Coverage

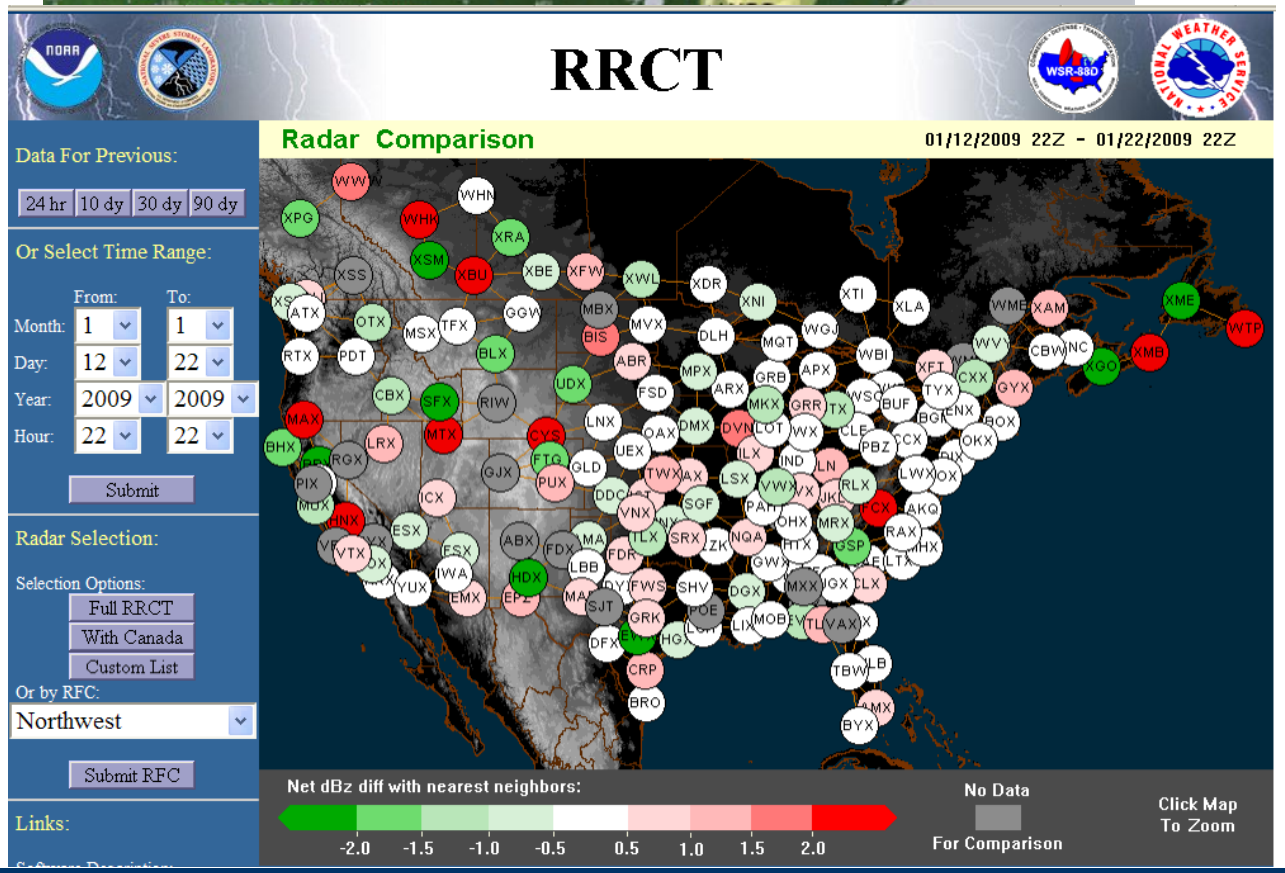
Environment Canada

NCDC

NOAA

CIO/HPCC





Canadian radar data integrated into NSSL precipitation estimation and RRCT systems.

(Real-time Radar Calibration Tool)

Real-time data is delayed 20-30 minutes

Future Directions

- **Questions to be answered**
  - Are additional radar observations needed to be successful with “Warn-On-Forecast” storm-scale modeling?
    - Lower altitude, more frequent, more complete coverage, multi-radar products
  - Can we better distinguish between tornadic and non-tornadic circulation signatures?
    - Or identify which circulations will become tornadoes?
    - Or identify precursor signatures for severe weather?
  - Can other radars be integrated into a national network?
    - Issues of calibration, data quality, attenuation (i.e. usability)
    - Precipitation estimation & flash flood warnings are very susceptible to data quality issues

Summary

• NSSL has demonstrated it's capability & experience working with other radar systems and integrating the data into NWS operations for evaluation.

• Other surveillance radars/networks can provide additional observational data.

- These data may be necessary to develop a better understanding of severe weather and flood events which will improve forecasts and warnings
- NSSL has several ongoing collaborations to determine the potential of these systems and how they may be used by NOAA
- We will continue testing/evaluation of new radar sources in the Hazardous Weather Testbed (HWT) and NWS Forecast Offices

Questions:

CASA Collaboration

- **What is NSSL's role in CASA?**
  - Provide severe weather detection algorithms (using WDSS-II) to CASA's Meteorological Command & Control (MC&C) system
    - MC&C determines network scanning strategy during each heartbeat (60 seconds) based on weather threats and user needs
  - Provides additional algorithm products for users
    - Nowcasts, Multi-Doppler winds, data quality control processes
  - Conduit to display of CASA data in the Hazardous Weather Testbed
    - Evaluation of CASA data in an operational environment

Dense Network Coverage

Real-time multi-Doppler example from NSSL WDSS-II

The synergistic results of high spatial and temporal resolution radars situated close together.