Understanding Tornadoes and Tornadogenesis

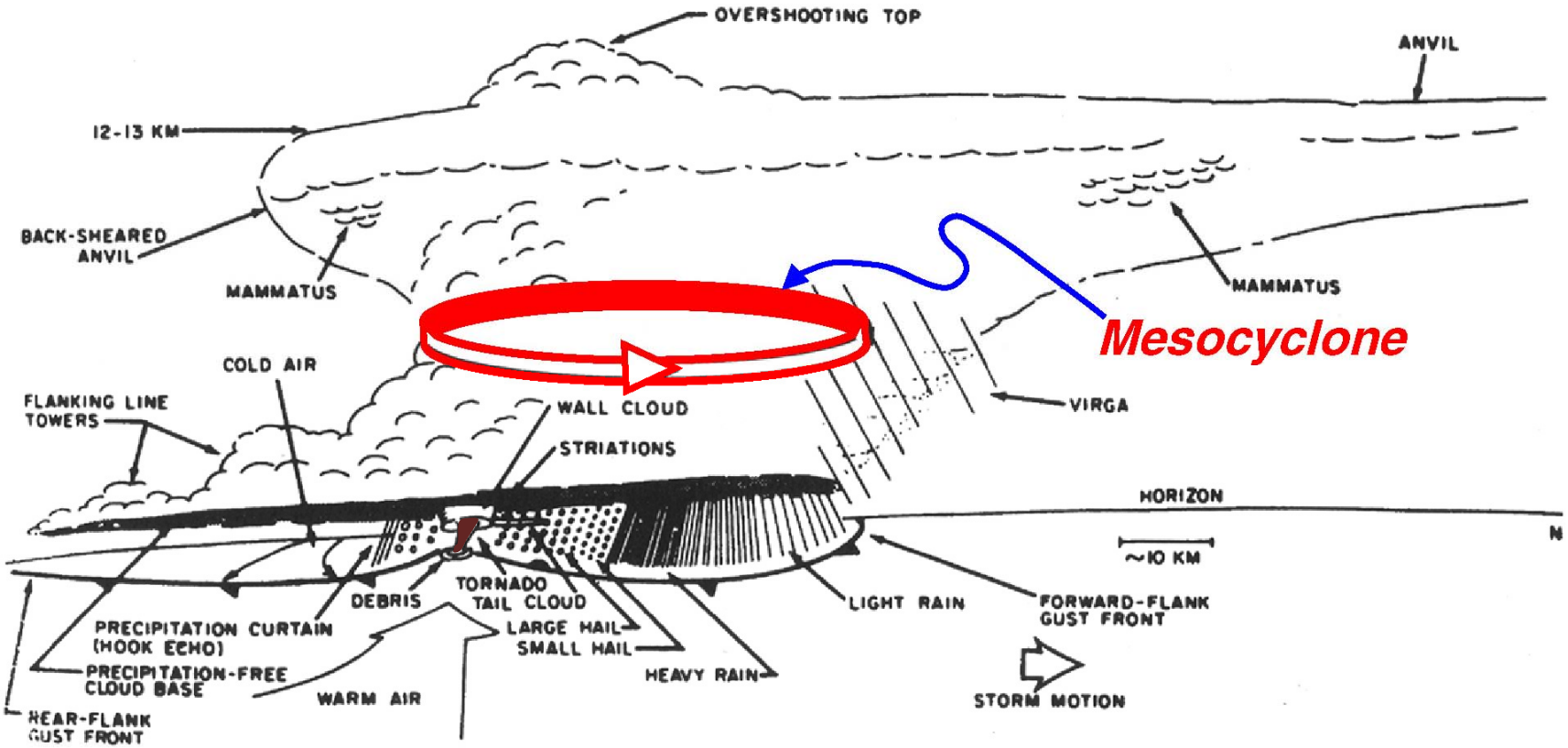
VORTEX2:
Verification of the Origins of Rotation in Tornadoes Experiment

Roger M. Wakimoto, Director

National Center For Atmospheric Research

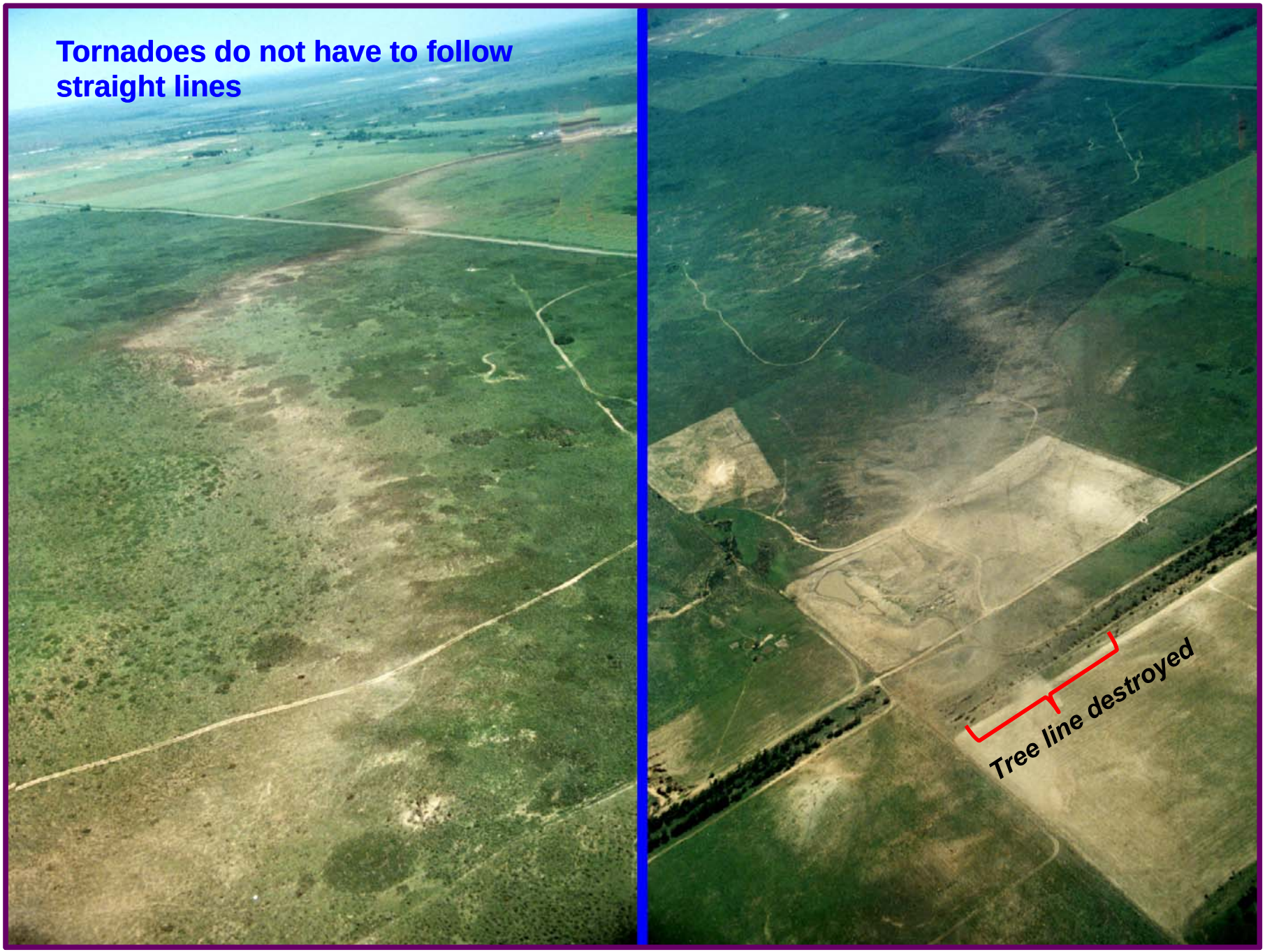
NCAR is sponsored by

SUPERCELL THUNDERSTORM

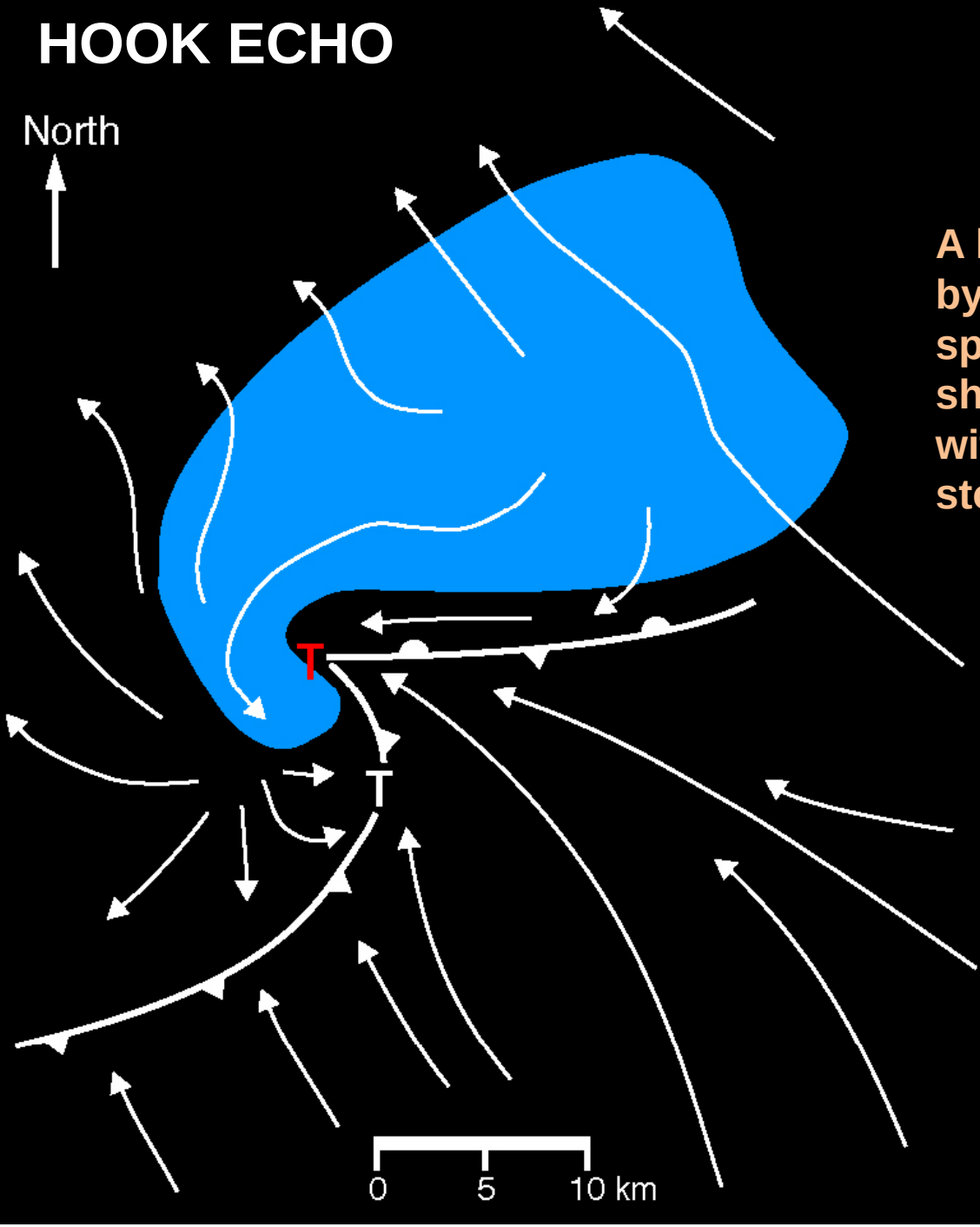


Two distinct circulations:

1. **Mesocyclone (~5 km wide),**
2. **Tornado (100s meter wide).**


Tornadoes do not have to follow straight lines
Tree line destroyed

HOOK ECHO



A horizontal scan by a radar reveals a specific echo shape associated with the supercell storm.

TORNADO QUESTIONS:

- Current warnings have a 13 minute average lead time and a 70% false alarm rate. Can the former be increased while decreasing the latter?

- What is the process that triggers tornadogenesis?

- Why are some tornadoes violent and long lasting while others are weak and short lived?

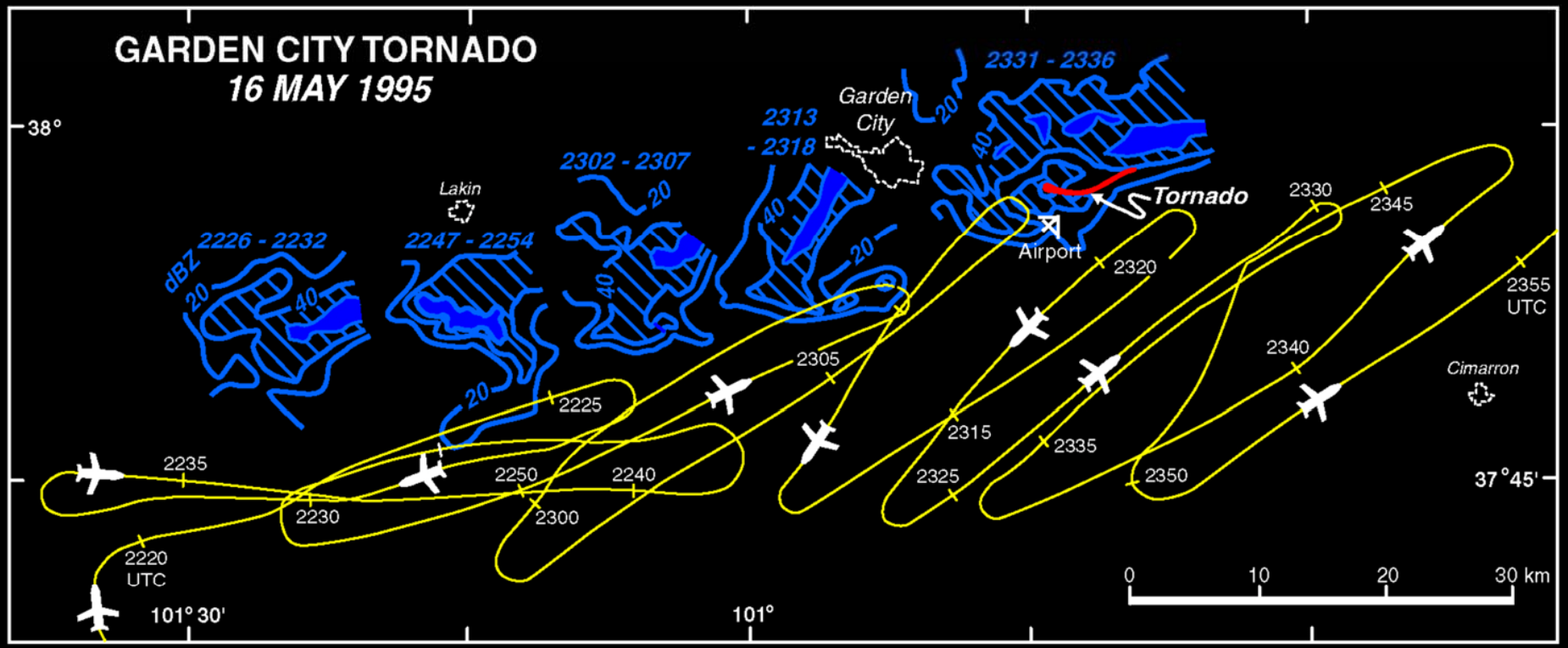
- What is the detailed wind structure within tornadoes and how strong are the winds near the surface?

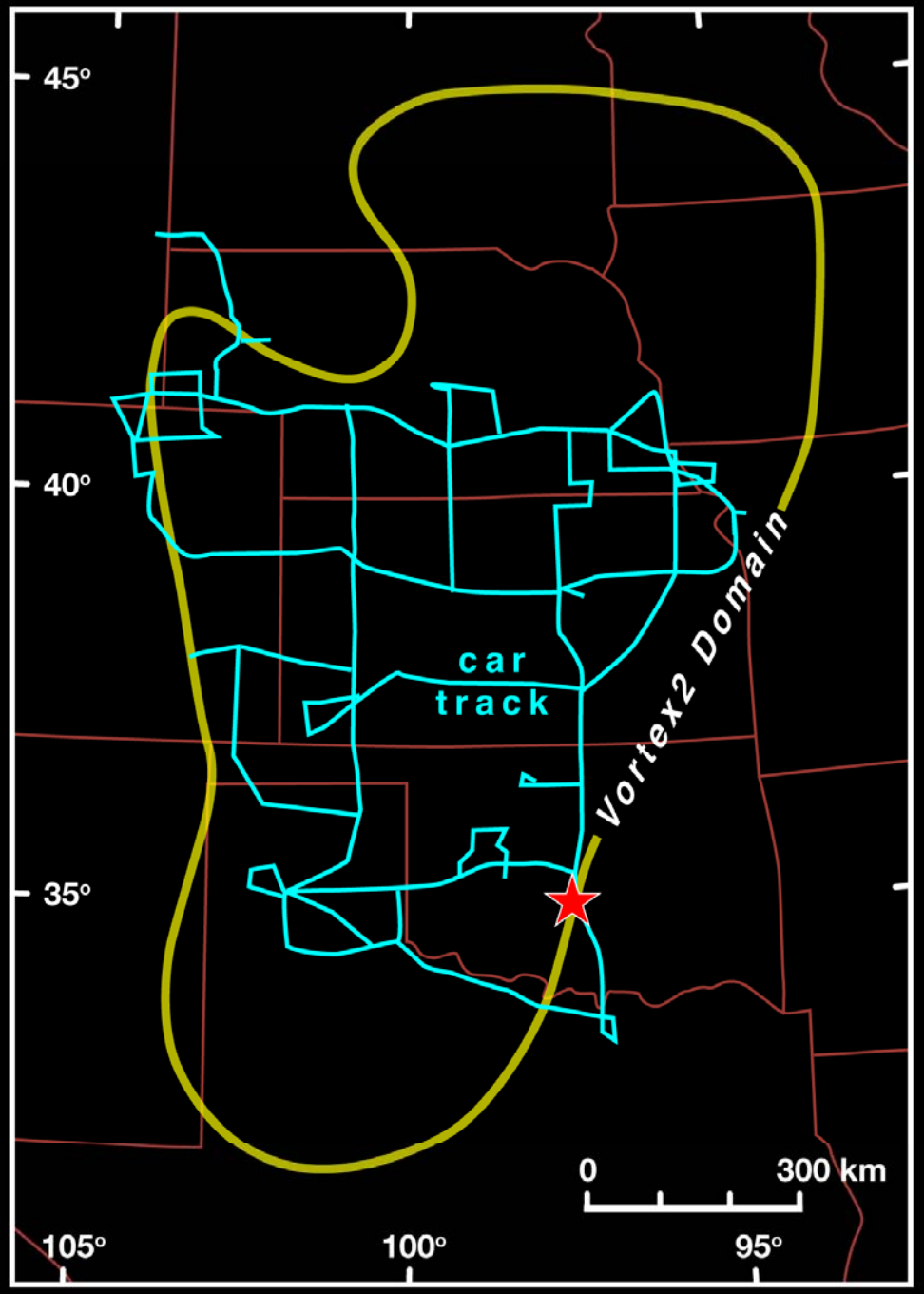
- Do tornadoes build up from the surface rather than descend from the storm (i.e., touchdown)? We already know that the rotation of dust devils and waterspouts build upwards from the ground.

- Why do only a small fraction of the rotating storms produce tornadoes? This impacts false alarm rates.

Up close observations with mobile radars have provided detailed information on the structure of tornadoes.

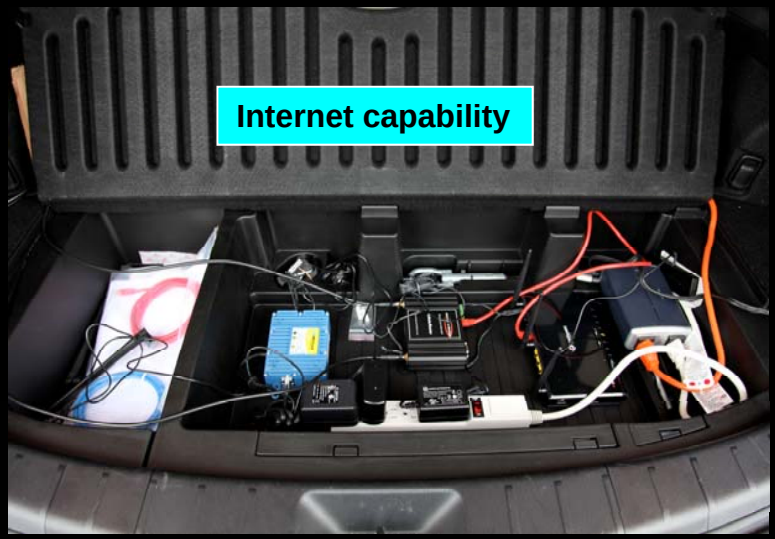
Airborne radar has also provided unique insights into tornadic storms.

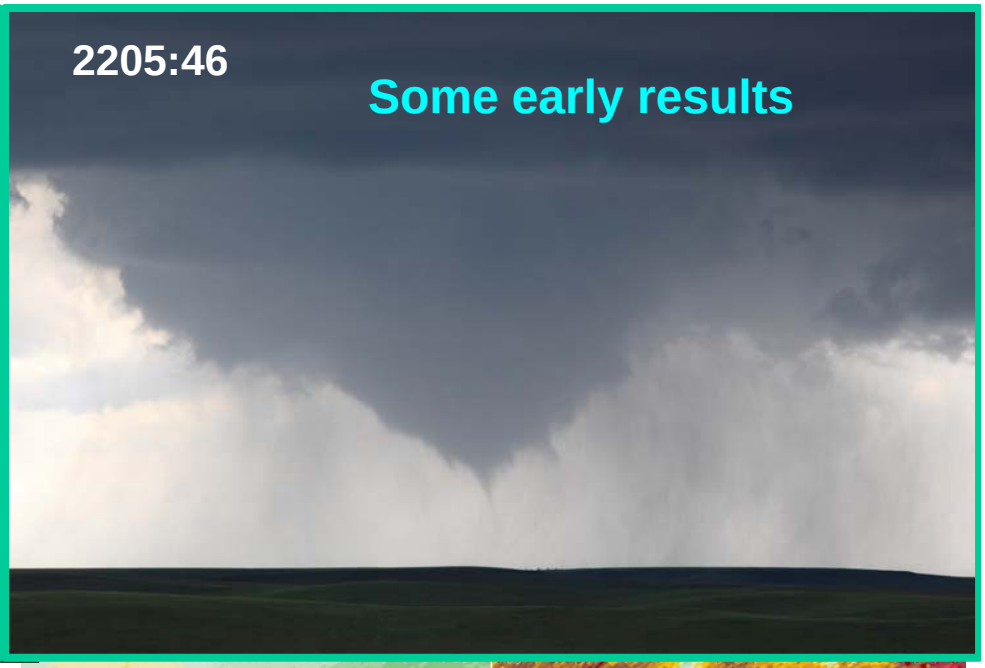

GARDEN CITY TORNADO
16 MAY 1995
38°
Lakin
Garden City
Tornado
Airport
Cimarron
2226 - 2232
2247 - 2254
2302 - 2307
2313 - 2318
2331 - 2336
dBZ
20
40
2220 UTC
2225
2230
2235
2240
2250
2300
2305
2315
2320
2325
2330
2335
2340
2345
2350
2355 UTC
37°45'
101° 30'
101°
0
10
20
30 km

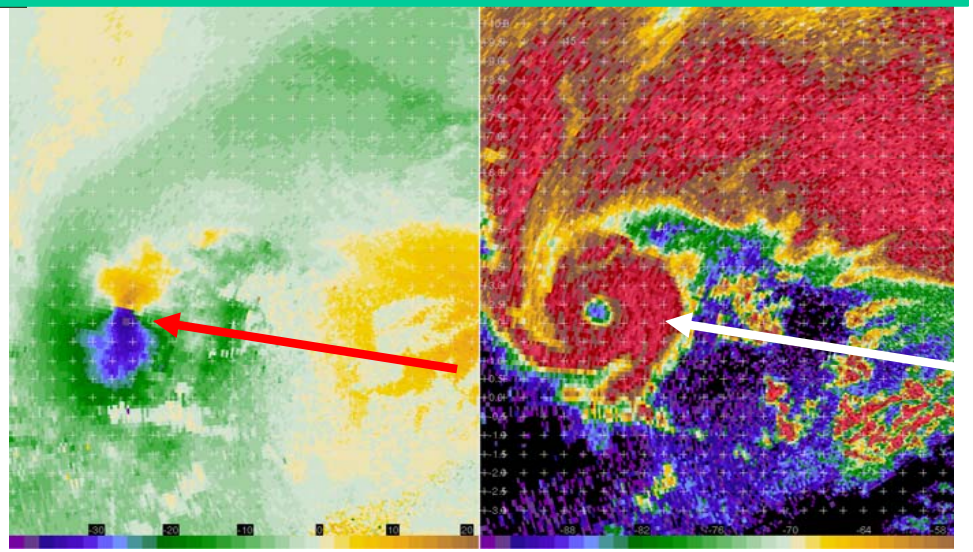


VORTEX2 (2009-2010)

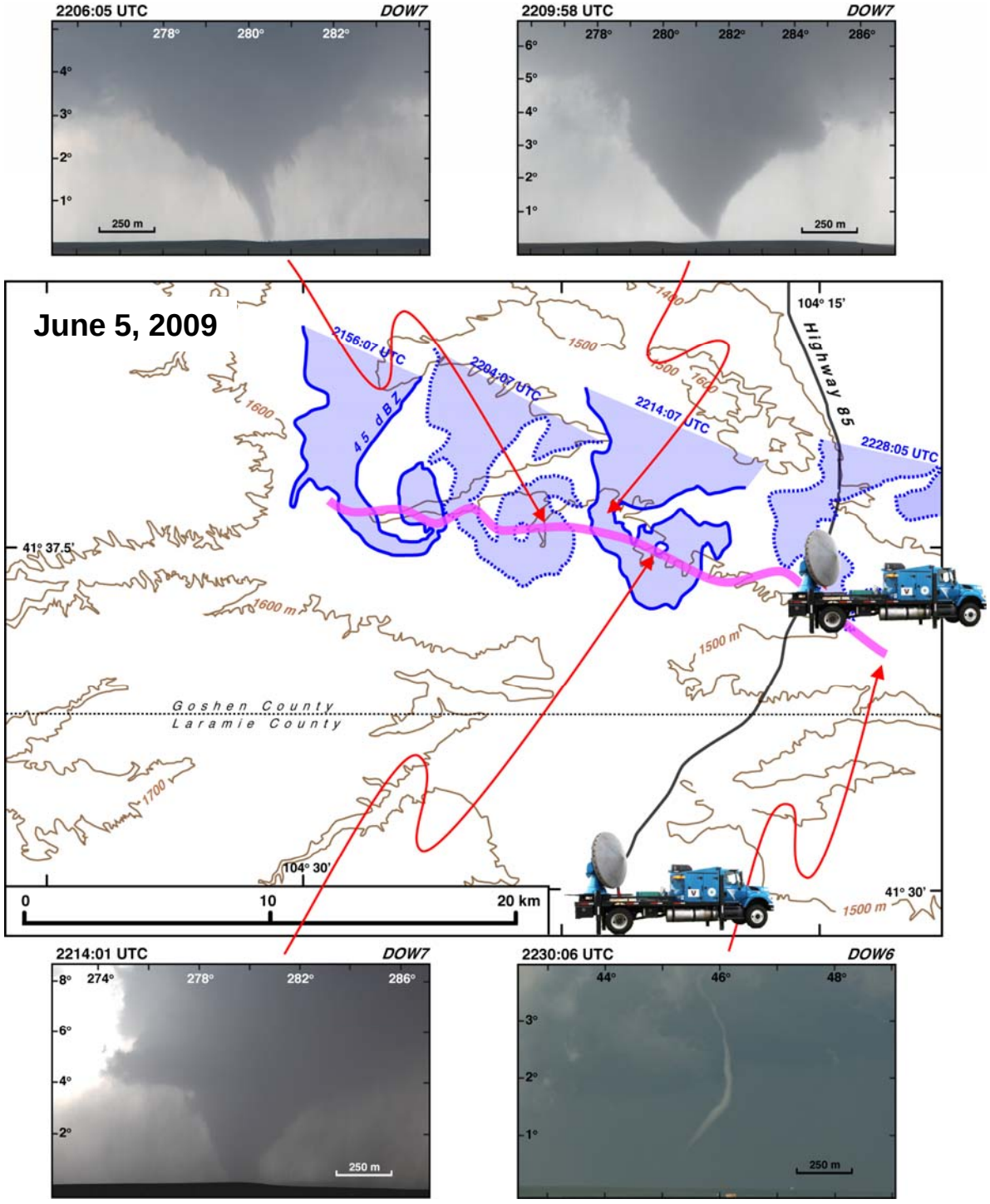
Over 100 Scientists and 40 instrumented vehicles. Largest coordinated experiment to study tornadoes and tornadic storms







The birth, mature stage and dissipation of a tornado
June 5, 2009
Southeastern Wyoming



Research results from VORTEX2 are expected in the next 1 or 2 years.

Modernizing the current National Weather Service radar from mechanical steering to electronic steering (phased array radars) hold great promise in improving forecast lead times (~2020)

- 20 to 30-second volume scan rates, compared with 5-7 minutes with the current WSR-88D

- "Dwell" – the ability to repeatedly sample areas of interest

- "Adaptive scanning" – the capability to quickly go back and look again at something that draws our attention, such as a severe weather feature

Thank you


Celebrating 50 years of continuous support of UCAR/NCAR
NSF