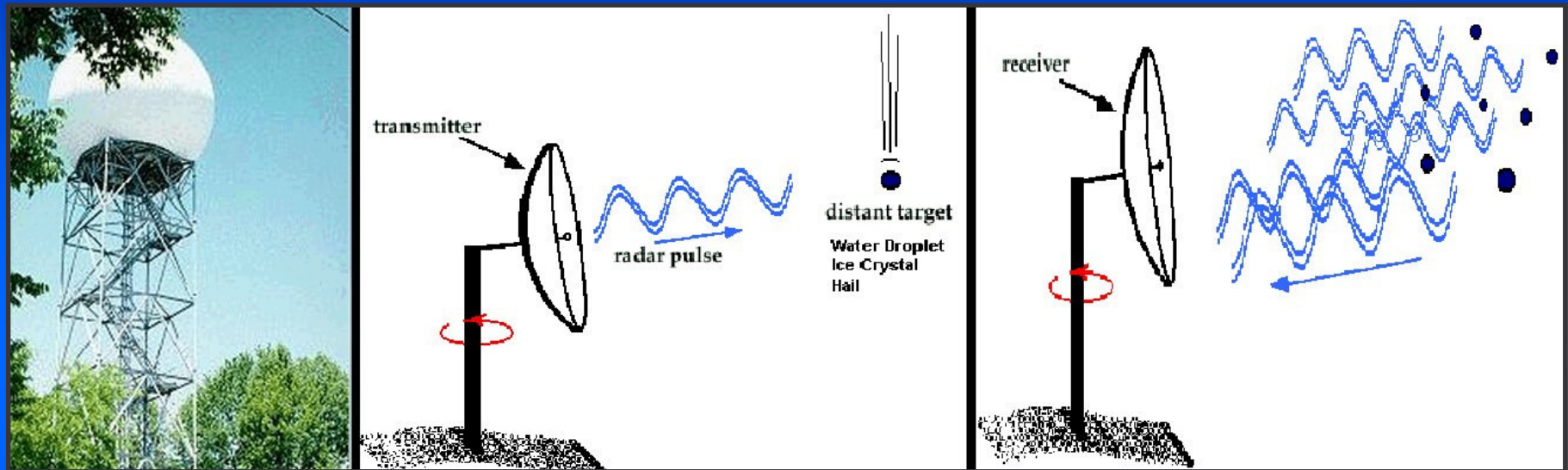


Basic Doppler Radar Interpretation

A Doppler radar map of the Louisville, Kentucky area. The map uses a color scale to represent precipitation intensity, with red and orange indicating heavy rain and yellow and green indicating lighter rain. Blue and purple colors are used to represent wind direction and speed. The map shows a large area of heavy rain (red/orange) centered over the Louisville area, with lighter rain (yellow/green) extending outwards. Wind direction is indicated by the color of the radar returns, with blue and purple colors suggesting a specific wind pattern. The map also shows the outlines of the surrounding states and counties.

Ted Funk
NWS Louisville, KY

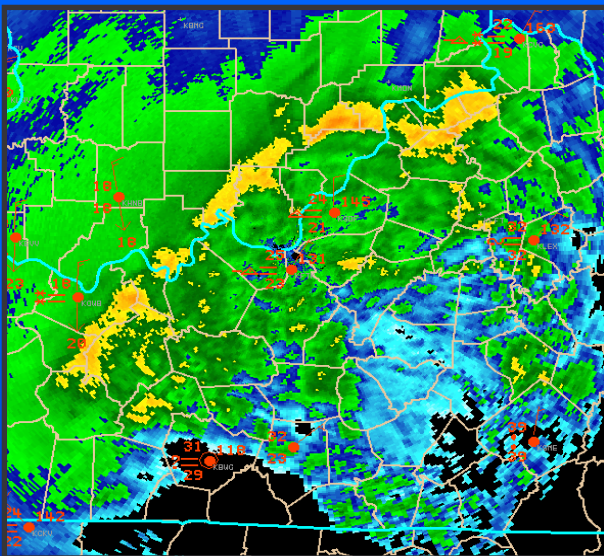
Basic WSR-88D Doppler Radar Facts



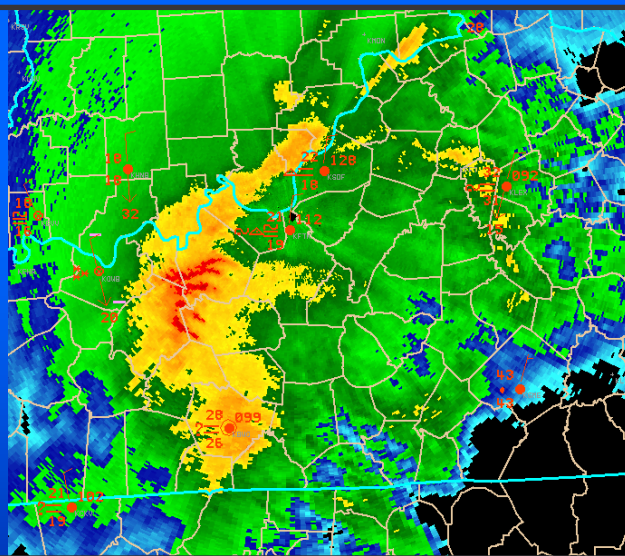
- ▶ Radar transmits pulses of electromagnetic energy, then listens for energy reflected back to it from various precipitation targets (echoes). The time it takes for echoes to return allows the radar to determine their location; minor differences in wavelength allows it to determine echo velocity
- ▶ Antenna diameter: 28 ft; allows radar to be very sensitive with long range
- ▶ Effective reflectivity range: 248 nm; Effective velocity range: 124 nm

Reflectivity

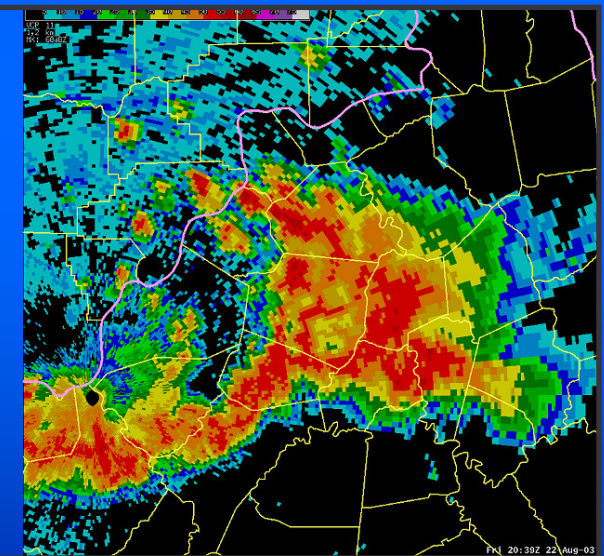
- ▶ Displays location, intensity, and movement of precipitation targets
- ▶ Power returned to radar determines intensity level, which is a function of target size and density. Hail, ice pellets, and large rain drops are highly reflective, more so than smaller drops and snow.
- ▶ Two modes of operation: precipitation mode and clear air mode



Smooth...Steady Snow
Cellular...Rain Showers

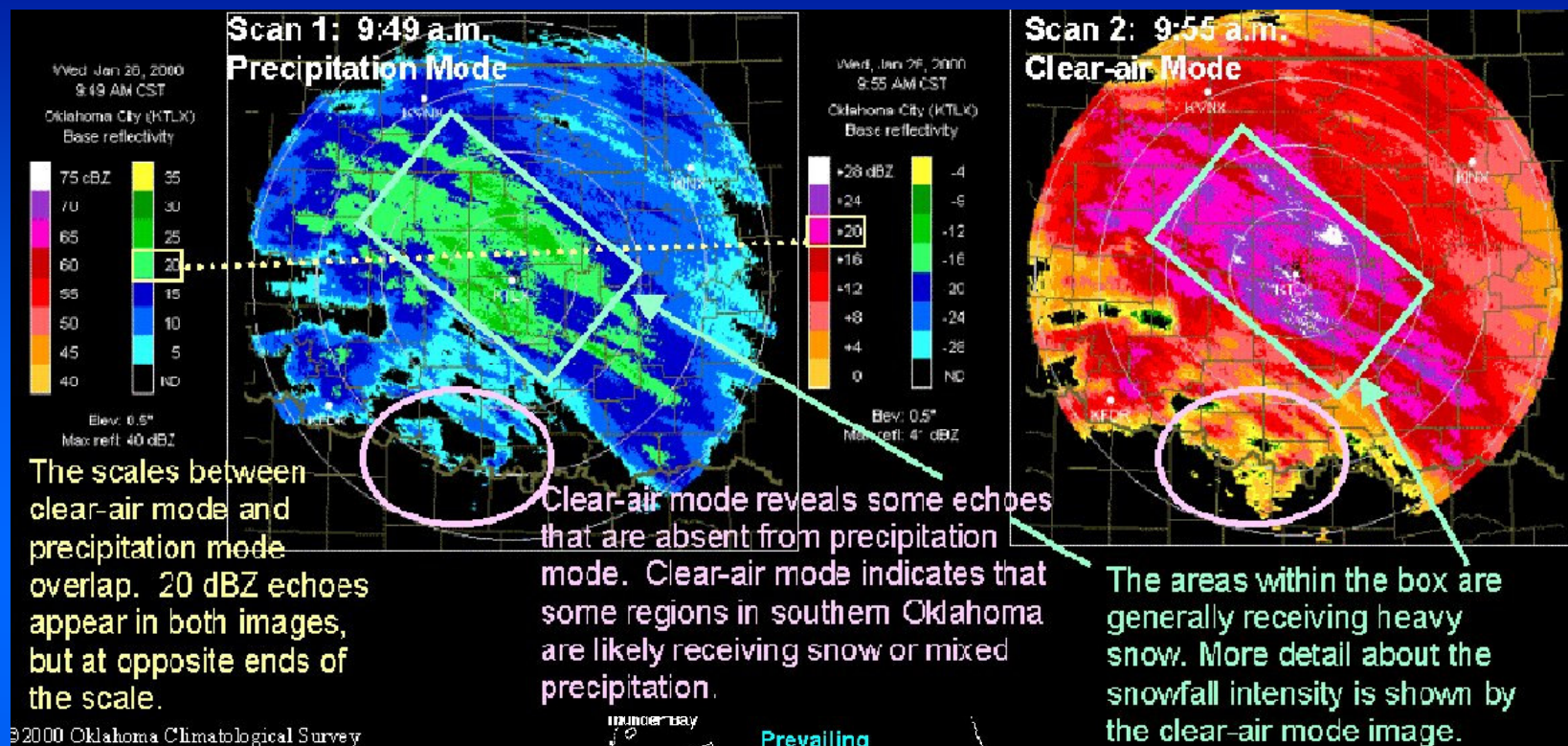


High (50 dBZ in red)
reflectivity in winter storms
may be ice pellets



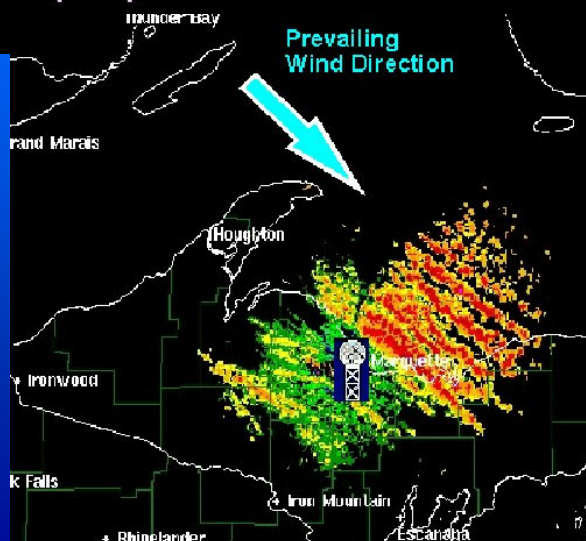
High reflectivity associated
with thunderstorms with
heavy rain and/or hail

Reflectivity Precipitation Mode Vs. Clear Air Mode



Precip Mode:

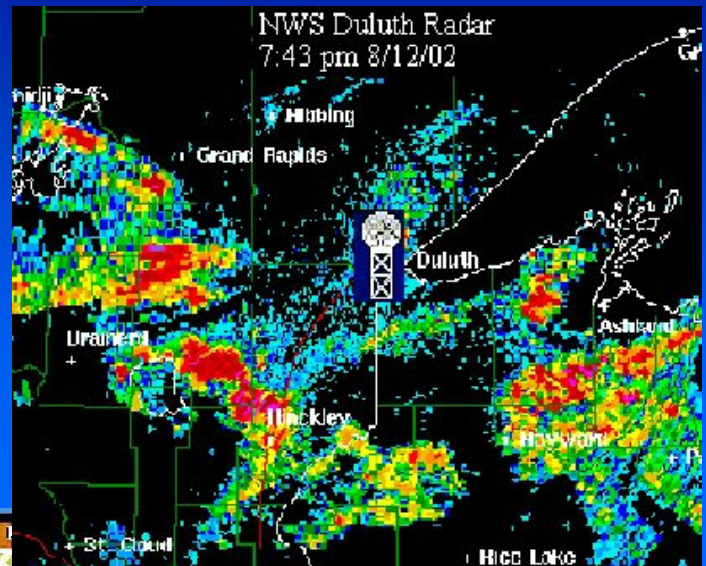
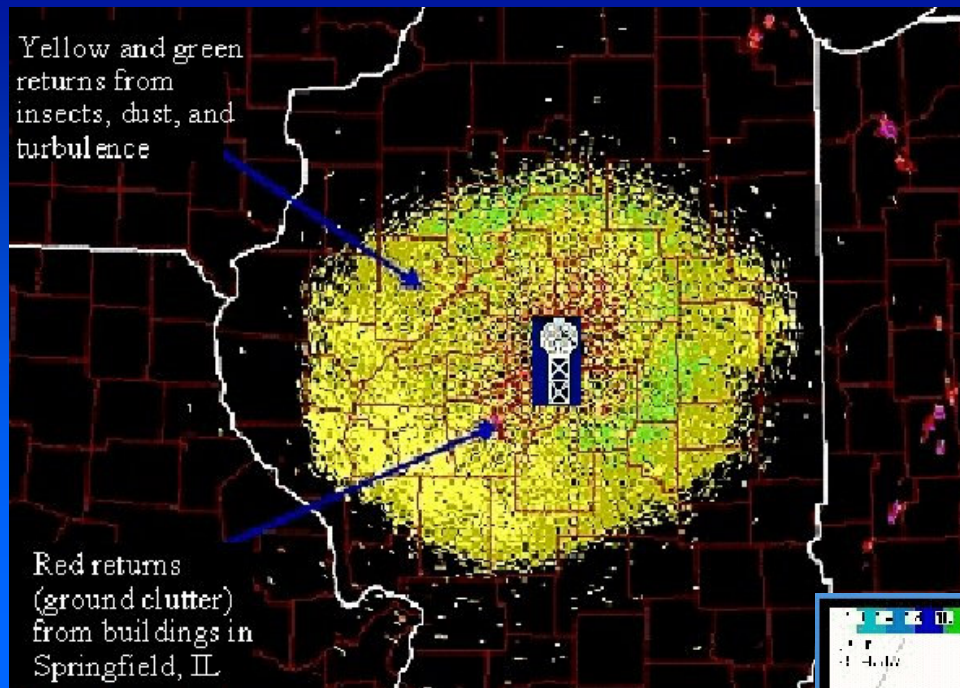
Used for significant rain and snow; provides higher range of reflectivity values to detect heavy precip



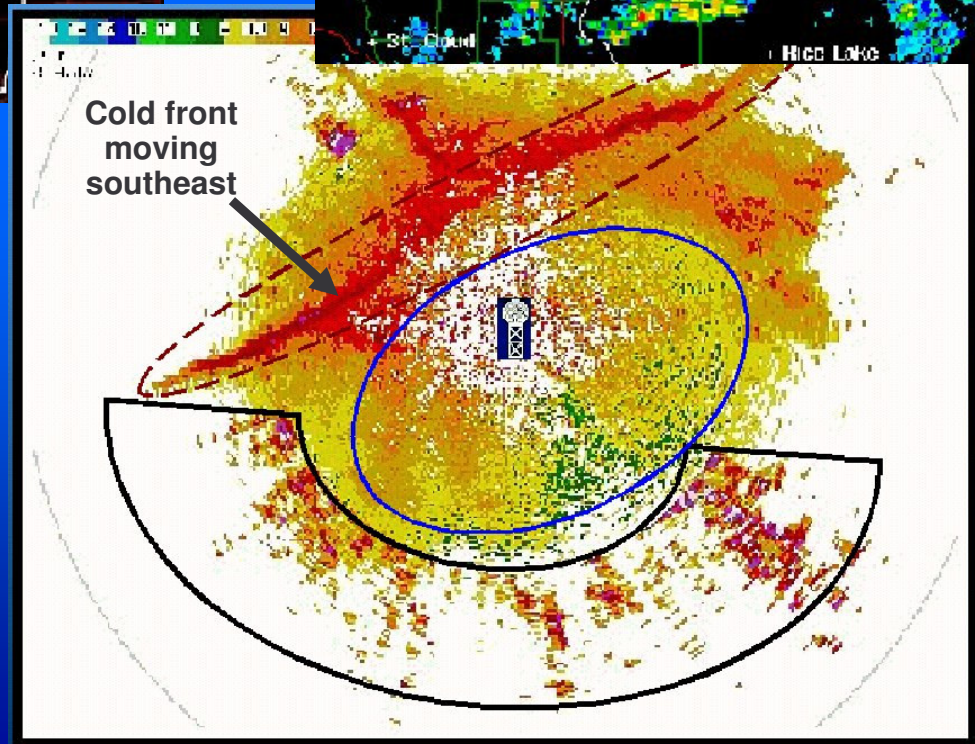
Clear Air Mode:

Used for light precip including light snow and flurries; more sensitive at lower values of reflectivity

Radar Ground Clutter/AP

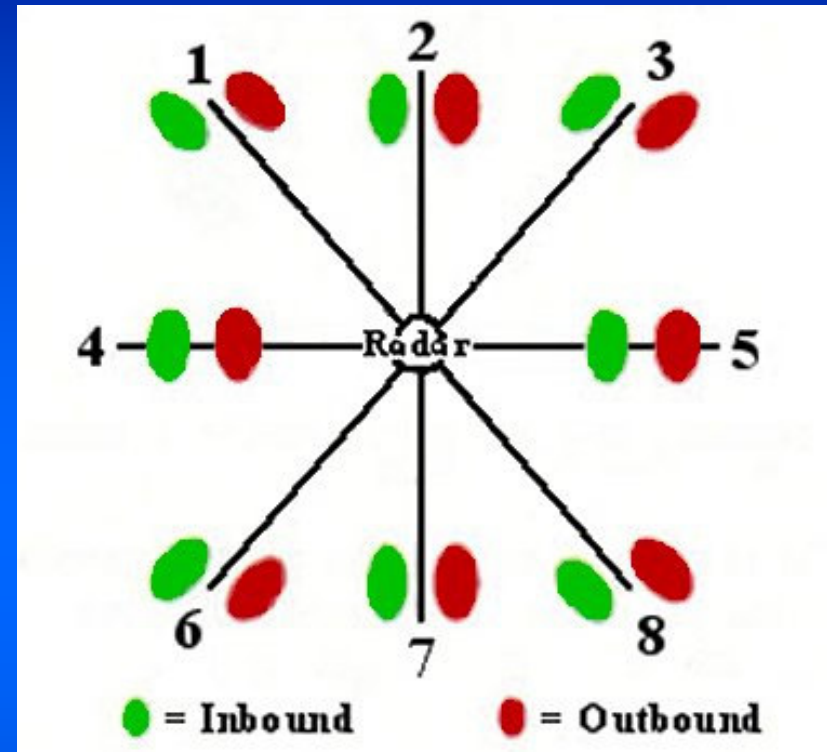


Occurs in clear air or precip modes.
Can appear as expanding circular area around radar. At night, low-level stable layer can form, causing radar beam to propagate along or into surface (ducting) near radar. Thus, radar picks up non-precip targets such as buildings, insects, dust, water droplets (haze), the ground, turbulence, etc.



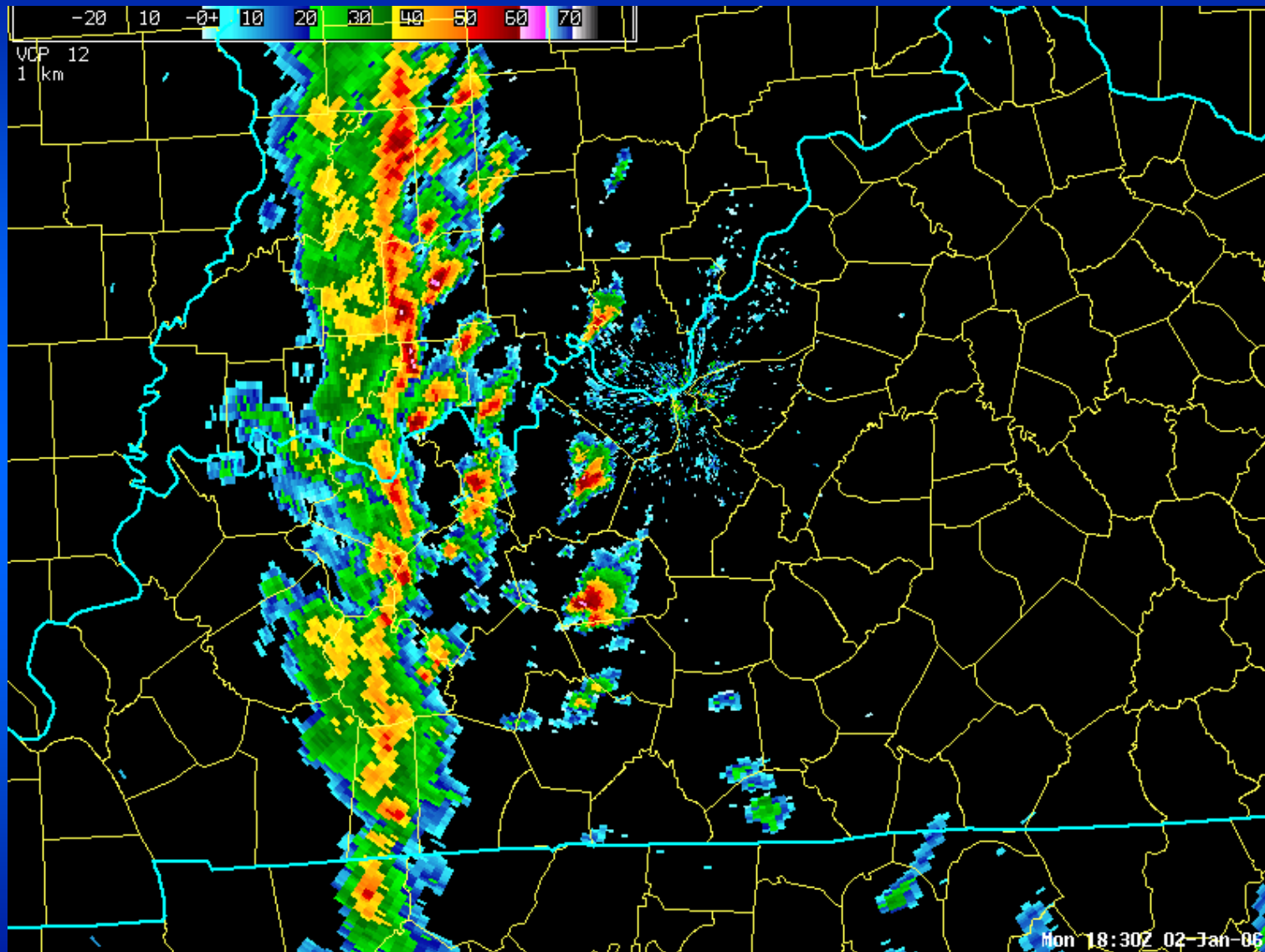
Velocity

- ▶ *Base/Ground-Relative Velocity:*
 - ▶ The wind felt by a stationary object
 - ▶ Detects strength of straight-line winds
- ▶ *Storm-Relative Velocity:*
 - ▶ The wind felt by a moving object
 - ▶ Detects rotation in a thunderstorm
- ▶ Target motion parallel to radar beam is resolved fully
- ▶ Target motion perpendicular to radar beam cannot be resolved
- ▶ Target motion at an angle to radar beam is resolved partially
- ▶ Green = Inbound winds toward radar
- ▶ Red = Outbound winds away from radar



- 1 = Cyclonic (CCW) convergence
- 2 = Pure cyclonic rotation
- 3 = Cyclonic divergence
- 4 = Pure convergence
- 5 = Pure divergence
- 6 = Anticyclonic (CW) convergence
- 7 = Pure anticyclonic rotation
- 8 = Anticyclonic divergence

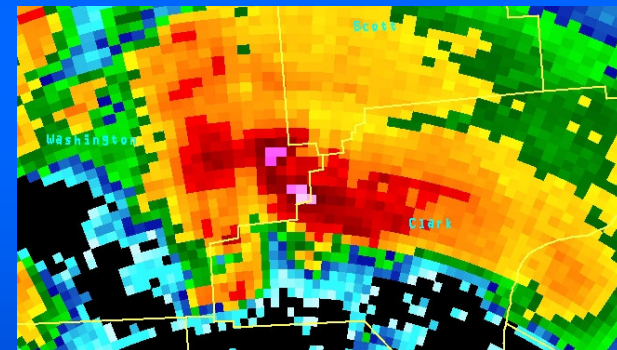
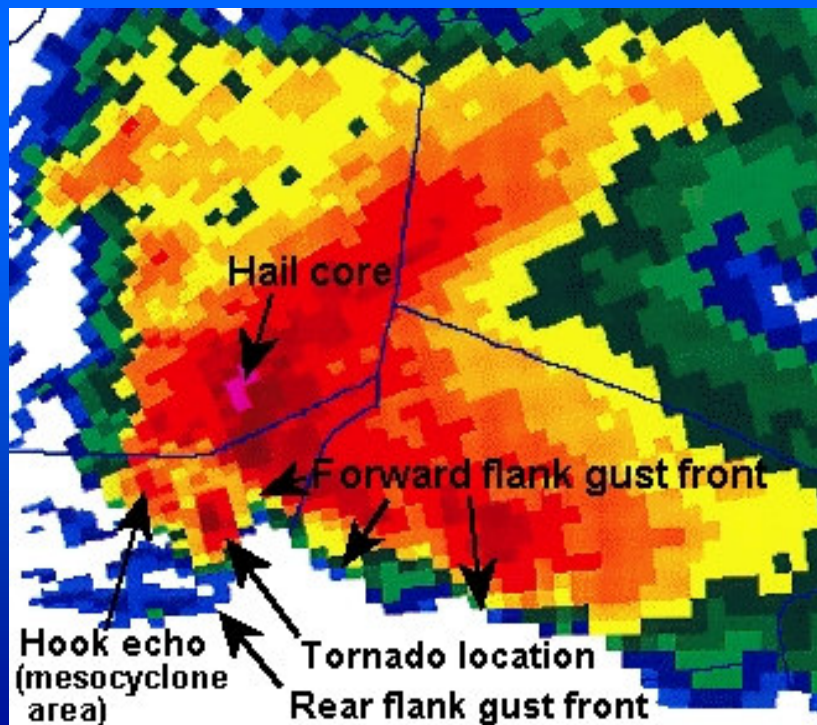
KL VX 0.5 deg Reflectivity from 1830-2044 UTC 02 Jan 2006



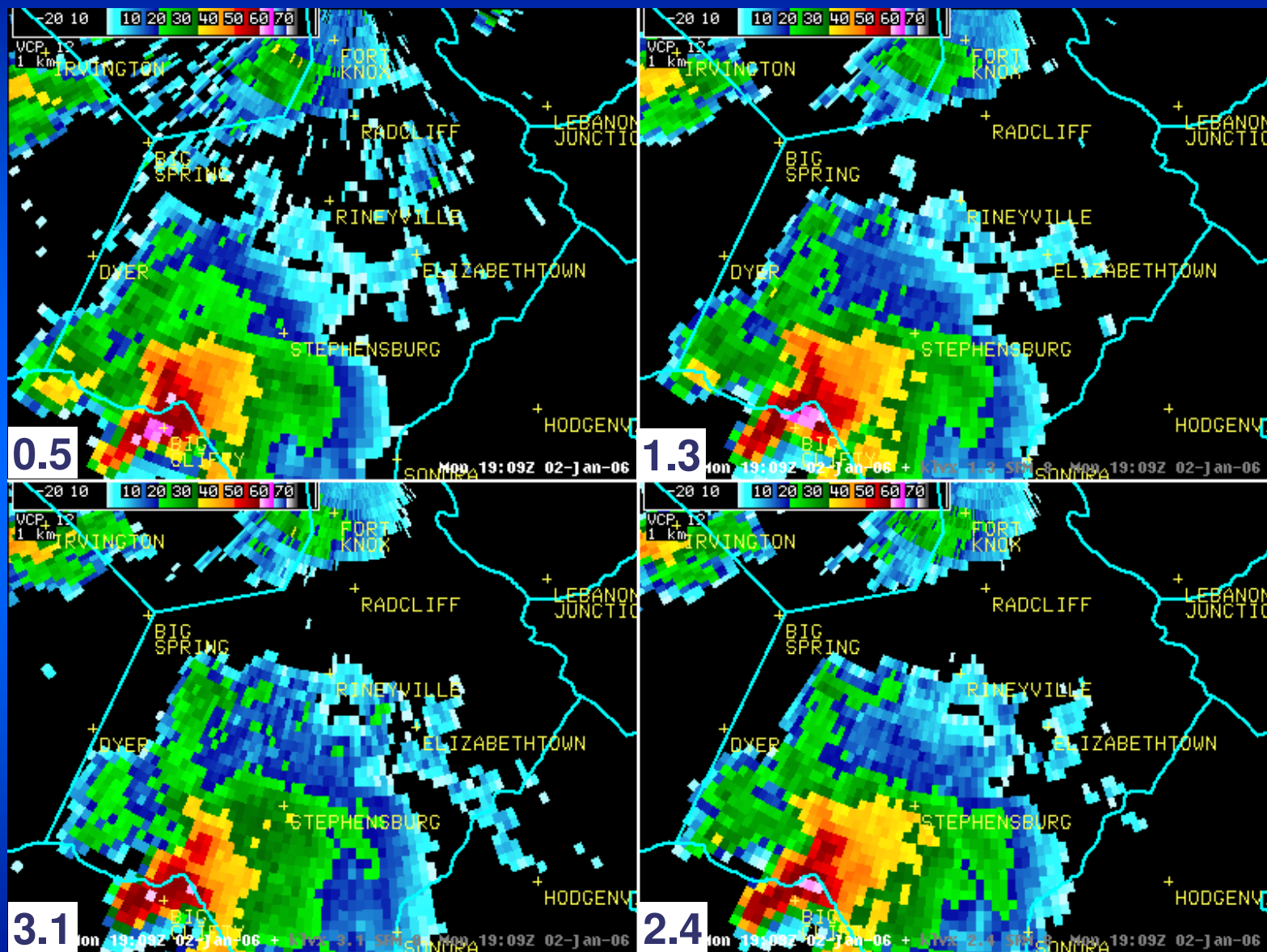
Squall line with small bowing segments and several supercells ahead of line

Supercell Thunderstorms

- Produce wind damage, large hail, tornadoes, and torrential rain
- Hook echo: low-level feature often on S or SW side of storm
- High reflectivity area at edge of hook often denotes tornado location
- Rear flank downdraft/straight line winds located just south of tornado
- Hail core and heavy rain to north or northeast of hook

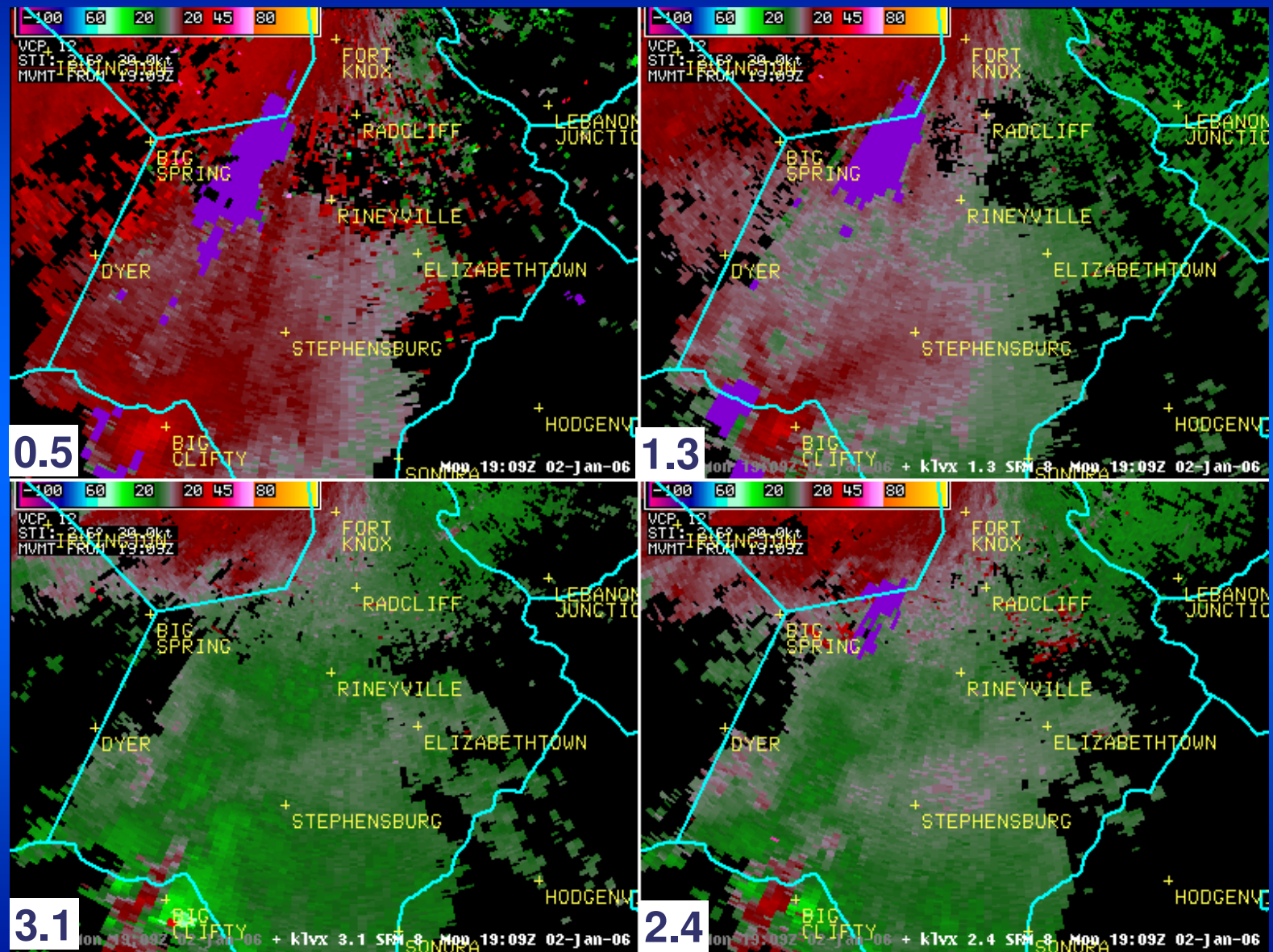


KL VX 4-Panel Reflectivity from 1830-2044 UTC 02 Jan 2006



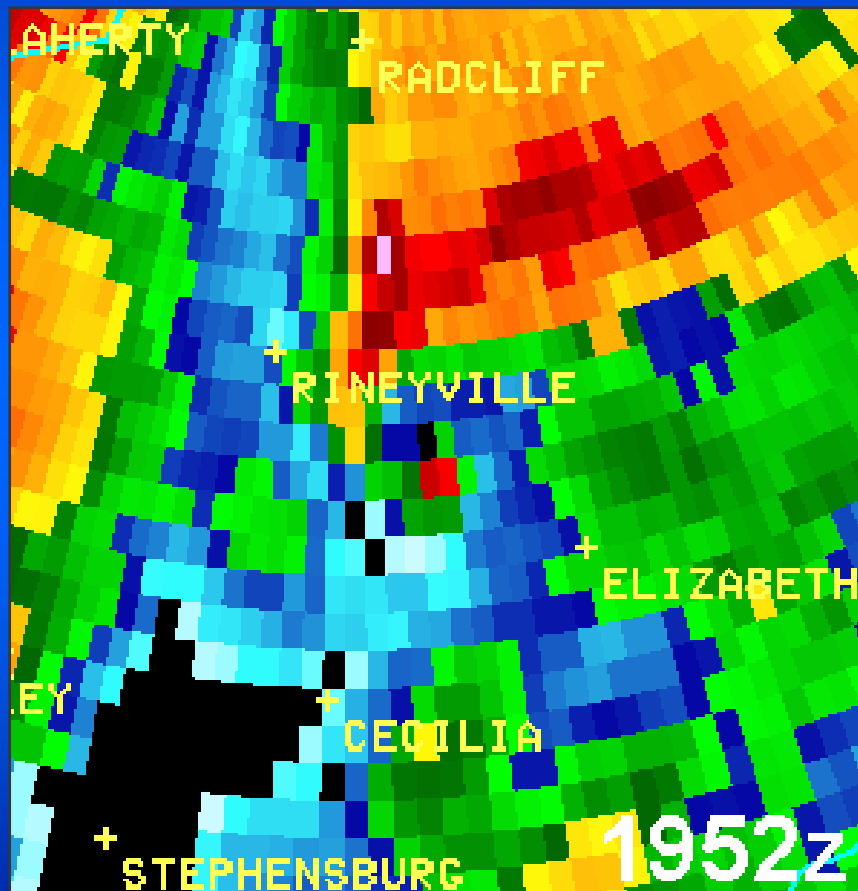
All radar elevation <10,000 ft

KL VX 4-Panel SR Velocity from 1830-2044 UTC 02 Jan 2006

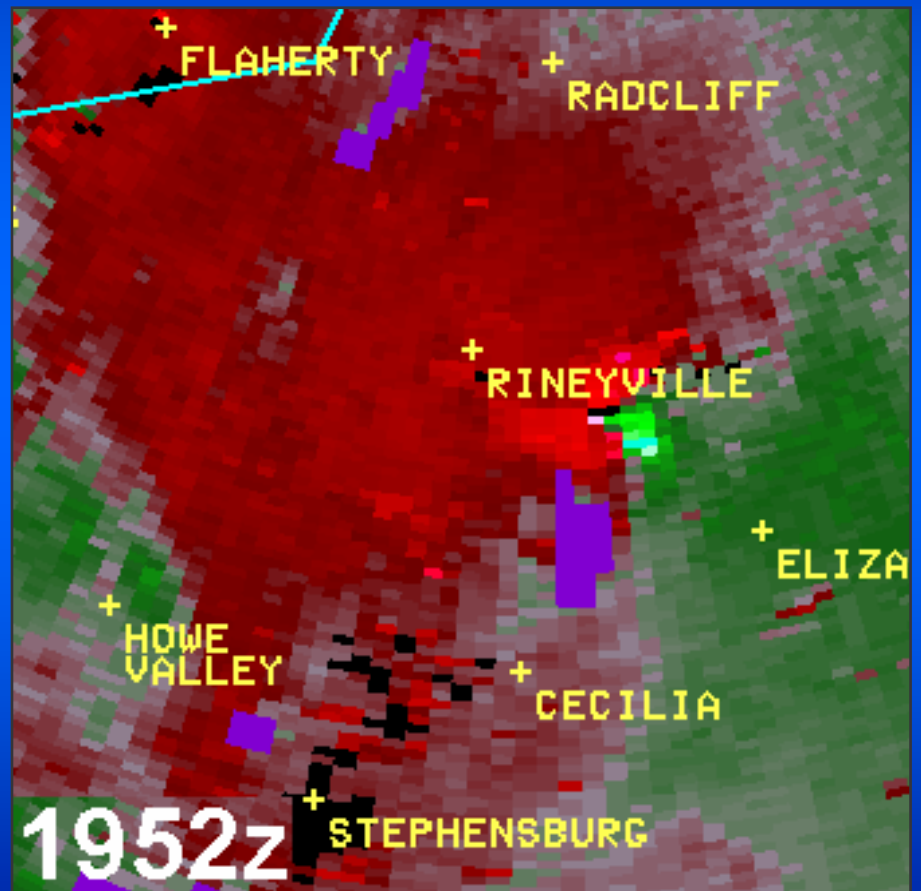


All radar elevation <10,000 ft

Hardin County, KY Tornado 02 Jan 2006

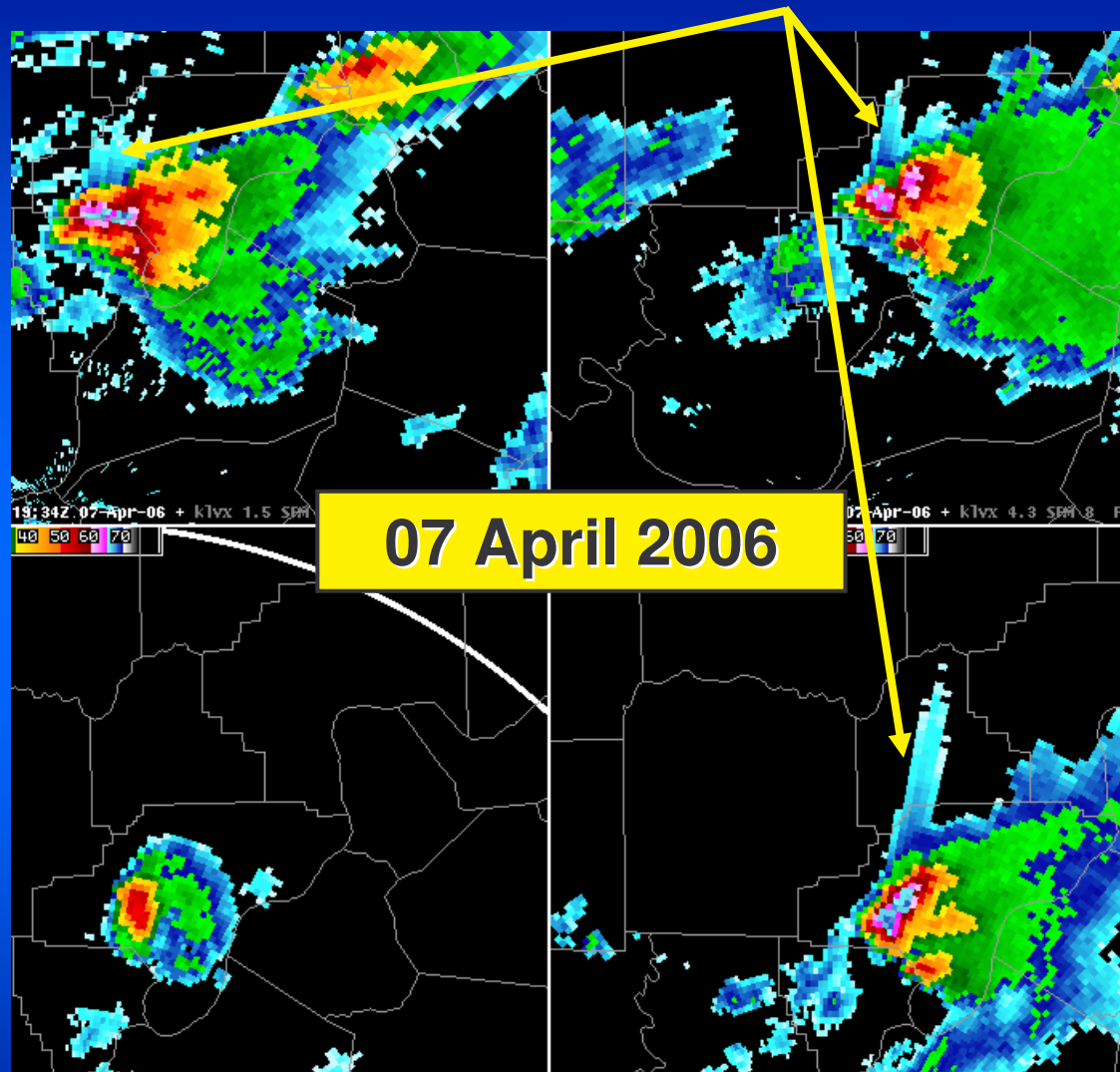


Reflectivity



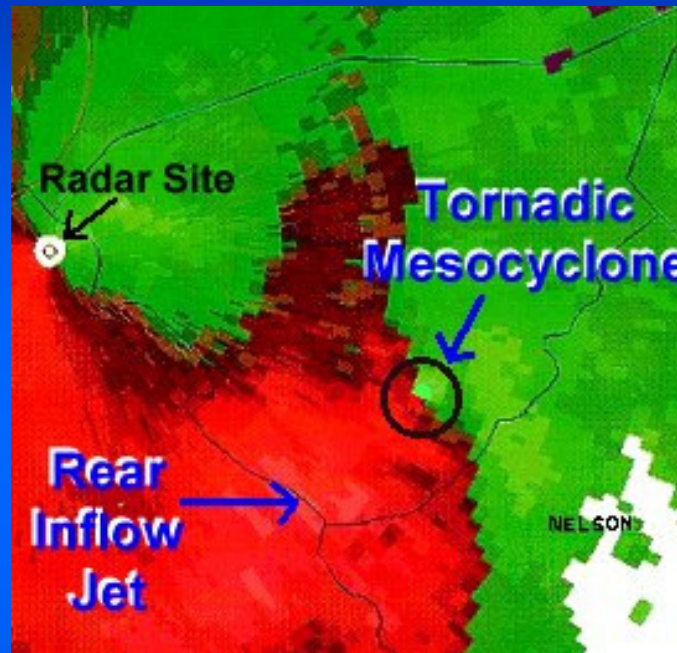
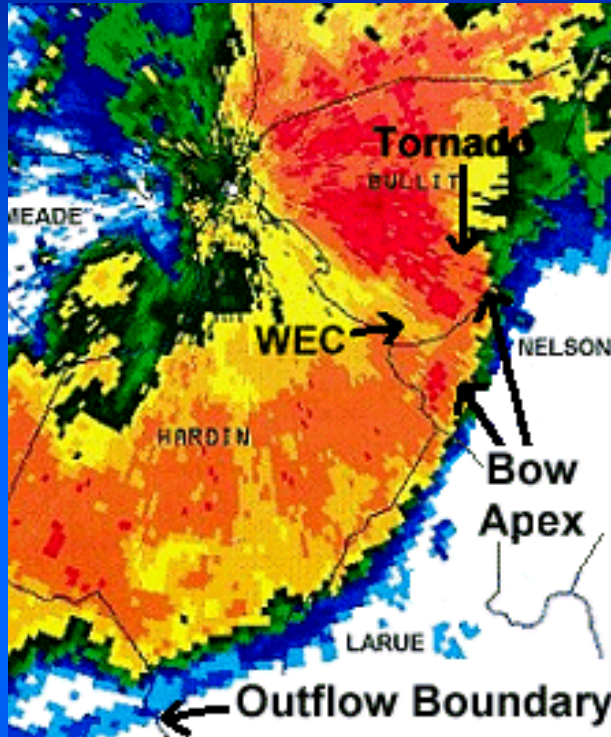
Storm-Relative Velocity

Hail Spike 3-Body Scatterer



Occurs down-radial from a high reflectivity hail core; can cause erroneous velocity data; suggests large hail already is or very soon will be occurring at the ground

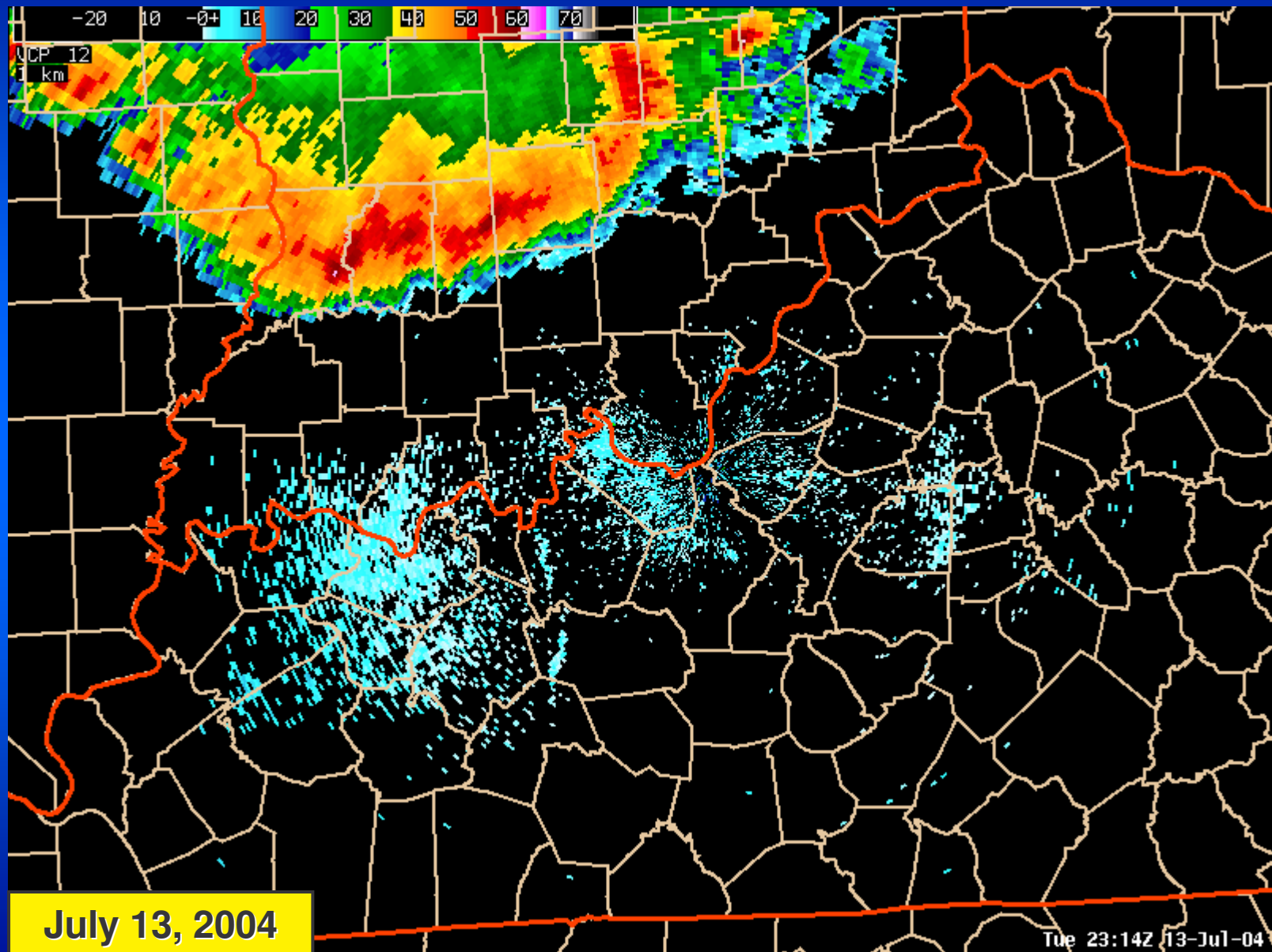
Bowing Squall Lines (Bow Echoes)

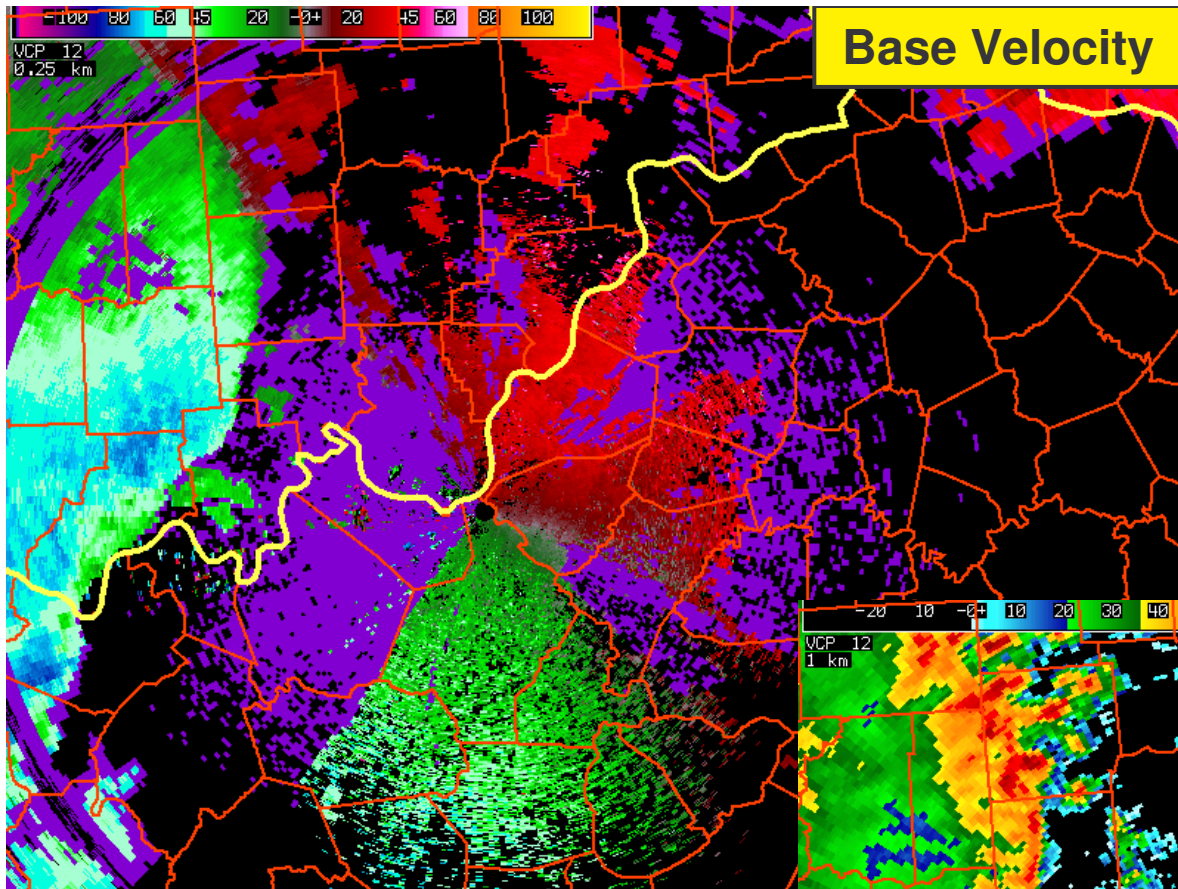


Occur frequently
across Ohio Valley

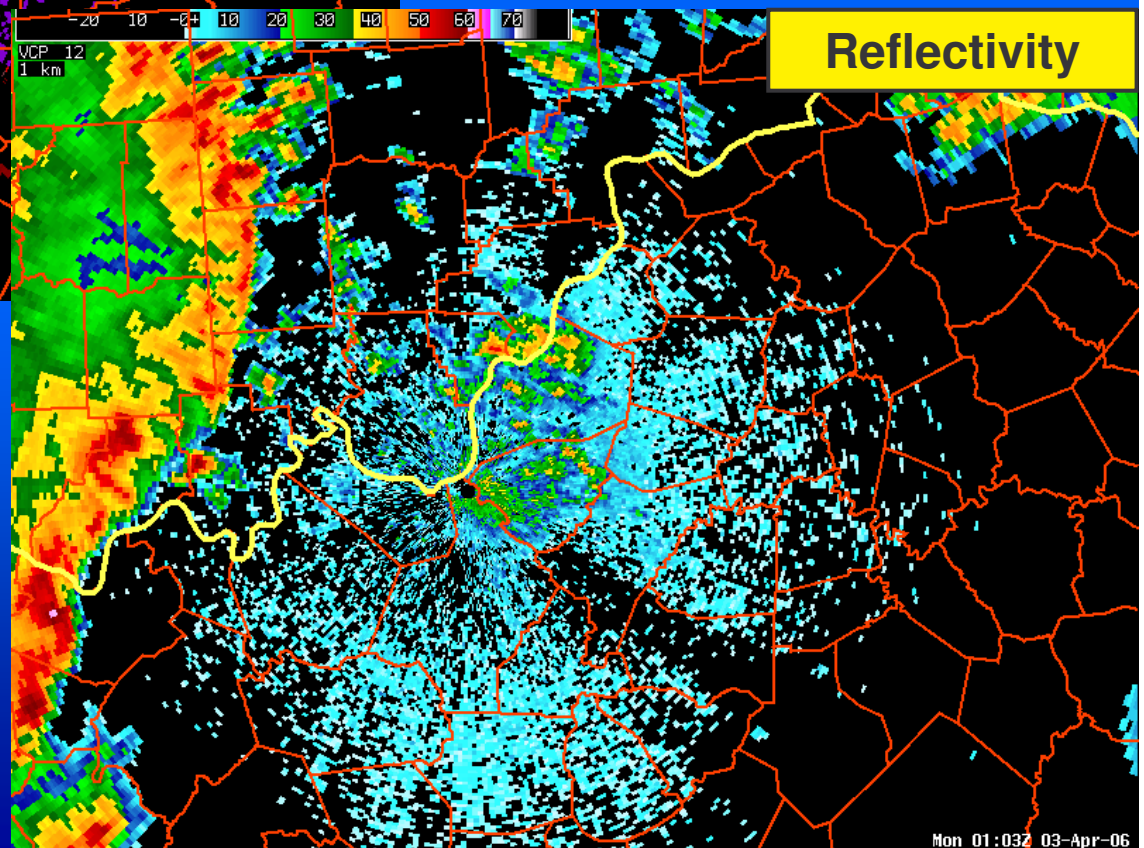
- Exhibit a bowing of reflectivity forward/downwind from rest of squall line; strong low-level reflectivity gradient on leading edge, indicating strong convergence and updraft
- Weak echo channels (WECs) frequently are noted behind leading intense convection, which usually are co-located with a local rear inflow jet (RIJ)
- Often produce significant damaging surface winds near bow apex on gust front (i.e., along leading edge of RIJ); non-supercell tornadoes possible along/north of apex

Bowing Squall Lines (Bow Echoes)



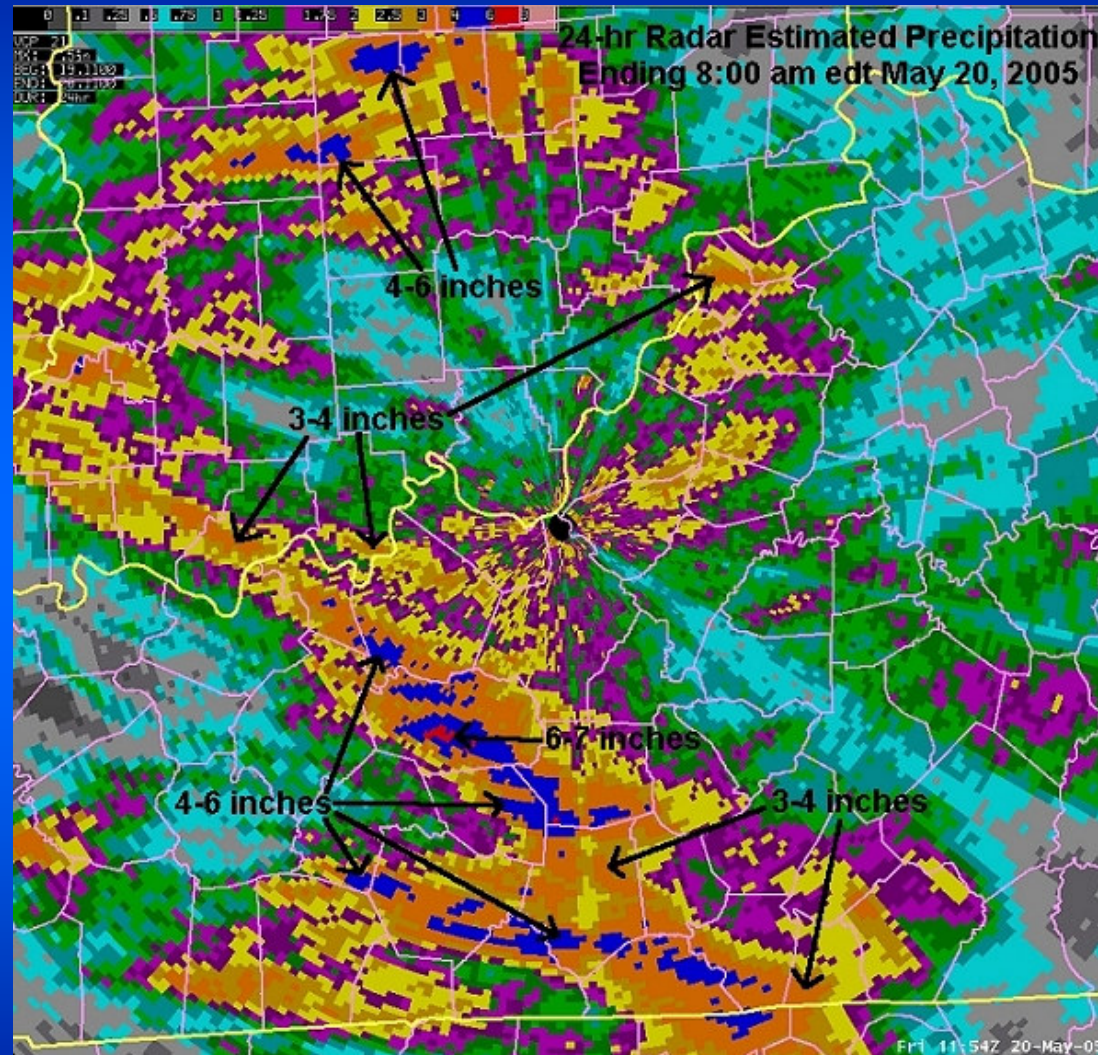


02 April 2006



60-80 mph winds
along leading edge of
bowing squall line
over south-central
Indiana and north-
central Kentucky

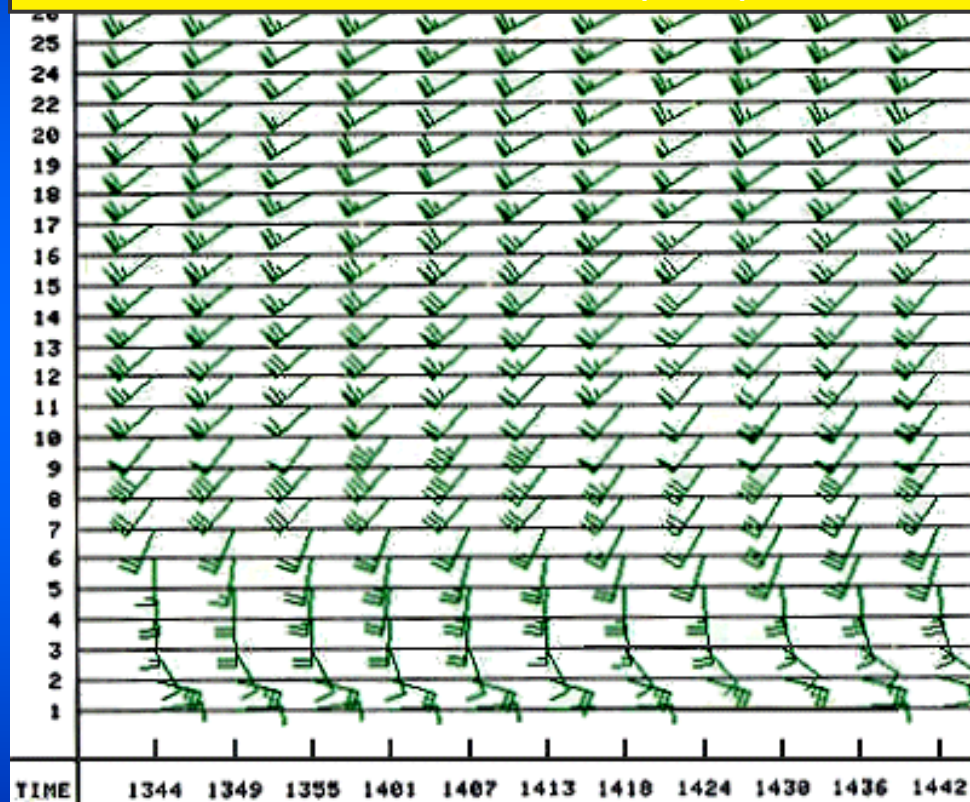
Radar Precipitation Estimation



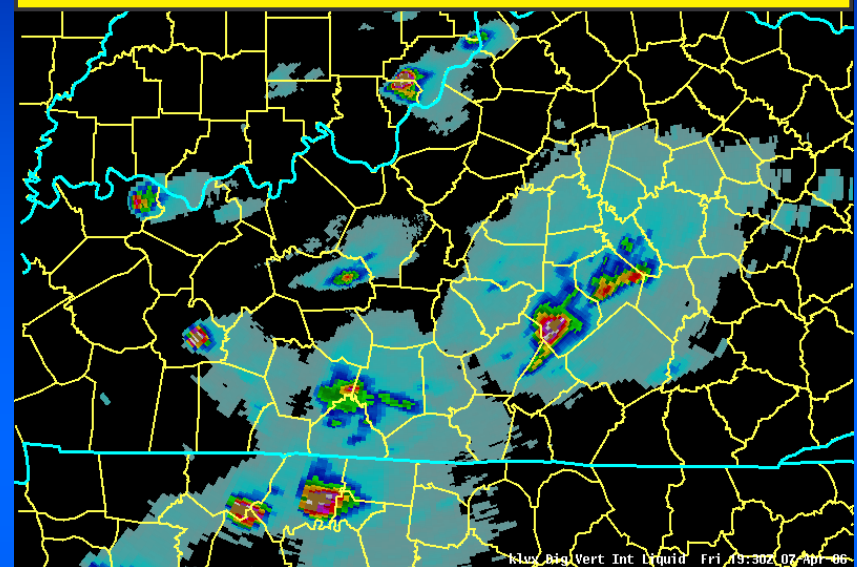
1-hour, 3-hour, and storm-total precipitation estimates
Considerations: hail (overestimate), distance, rainfall rate, air mass type

Other Radar Products

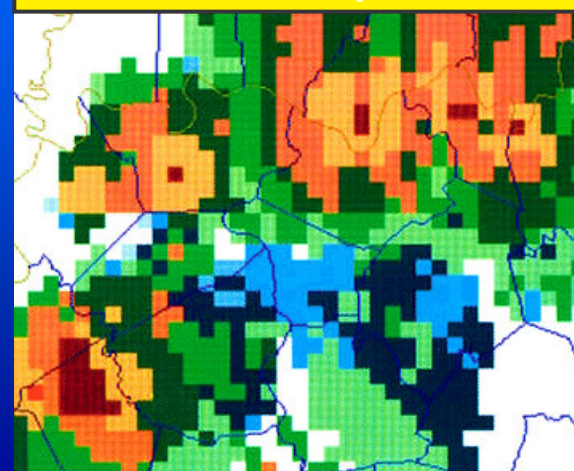
Vertical Wind Profile (VWP)



Digital Vertically Integrated Liquid (DVIL)



Echo Tops

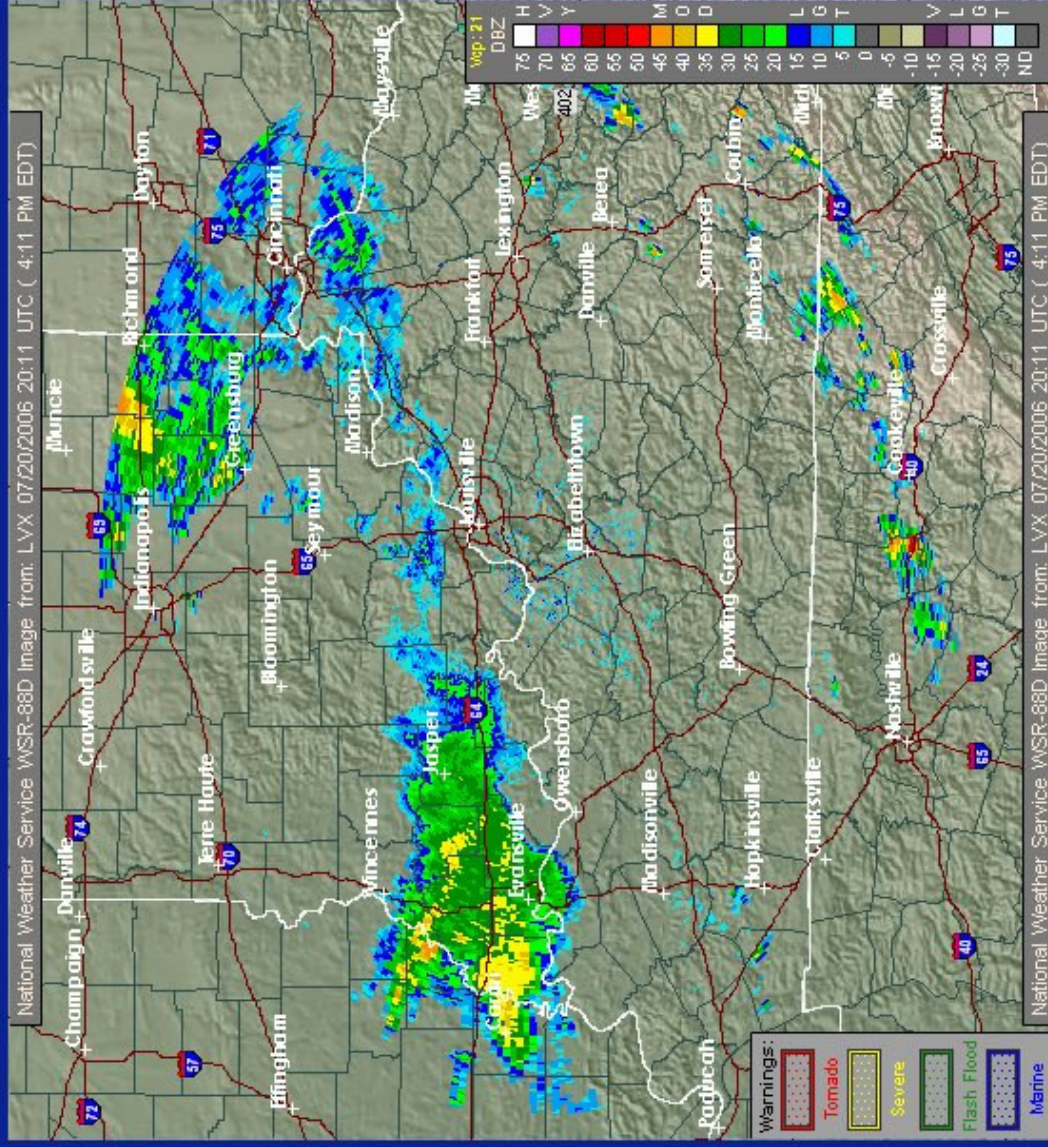


Louisville, KY Radar

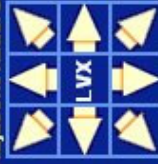
Go to: Standard Version Local weather forecast by "City, St" City, St Go

Base Reflectivity

NWS Louisville, KY 04:11 PM EDT Thu Jul 20 2006



Adjacent Radars:



Short Range Images

Reflectivity: Loop Loop
Base: Loop Loop

Velocity: Loop Loop
Storm Relative: Loop Loop
Base: Loop Loop

Rainfall: Loop Loop
1-Hour Total: Loop Loop
Storm Total: Loop Loop

Mouse Over Off

Long Range Images
Reflectivity: Loop
Base: Loop

U.S. Views
Reflectivity: Loop
National: Loop
Alaska: Loop
Hawaii: Loop
Guam: Loop
Puerto Rico: Loop
Radar by State: Loop

Additional Info:
Radar FAQ
Downloading Images
GIS Users
Doppler University
Color Blindness Tool
Credits