



# High Resolution Radar Imagery In AWIPS

*Evan M. Bookbinder*

*WFO Springfield, Missouri*

*David L. Andra, Jr.*

*WFO Norman, Oklahoma*



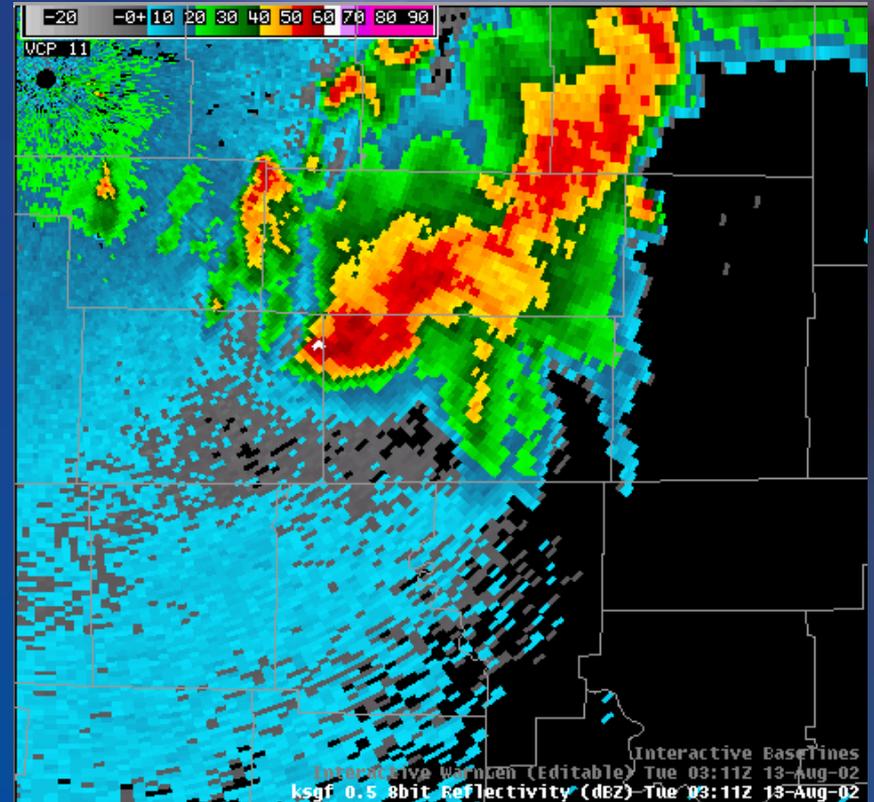
# Background

- ORPG and AWIPS 5.2.1
- Known as “8-bit” Products
  - 8 bit  $\Rightarrow 2^8 = 256$  data levels
- Like WSR-88D Level II
- DZ – 8 Bit Reflectivity
- DV – 8 Bit Velocity
- 8 Bit SRM Available in AWIPS OB1



# DZ - 8 Bit Reflectivity

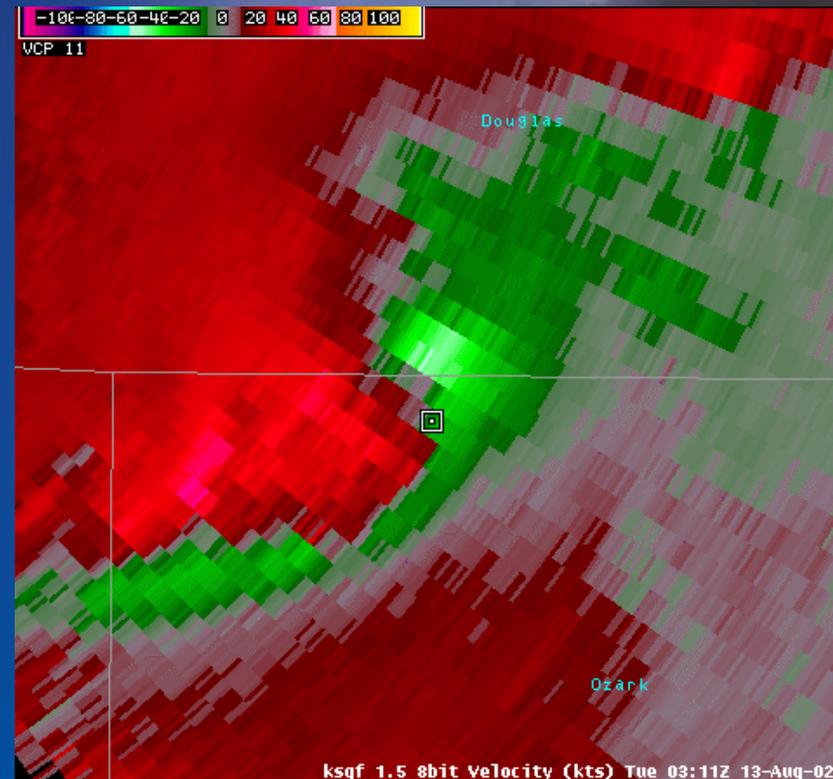
- VCP mode invariant
  - Scaled Range of  $< -32$  to  $> 90$  dBZ (0.5 dBZ resolution)
- .54 nm res thru 248 nm
- Available at all VCP angles
- Factor of 5 larger file size than “Level IV” Z





# DV – 8 Bit Velocity

- Ground relative (default)
- SRM computed from AWIPS distance/speed tool or WARNGEN derived motion vector
- Range  $> \infty$  123 kts (1 kt res)  
(Values indefinite on SRM)
- .13 nm res to 124 nm
- Available at all VCP angles
- Factor of 10 larger file size than “Level IV” Velocity





# Strengths

- Best resolutions from radar
  - Very high detail spatially and in data magnitudes
    - TVS
    - Mesocyclones
    - Microbursts
    - Convective storm structures
    - Gust front winds
    - Rainfall rate assessment
    - Boundaries
    - Data artifact identification
    - Algorithm validation / QC



# Strengths

- ◆ Radar mode invariant
  - ◆ Seamless transition at precipitation detection
- ◆ High reflectivities displayed in clear air mode
  - ◆ Winter / bright band events
    - ◆ No longer need to “force” clear air mode (except for VCP31 long pulse techniques)
  - ◆ Convection



# Limitations

- ✦ Large files sizes
  - ✦ Narrowband loadshed threat
  - ✦ LAN-to-LAN connection O.K.
- ✦ Cannot do image pairing and maintain data resolution on HP workstations, Linux O.K.!
  - ✦ With Linux, use image combine feature of D2D to develop high resolution Z/V and Z/SRM four panels.
  - ✦ Load these with procedures



# Limitations

- ✦ Not delivered with suitable color tables
- ✦ Generation of 8-Bit SRM cumbersome with storm motion derived from either “Distance/Speed tool” or latest WarnGen motion vector.
  - ✦ Default motion not taken from RPG (to be fixed in AWIPS OB2)
- ✦ “8-bit” nomenclature confusing
  - ✦ May want to change menu labels to “Hi-Res” or the like
- ✦ High detail, especially in DV, may be confusing when viewing storms close to RDA



# Case Examples

*WFO Davenport, Iowa*

*Aug 21, 2002*

*WFO Springfield, Missouri*

*Aug 13, 2002*

*May 4, 2003*

**Image capture credits: Ray Wolf (DVN), Evan Bookbinder (SGF)**

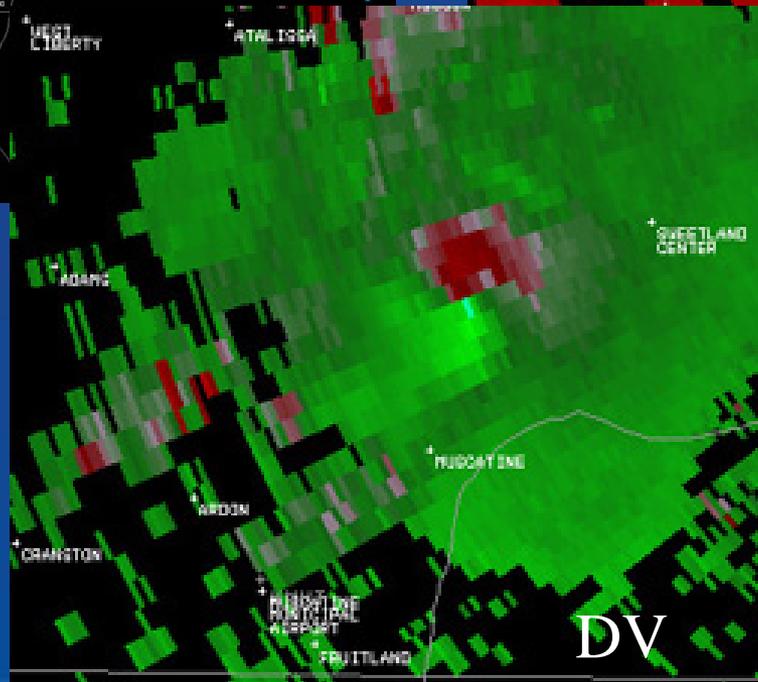
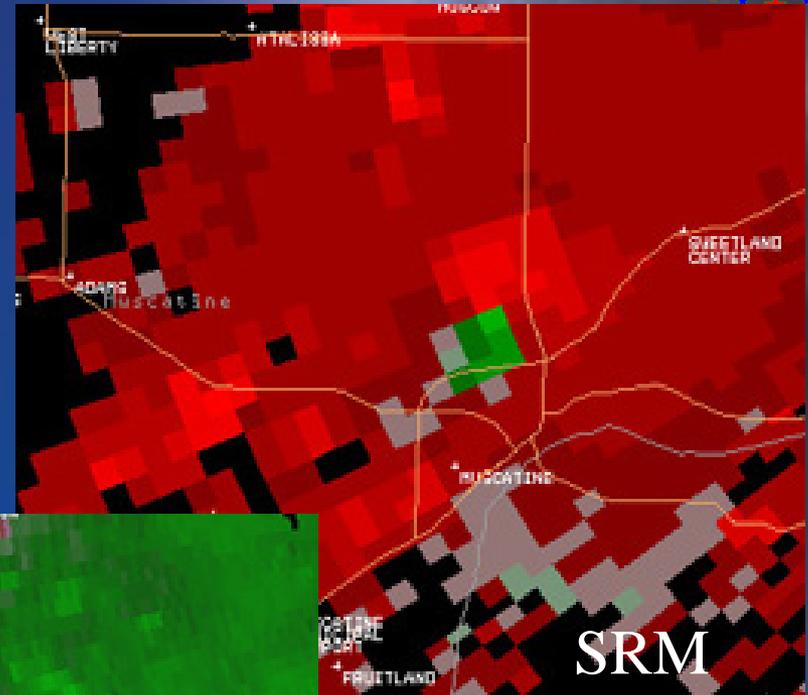
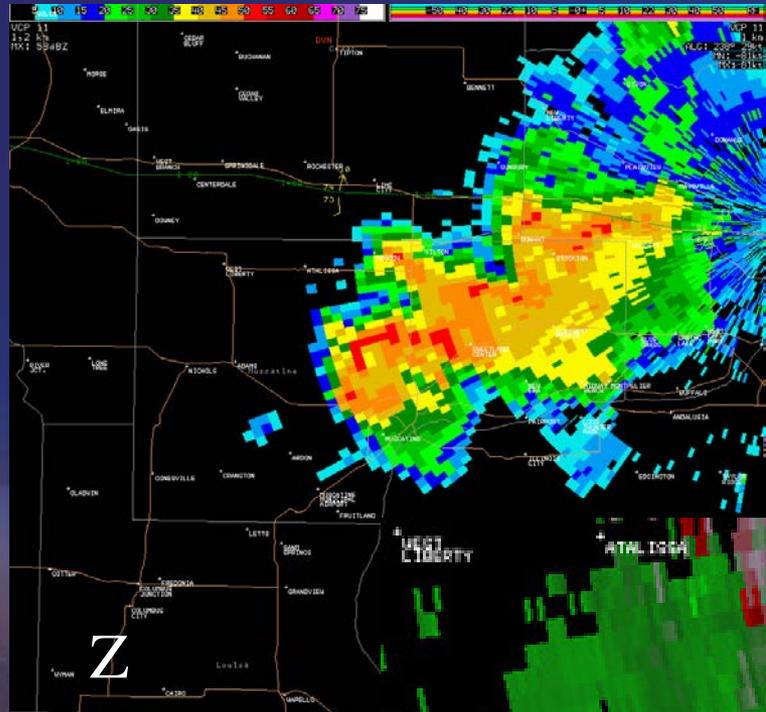
# Muscatine County IA – 21 Aug 2002



- ◆ F1 Tornado
- ◆ 1.6 mile path
- ◆ Damage to farm, trees
- ◆ 8 bit velocity key to warning



# Muscatine County IA – 21 Aug 2002

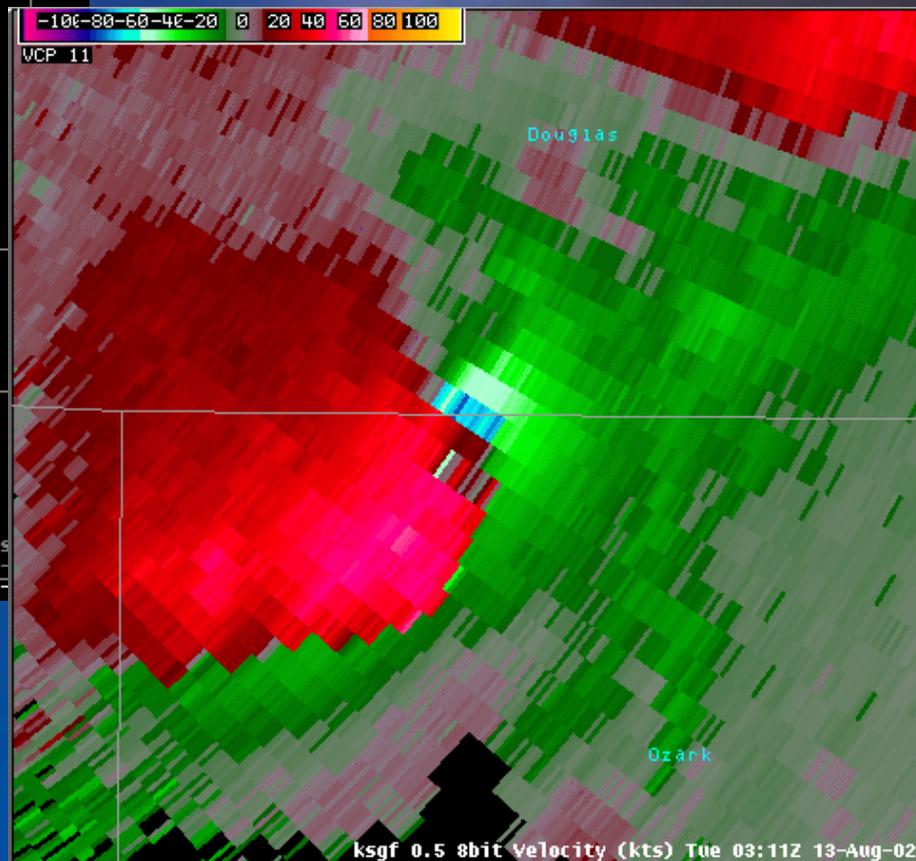
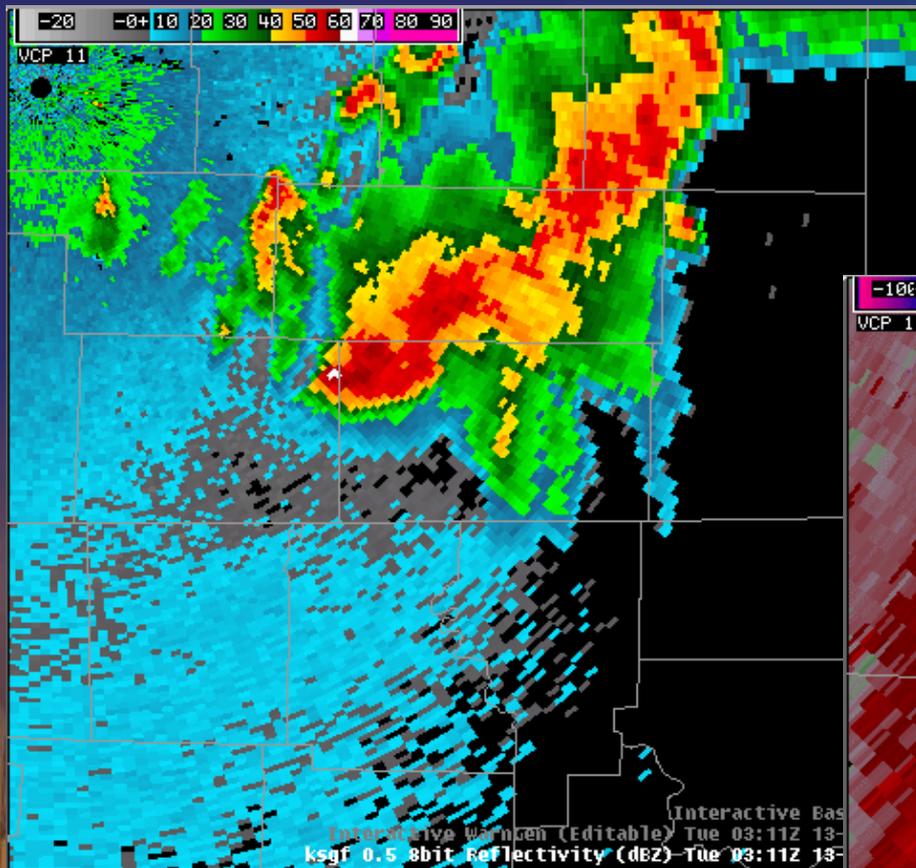


# Ozark County, MO – 13 Aug 2002

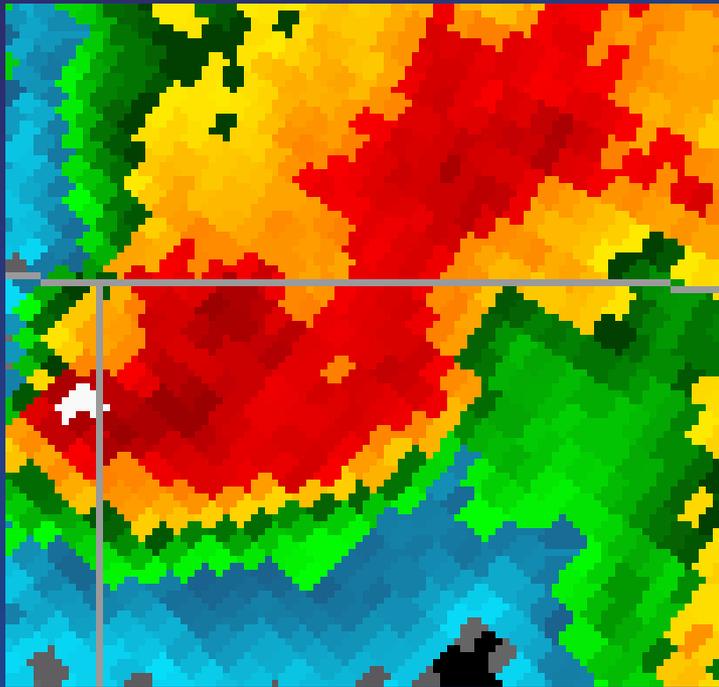


- ✦ Only 6 tornadoes in August on record in SGF CWA prior.
- ✦ 2 F1 tornadoes & large “RFD” swath
- ✦ Damage to farm, trees, silos
- ✦ 8 bit velocity again paramount to detection of tornadoes and gust front

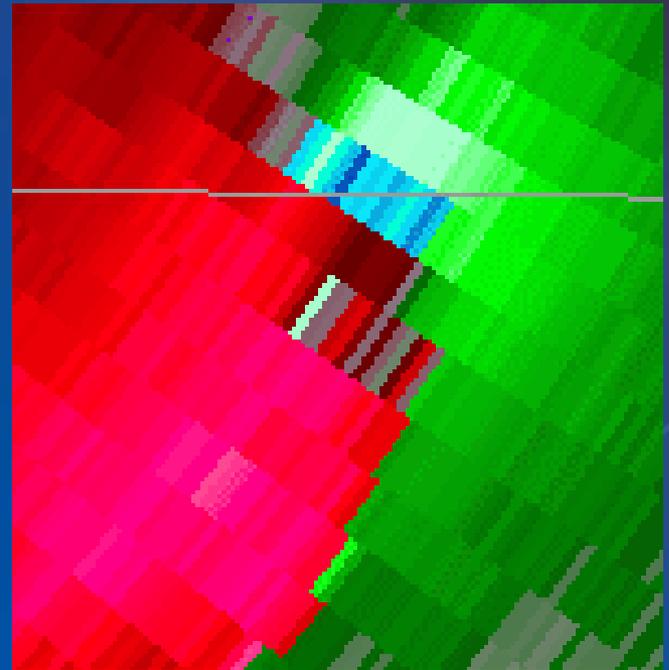
# Wasola, MO – 13 Aug 2002



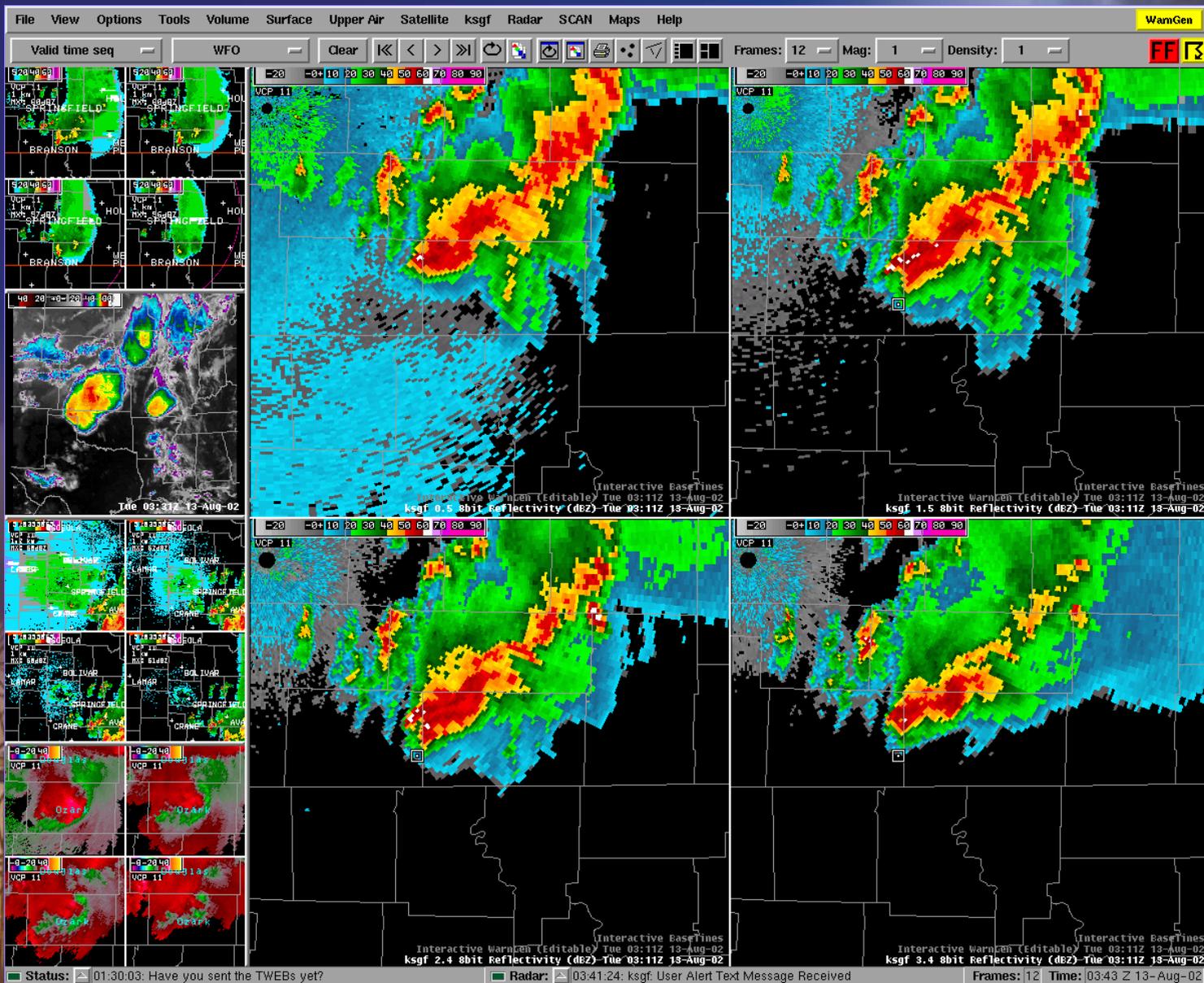
# Wasola, MO – 13 Aug 2002



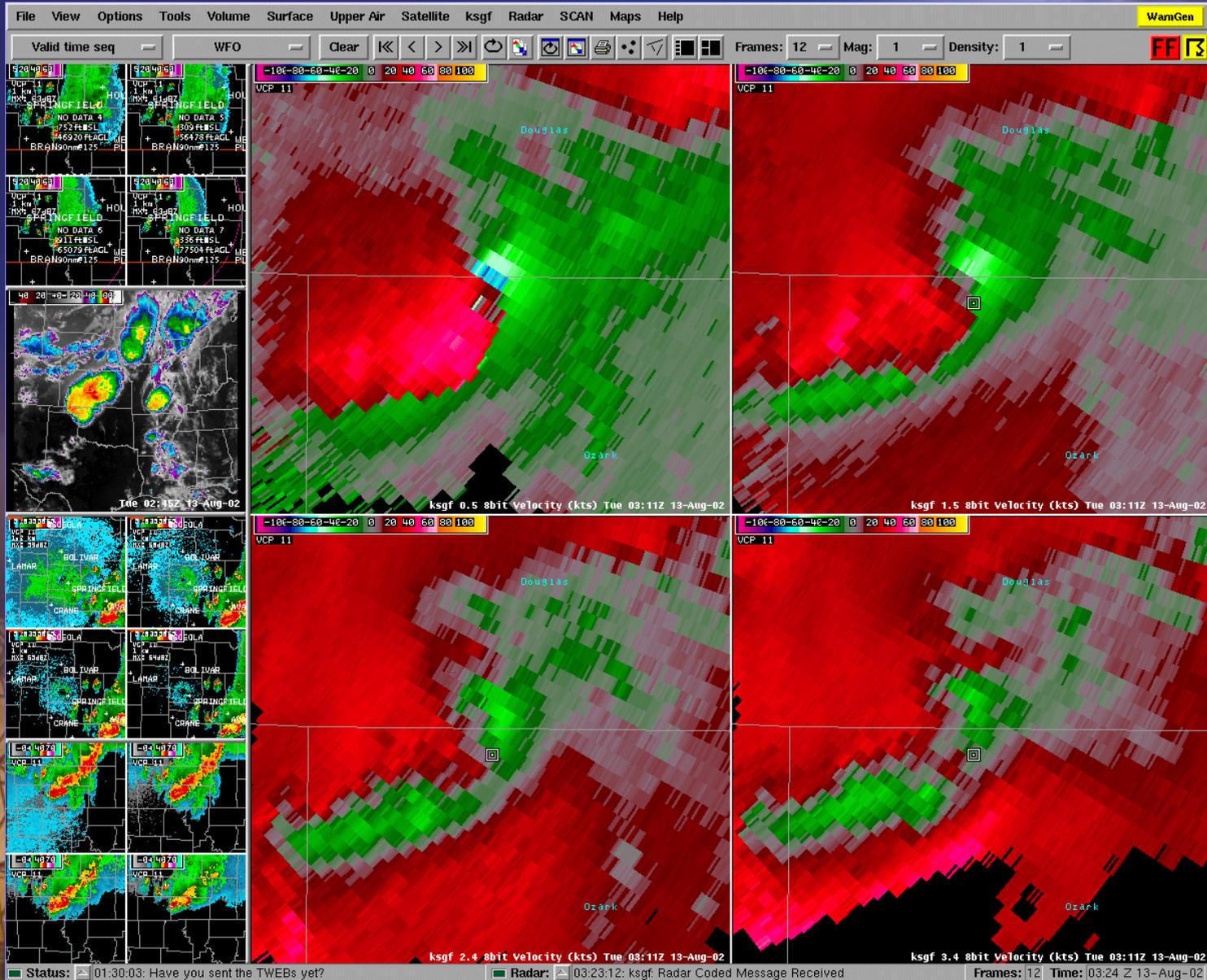
**Close-up**



# Wasola, MO – 13 Aug 2002



# Wasola, MO – 13 Aug 2002



# May 4, 2003 Tornado Outbreak

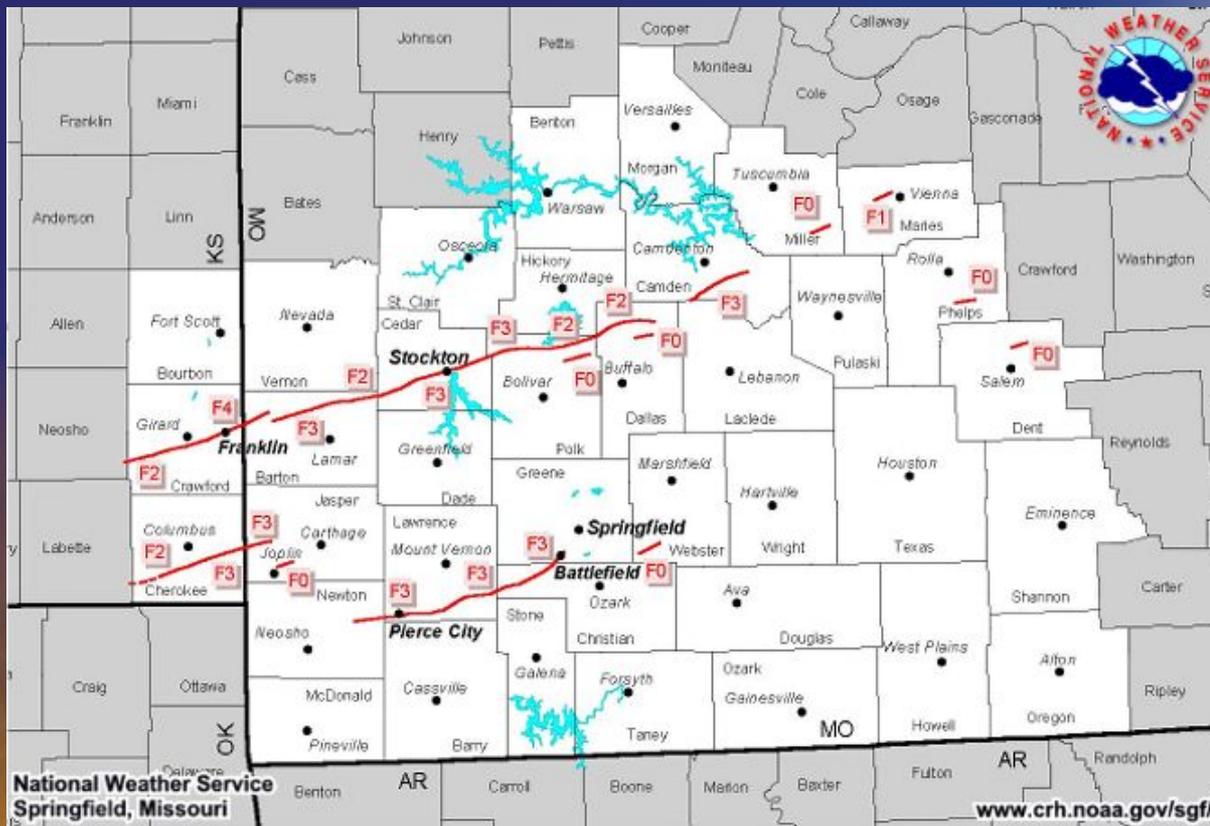


Pierce City, MO



Girard, KS

# May 4, 2003 Tornado Outbreak

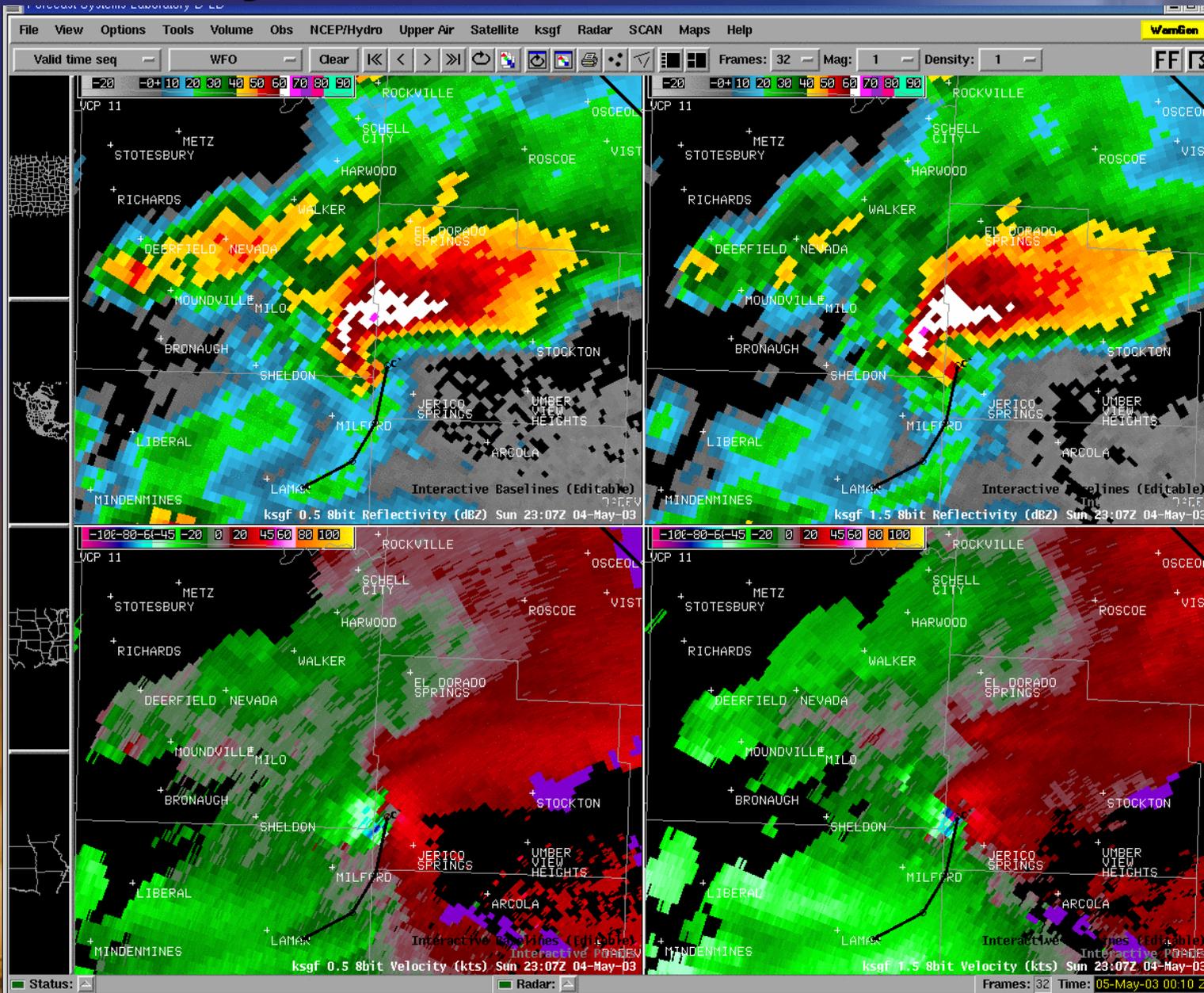


- 14 tornadoes
- 15-80 mile path lengths
- 24 deaths
- Damage in hundreds of millions.

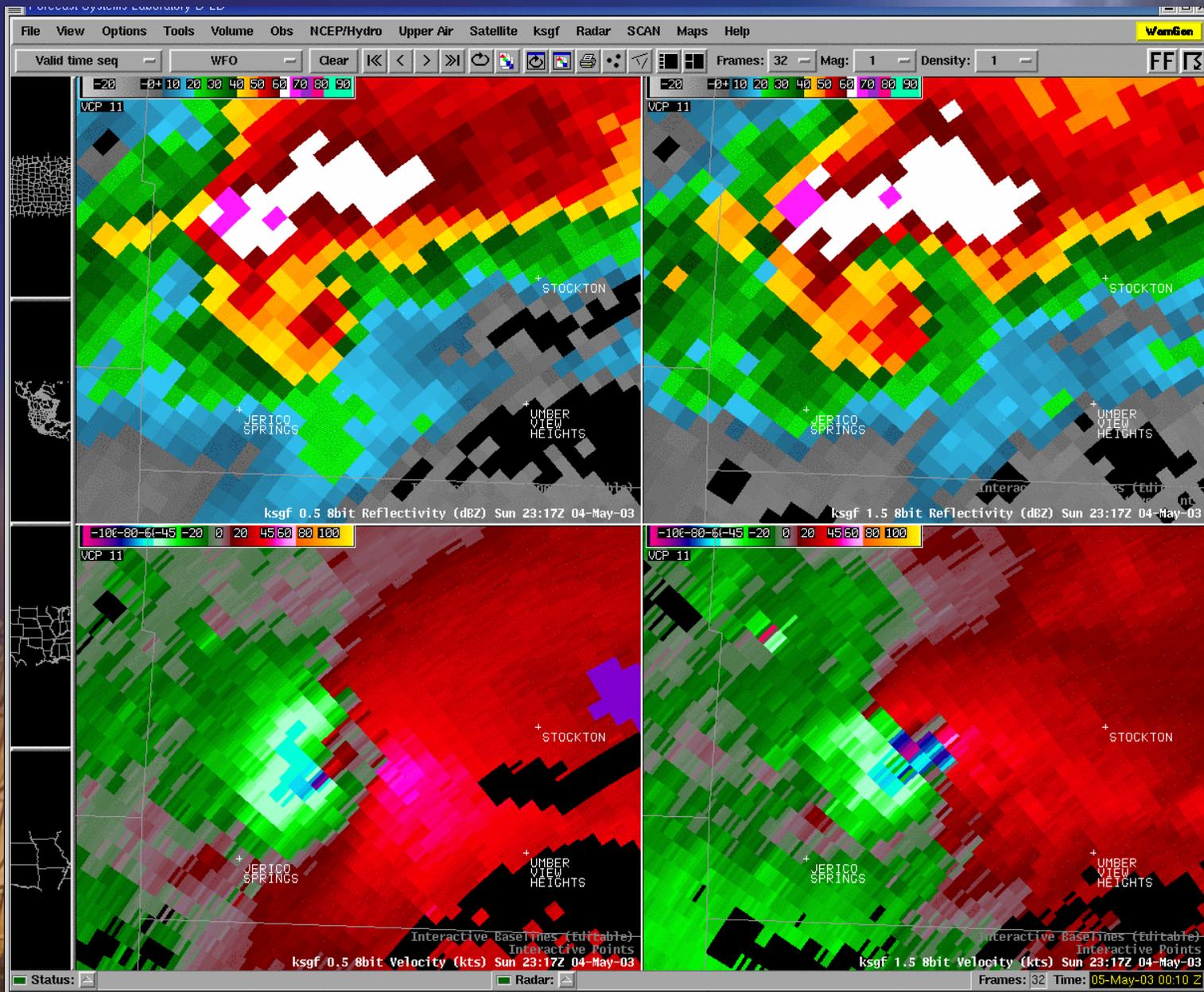
• 8-Bit Data allowed warning forecasters to assess magnitude of tornadoes and debris field!!

**Cities Affected:** Pierce City, Stockton, Liberal, Aurora, Battlefield, Franklin KS, Humansville, Urbana, Carl Junction

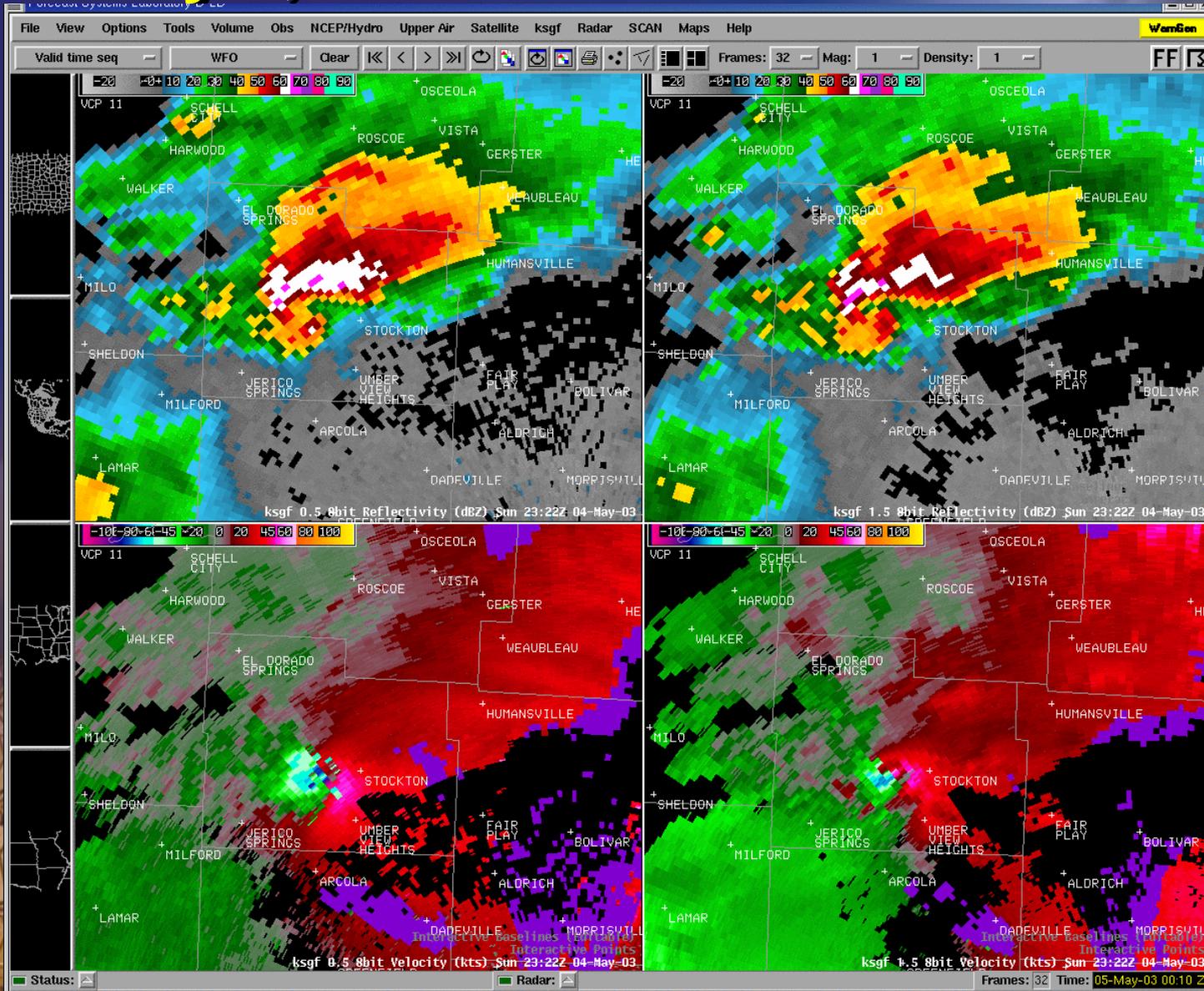
# May 4, 2003 Tornado Outbreak



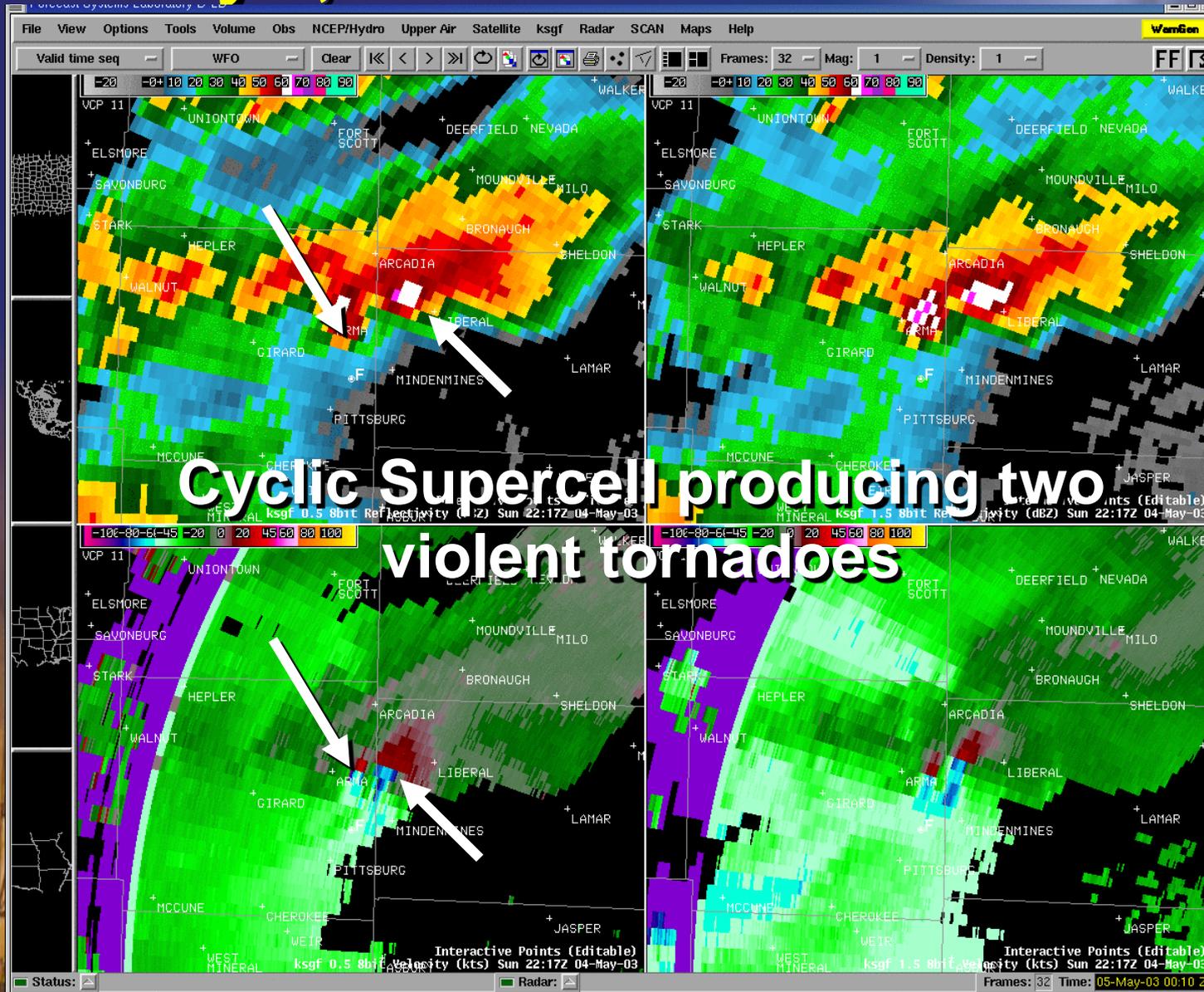
# May 4, 2003 Tornado Outbreak



# May 4, 2003 Tornado Outbreak



# May 4, 2003 Tornado Outbreak



Cyclic Supercell producing two violent tornadoes

# Summary and Recommendations



- ◆ Develop color tables
  - ◆ Target phenomena
    - ◆ Boundaries, mesocyclones, gust fronts, rainfall rates, and so on
    - ◆ Break points at important thresholds (60 dBZ or 50 knots)
  - ◆ Use “interpolate” capability to add range of color
  - ◆ *See attached example tables*

# Example 8-Bit Z Curve



-32.5 dBZ (204,204,204) and 4.5 (96,96,96)....click interpolate

5 (32,96,128) and 19.5 (48, 208, 255) ... click interpolate

20 (0,255,0) to 39.5 (0,76,0)...click interpolate

40 (255, 230,0) to 49.5 (255,128,0) ....click interpolate

50 (255,0,0) to 59.5 (96,0,0)...click interpolate

60-64.5 (255,255,255)...fill

65-69.5 (255,32,255)...fill

70-74.5 (148,32,204)...fill

75-79.5 (255,0,128)...fill

80+ dBZ (0,255,150)...fill

**Example color tables from Evan Bookbinder, WFO SGF**

WDM Workshop Boulder, CO July 2003

# Example 8-Bit Vel Curve



Range Folding (far left color band) (128,0,208)

-123.4 kts (255,0,128) to -90.5 (0,0,160) ... click interpolate

-90.5 (0,0,160) to -70 (0,224,255)...click interpolate

-69 to -60 (0,255,224)...click fill

-59 to -50.5 (160,255,208)...click fill

-49.5 (160,255,208) to -40 (0,255,0)... click interpolate

-40 (0,255,0) to -10.5 (16,96,16)... click interpolate

-10.5 (16,96,16) to -1 (112,128,112)...click interpolate

0 (144,128,144) to 10.5 (112,0,0)..click interpolate

10.5 (112,0,0) to 40 (255,0,0)...click interpolate

40 (255,0,0) to 48.6(255,0,128)...click interpolate

49.5 (255,0,144) to 69 (255,196,255)...click interpolate

70 kts (255,96,0) to 121.5 (255,255,0)...click interpolate

# Summary and Recommendations



- ✦ Develop AWIPS Procedures!
  - ✦ Build appropriate color table and maps into procedure
  - ✦ Examples:
    - ✦ 4 panel to compare multiple angles of DZ, DV
    - ✦ 4 panel to compare TDA to lowest 4 angles of DV
    - ✦ 4 panel to compare Z, DZ (or DR) with rain rate color table, OHP, and STP

# Summary and Recommendations



## ◆ RPS List Recommendations

- ◆ VCP 11 → 65 products on LAN Connection
- ◆ Only lowest 4 tilts of Z/V/SRM are required for national collection and public consumption.
- ◆ Eliminate old 16 level products above 3.4 degrees. Since 8-bit SRM is generated on the fly and not in RPS list, all offices should have full VCP 11 tilt suite of 8-bit Z and V products.