STORM CHASING

ECMWF meeting
14th June 2017

Paul Knightley, MeteoGroup

STORM CHASING

- Chaser
- Storm
- Tornado
- Location
- Equipment

Storm chasing

Chaser

- What kind of personality?
- Chasing with a team or alone?
- What kind of knowledge is required?
- What kind of experience?

- Tour company?

STORM CHASING

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Storm chasing

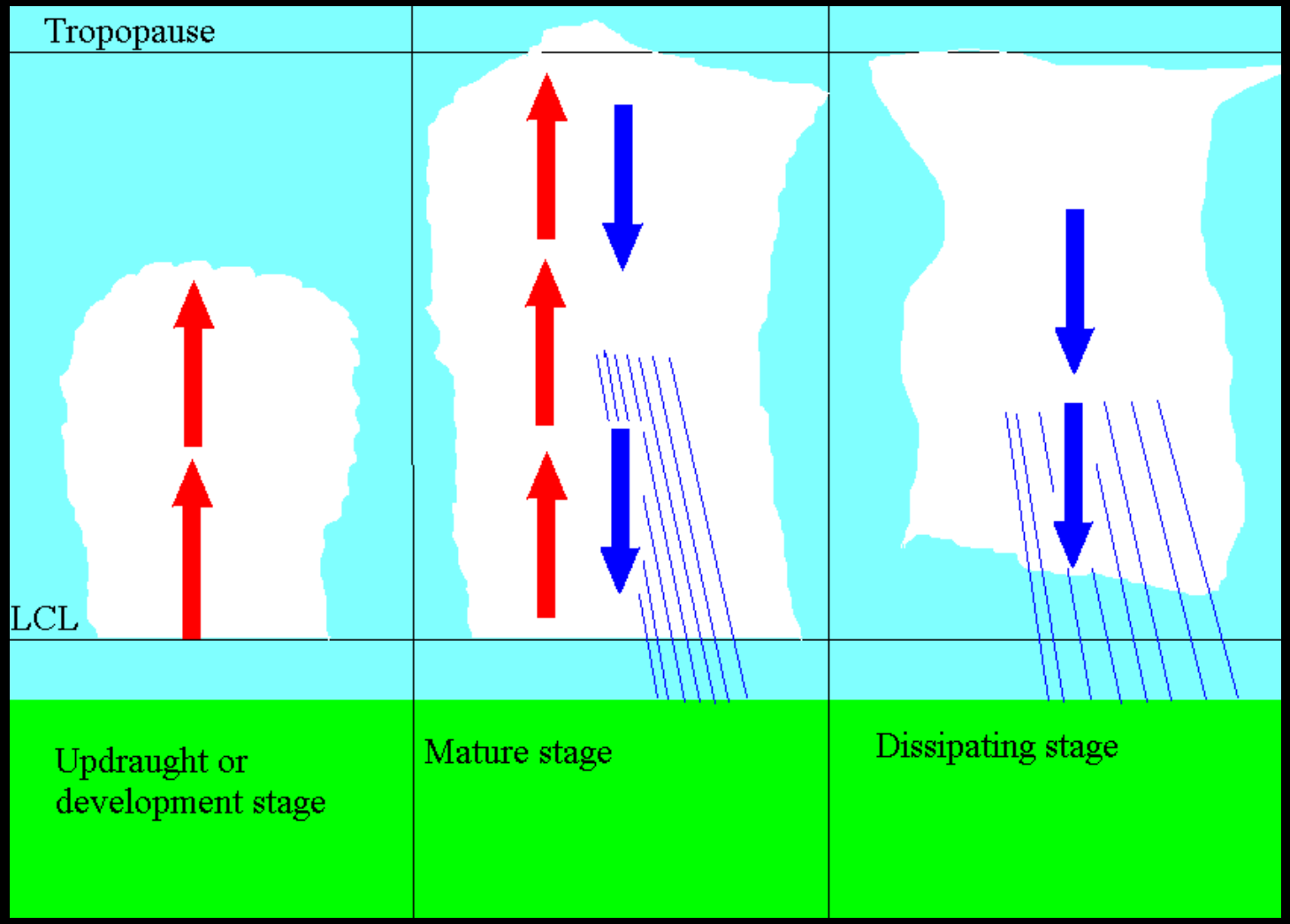
Storm

Moisture

Instability

Lift

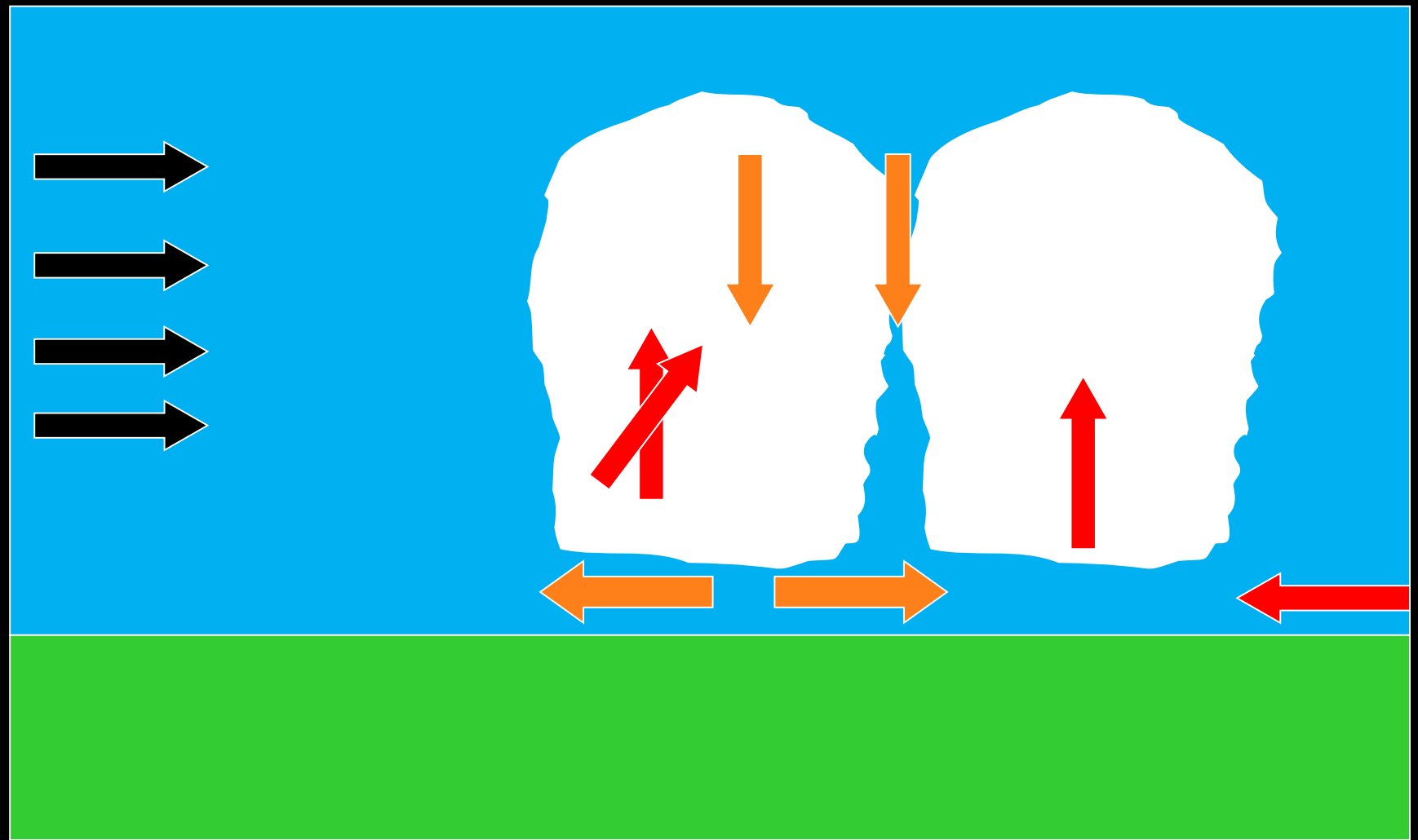
Storm


Tropopause
LCL
Updraught or development stage
Mature stage
Dissipating stage

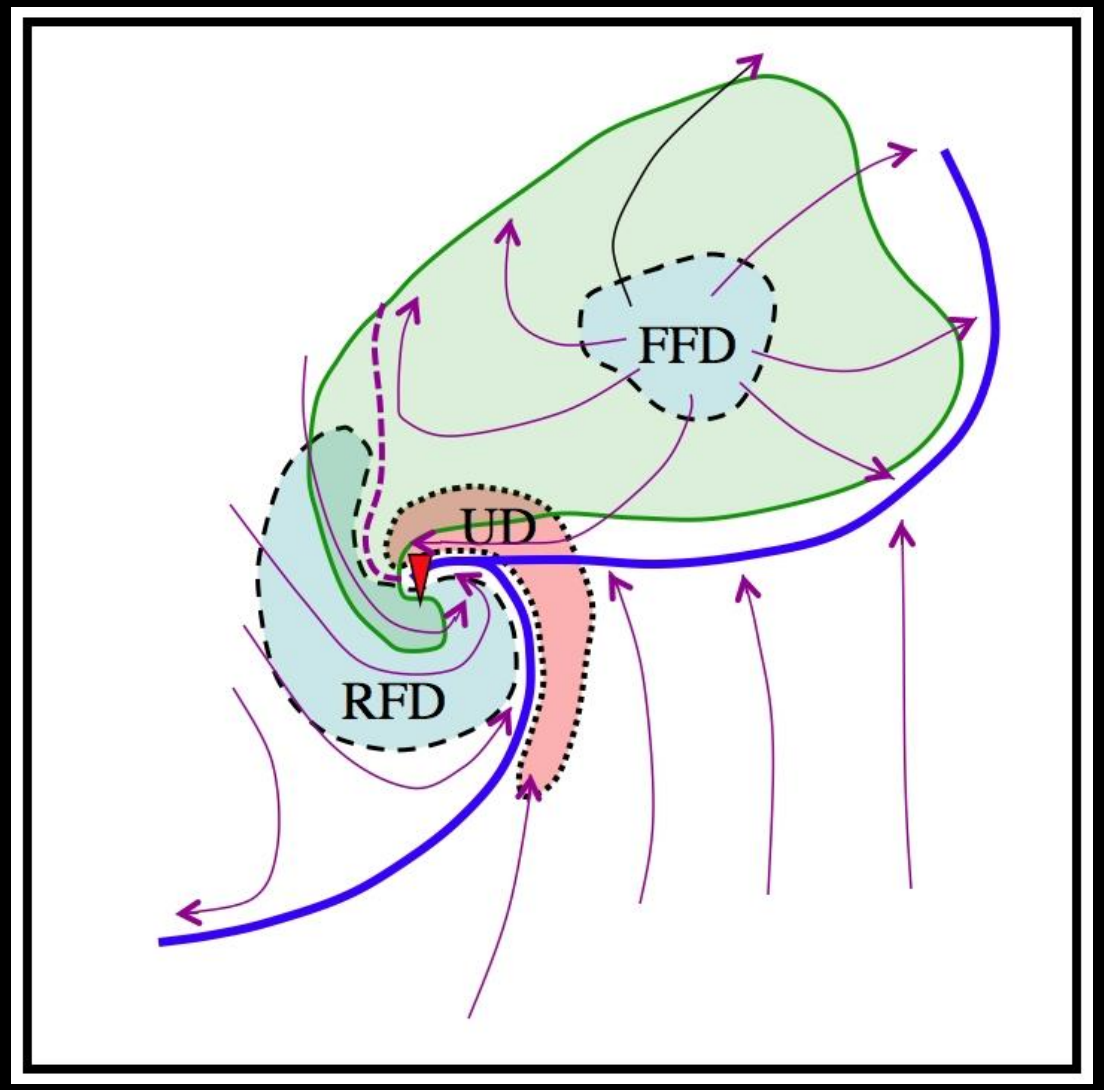
Storm

What does ‘severe’ mean?

Storm



Storm



Thanks to Dr. Chuck Doswell III

http://www.flame.org/~cdoswell/SuptorRoles/SuptorRoles.html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Storm chasing

Tornado

- Definition
- Why?
- Types

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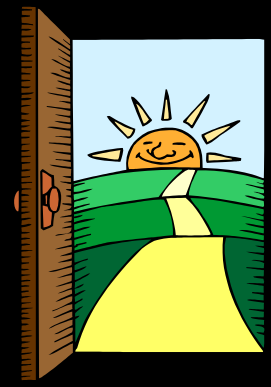
Storm chasing

Location



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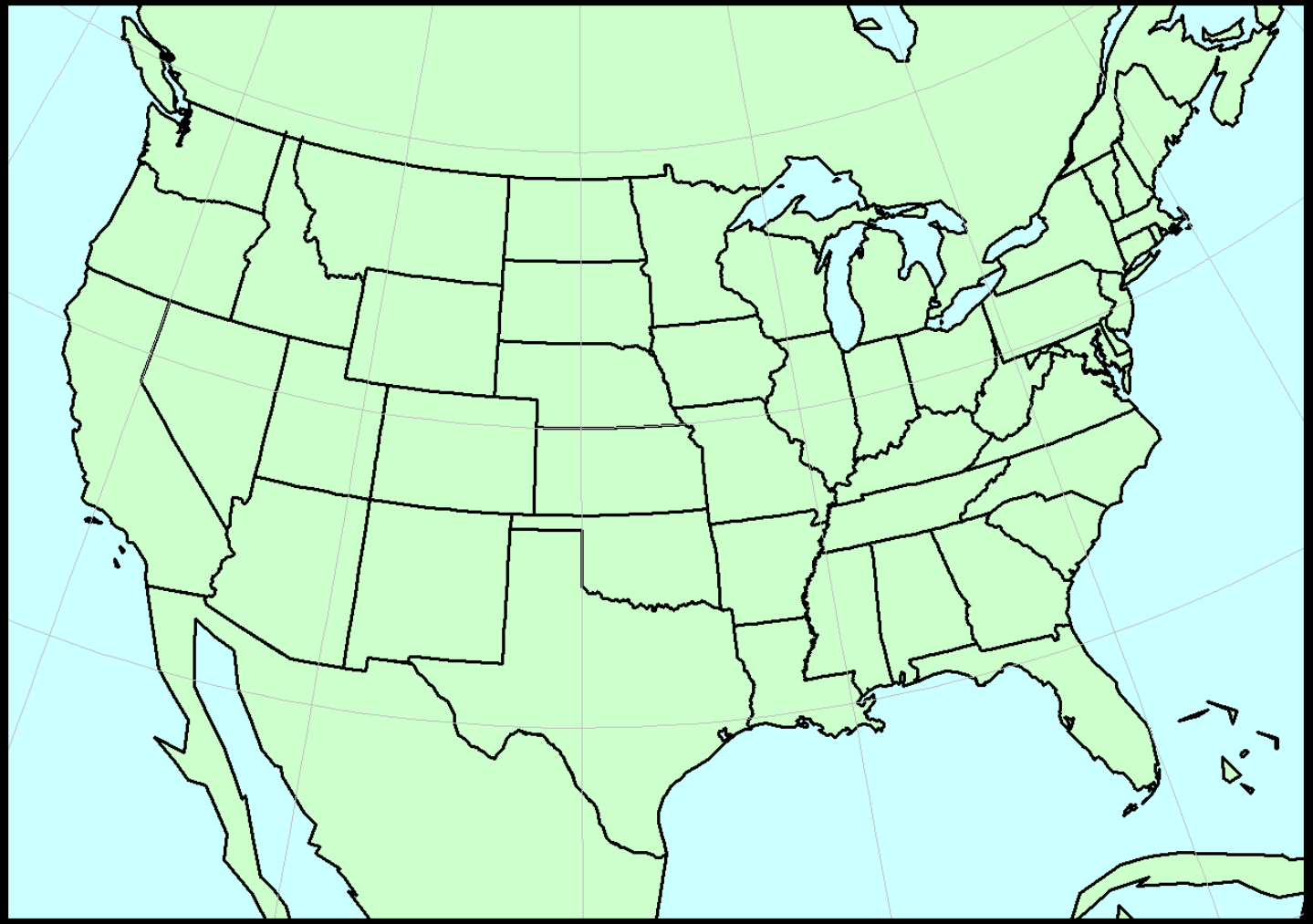

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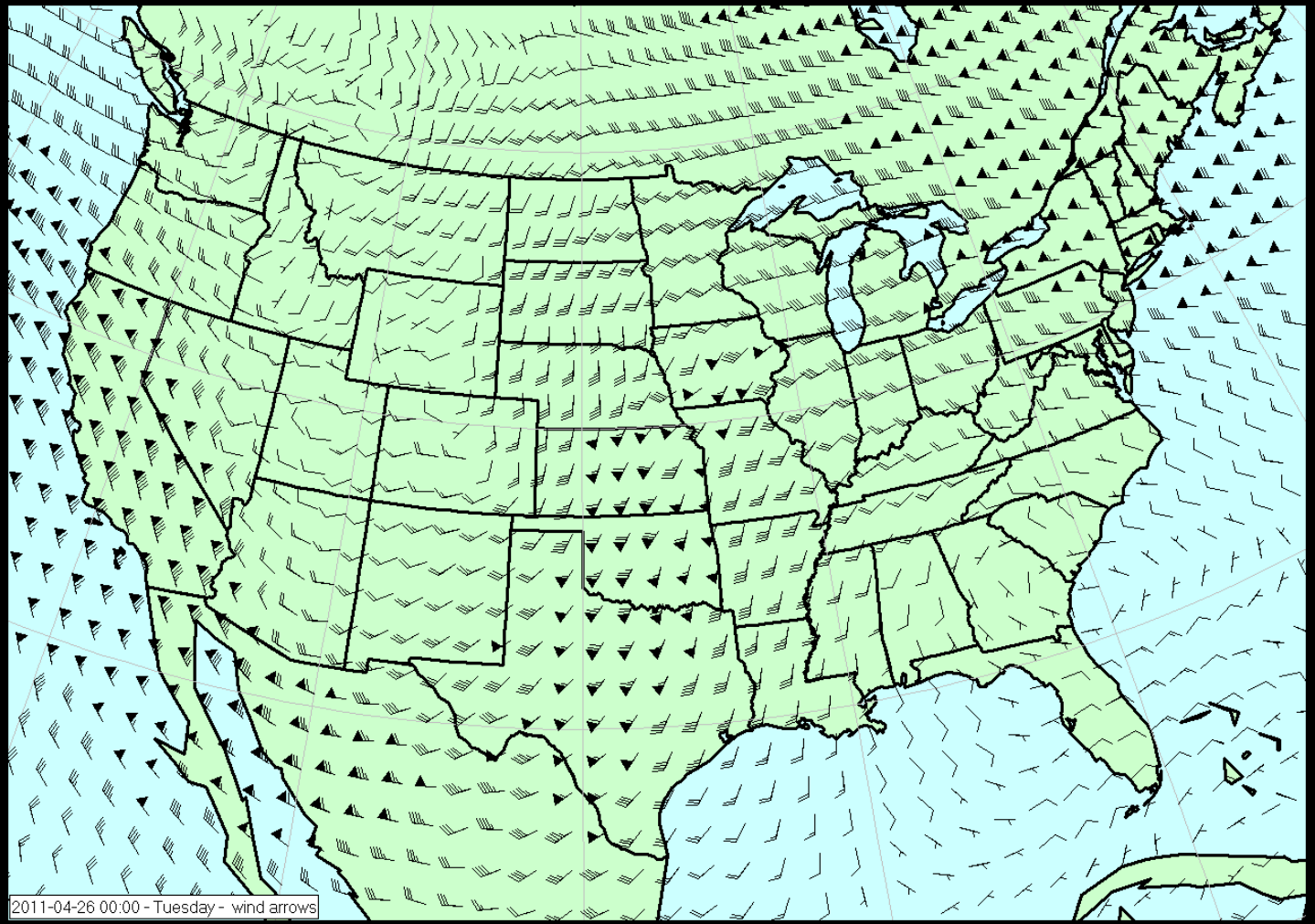

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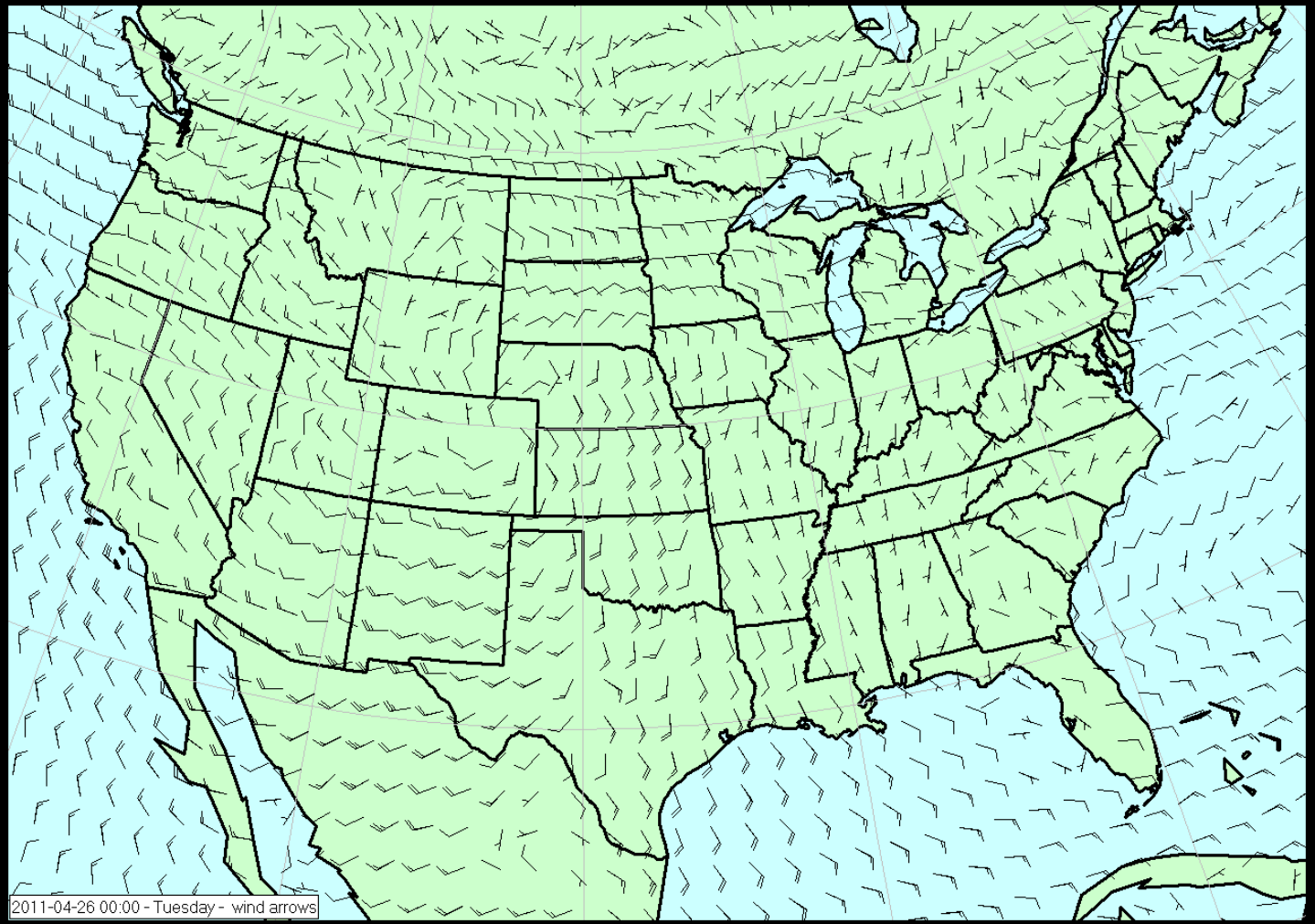

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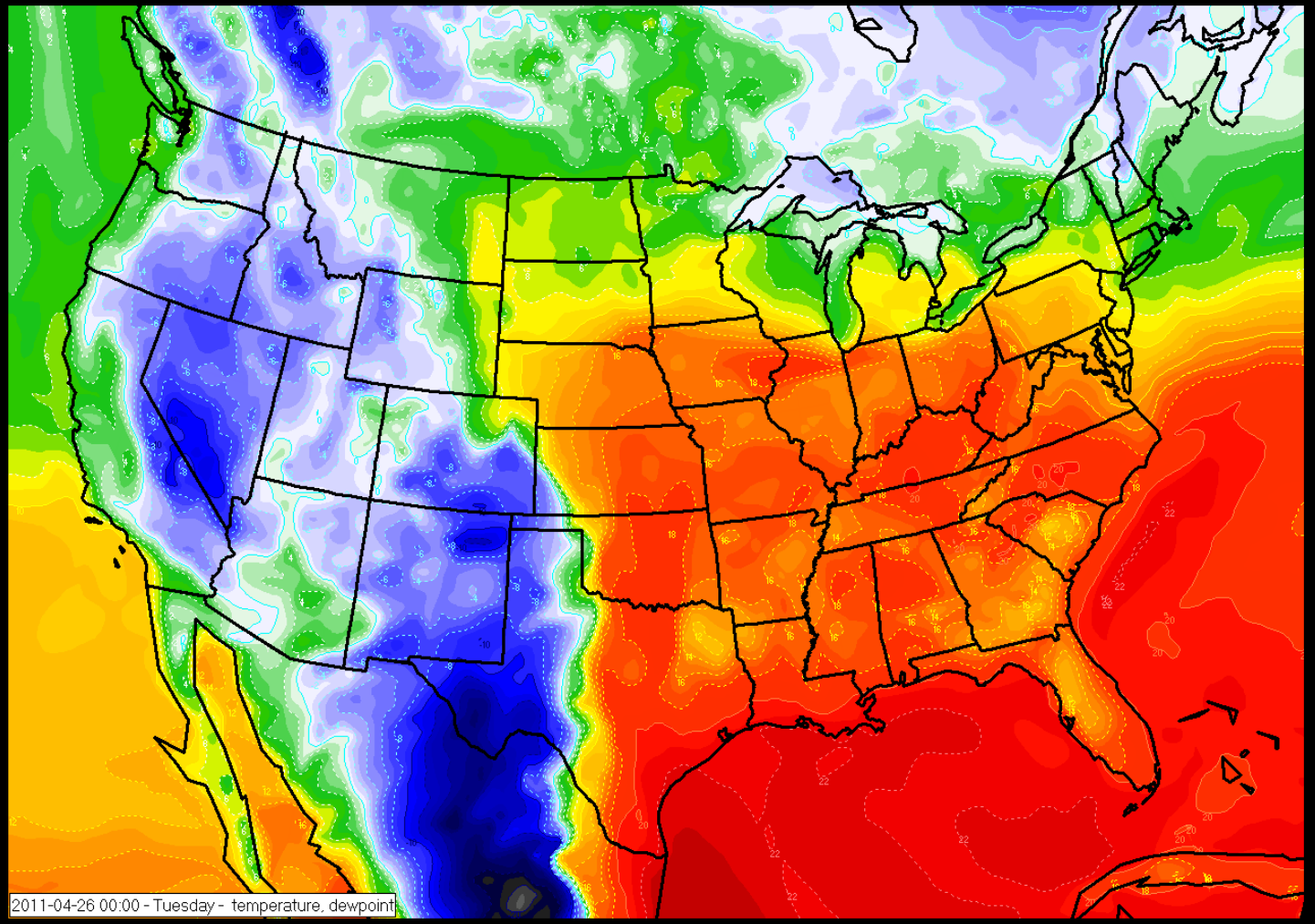

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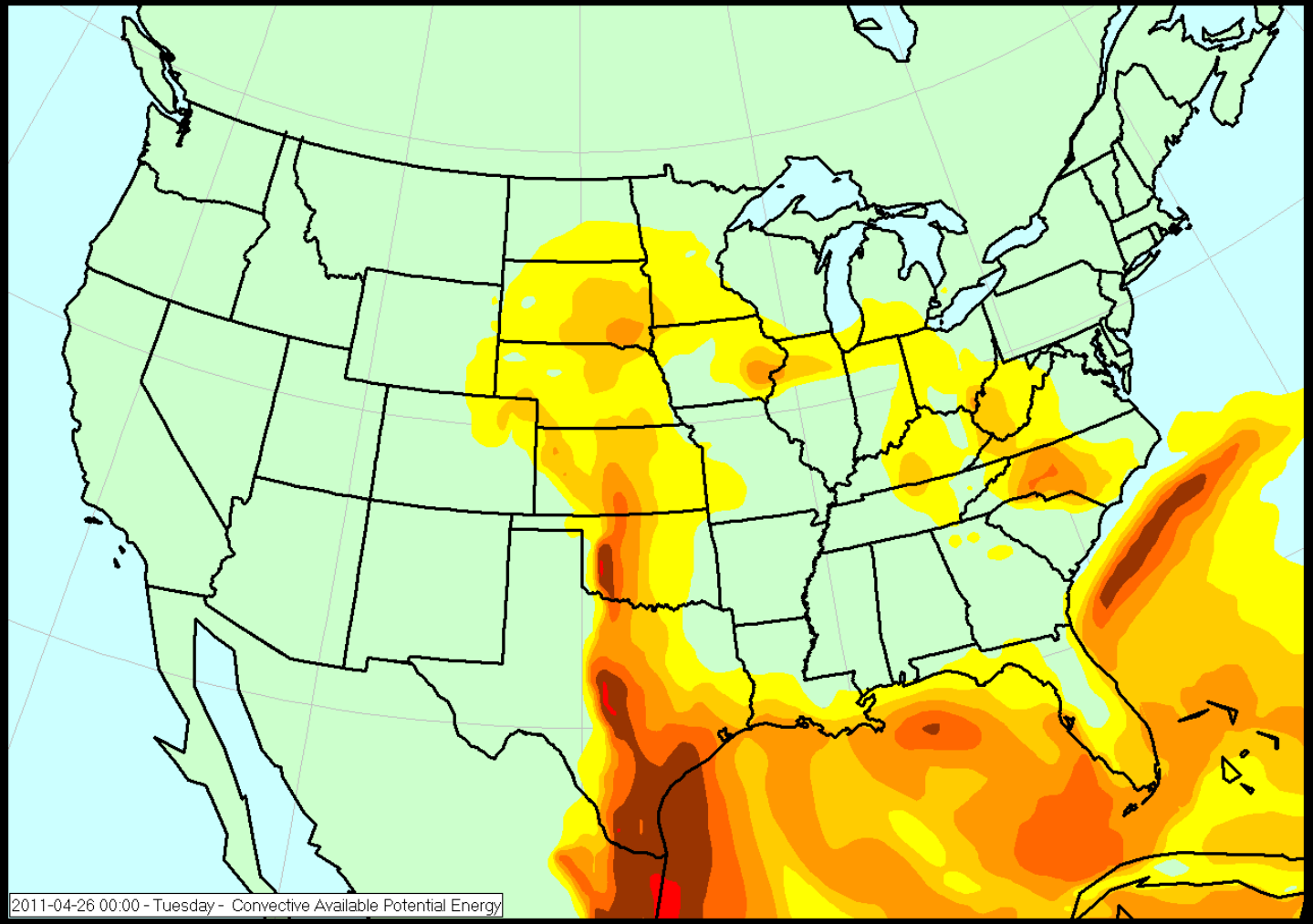
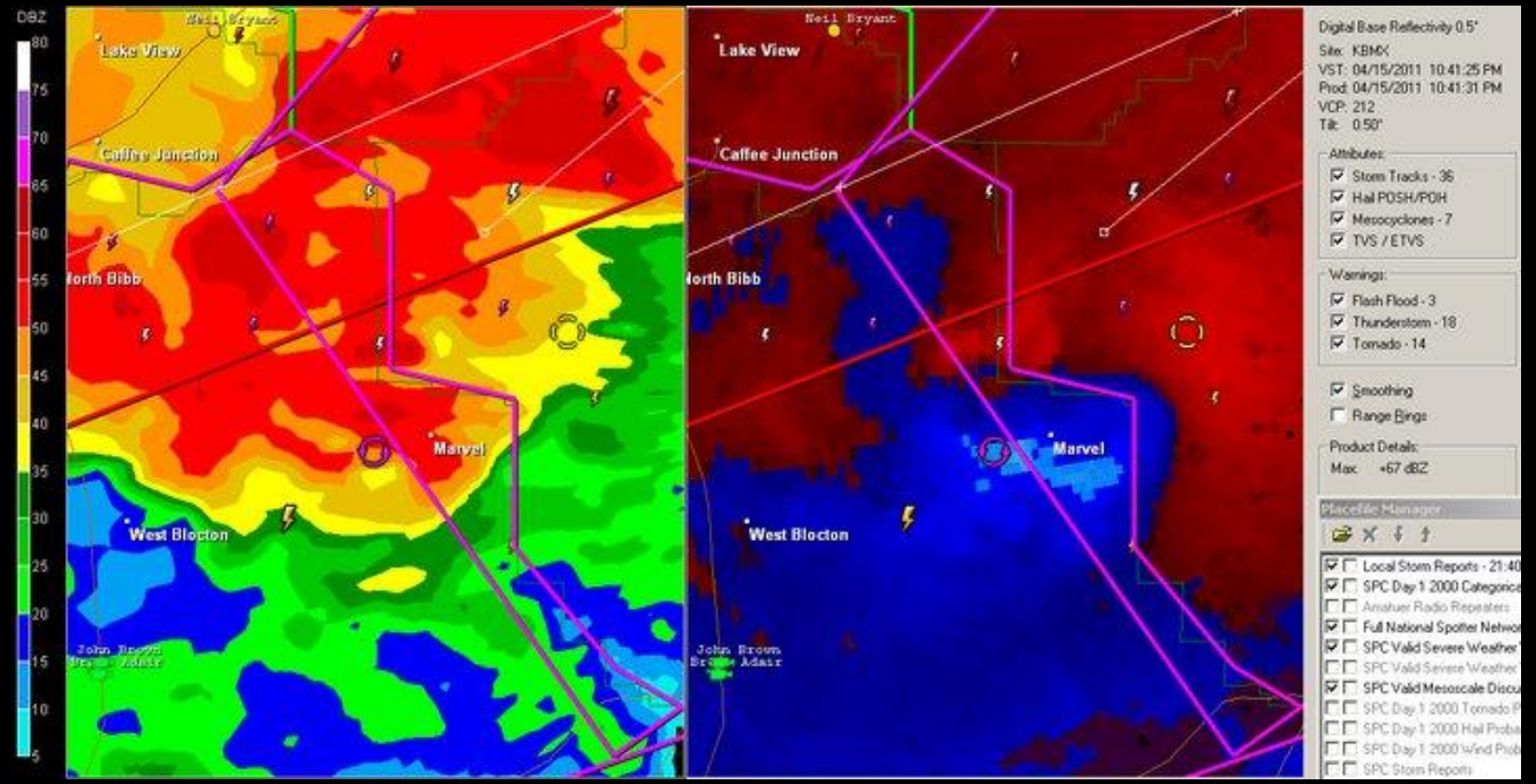

2011-04-26 00:00 - Tuesday - Convective Available Potential Energy

Location

Location


DBZ
80
75
70
65
60
55
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45
40
35
30
25
20
15
10
5
Neil Bryant
Lake View
Caffee Junction
North Bibb
Marvel
West Blocton
John Brown
Digital Base Reflectivity 0.5°
Site: KBMX
VST: 04/15/2011 10:41:25 PM
Prod: 04/15/2011 10:41:31 PM
VCP: 212
Tilt: 0.50°
Attributes:
Storm Tracks - 35
Hail POSH/POH
Mesocyclones - 7
TVS / ETVS
Warnings:
Flash Flood - 3
Thunderstorm - 18
Tornado - 14
Smoothing
Range Rings
Product Details:
Max: +67 dBZ
Placefile Manager
Local Storm Reports - 21:40
SPC Day 1 2000 Categorica
Amateur Radio Repeaters
Full National Spotter Networ
SPC Valid Severe Weather
SPC Valid Severe Weather
SPC Valid Mesoscale Discu
SPC Day 1 2000 Tornado P
SPC Day 1 2000 Hail Probs
SPC Day 1 2000 Wind Prob
SPC Storm Reports

Location

STORM CHASING

- Chaser
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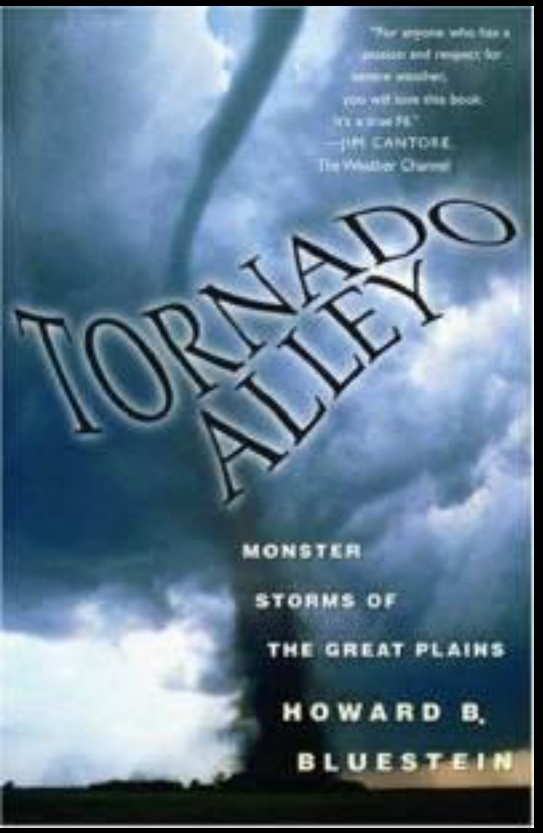
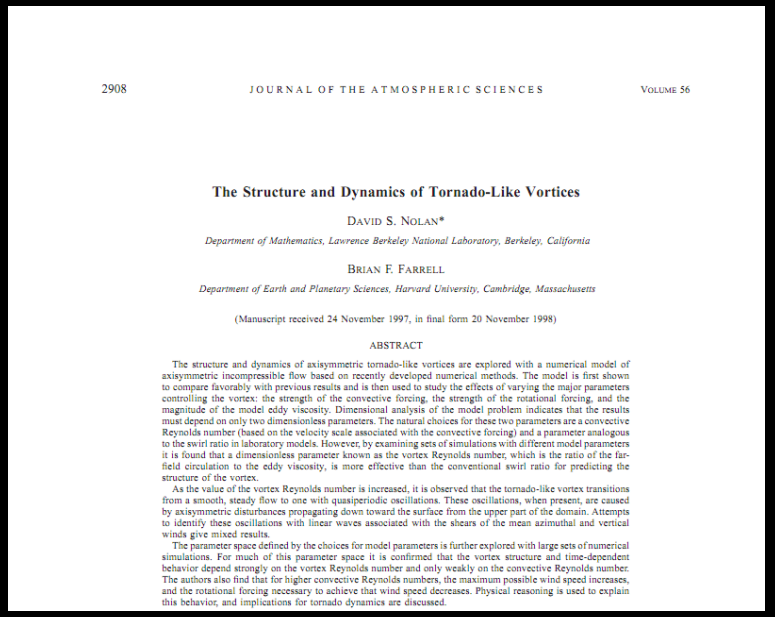
Storm chasing

Equipment

- Knowledge
- Car
- Cameras
- Laptop
  - GPS
  - Radar
  - Internet

Equipment





2908 JOURNAL OF THE ATMOSPHERIC SCIENCES VOLUME 56

The Structure and Dynamics of Tornado-Like Vortices

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Department of Earth and Planetary Sciences, Harvard University, Cambridge, Massachusetts

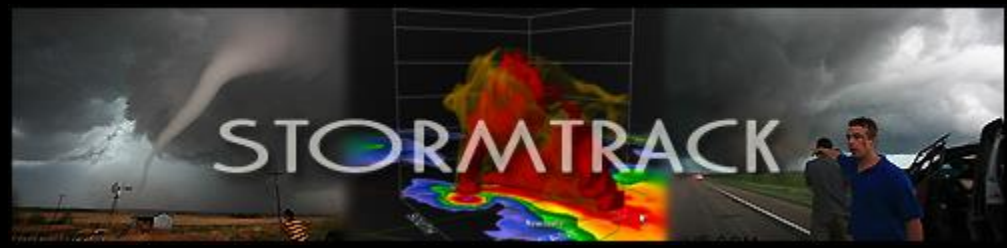
(Manuscript received 24 November 1997, in final form 20 November 1998)

ABSTRACT

The structure and dynamics of axisymmetric tornado-like vortices are explored with a numerical model of axisymmetric incompressible flow based on recently developed numerical methods. The model is first shown to compare favorably with previous results and is then used to study the effects of varying the major parameters controlling the vortex: the strength of the convective forcing, the strength of the rotational forcing, and the magnitude of the model eddy viscosity. Dimensional analysis of the model problem indicates that the results must depend on only two dimensionless parameters. The natural choices for these two parameters are a convective Reynolds number (based on the velocity scale associated with the convective forcing) and a parameter analogous to the swirl ratio in laboratory models. However, by examining sets of simulations with different model parameters it is found that a dimensionless parameter known as the vortex Reynolds number, which is the ratio of the far-field circulation to the eddy viscosity, is more effective than the conventional swirl ratio for predicting the structure of the vortex.

As the value of the vortex Reynolds number is increased, it is observed that the tornado-like vortex transitions from a smooth, steady flow to one with quasiperiodic oscillations. These oscillations, when present, are caused by axisymmetric disturbances propagating down toward the surface from the upper part of the domain. Attempts to identify these oscillations with linear waves associated with the shears of the mean azimuthal and vertical winds give mixed results.

The parameter space defined by the choices for model parameters is further explored with large sets of numerical simulations. For much of this parameter space it is confirmed that the vortex structure and time-dependent behavior depend strongly on the vortex Reynolds number and only weakly on the convective Reynolds number. The authors also find that for higher convective Reynolds numbers, the maximum possible wind speed increases, and the rotational forcing necessary to achieve that wind speed decreases. Physical reasoning is used to explain this behavior, and implications for tornado dynamics are discussed.



Equipment


Home & Pharmacy
DODGE
TEXAS
JJS-9697
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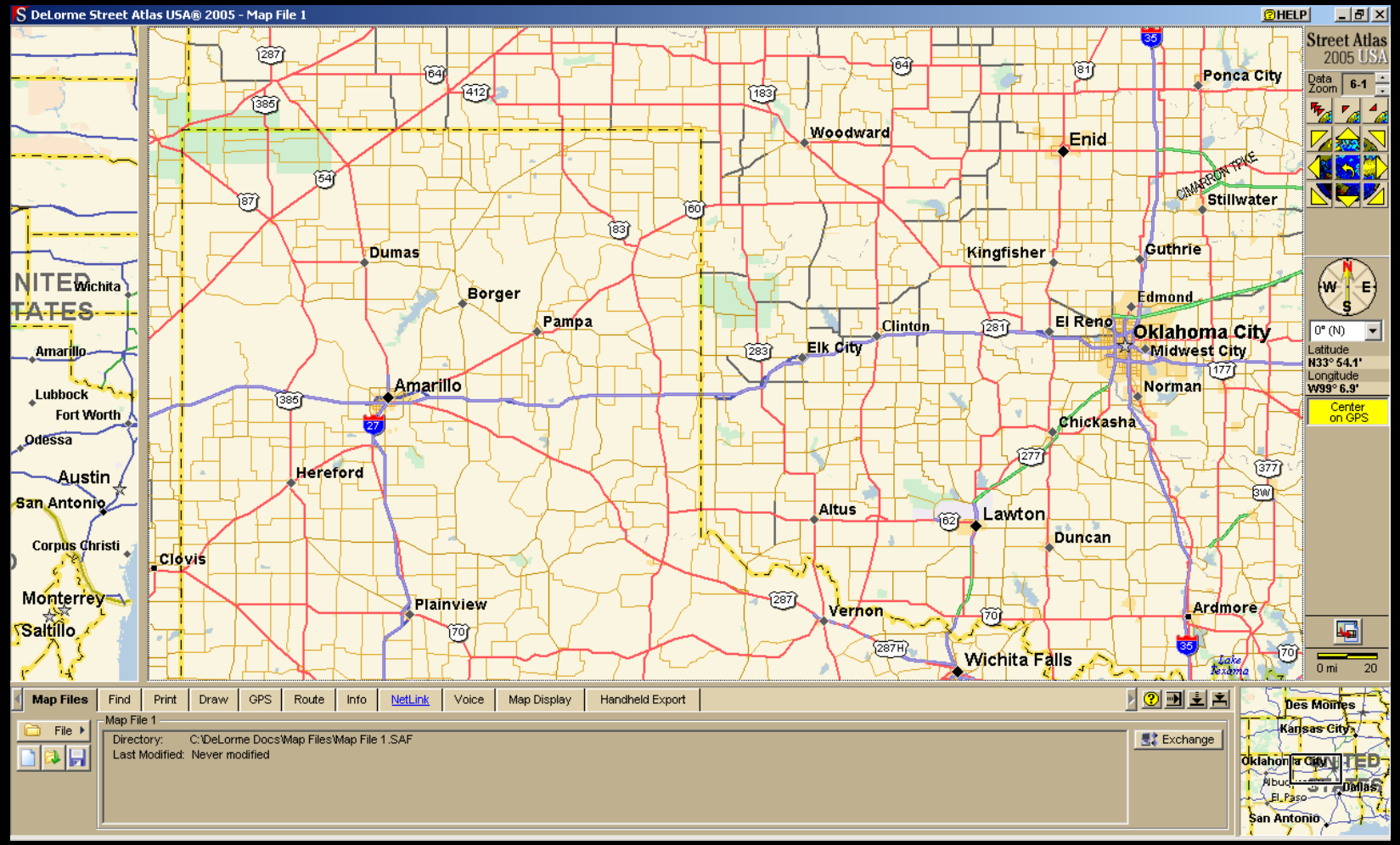
Equipment

- Camera
  - Still or video?
  - HD or 4K?
  - Digital or film?
  - Compact or SLR/DSLR
    - TRIPOD!!
  - Go Pro?

Equipment

- Laptop
  - GPS
  - Radar
  - Internet
- Mobile phone

Equipment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HELP
Street Atlas 2005 USA
Data Zoom 6-1
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Woodward
Stillwater
Cimarron Tpke
Kingfisher
Guthrie
Edmond
El Reno
Oklahoma City
Midwest City
Clinton
Elk City
Norman
Chickasha
Lawton
Duncan
Altus
Ardmore
Wichita Falls
Vernon
Plainview
Hereford
Clovis
Amarillo
Borger
Pampa
Dumas
Wichita
Lubbock
Fort Worth
Odessa
Austin
San Antonio
Corpus Christi
Monterrey
Saltillo
Latitude N33° 54.1'
Longitude W99° 6.9'
Center on GPS
0 mi 20
Map Files
Find
Print
Draw
GPS
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Dallas
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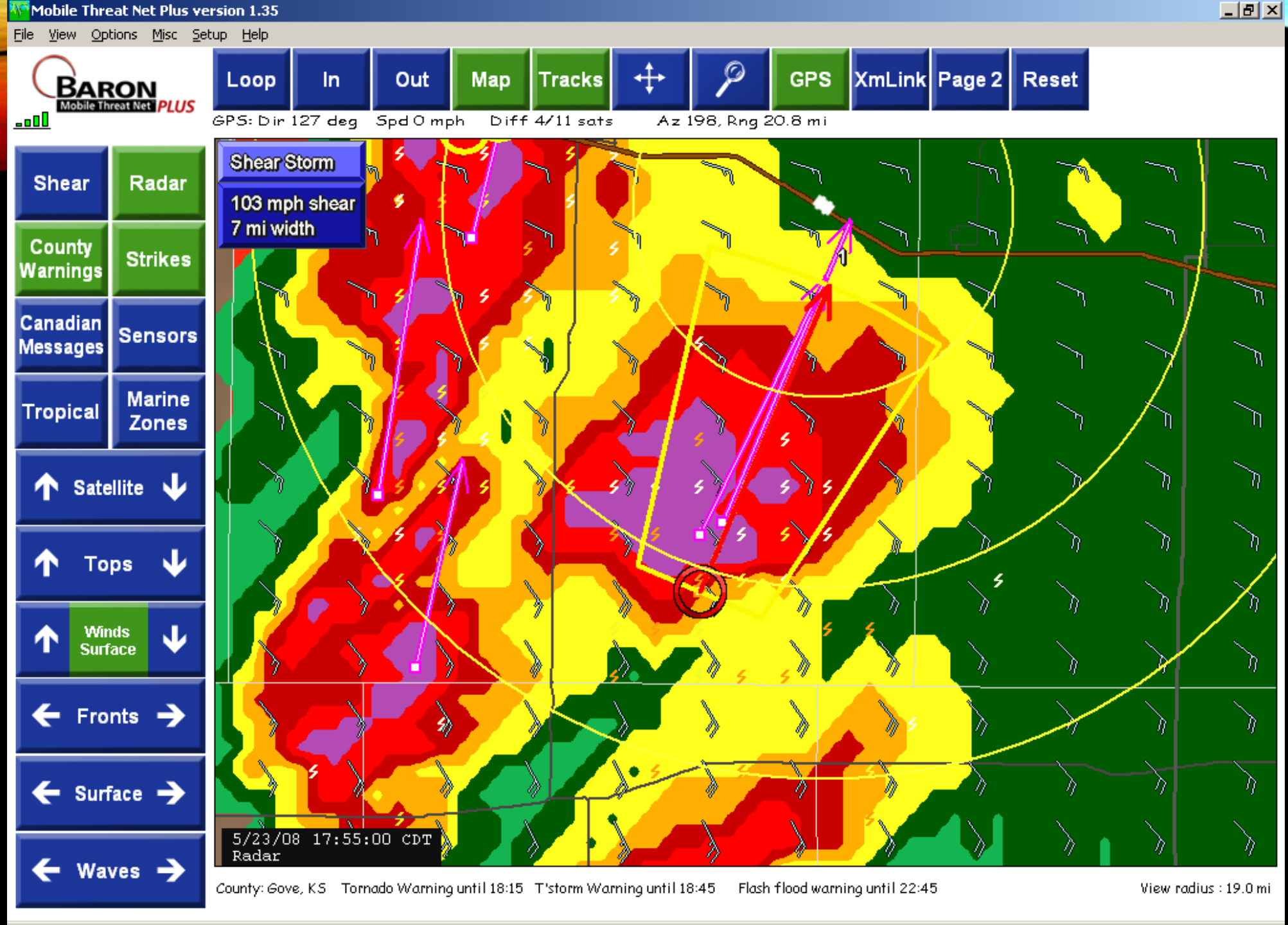
San Antonio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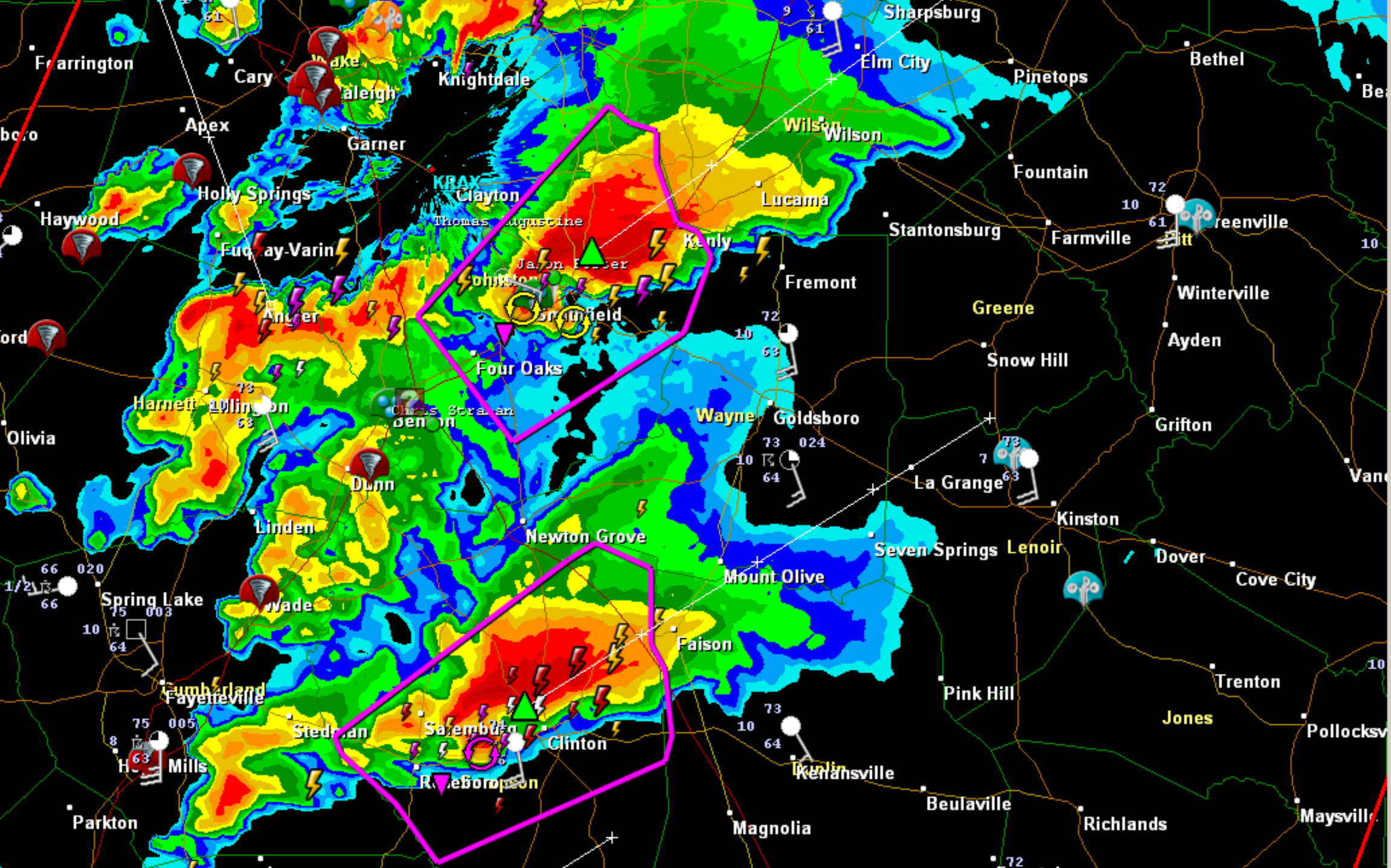
File View Options Misc Setup Help
BARON Mobile Threat Net PLUS
Loop In Out Map Tracks GPS XmLink Page 2 Reset
GPS: Dir 127 deg Spd 0 mph Diff 4/11 sats Az 198, Rng 20.8 mi
Shear Radar
County Warnings Strikes
Canadian Messages Sensors
Tropical Marine Zones
Satellite
Tops
Winds Surface
Fronts
Surface
Waves
Shear Storm
103 mph shear
7 mi width
5/23/08 17:55:00 CDT
Radar
County: Gove, KS Tornado Warning until 18:15 T'storm Warning until 18:45 Flash flood warning until 22:45
View radius : 19.0 mi



Digital Base Reflectivit
Site: KRAX
VST: 04/16/2011 09
Prod: 04/16/2011 09
VCP: 212
Tilt: 1.30°

Attributes:
- [x] Storm Tracks - 3
- [x] Hail POSH/POH
- [x] Mesocyclones -
- [x] TVS / ETVS - 2

Warnings:
- [x] Flash Flood - 7
- [x] Thunderstorm - 8
- [x] Tornado - 9

- [x] Smoothing
- [ ] Range Rings

Product Details:
Max: +65 dBZ

Placefile Manager
- [x] Local Storm R
- [x] SPC Day 1 20
- [ ] Amatuer Radio
- [x] Full National S
- [x] SPC Valid Sev
- [ ] SPC Valid Sev
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- [ ] SPC Day 1 20
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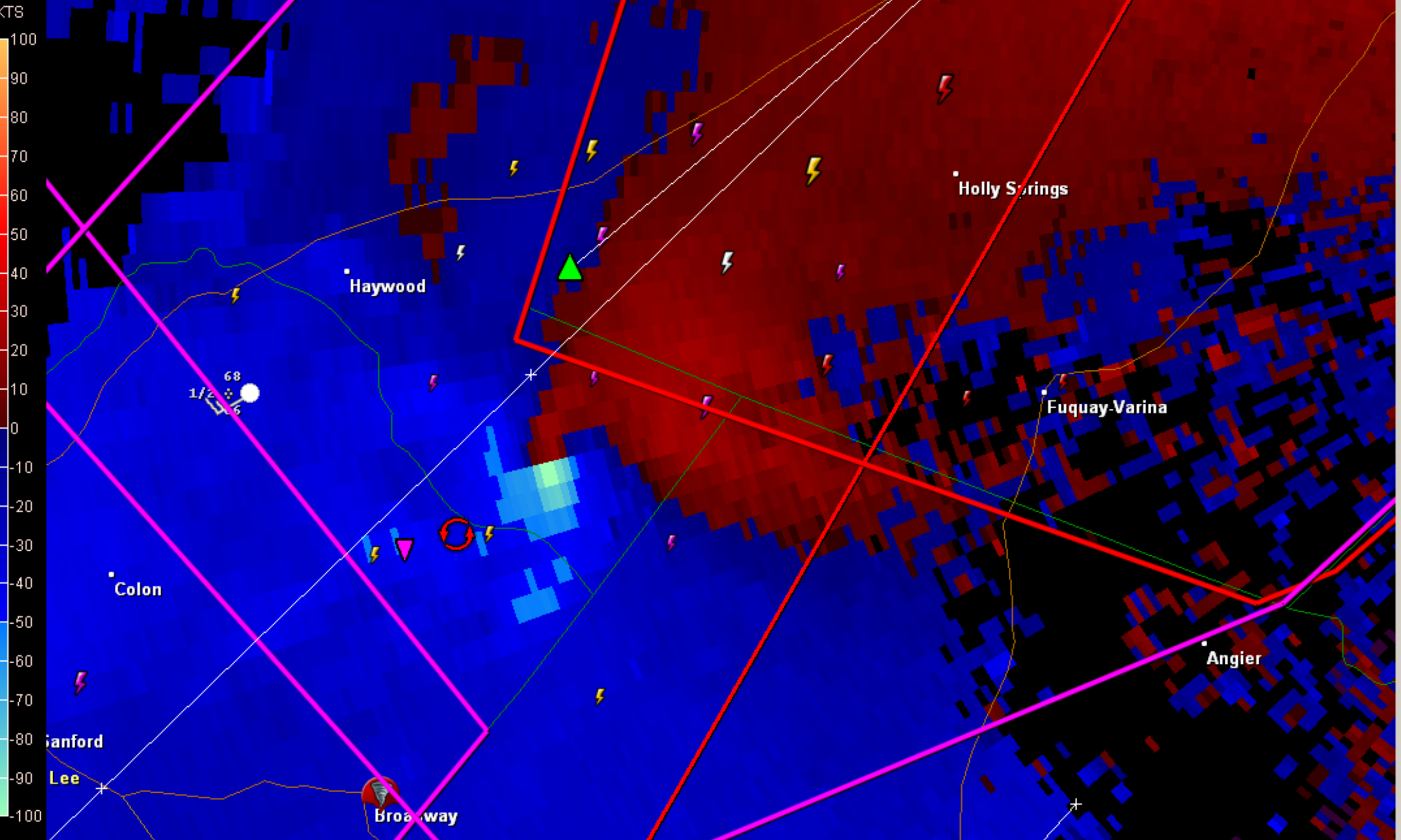
KTS
100
90
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-30
-40
-50
-60
-70
-80
-90
-100
Holly Springs
Haywood
Fuquay-Varina
Colon
Angier
Lee
68
Digital Base V
Site: KRAX
VST: 04/16/2
Prod: 04/16/2
VCP: 212
Tilt: 0.50°
Attributes:
Storm T
Hail PO
Mesocy
TVS / E
Warnings:
Flash Fl
Thunde
Tornad
Smooth
Range
Product De
Max: +12
Min: -12
Placefile Ma
Local
SPC D
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SPC V
SPC D
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SPC D
SPC S

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Storm chasing


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