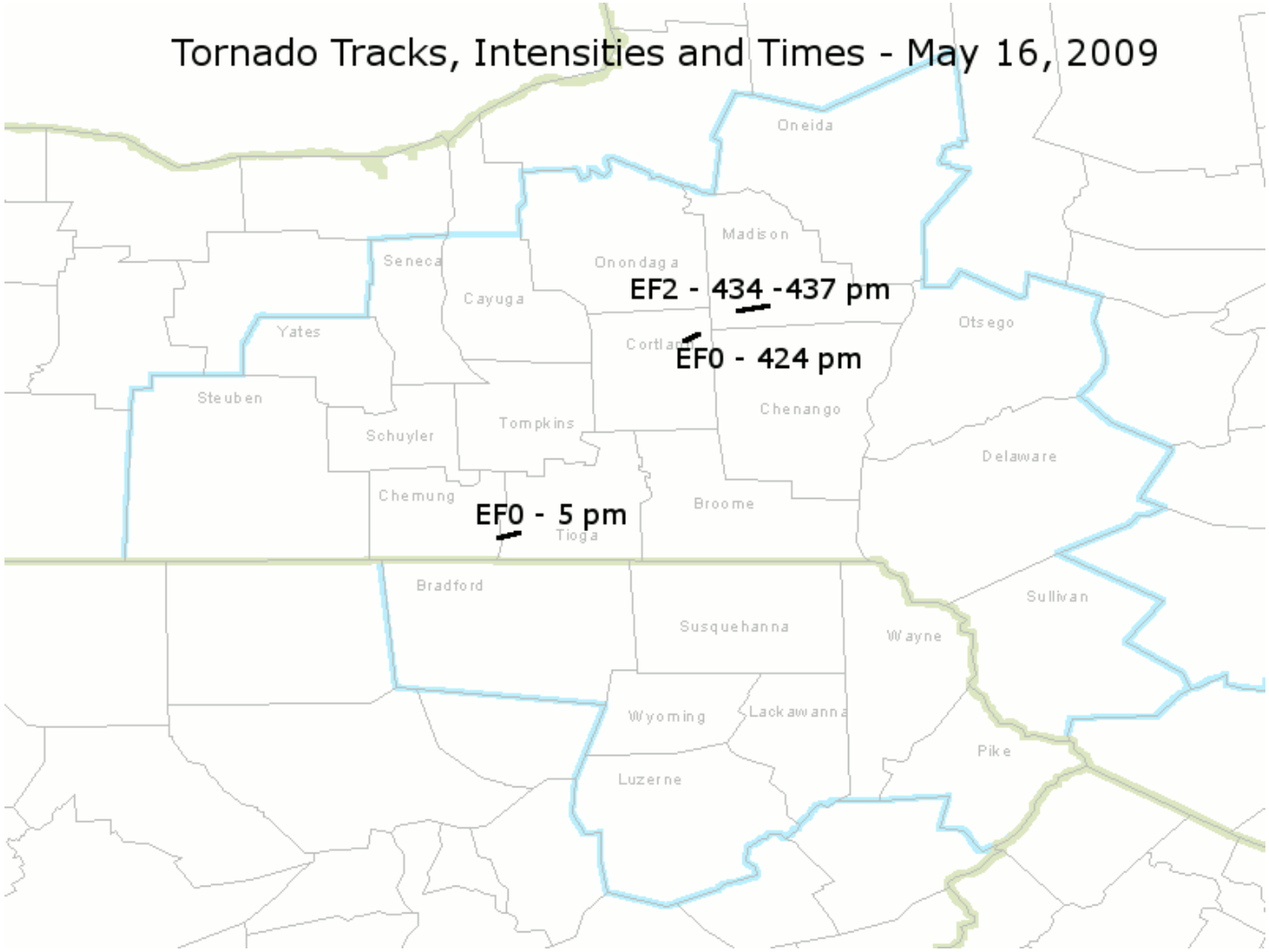
The May 16, 2009 Severe Weather Outbreak

Part I : The pre-storm environment

May 16, 2009

- 3 Tornadoes – 1 EF2 tornado and 2 EFO tornadoes
- 9 severe wind reports
- 5 large hail reports

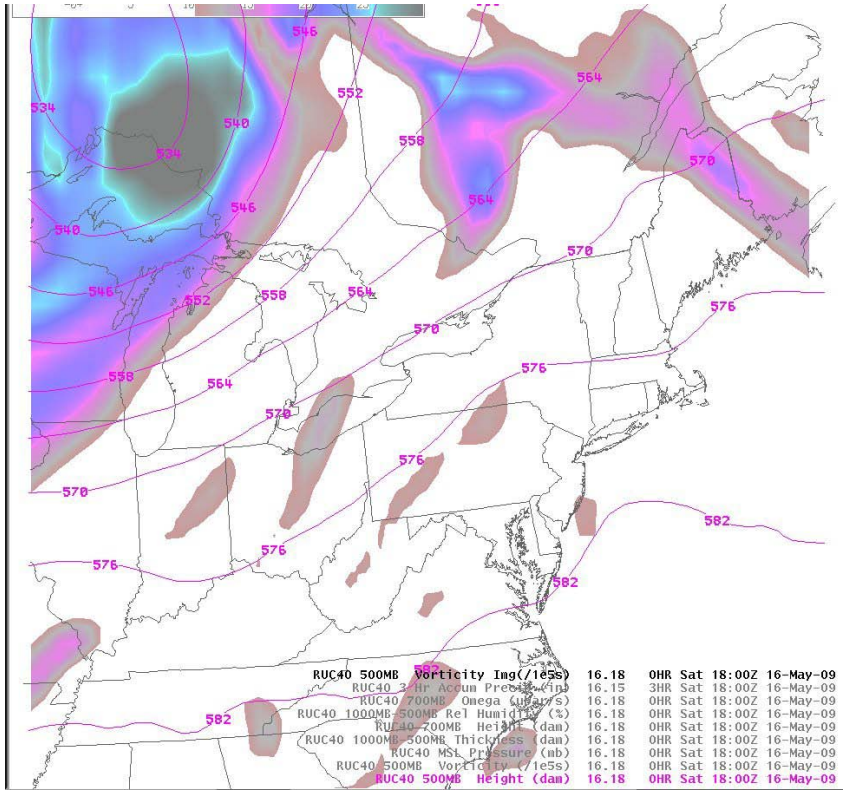
Tornado Tracks

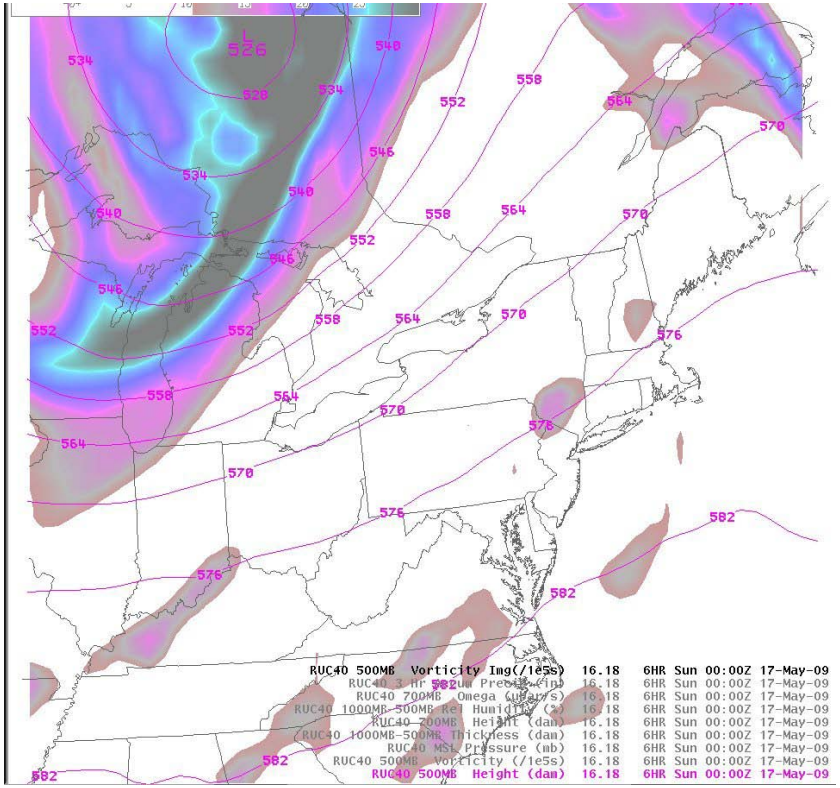


Outline

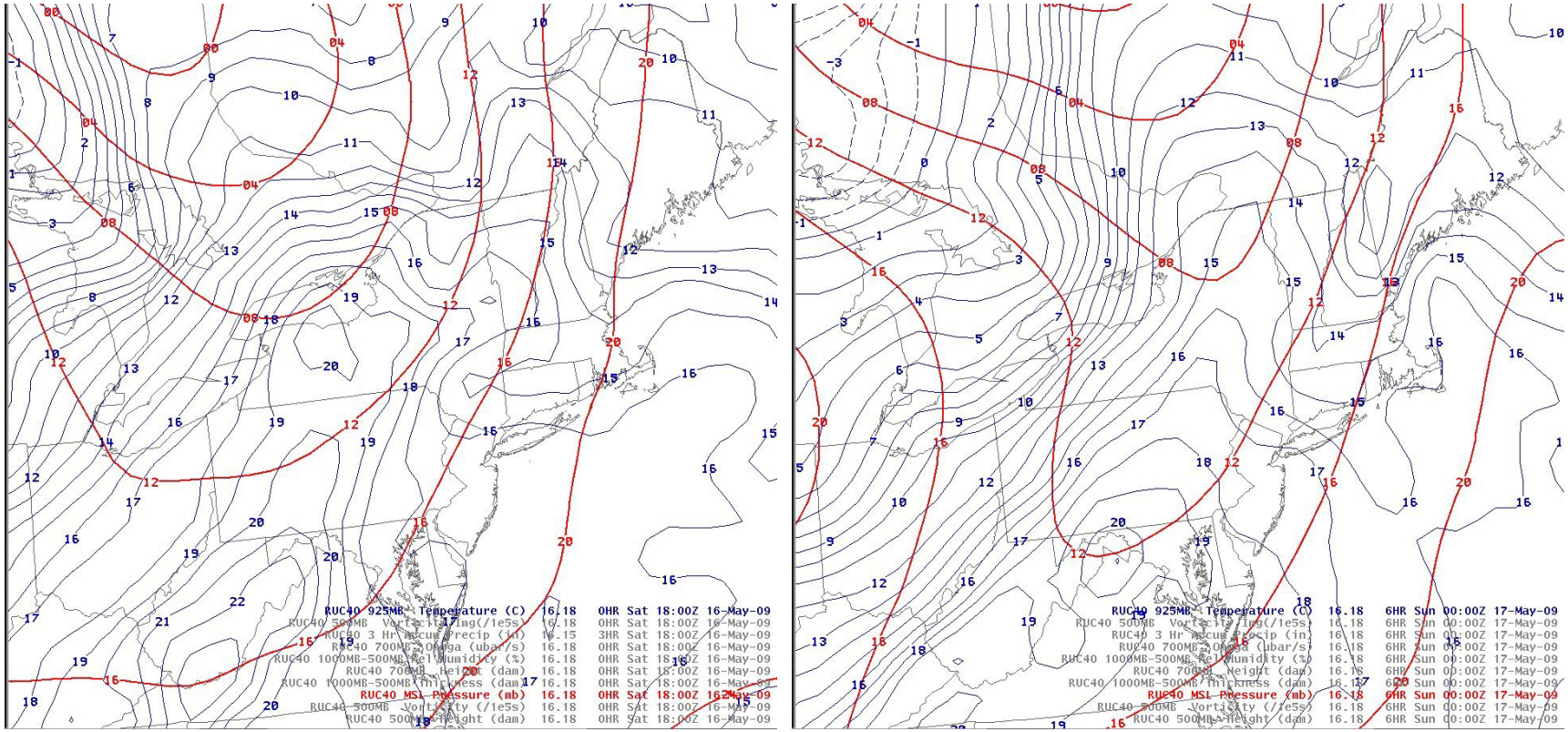
- Large-scale pattern
- CAPE forecasts and evaluation
- SPC analyses

500 mb heights and vorticity

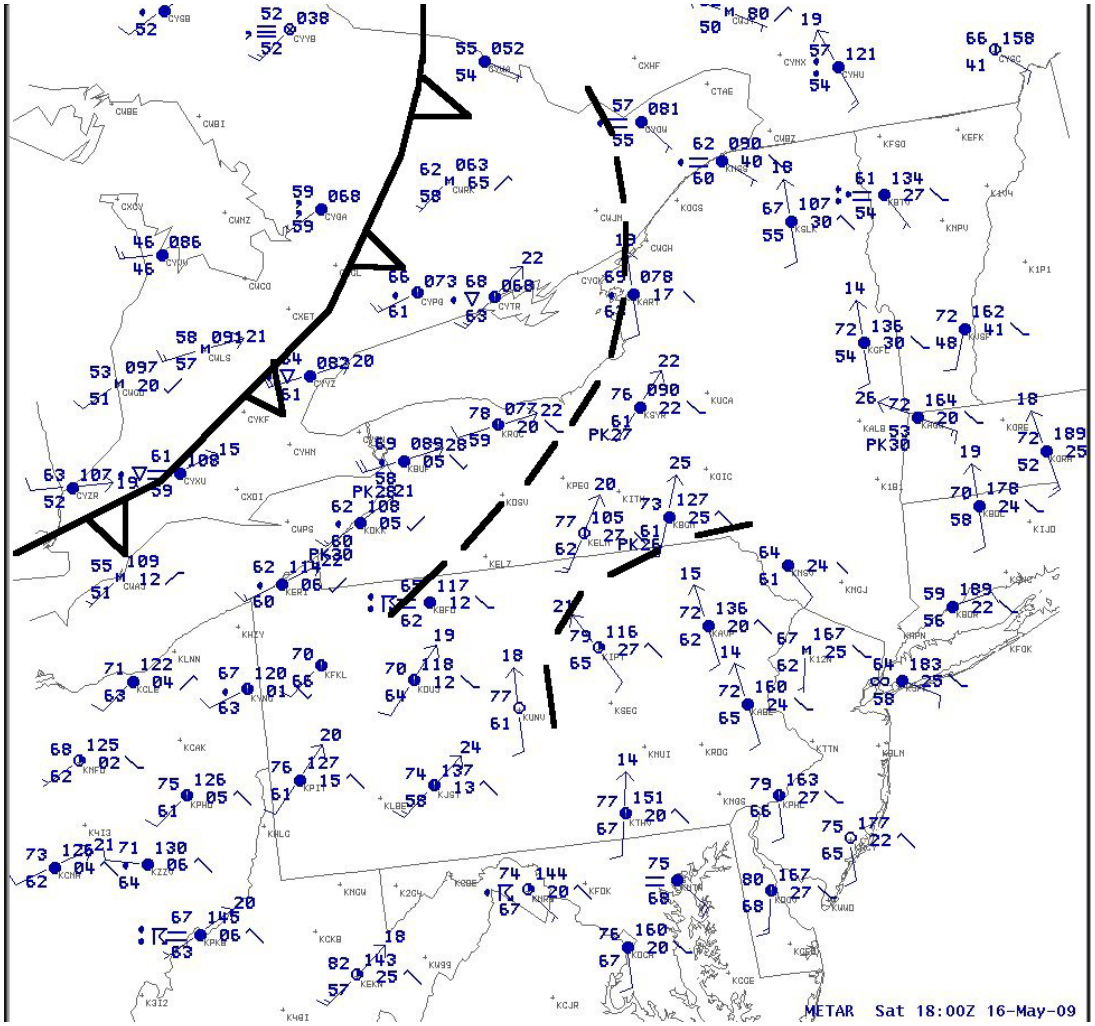




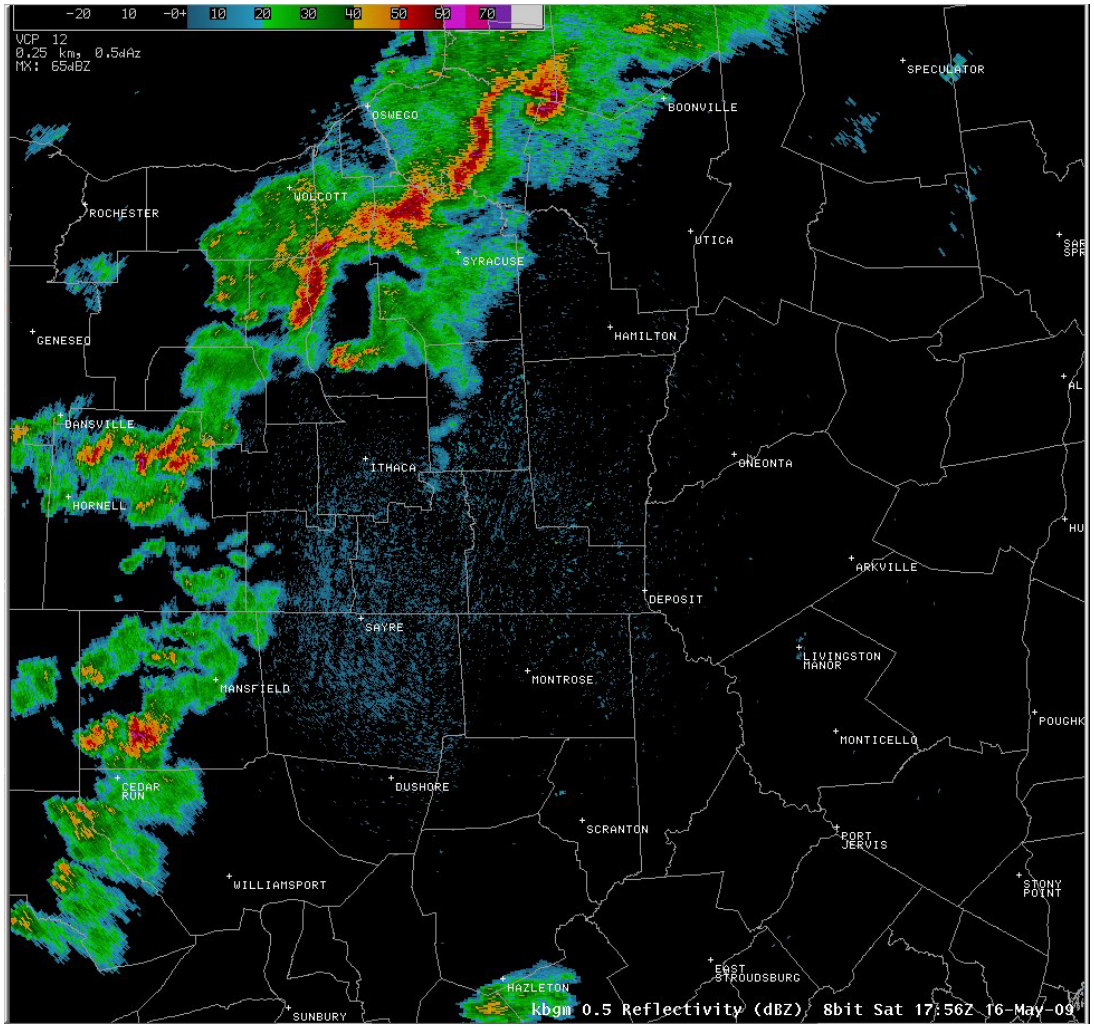
Sea-level pressure and 925 hPa temperature



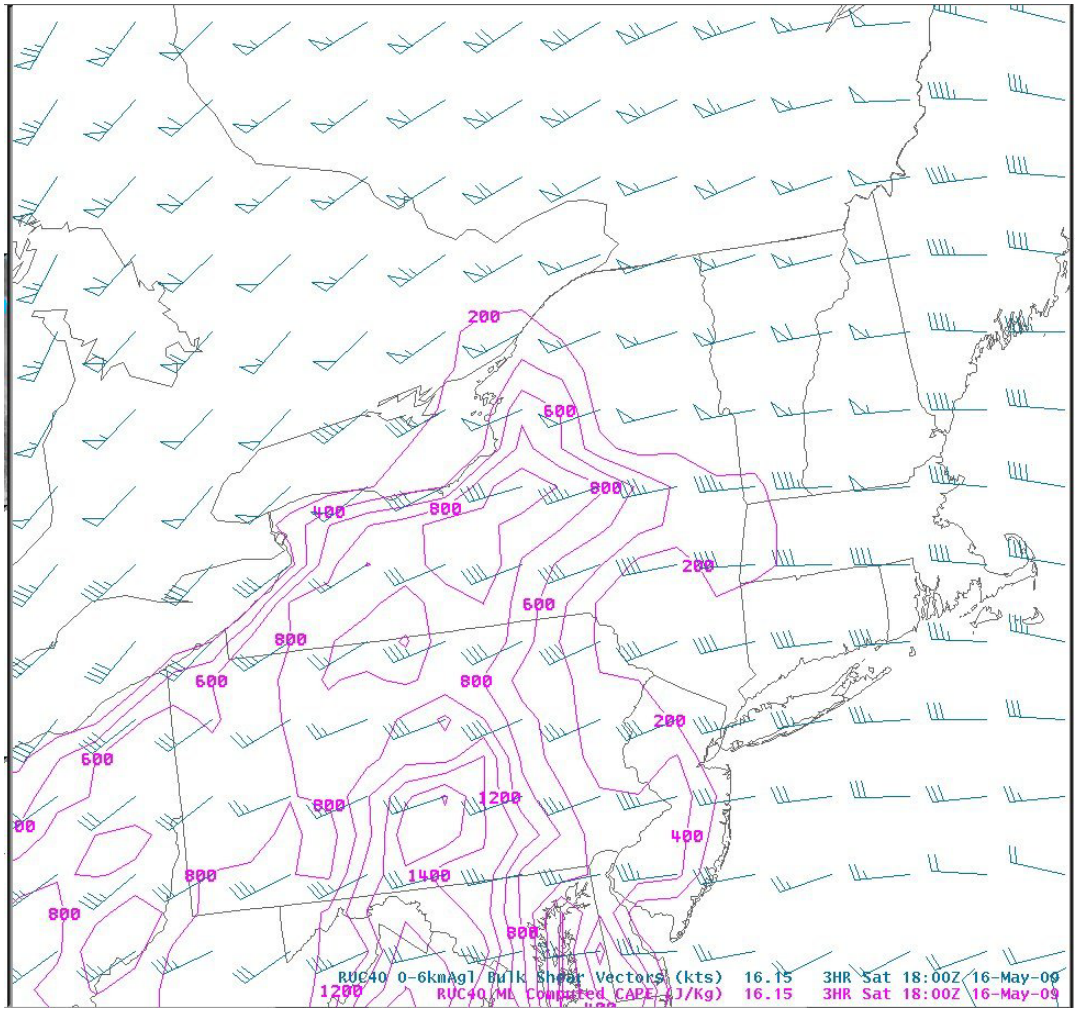
Surface analysis – 18z May 16



WSR-88D Reflectivity – 18z May 16



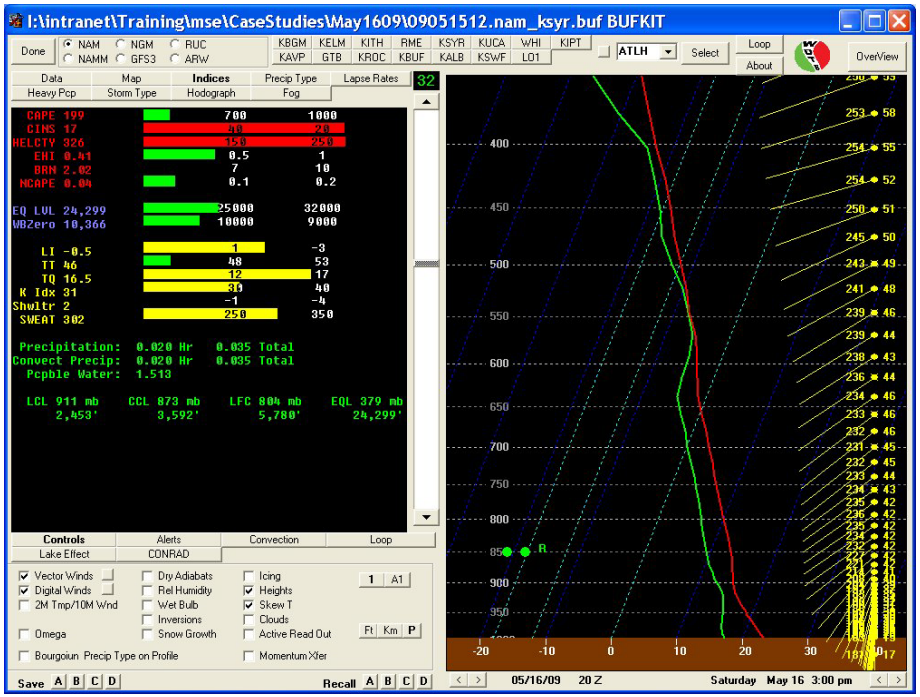
MLCAPE and 0-6 km shear

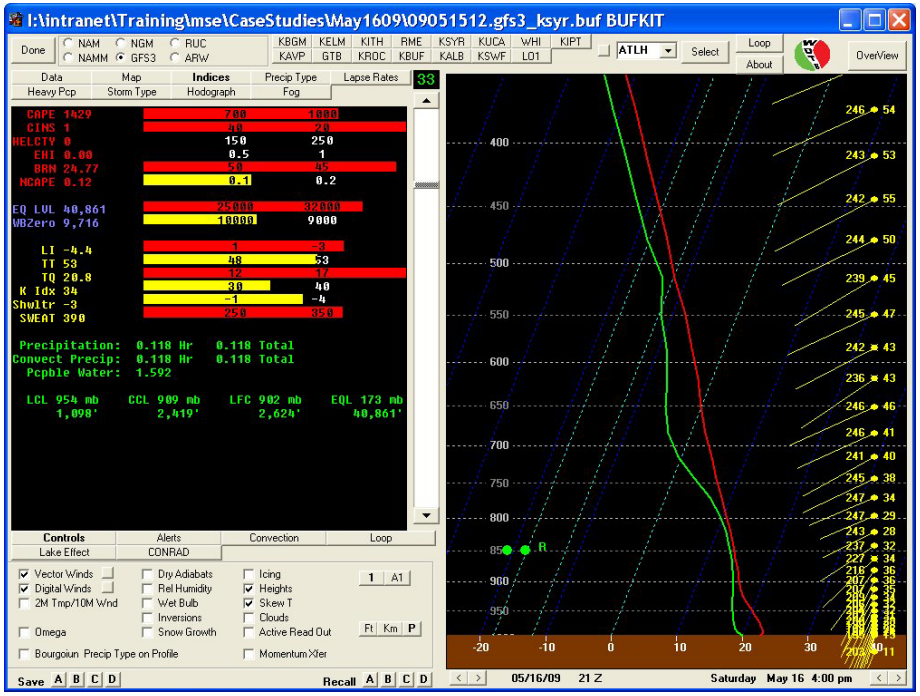


Summary

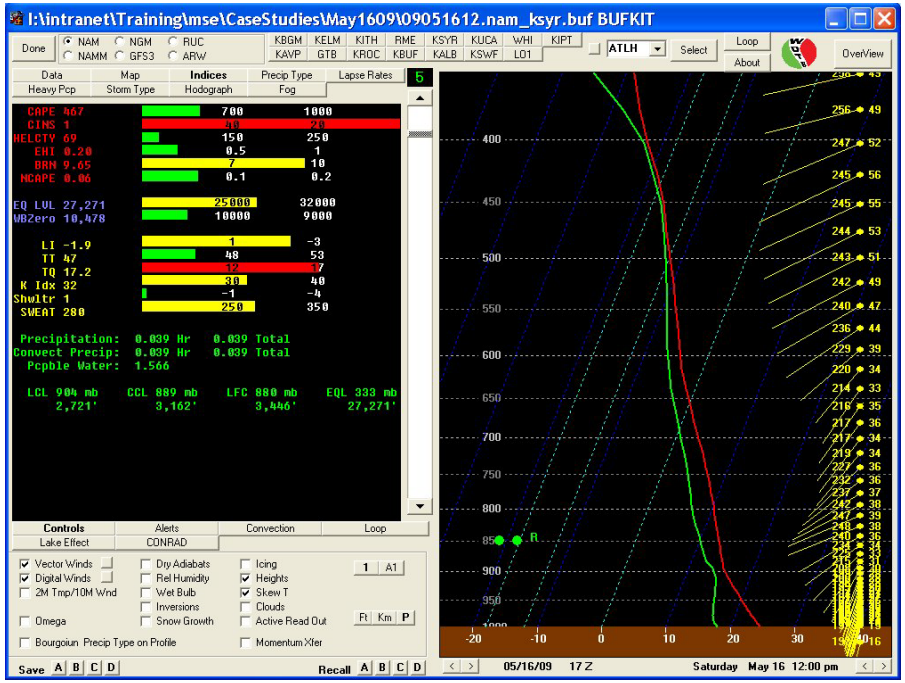
- A 500 mb trough was located over the western Great Lakes, moving slowly east. Forcing with this trough over central NY was minimal.
- A surface cold front was moving east across the eastern Great Lakes.
- A surface trough was moving east downstream from the front, across central NY. Storms developed along this trough.
- Another trough was located over northeast Pennsylvania. The flow was from the southeast east of this trough, and southwest to the west and north.
- Modest CAPE and strong deep-layer shear combined with these features to set the stage for severe weather on the 16th.

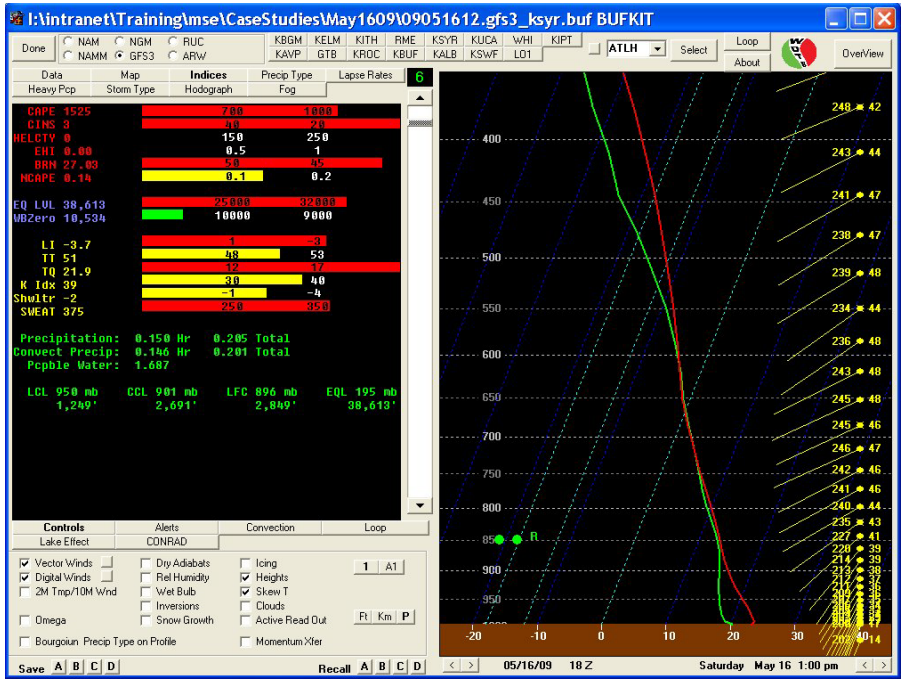
Forecasts for SYR made 12z May 15, 2009



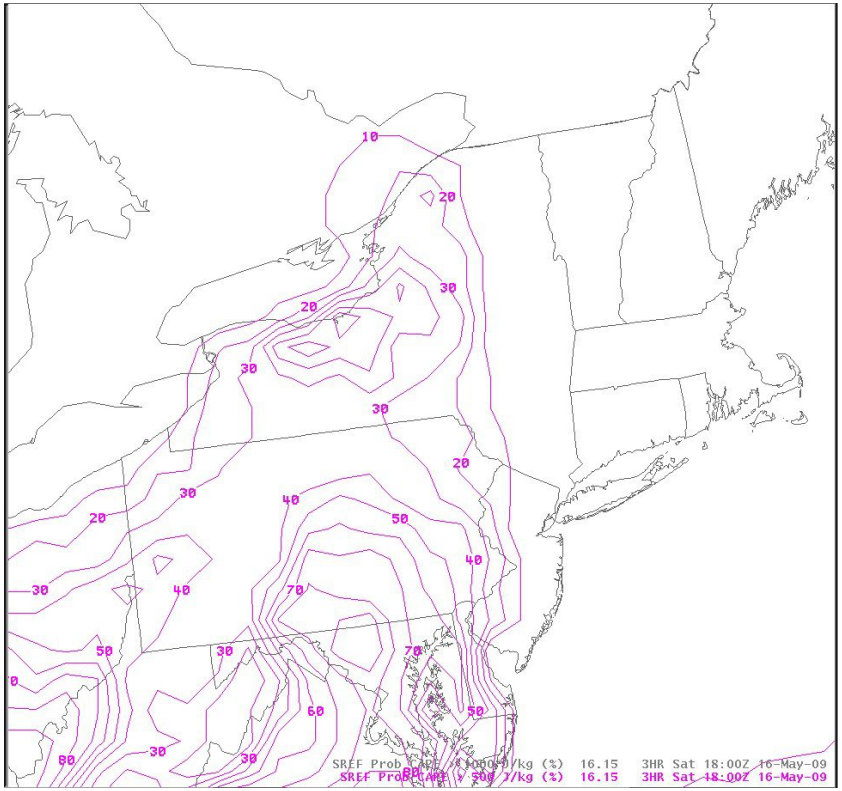


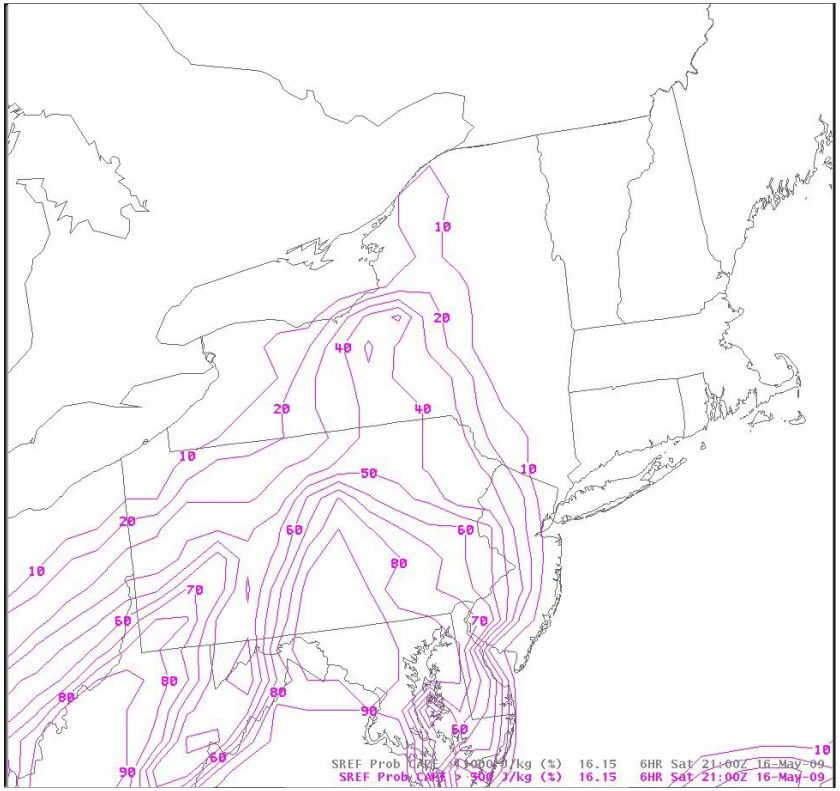
Forecasts for SYR made at 12z May 16, 2009



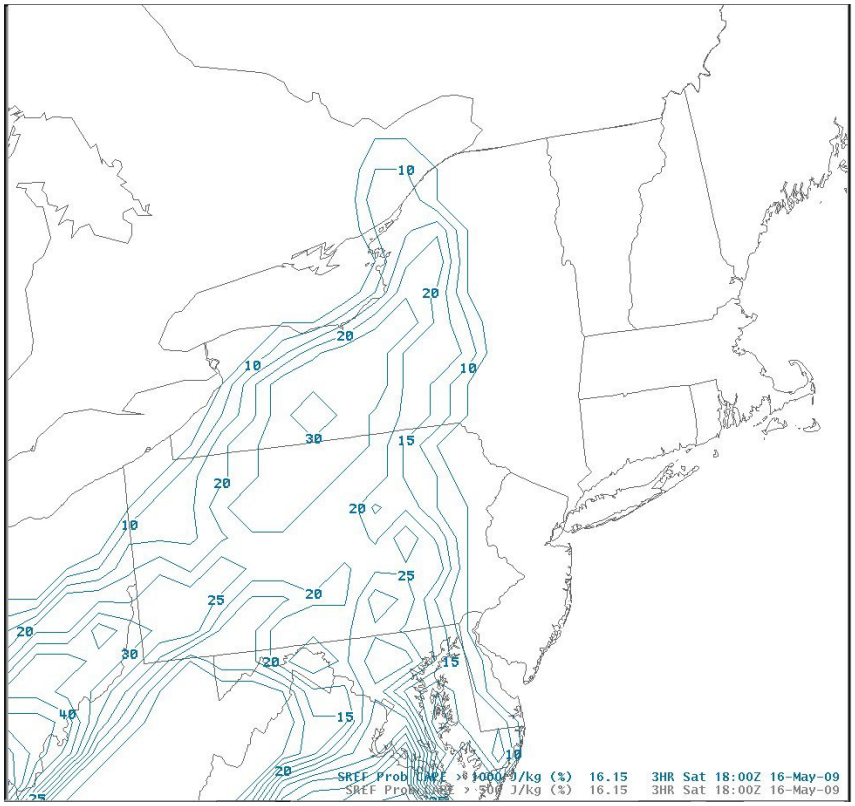


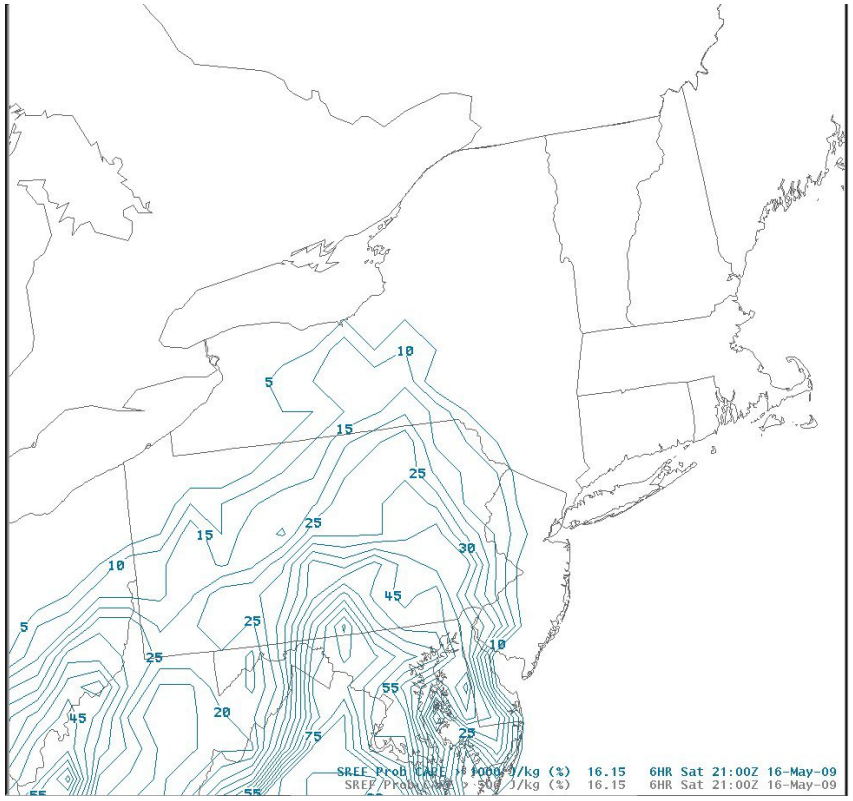
SREF probability of CAPE greater than 500 J/kg



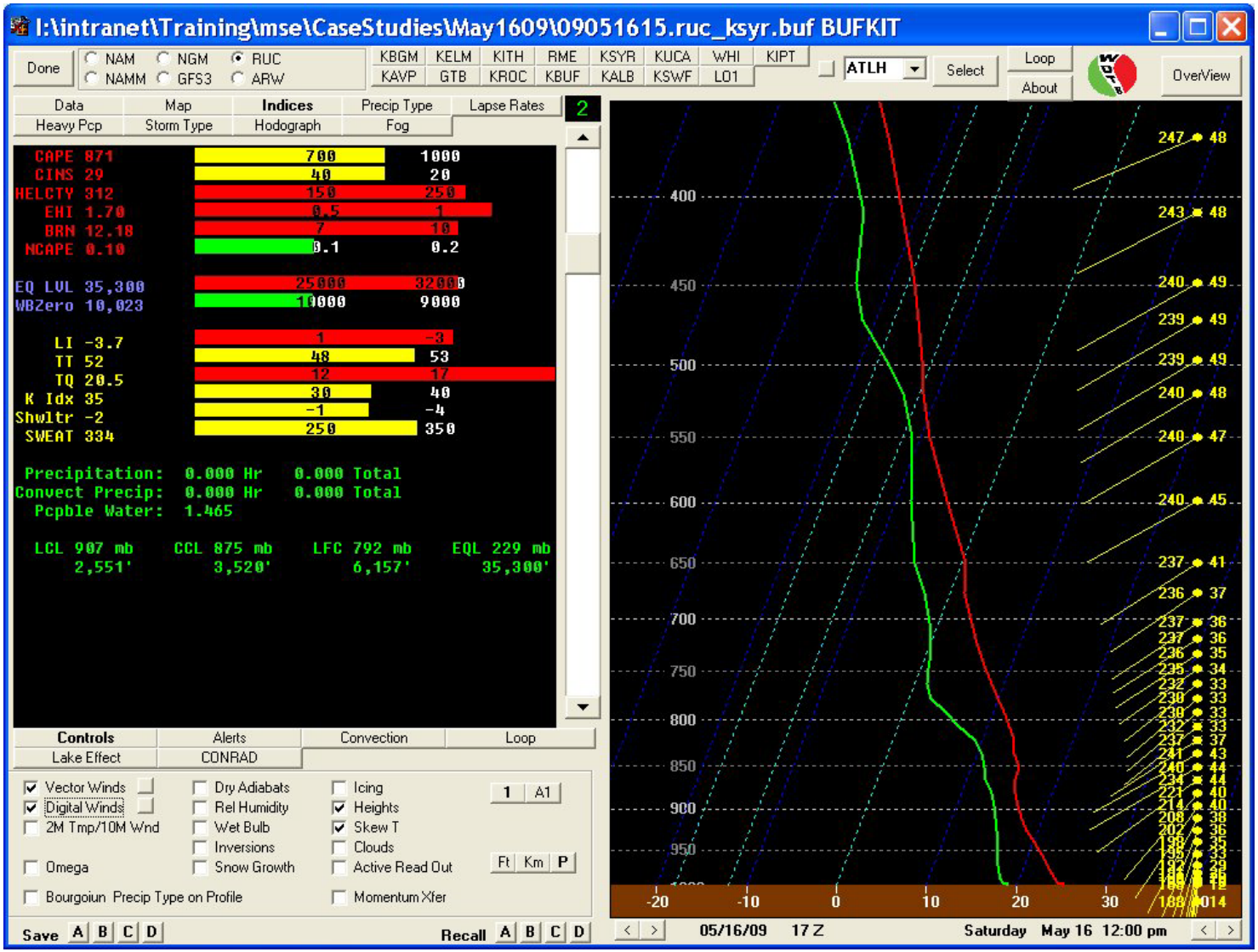


SREF probability of CAPE greater than 1000 J/kg

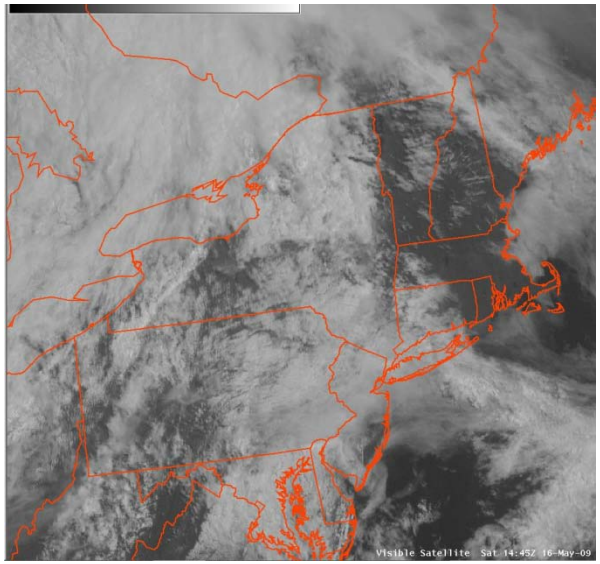


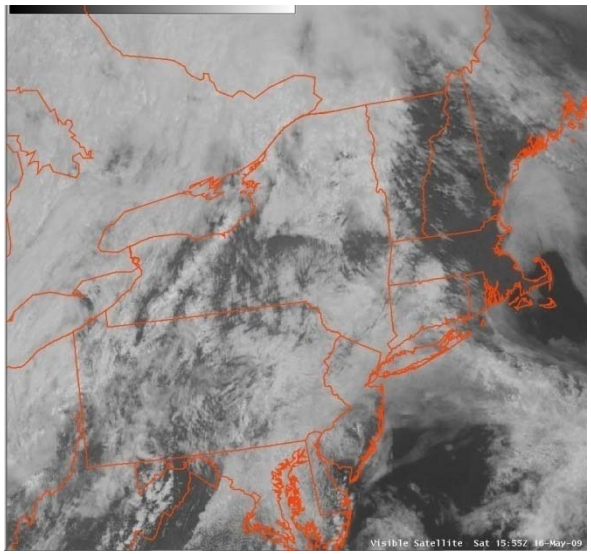


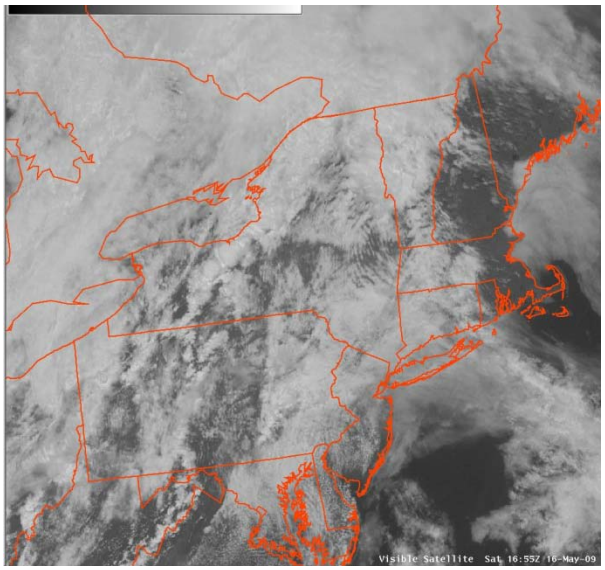
RUC forecast for SYR at 15z May 16

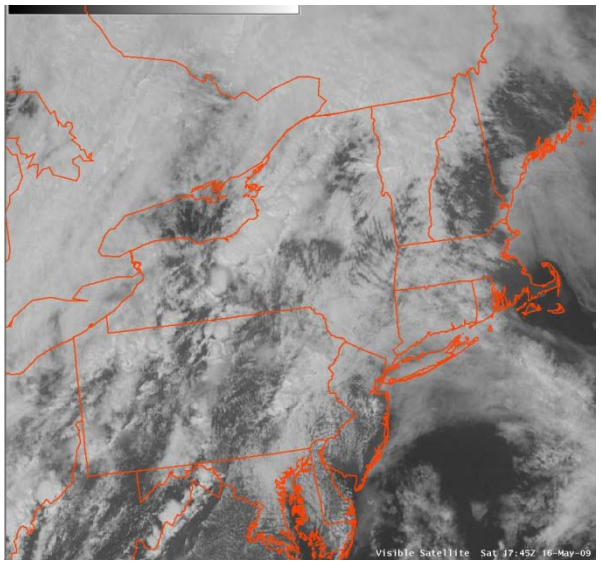


Visible satellite imagery – 15z-18z May 16, 2009

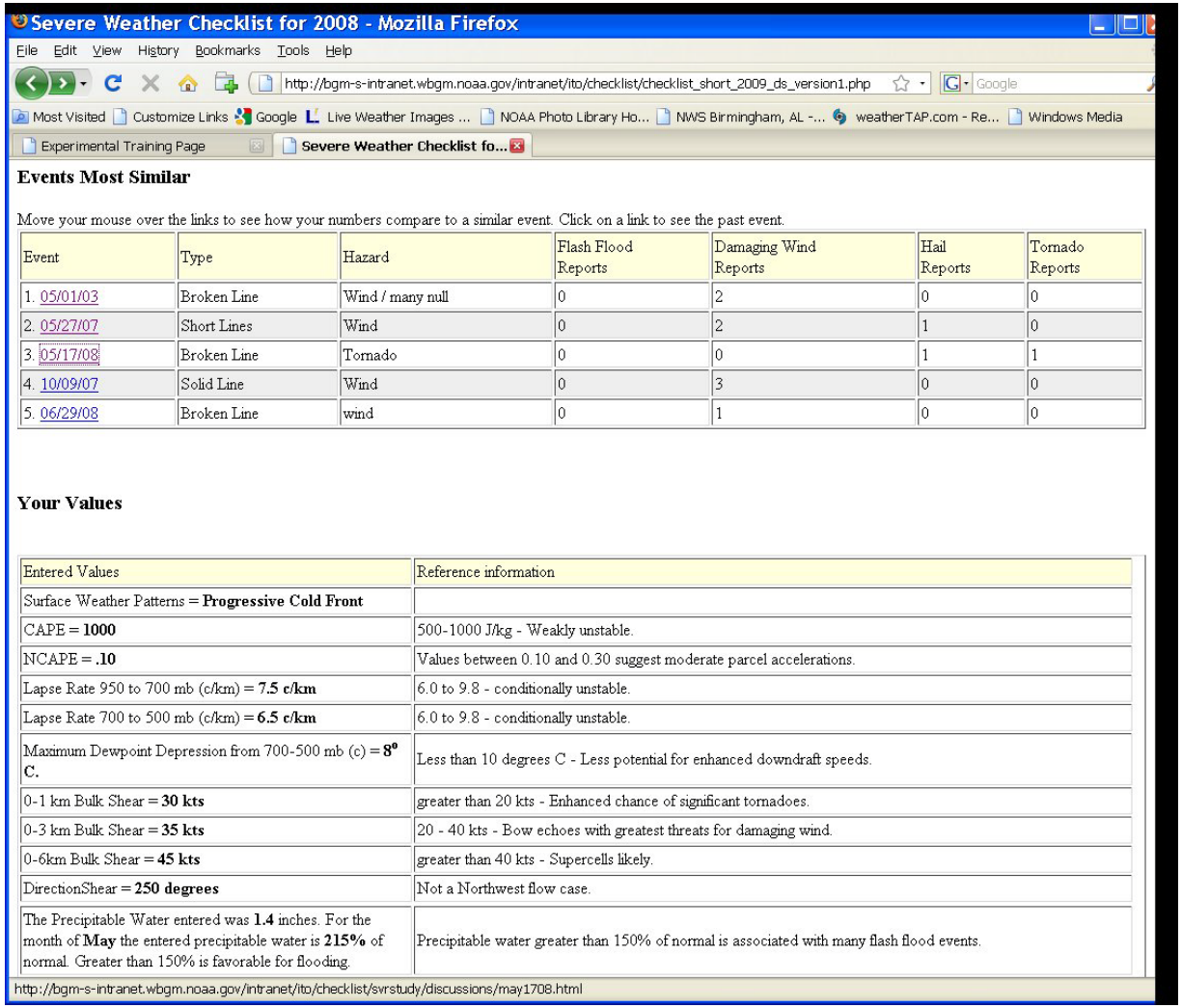








Severe Weather Checklist



Severe Weather Checklist for 2008 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://bgm-s-intranet.wbgm.noaa.gov/intranet/ito/checklist/checklist_short_2009_ds_version1.php

Most Visited | Customize Links | Google | Live Weather Images ... | NOAA Photo Library Ho... | NWS Birmingham, AL -... | weatherTAP.com - Re... | Windows Media

Experimental Training Page | Severe Weather Checklist fo...

Events Most Similar

Move your mouse over the links to see how your numbers compare to a similar event. Click on a link to see the past event.

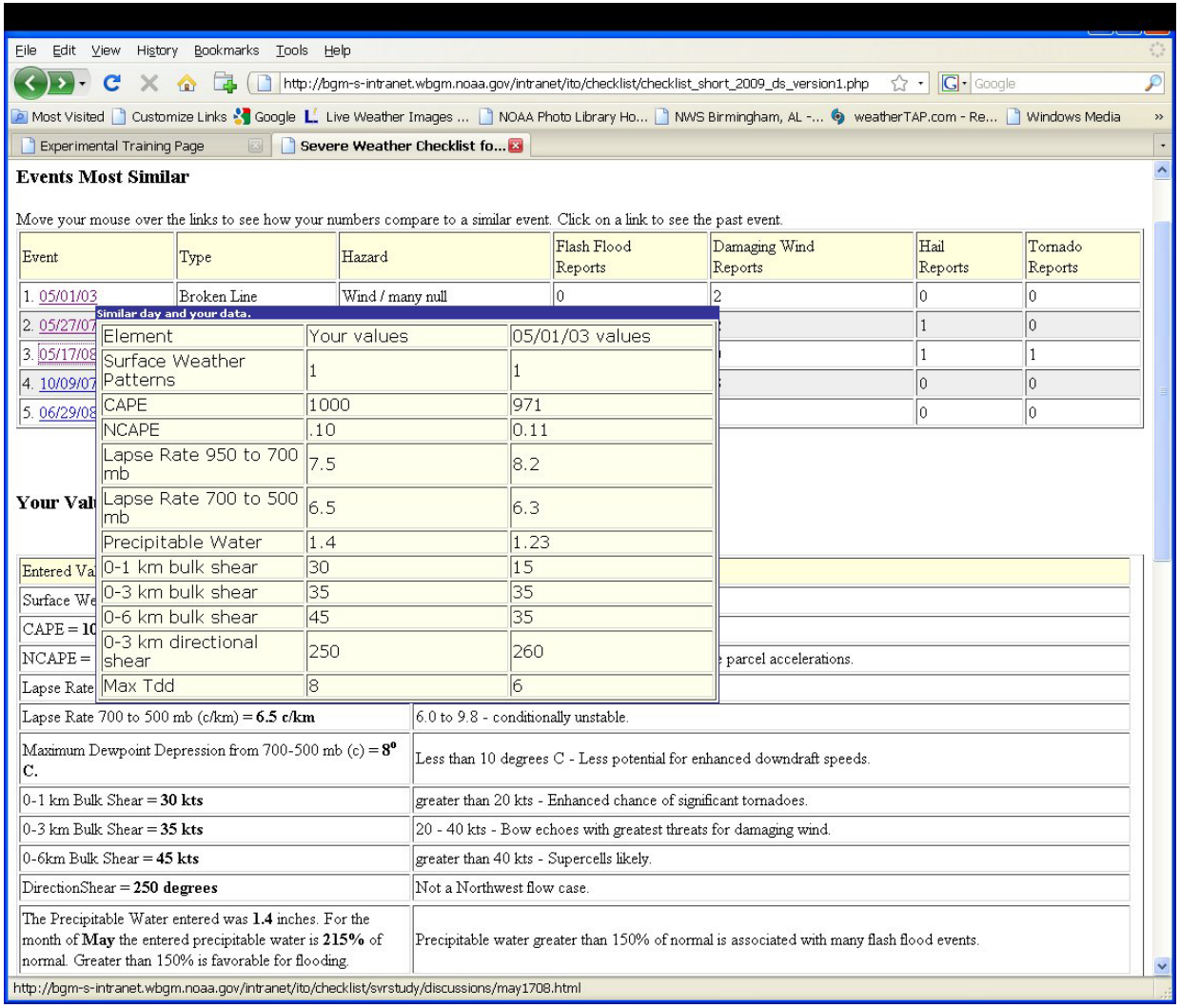
Event	Type	Hazard	Flash Flood Reports	Damaging Wind Reports	Hail Reports	Tornado Reports
1. 05/01/03	Broken Line	Wind / many null	0	2	0	0
2. 05/27/07	Short Lines	Wind	0	2	1	0
3. 05/17/08	Broken Line	Tornado	0	0	1	1
4. 10/09/07	Solid Line	Wind	0	3	0	0
5. 06/29/08	Broken Line	wind	0	1	0	0

Your Values

Entered Values	Reference information
Surface Weather Patterns = **Progressive Cold Front**	
CAPE = **1000**	500-1000 J/kg - Weakly unstable.
NCAPE = **.10**	Values between 0.10 and 0.30 suggest moderate parcel accelerations.
Lapse Rate 950 to 700 mb (c/km) = **7.5 c/km**	6.0 to 9.8 - conditionally unstable.
Lapse Rate 700 to 500 mb (c/km) = **6.5 c/km**	6.0 to 9.8 - conditionally unstable.
Maximum Dewpoint Depression from 700-500 mb (c) = **8° C.**	Less than 10 degrees C - Less potential for enhanced downdraft speeds.
0-1 km Bulk Shear = **30 kts**	greater than 20 kts - Enhanced chance of significant tornadoes.
0-3 km Bulk Shear = **35 kts**	20 - 40 kts - Bow echoes with greatest threats for damaging wind.
0-6km Bulk Shear = **45 kts**	greater than 40 kts - Supercells likely.
DirectionShear = **250 degrees**	Not a Northwest flow case.
The Precipitable Water entered was **1.4** inches. For the month of **May** the entered precipitable water is **215%** of normal. Greater than 150% is favorable for flooding.	Precipitable water greater than 150% of normal is associated with many flash flood events.

http://bgm-s-intranet.wbgm.noaa.gov/intranet/ito/checklist/svrstudy/discussions/may1708.html

Similar historical event – high CAPE



File Edit View History Bookmarks Tools Help

http://bgm-s-intranet.wbgm.noaa.gov/intranet/ito/checklist/checklist_short_2009_ds_version1.php

Most Visited | Customize Links | Google | Live Weather Images ... | NOAA Photo Library Ho... | NWS Birmingham, AL -... | weatherTAP.com - Re... | Windows Media

Experimental Training Page | Severe Weather Checklist fo...

Events Most Similar

Move your mouse over the links to see how your numbers compare to a similar event. Click on a link to see the past event.

Event	Type	Hazard	Flash Flood Reports	Damaging Wind Reports	Hail Reports	Tornado Reports
1. 05/01/03	Broken Line	Wind / many null	0	2	0	0
2. 05/27/07					1	0
3. 05/17/08					1	1
4. 10/09/07					0	0
5. 06/29/08					0	0

Similar day and your data.

Element	Your values	05/01/03 values
Surface Weather Patterns	1	1
CAPE	1000	971
NCAPE	.10	0.11
Lapse Rate 950 to 700 mb	7.5	8.2
Lapse Rate 700 to 500 mb	6.5	6.3
Precipitable Water	1.4	1.23
0-1 km bulk shear	30	15
0-3 km bulk shear	35	35
0-6 km bulk shear	45	35
0-3 km directional shear	250	260
Max Tdd	8	6

Your Vali

Entered Va

Surface We

CAPE = 10

NCAPE =

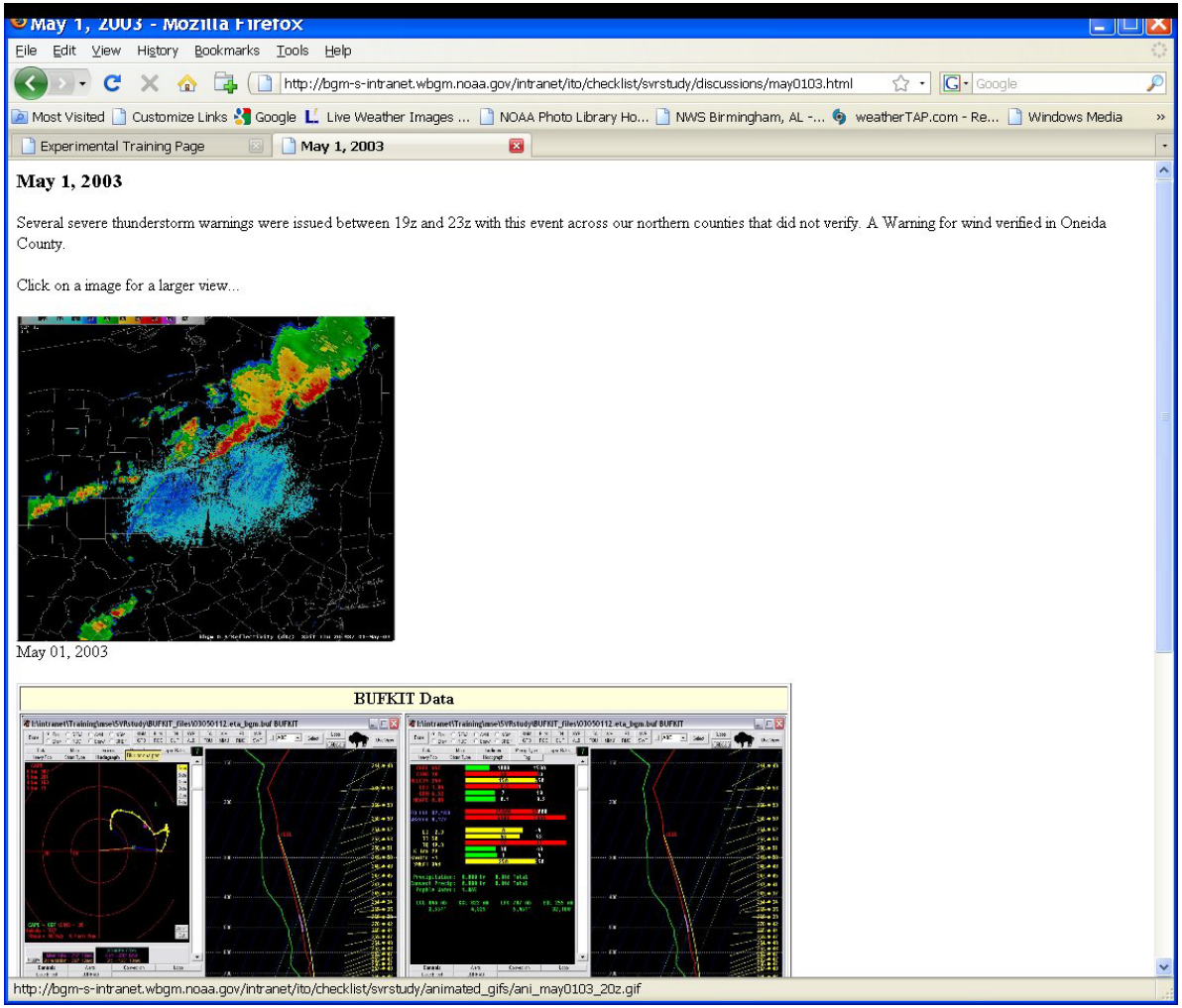
parcel accelerations.

Lapse Rate

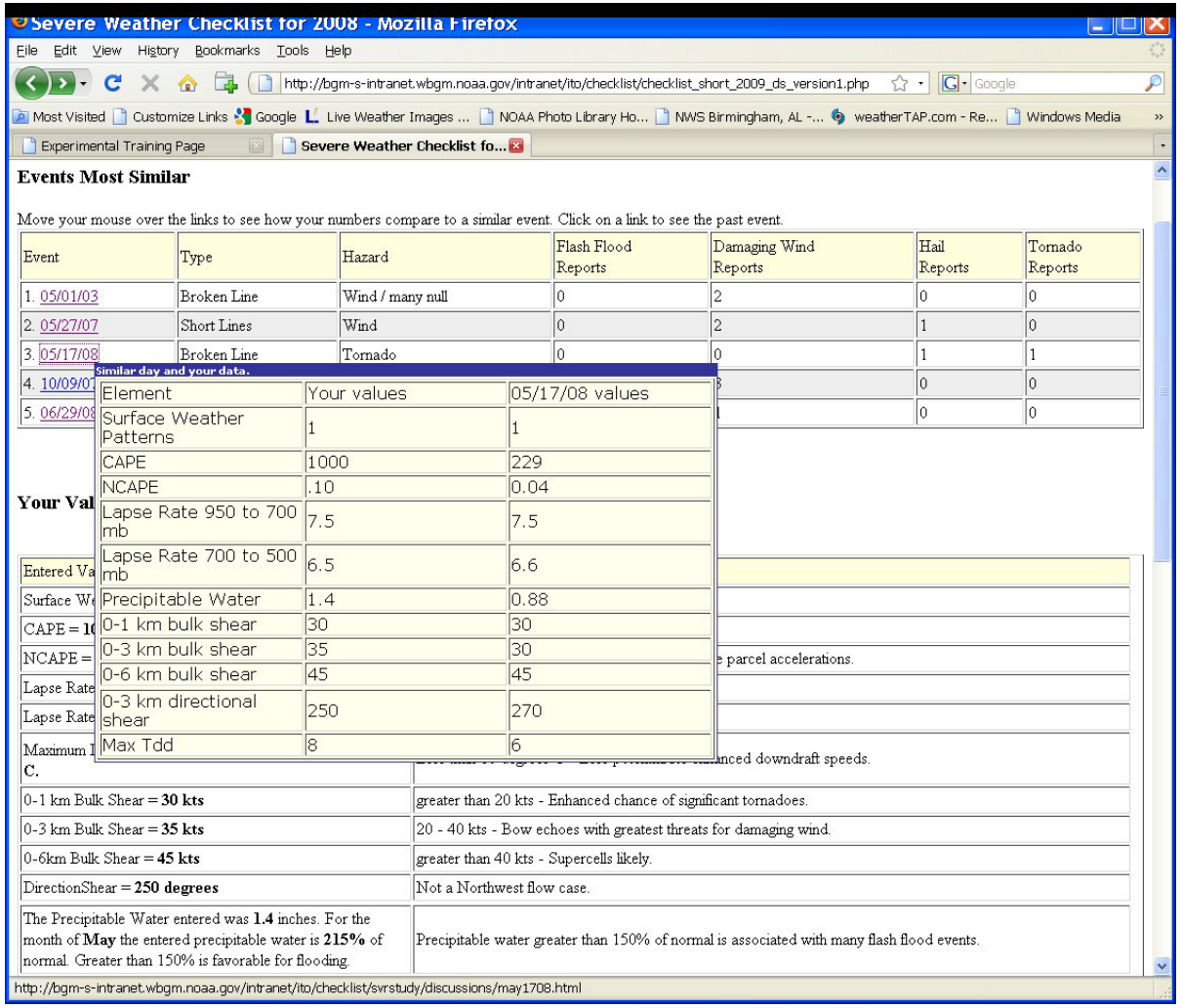
Lapse Rate 700 to 500 mb (c/km) = **6.5 c/km**	6.0 to 9.8 - conditionally unstable.
Maximum Dewpoint Depression from 700-500 mb (c) = **8° C.**	Less than 10 degrees C - Less potential for enhanced downdraft speeds.
0-1 km Bulk Shear = **30 kts**	greater than 20 kts - Enhanced chance of significant tornadoes.
0-3 km Bulk Shear = **35 kts**	20 - 40 kts - Bow echoes with greatest threats for damaging wind.
0-6km Bulk Shear = **45 kts**	greater than 40 kts - Supercells likely.
DirectionShear = **250 degrees**	Not a Northwest flow case.
The Precipitable Water entered was **1.4** inches. For the month of **May** the entered precipitable water is **215%** of normal. Greater than 150% is favorable for flooding.	Precipitable water greater than 150% of normal is associated with many flash flood events.

http://bgm-s-intranet.wbgm.noaa.gov/intranet/ito/checklist/svrstudy/discussions/may1708.html

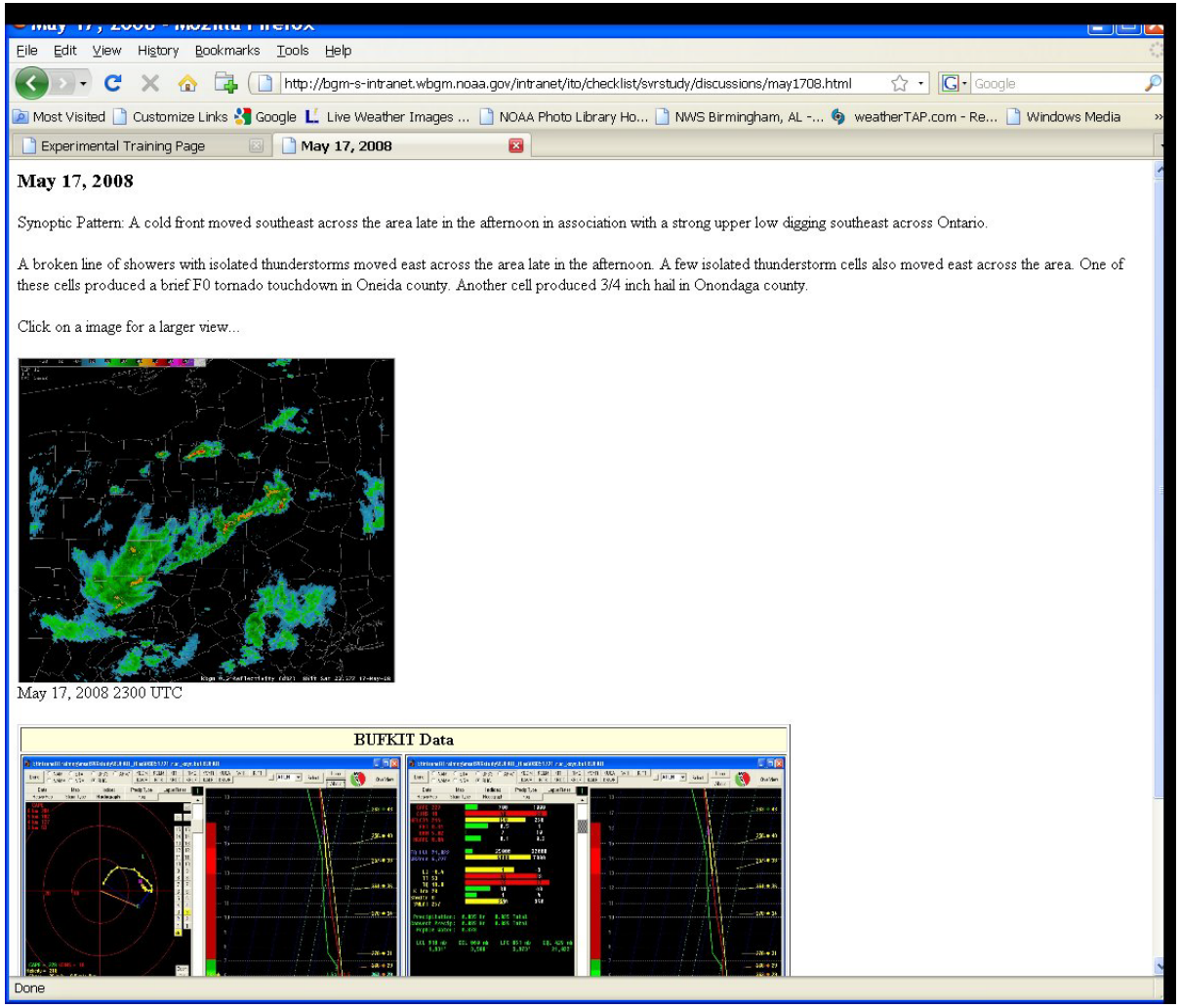
Similar historical event – high CAPE – radar image



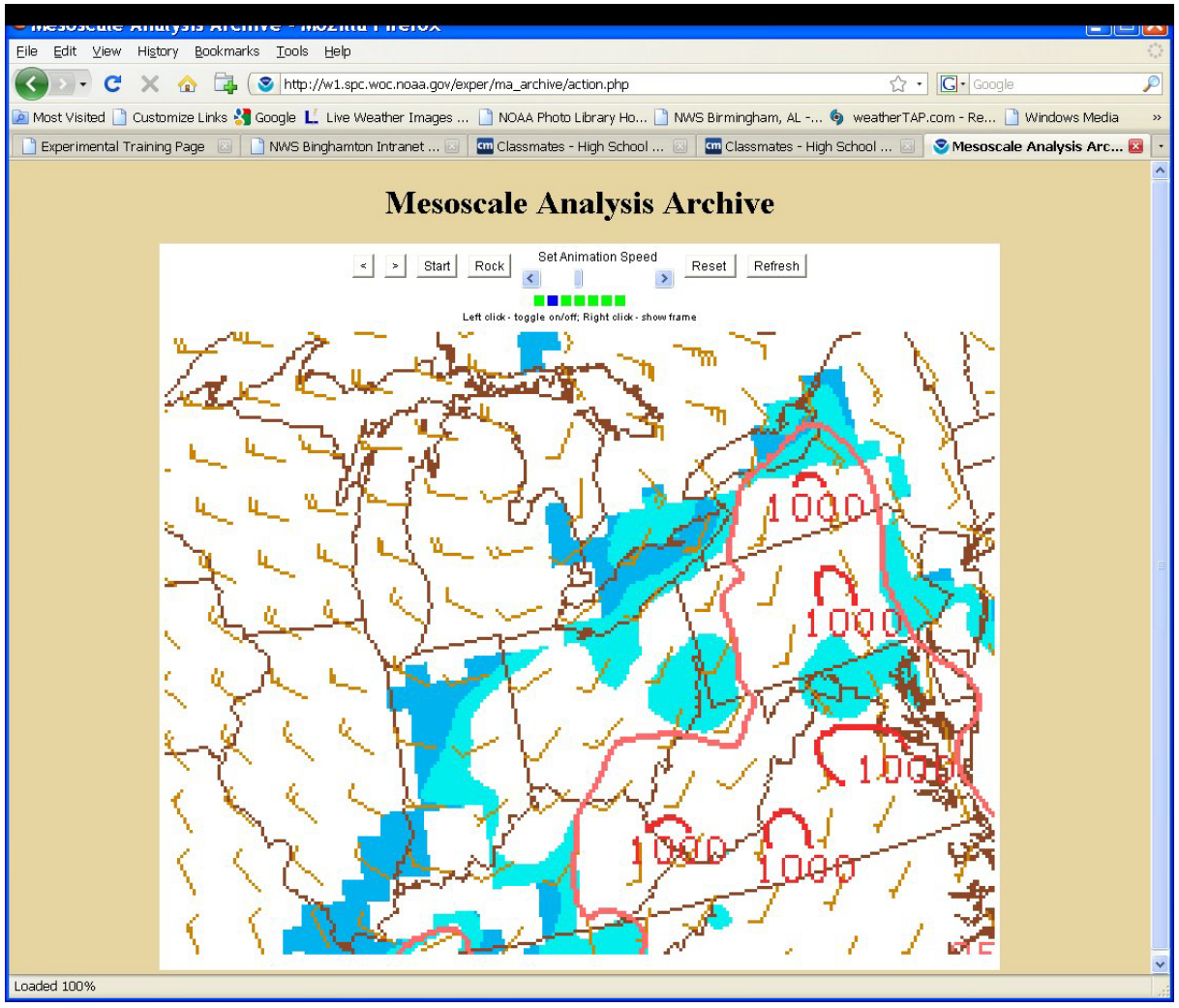
Similar historical event – low CAPE



Similar historical event – low CAPE – radar imagery



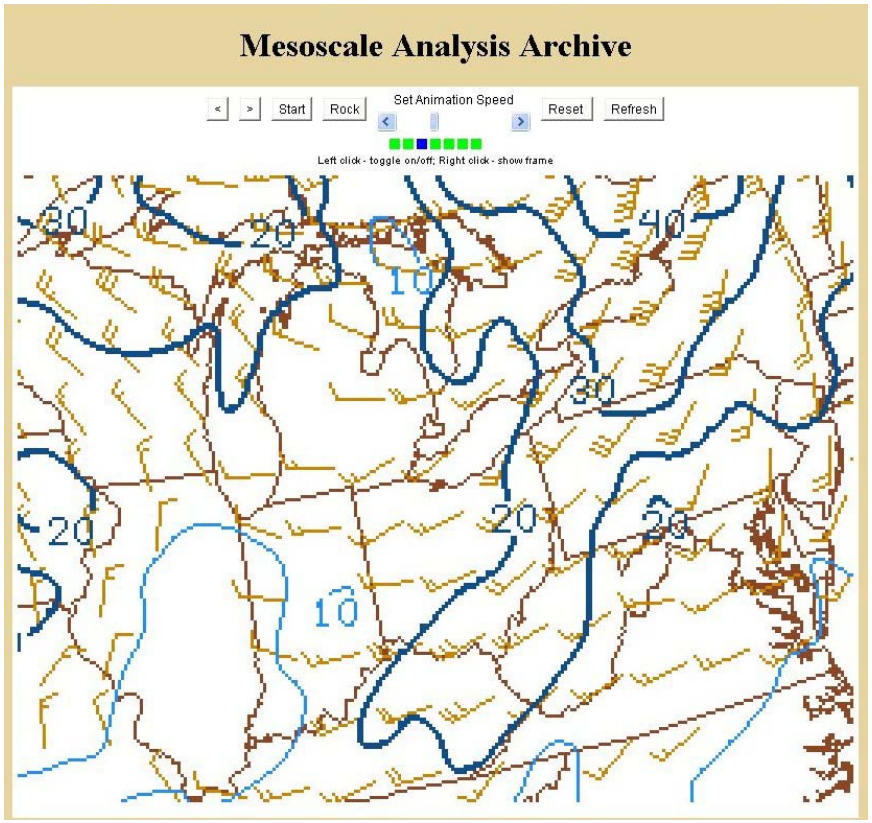
SPC analyzed CAPE – 17z May 16

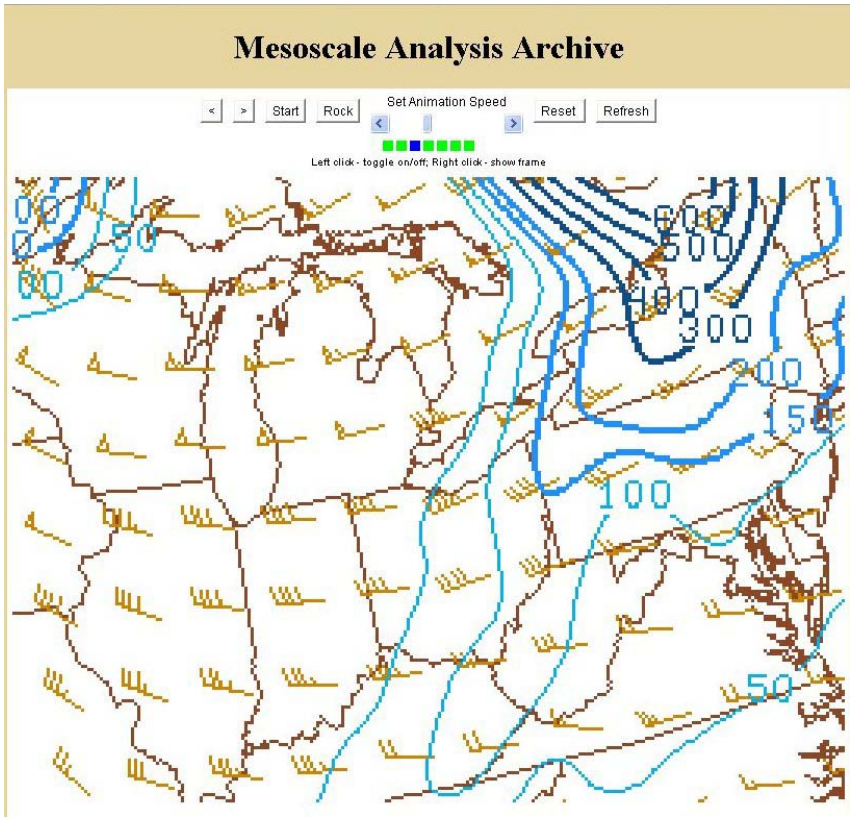


Summary

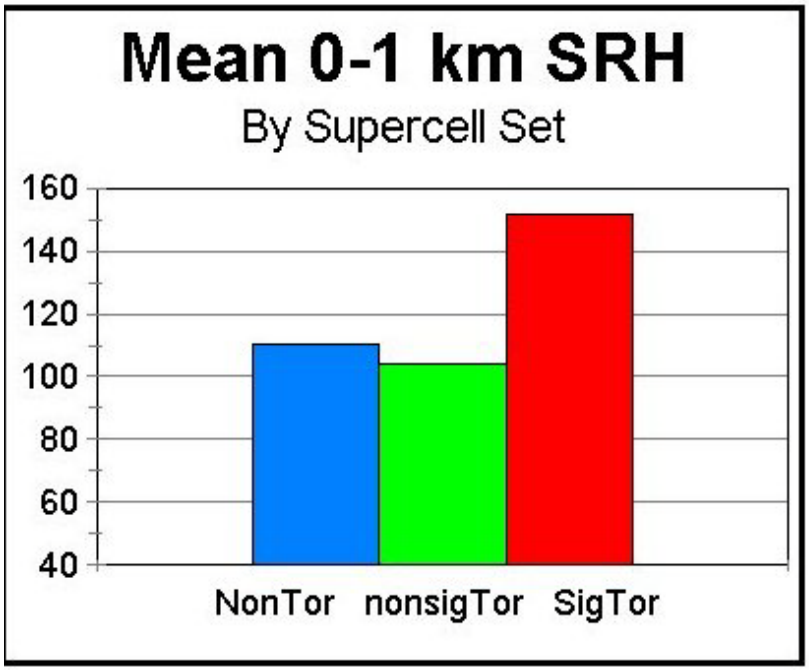
- Anticipating the amount of CAPE available for this event was challenging
- The NAM forecast much less CAPE than the GFS
- The severe checklist and a look at similar historical events indicated that the amount of CAPE would have a large impact on the severity of the event
- Subsequent RUC forecasts and the SPC analysis indicated that the “real” CAPE for this event was about mid-way between the NAM and GFS forecasts

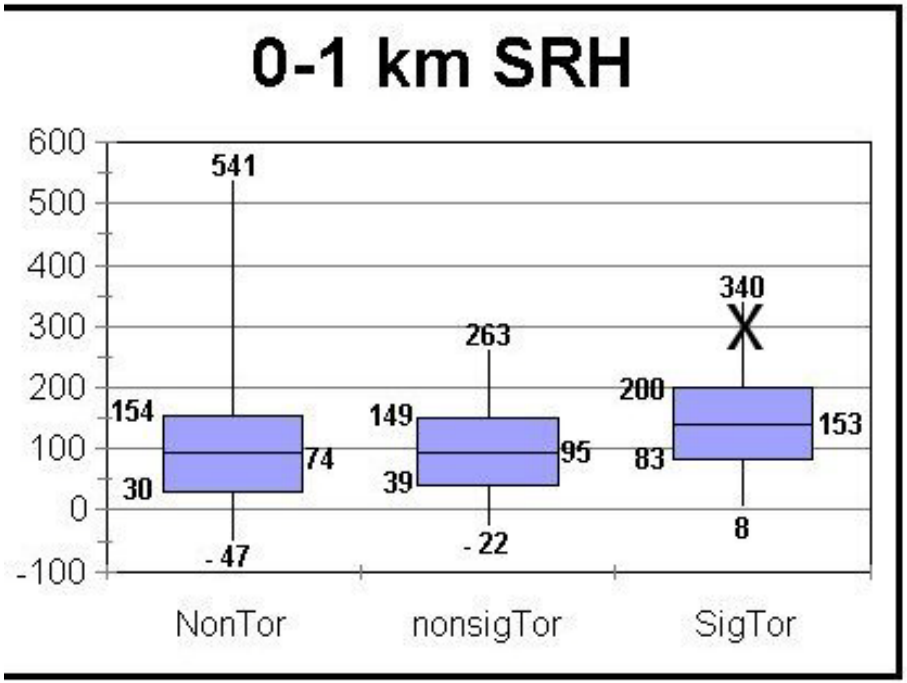
0-1 km shear and SRH



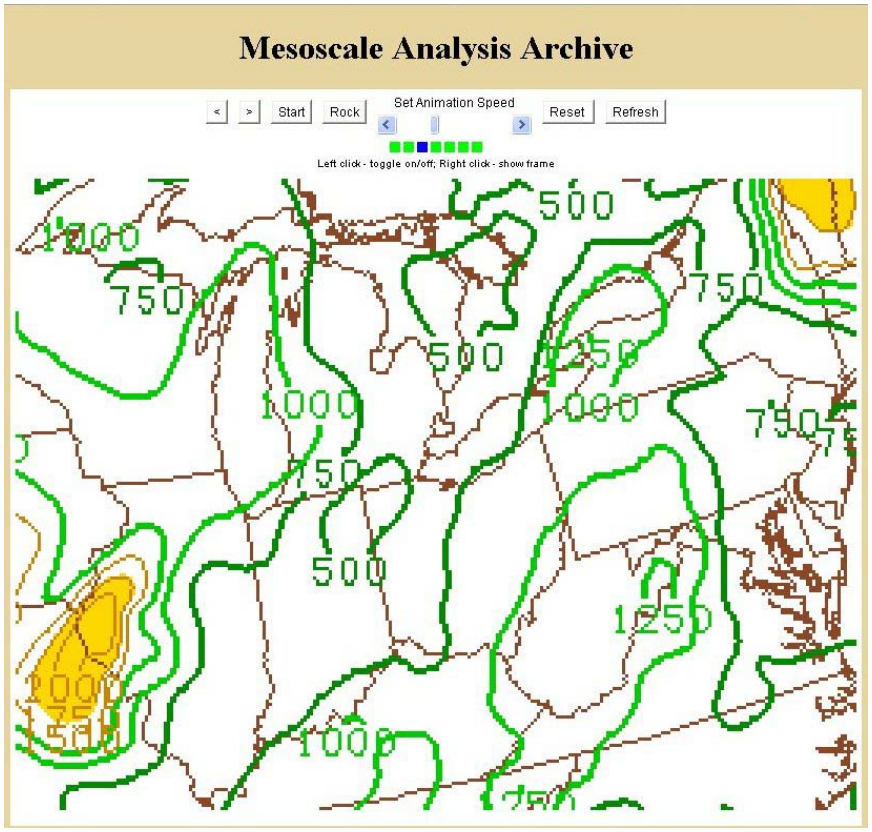


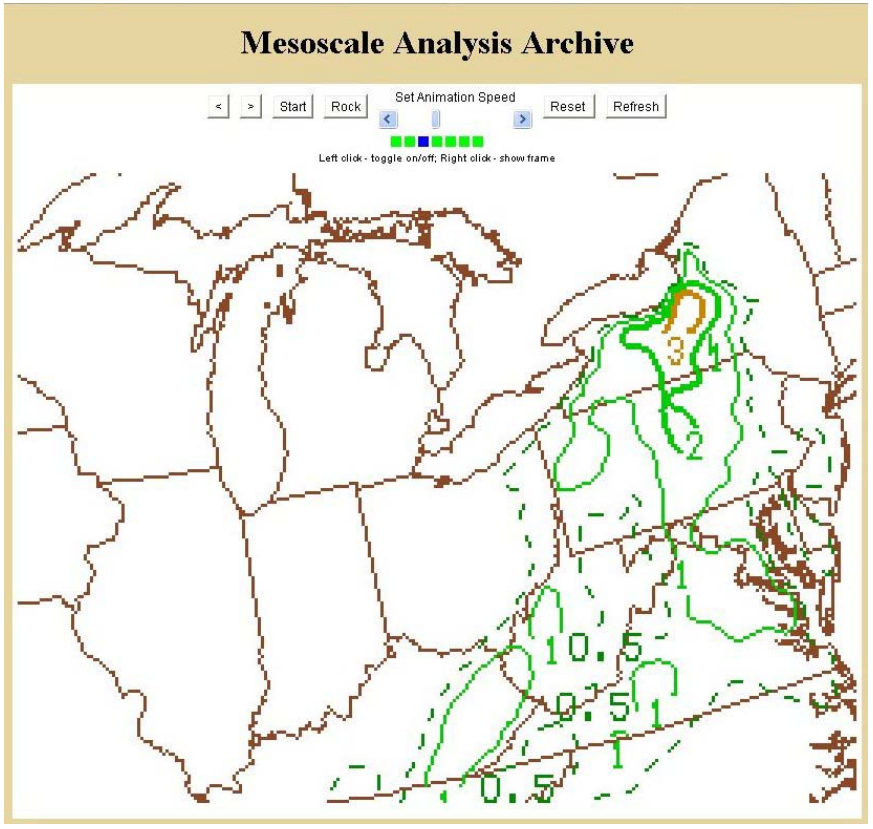
Nomograms – 0-1 km SRH



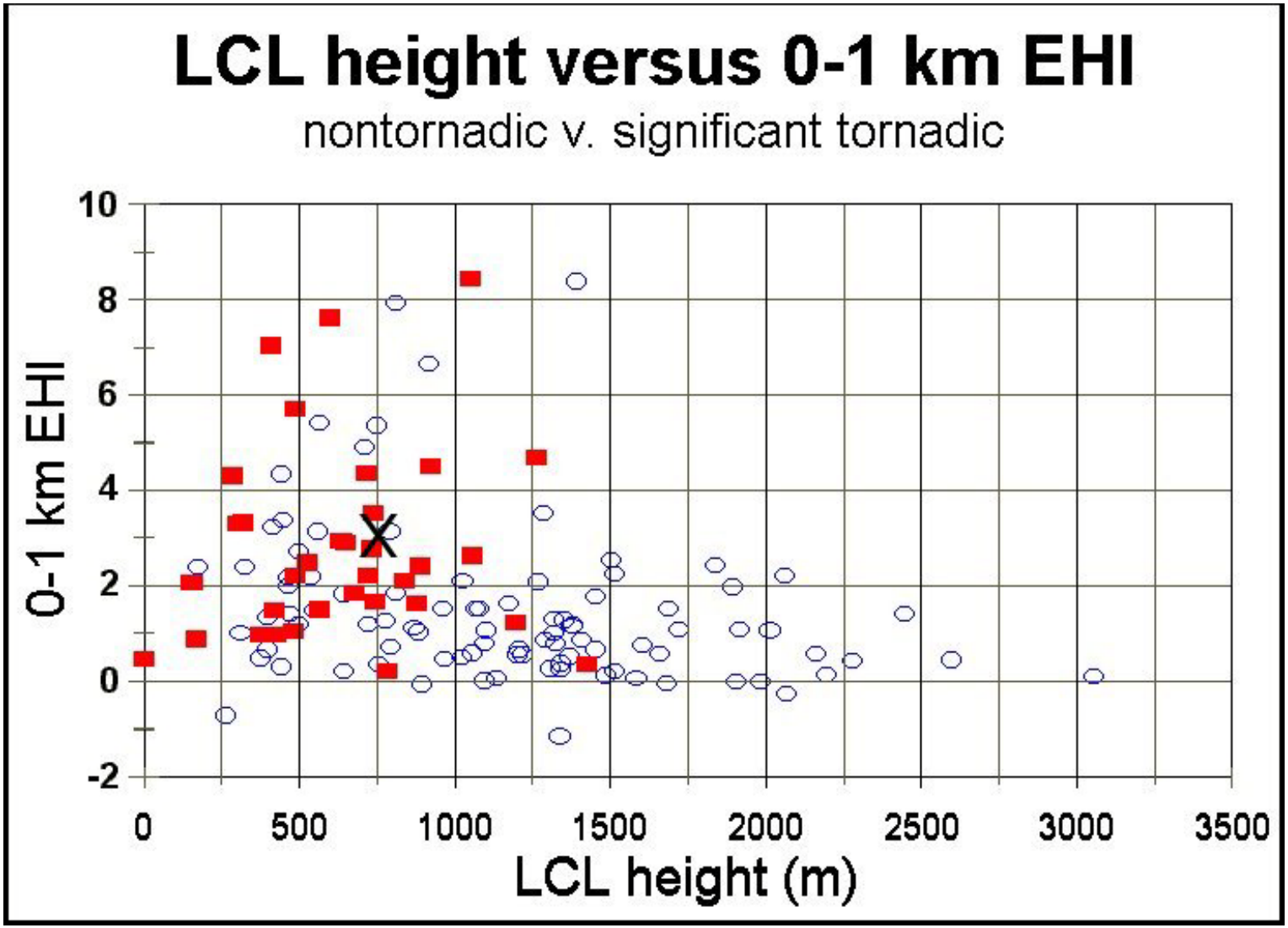


LCL height and 0-1 km EHI

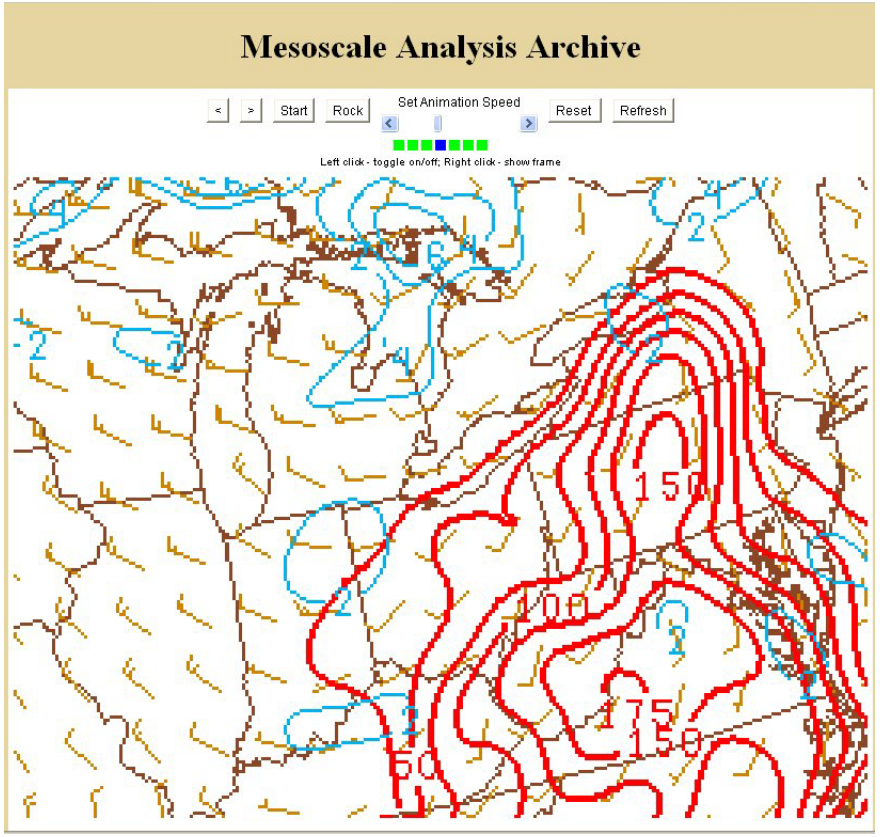


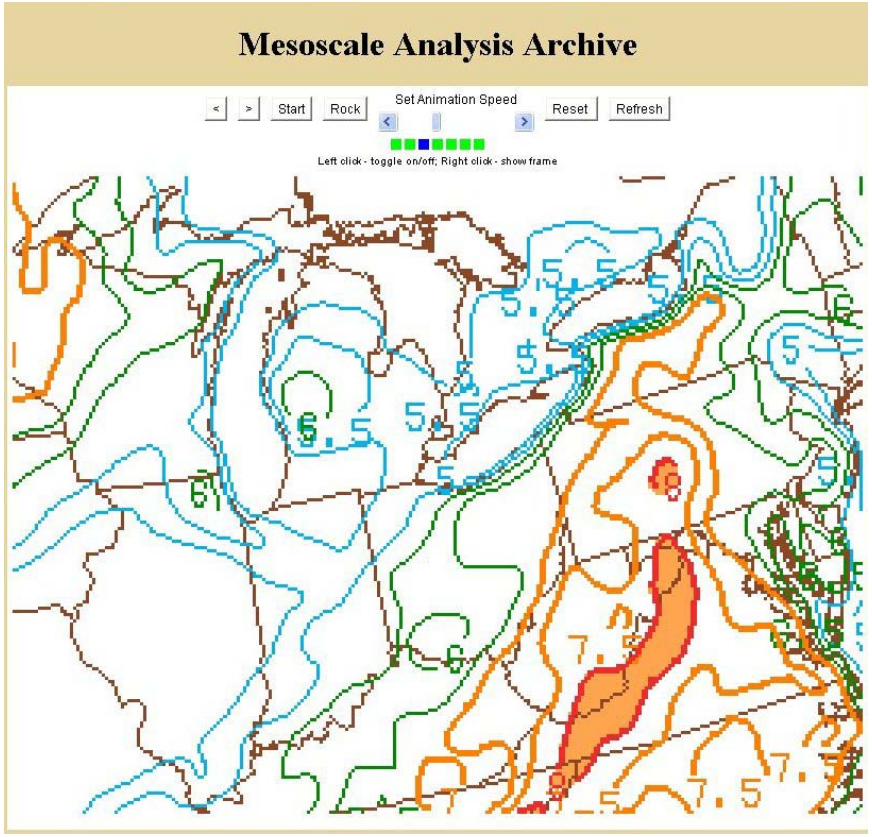


Nomogram – LCL height and 0-1 km EHI

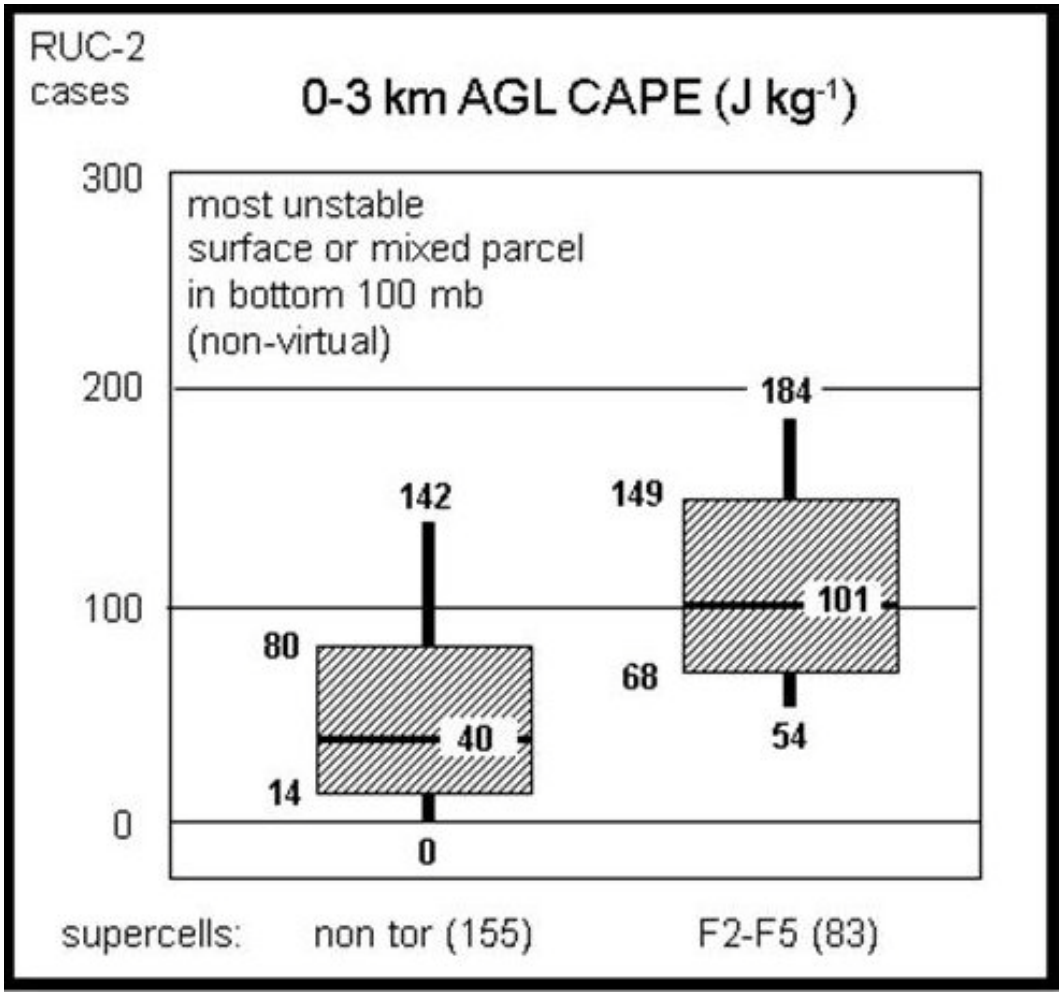


0-3 km CAPE and 0-3 km lapse rate

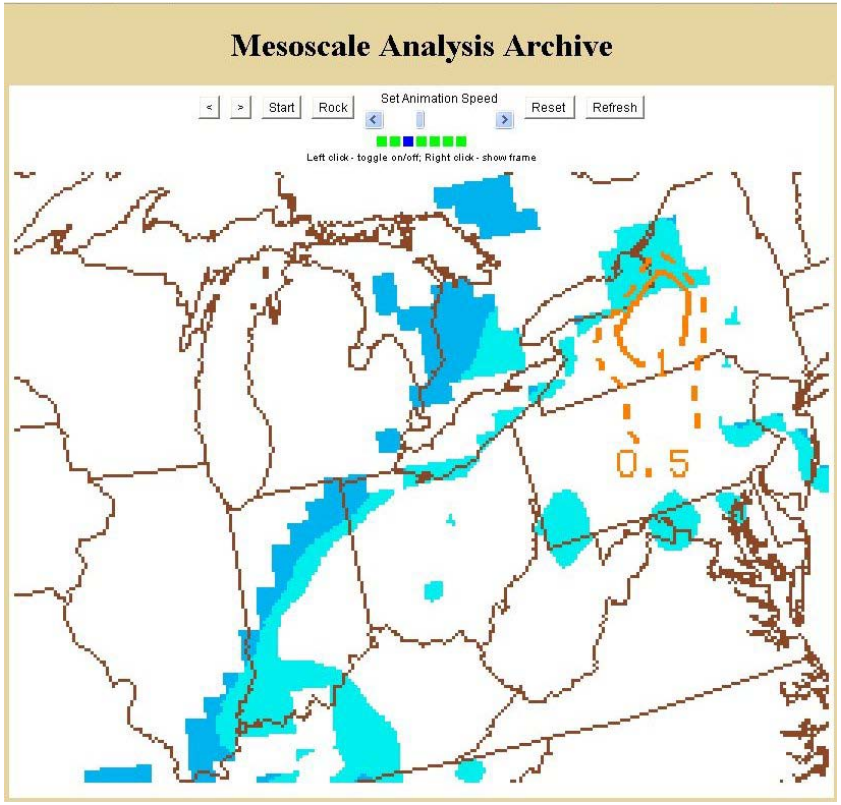


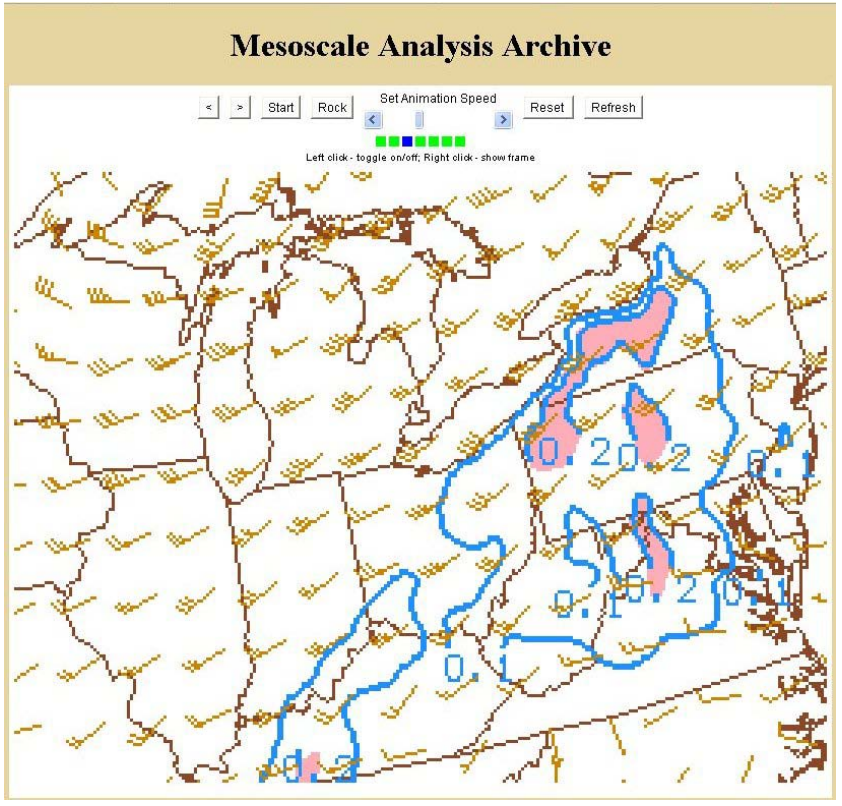


Nomogram – 0-3 km CAPE

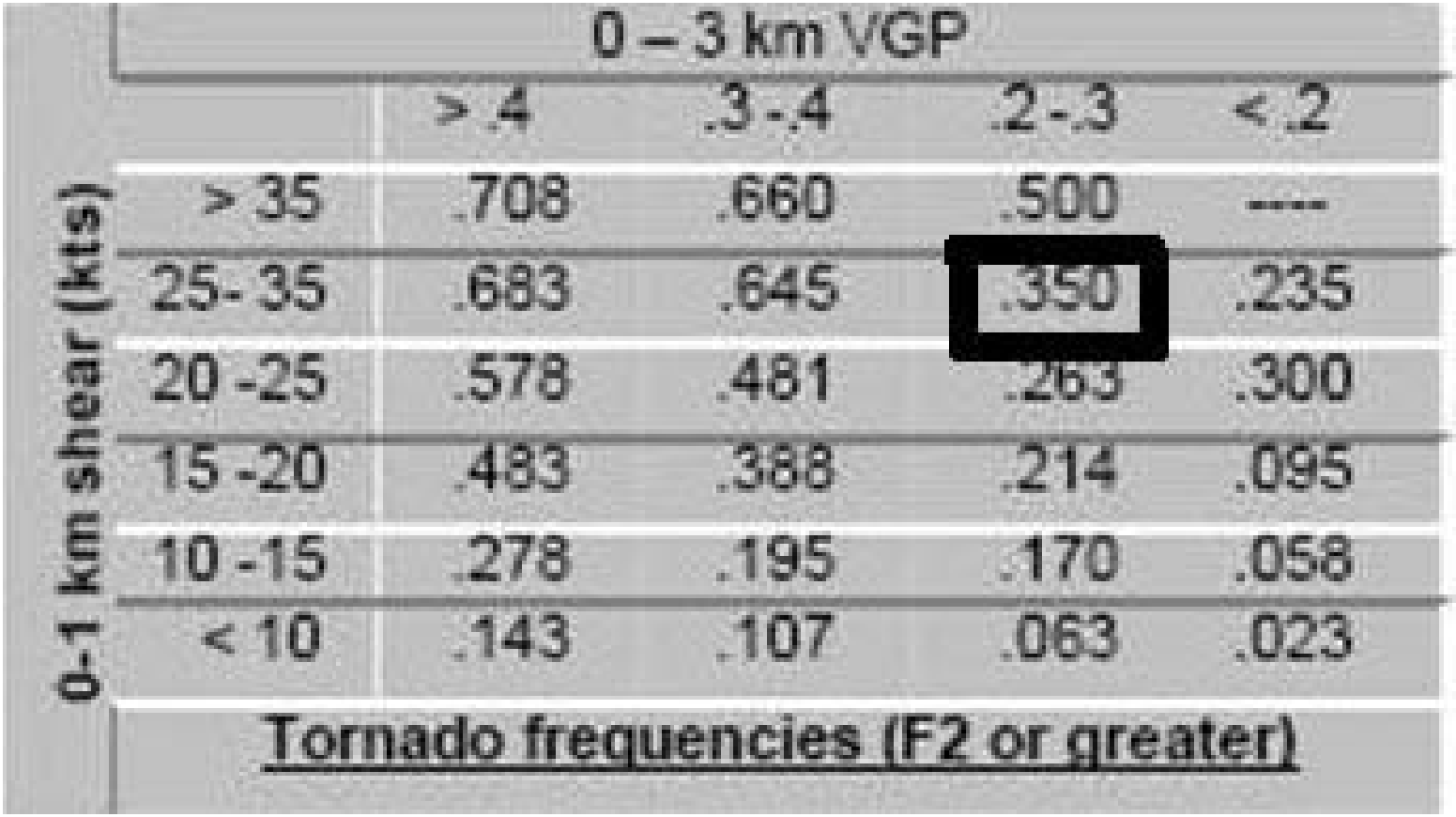


Sig Tor Parameter and 0-3 km VGP





Nomogram – VGP vs. 0-1 km shear



0-1 km shear (kts)	0 – 3 km VGP > .4	.3 -.4	.2 -.3	< .2
> 35	.708	.660	.500	----
25- 35	.683	.645	.350	.235
20 -25	.578	.481	.263	.300
15 -20	.483	.388	.214	.095
10 -15	.278	.195	.170	.058
< 10	.143	.107	.063	.023

Tornado frequencies (F2 or greater)

Summary – The May 16, 2009 central New York tornado event…

- Occurred in an environment with modest mid-upper tropospheric forcing for upward motion
- Occurred along a surface trough, ahead of moderately strong surface cold front
- Occurred in an environment characterized by modest CAPE and strong deep layer shear
- Occurred in an environment characterized by strong low-level shear and low LCL heights, resulting in large values for some severe weather composite indices (such as the significant tornado parameter, EHI and VGP).
- Model differences in CAPE forecasts prior to the event made it difficult to anticipate the event's severity prior to the event onset.

References

- Thompson, R.L., and R. Edwards, 2000: RUC-2 supercell proximity soundings, part II: an independent assessment of supercell forecast parameters., Preprints, 20th AMS Conference on Severe Local Storms, Orlando, Amer. Meteor. Soc.

- Thompson, R.L., R.E. Edwards and C.M. Mead, 2004: An update to the supercell composite and significant tornado parameter., Preprints, 22ndth AMS Conference on Severe Local Storms, Hyannis, Amer. Meteor. Soc.

- Togstad, W.E., S.J. Taylor and J.L. Peters, 2004: An examination of severe thunderstorm discrimination skills from traditional Doppler radar parameters and near storm environment (NSE) factors at large radar range., Preprints, 22nd AMS Conference on Severe Local Storms, Amer. Meteor. Soc.