

# The July 8, 2014 Significant Severe Weather Event in Central New York and Northeast Pennsylvania

## Part 1: The Convective Environment, Pre-event Forecasting Challenges and Tools

Mike Evans  
WFO Binghamton, NY

23<sup>rd</sup> Annual Great Lake Operational Meteorology Workshop  
August 25-27, 2015

# A Rare Severe Weather and Tornado Event in Central New York and Northeast Pennsylvania: July 8, 2014

- 6 Tornadoes and numerous severe reports.
- First tornado fatalities in our county warning area since 1998.
- A mix of tornadic and non-tornadic supercells.
- Fatalities occurred with a relatively subtle Bookend Vortex Signature.



Damage near Smithfield, NY

# Forecasting and warning factors

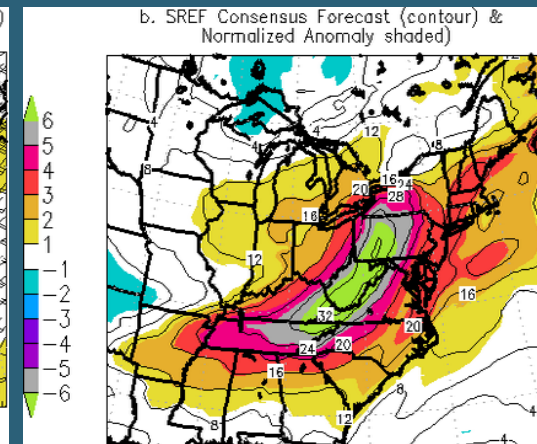
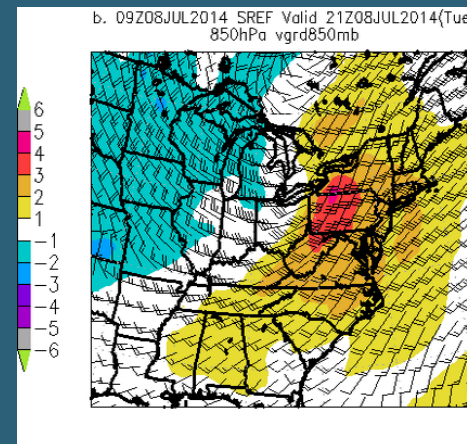
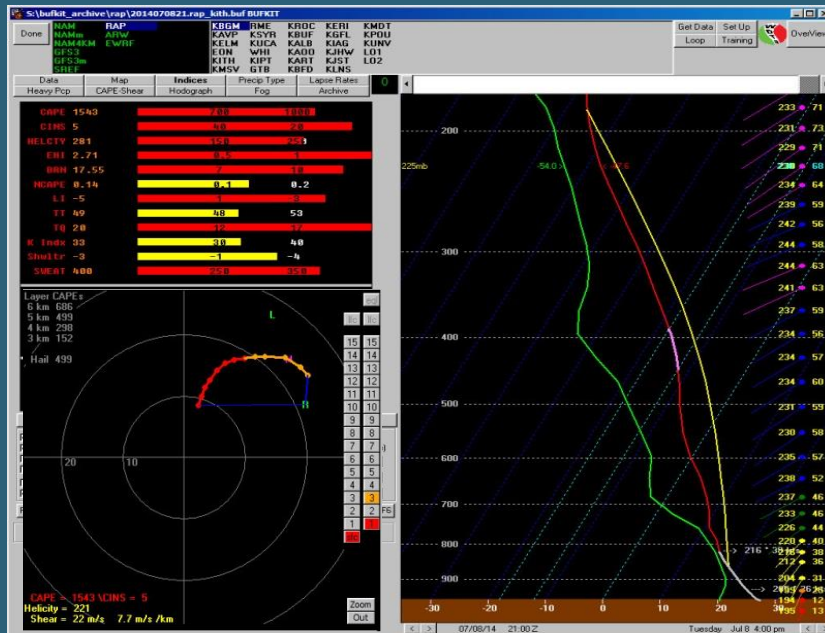
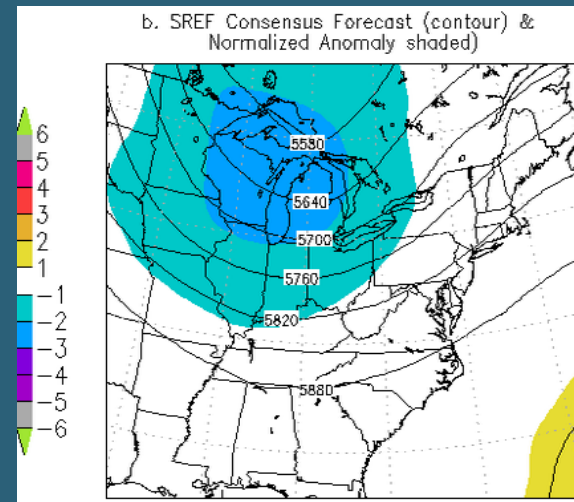
- New tools helped forecasters to anticipate the evolution and magnitude of the event.
- Dual polarization data may have been helpful to discriminate between tornadic vs. non-tornadic storms.



Damage near Smithfield, NY

# Synoptic Setup

- Trough and cold front approach from the west.
- Large low-level wind anomalies.
- Degree of instability was in question.

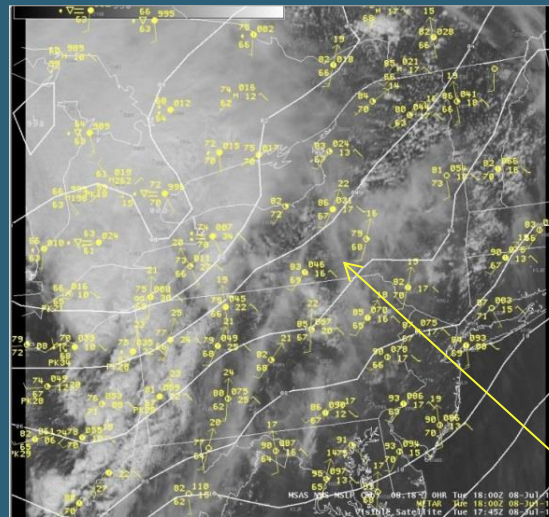


SREF 500 mb hts (top), 850 v wind (left) and 850 moisture flux (right) and anomalies valid 21z  
 (courtesy WFO CTP → <http://cms.met.psu.edu/sref/ensembles/>)

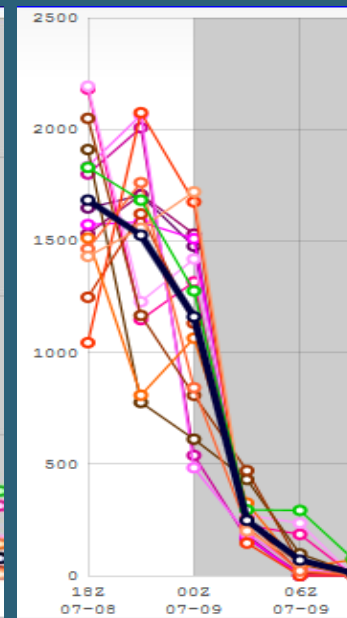
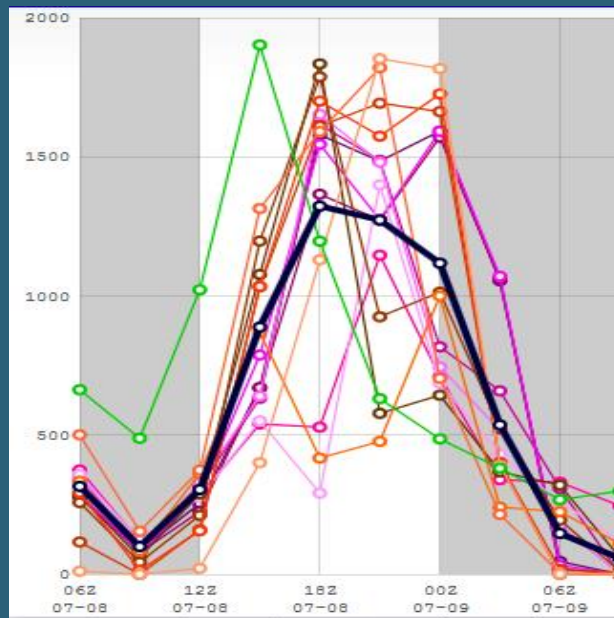
00-h RAP sounding valid 21z at ITH

# Instability forecast trends

- Potential limit to instability: dense cloud cover ahead of the cold front.
- Mean 03Z SREF MLCAPE at BGM  $\sim 1200$  J/kg with lots of spread.
- Mean 15Z SREF MLCAPE at BGM increased to over 1500 J/kg with less spread.



Visible satellite and surface plot at 18Z



SREF MLCAPE plume at BGM (03Z run left, 15Z run right)

# WFO Binghamton Severe Weather Analog System



Move your mouse pointer over the question marks for popup information. The icon will change if there is more information available.

Parameters	Entry	References	Where to find?
Surface Weather Patterns =	Progressive Cold Front <input type="button" value="v"/>		
12 hour 500 mb height falls (m) = Values of falling heights should be positive.	<input type="text"/>		
Mixed Layer CAPE =	<input type="text"/>		
CIN =	<input type="text"/>		
Lapse Rate 950 to 700 mb (c/km) =	<input type="text"/>		
Lapse rate 700 to 500 mb (c/km) =	<input type="text"/>		
Maximum Dewpoint Depression from 700-500 mb (c) =	<input type="text"/>		
0-1 km Helicity =	<input type="text"/>		
0-1 km bulk shear (in knots) =	<input type="text"/>		
0-3 km bulk shear (in knots) =	<input type="text"/>		
0-6 km bulk shear (in knots) =	<input type="text"/>		
0-3 km directional shear vector (in degrees) =	<input type="text"/>		
EL storm relative flow (knots) =	<input type="text"/>		
Enter the Precipitable Water. (inches)	<input type="text"/>		
Enter the Soil Moisture.	<input type="text"/>		

## Related Information

- [To the long checklist.](#)
- [Past checklists.](#)

# Use MLCAPE = 1300 J/kg

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	All Hail Reports	Hail 1" or greater	Tornado Reports
1. <a href="#">7/29/2010</a>	Broken Line	wind	0	6	0	0	0
2. <a href="#">8/16/2010</a>	Broken Line	wind / hail	0	4	3	1	0
3. <a href="#">6/2/2013</a>	Short Lines	wind	0	5	0	1	0
4. <a href="#">6/10/2008</a>	Isolated Supercells	Wind / hail	0	11	4	2	0
5. <a href="#">7/26/2011</a>	Short Lines	wind / hail / tornado	0	17	13	12	1

**Alert: Parameters are favorable for tornadic supercells, also Dave - watch out for those pesky mini-supercells!**

## Your Values

Entered Values	Reference information
Surface Weather Patterns = <b>Progressive Cold Front</b>	
12 Hour 500 mb Height Falls = <b>20 m</b>	Weak upper forcing.
CAPE = <b>1300</b>	1000-2500 J/kg - Moderately unstable.
CIN = <b>0</b>	Less than 10 - No significant inhibition.
Lapse Rate 950 to 700 mb (c/km) = <b>7.5 c/km</b>	6.0 to 9.8 - conditionally unstable.
Lapse Rate 700 to 500 mb (c/km) = <b>5.5 c/km</b>	Less than 6.0 - stable.
Maximum Dewpoint Depression from 700-500 mb (c) = <b>10 ° C.</b>	Greater than 10 degrees C - significant potential for enhanced downdraft speeds.
0-1 km Helicity = <b>150</b>	Above the threshold for a favorable tornado day. IT'S CLOBBERIN TIME!
0-1 km Bulk Shear = <b>30 kts</b>	greater than 20 kts - Enhanced chance of significant tornadoes.
0-3 km Bulk Shear = <b>40 kts</b>	20 - 40 kts - Bow echoes with greatest threats for damaging wind.
0-6km Bulk Shear = <b>50 kts</b>	greater than 40 kts - Supercells likely.
DirectionShear = <b>240 degrees</b>	Not a Northwest flow case.
EL Storm Relative Flow = <b>25 kts</b>	Weak storm relative winds, less than 35 kts, at the equilibrium level favor <b>wind</b> over hail.
The Precipitable Water entered was <b>1.8 inches</b> . For the month of <b>July</b> the entered precipitable water is <b>171%</b> of normal. Greater than 150% is favorable for flooding.	Precipitable water greater than 150% of normal is associated with many flash flood events.

# Use MLCAPE = 1700 J/kg

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	All Hail Reports	Hail 1" or greater	Tornado Reports
1. <a href="#">6/10/2008</a>	Isolated Supercells	Wind / hail	0	11	4	2	0
2. <a href="#">7/21/2010</a>	cluster of storms	wind / hail	0	24	44	23	0
3. <a href="#">7/26/2012</a>	Solid Line	tornadoes / wind	0	32	2	1	7
4. <a href="#">7/29/2011</a>	cluster of storms	wind / tornadoes	0	10	0	0	3
5. <a href="#">7/29/2010</a>	Broken Line	wind	0	6	0	0	0

**Alert: Parameters are favorable for tornadic supercells!**

## Your Values

Entered Values	Reference information
Surface Weather Patterns = <b>Progressive Cold Front</b>	
12 Hour 500 mb Height Falls = <b>20 m</b>	Weak upper forcing.
CAPE = <b>1700</b>	1000-2500 J/kg - Moderately unstable.
CIN = <b>0</b>	Less than 10 - No significant inhibition.
Lapse Rate 950 to 700 mb (c/km) = <b>7.5 c/km</b>	6.0 to 9.8 - conditionally unstable.
Lapse Rate 700 to 500 mb (c/km) = <b>5.5 c/km</b>	Less than 6.0 - stable.
Maximum Dewpoint Depression from 700-500 mb (c) = <b>10 ° C.</b>	Greater than 10 degrees C - significant potential for enhanced downdraft speeds.
0-1 km Helicity = <b>150</b>	Above the threshold for a favorable tornado day. IT'S CLOBBERIN TIME!
0-1 km Bulk Shear = <b>30 kts</b>	greater than 20 kts - Enhanced chance of significant tornadoes.
0-3 km Bulk Shear = <b>40 kts</b>	20 - 40 kts - Bow echoes with greatest threats for damaging wind.
0-6km Bulk Shear = <b>50 kts</b>	greater than 40 kts - Supercells likely.
DirectionShear = <b>240 degrees</b>	Not a Northwest flow case.
EL Storm Relative Flow = <b>25 kts</b>	Weak storm relative winds, less than 35 kts, at the equilibrium level favor <b>wind</b> over hail.
The Precipitable Water entered was <b>1.8</b> inches. For the month of <b>July</b> the entered precipitable water is <b>171%</b> of normal. Greater than 150% is favorable for flooding.	Precipitable water greater than 150% of normal is associated with many flash flood events.



# Comparison

Severe Weather Checklist - Strad...

bgm-fw-intranet2.wbgn.noaa.gov/intranet/fo/checklist/checklist\_short.php

Most Visited 16 National Oceanic and ...

Bookmarks

Search:

Bookmarks Toolbar  
Bookmarks Menu  
Unsorted Bookmarks

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	All Hail Reports	Hail 1" or greater	Tornado Reports
<a href="#">1. 7/21/2010</a>	cluster of storms	wind / hail	0	24	44	23	0
<a href="#">2. 6/10/2008</a>	Isolated Supercells	Wind / hail	0	11	4	2	0
<a href="#">3. 7/26/2012</a>	Solid Line	tornadoes / wind	0	32	2	1	7
<a href="#">4. 7/29/2010</a>	Similar day and your data.						
<a href="#">5. 7/26/2011</a>							
	Element	Your values	7/26/2012 values				
	Surface Weather Patterns	1	1				
	12 Hour 500 mb Height Fall	20	10				
	CAPE	1700	2005				
	CIN	0	5				
	Lapse Rate 950 to 700 mb	7.5	6.7				
	Lapse Rate 700 to 500 mb	6.5	5.9				
	0-1 km Helicity	150	81				
	0-1 km bulk shear	25	20				
	0-3 km bulk shear	40	45				
	0-6 km bulk shear	50	35				
	0-3 km directional shear	240	270				
	Max Tdd	10	7				
	EL Storm Relative Flow	25	16				
	Precipitable Water	1.70	2.14				
	0-6km Bulk Shear = 50 kts		greater than 40 kts - Supercells likely.				
	DirectionShear = 240 degrees		Not a Northwest flow case.				
	EL Storm Relative Flow = 25 kts		Weak storm relative winds, less than 35 kts, at the equilibrium level favor wind over hail.				
	The Precipitable Water entered was 1.70 inches. For the month of July the entered precipitable water is 162% of		Precipitable water greater than 150% of normal is associated with many flash flood events.				

Alert: Para

Your Value

Entered Value

Surface Weather

12 Hour 500 mb

CAPE = 1700

CIN = 0

Lapse Rate 950 to 700 mb

Lapse Rate 700 to 500 mb

0-1 km Helicity

0-1 km bulk shear

Lapse Rate 950 to 700 mb

Lapse Rate 700 to 500 mb

Maximum Directional Shear

10 ° C.

0-1 km Helicity

0-1 km Bulk Shear

0-3 km Bulk Shear

for enhanced downdraft speeds.

IT'S CLOBBERIN TIME!

cannot tornadoes.

or damaging wind.

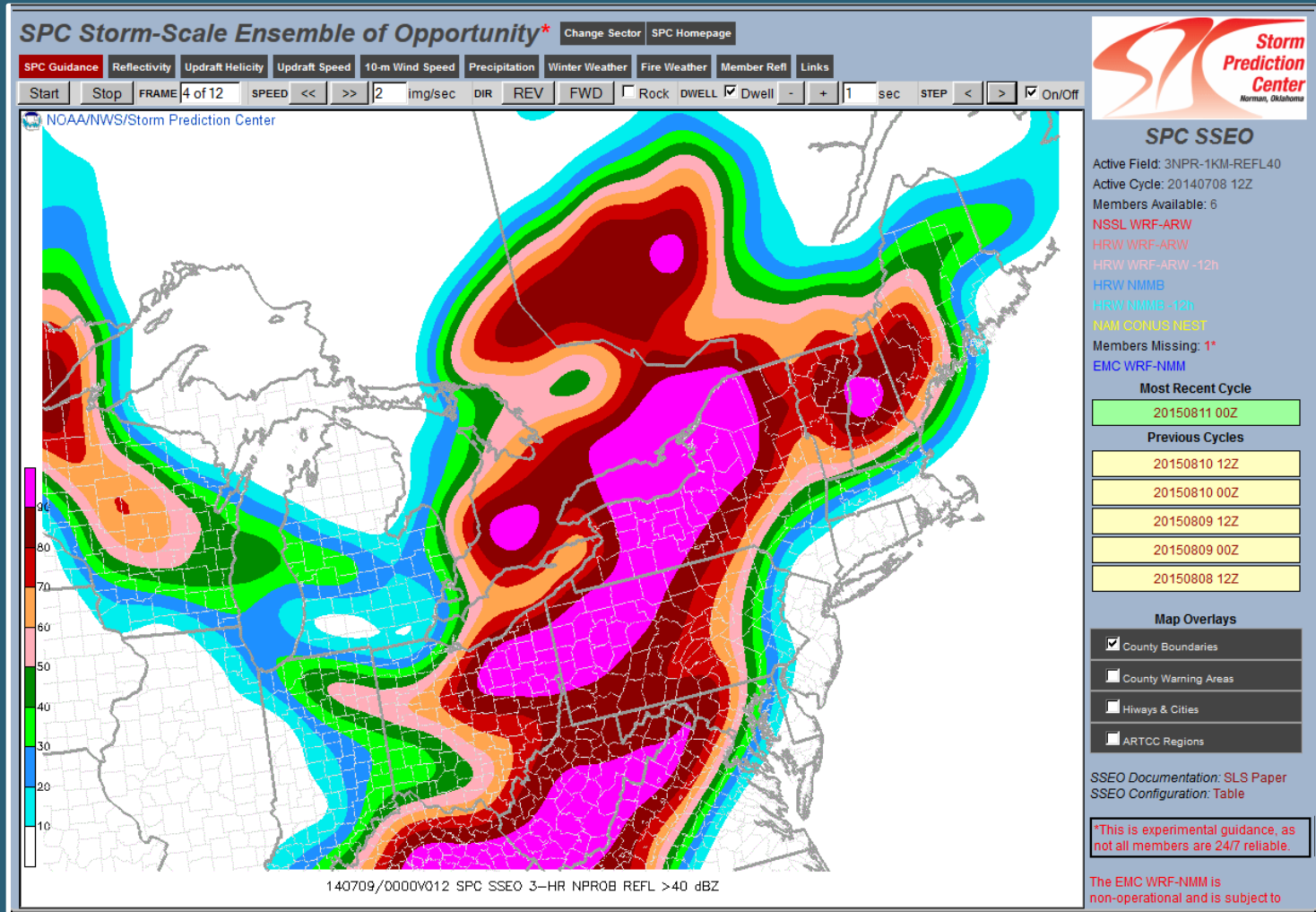
bgm-fw-intranet2.wbgn.noaa.gov/intranet/fo/checklist/svrstudy/discussions/jul2612.html

# SPC Storm-scale ensemble of opportunity

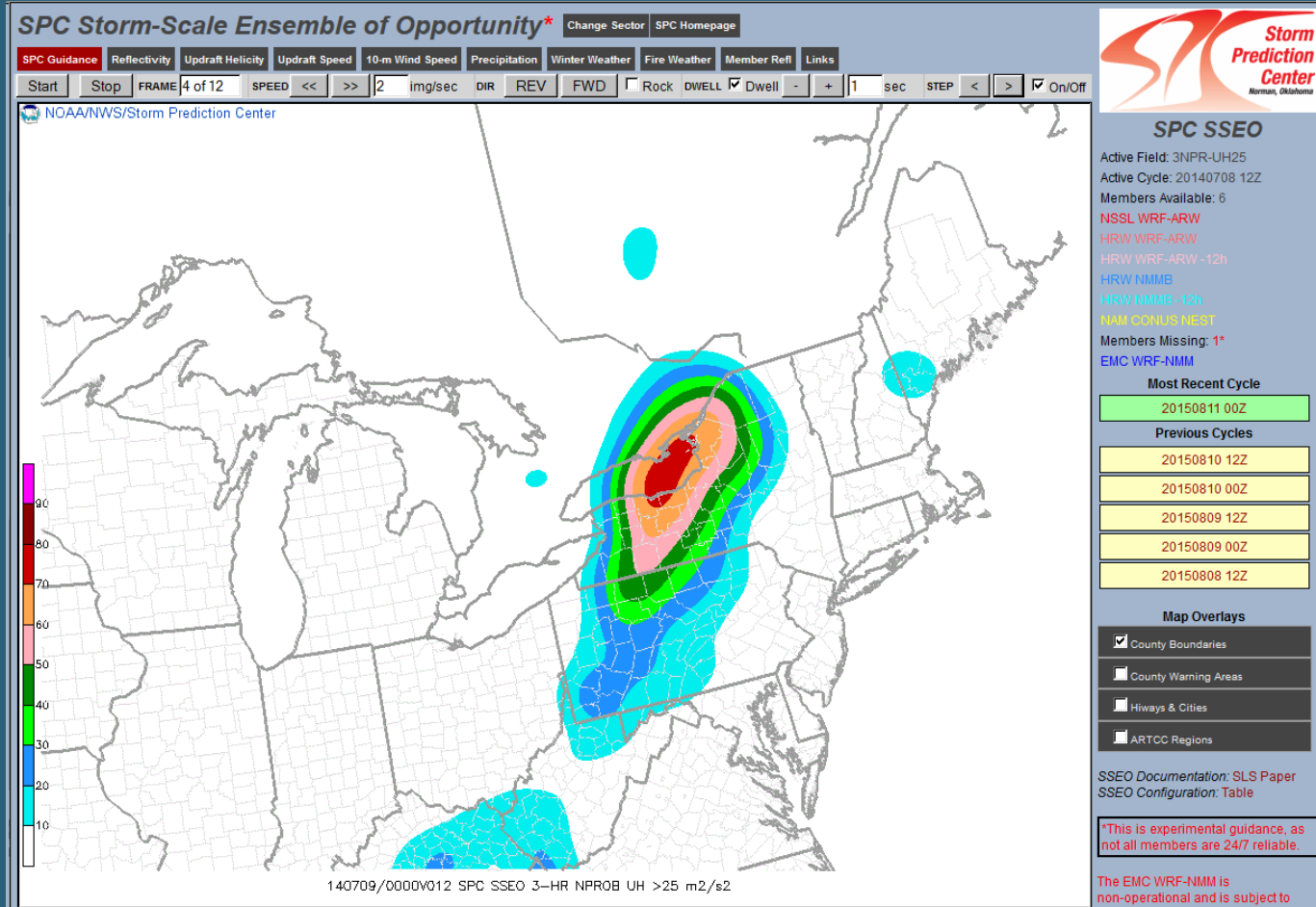
<http://www.spc.noaa.gov/exper/sseo/>

- NSSL WRF-ARW – 4 km
- EMC HRW WRF-ARW – 5.15 km
- EMC HRW WRF-ARW – 5.15 km (time lagged 12 h)
- EMC WRF-NMM – 4 km
- EMC HRW NMMB – 4 km
- EMC HRW NMMB – 4 km (time lagged 12 h)
- NAM CONUS Nest – 4 km

# SPC Storm-scale ensemble

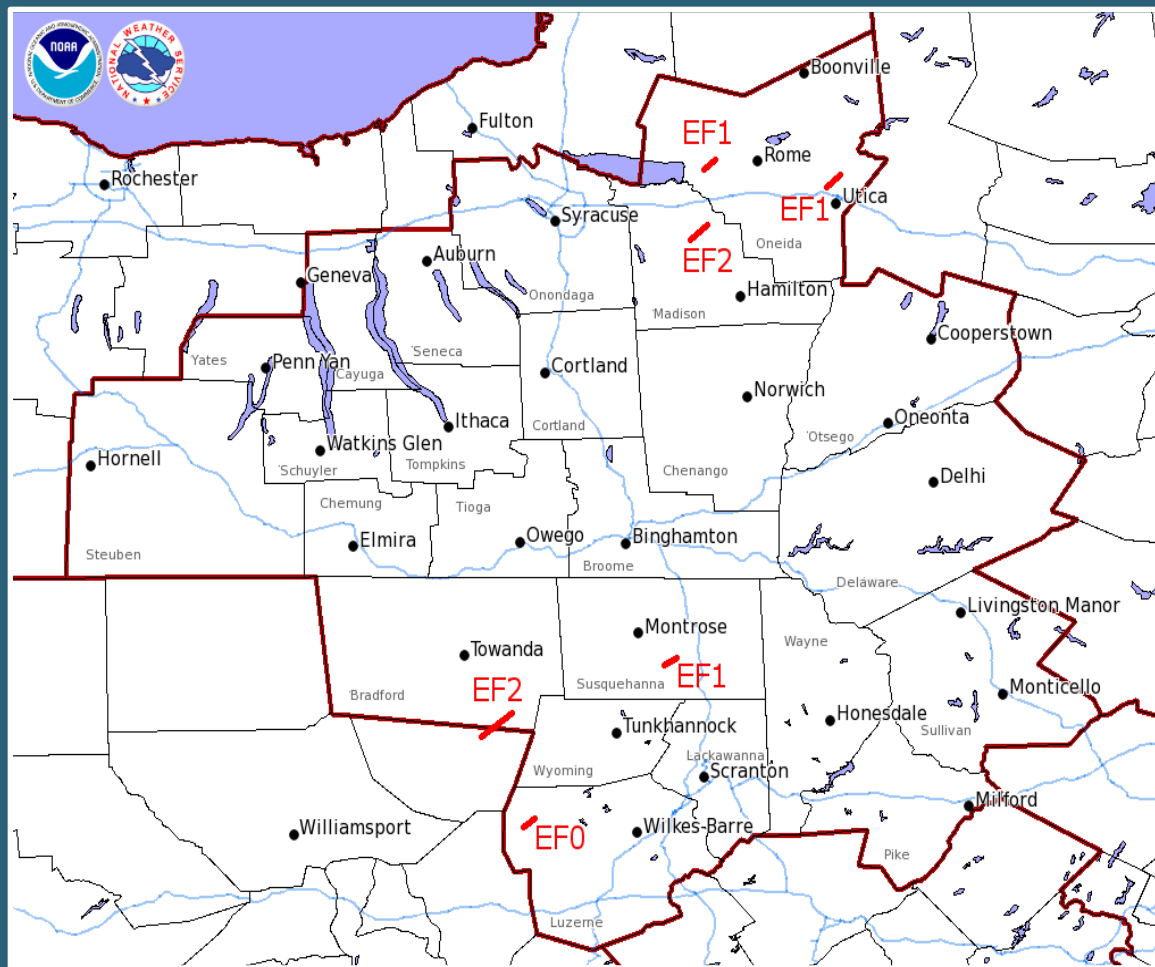


# SPC Storm-scale ensemble



# Tornado Tracks

- Six Tornadoes occurred in BGM CWA.
- Two tornadoes were rated EF2.
- The tornado with 5 fatalities occurred in Madison county.



Tornado tracks and EF ratings from July 8, 2014

# Summary

- A rare severe weather and tornado event in central New York and northeast Pennsylvania occurred on July 8, 2014.
- New tools showed promise helping forecasters to anticipate the occurrence and magnitude of the event.