



# Radar & Applications Course (RAC)

## Base and Derived Products

Lesson: Products Review & Case Study

Warning Decision Training Division (WDTD)

# Objectives

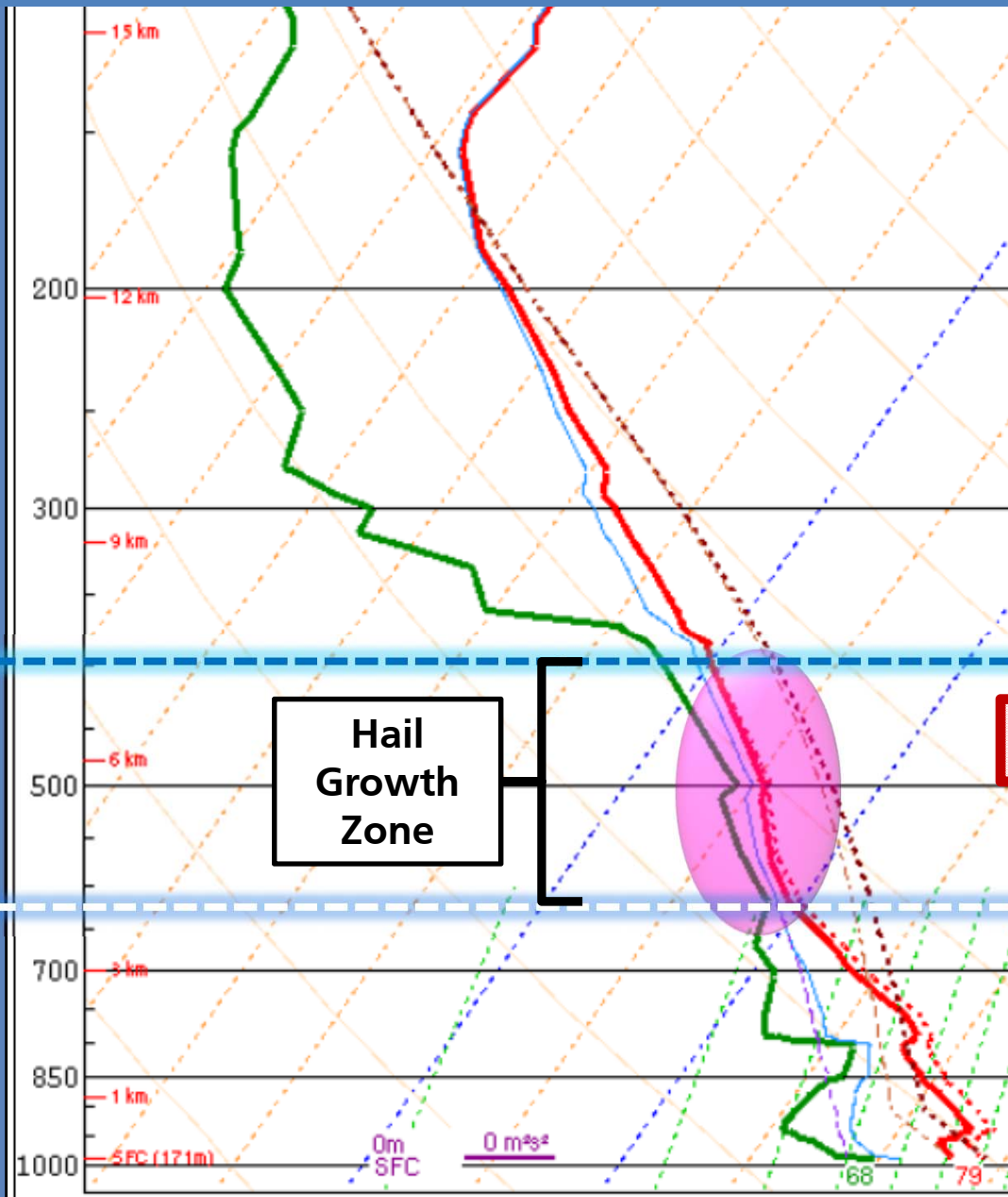
1. Demonstrate how to incorporate radar products into decision-making process to improve effectiveness
2. Identify methods for displaying radar product and other data in CAVE to make your warning decision-making process more efficient

# Outline

- **Part 1:** Case studies
- **Part 2:** AWIPS CAVE radar data display techniques
- **Part 3:** Data quality takeaways

# Part 1: Case Studies

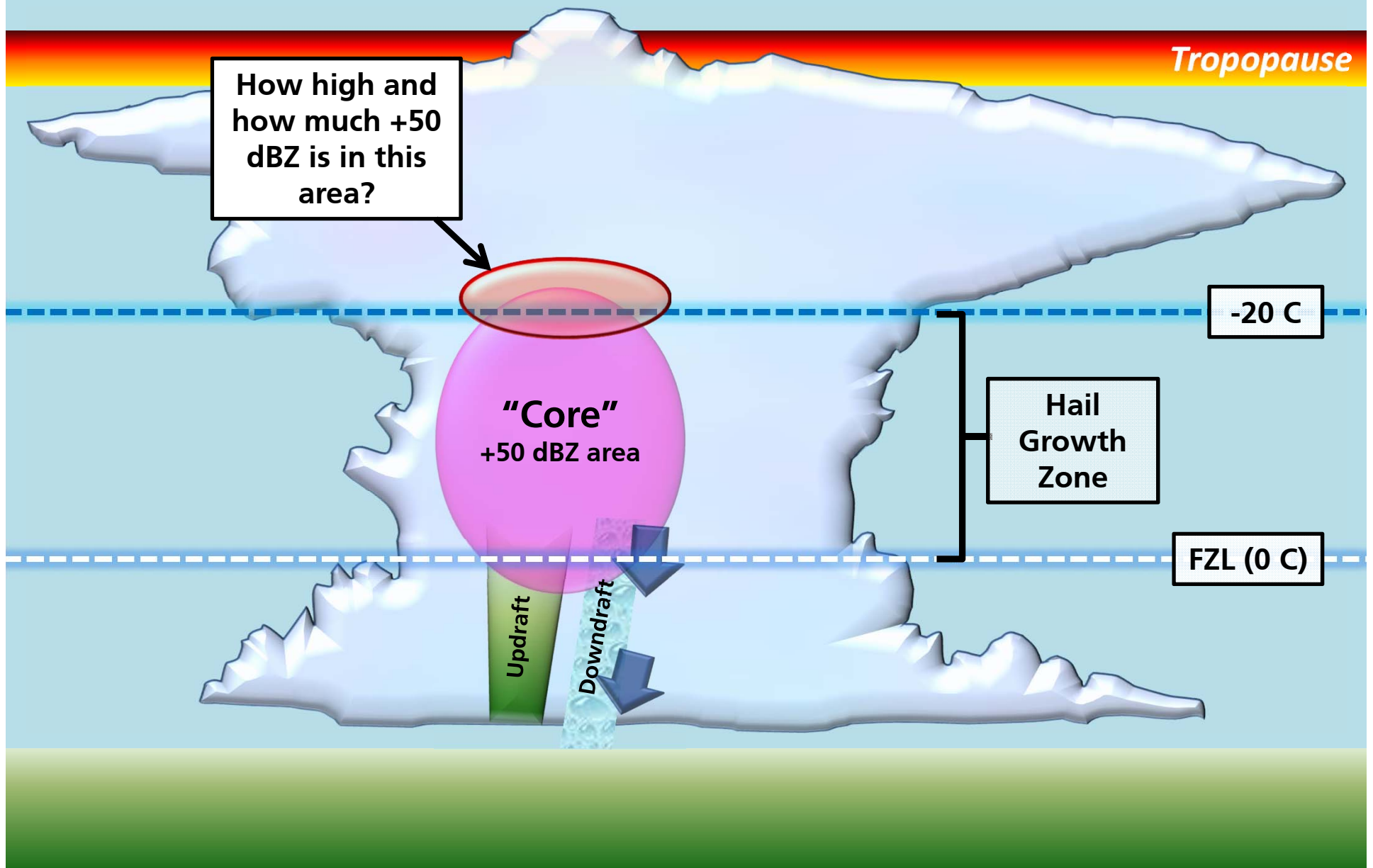
# Core Heights



Severe (1") Hail Warning Criteria:  
50-dBZ Echo Height Above the  
Melting (Freezing) Level

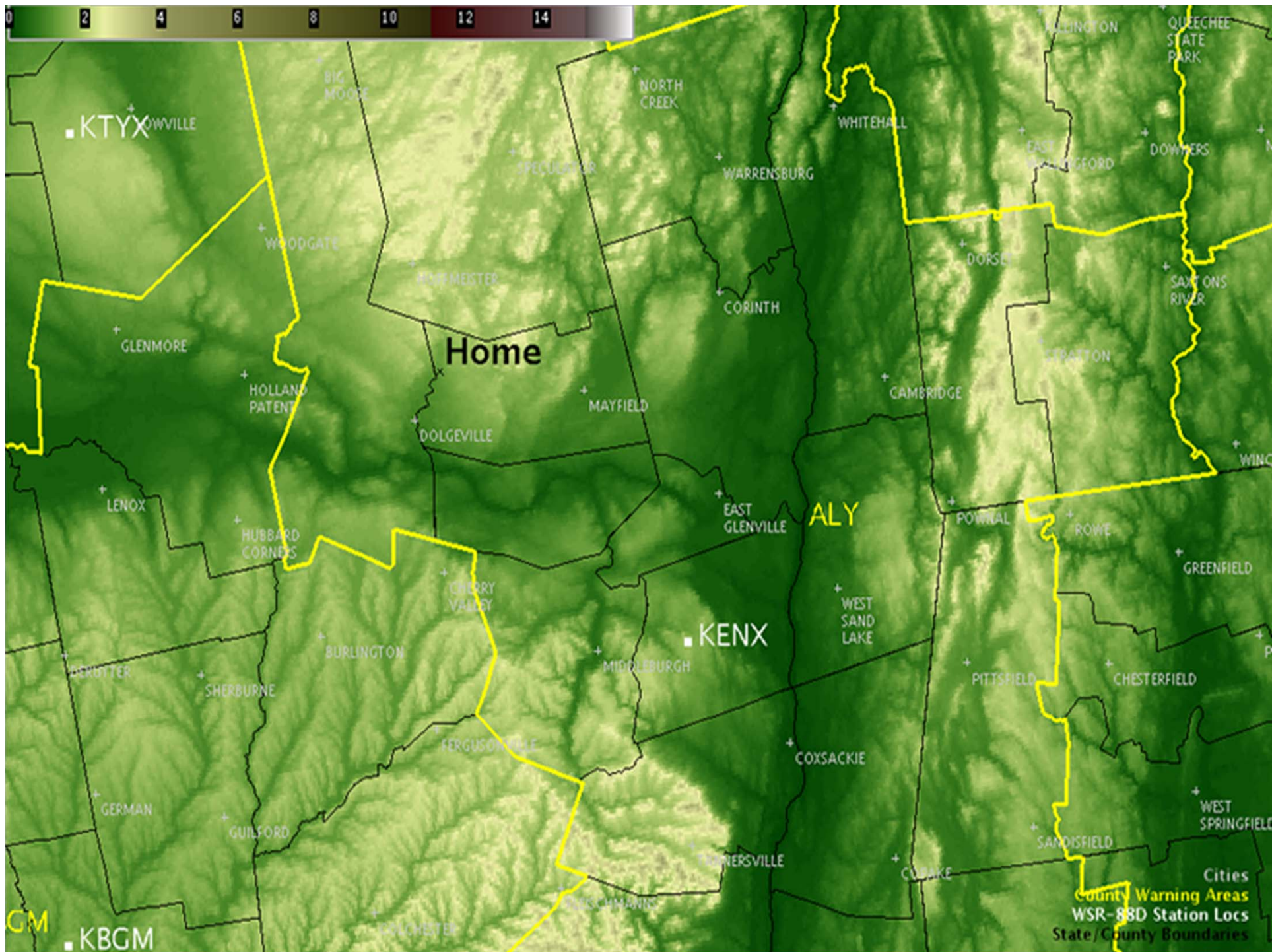
Melting Level	50 dBZ height 25th Percentile
6500	22000
7000	23000
7500	24000
8000	24900
8500	25900
9000	26900
9500	27900
10000	28800
10500	29800
11000	31900
11500	32900
12000	33900
12500	34900
13000	35800
13500	36800
14000	37800
14500	38800

# Thunderstorm Core Interrogation



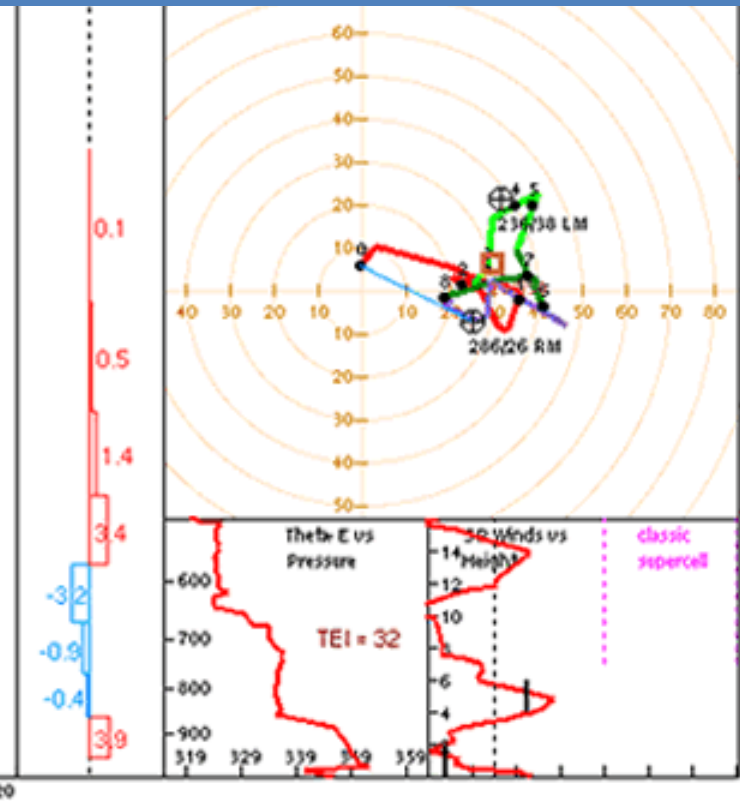
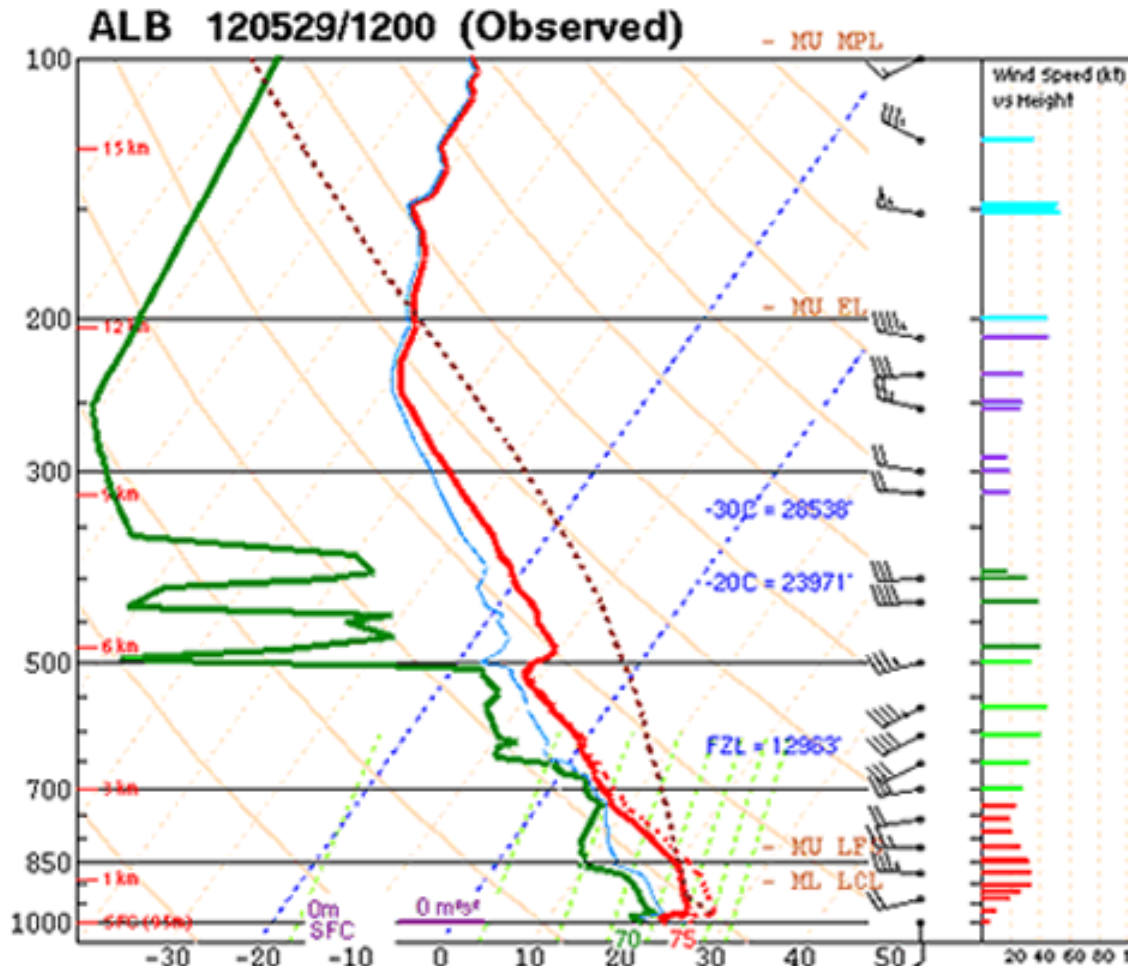
## Case Study #1: May 29, 2012 (ALY)

- One decision point at an exact time
  - *In real-life, you would make decisions on data, not exact times*
- Goal is to learn how to make a warning decision using all products available
- Stratford, NY (NW CWA)





# 1200 UTC - ALY



PARCEL	CAPE	CINH	LCL	LI	LFC	EL
SURFACE	1652	-194	349m	-7	2146m	38675'
MIXED LAYER	2173	-96	944m	-9	1972m	39186'
FCST SURFACE	3380	0	1616m	-11	1616m	41738'
MU (975 mb)	2841	-69	642m	-10	1734m	40401'

PW = 1.63 in	3CAPE = 81 J/kg	WBZ = 11789'	WNDG = 0.0
K = 39	DCAPE = 1108 J/kg	FZL = 12963'	ESP = 0.0
MidRH = 72%	DownT = 61 F	ConvT = 90F	MMP = 0.54
LowRH = 69%	MeanW = 15.2 g/kg	MaxT = 92F	
SigSevere = 47464 m3/s3			

Sfc-3km Agl Lapse Rate = 6.3 C/km	<b>Supercell = 0.0</b> <b>Left Supercell = 0.0</b> <b>Sig Tor (CIN) = 0.0</b> <b>Sig Tor (fixed) = 1.1</b> <b>Sig Hail = 1.7</b>
3-6km Agl Lapse Rate = 6.0 C/km	
850-500mb Lapse Rate = 7.7 C/km	
700-500mb Lapse Rate = 7.2 C/km	

	SRH(m2/s2)	Shear(kt)	MnWind	SRW
SFC - 1 km	139	37	255/18	149/14
SFC - 3 km	149	29	266/23	166/9
Eff Inflow Layer	0	0	175/6	117/28
SFC - 6 km		42	256/27	187/13
SFC - 8 km		21	258/28	189/13
Lower Half Storm Depth		42	257/27	187/13
Cloud Bearing Layer		22	261/30	204/13
BRN Shear = 51 m/s²				
4-6km SR Wind =		207/27 kt		
..... Storm Motion Vectors.....				
Bunkers Right =		266/26 kt		
Bunkers Left =		236/38 kt		
Corfidi Downshear =		255/39 kt		
Corfidi Upshear =		243/8 kt		

\*\*\* BEST GUESS PRECIP TYPE \*\*\*

**Rain.**  
Based on sfc temperature of 74.8 F.

**SARS - Sounding Analogs**

SUPERCCELL	SGFNT HAIL
99060200.TBN SIO	
00103122.FNB WEAK	
03050221.H5V NON	
04040422.LRD NON	
	No Quality Matches

(21 loose matches) SARS: 71% TOR

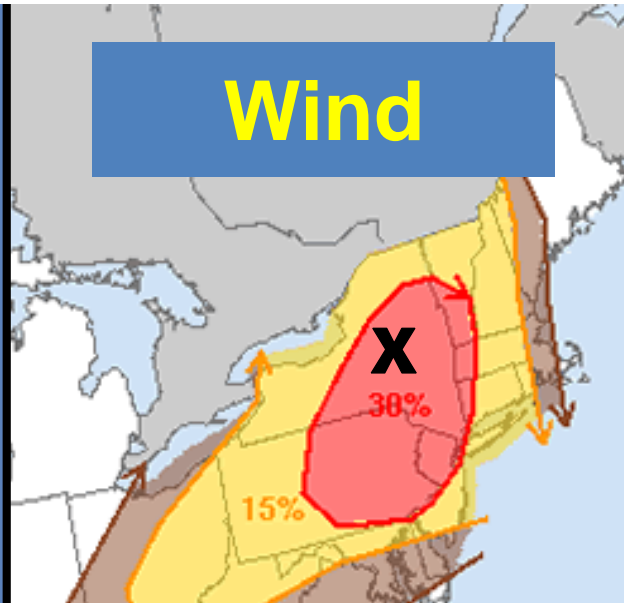
(66 loose matches) SARS: 43% SIG

1km & 6km AGL Wind Barbs

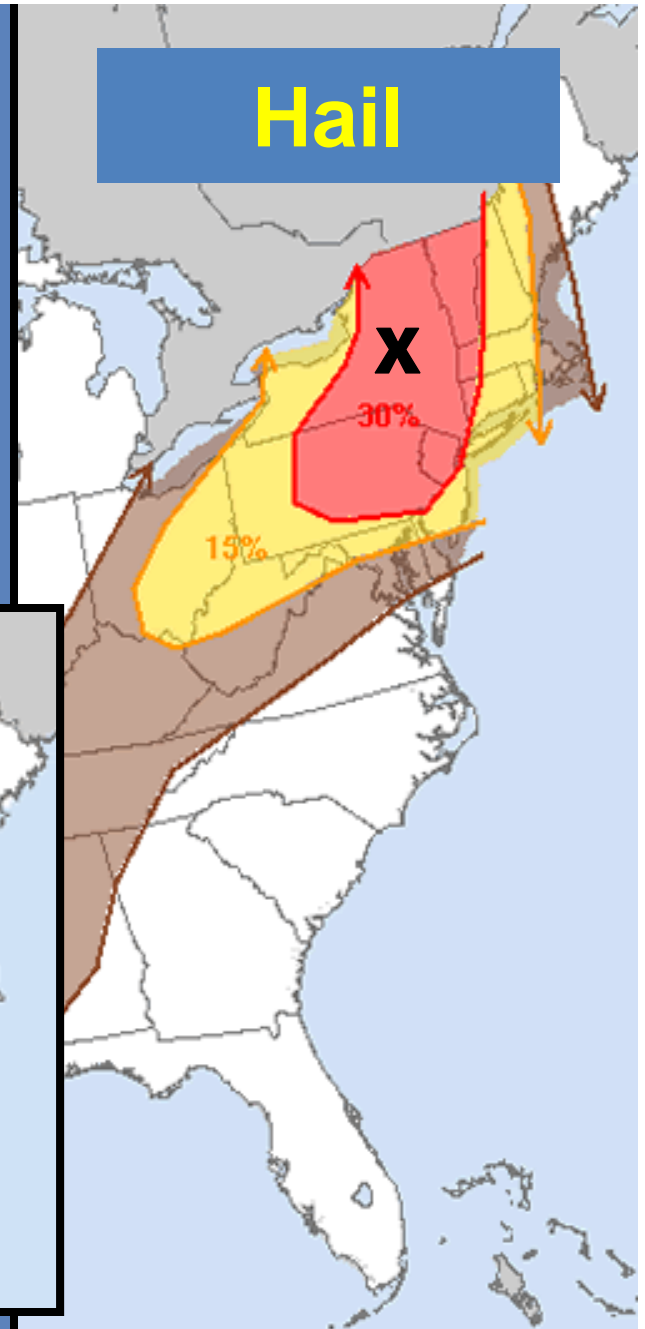
# SPC Day 1



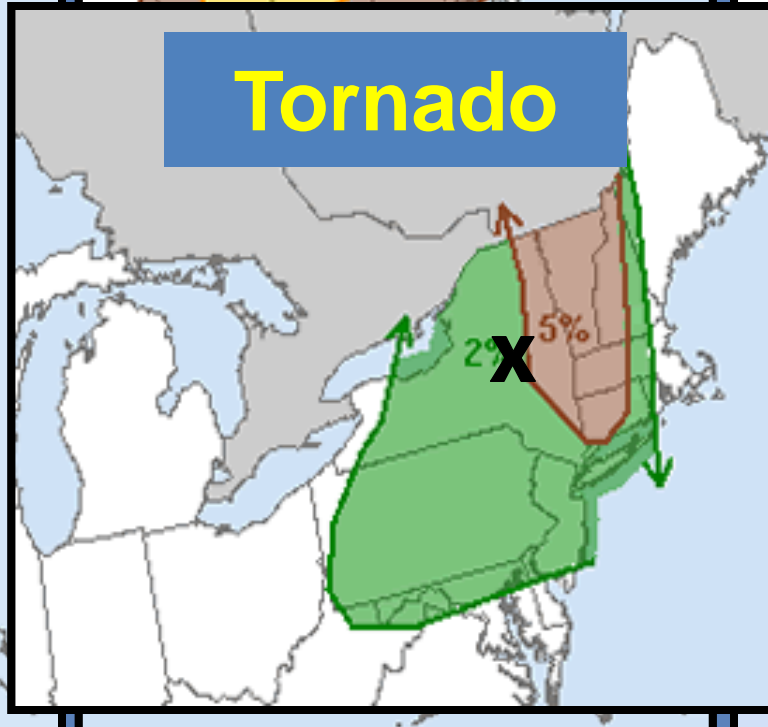
# Wind



# Hail



# Tornado



Categorical Outlook Legend:

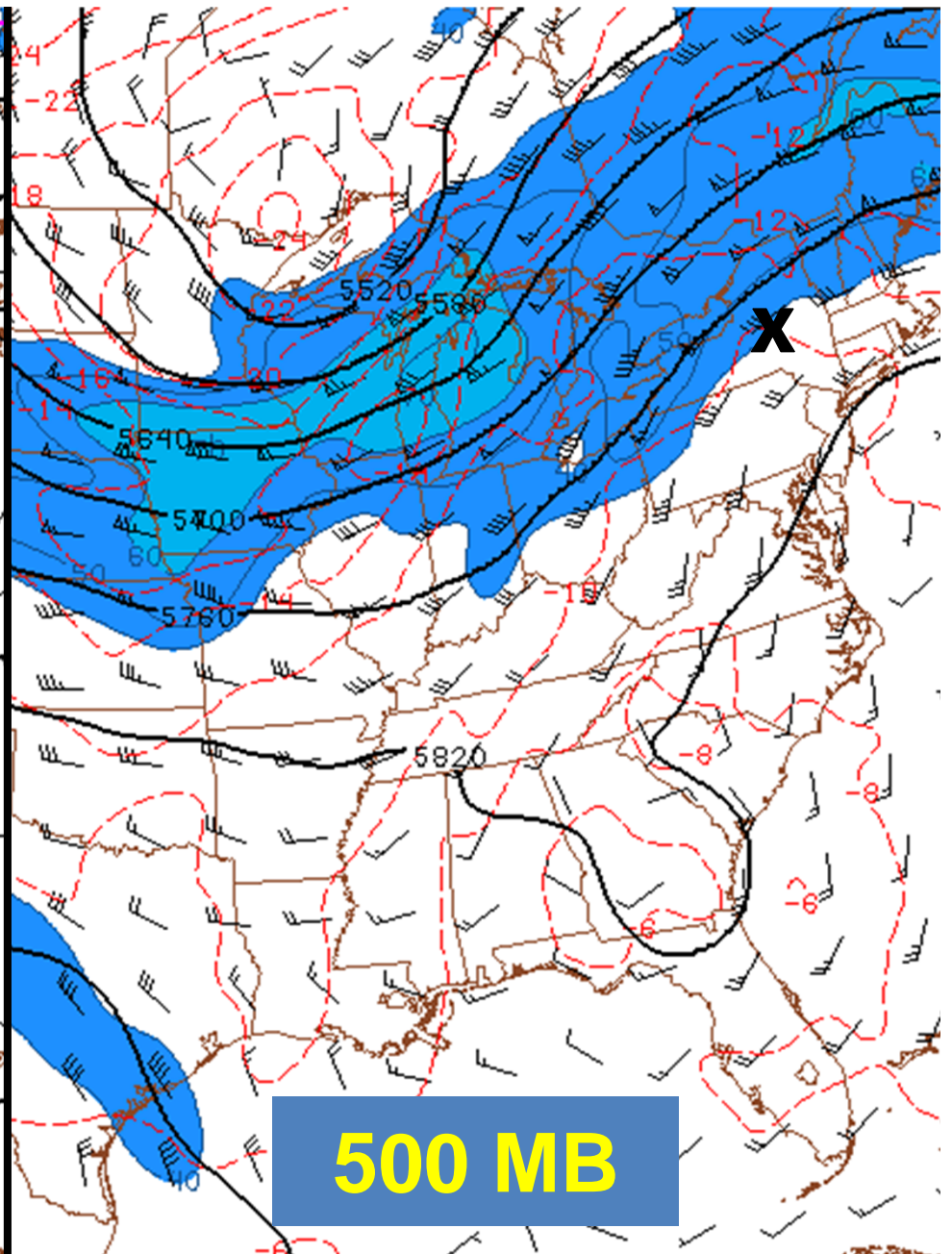
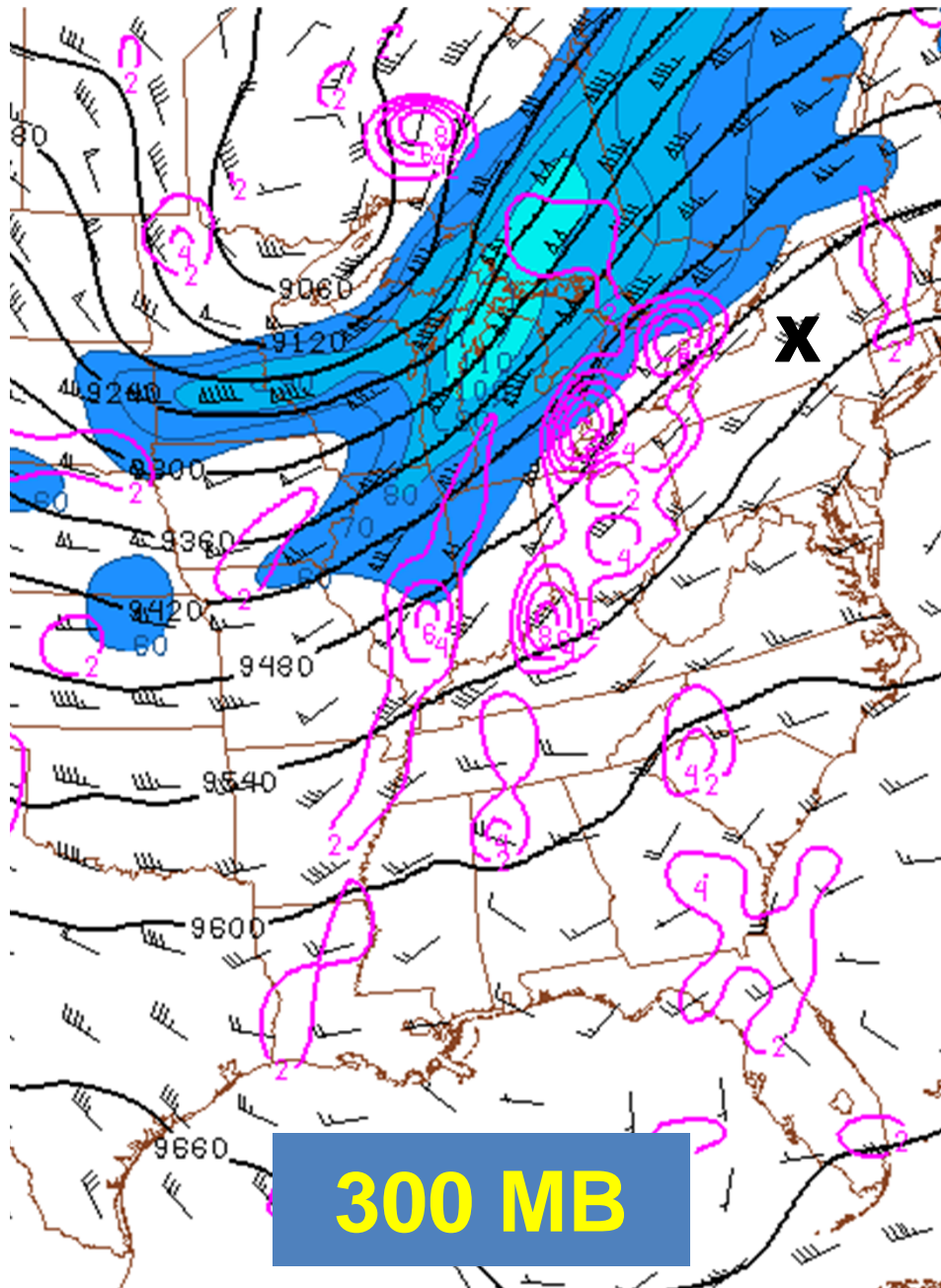
TSTM ■ SLGT ■ MDT ■ HIGH ■

Wind Probability Legend (in %):

5 ■ 15 ■ 30 ■ 45 ■ 60 ■ Sig ■

Hail Probability Legend (in %):

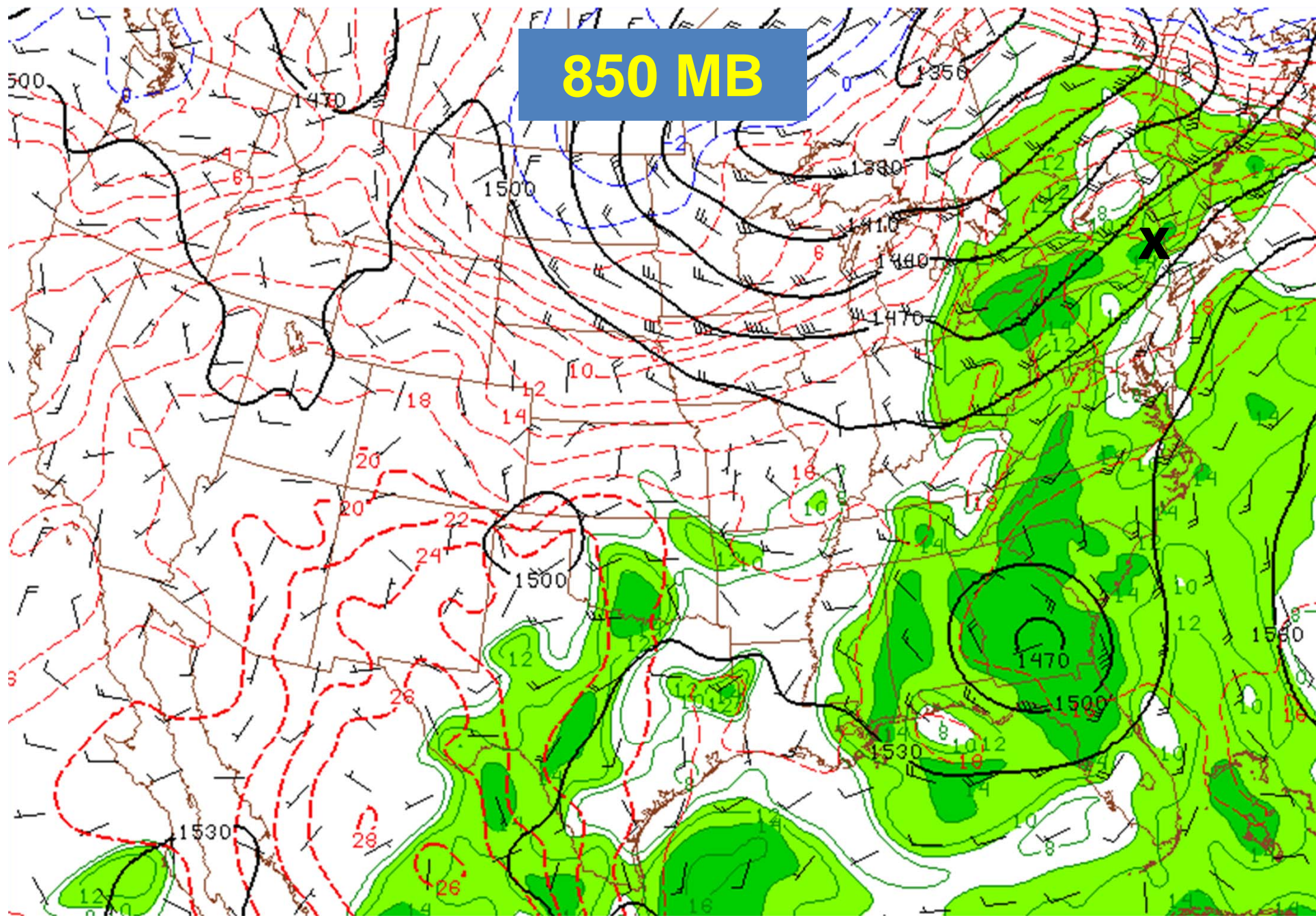
5 ■ 15 ■ 30 ■ 45 ■ 60 ■ Sig ■



60 80 100 120 140 160



# 850 MB

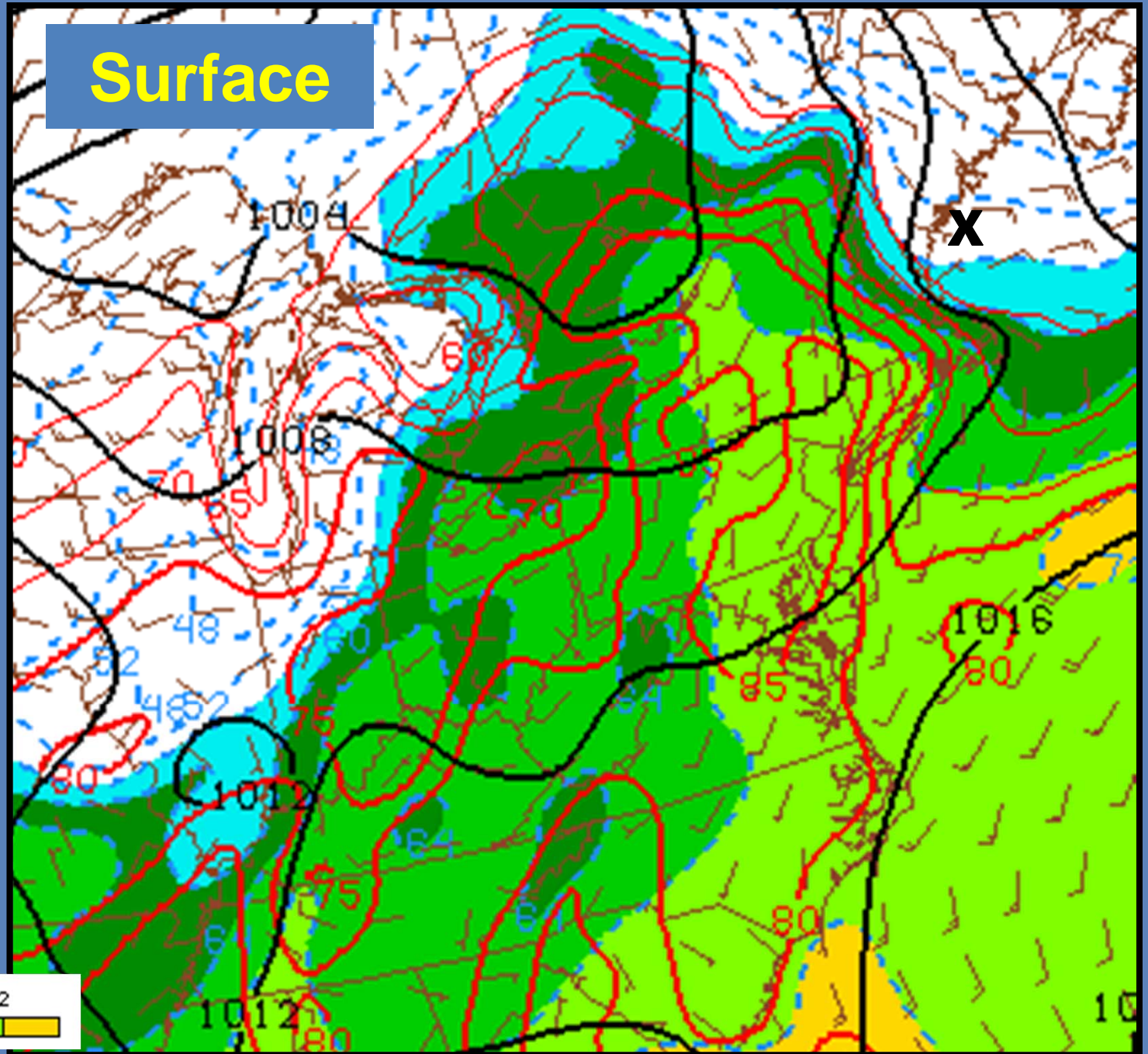


120529/1600V001 850mb hght/temp/dwpt (f111)/wind

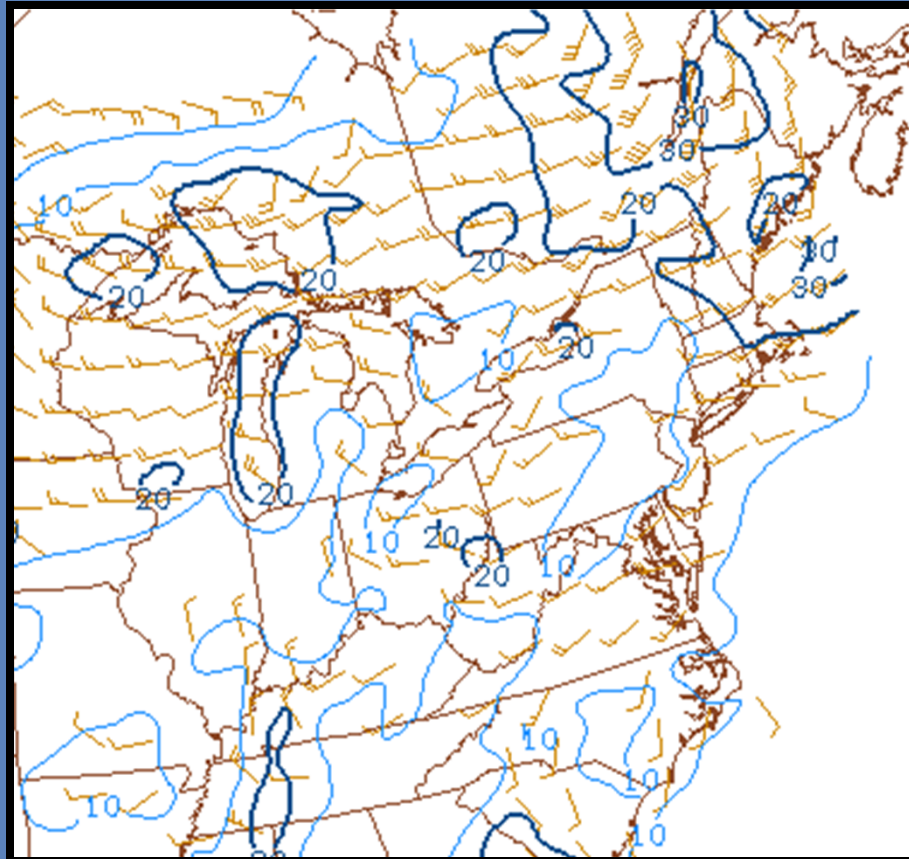
10 14



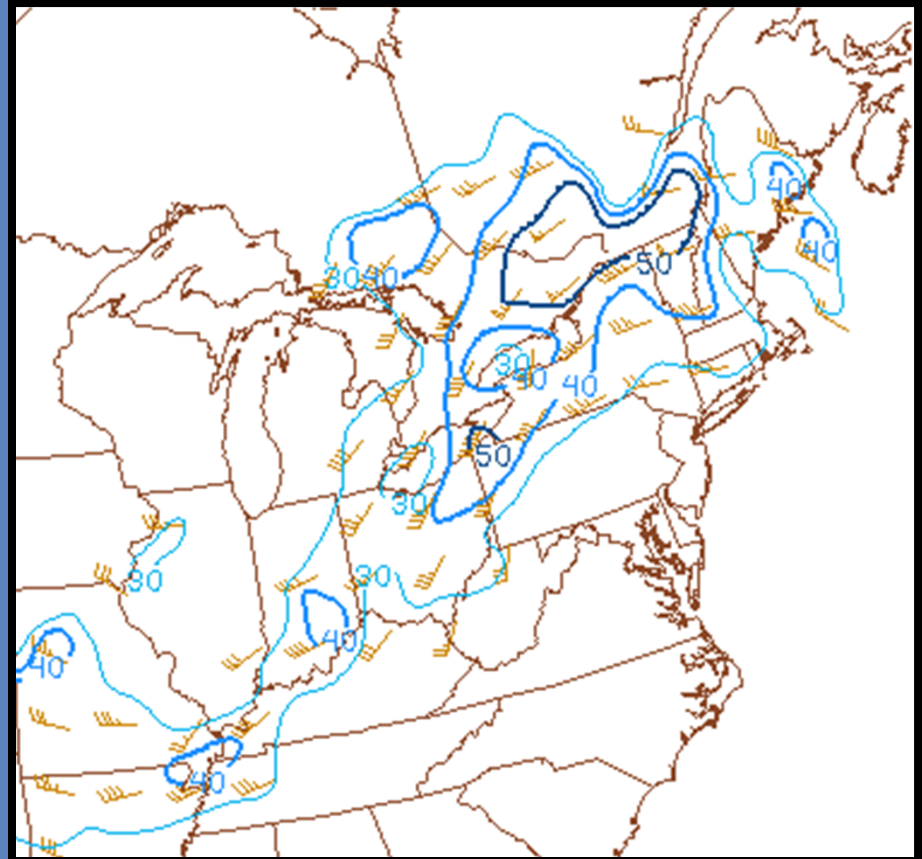
# Surface



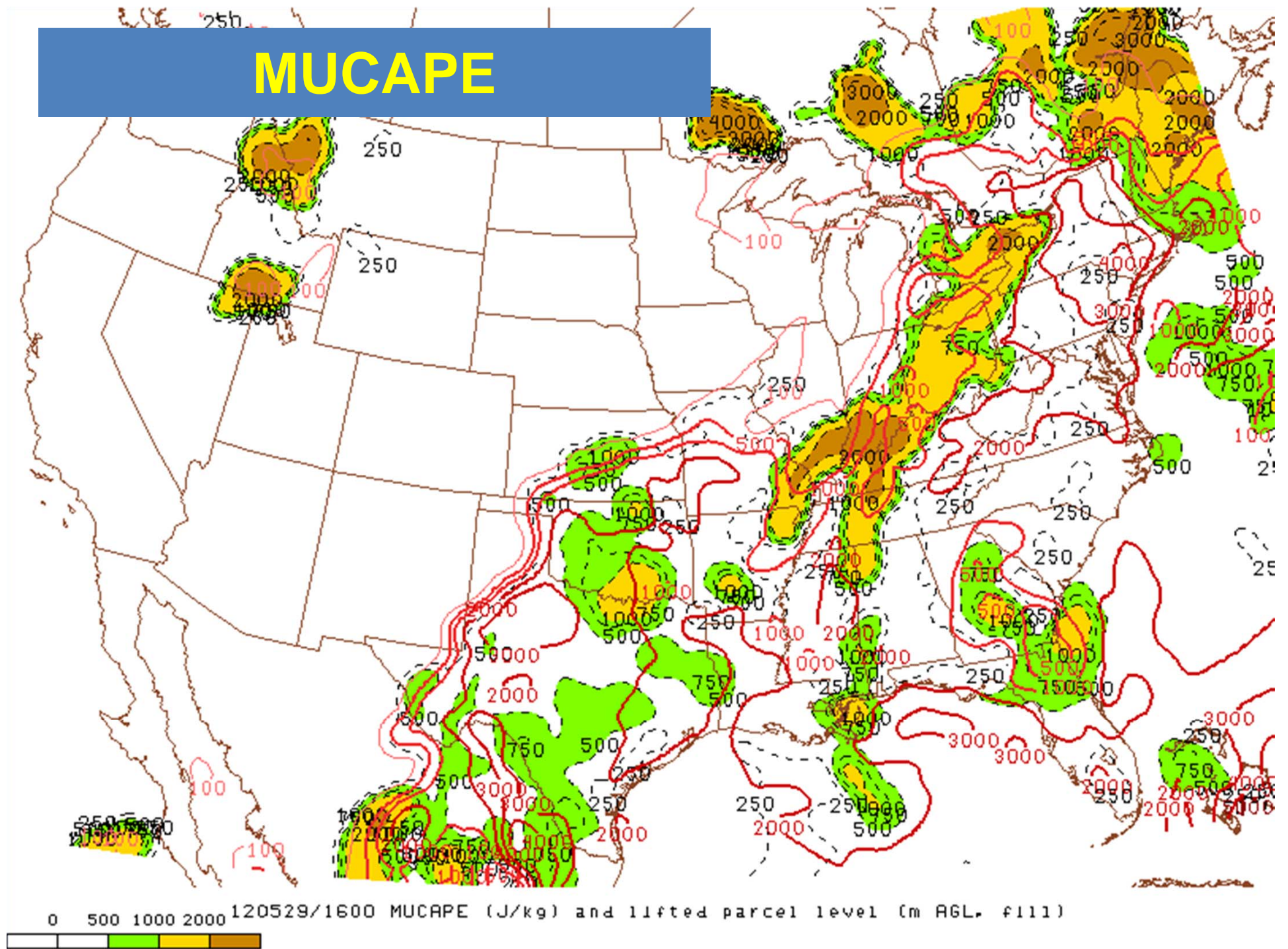
## 0-1 km Shear



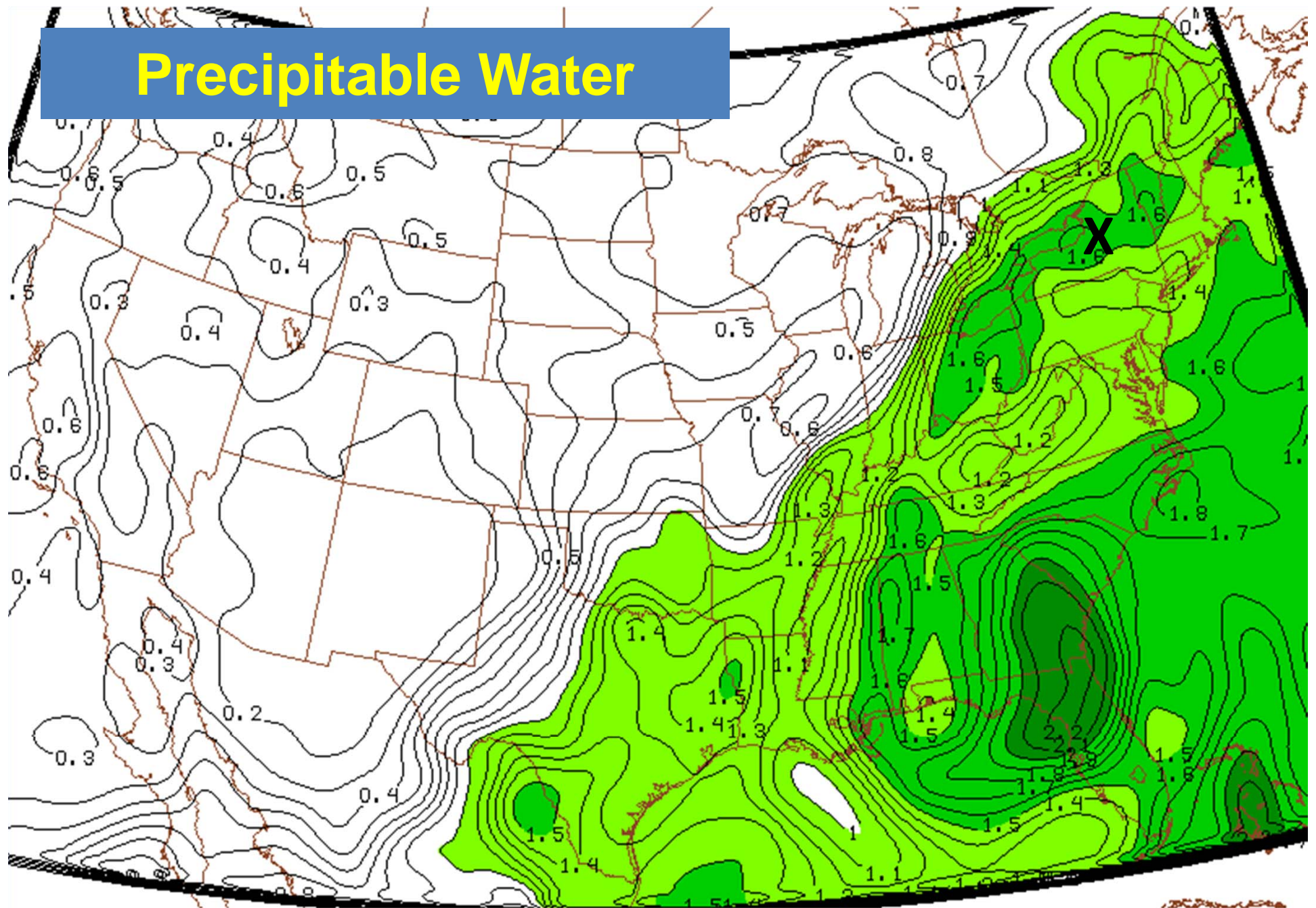
## Eff. Bulk Shear



# MUCAPE



# Precipitable Water



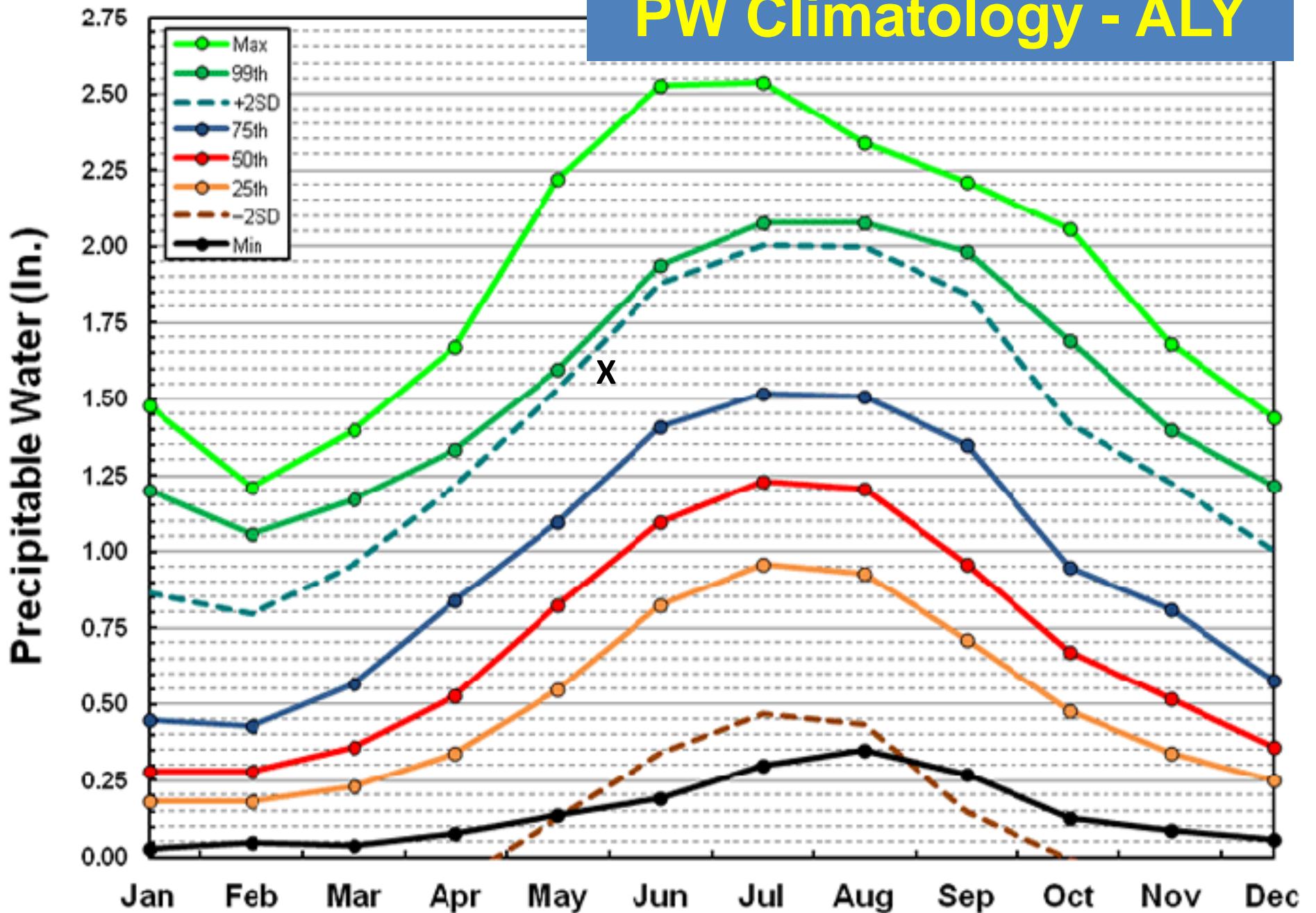
1.0 1.5 2.0

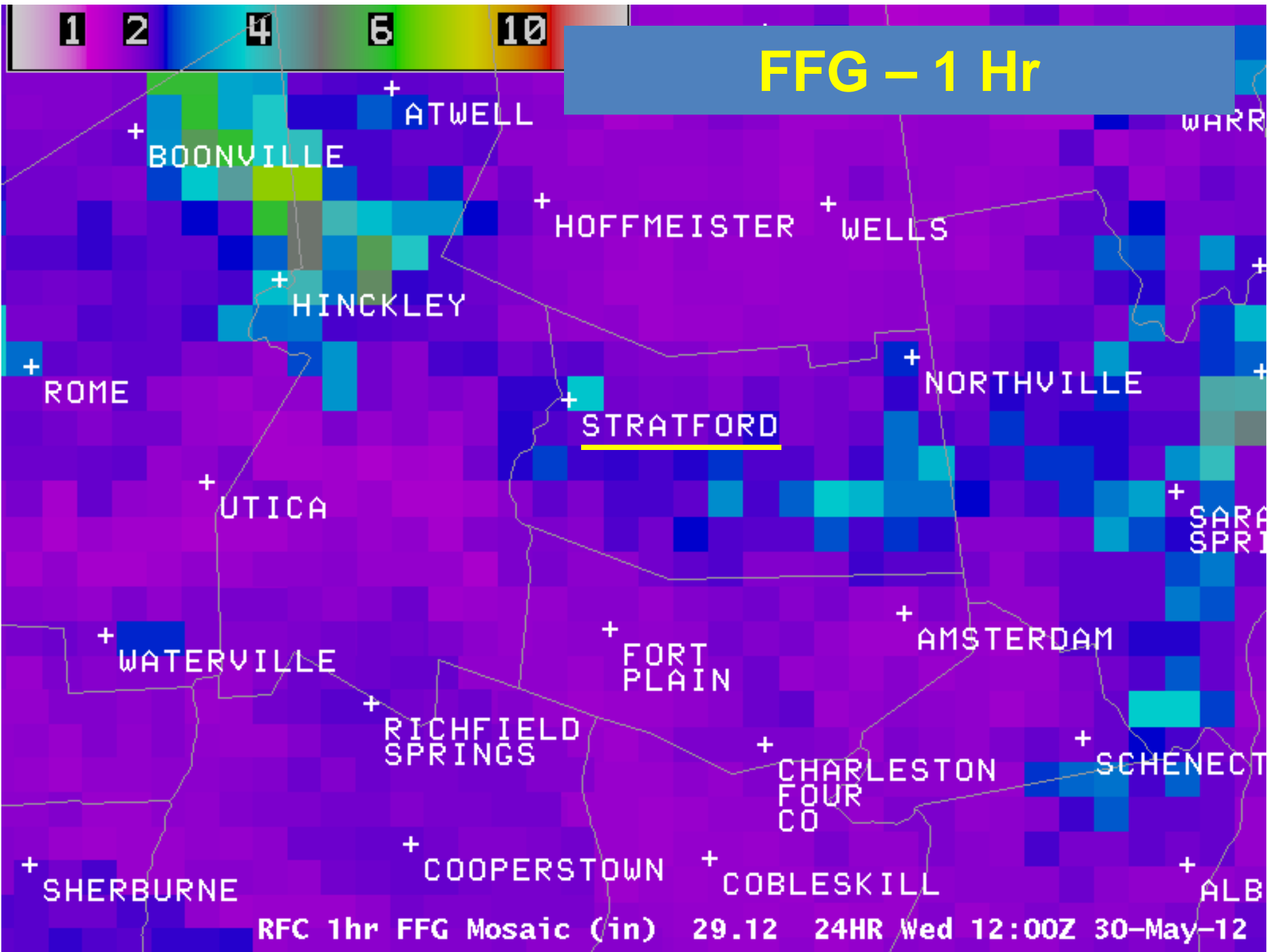
120529/1600 precipitable water (in) lowest 400 mb

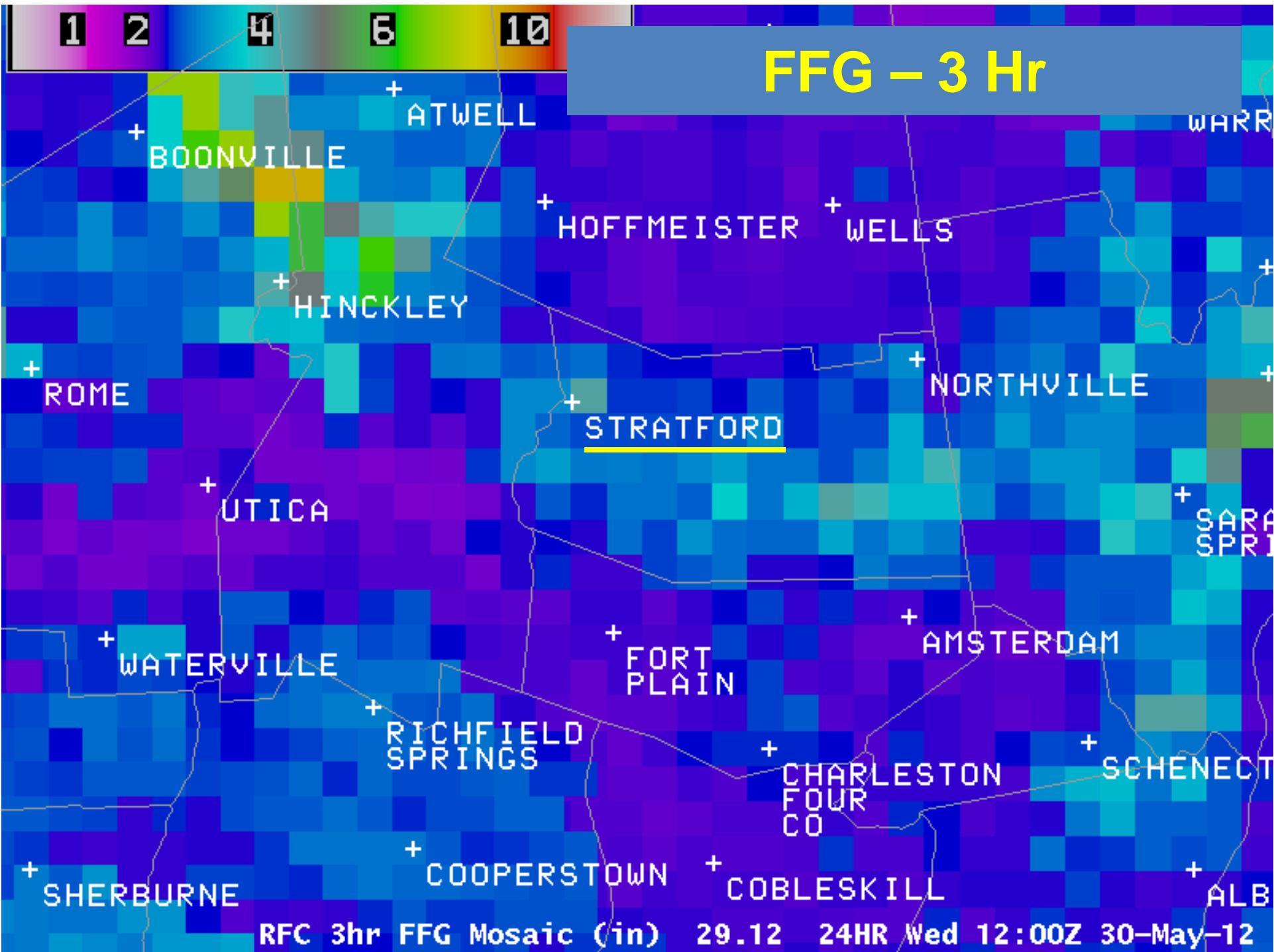


1948-2011 ALY/ALB/RME

# PW Climatology - ALY



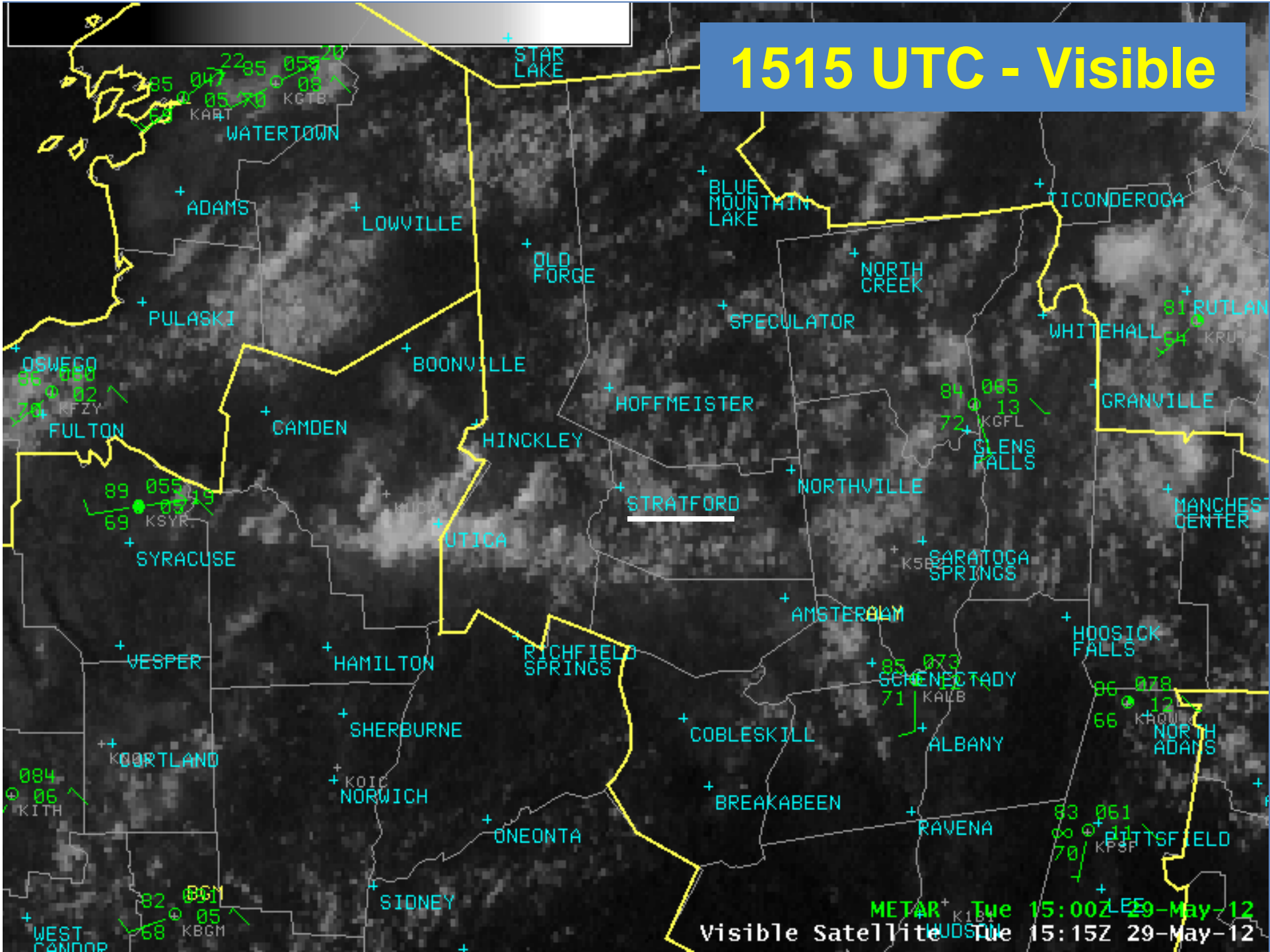




# Environment Summary

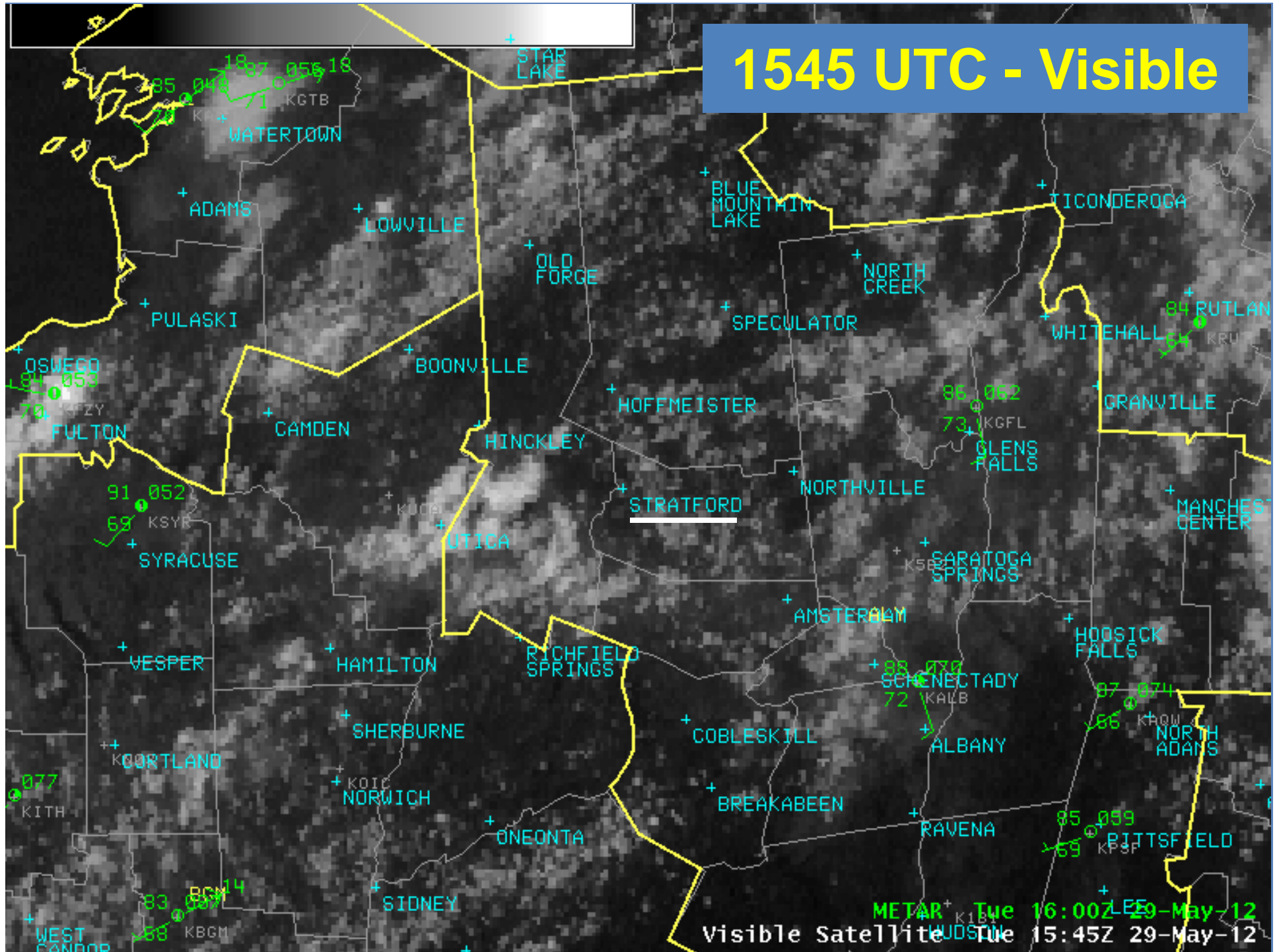
- Approaching trough
- Ample low-level moisture
- Great instability
  - MU CAPE = 2000 – 3000 J/kg
  - Virtually no cap (limits isolated storms)
- Shear
  - Deep = 30-40 kts
  - Low-level (best to the northeast)

# 1515 UTC - Visible

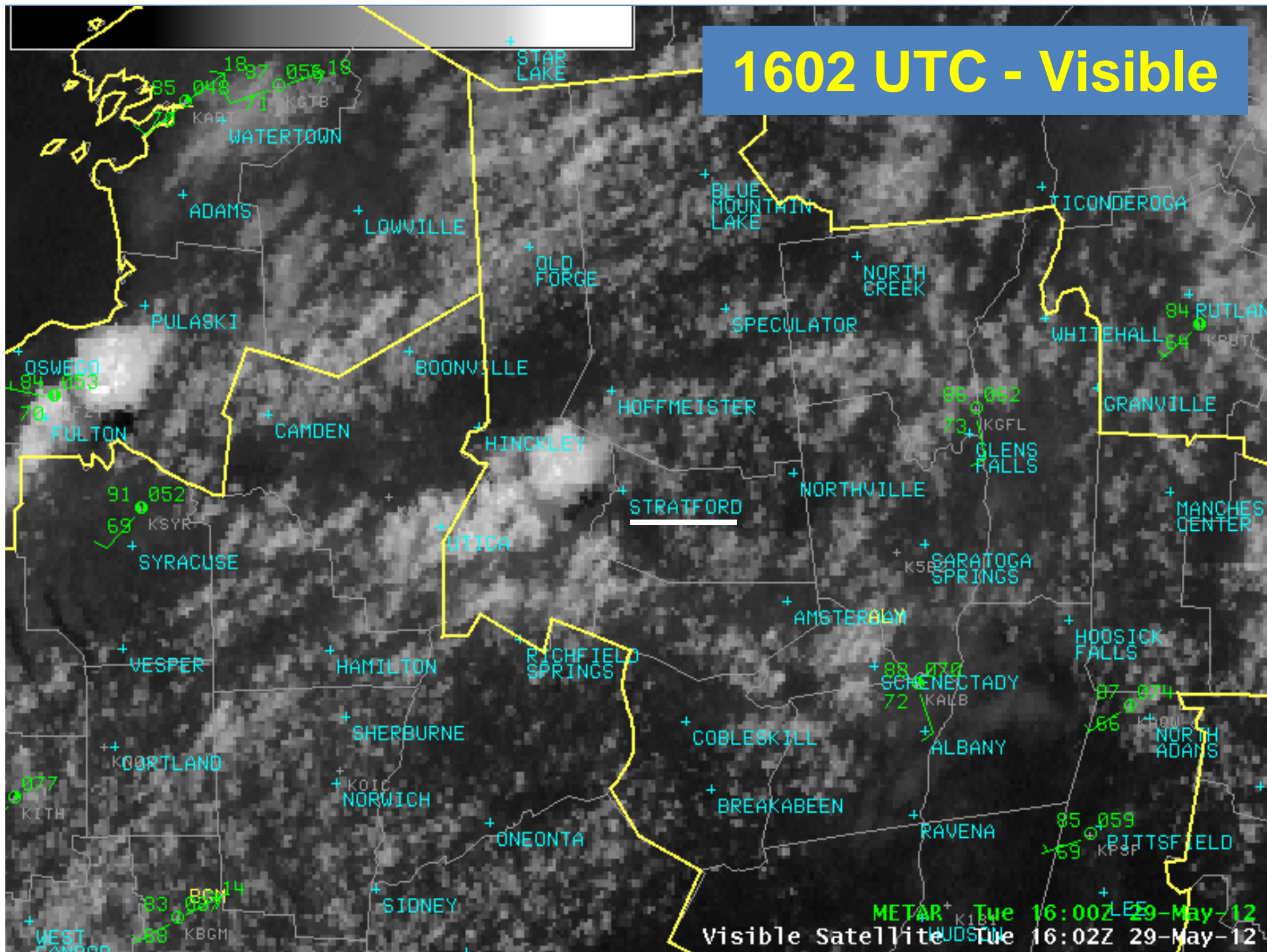


METAR + Tue 15:00Z 29-May-12  
Visible Satellite Tue 15:15Z 29-May-12

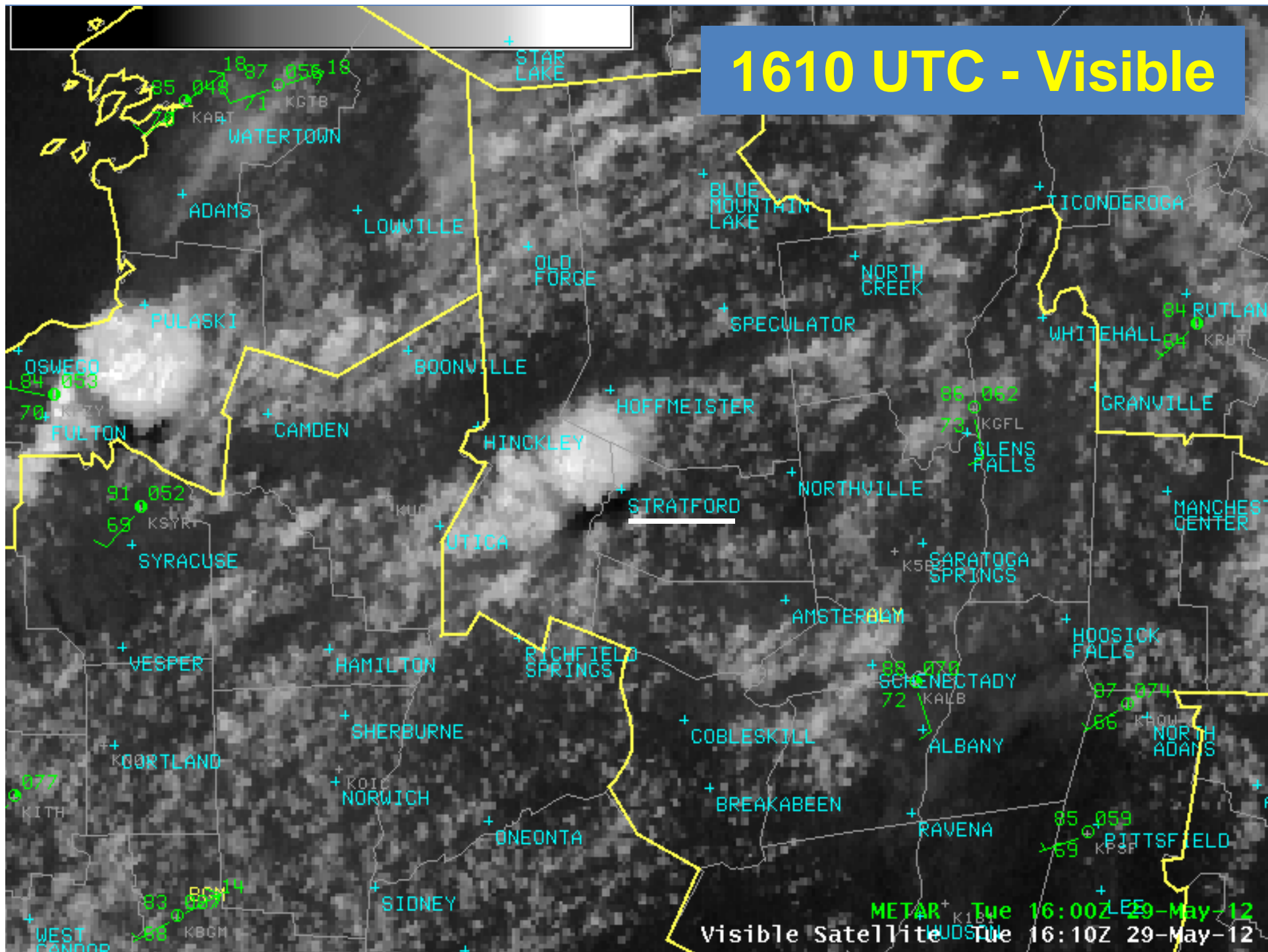
1545 UTC - Visible



# 1602 UTC - Visible



# 1610 UTC - Visible

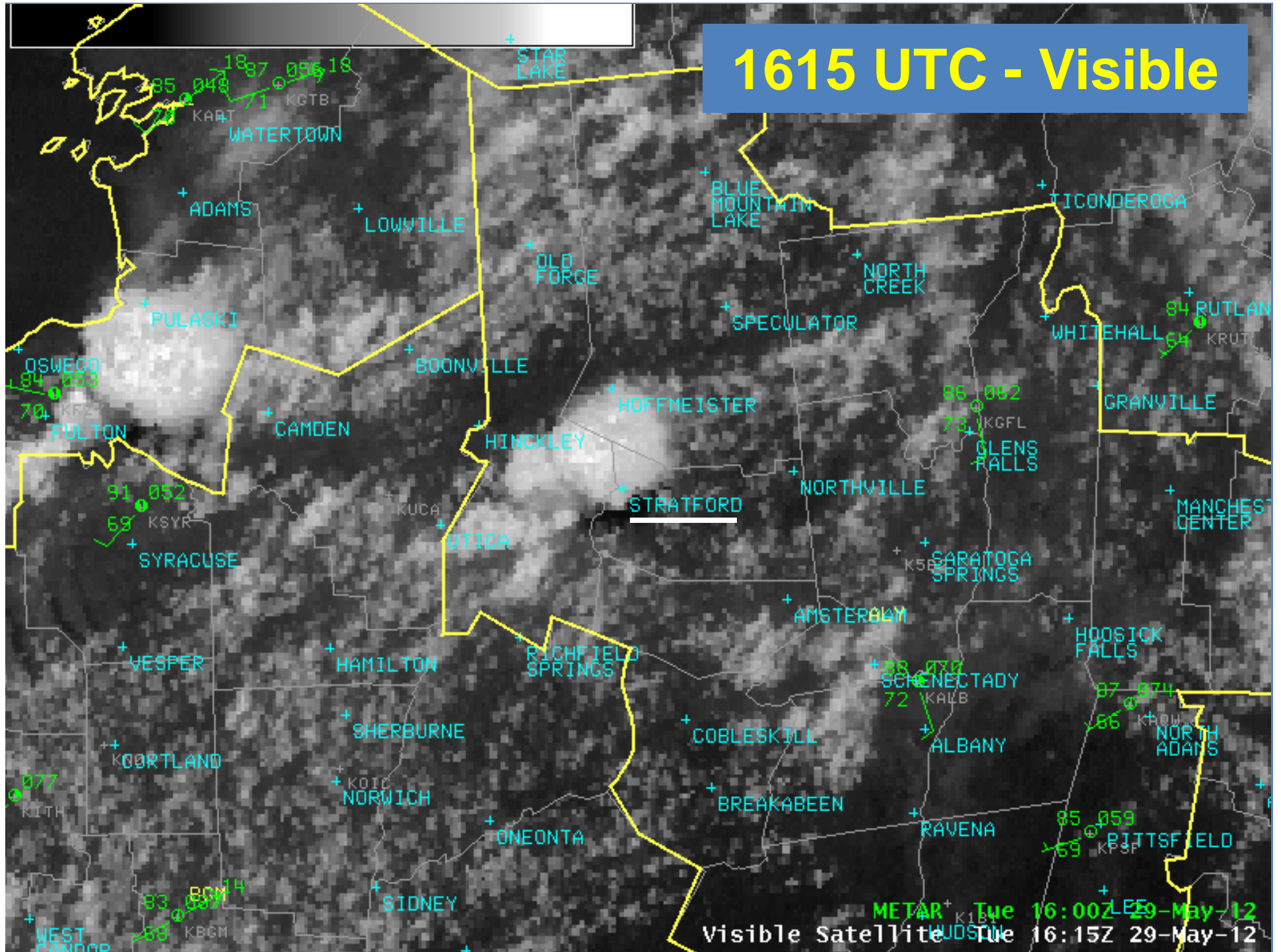


METAR K1LB Tue 16:00Z 29-May-12

Visible Satellite Tue 16:10Z 29-May-12



# 1615 UTC - Visible



# SPC Watches



**Tornado Watch # 313 - Valid from 1230 PM until 900 PM EDT**

# Decision Point #1 (1644 UTC)

**May 29, 2012 @ 1644 UTC**

- It's warning time! What would you do?

**TOR**

**SVR**

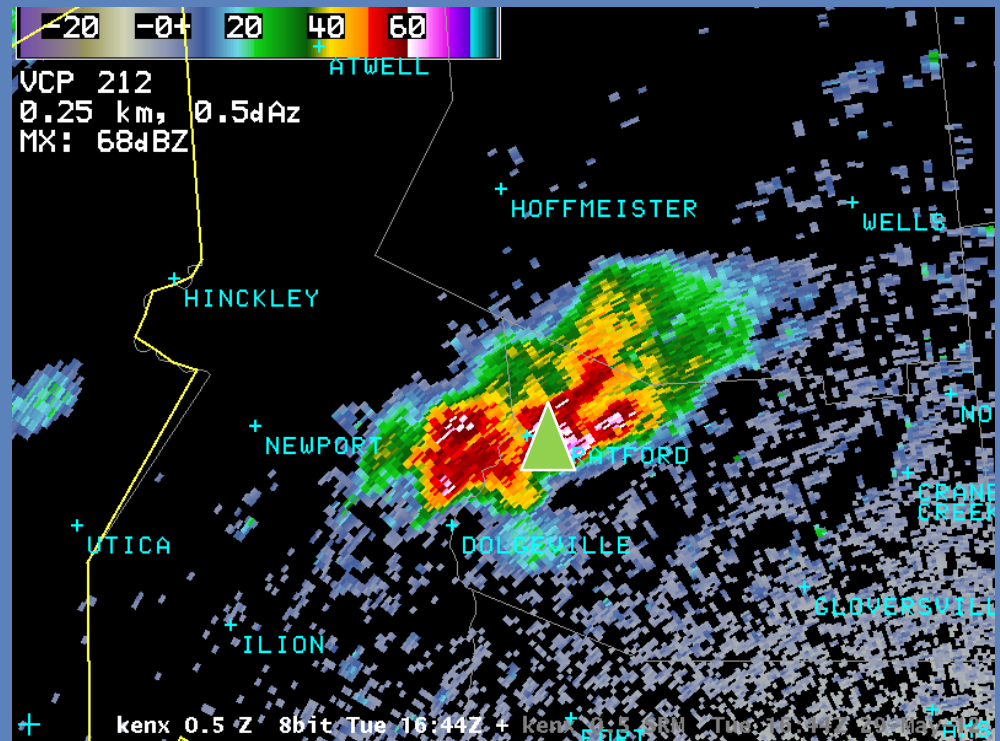
**NOTHING**

**FFW**

**OTHER**

# May 29, 2012 (Verification)

- 2.75" hail reported at 1649 UTC in Stratford, NY
- Numerous storms after this one with severe hail and damaging winds

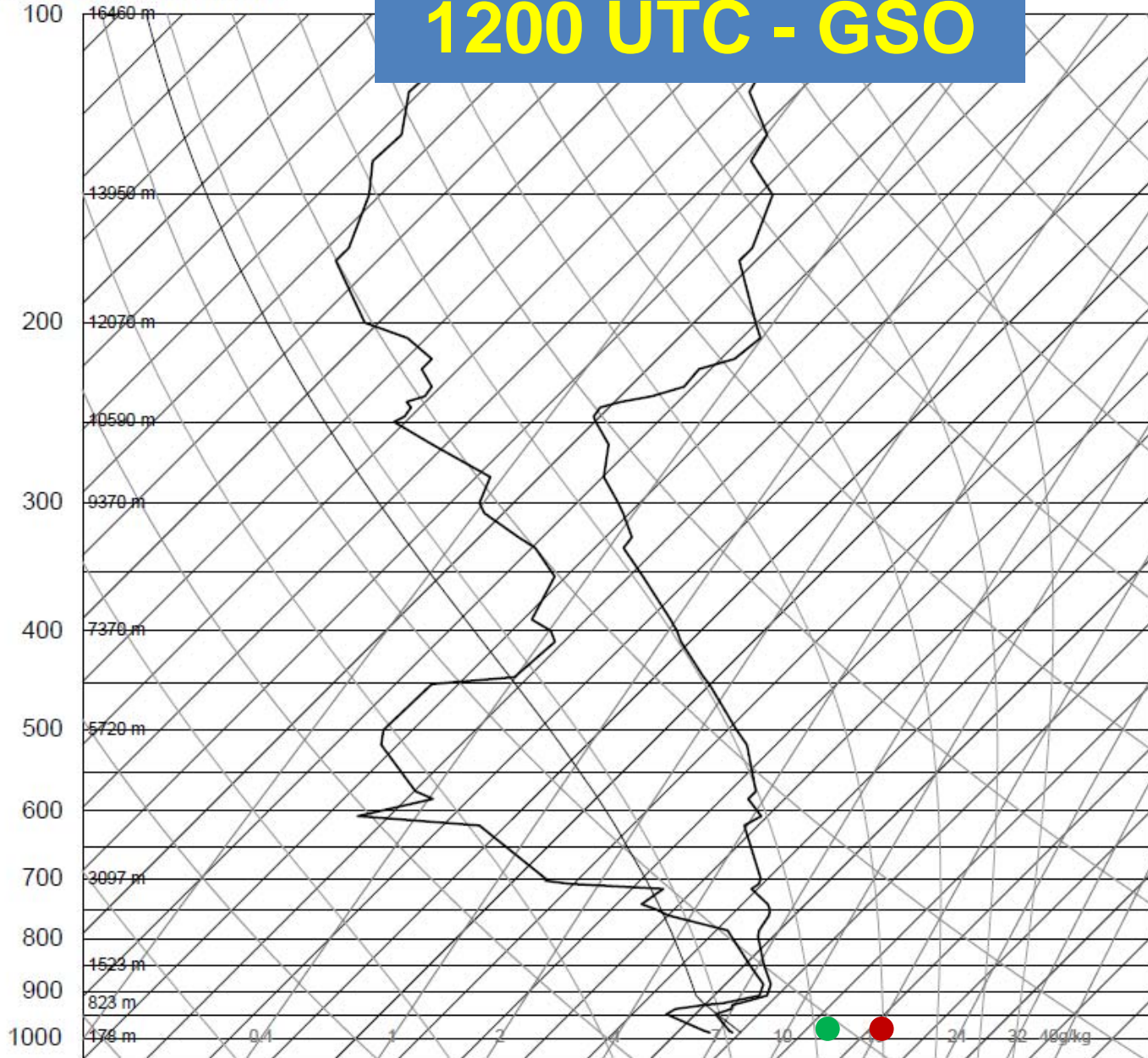


## Case Study #2 - Feb 24, 2016 (AKQ/RAH)

- Two locations this time:
  - Waverly, VA
  - Oxford, NC

72317 GSO Greensboro

1200 UTC - GSO



SLAT	36.08
SLOE	-79.95
SELV	270.0
SHOW	6.47
LIFT	14.78
LFTV	14.71
SWET	147.9
KINX	9.40
CTOT	19.80
VTOT	20.90
TOTL	40.70
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	276.9
LCLP	913.8
MLTH	284.2
MLMR	5.58
THCK	554.2
PWAT	17.79

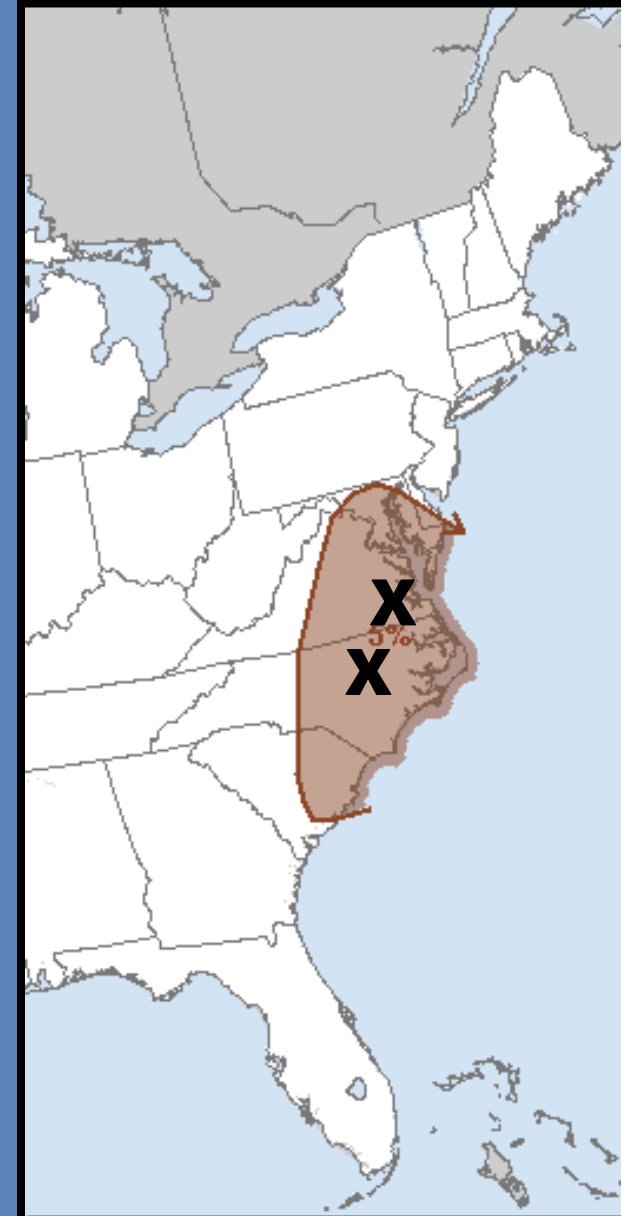
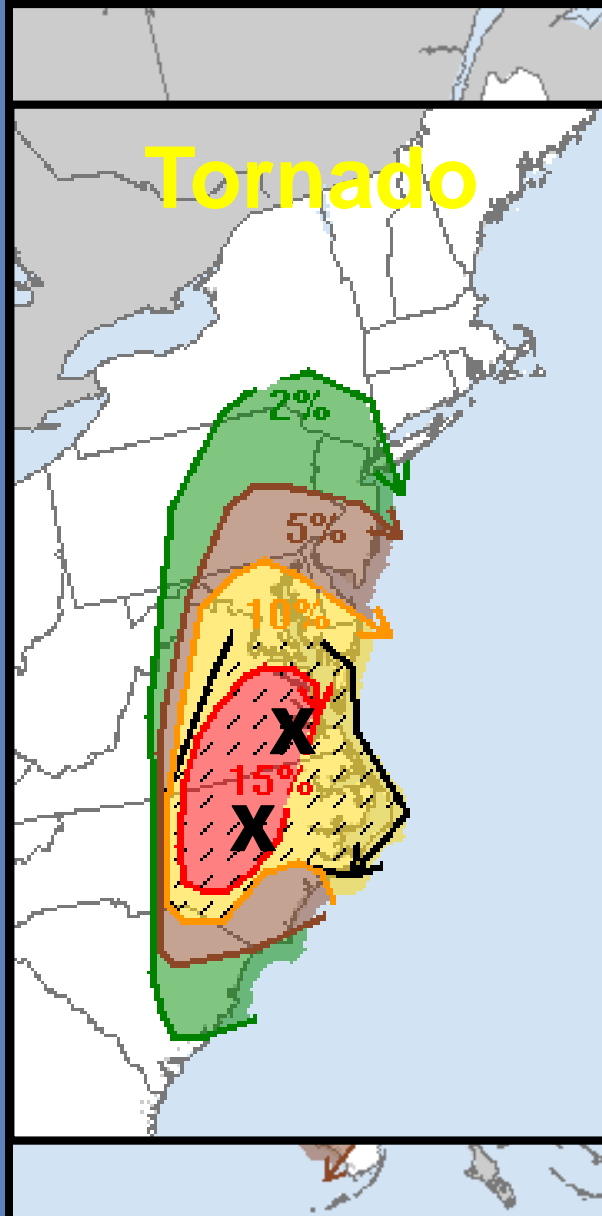
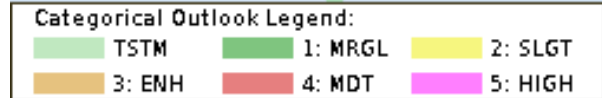
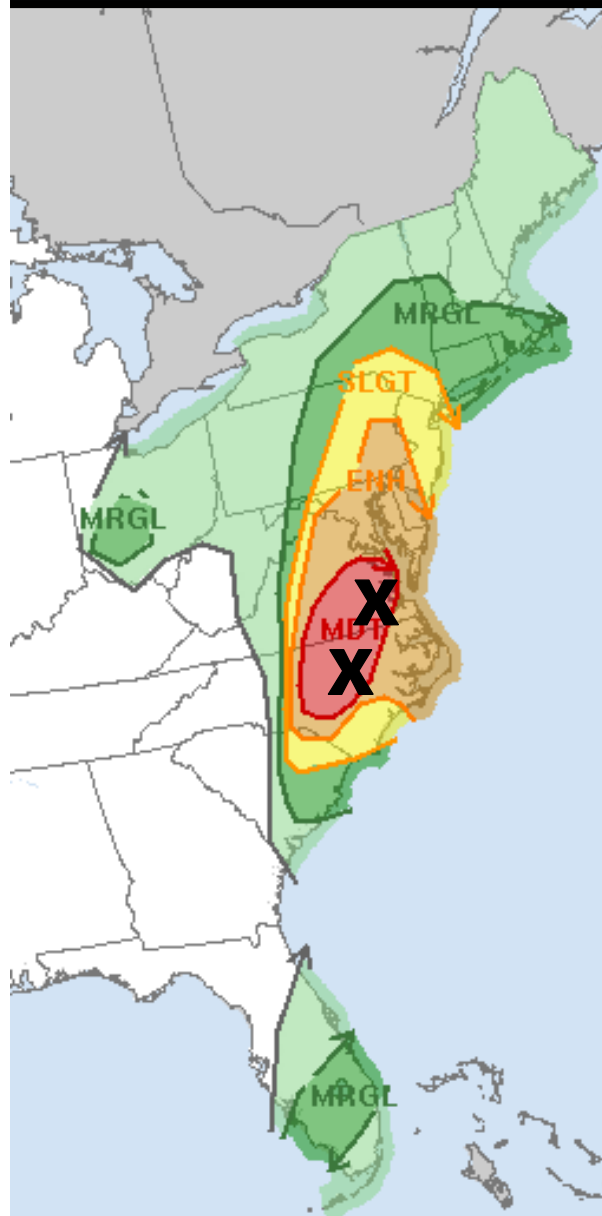
12Z 02 Feb 2016

University of Wyoming

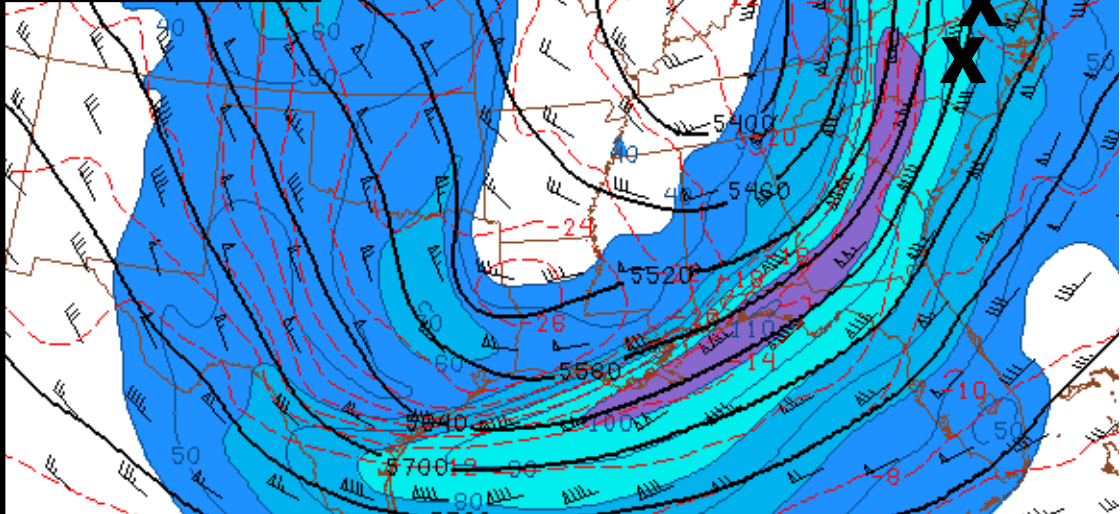
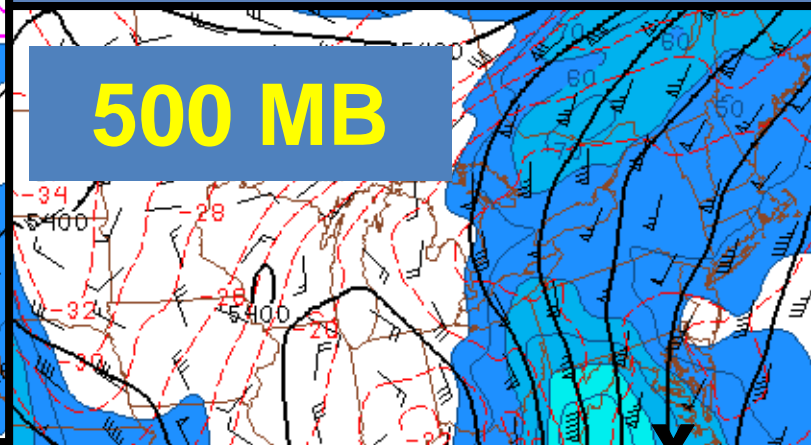
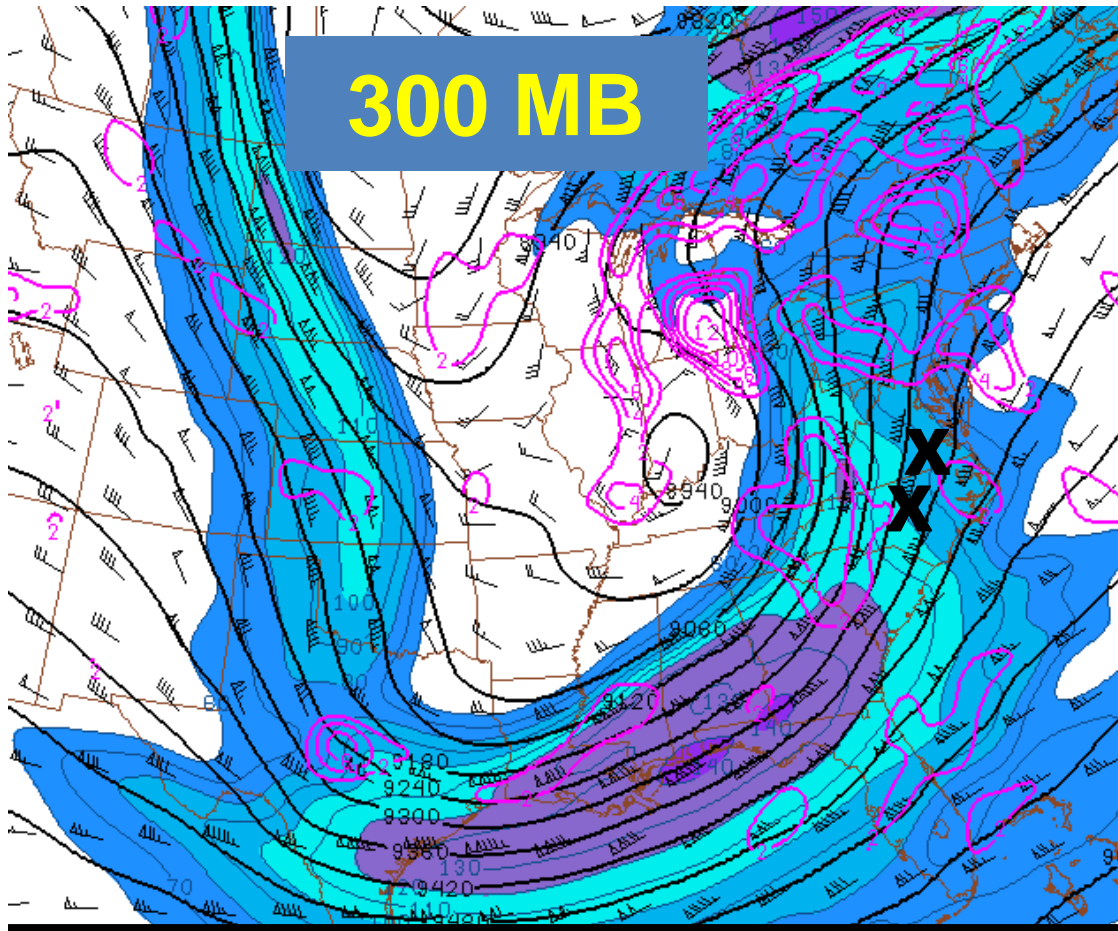
# SPC Day 1

# Wind

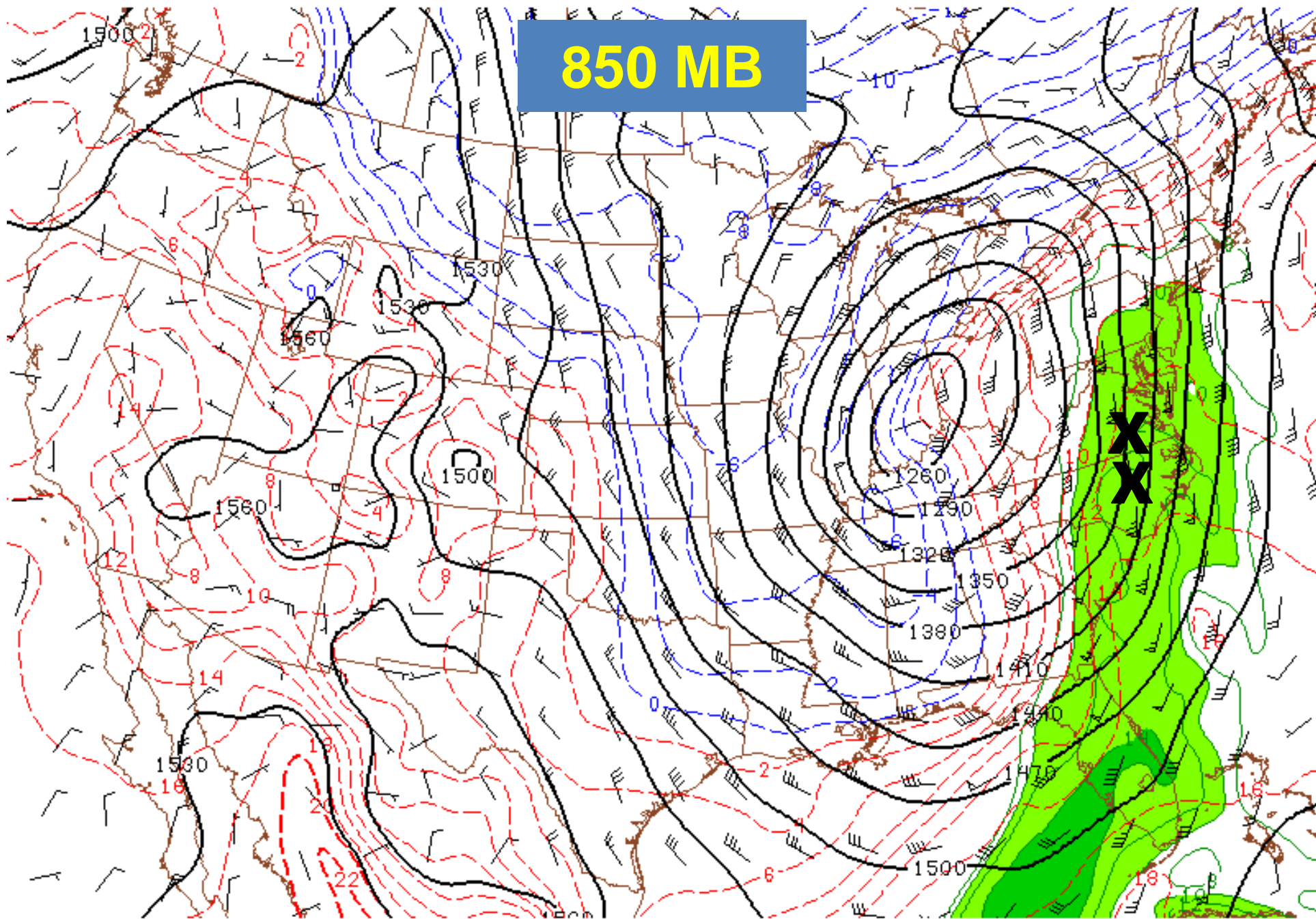
# Hail







# 850 MB

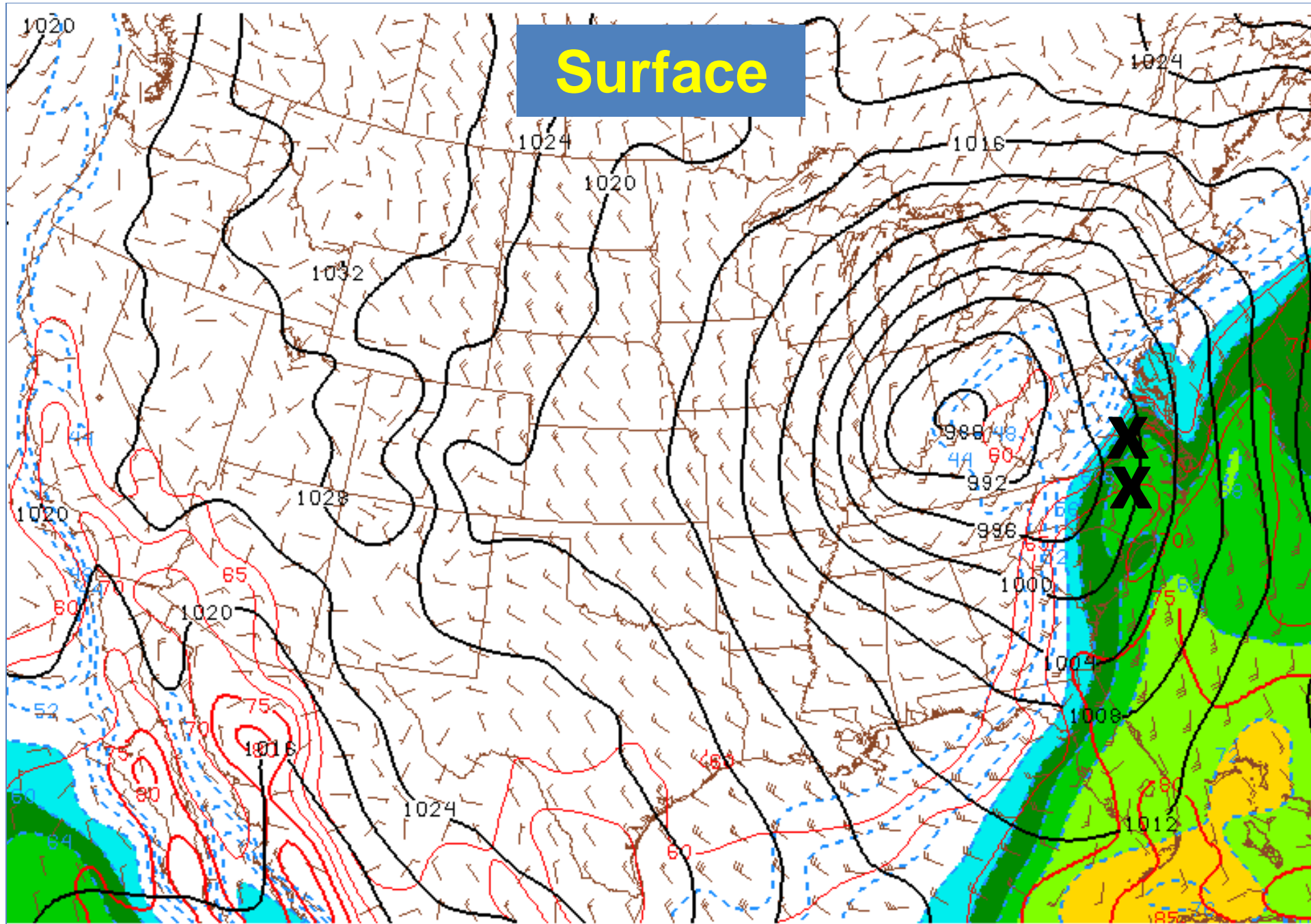


160224/1900V001 850mb hght/temp/dwpt (f111)/wind

10 14



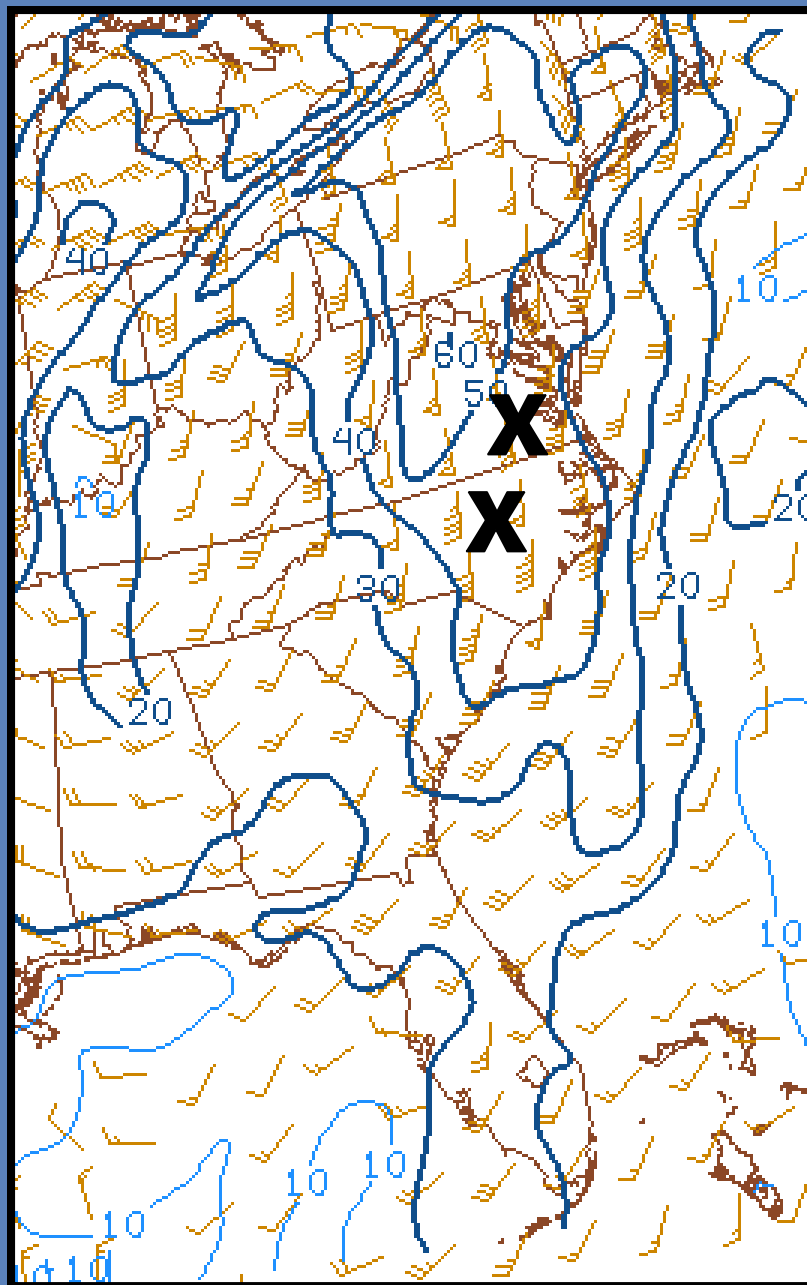
# Surface



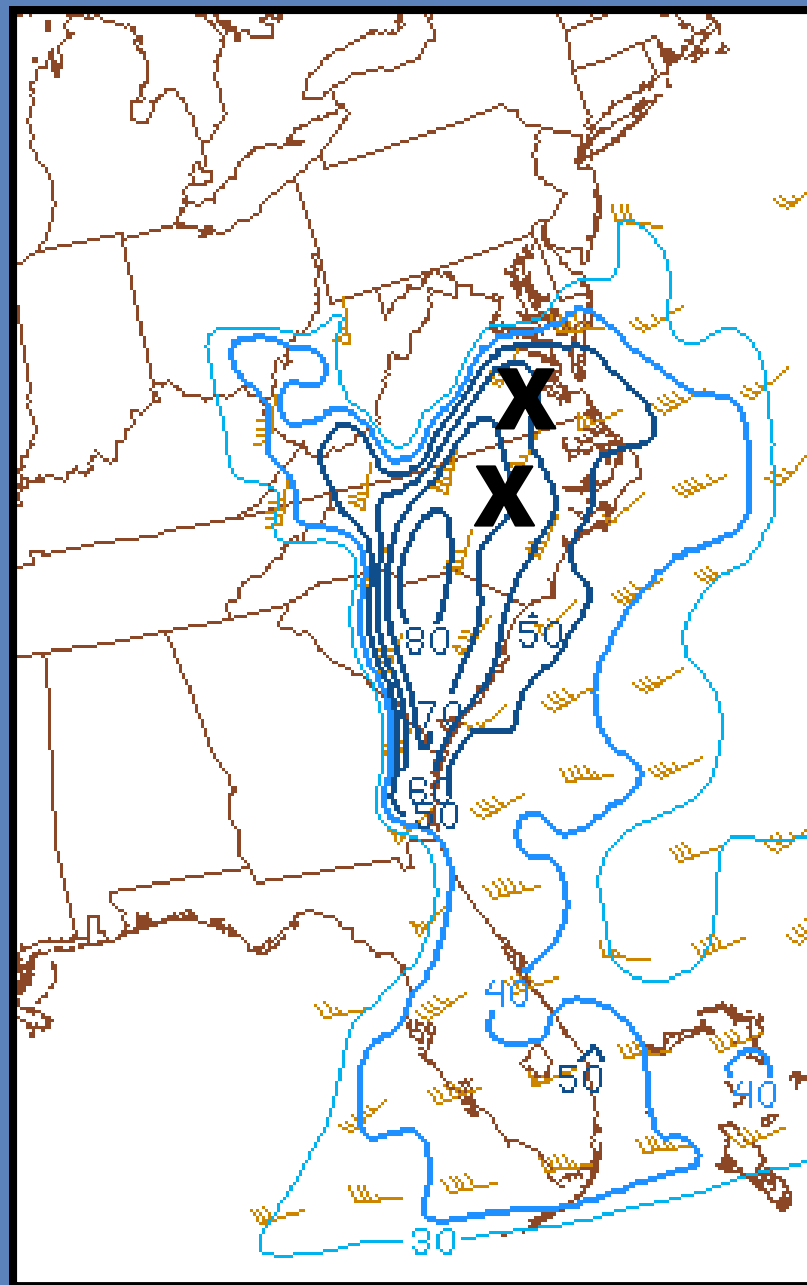
56 60 64 68 72

160224/1900 Surface temp, dewpoint, and pmsl

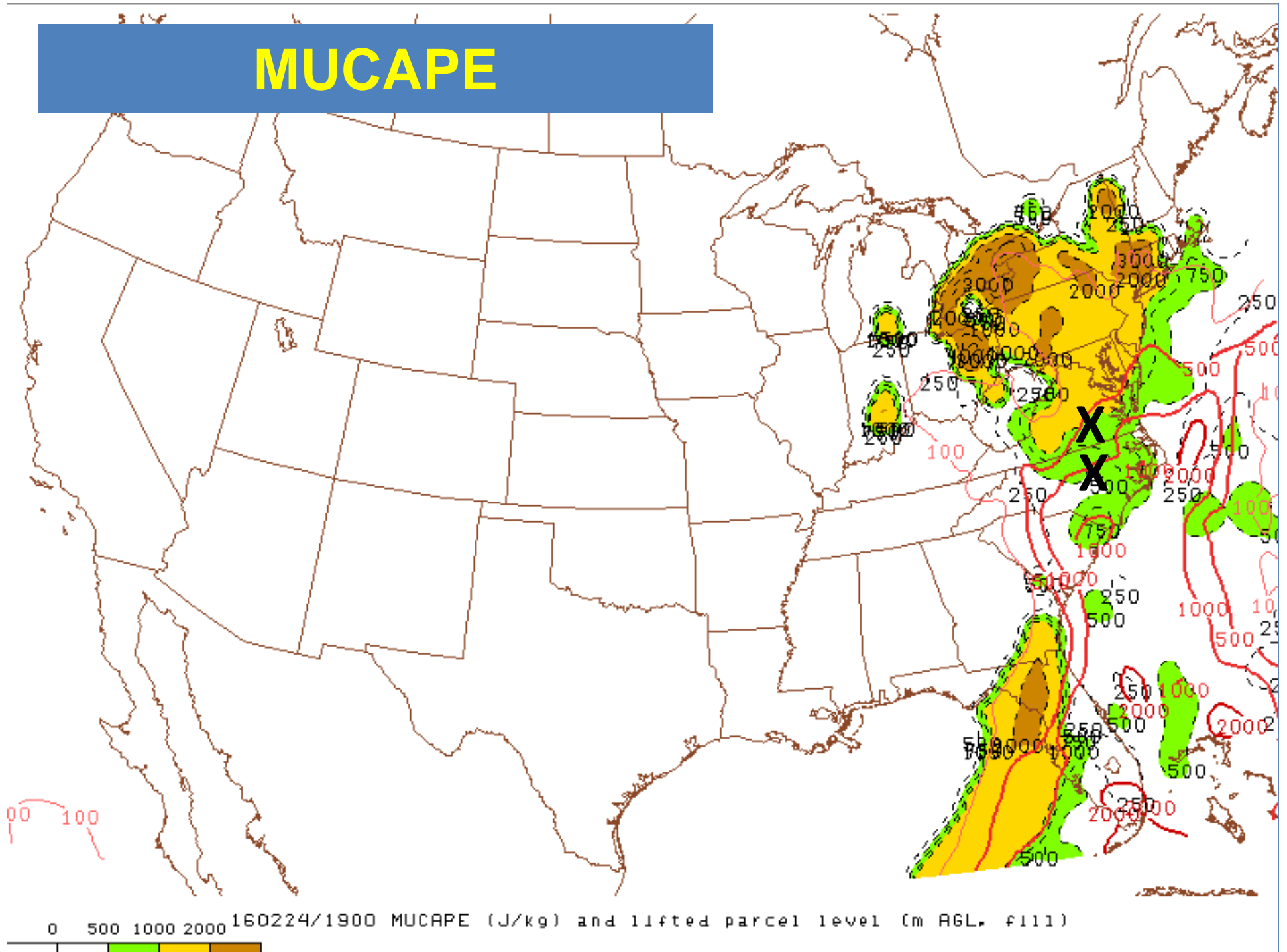
## 0-1 km Shear



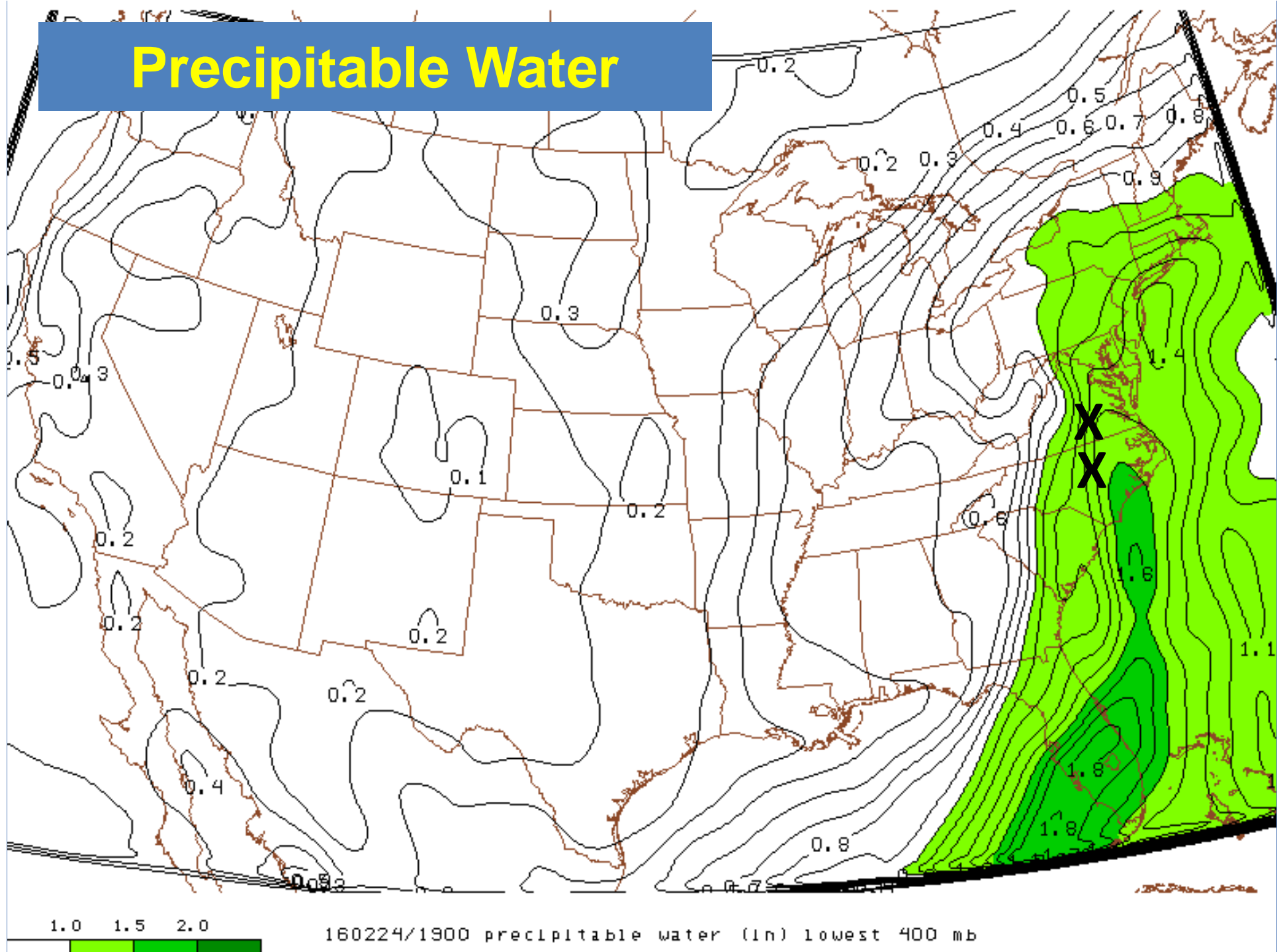
## Eff. Bulk Shear



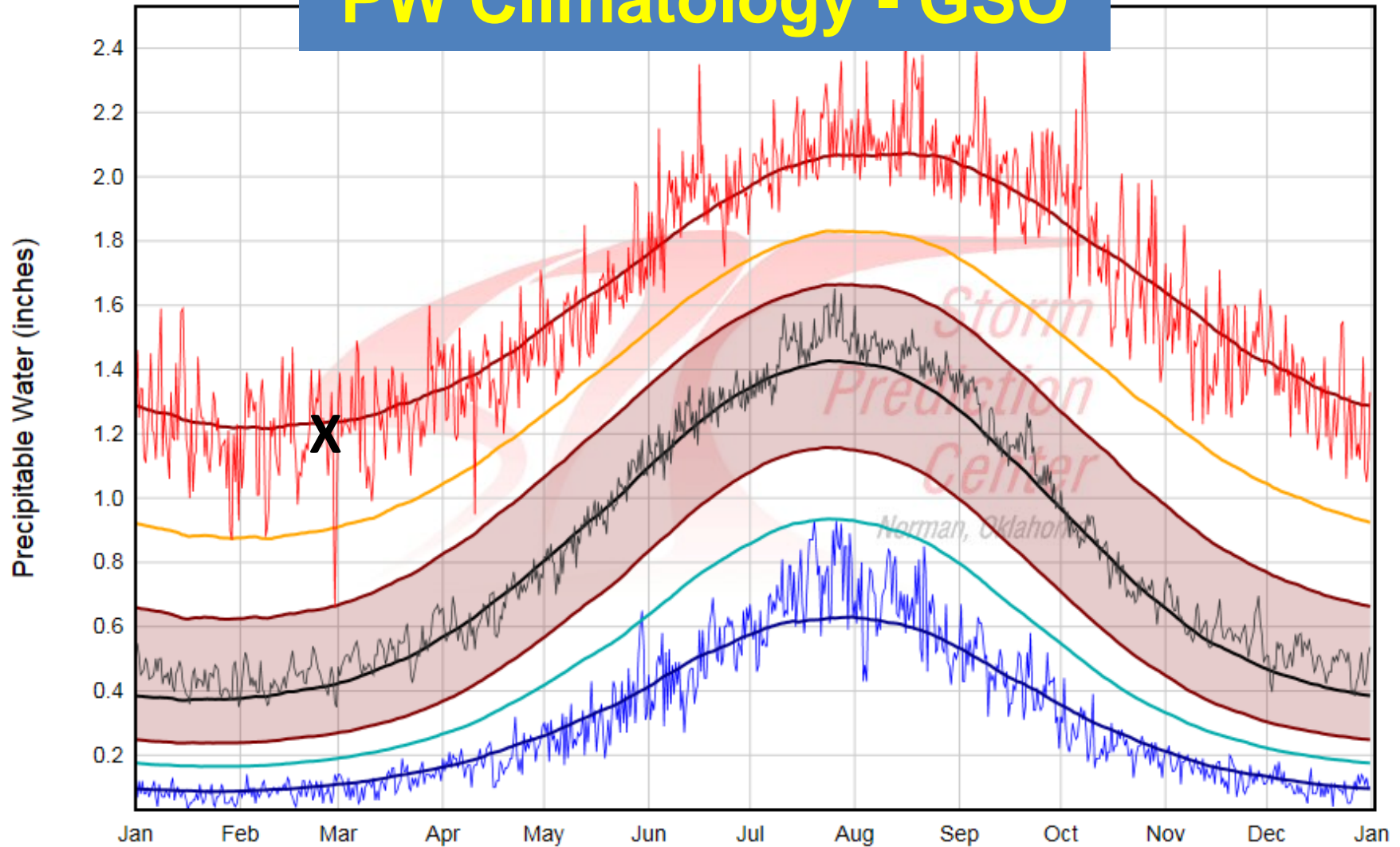
# MUCAPE



# Precipitable Water



# PW Climatology - GSO



24 Feb 12 UTC

Daily Min (Thin Line): 0.07  
Min Moving Average: 0.10  
10% Moving Average: 0.18  
25% Moving Average: 0.26

Median Moving Average: 0.41  
Daily Mean (Thin Line): 0.46

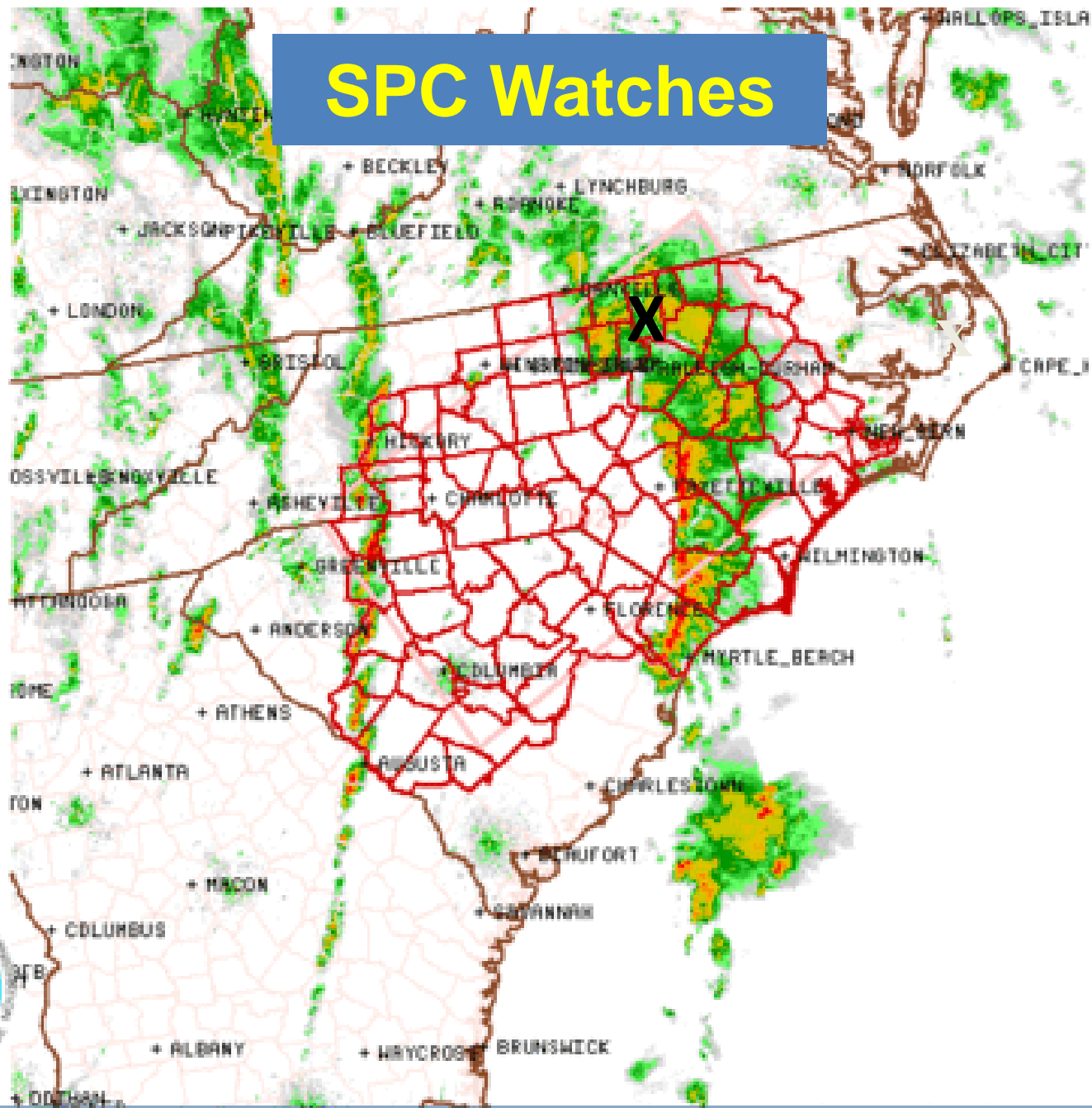
75% Moving Average: 0.65  
90% Moving Average: 0.90  
Max Moving Average: 1.23  
Daily Max (Thin Line): 1.40

# Environment Summary

- Approaching trough
- Seasonally significant low-level moisture
- Sufficient instability
  - MU CAPE =  $\sim 1000$  J/kg
- Shear
  - Deep =  $\sim 70$  kts
  - Low-level = 40+ kts

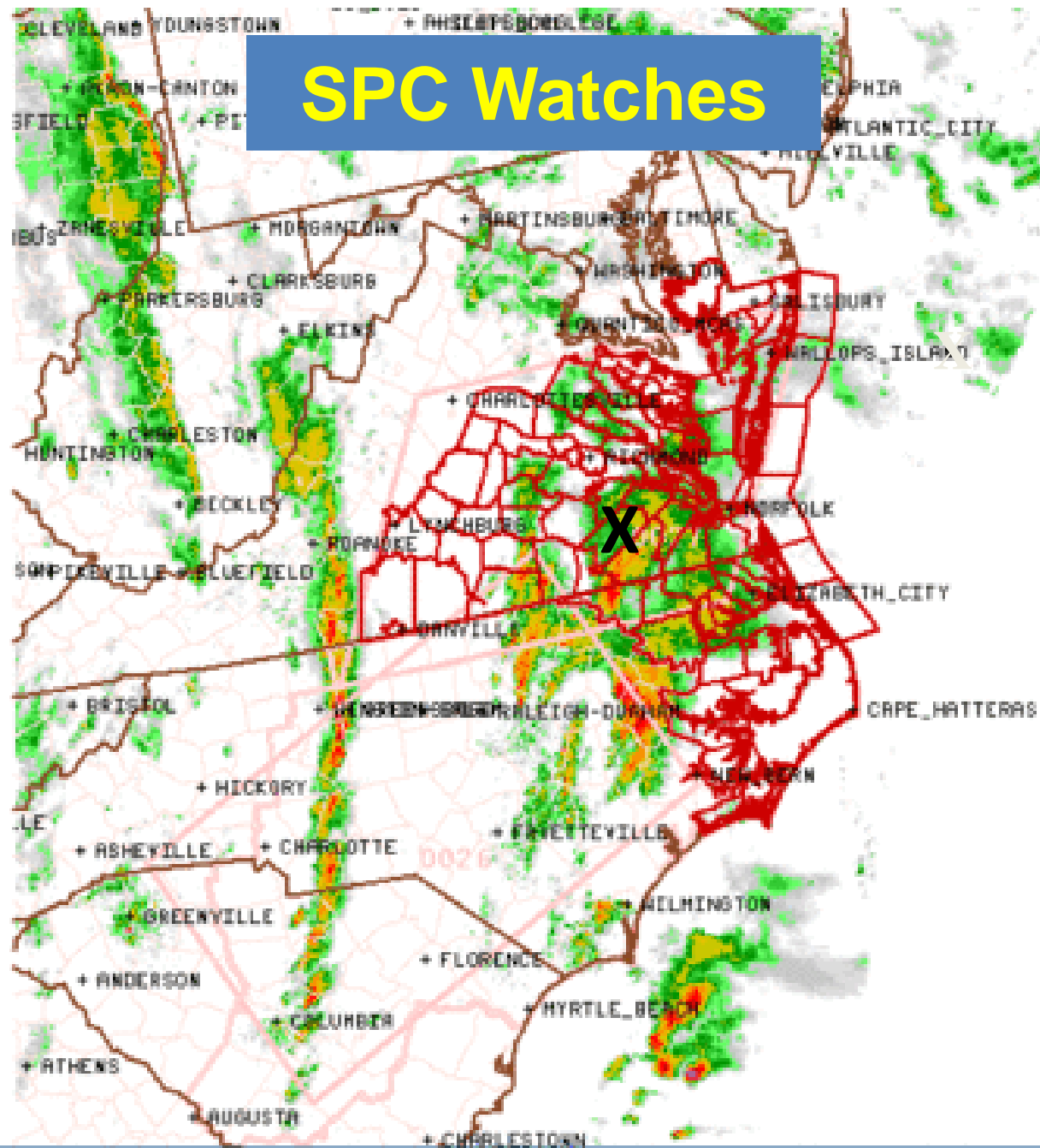


# SPC Watches



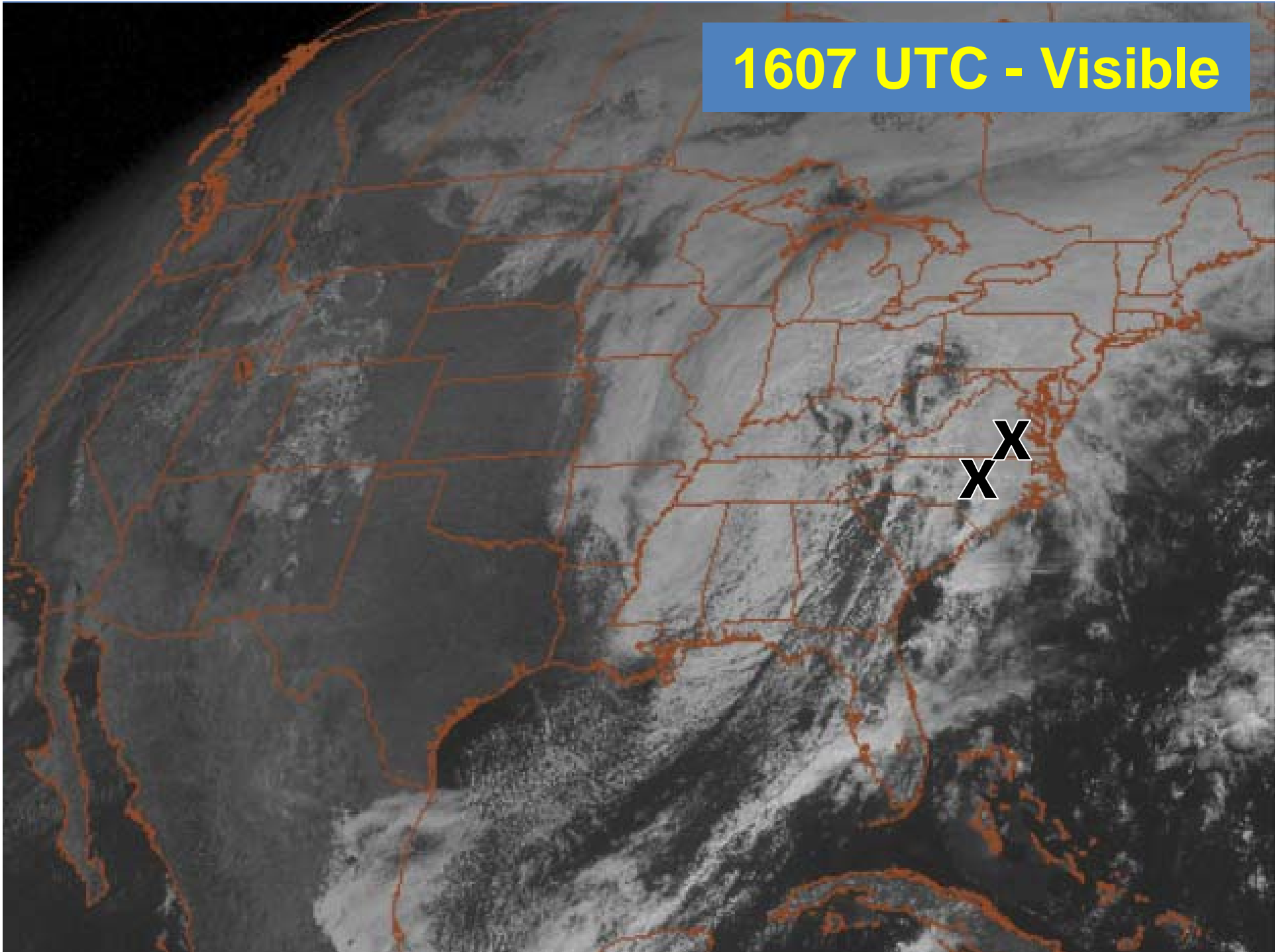
**Tornado Watch # 26 - Valid from 1115 AM until 700 PM EST**

# SPC Watches

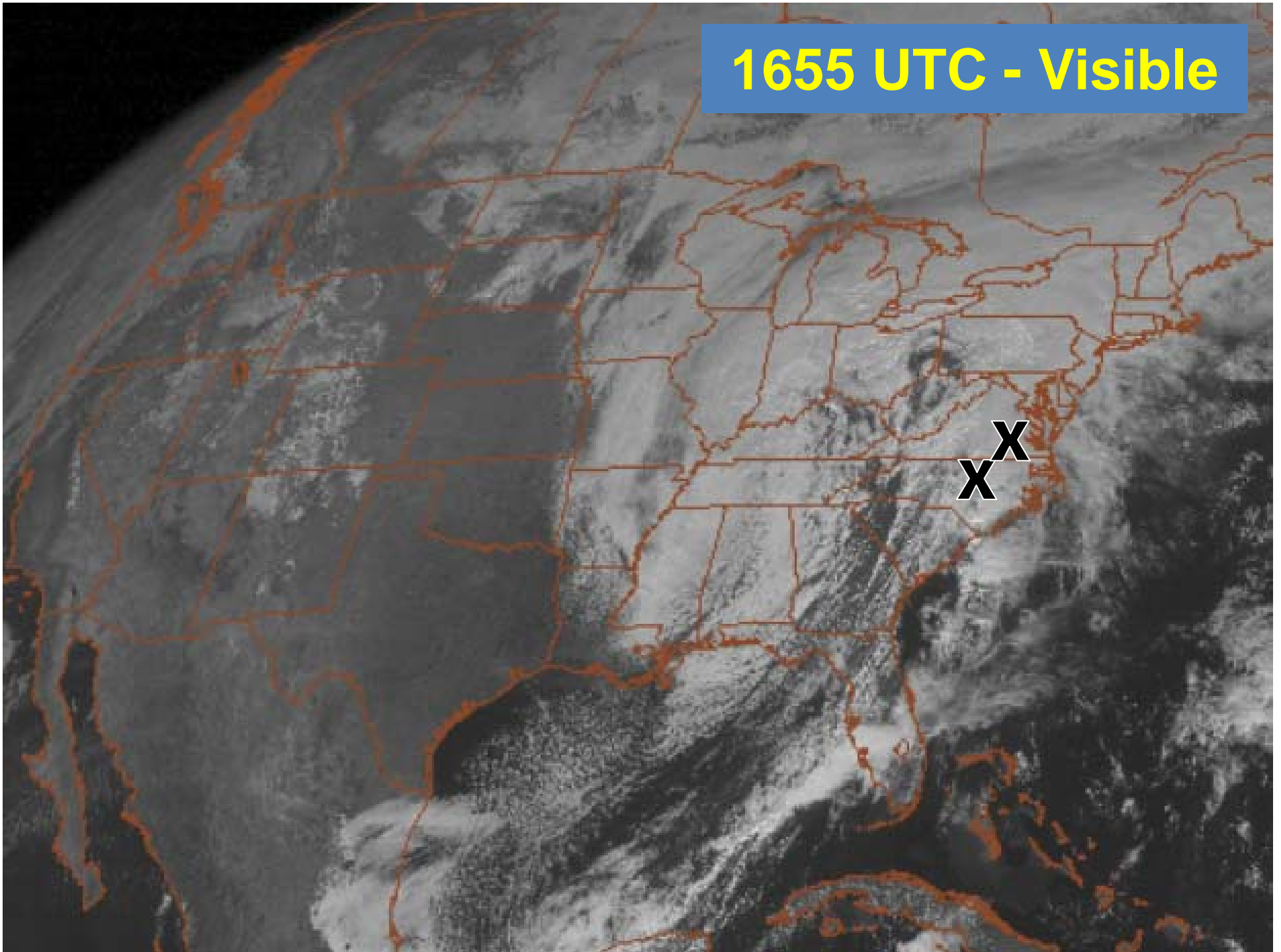


**Tornado Watch # 27 - Valid from 145 PM until 900 PM EST**

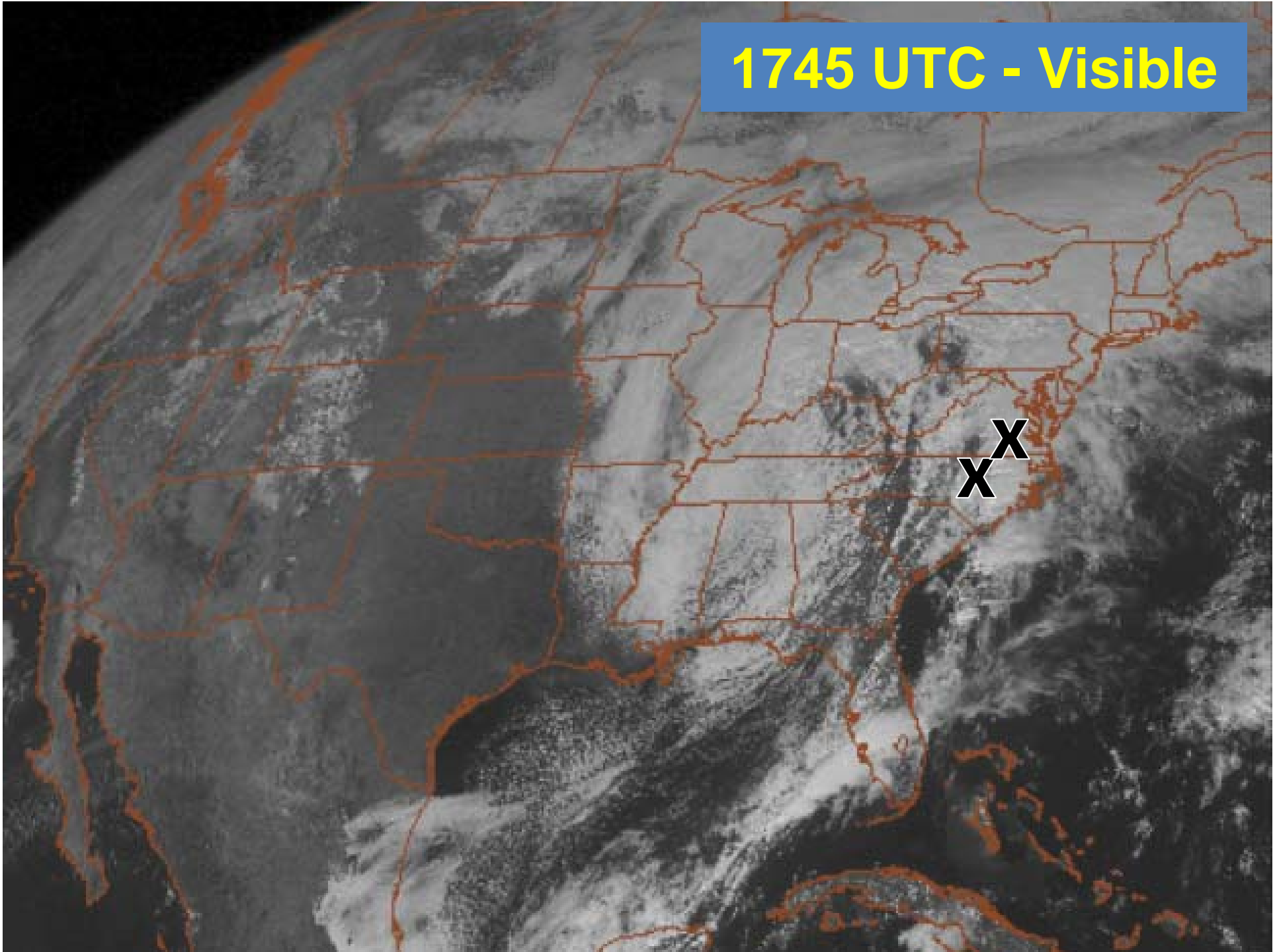
1607 UTC - Visible



1655 UTC - Visible

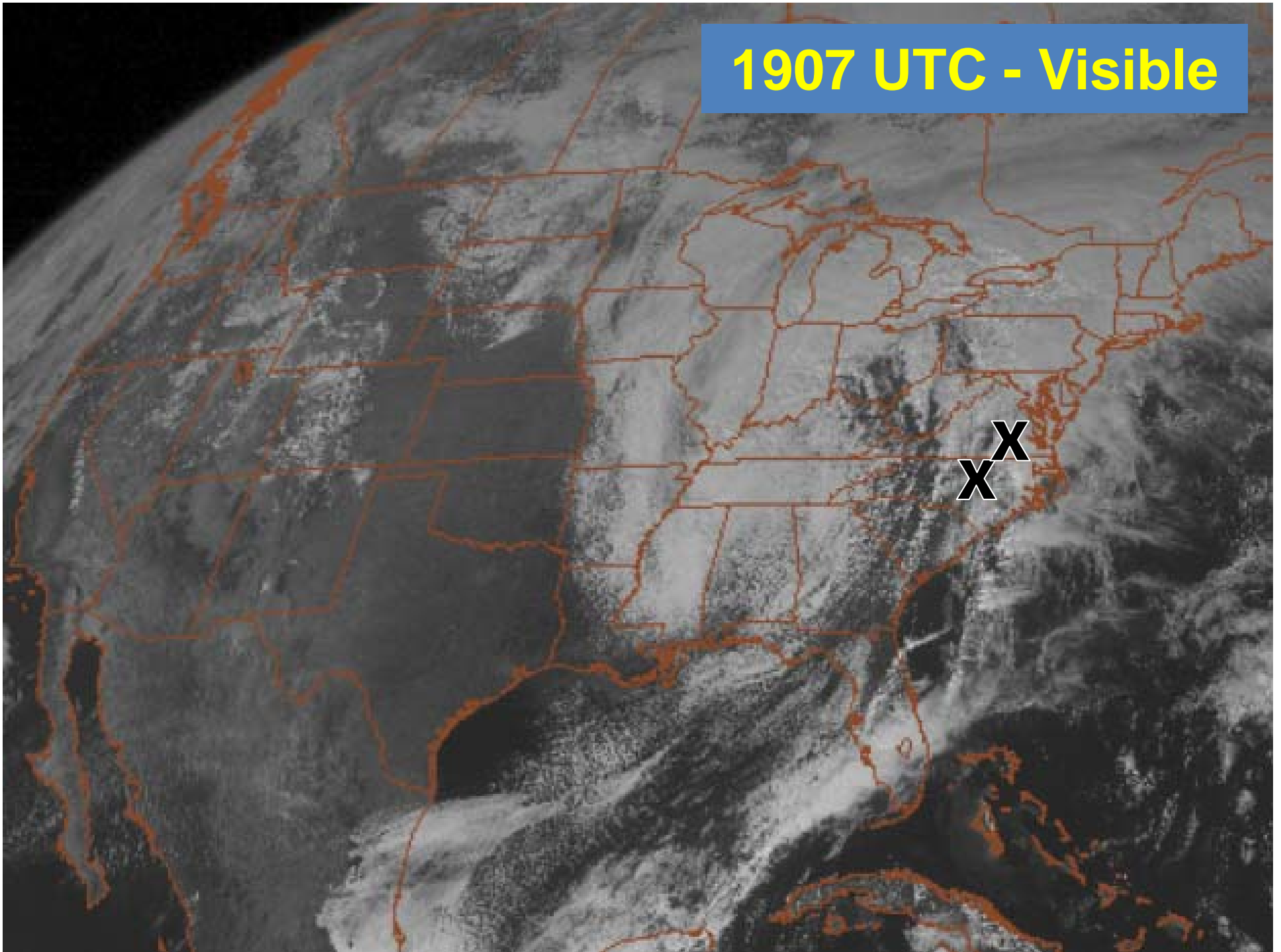


1745 UTC - Visible



1907 UTC - Visible

X  
X  
X



**Decision Point #2:  
Waverly, VA @ 1931 UTC**

# February 24, 2016 @ 1931 UTC

- It's warning time! What would you do?

**TOR**

**SVR**

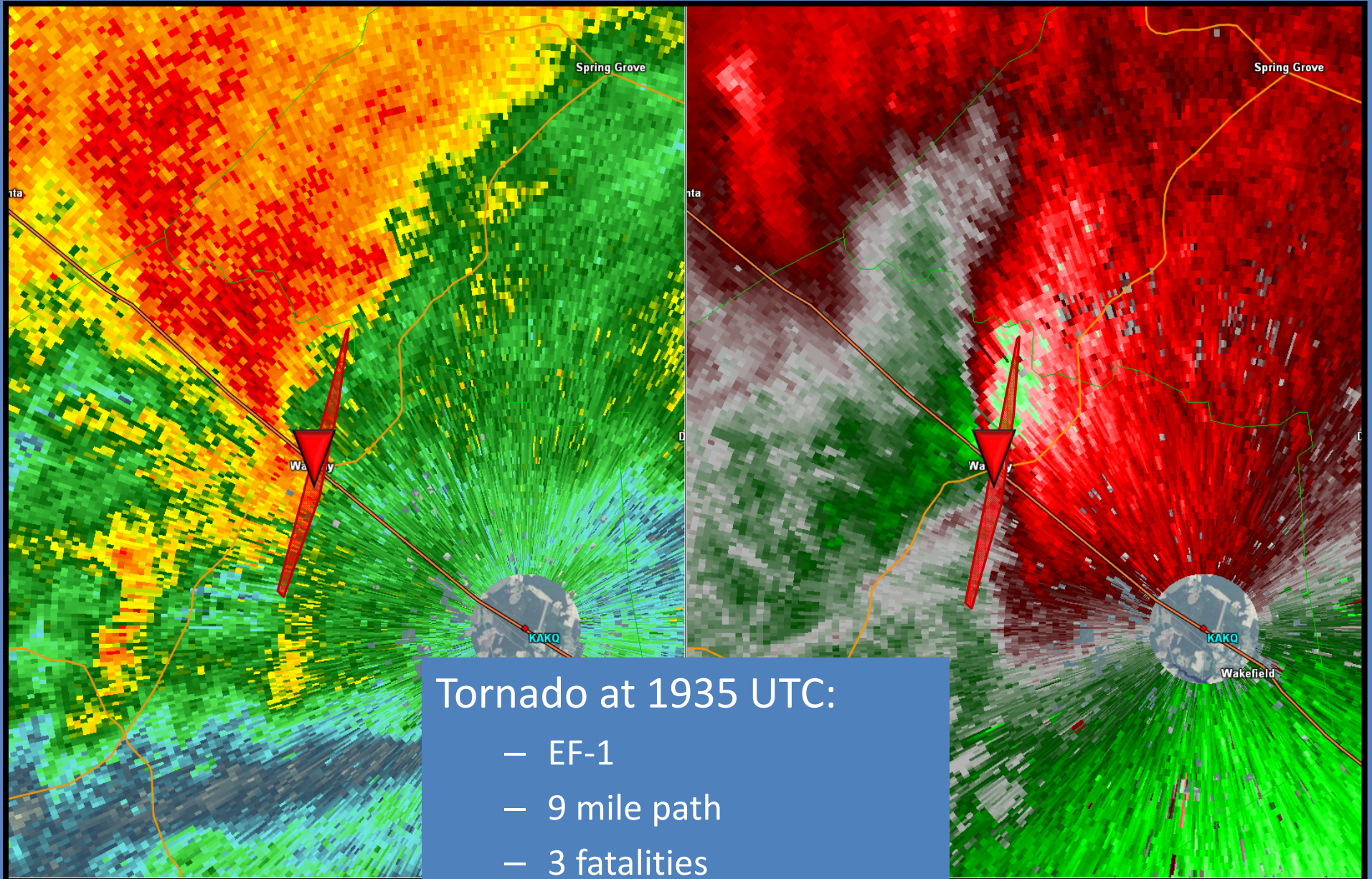
**NOTHING**

**FFW**

**OTHER**



# February 24, 2016 (Verification)



# Break Time!!!

- Then we'll come back for more fun stuff!

**Decision Point #3:  
Oxford, NC @ 2232 UTC**

# February 24, 2016 @ 2232 UTC

- It's warning time! What would you do?

**TOR**

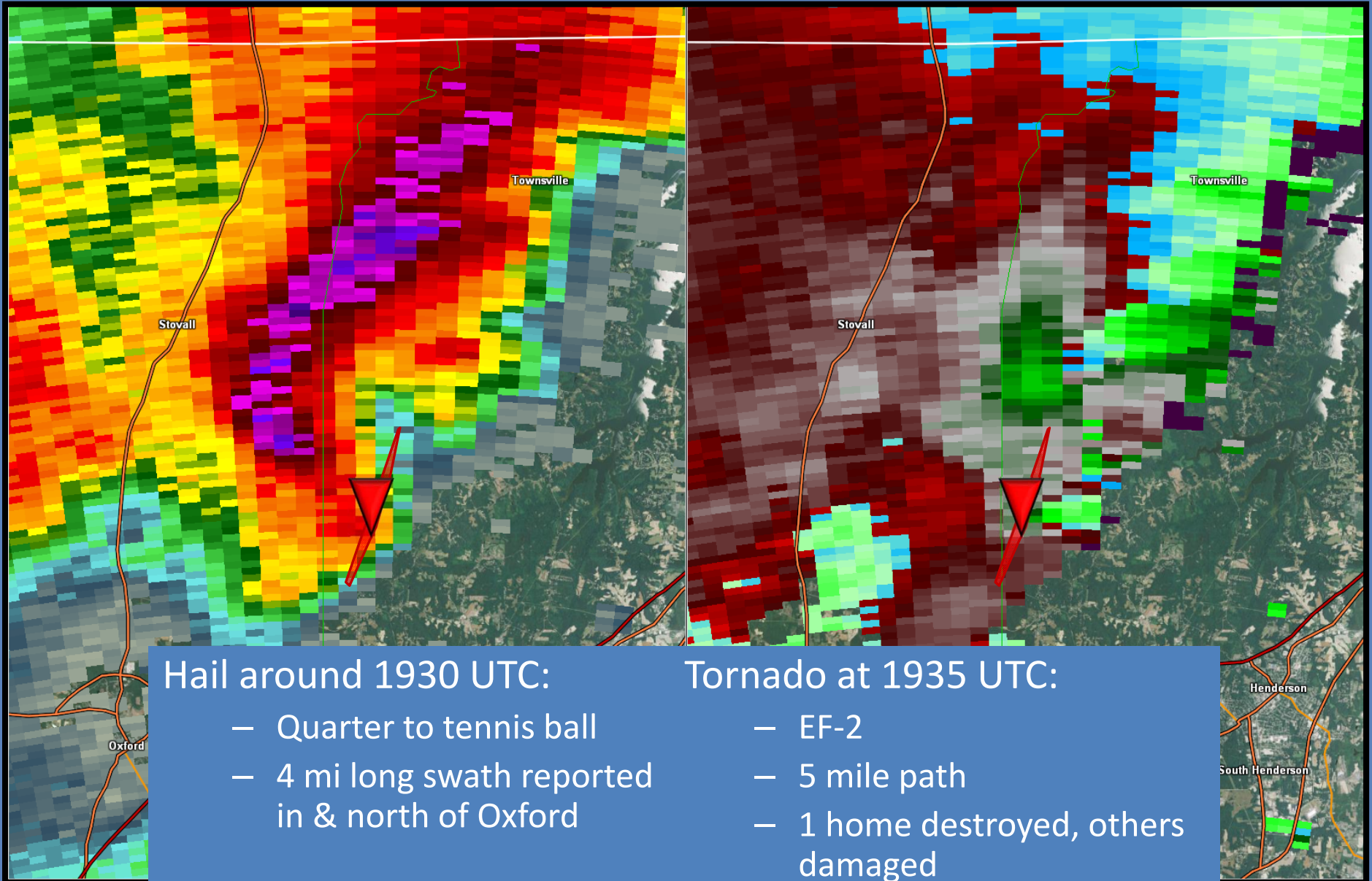
**SVR**

**NOTHING**

**FFW**

**OTHER**

# February 24, 2016 (Verification)



## Hail around 1930 UTC:

- Quarter to tennis ball
- 4 mi long swath reported in & north of Oxford

## Tornado at 1935 UTC:

- EF-2
- 5 mile path
- 1 home destroyed, others damaged

## **Part 2: AWIPS D-2D Display Layout**

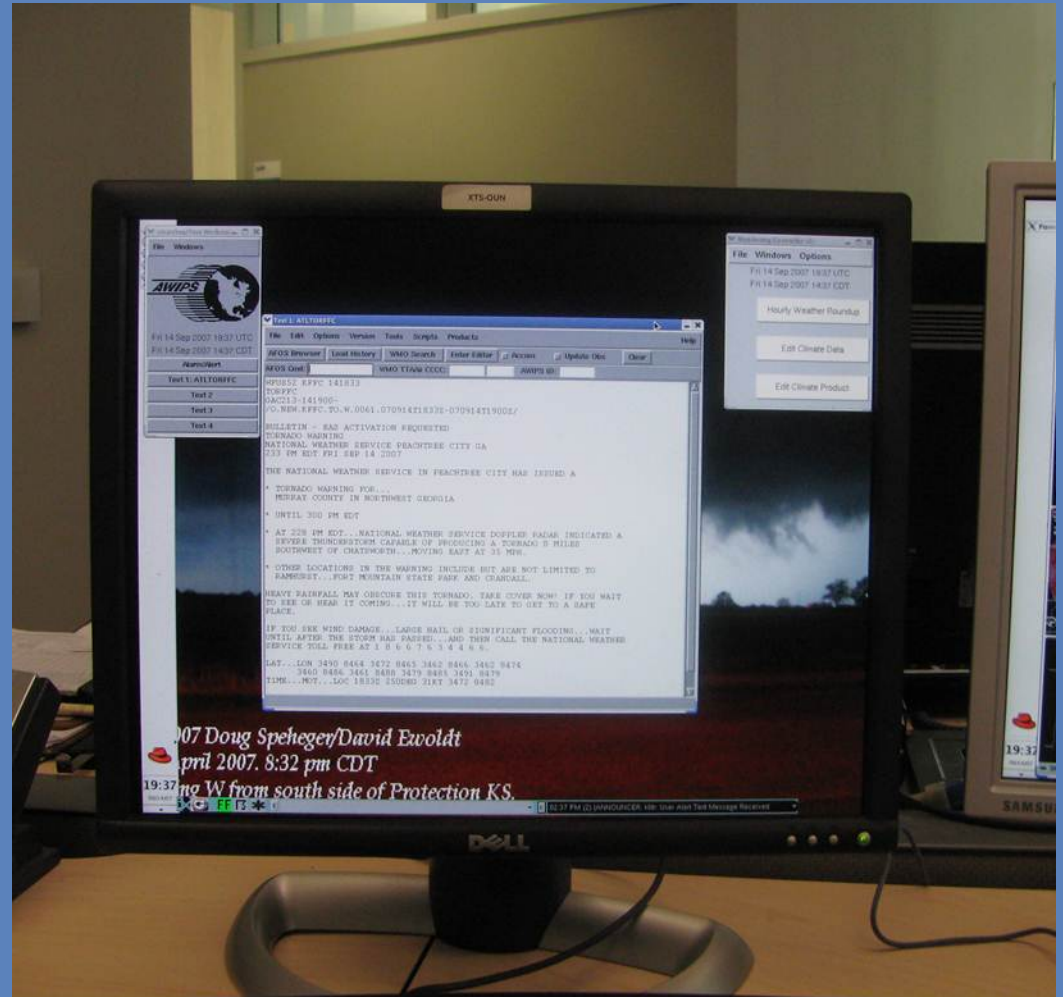
# Overview

- Many methods are possible and valid
- Choose what works for you
- Experiment with layouts and procedures
- Time match to LIVE data
- Save Perspectives for consistency



# Text Workstation

- Edit warning text
- Send products
  - Proofread your products before sending!  
Spellcheck!
- Read products you sent or neighboring offices have sent





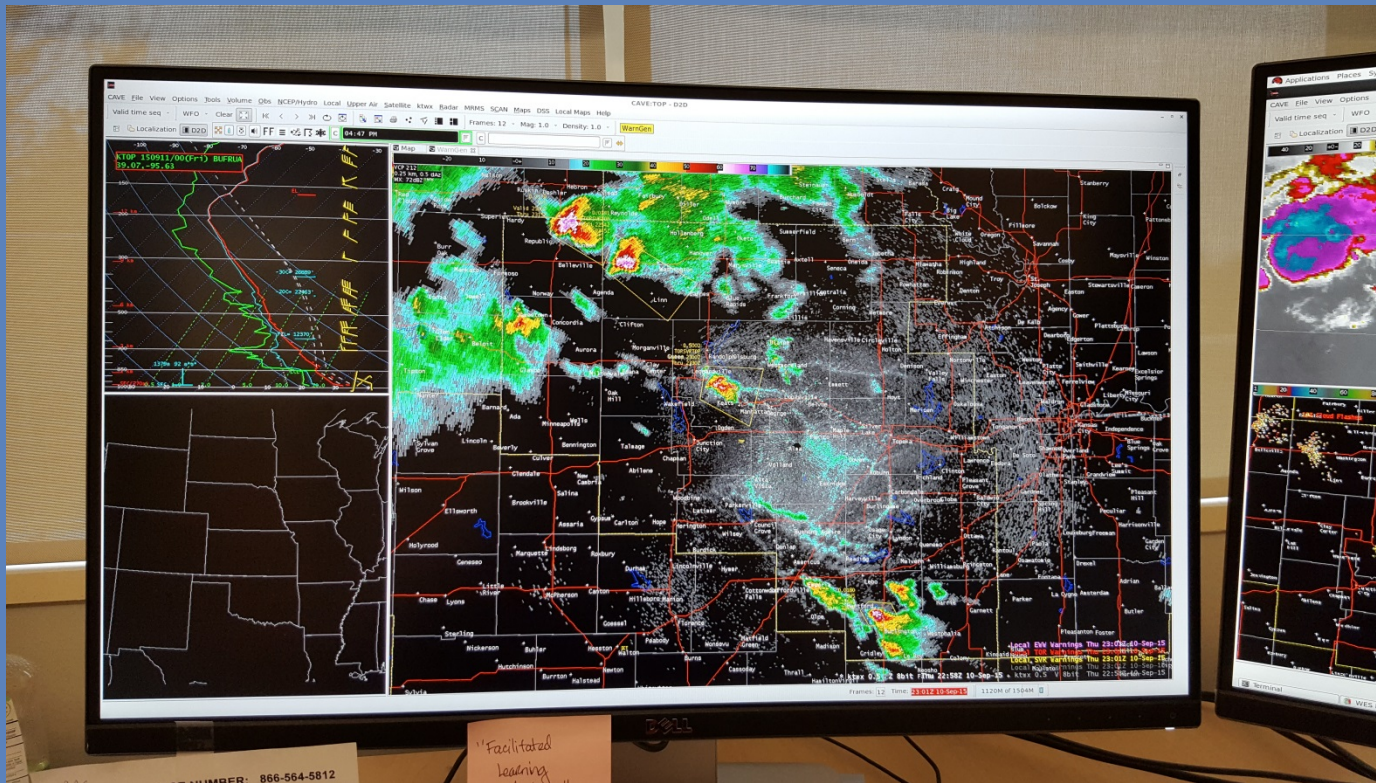
# Right Monitor

- Radar analysis
  - All-tilts, 64 frames of base data moments, use PCR and Env. Data Packge
  - Build MRMS into live data (time match to radar)
  - Derived products (i.e. STI, HI, etc.)
  - Precipitation 4-panel
- Real Time Data
  - Total Lightning
  - GOES-R



# Left Monitor

- Environmental assessment
  - Satellite, METARs, models, soundings, FFMP, etc.
  - Adjacent Radars
- WarnGen
  - Maps
  - Special Events



# Overall Theme

**Warning/Product  
Distribution  
Supplementary  
Analysis**

**Heavy Data  
Analysis/Real Time  
Products**

# Alternatives

## Severe Convective/CWA Wide

WarnGen (0.5 Z/V 12  
Frames)  
Sfc Obs/MSAS  
Upper Air/Sounding  
IR/Vis/WV Satellite

All Tilts Radar Tabs  
Total Lightning Tab  
GOES-R Tab (if nec.)

# Alternatives

## Sectorized/Flash Flood Forecaster

WarnGen (0.5 Z/V 12  
Frames)  
Sfc Obs/MSAS  
Upper Air/Sounding  
IR/Vis/WV Satellite  
FFMP

1 hr/STA Dual Pol  
1 hr/STA Legacy  
RFC FFG  
Topo Map  
All Tilts PCR

# Alternatives MesoAnalyst

WarnGen (0.5 Z/V 12  
Frames)  
Sfc Obs/MSAS  
Upper Air/Sounding  
IR/Vis/WV Satellite

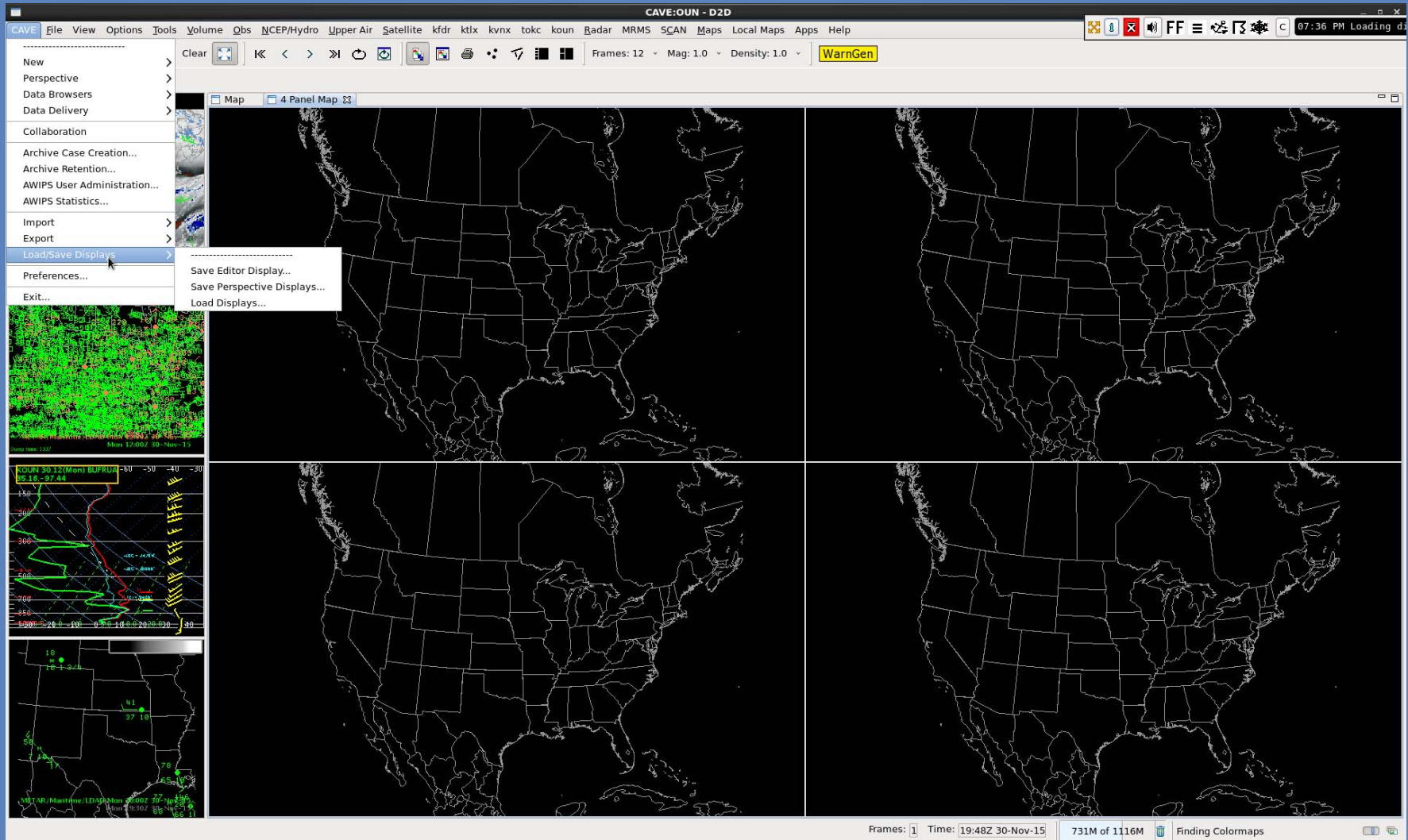
Sector Radar All-Tilts  
PCR  
LAPS/HRRR/RUC  
NAM/GFS  
Forecast Soundings

# Data Overlays

- Experiment with data overlays (MRMS, lightning, etc)
- Time match to radar/fastest updating product
- Draw FFWs with FFMP if it helps
- Use Tabs, experiment with panel layouts

# CAVE -> Load/Save Displays

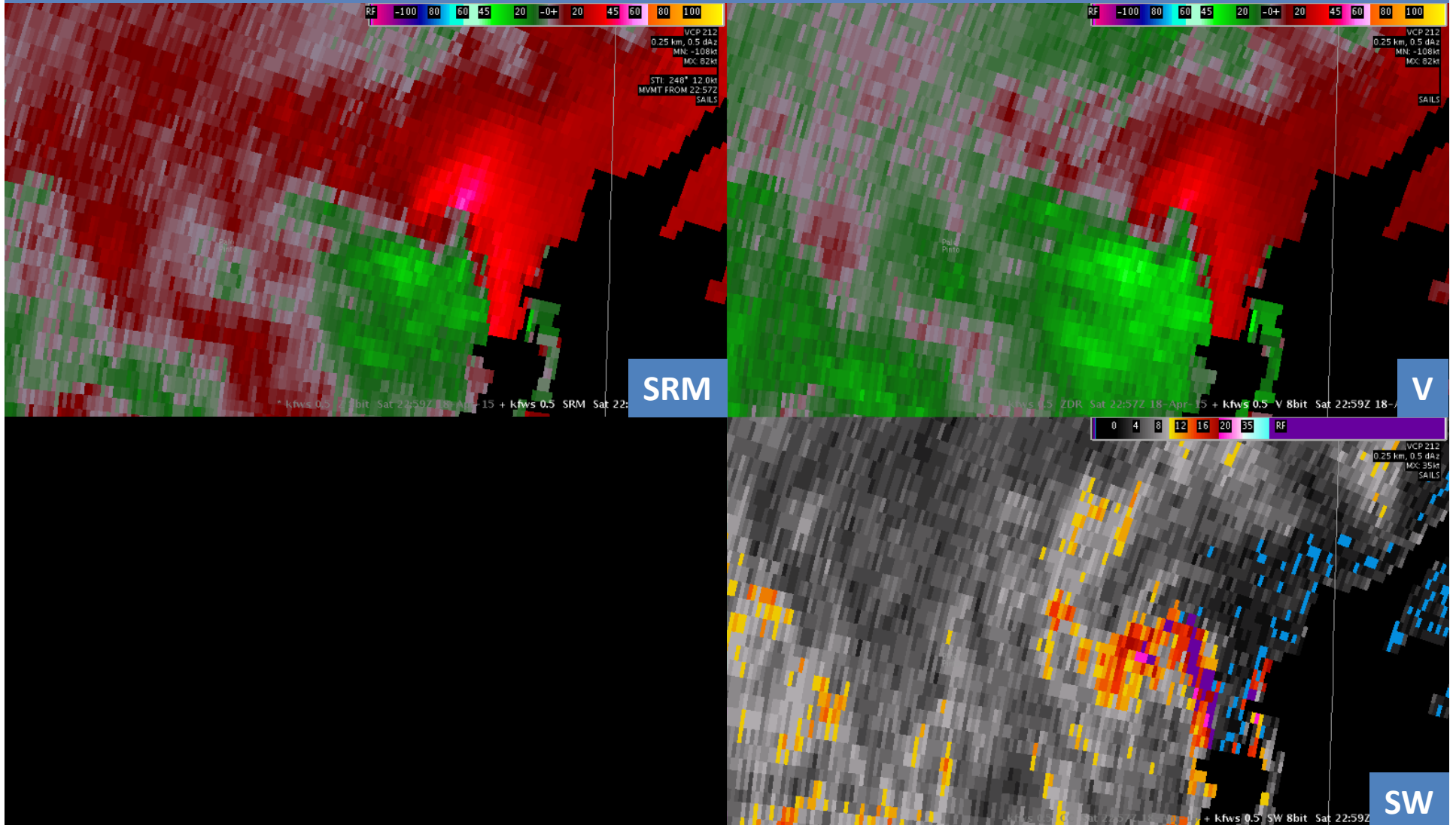
## Save Editor Display/Load Display



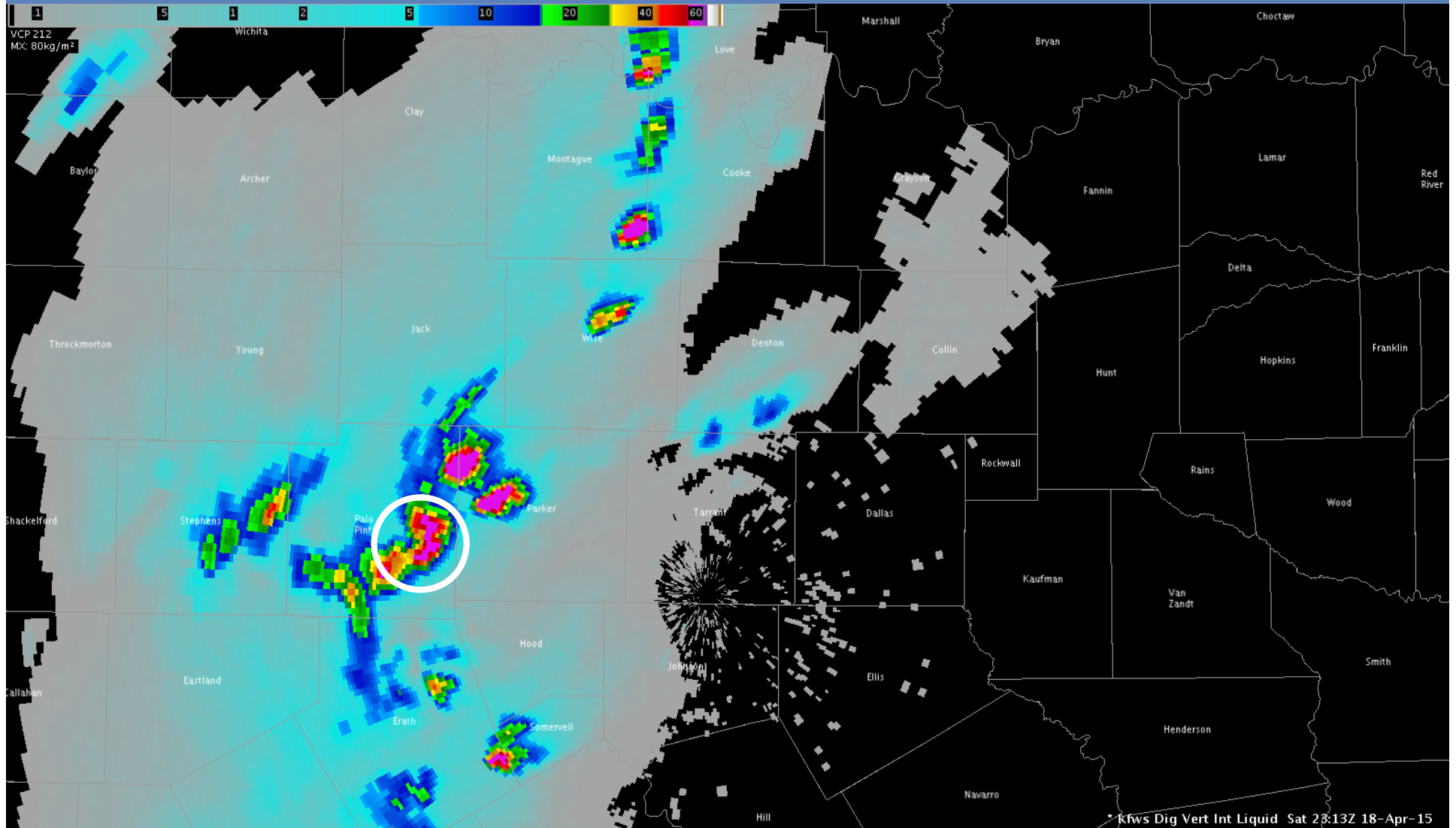


# Part 3: Data Quality Takeaways

# Base Warning Decisions on Base Products as Much as Possible



# Avoid Rules of Thumb



# Ensure Storm-Relative Motion Vector Is Accurate

**Radar Display Controls**

**STI** Num storms to show:  40  
Type of track to show:

**HI**

	POH	POSH
Low $\Delta$	<input type="text" value="30"/>	<input type="text" value="30"/>
High $\blacktriangle$	<input type="text" value="50"/>	<input type="text" value="50"/>

**TVS**  Show elevated TVS

**DMD,MD,TVS**  Show extrapolated features

**DMD** Min feature strength:  3  
 Show overlapping Mesos  
Type of track to show:

**SRM**

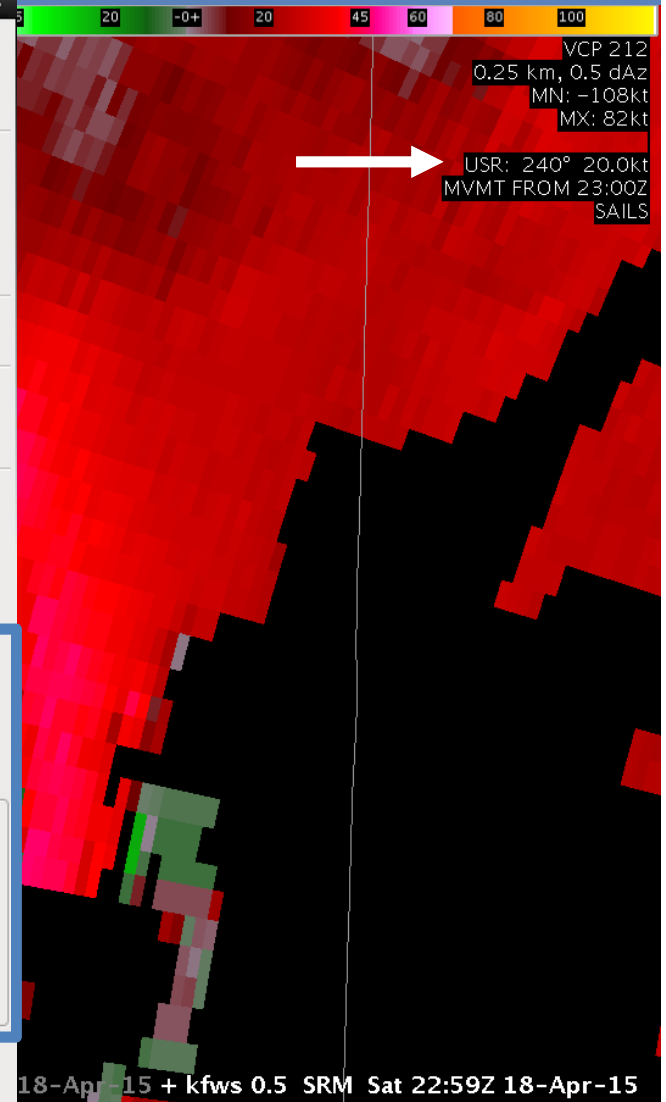
- Storm Motion from WarnGen Track
- Average Storm Motion from STI
- Custom Storm Motion

Custom Storm Motion

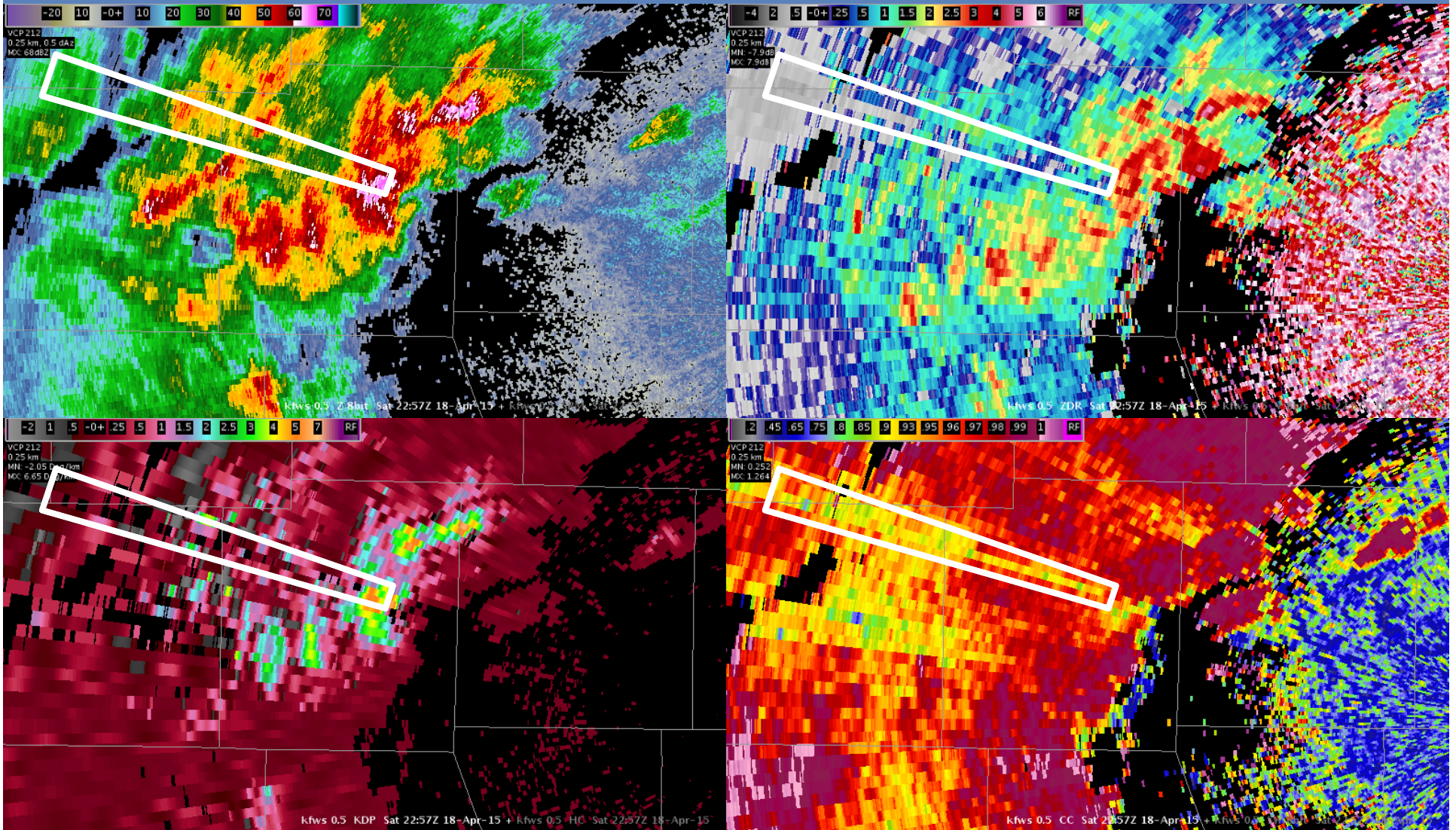
Dir:  240  
0 359

Spd:  20  
0 99

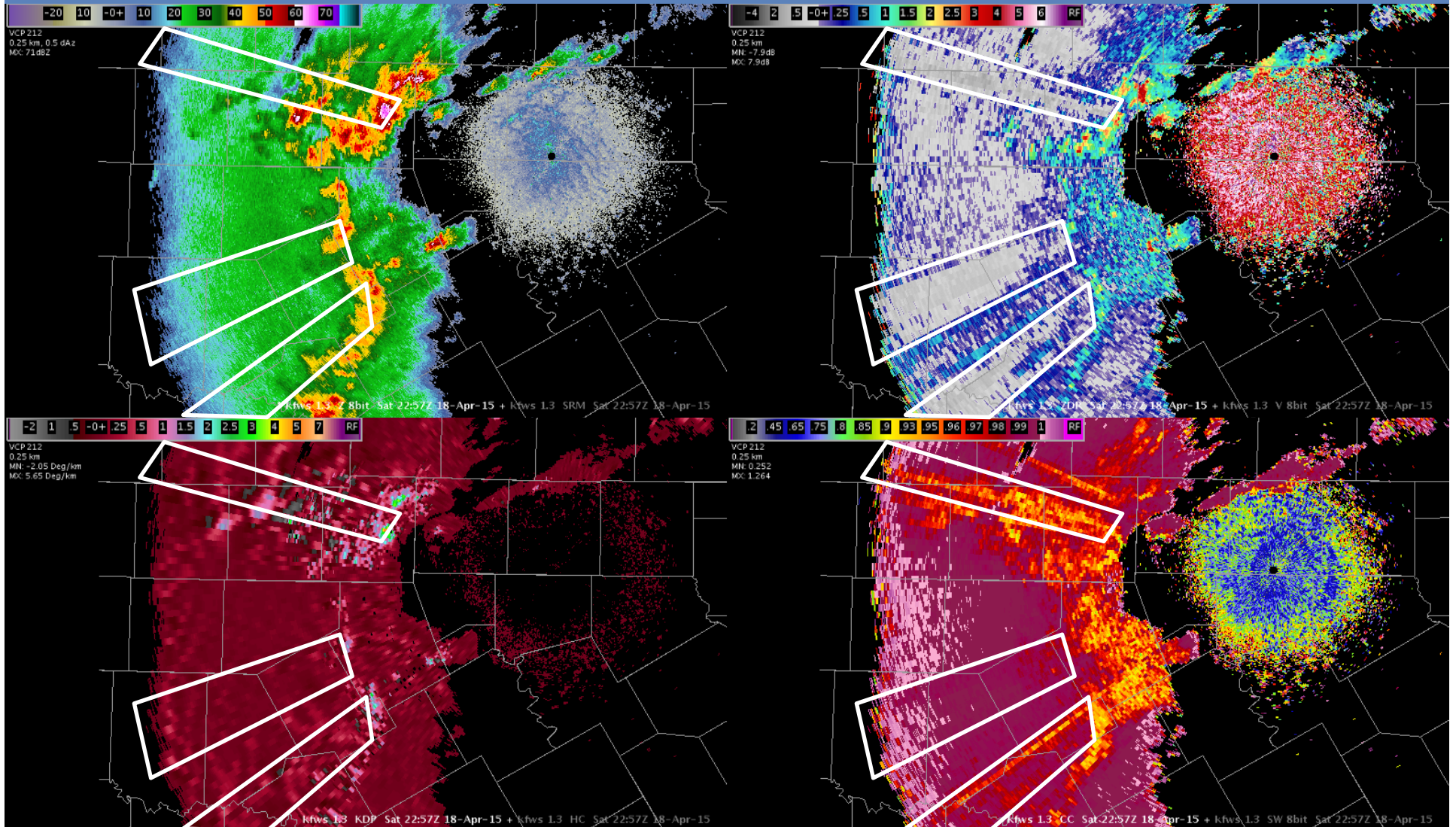
Close



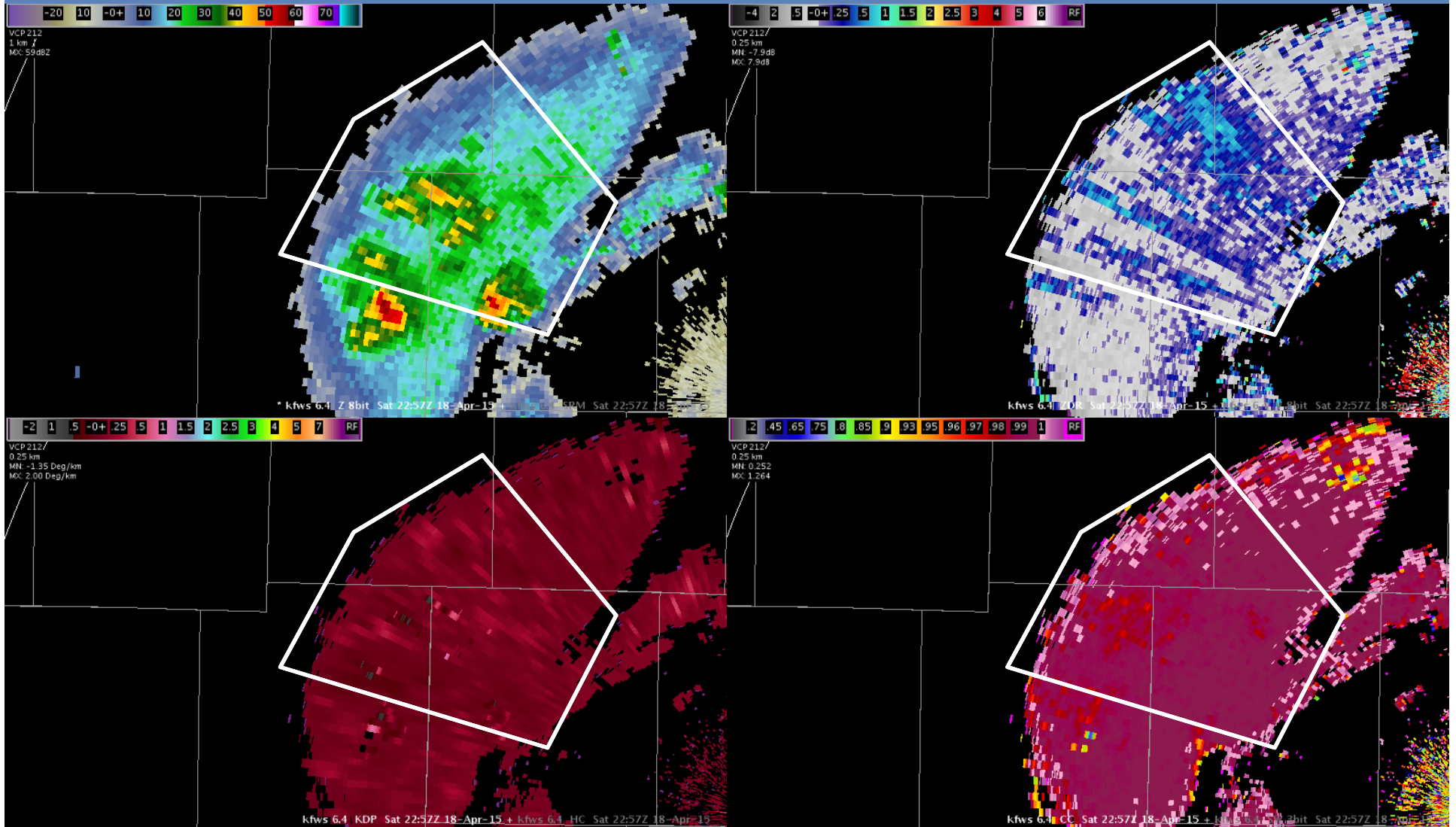
# Data Quality Pop Quiz Question #1



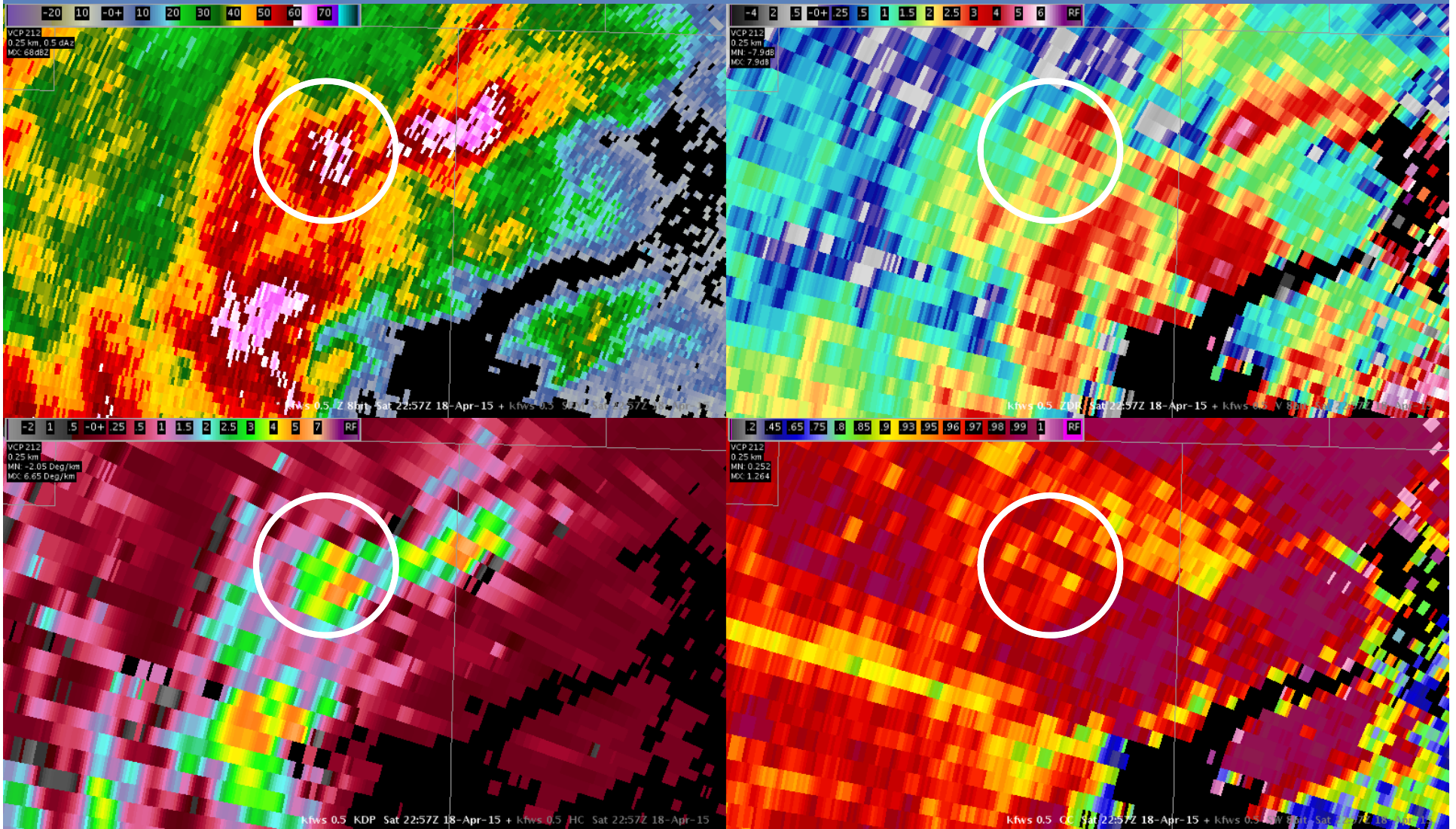
# Data Quality Pop Quiz Question #2



# Data Quality Pop Quiz Question #3

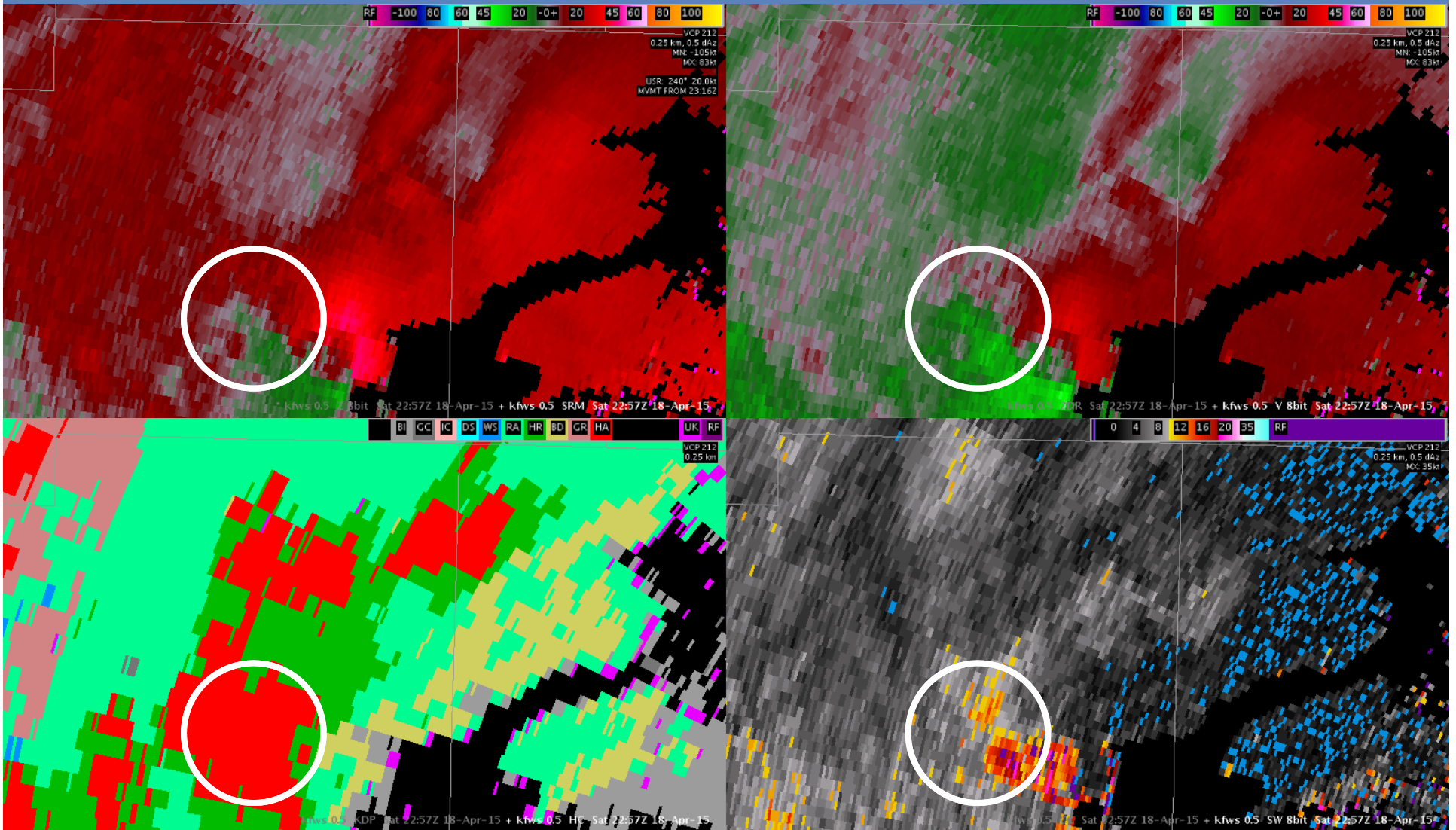


# Know the Difference between Classic Hail & Small, Melting Hail Signatures

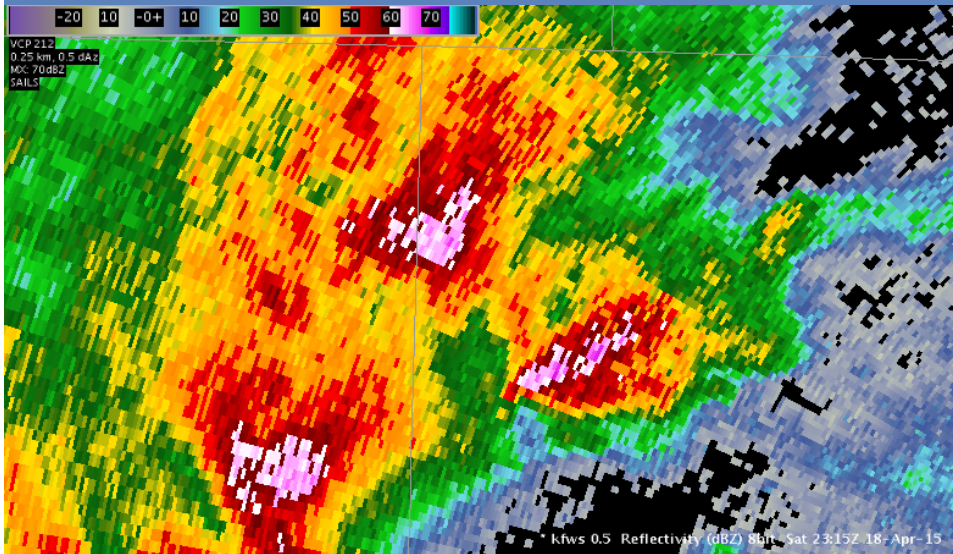




# What Kind of Hail is Dominating the Signal Here?



# Where Is the Rainfall the Most Intense?



# Be Aware of Combined Attribute Table Contents

STM ID	AZ/RAN	TYS	MDA	POSH/POH/MX SIZE	VIL	DBZM	HT	TOP	FCST	MVMT
R0	282/ 44	TVS	6	80/100/ 1.50	55	62	7.7	29.3	311/ 12	
Q6	216/104	NONE	6	70/100/ 1.25	54	60	13.8	33.8	282/ 14	
K4	349/ 57	NONE	1	90/100/ 1.75	47	65	10.5	26.7	48/ 2	
N4	298/ 42	NONE	1	80/100/ 1.50	48	64	5.3	30.3	74/ 4	

# End of Topic on Base & Derived Products

- Free to move on to Winter and Severe Topics
- Workshop
  - Many opportunities to apply these concepts

# Questions?

## Contact Information:

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