An analysis of precipitation events associated with terrain-generated convergence in the Mohawk and Hudson River valleys of New York

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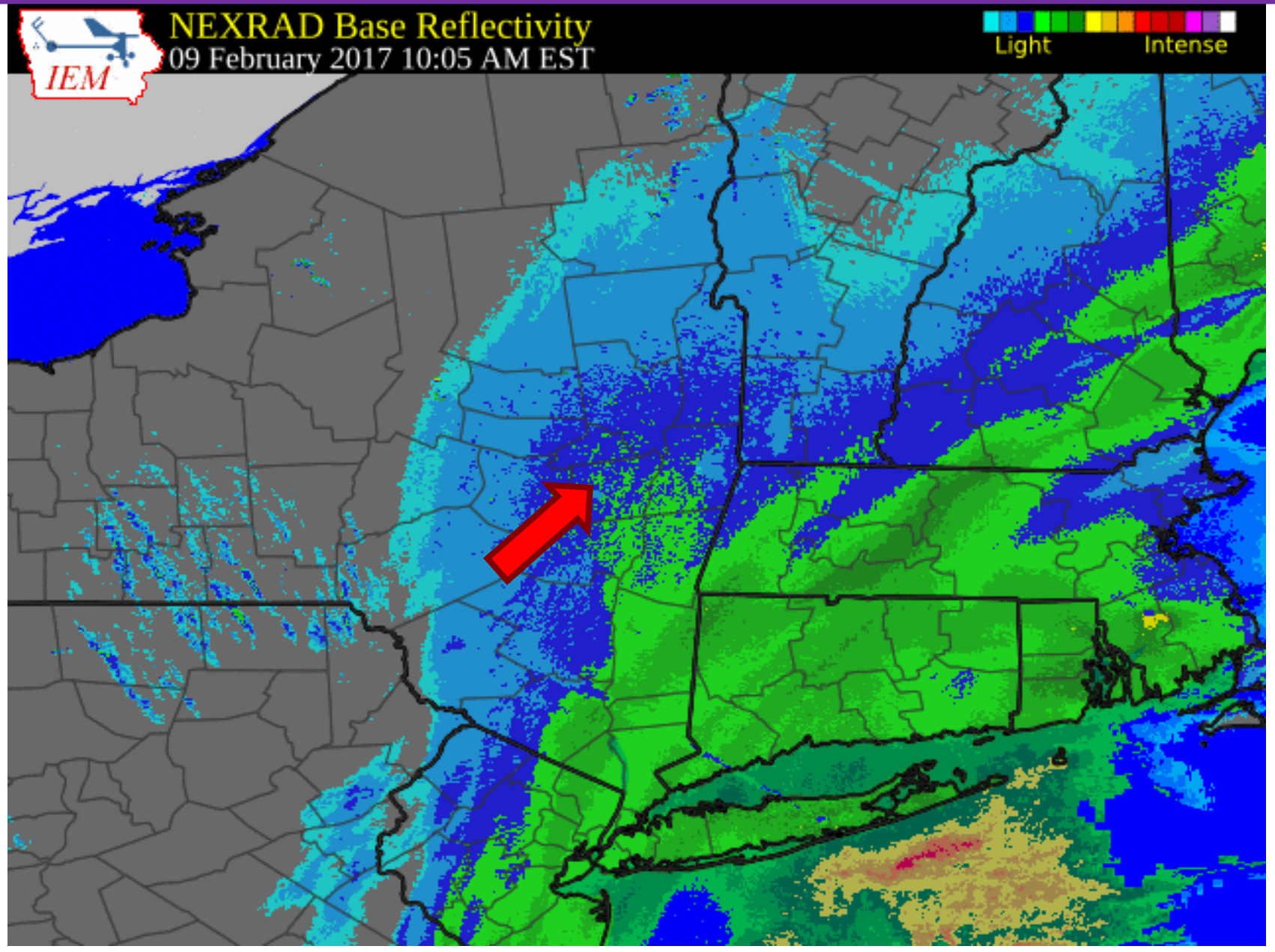
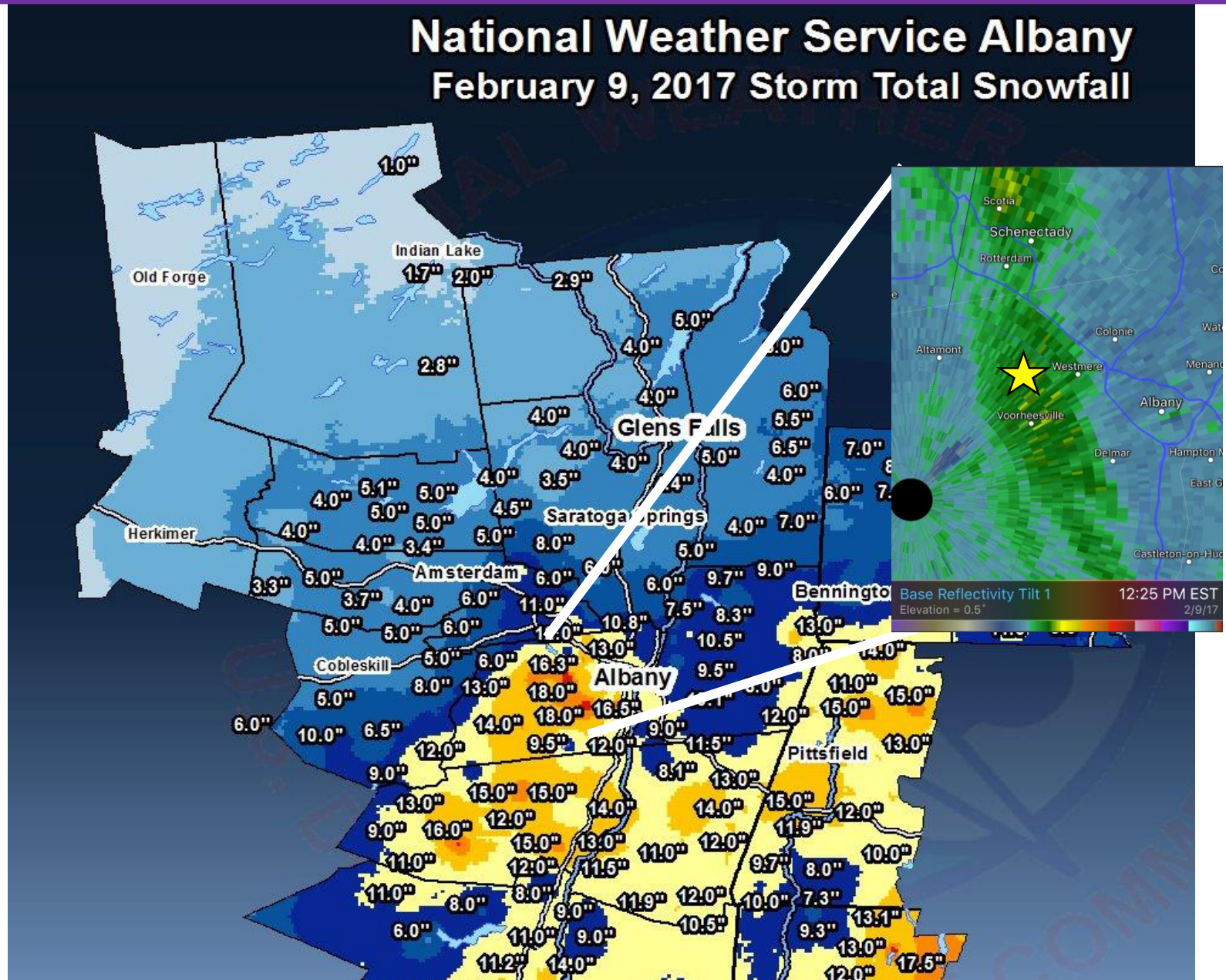
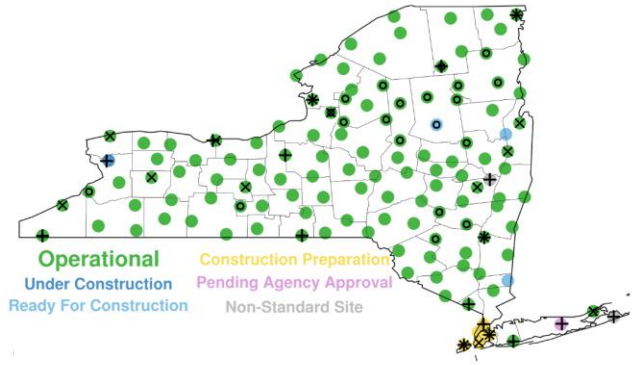
9–10 February 2017

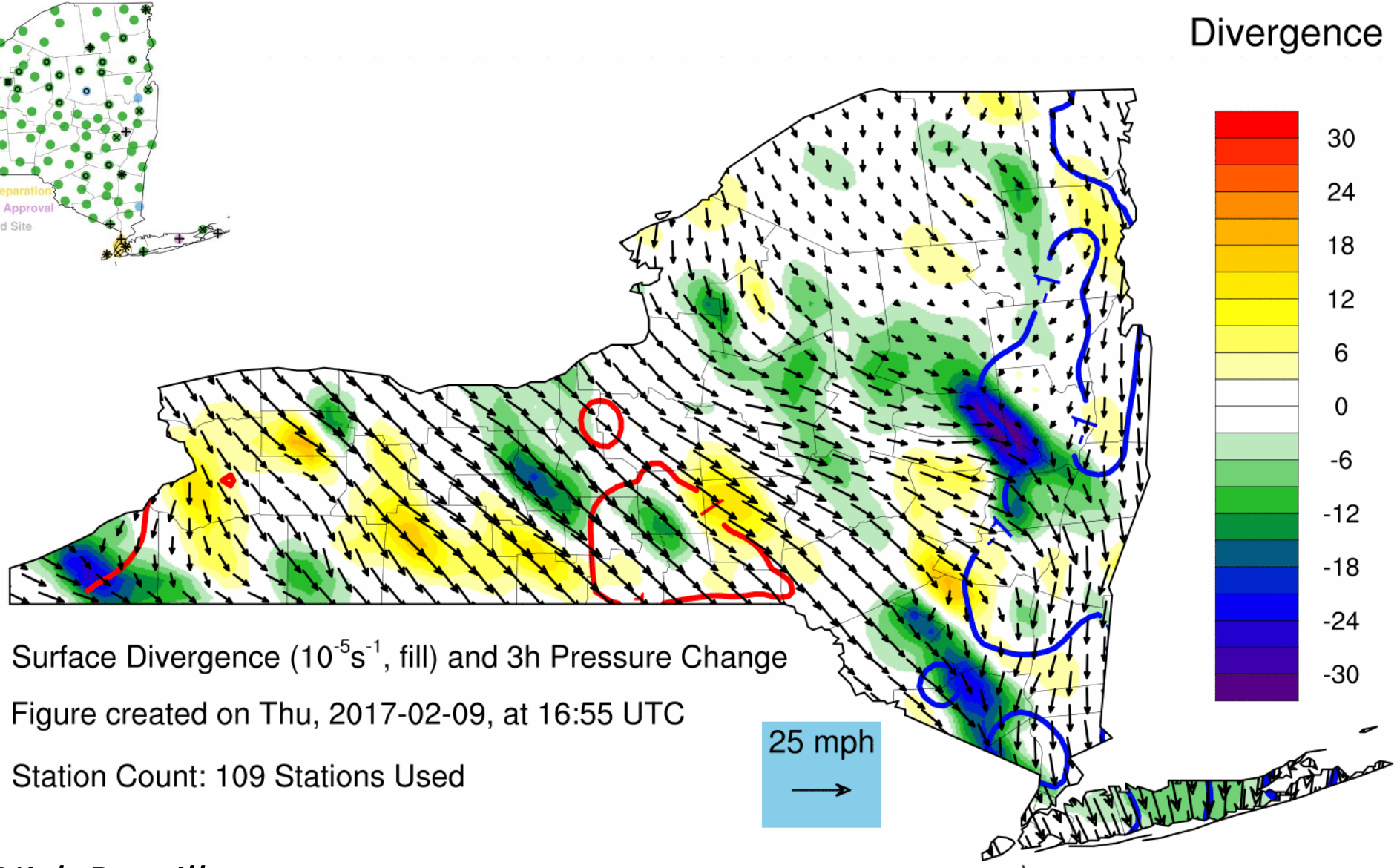

NEXRAD Base Reflectivity
09 February 2017 10:05 AM EST
IEM
Light
Intense

"My house is located approximately due N of Voorheesville and due W of Westmere on the radar. Snow is falling at the rate of **2-3" per hour** and we have accumulated ~12" so far."

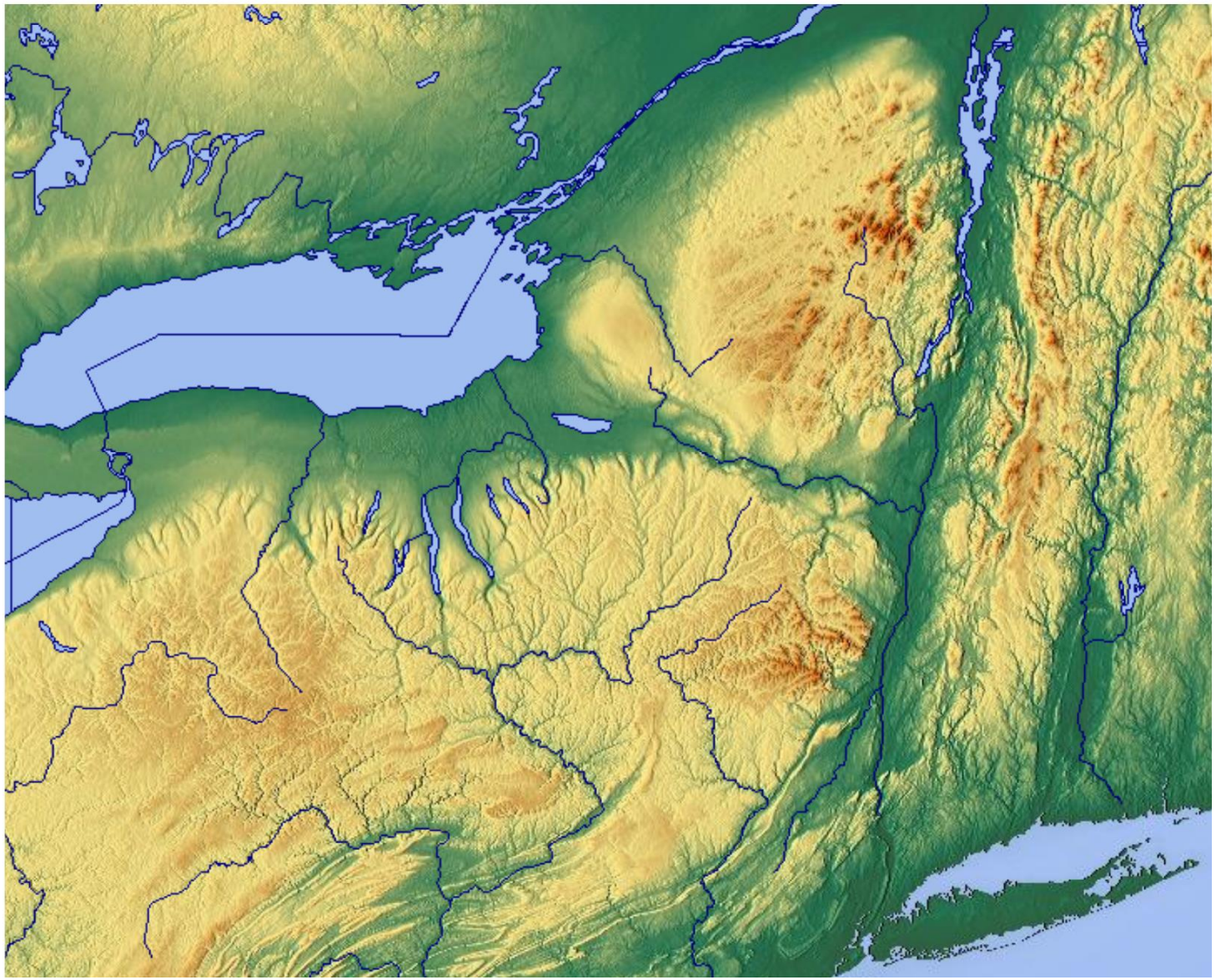
-Lance Bosart

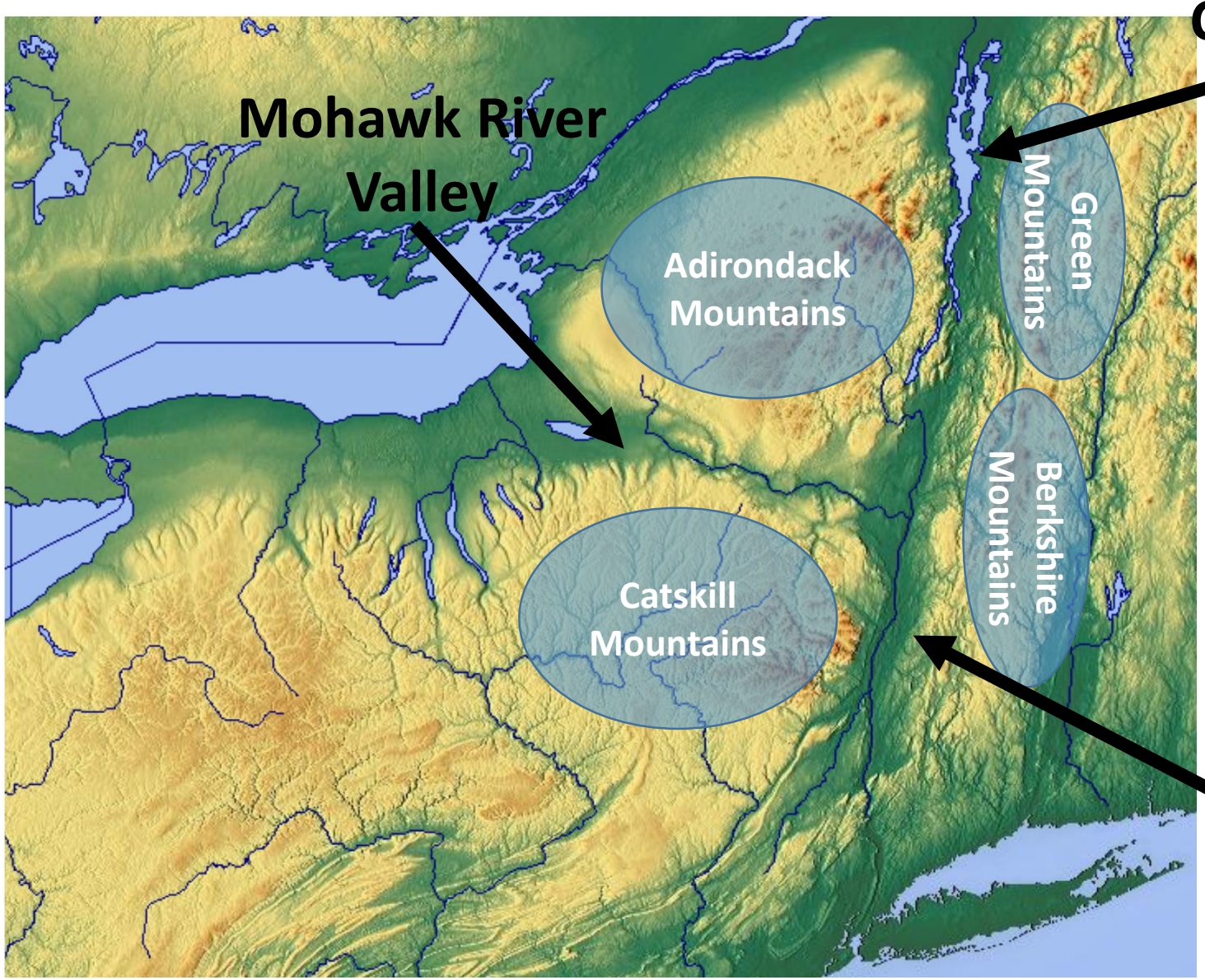






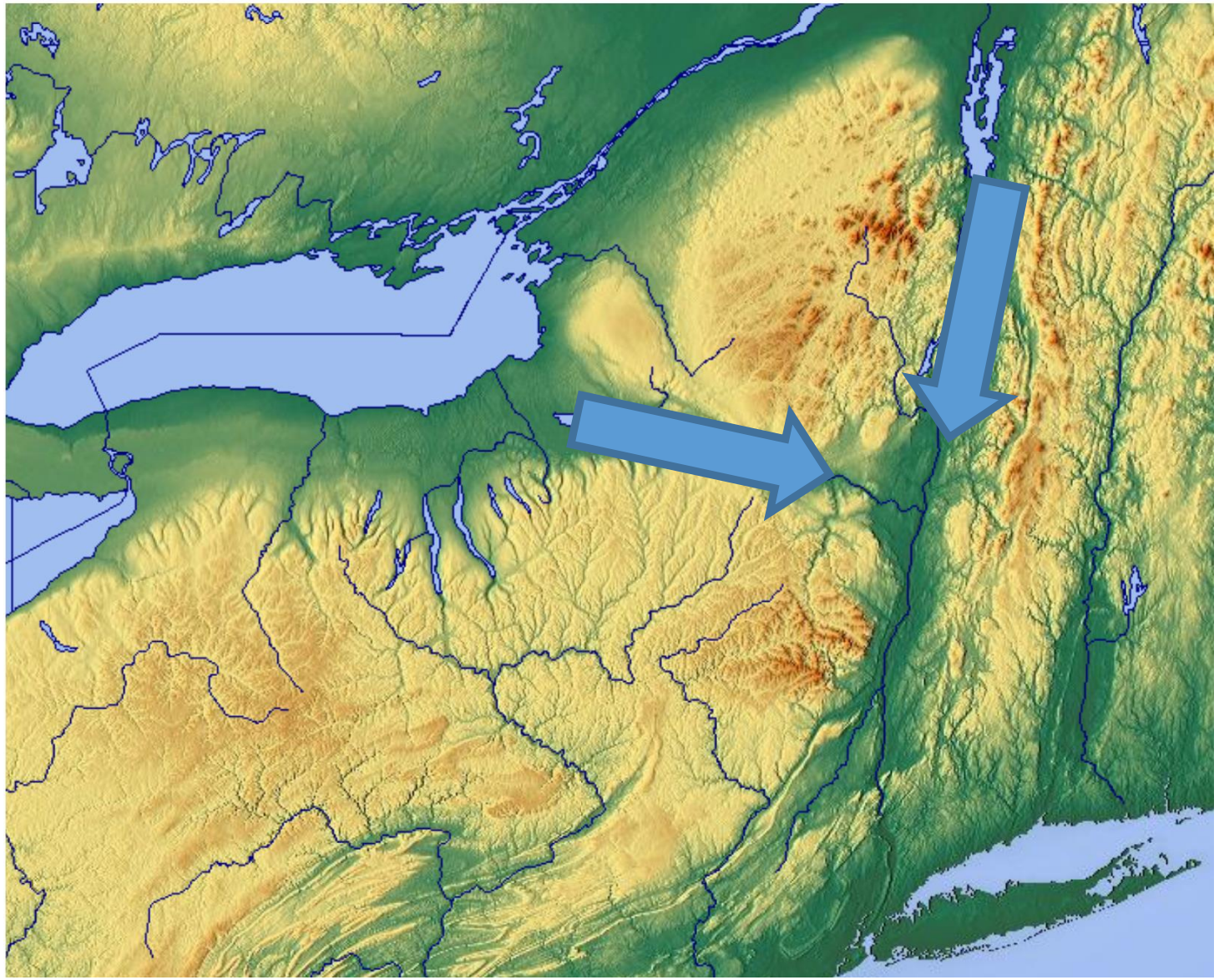
Courtesy of Nick Bassill




Champlain Valley
Mohawk River Valley
Adirondack Mountains
Green Mountains
Berkshire Mountains
Catskill Mountains
Hudson River Valley

Cold season Mohawk–Hudson convergence (MHC):

- Northerly, channeled flow in the Hudson Valley and westerly, channeled flow in the Mohawk Valley



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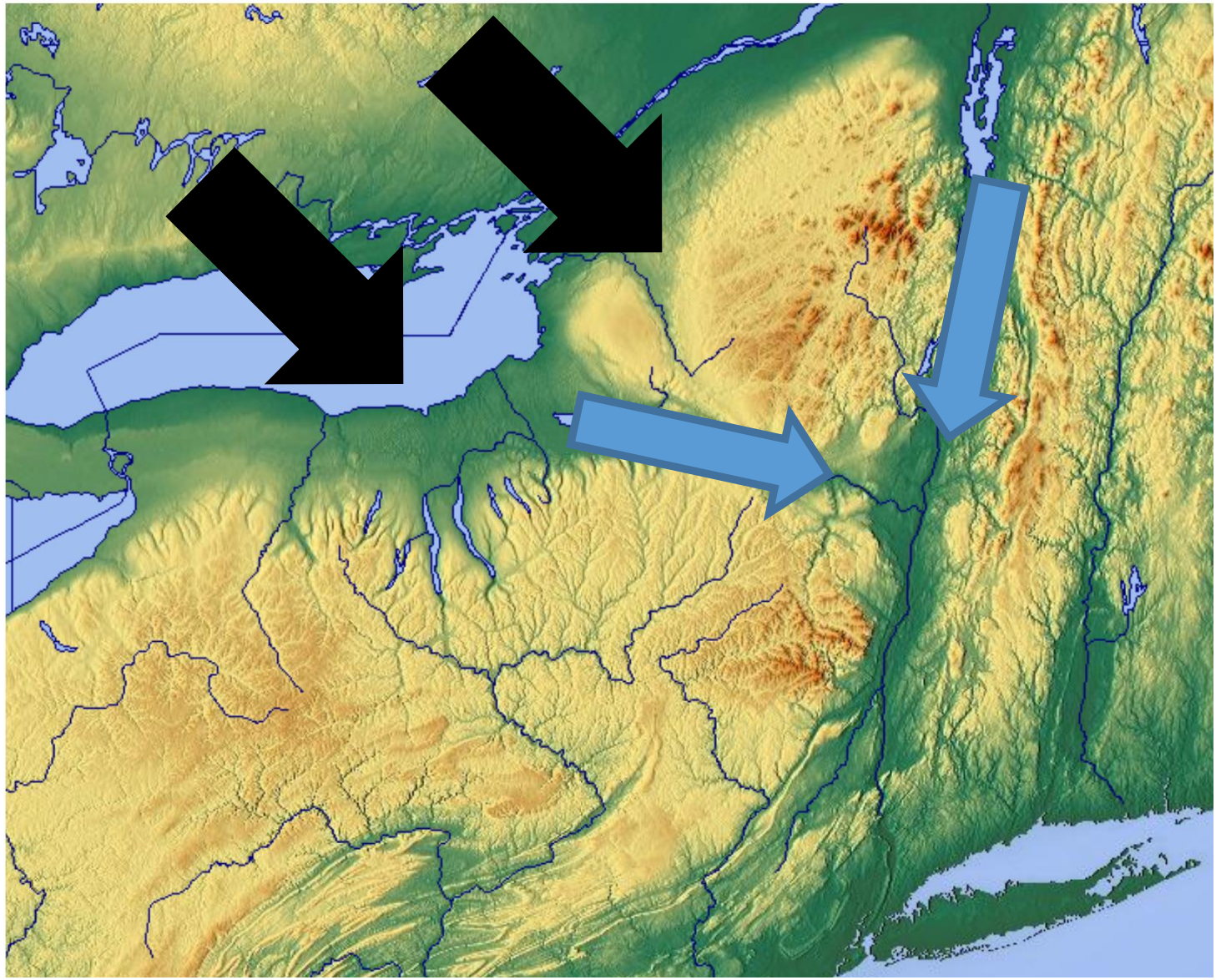

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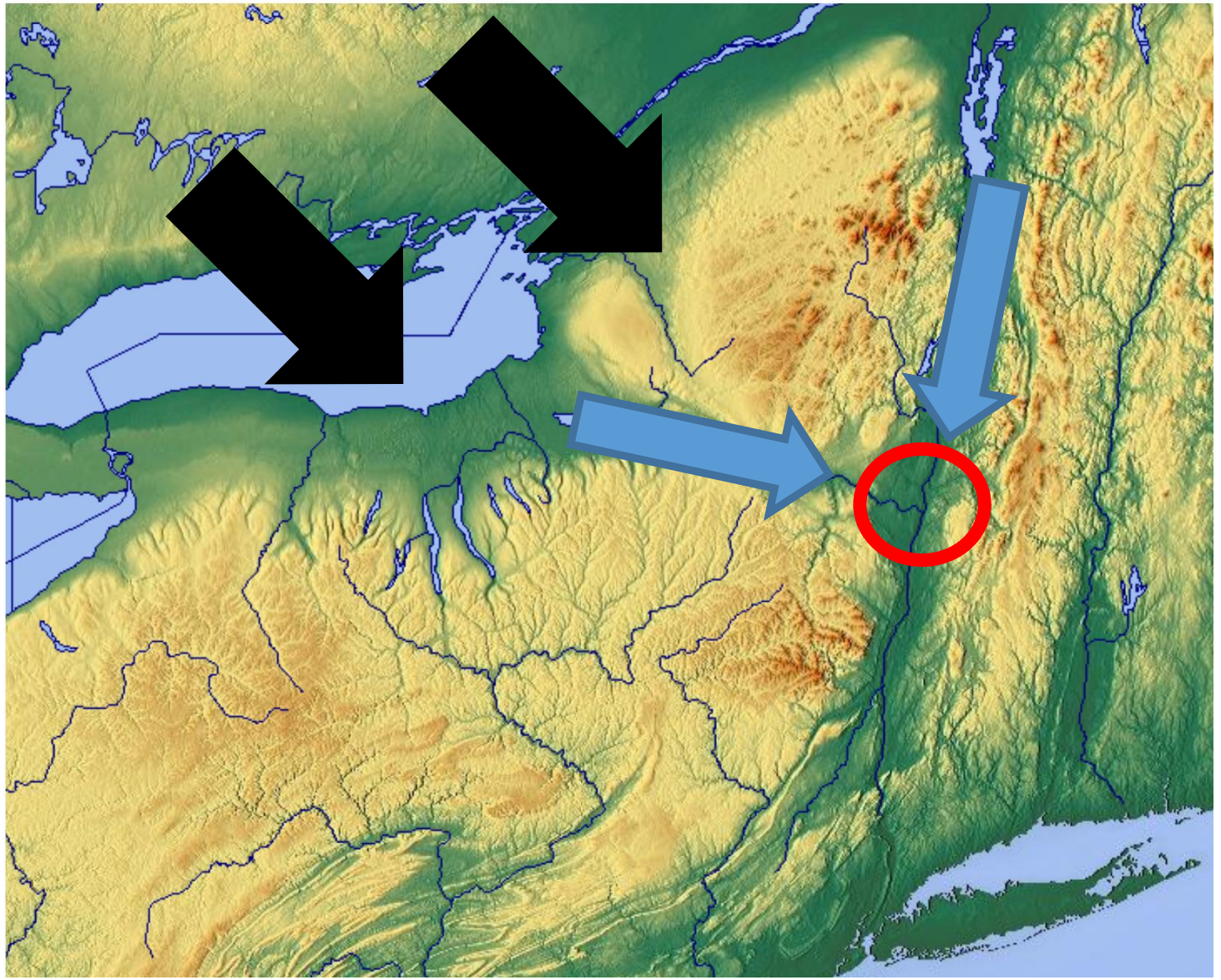
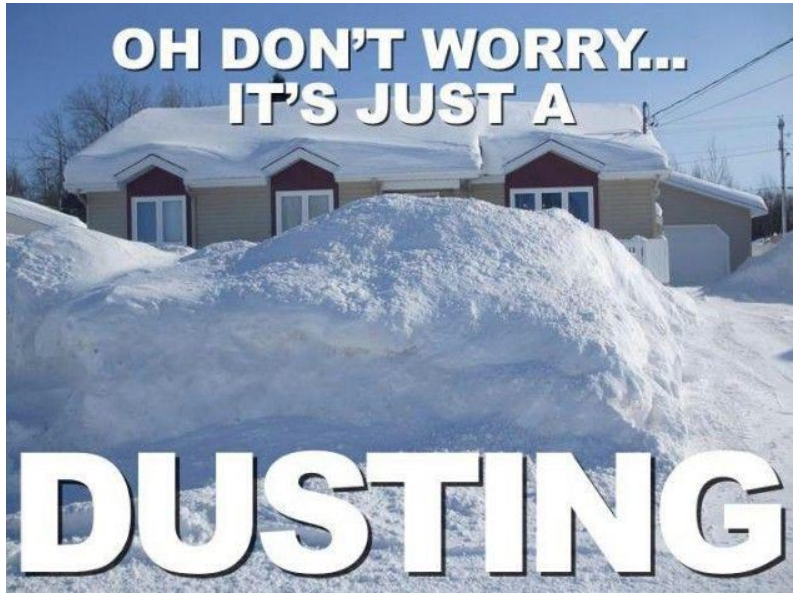


Case selection of cold MHC events

- Cases had to ***lack strong synoptic scale forcing*** in the Capital District Region and had to be ***independent of lake-effect snow***

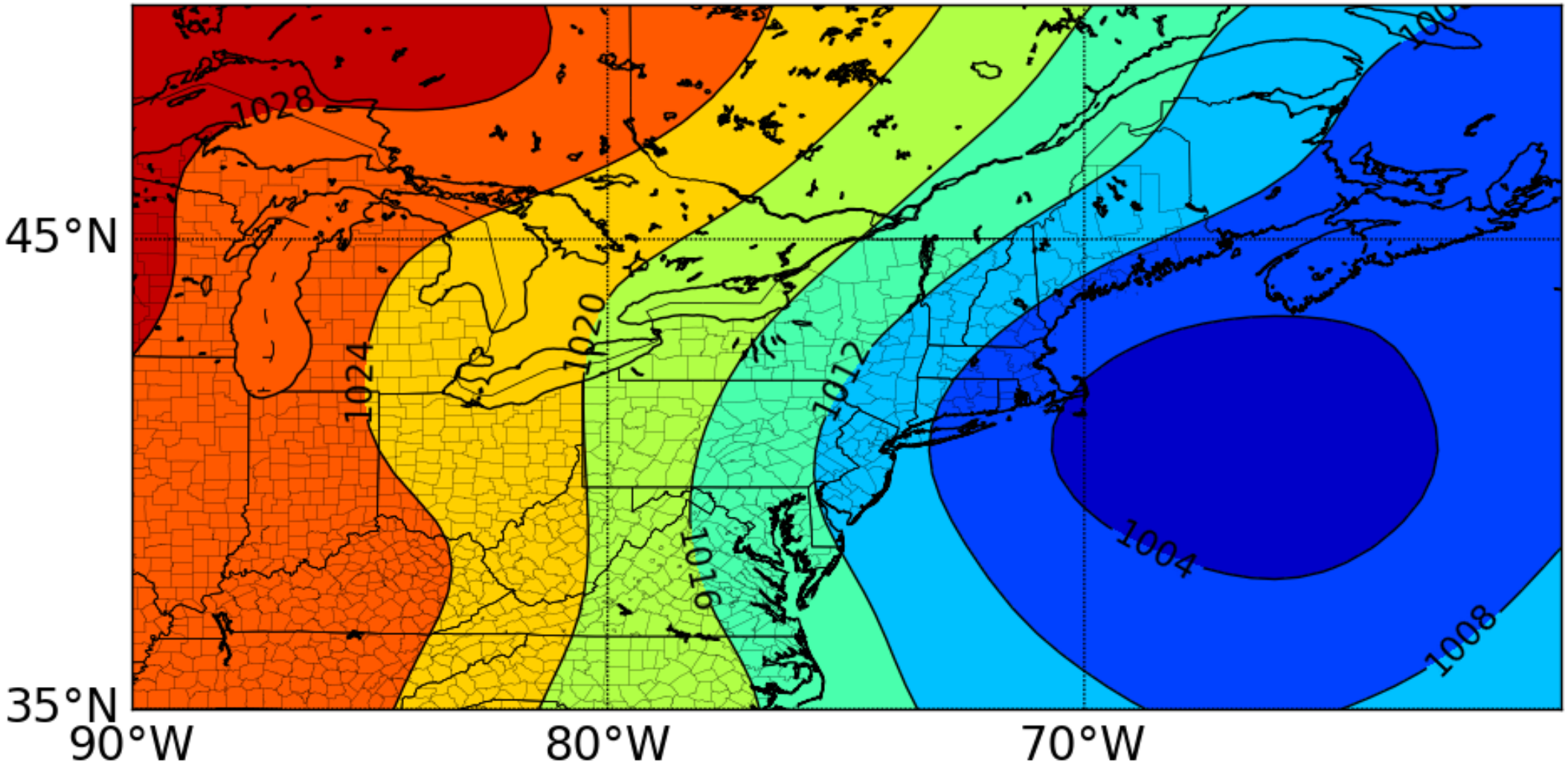
- ***12*** identified ***cases*** from November 2002 to September 2013

Pure cold season MHC events (n=12)			
Year	**Month**	**Day**	**Time of maximum reflectivity (UTC)**
2002	11	27	1800
	12	16	0000
2003	1	24	0000
2005	1	17	1200
2007	1	29	0600
	2	23	0600
2008	1	2	1200
	12	19	1200
		31	1800
2011	1	12	1800
	10	30	0600
2013	9	13	1800



- Composited using the ***0.5° Climate Forecast Reanalysis System*** (CFSR), centered on the ***time*** of ***maximum reflectivity***
- ***Coarse resolution*** for a mesoscale event, but simply using the CFSR to determine the ***overall synoptic setup*** for these events
- ***13-km Rapid Update Cycle*** (RUC) initialized at 1200 UTC was used for the ***case study*** of ***2 January 2008***

Mean sea level pressure



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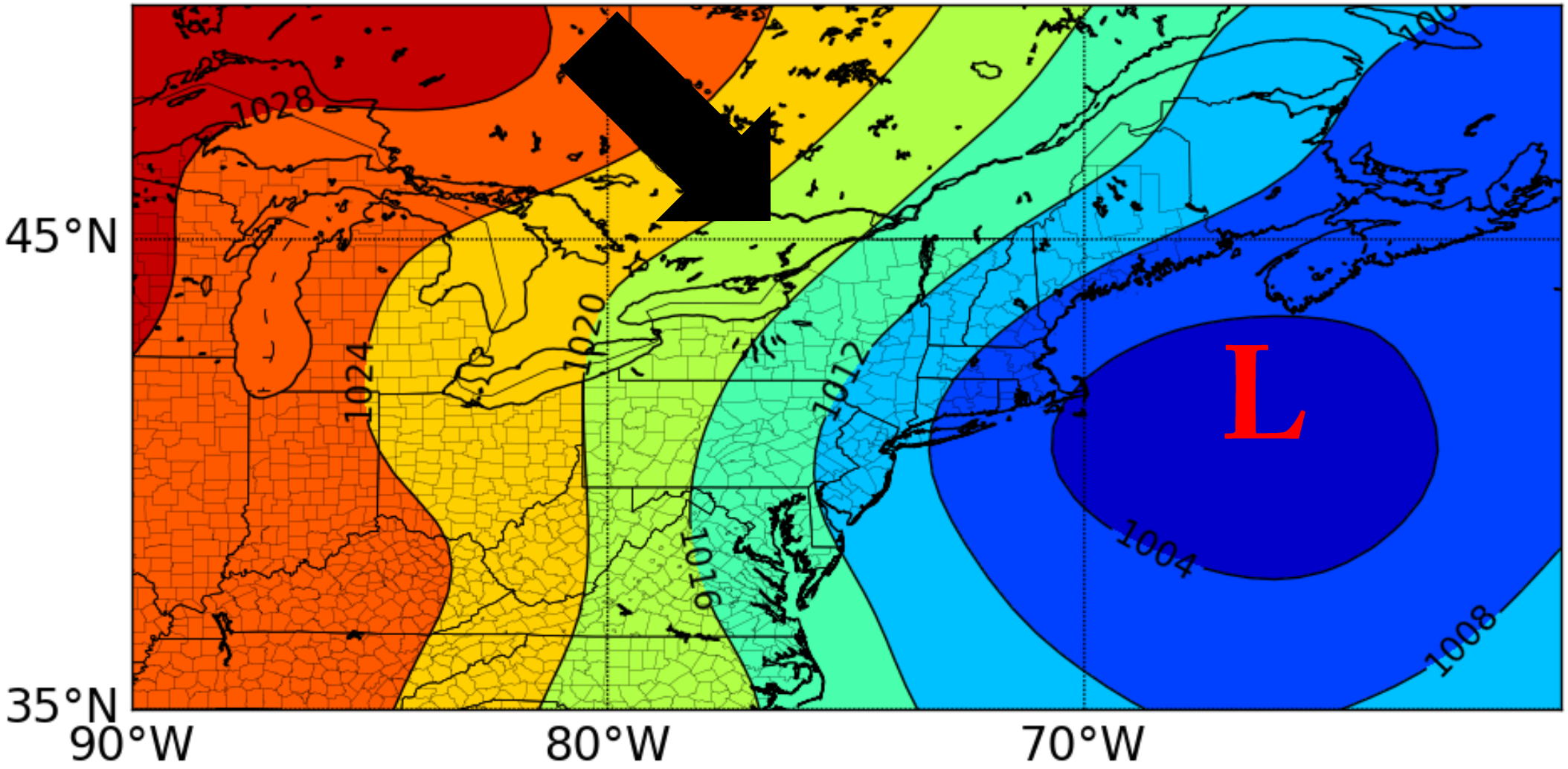
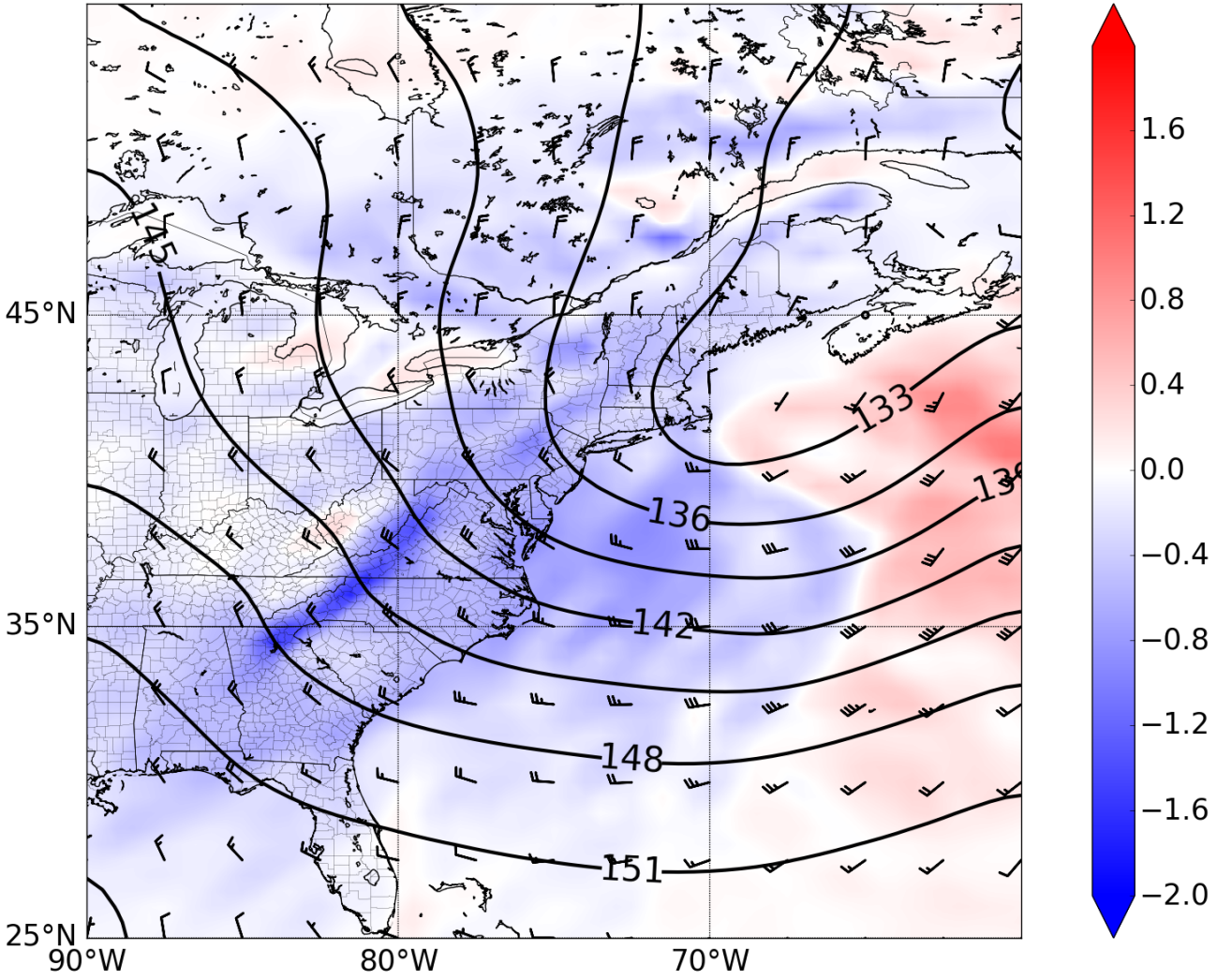
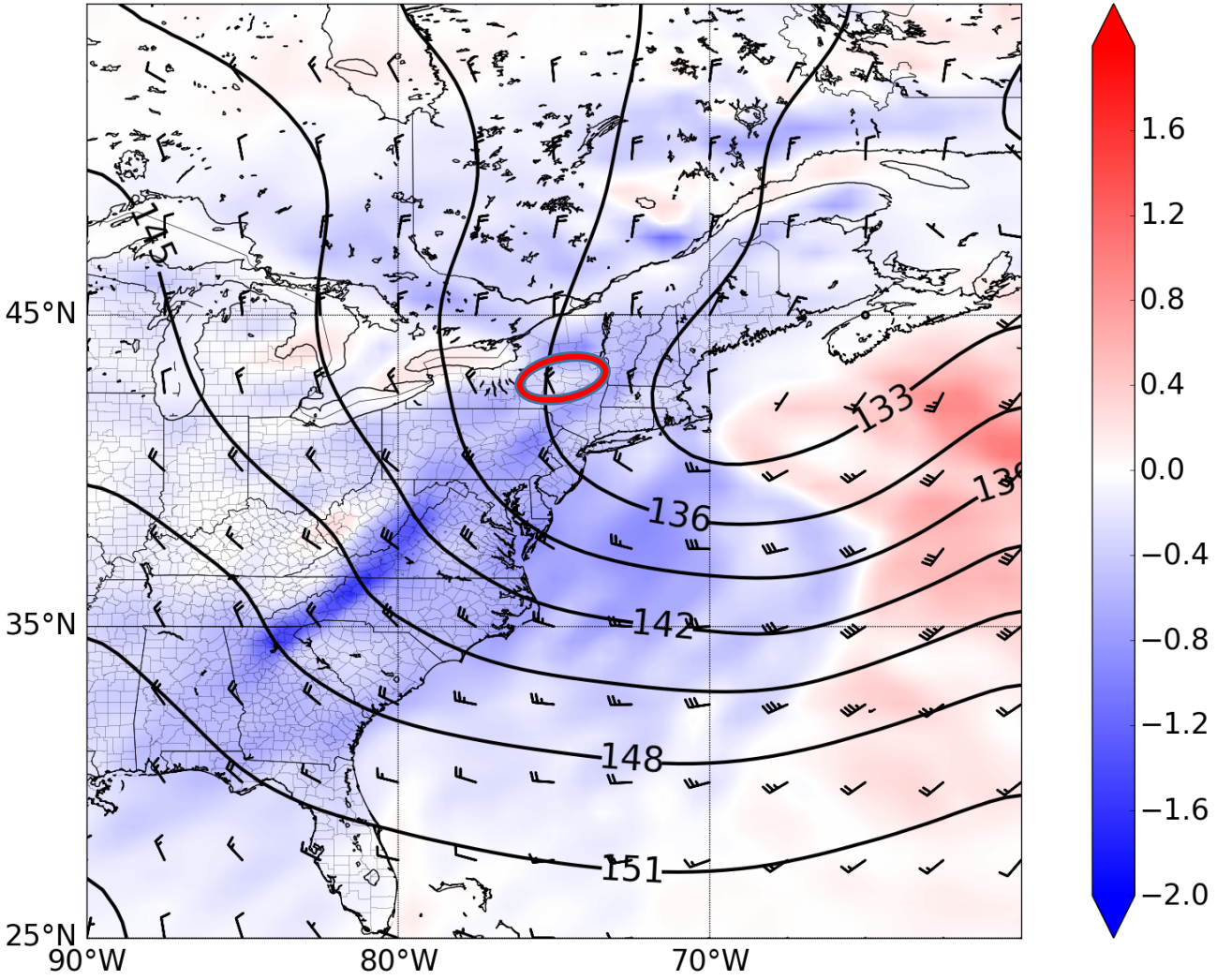


850-hPa temperature advection

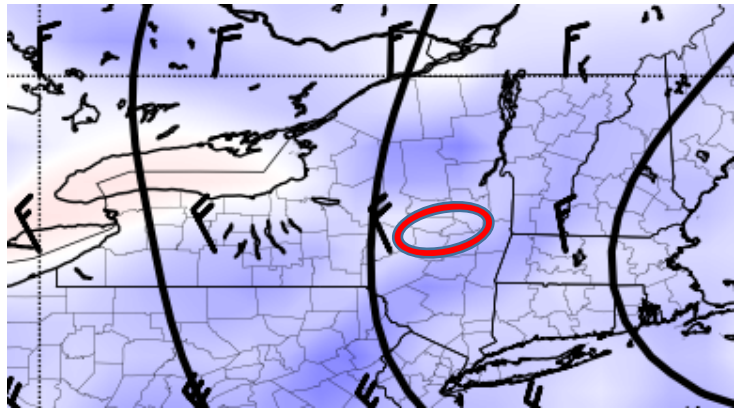


- At 850-hPa ***cold air advection*** dominates

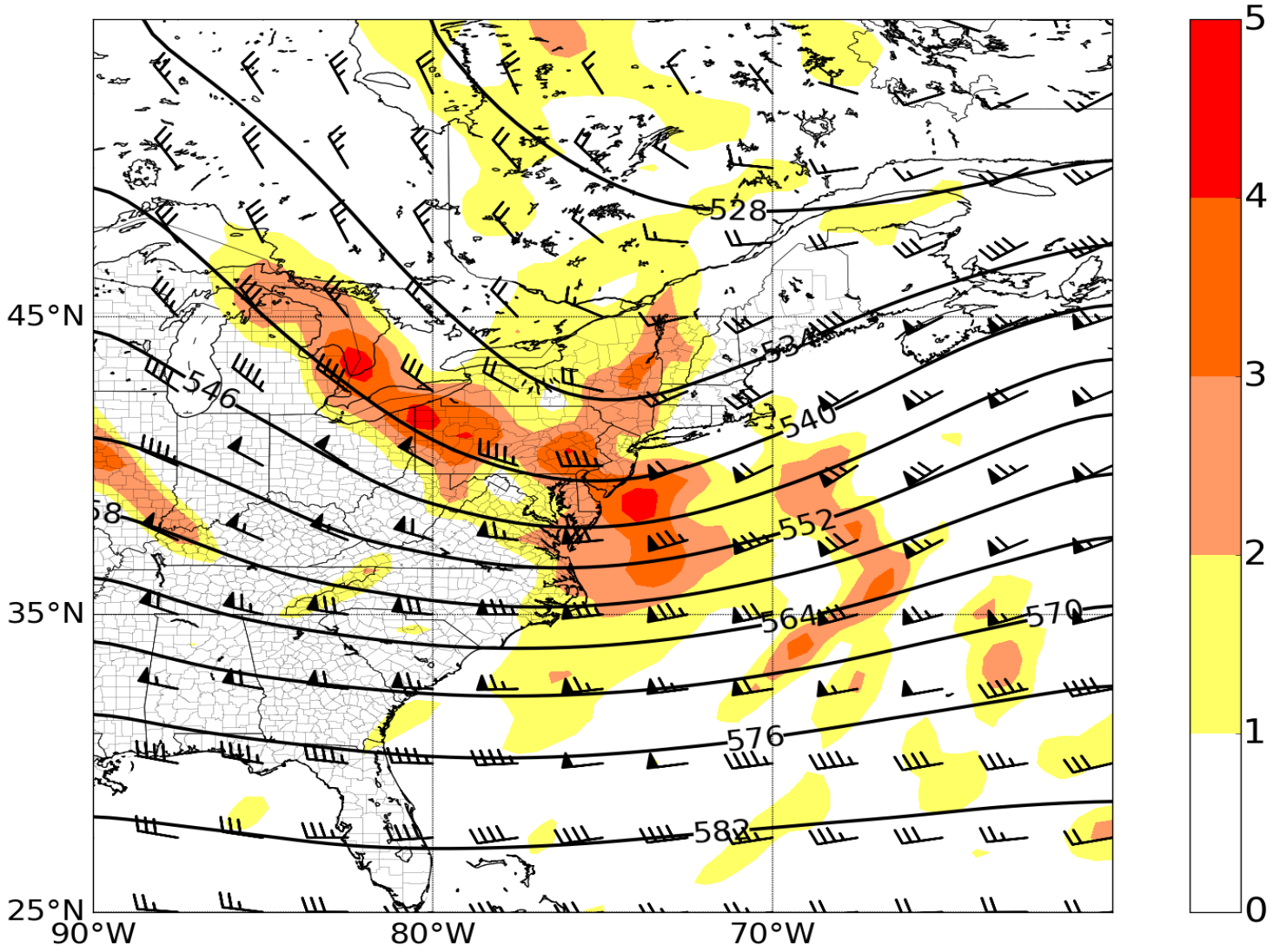
850-hPa temperature advection



- At 850-hPa ***cold air advection*** dominates
- Nearly ***neutral*** temperature ***advection*** occurs in the ***Capital District***

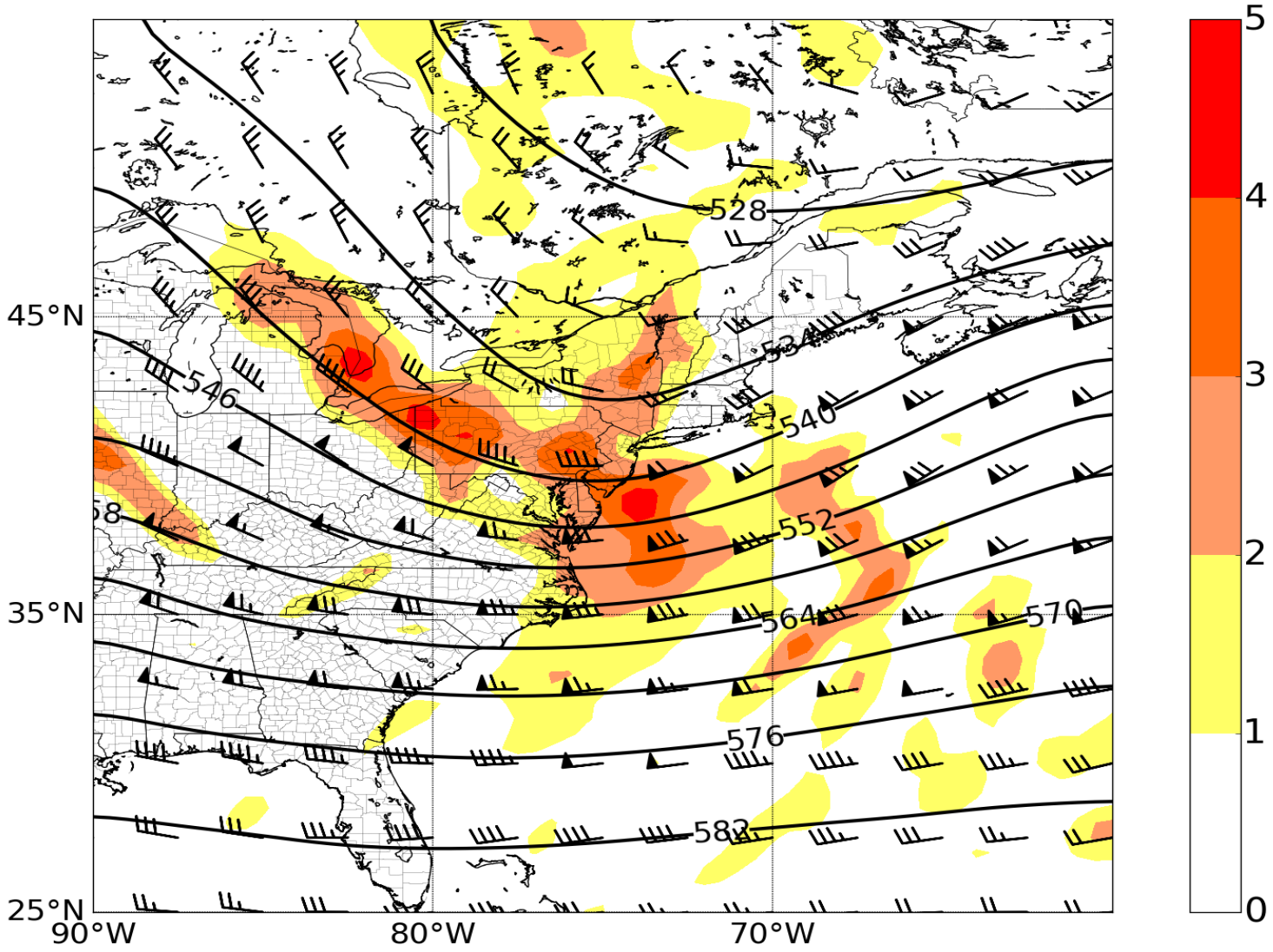


500-hPa relative vorticity



- ***Maximum*** 500-hPa ***relative vorticity*** over ***eastern NY***

500-hPa relative vorticity



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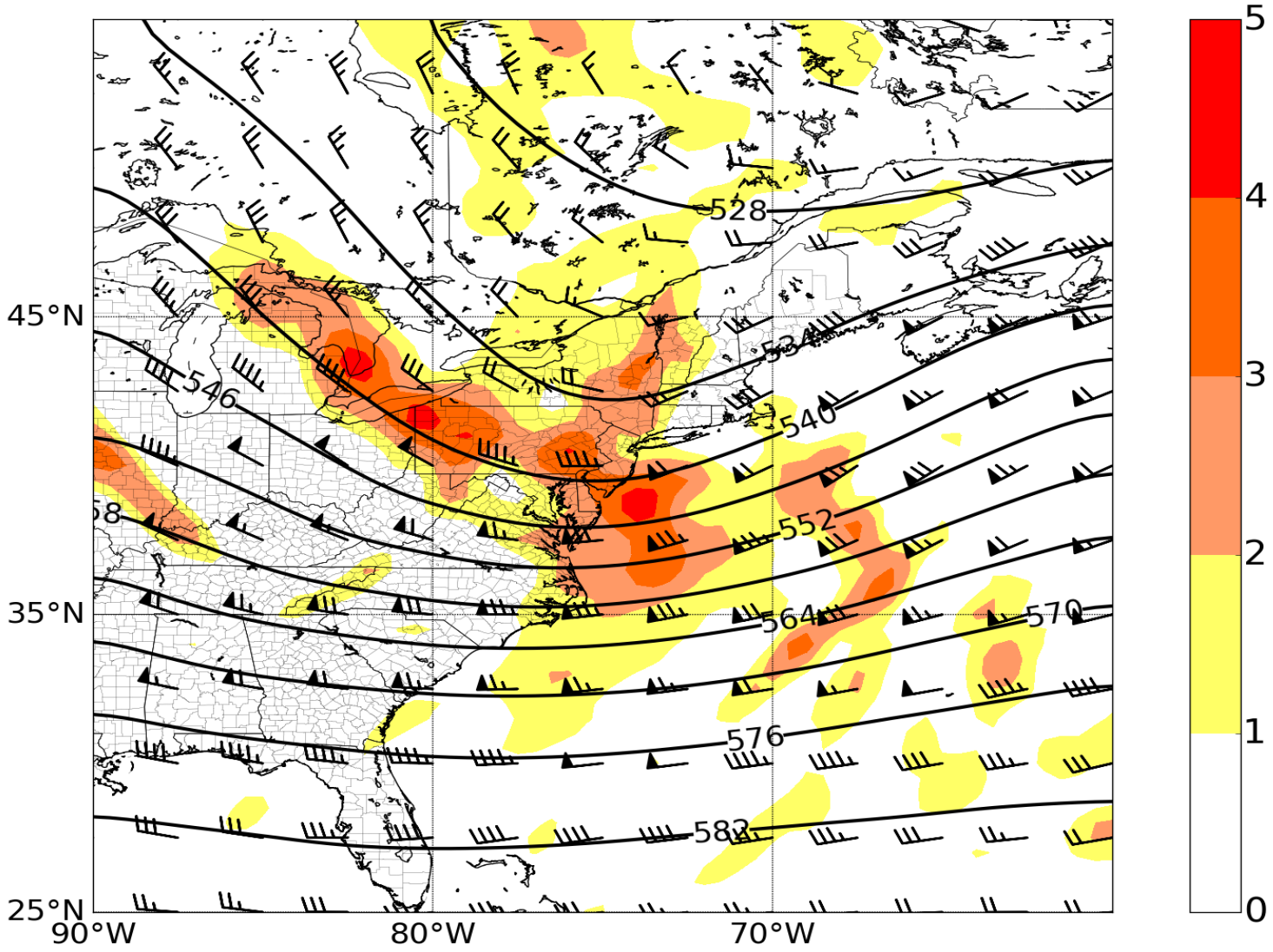
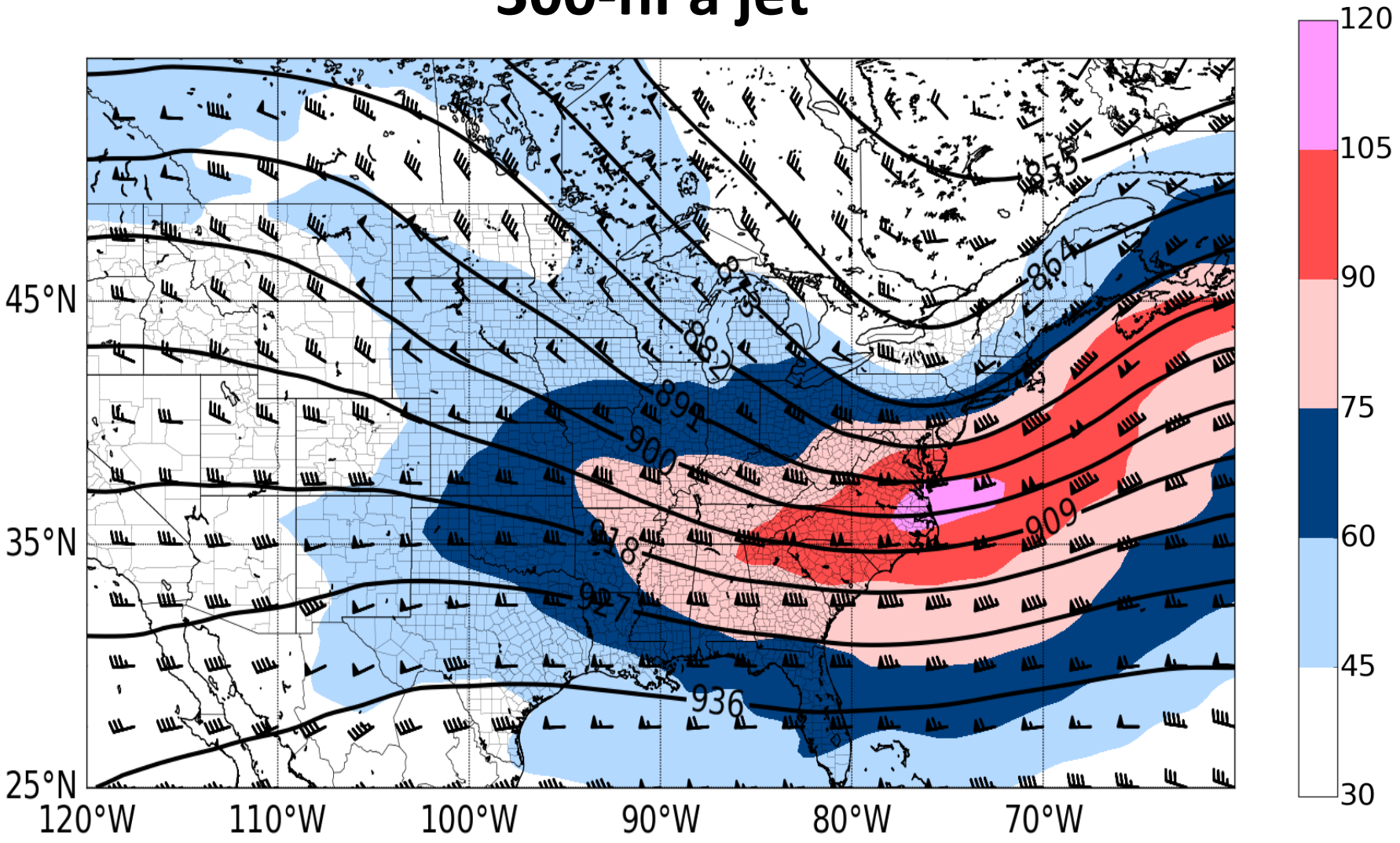


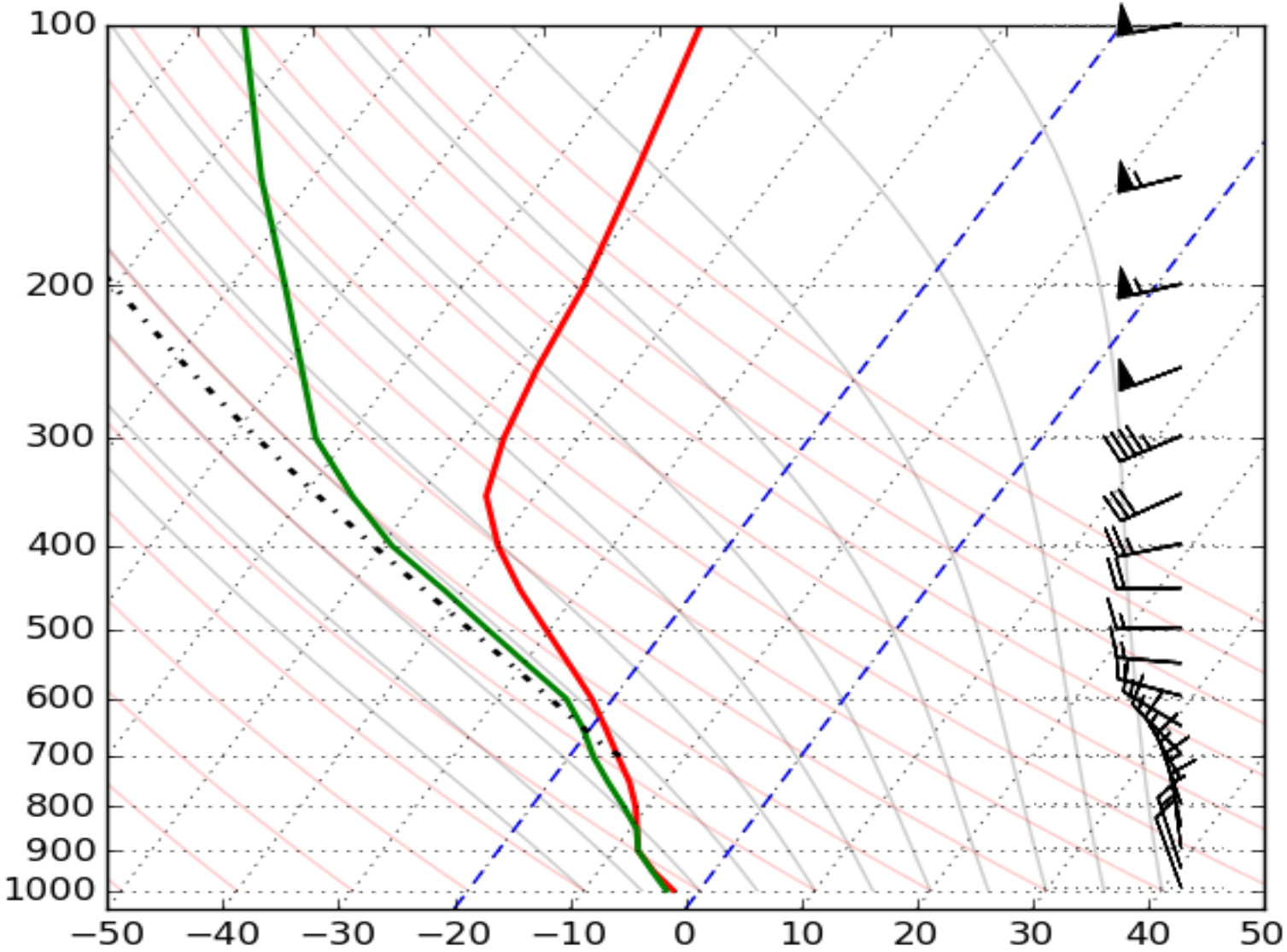
- ***Maximum*** 500-hPa ***relative vorticity*** over ***eastern NY***
- Implied ***anticyclonic relative vorticity advection*** upstream of the trough axis
- Signals ***upper-level descent***, at least in the layer

300-hPa jet



- ***Jet*** and ***trough configuration*** is ***not favorable*** for ***upper-level divergence*** over the Capital District

Composite sounding



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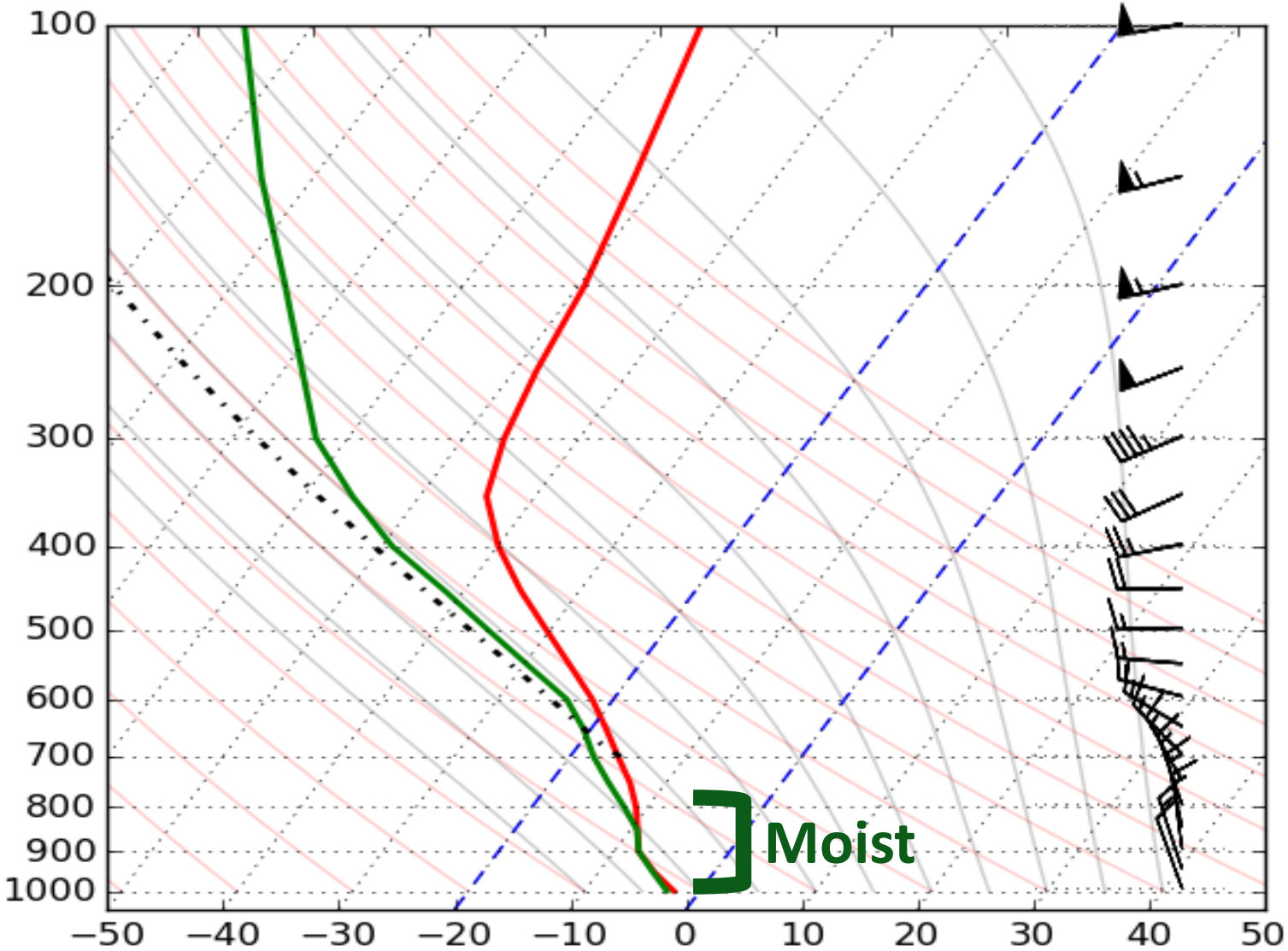

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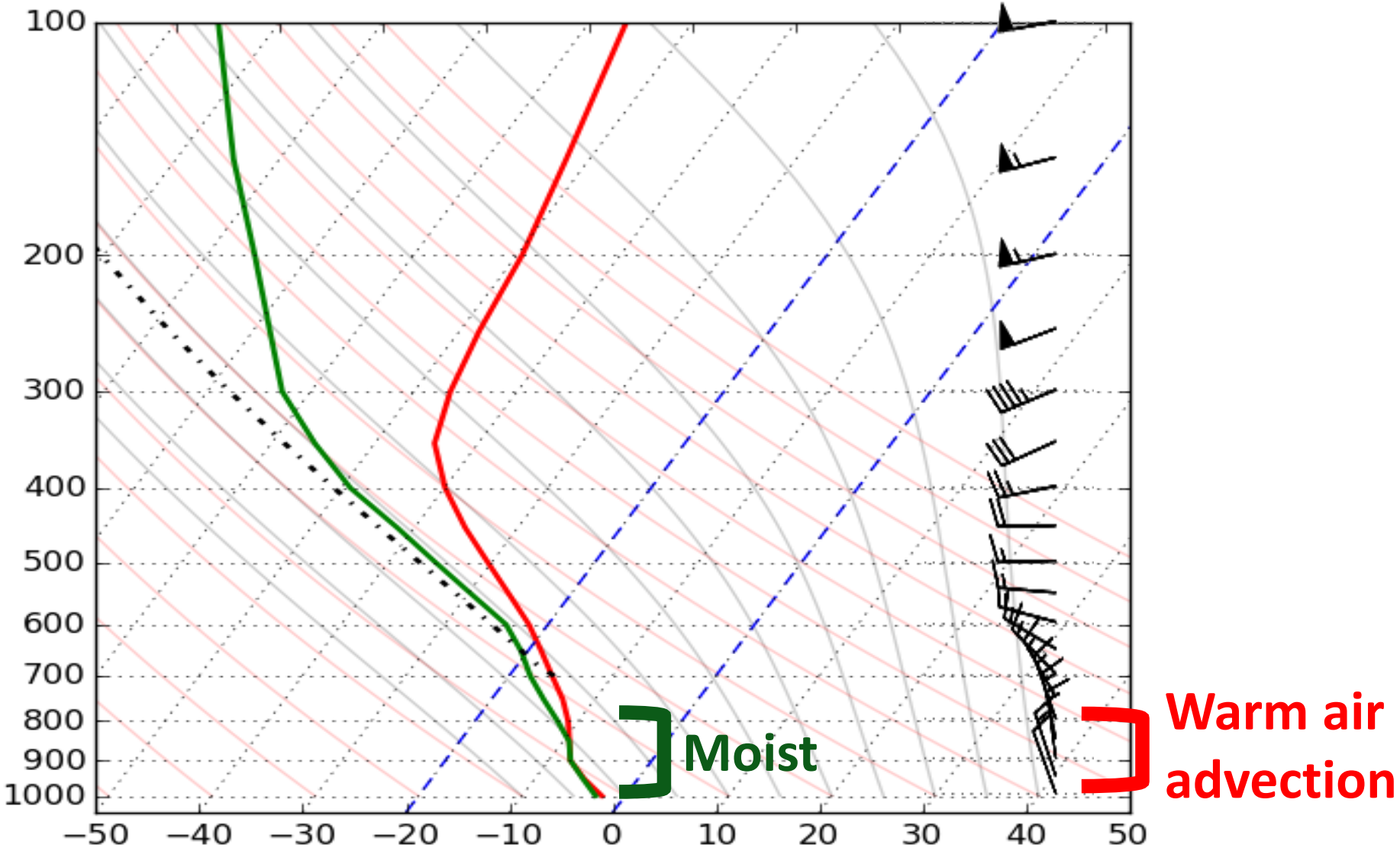

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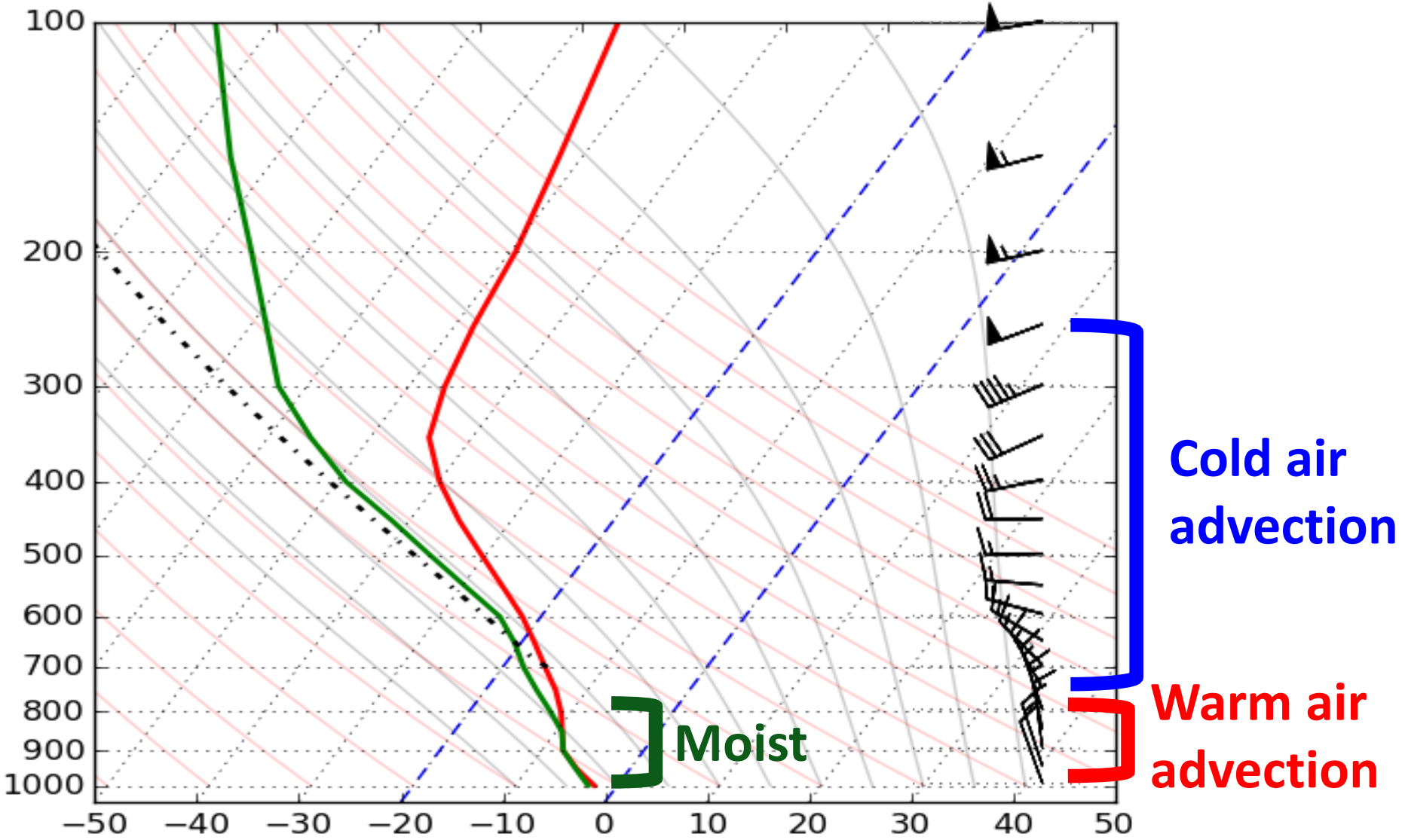

Key points from MHC composite:

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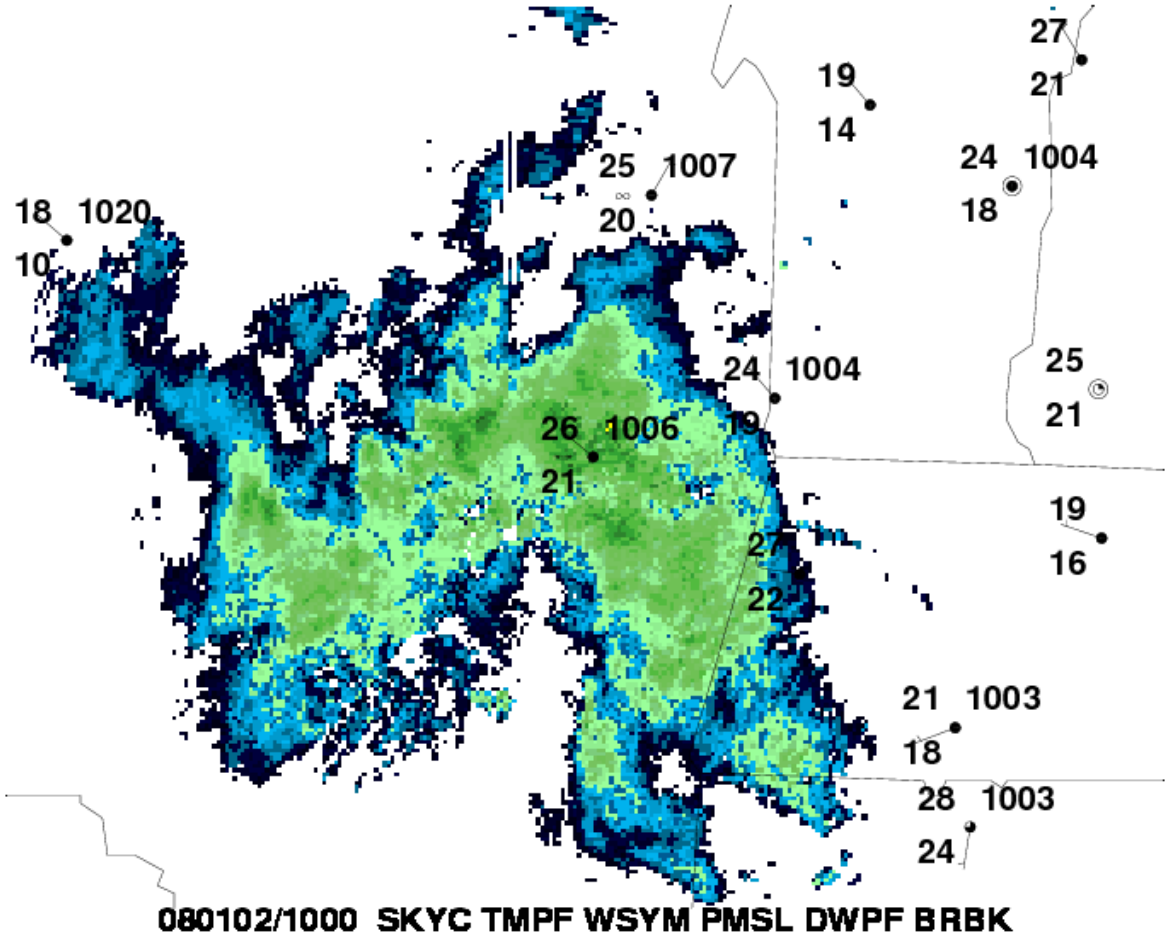
- ***Anticyclonic vorticity advection*** at 500-hPa
- Capital District ***not*** located in a region of ***upper-level divergence***

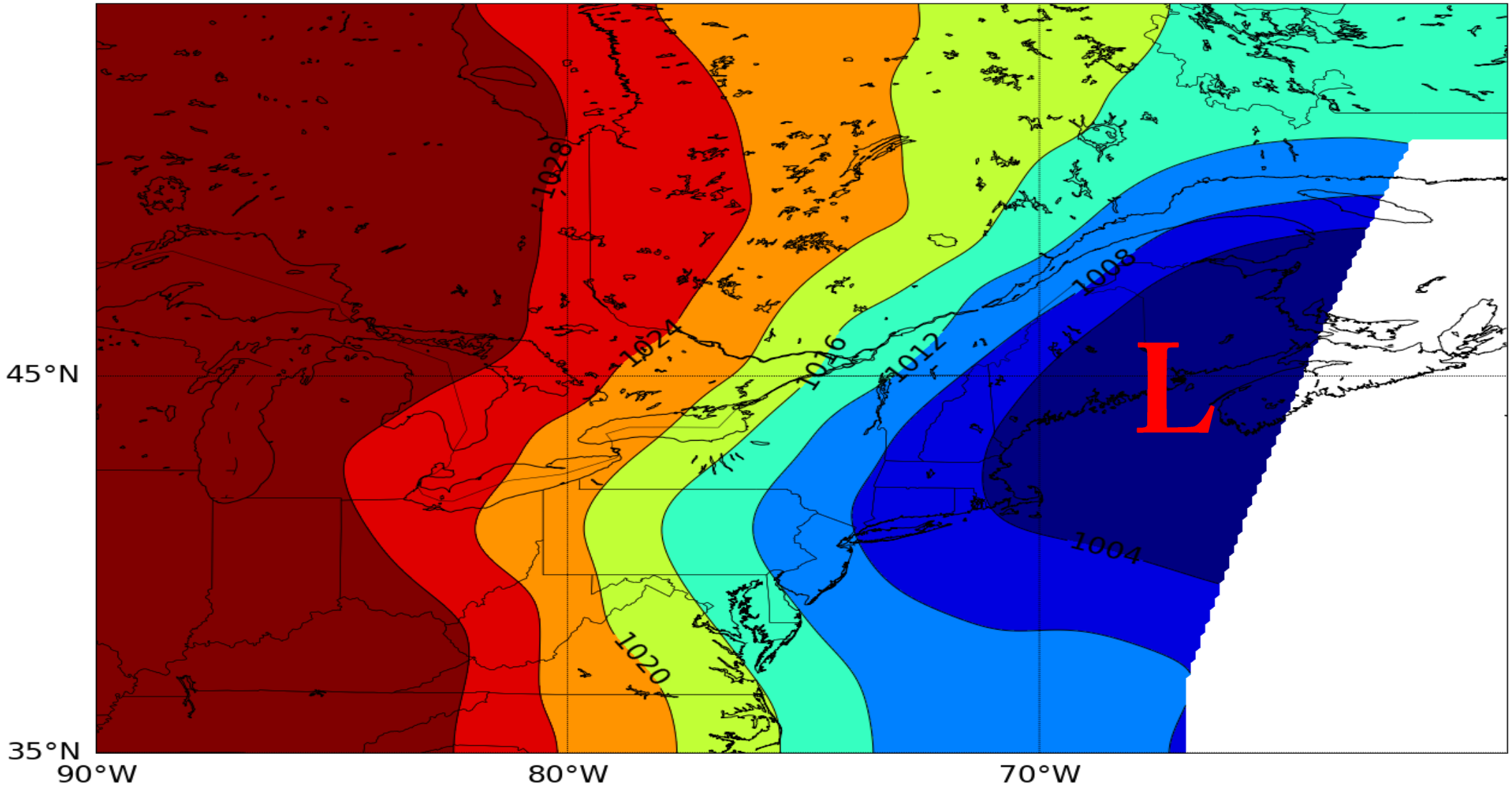
Case study:

- On 2 January 2008, a ***departing low*** off the New England coast had dropped more than ***15 cm*** of ***snow*** around the ***Capital District***

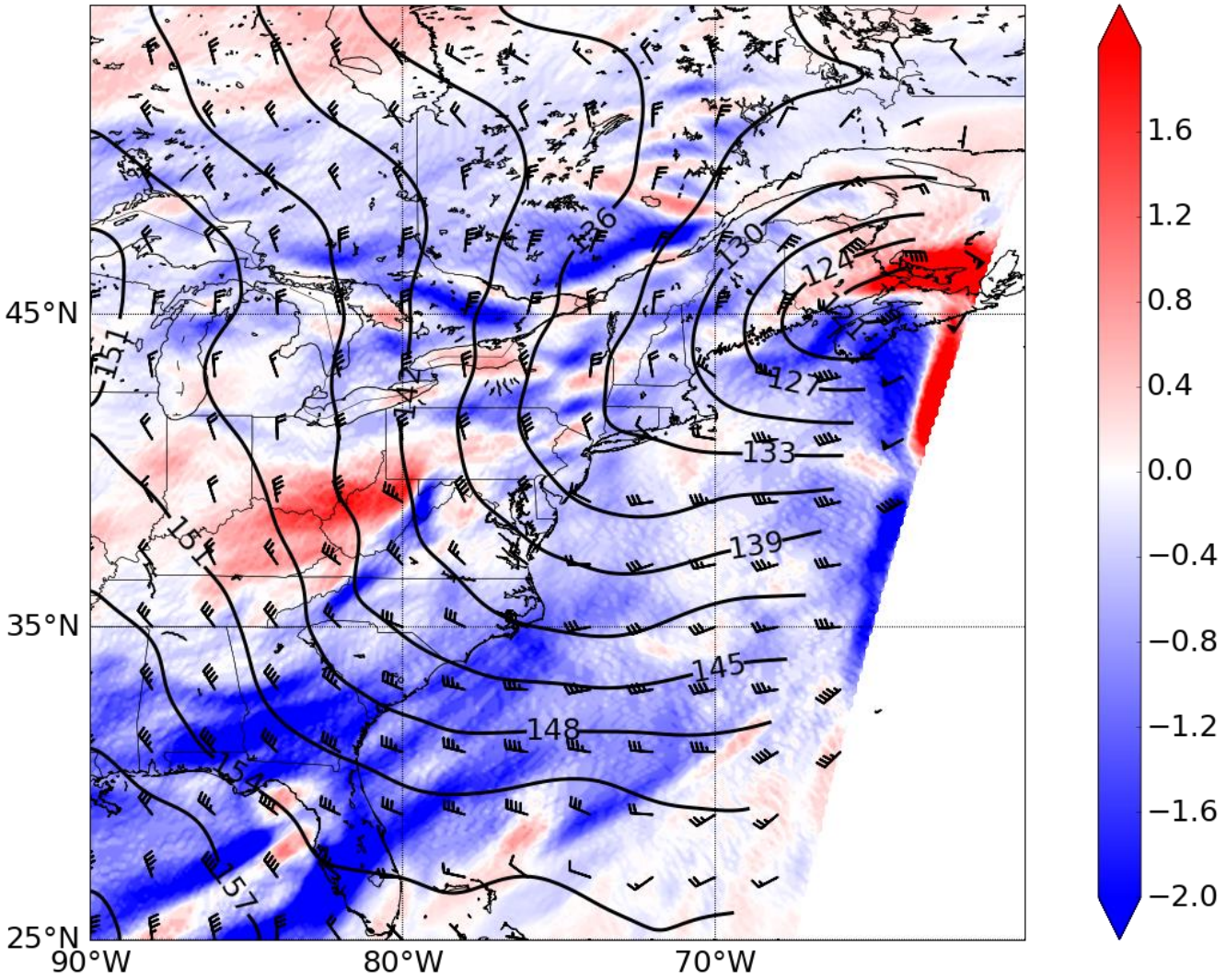
- Upwards of an ***additional 12.7 cm*** was reported in Cohoes, NY ***due to MHC***



1200 UTC mean sea level pressure

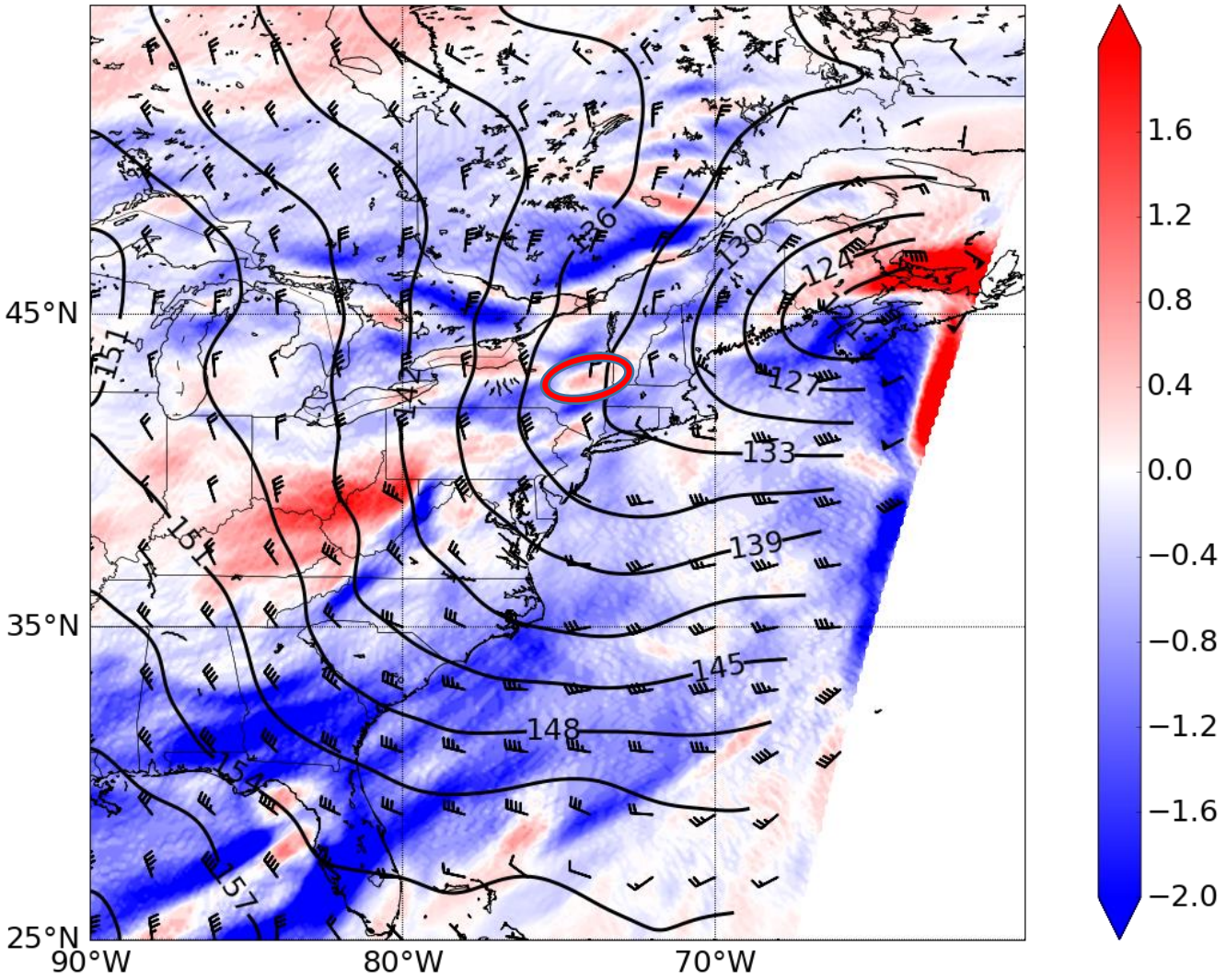


1200 UTC 850-hPa temperature advection

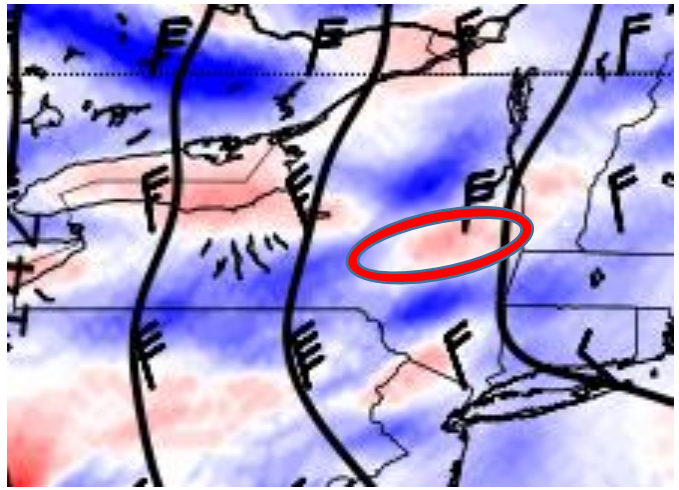


- ***Warm air advection*** at 850-hPa

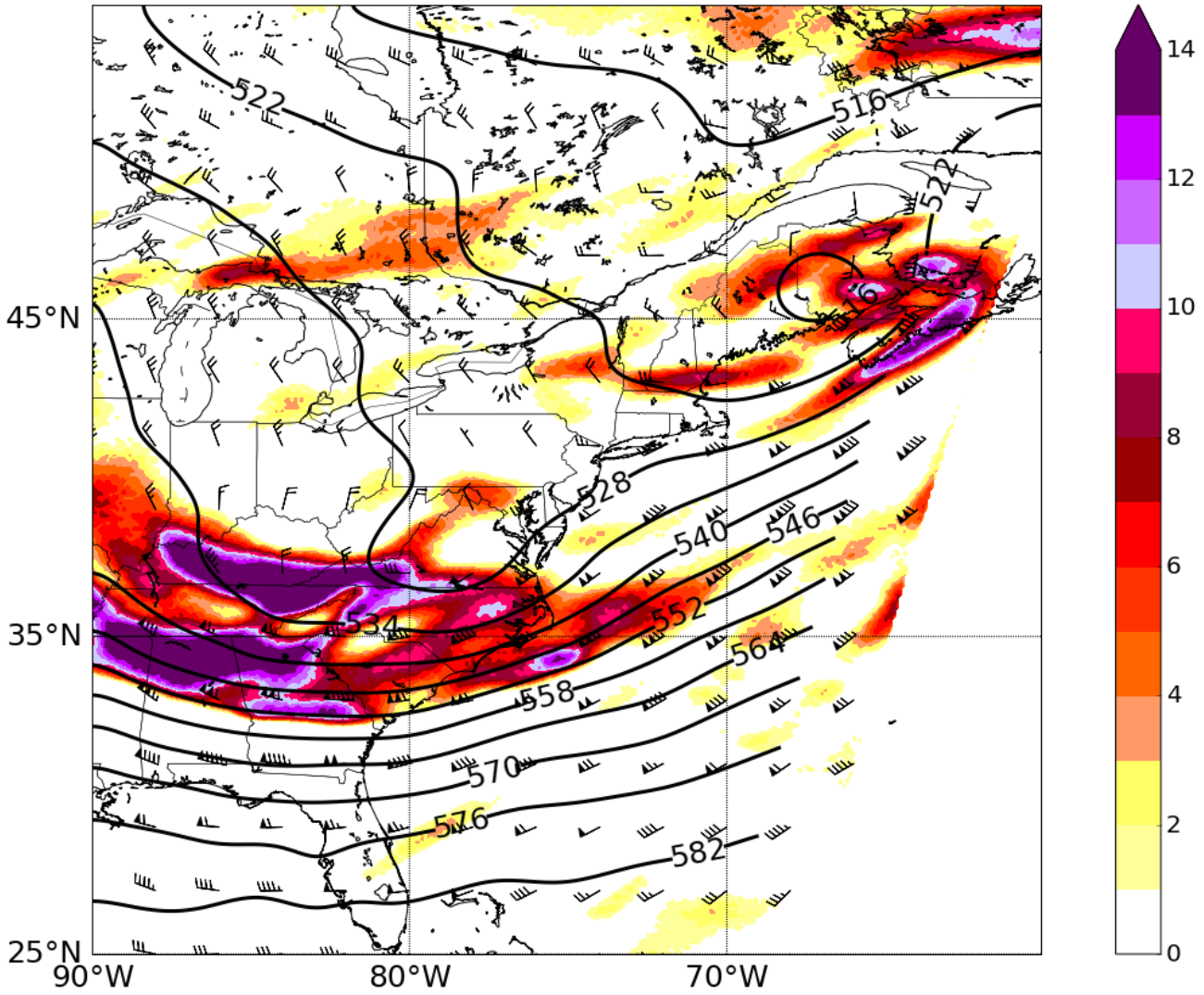
1200 UTC 850-hPa temperature advection



- ***Warm air advection*** at 850-hPa
- ***Matches*** the ***composite***, just with a ***stronger signal***

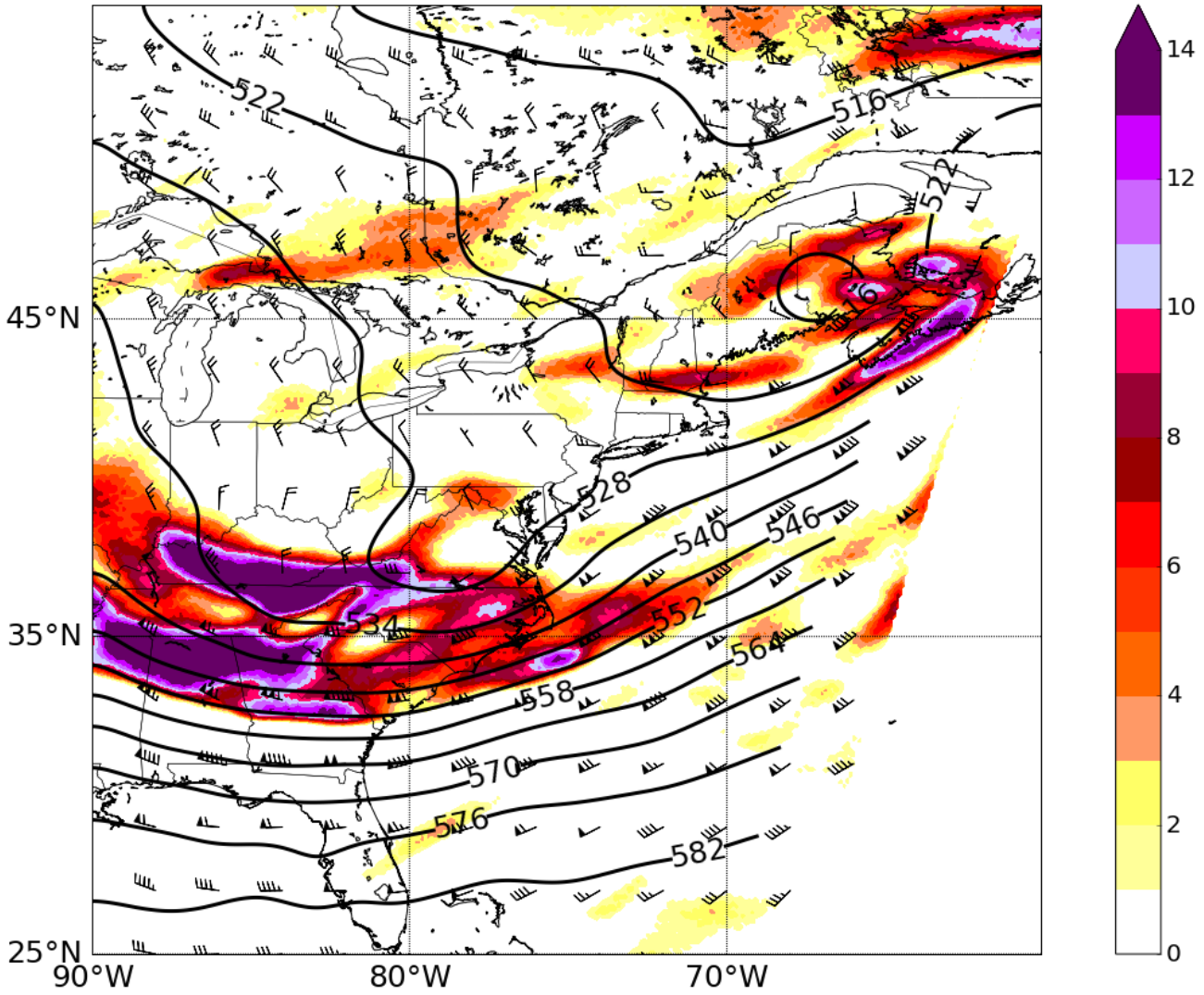


1200 UTC 500-hPa relative vorticity



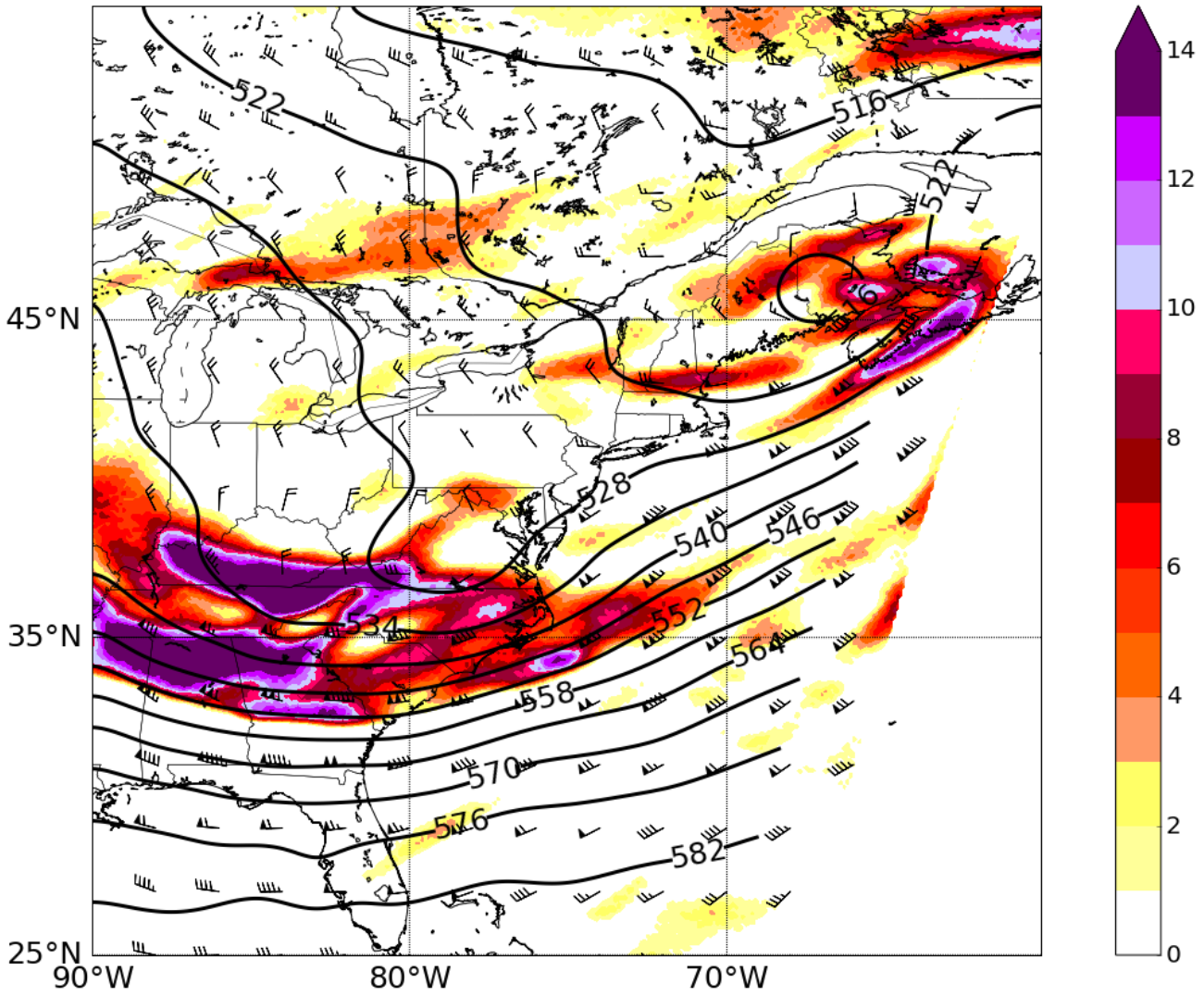
- ***Cyclonic relative vorticity advection*** at 500-hPa

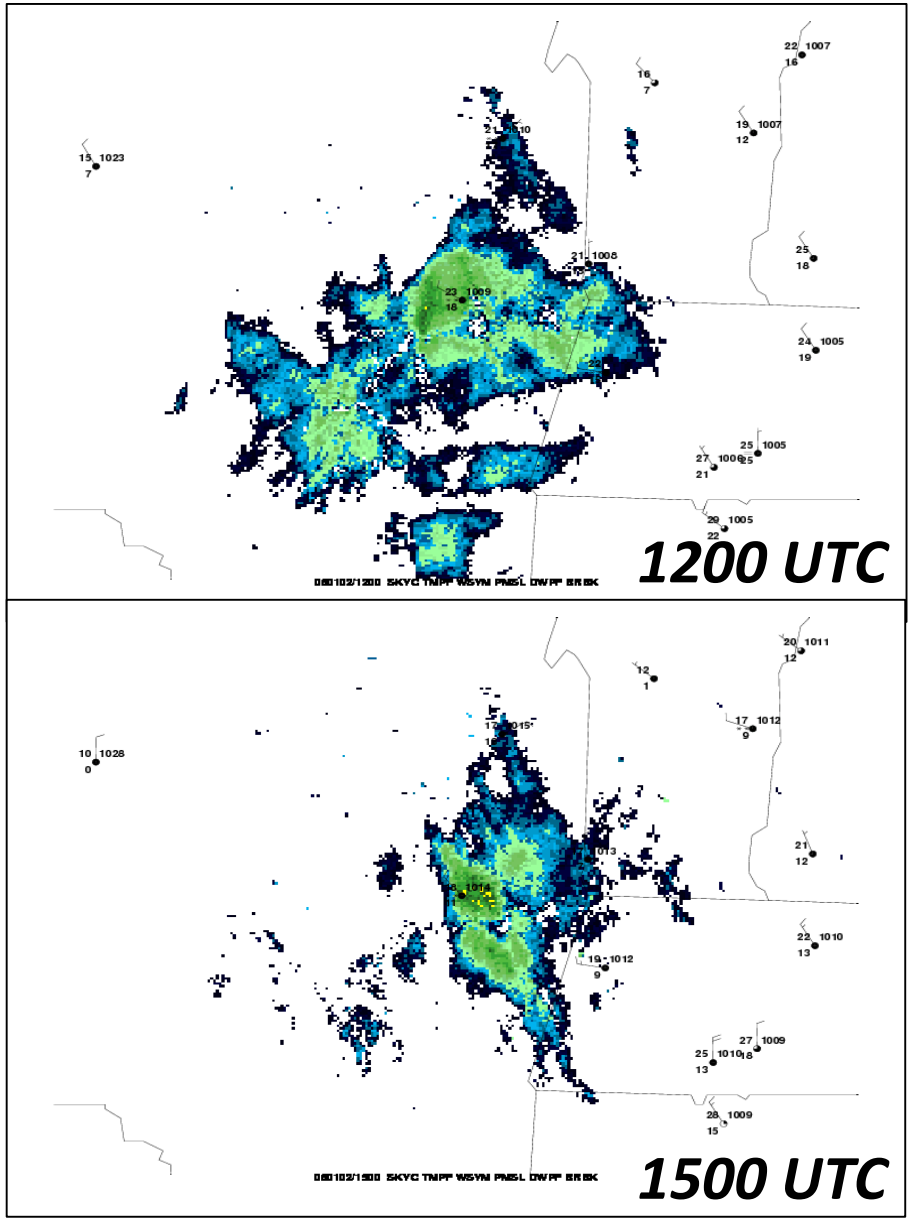
1200 UTC 500-hPa relative vorticity



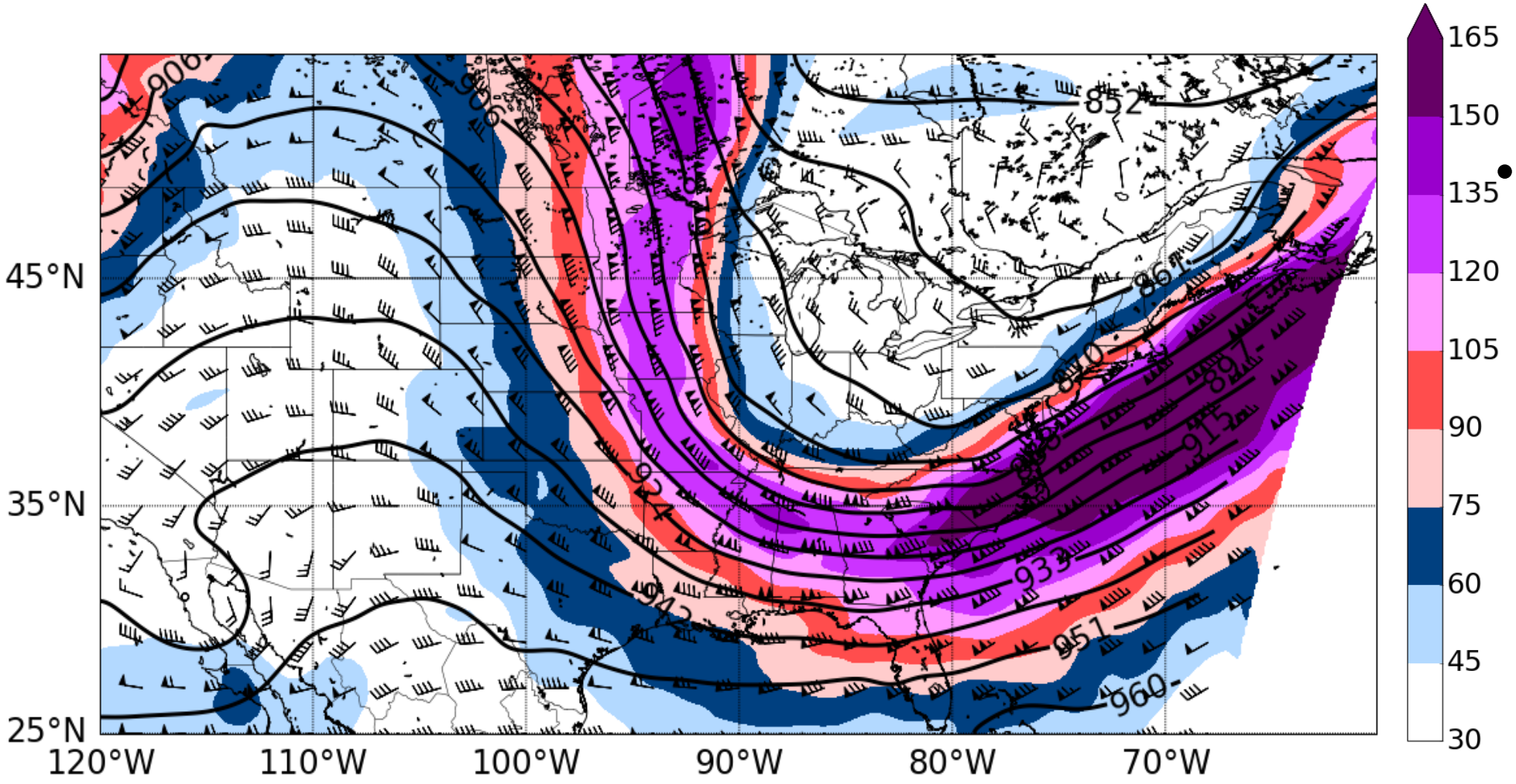
- ***Cyclonic relative vorticity advection*** at 500-hPa
- After the ***vorticity maximum moves through***, the Capital District is in a region of ***anticyclonic relative vorticity advection forcing descent***

1200 UTC 500-hPa relative vorticity



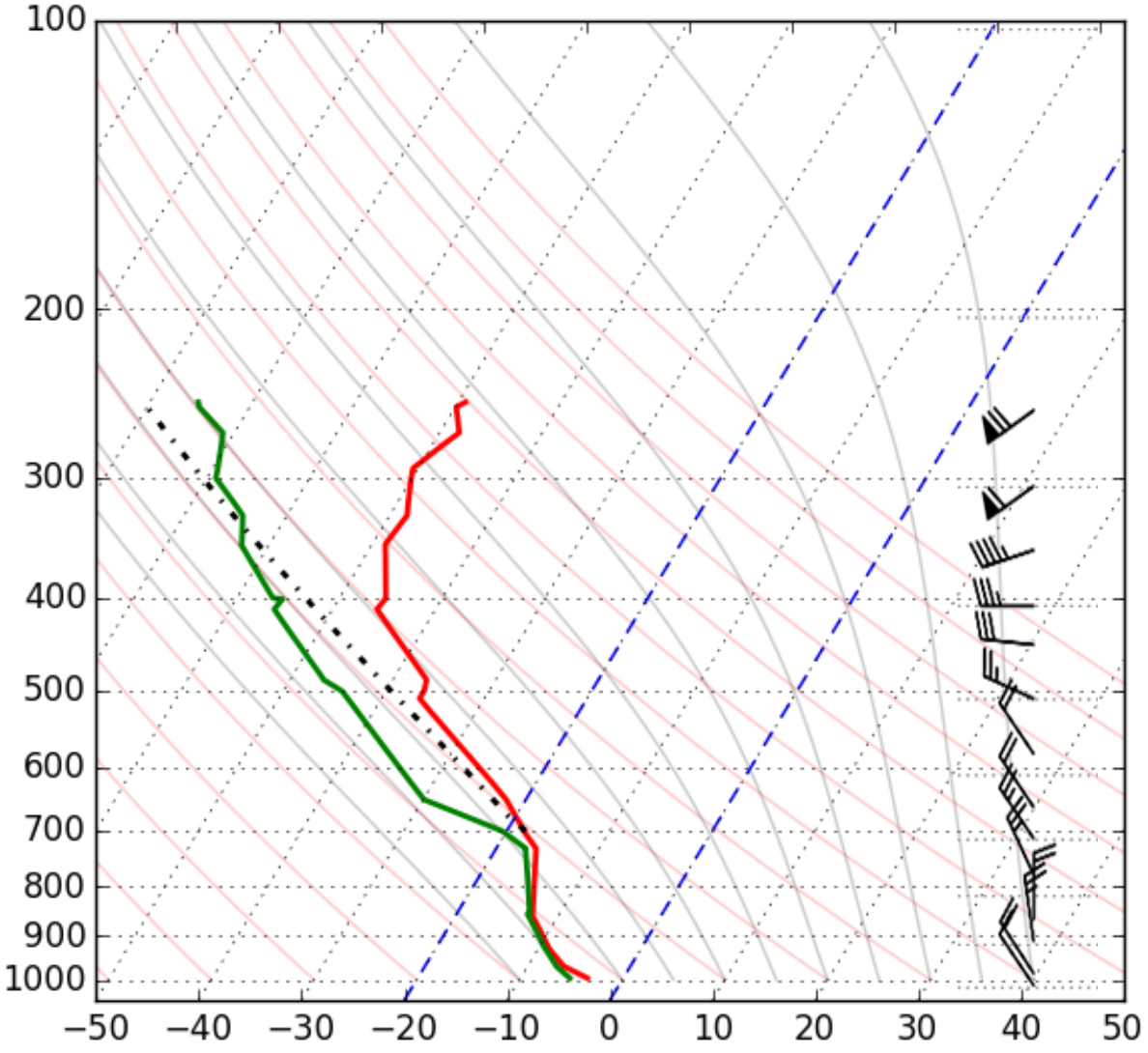


1200 UTC 300-hPa jet

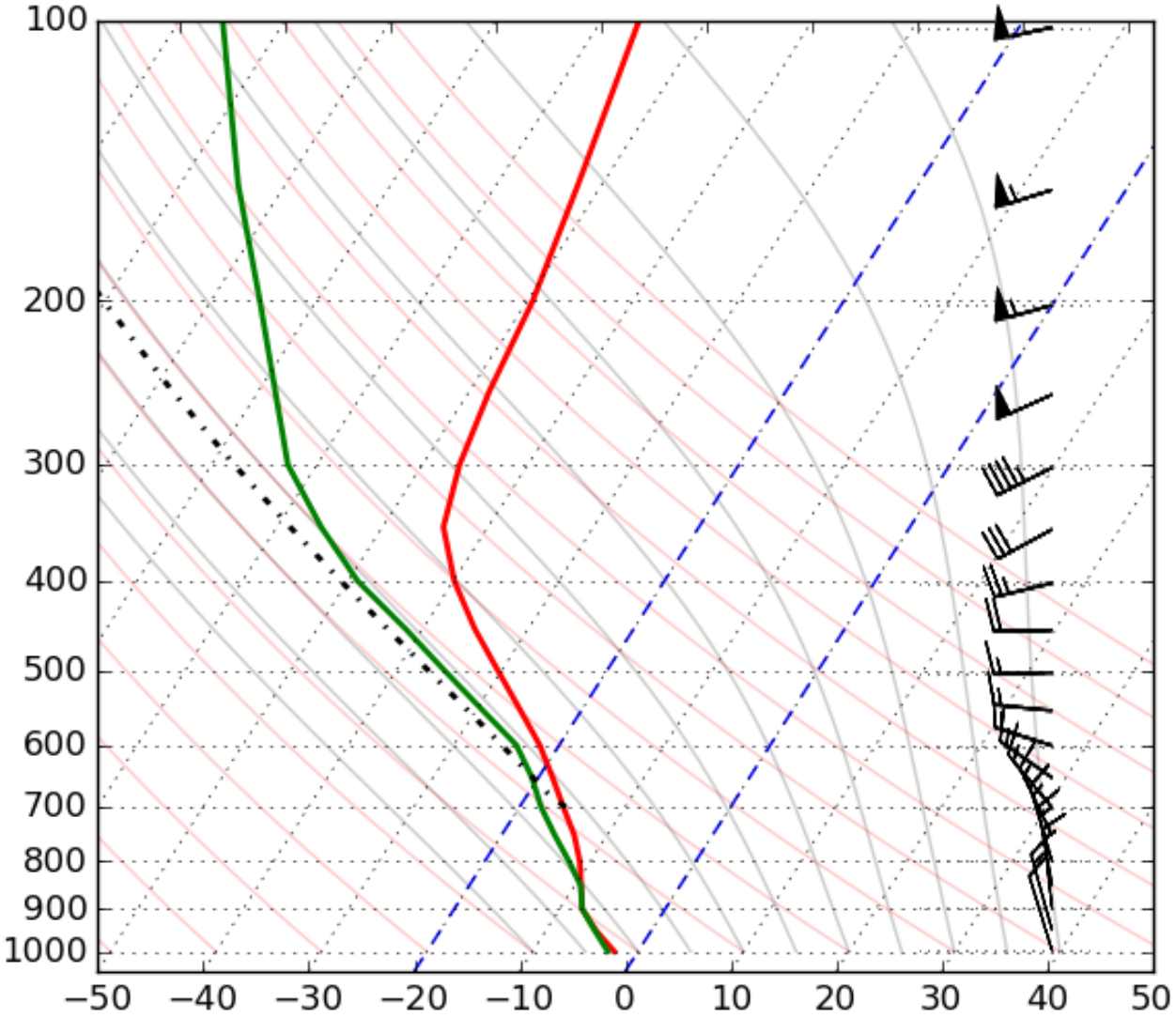


- ***Jet pattern*** is ***not favorable*** for ***upper-level divergence*** over the Capital District

Observed sounding at 1200 UTC



MHC composite sounding



Forecasting tips:

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- ***Low-level warm air advection*** leads to ***low-level upward vertical motion*** in a ***saturated boundary layer***

- ***Mid-level anticyclonic vorticity advection*** associated with a 500-hPa trough forces ***mid-level descent***, ***capping*** the ***phenomenon***

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Questions?

dcard@albany.edu