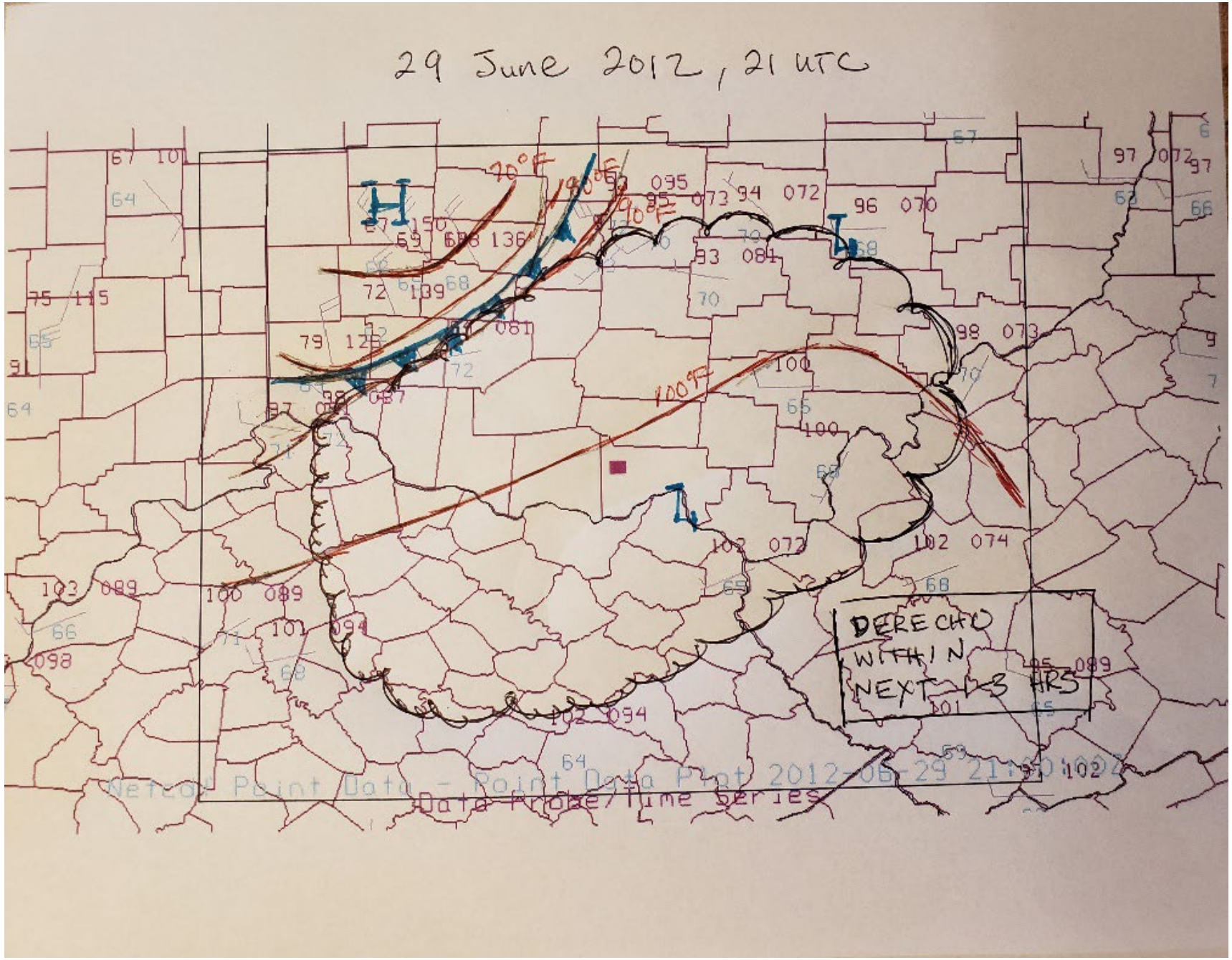
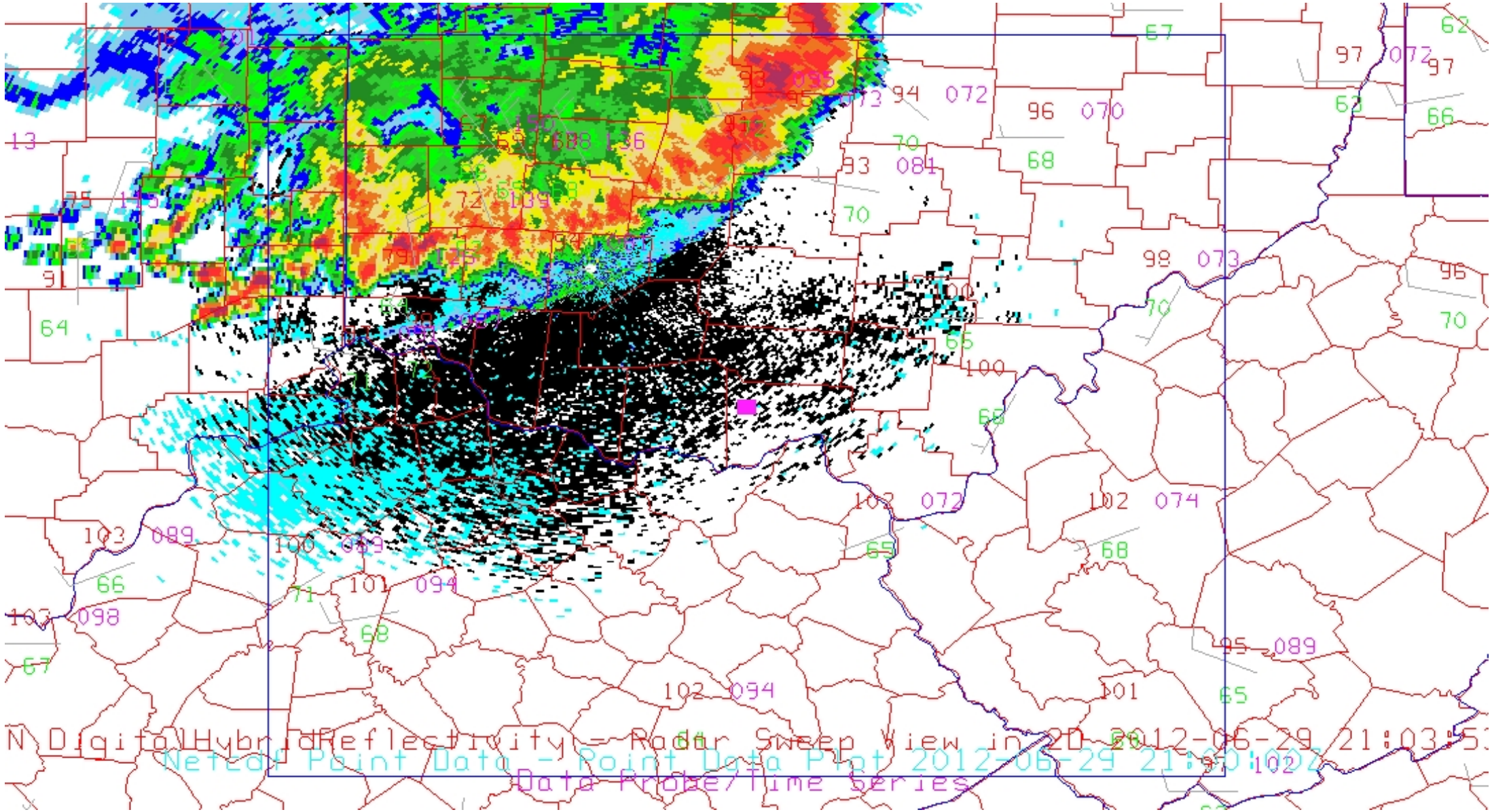
Homework 2 Key

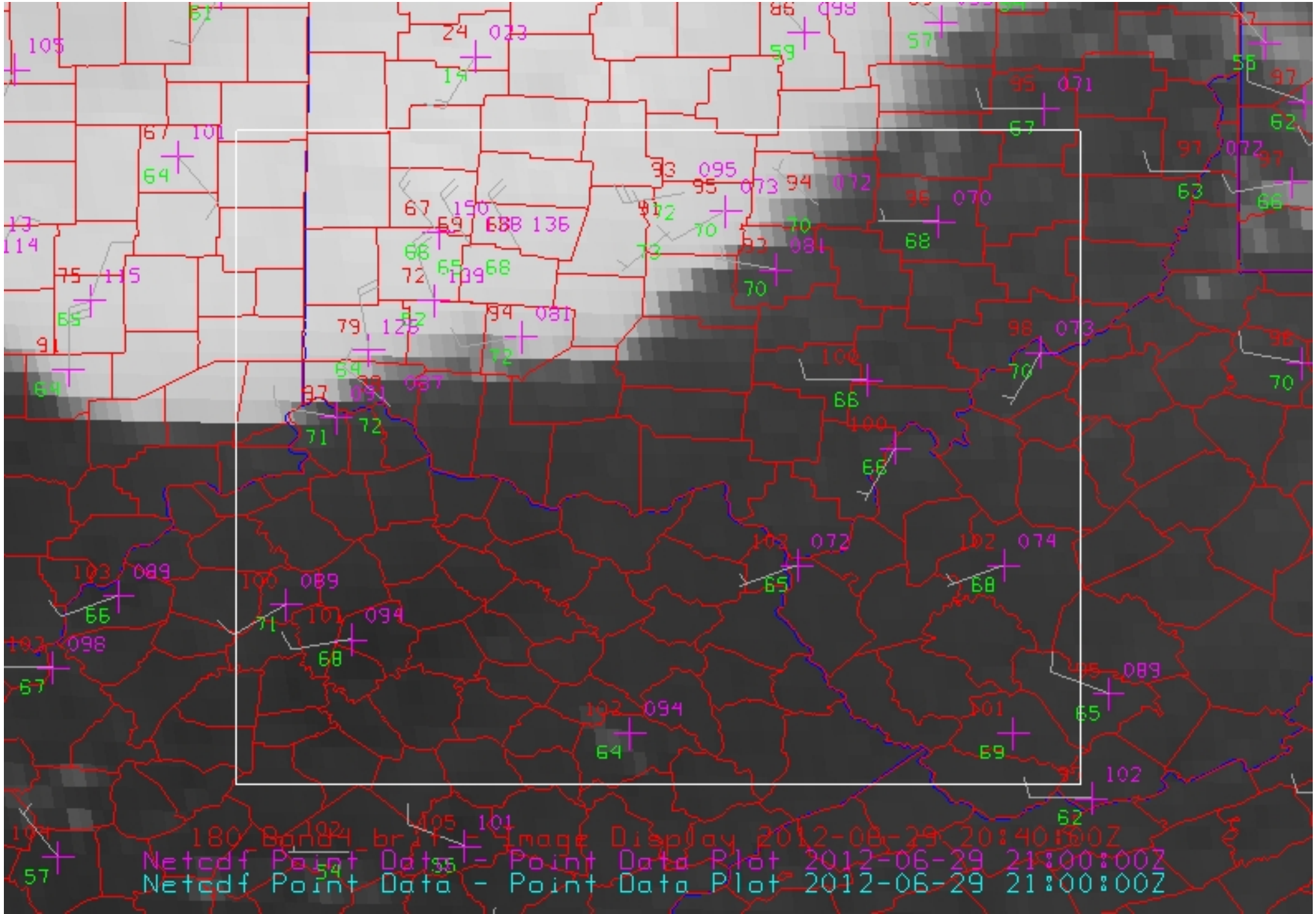
Part 1: IDV Analyses, mesoanalysis
50 points

Part 2: outflow speed, storm motion
25 points

Part 3: SPC type discussion
25 points

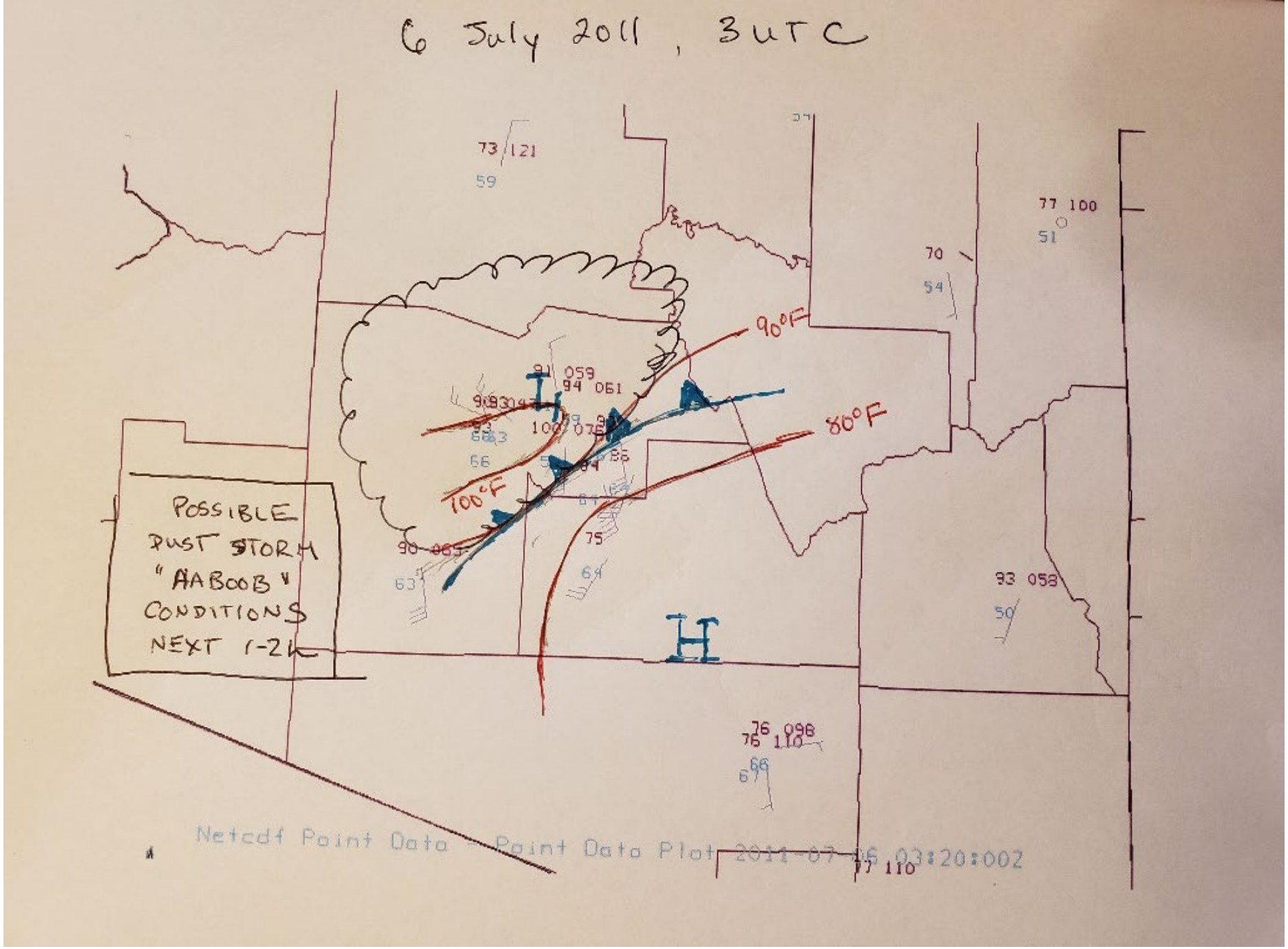

29 June 2012, 21 UTC
70°F
90°F
100°F
H
DERECHO
WITHIN
NEXT 1-3 HRS
Data Probe/Time Series

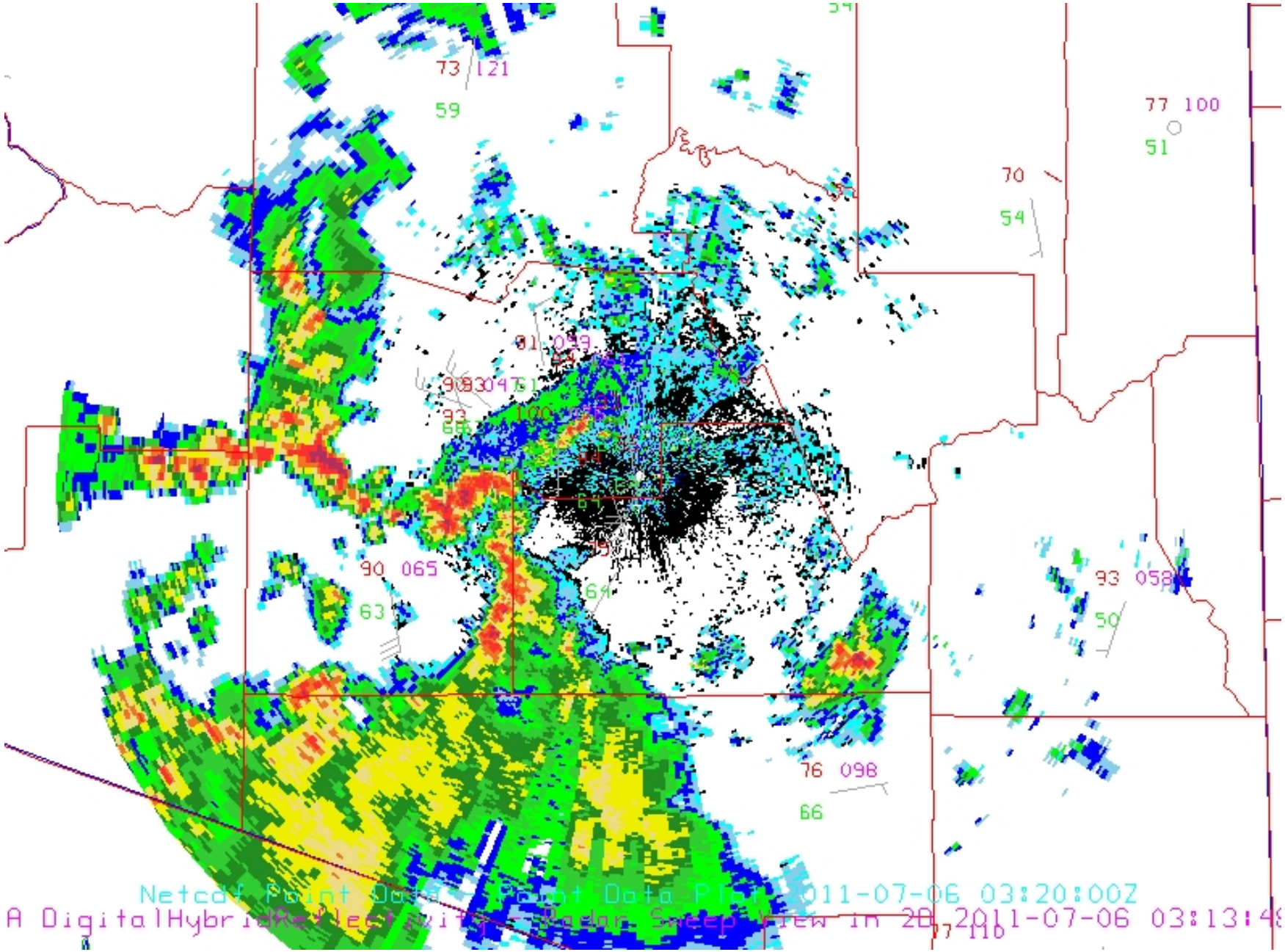

N Digital Hybrid Reflectivity - Radar Sweep View in 2D 2012-06-29 21:03:51
NetCDF Point Data - Point Data Plot 2012-06-29 21:00:02
Data Probe/Time Series

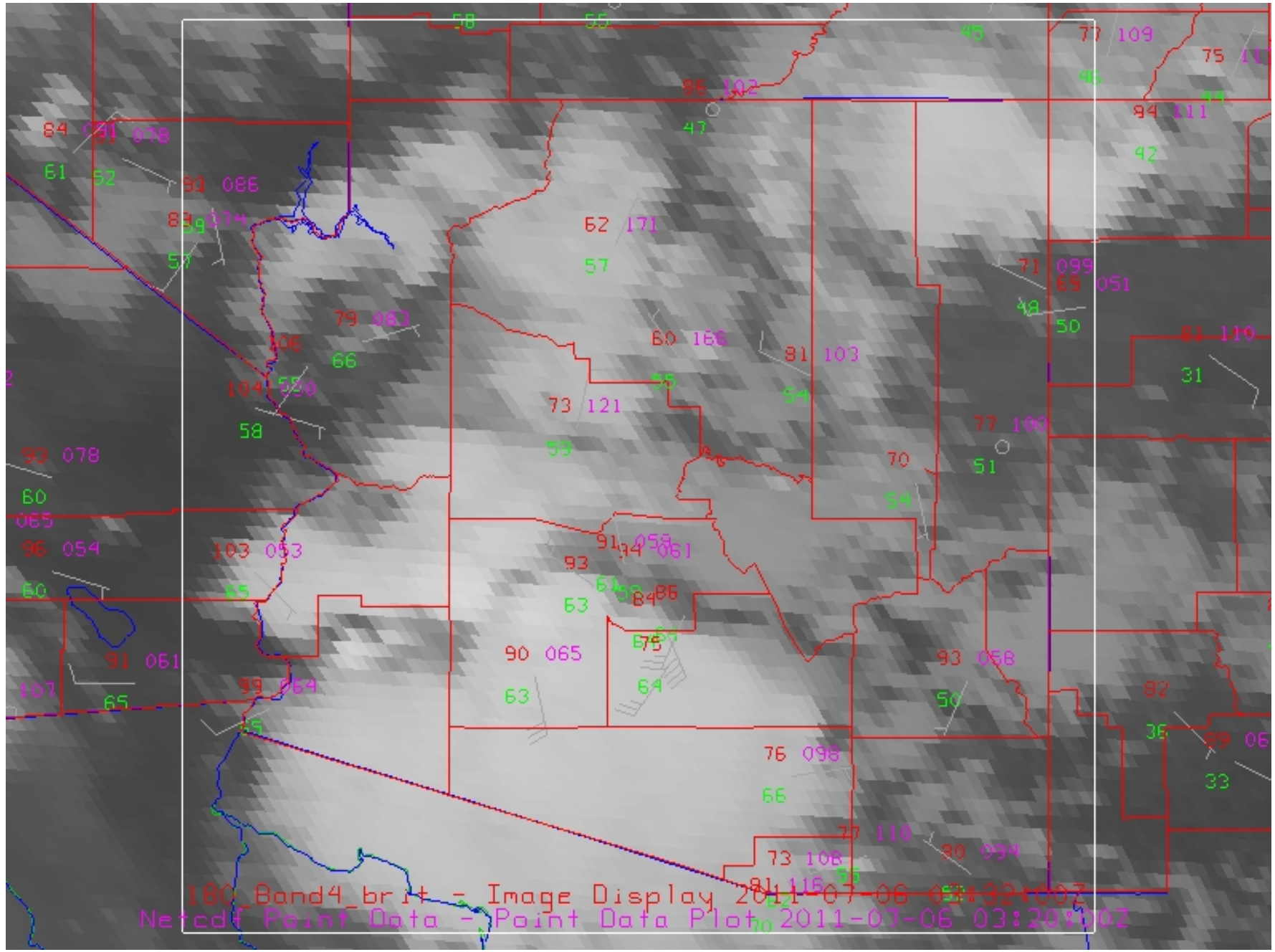

Netcdf Point Data - Point Data Plot 2012-06-29 21:00:00Z

Wilmington, OH: 29 June 2012
Key points for SPC type discussion

- Area is being affected by well-developed summertime mesoscale convective system (QLCS) in the Midwest per IR imagery, with strong leading convective line. Air is very warm (90-100 degrees F) and moist (dewpoints 60-70 degrees F), so high theta-e to fuel storm.
- MCS is moving to the ESE in an environment of unidirectional shear, so severe thunderstorm watches/warnings should be issued for south-central, southeastern Ohio.
- There is about a 30 degree F difference in temperature associated with MCS passage, so relatively strong winds with gust front passage can be expected (tropical storm force or greater). Clear gust front clear air return signature.
- Clearest dangers associated with the leading line are heavy rainfall and possible flash flooding and straight line winds. Derecho event.
- Tornadoes also may be possible where the convective line breaks down on its southwestern end.

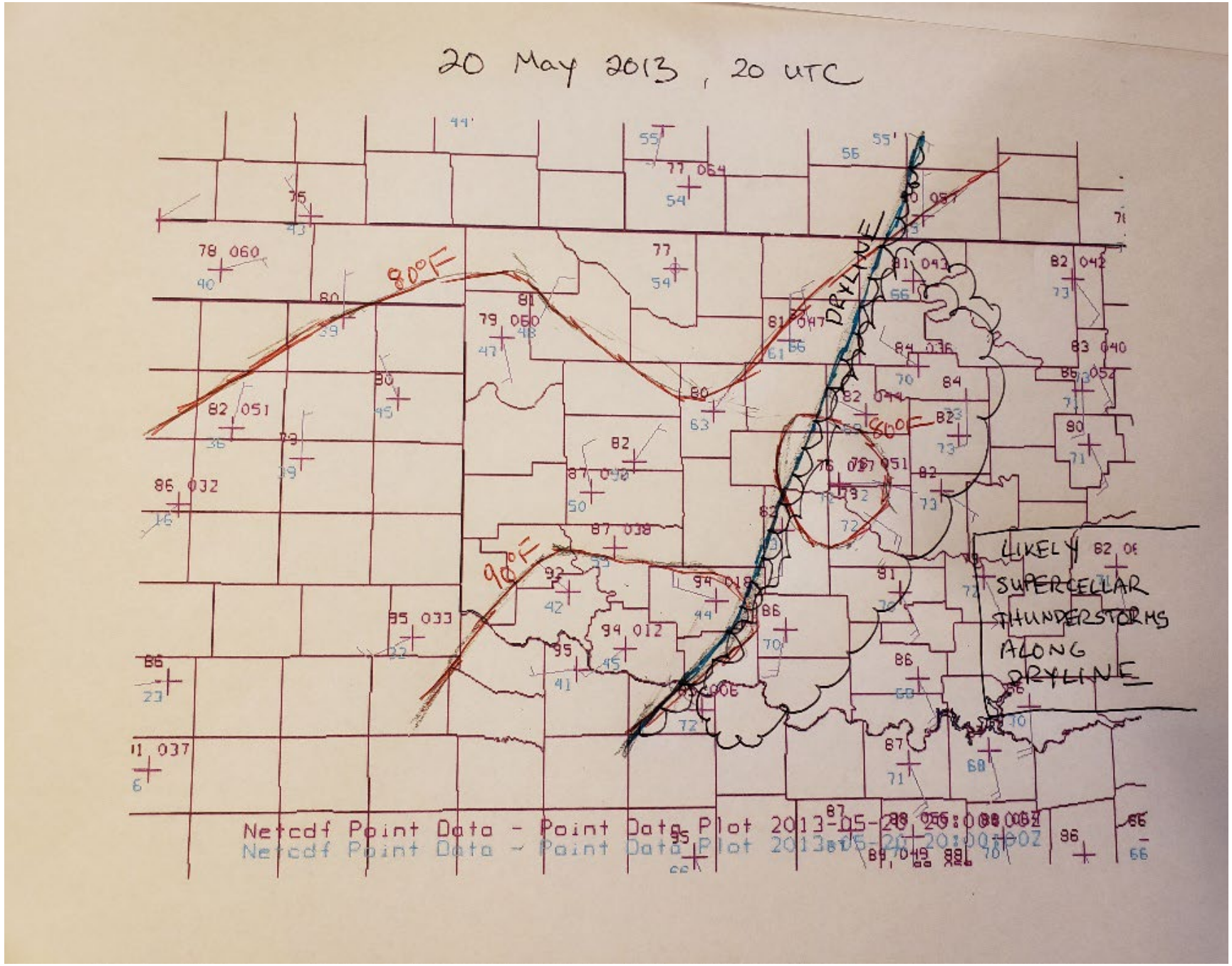

6 July 2011, 3UTC
90°F
80°F
100°F
H
POSSIBLE DUST STORM "HABOOB" CONDITIONS NEXT 1-2H
Netcdf Point Data - Point Data Plot 2011-07-06 03:20:00Z

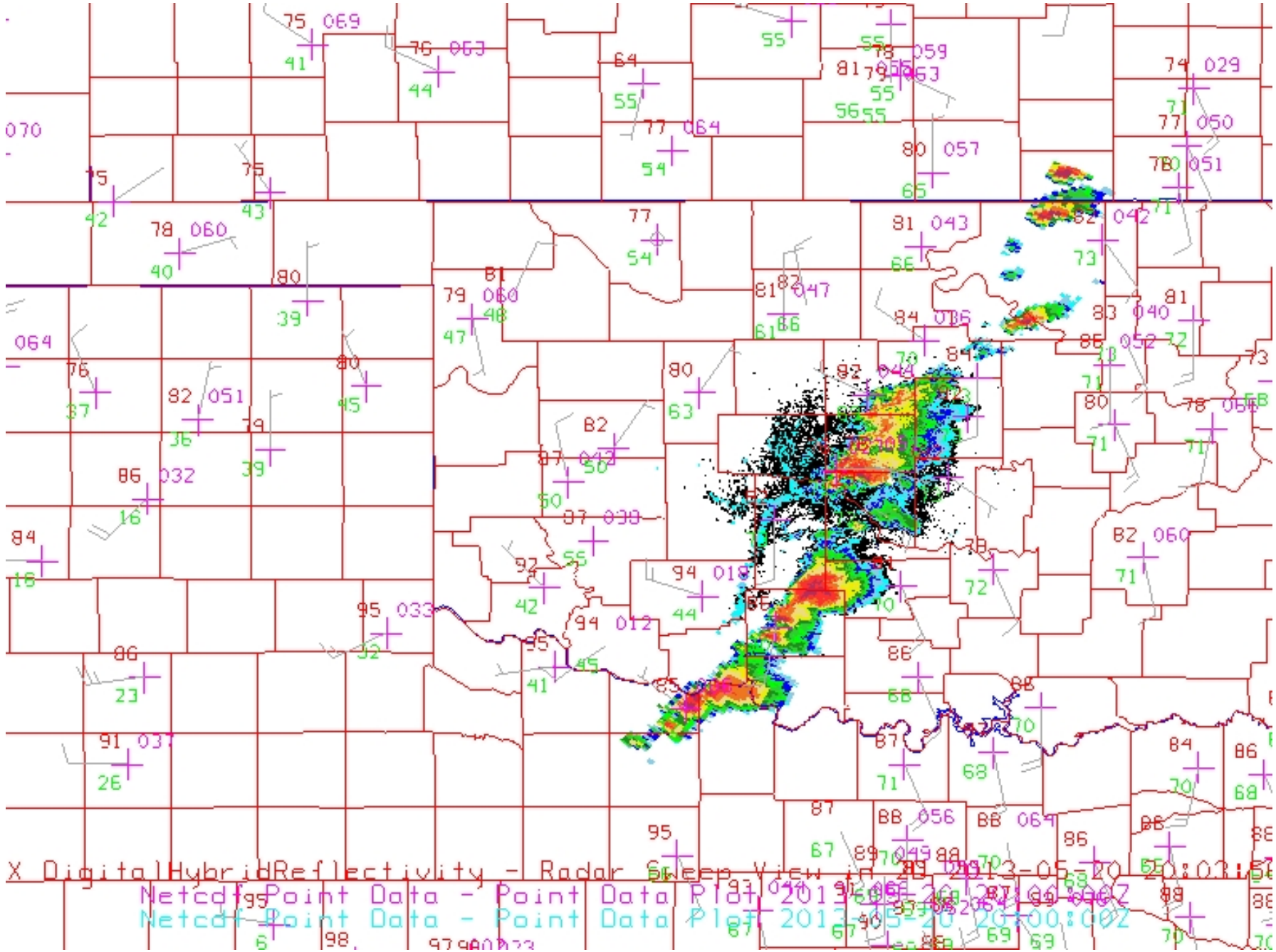

73 121
59
77 100
51
70
54
01 099
90 065
63
61
93 058
50
76 098
66
Netcdf Point Data
Point Data Plot
2011-07-06 03:20:00Z
A DigitalHybridReflectivity
Radar Sweep View in 2D
2011-07-06 03:13:48


180_Band4_brit - Image Display 2011-03-06 03:20:00Z
Netcdf Point Data - Point Data Plot 2011-03-06 03:20:00Z

Phoenix, AZ: 5 July 2011
Key points for SPC type discussion

- Westward propagating monsoon convection is organizing after initiating on the Mogollon Rim and Tucson area earlier in the afternoon.
- Thunderstorm outflow boundary and gust front moving northwestward along I-10 corridor. There is on the order of a 20-30 F temperature difference associated with the outflow boundary. 40 knot winds (nearly 50 mph) reported at 3 UTC.
- A strong haboob (dust storm) is occurring along the gust front and moving into the Phoenix metropolitan area. Severe thunderstorm warnings and dust storm warnings should be issued.
- Convergence of outflow boundaries is triggering the development of new convective lines downwind of the Mogollon Rim (evident in radar animation).
- Following the haboob in Phoenix, convection organizes into a MCS that propagates toward Colorado River Valley. Remanant MCV reaches southern California.


20 May 2013, 20 UTC
80°F
90°F
DRYLINE
LIKELY SUPERCELLAR THUNDERSTORMS ALONG DRYLINE
Netcdf Point Data - Point Data Plot 2013-05-20 20:00:00Z


X DigitalHybridReflectivity - Radar Sweep View
Netcdf Point Data - Point Data Plot 2013-05-20 20:00:00Z
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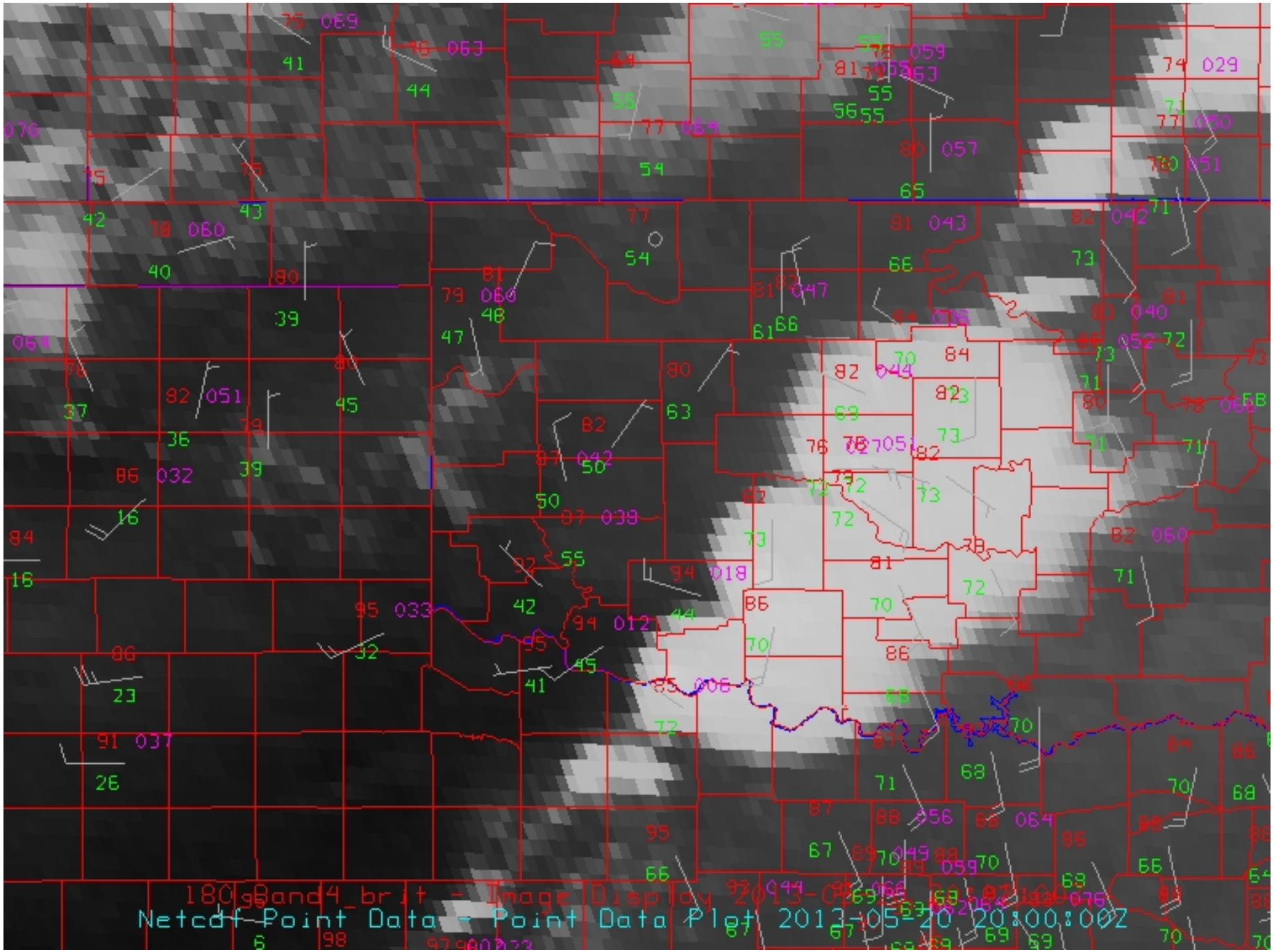
180 Band4_brit - Image Display 2013-05-20 20:00:00Z
Netcdf Point Data - Point Data Plot 2013-05-20 20:00:00Z

Norman, OK: 20 May 2013
Key points for SPC type discussion

- A very clear dryline is located in Central Oklahoma. 20-30 degree F dew point temperature contrast along the line. There is not a great deal of temperature contrast, so these classic central U.S. dryline storms.
- High directional shear environment, with clockwise turning hodograph.
- Dryline is serving as initiation point for the development of supercell thunderstorms. At the time of this analysis (20 UTC) there already are well-developed, right moving supercells. These storms have developed and intensified very rapidly (within a few hours) as there were generally no appreciable radar echoes at 18 UTC and prior.
- Tornado warnings should be issued for all locations where distinct supercells are present per the radar imagery. Tornado watches should be issued for central and eastern Oklahoma, in area approximately east of I-35 as shown on the map.

Grading notes for Part 2

- Estimation of gust front speed should generally follow the procedure used for midterm exam
- Full credit was given for estimates of storm motion provided the methodological approach explained and a reasonable speed and direction obtained. As these results will carry over to next assignment, not showing them on the key for now.

Sample student solution: Part 2

Table 1: Values used to estimate storm outflow speed $c_{outflow}$, associated observed wind speeds, and components of storm motion vector c_{SM} for each weather case.

	T_{otflow} (°C)	T_{env} (°C)	θ' (K)	θ (K)	g' ($m^2 s^{-2}$)	H (m)	$c_{outflow}$ ($m\ s^{-1}$)	obs. max sfc. wind ($m\ s^{-1}$)	c_{SM} ($m\ s^{-1}$) $\hat{i}$	c_{SM} ($m\ s^{-1}$) $\hat{j}$
ILN	19.44	36.67	17.22	309.67	0.55	1371.95	27.35	15.30	26.16	-12.20
PHX	23.89	38.89	15.00	311.89	0.47	2134.15	31.72	20.40	-10.44	9.27
OUN	24.44	30.00	5.56	303.00	0.18	609.76	10.47	17.85	10.20	6.18