

2010 Connecticut Ozone Season Forecasting Summary



2010

3rd Hottest Summer On Record

24 Exceedences Days

34 Days $\geq 90^{\circ}$
Windsor Locks

24 Ozone Exceedance Events

May 1,
June 4, 5, 24, 26, 27, 28
July 4, 5, 6, 7, 12, 16
July 17, 18, 19, 21, 28
August 9, 10, 17
September 1, 2 & 7

How did we do this past year?

Actual Exceedences Days = 24
Forecast Exceedences Days = 18

Month	Actual Dates	Forecast Dates
May	1	
June	4, 5, 24, 26, 27 & 28	19 & 24
July	4, 5, 6, 7, 12, 16, 17, 18, 19, 21 & 28	4, 5, 6, 7, 16, 17, 19, 21, 24 & 28
August	9, 10 & 17	10, 17, 19 & 31
September	1, 2, & 7	1 & 2
Total	24	18

**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
May 2010**

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Cornwall	87	65	55	56	63	54	41	46	40	45	45	46	47	28	M	M	45	38	38	52	62	58	44	33	47	55	41	46	48	41	48	
Danbury	88	65	39	52	64	51	40	44	39	43	45	36	47	48	43	40	44	36	34	52	66	56	39	32	56	49	45	41	52	42	47	
East Hartford	73	69	38	51	62	53	42	43	41	46	45	43	M	M	M	M	M	37	34	45	59	61	40	37	59	51	40	53	50	42	44	
Greenwich	68	58	34	60	63	56	41	46	42	49	45	50	43	43	47	40	41	42	35	41	58	46	39	37	36	63	38	30	39	42	50	
Groton	61	44	38	58	65	53	44	49	40	48	47	49	48	44	43	38	47	39	34	42	48	50	36	39	43	67	34	43	46	43	44	
Madison	58	45	40	53	63	53	45	48	39	46	46	50	46	43	43	41	39	41	34	43	50	44	36	37	40	71	34	42	42	44	39	
Middletown	80	69	38	55	66	54	44	50	41	47	45	46	47	47	43	43	50	38	34	52	57	61	38	36	55	54	36	48	49	43	42	
New Haven	73	52	21	39	53	45	36	38	36	43	35	42	34	37	41	31	34	33	30	35	53	56	37	32	21	44	34	24	32	41	43	
Stafford	75	74	45	58	66	54	46	38	37	47	47	46	47	48	42	47	45	40	36	48	60	72	43	40	60	55	35	45	49	41	45	
Stratford	69	54	37	57	67	56	17	47	41	49	52	57	48	44	47	41	42	48	37	48	55	51	42	41	40	68	42	34	44	50	49	
Westport	68	58	30	57	62	54	44	44	41	47	45	45	45	47	45	40	42	36	32	46	58	49	35	38	42	58	37	30	43	43	47	
# days > Federal Standard	1																															

Good (0-59 ppb)

Moderate (60-75 ppb)

Unhealthy for Sensitive Groups (76-95 ppb)

Unhealthy (96-115 ppb)

Very Unhealthy (116 > ppb)

Units - parts per billion (ppb)

Federal Standard = 75 ppb

M = missing data

* Data is preliminary and has not been quality assured

**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
June 2010**

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Cornwall	45	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	43	39	36
Danbury	44	71	57	70	52	43	35	30	49	46	48	55	31	28	39	44	34	56	75	58	41	56	48	58	56	54	84	52	46	40
East Hartford	41	61	58	67	50	45	37	32	38	37	40	36	28	43	46	40	29	49	61	57	42	47	45	54	56	46	76	47	42	34
Greenwich	50	58	65	77	62	51	38	35	49	47	42	48	35	27	45	43	35	51	61	67	50	55	51	68	62	69	70	62	52	43
Groton	46	50	48	51	76	51	39	34	49	45	40	44	35	46	43	40	33	52	50	50	52	49	58	78	47	68	60	74	33	48
Madison	52	51	52	48	75	52	38	34	51	47	40	40	28	45	45	42	32	57	51	56	58	52	61	70	54	76	56	80	57	51
Middletown	48	56	67	65	56	47	37	33	49	41	40	43	27	39	46	42	30	56	56	62	43	43	46	60	59	55	83	55	49	40
New Haven	41	55	52	66	46	43	34	29	49	40	39	44	26	31	39	36	28	33	55	65	39	49	45	48	50	64	76	57	45	39
Stafford	46	64	60	64	46	42	35	31	45	43	40	38	29	41	46	45	29	54	59	60	47	51	49	58	58	48	75	50	45	37
Stratford	56	64	71	77	75	55	39	35	57	50	46	54	34	44	48	48	34	47	59	65	50	56	39	M	M	M	M	64	51	47
Westport	50	55	66	77	66	50	37	33	50	48	44	50	32	32	45	44	35	58	63	68	50	51	50	63	60	71	69	66	51	42
# days > Federal Standard				2	3																			4		5	6	7		

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**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
July 2010**

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Cornwall	29	35	49	66	66	57	66	44	42	37	41	72	49	32	47	59	52	48	57	45	50	34	45	41	36	33	52	65	54	36	50
Danbury	26	36	54	70	65	56	72	50	40	41	45	84	47	33	49	91	61	54	63	49	66	37	25	49	39	32	40	76	47	38	48
East Hartford	23	29	46	60	64	53	60	39	32	39	43	67	44	25	45	77	52	45	67	42	M	34	23	43	37	31	34	79	38	35	45
Greenwich	31	35	57	66	74	74	79	46	33	47	52	82	39	37	48	69	69	58	60	56	76	41	33	58	43	34	58	70	55	49	52
Groton	27	35	60	70	73	58	51	36	25	38	51	60	44	36	36	49	75	72	M	57	72	39	38	51	43	34	52	56	57	47	50
Madison	32	37	62	82	79	80	59	37	28	36	57	69	43	43	39	56	81	77	56	62	65	38	30	58	43	32	57	60	62	52	47
Middletown	26	33	60	63	70	59	56	41	29	45	55	75	46	32	39	78	66	56	72	49	73	36	35	48	M	30	41	73	45	36	47
New Haven	25	30	57	67	63	59	61	40	26	39	47	67	43	36	38	60	70	53	54	48	68	35	29	52	37	30	45	60	48	40	45
Stafford	25	31	52	65	69	46	52	42	33	38	43	71	52	27	49	83	M	M	78	41	61	36	34	42	39	34	42	87	43	39	39
Stratford	32	33	65	79	80	74	77	47	34	47	60	76	44	40	52	67	80	72	68	67	77	41	44	68	42	36	61	71	62	53	55
Westport	31	35	61	70	79	71	73	42	34	45	55	83	42	32	46	70	78	59	68	62	79	40	27	60	40	33	62	78	55	52	53
# days > Federal Standard				8	9	10	11					12				13	14	15	16		17							18			

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Very Unhealthy (116 > ppb)

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**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
August 2010**

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Cornwall	49	61	51	64	44	41	45	56	68	48	42	35	42	41	35	35	52	57	58	47	46	41	38	32	27	34	31	42	57	66	64	
Danbury	54	65	53	71	55	47	60	69	84	60	47	34	38	41	37	38	57	49	71	47	54	44	41	30	25	39	25	40	48	61	54	
East Hartford	39	51	48	62	51	40	38	53	74	48	49	31	37	37	32	29	52	44	62	41	43	34	33	29	28	33	28	33	50	57	57	
Greenwich	48	53	45	56	66	50	66	53	69	78	64	37	31	37	33	37	82	59	66	60	51	43	42	31	22	44	34	45	66	69	66	
Groton	33	39	36	40	56	48	51	44	56	66	51	28	28	32	33	34	61	44	62	52	40	44	39	30	28	44	31	40	56	64	69	
Madison	38	43	41	42	70	54	58	48	66	66	58	28	27	34	35	35	68	50	71	51	42	48	41	31	31	44	30	47	64	72	66	
Middletown	40	49	48	54	56	45	51	55	80	63	52	28	36	37	33	36	63	46	66	45	44	44	40	31	30	38	32	39	57	63	61	
New Haven	40	43	40	44	57	43	55	50	61	58	57	27	32	33	32	27	61	47	59	45	45	42	37	26	28	36	25	38	49	59	53	
Stafford	44	57	58	70	53	45	43	58	83	57	38	35	41	39	35	37	57	51	73	46	48	41	39	31	25	40	35	37	55	64	61	
Stratford	44	54	47	53	70	56	60	55	70	73	65	35	33	37	38	41	77	60	71	51	51	48	46	32	33	45	30	47	65	65	59	
Westport	43	56	49	56	70	51	63	44	25	79	63	27	31	36	35	39	77	55	70	51	49	43	40	29	28	43	31	39	54	63	63	
# days > Federal Standard									19	20							21															

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**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
September 2010**

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Cornwall	74	83	48	40	32	50	68	45	21	19	30	25	34	38	32	35	31	32	42	31	M	M	M	M	M	M	19	25	41	29
Danbury	76	97	33	40	34	58	71	52	21	17	34	26	38	38	31	33	24	36	46	32	36	71	45	53	56	32	21	24	44	19
East Hartford	66	89	28	38	30	47	64	45	16	17	34	25	M	32	31	35	24	29	40	31	30	60	38	58	50	31	14	18	42	15
Greenwich	91	72	37	43	41	55	57	61	25	19	42	27	34	42	35	45	32	35	46	35	37	60	44	51	60	34	21	26	29	21
Groton	78	71	26	47	42	49	52	64	22	19	35	27	29	46	35	54	45	33	44	32	42	61	34	51	65	28	24	29	44	20
Madison	70	75	25	47	43	54	56	71	23	19	35	30	33	46	35	56	44	34	53	34	44	57	37	55	71	31	22	31	45	20
Middletown	79	86	35	42	35	51	63	54	20	19	36	26	27	43	33	52	39	33	54	33	36	68	40	63	62	32	22	27	48	21
New Haven	53	66	26	38	33	36	48	46	19	18	36	27	26	37	31	50	27	34	49	31	37	55	39	52	58	31	19	21	25	17
Stafford	75	101	40	43	34	54	78	50	21	18	33	27	33	40	36	49	41	33	45	34	39	74	44	71	57	33	19	27	54	26
Stratford	80	74	37	44	42	57	57	63	26	21	44	33	34	43	36	56	41	38	53	34	43	62	44	59	67	36	25	30	40	30
Westport	87	79	31	43	40	58	60	60	24	19	42	30	30	44	34	50	32	36	55	34	38	62	42	63	64	33	21	27	36	17
# days > Federal Standard	22	23					24																							

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Connecticut

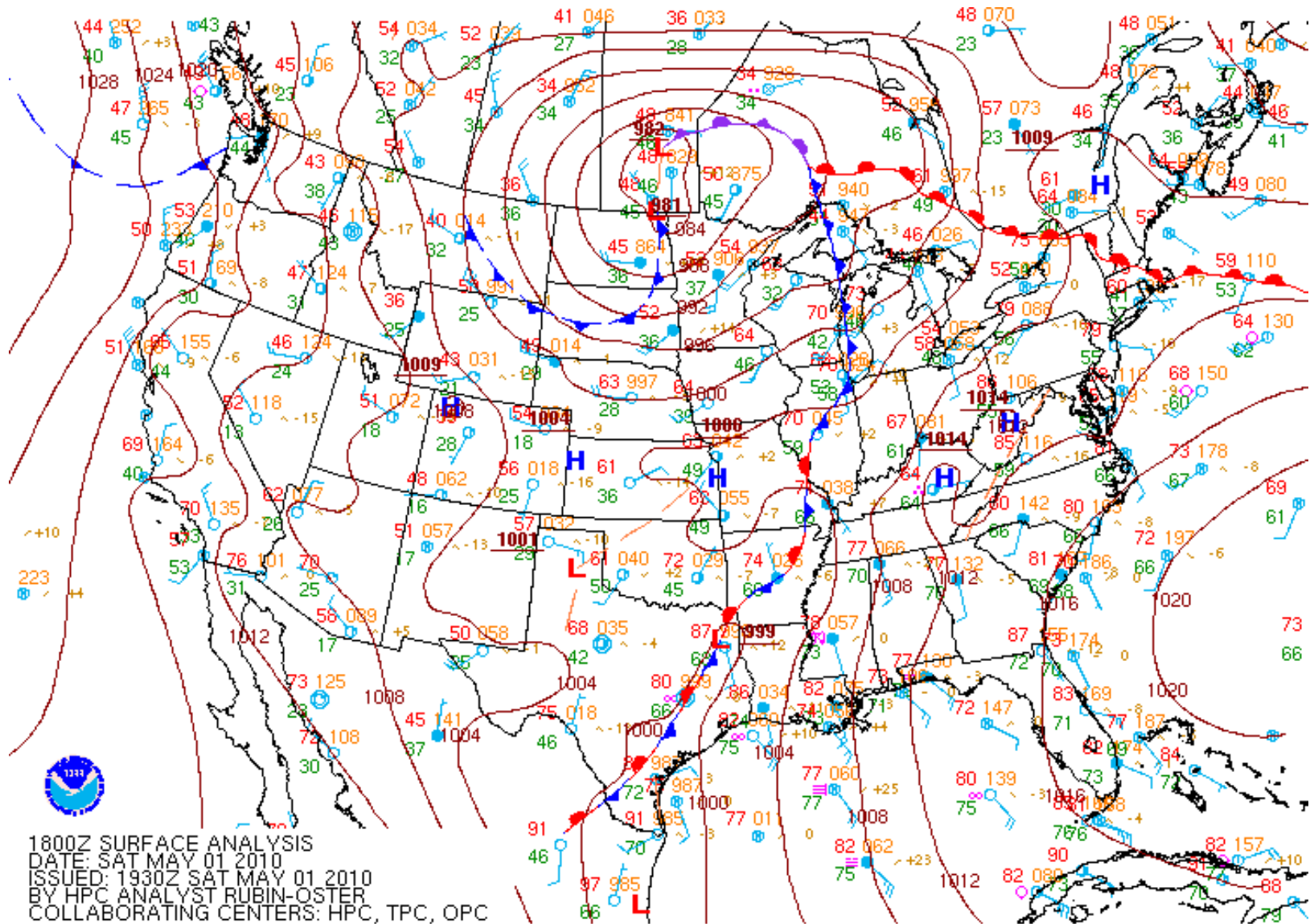
May 1

July 4 & 24

September 2

2010 Ozone Case Studies

May 1, 2010 18z

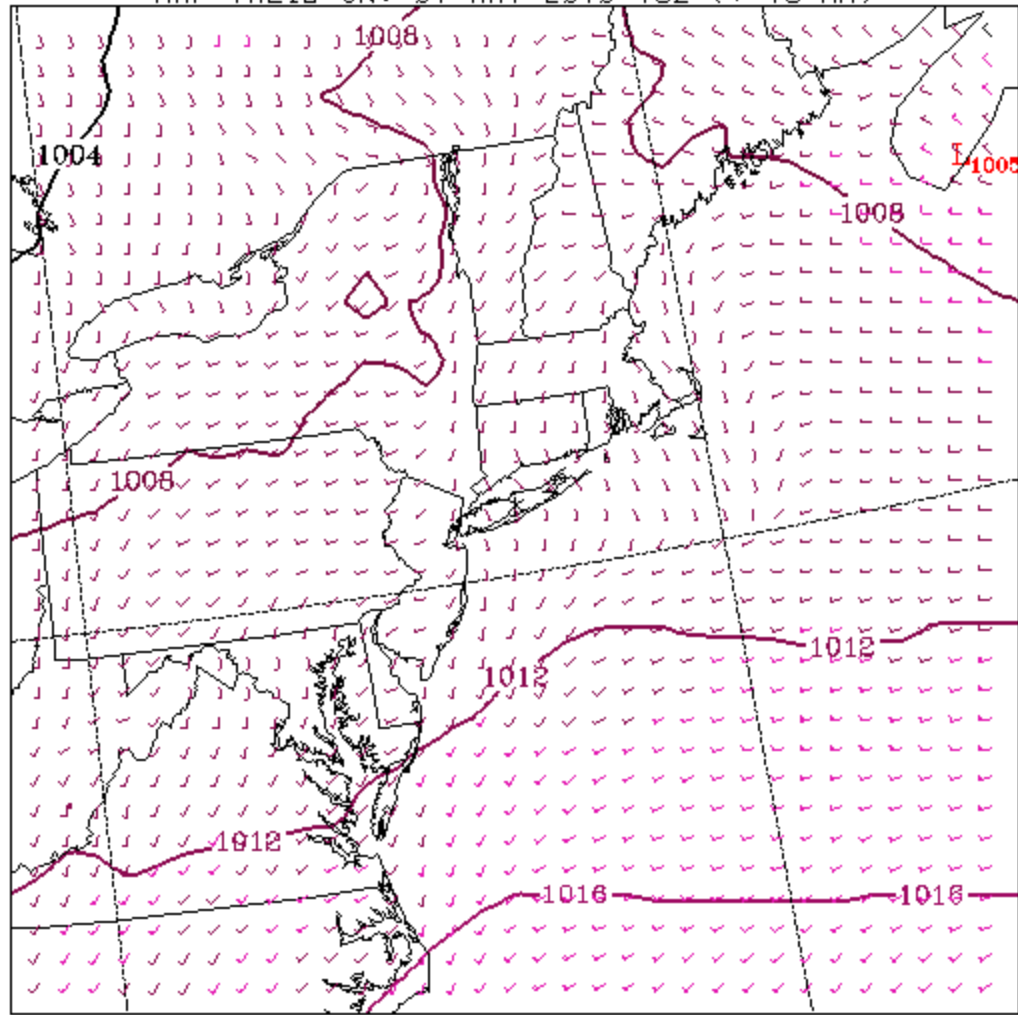


1800Z SURFACE ANALYSIS
DATE: SAT MAY 01 2010
ISSUED: 1930Z SAT MAY 01 2010
BY HPC ANALYST RUBIN-OSTER
COLLABORATING CENTERS: HPC, TPC, OPC

METEOROLOGICAL DATASET INFORMATION

Initialization time: 00 UTC 01 MAY 2010

EDAS40 MAP
MAP VALID ON: 01 MAY 2010 18Z (+ 18 HR)

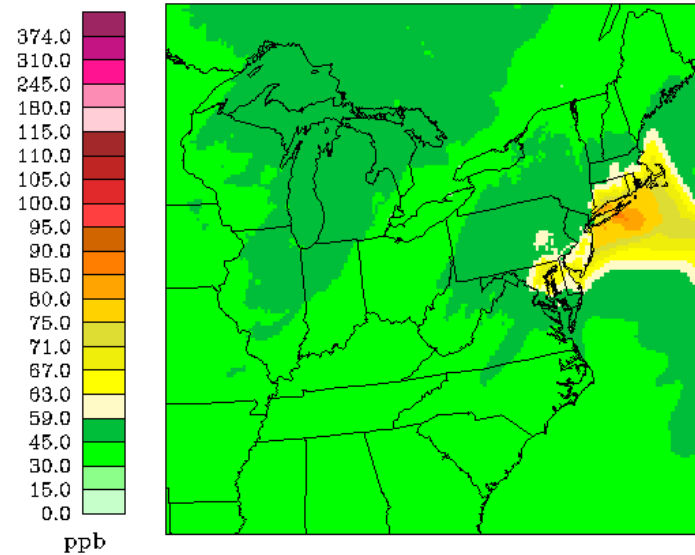


MEAN SEA-LEVEL PRESSURE (HPA)
WIND FLAGS (KNTS) AT HEIGHT: 10 m AGL

NOAA - AIR RESOURCES LABORATORY
READY Web Server

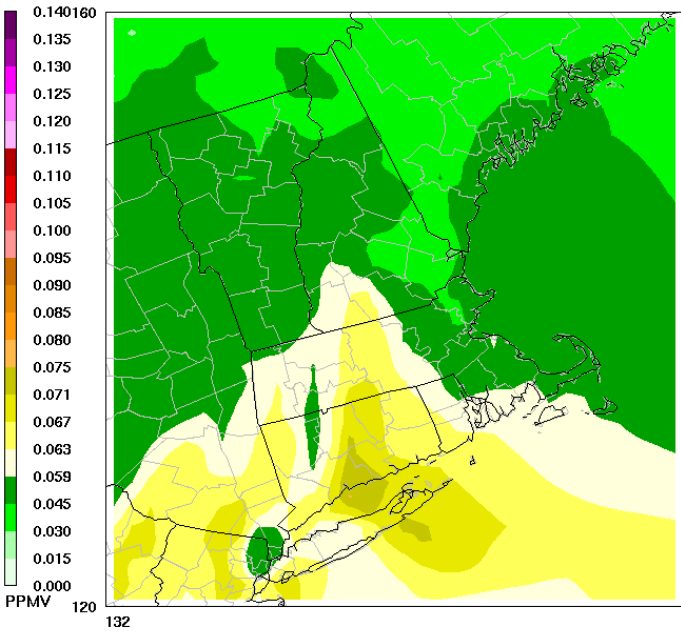
Winds somewhat weak and S'erly on LI and to the S. Hint of curved circulation E of NJ. S wind inland drove O3 N in Hudson Valley, CT and W MA.

NYSDEC 3x 12-km (Init UTC 1200 04/30/2010)
 8-hr Daily Maximum Ozone Concentration
 Saturday, 05/01/2010



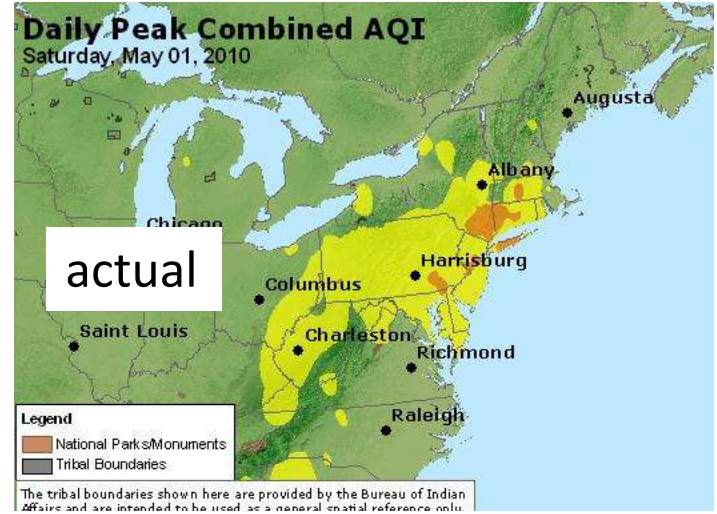
24HR Peak 8HR-AVE Ozone - NESCAUM (15km)

BAMS Environmental Modeling Center
 15km Domain Initialized 20100430 at 06z

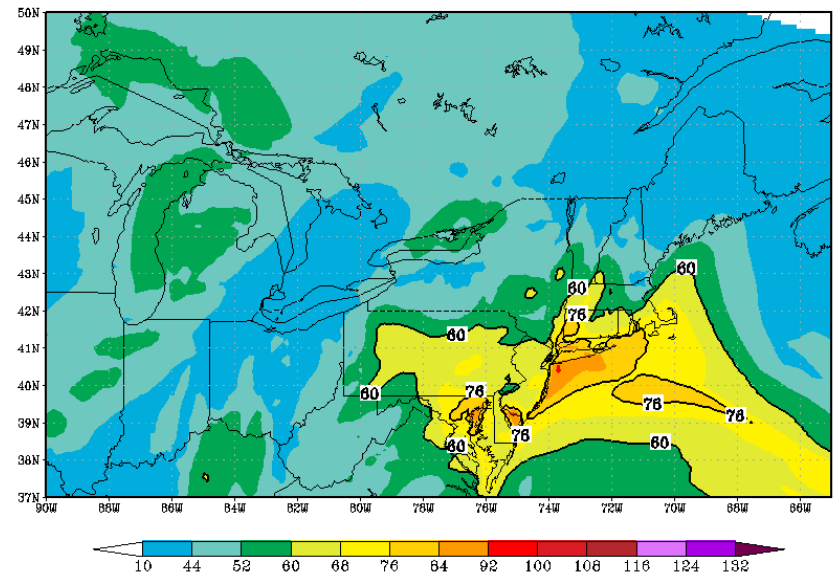


May 1, 2010 6:00:00
 Min= 0.029 at (133,159). Max= 0.075 at (145,127)

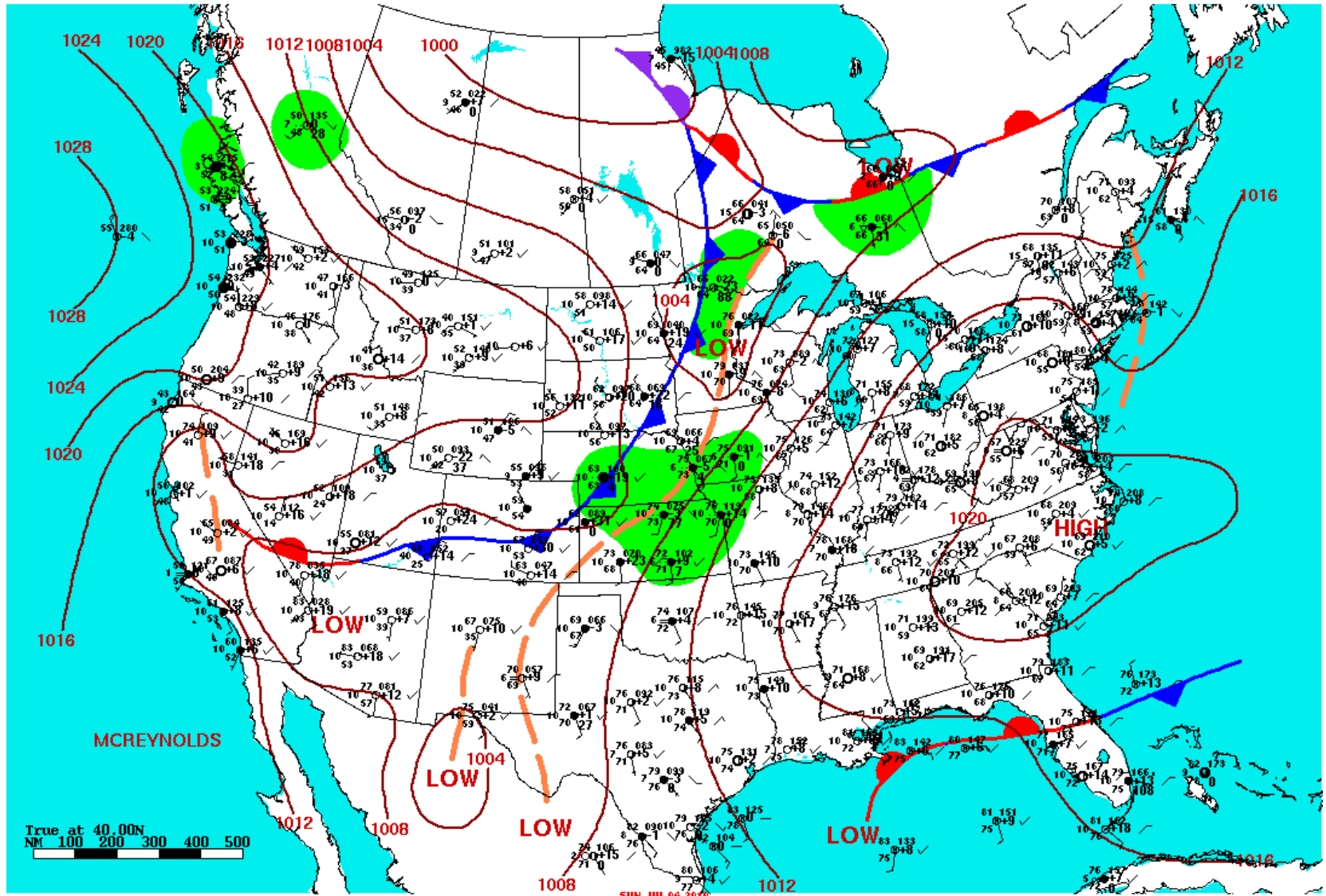
Most of the models missed the exceedences coming further north. SUNY model missed the plume coming up the Hudson Valley, but did well on LI. **NOAA model had best spatial performance.** The MAQSIP model underestimated the ozone everywhere. Possible that the MAQSIP model underestimates ozone aloft??



(prd) 12Z 25H-48H 2 day 8h max sf O₃ (ppbv) Valid 01 MAY 2010

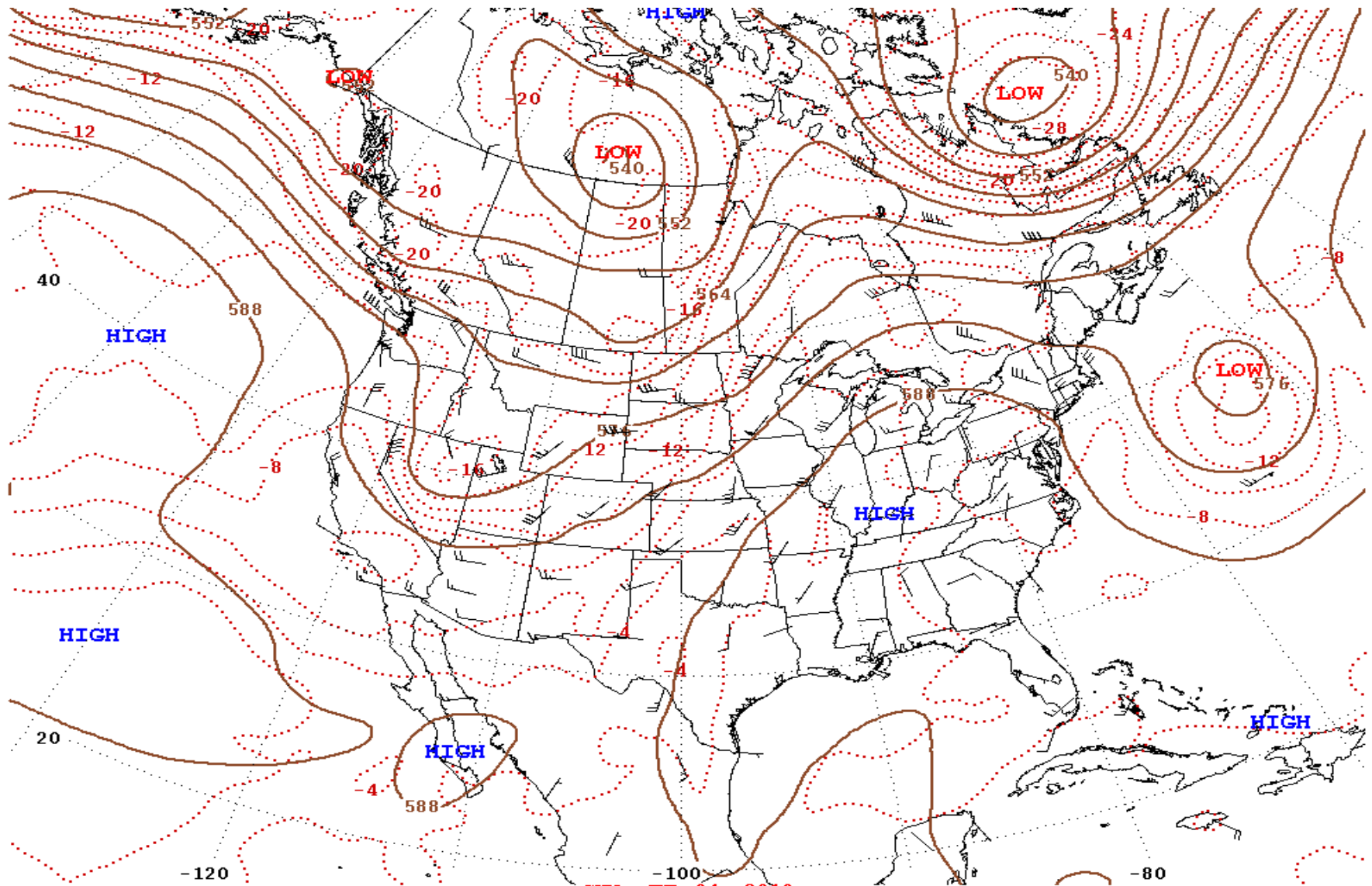


July 4, 2010, 12Z Surface Map



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

500 Millibar Flow, July 4, 2010, 12Z

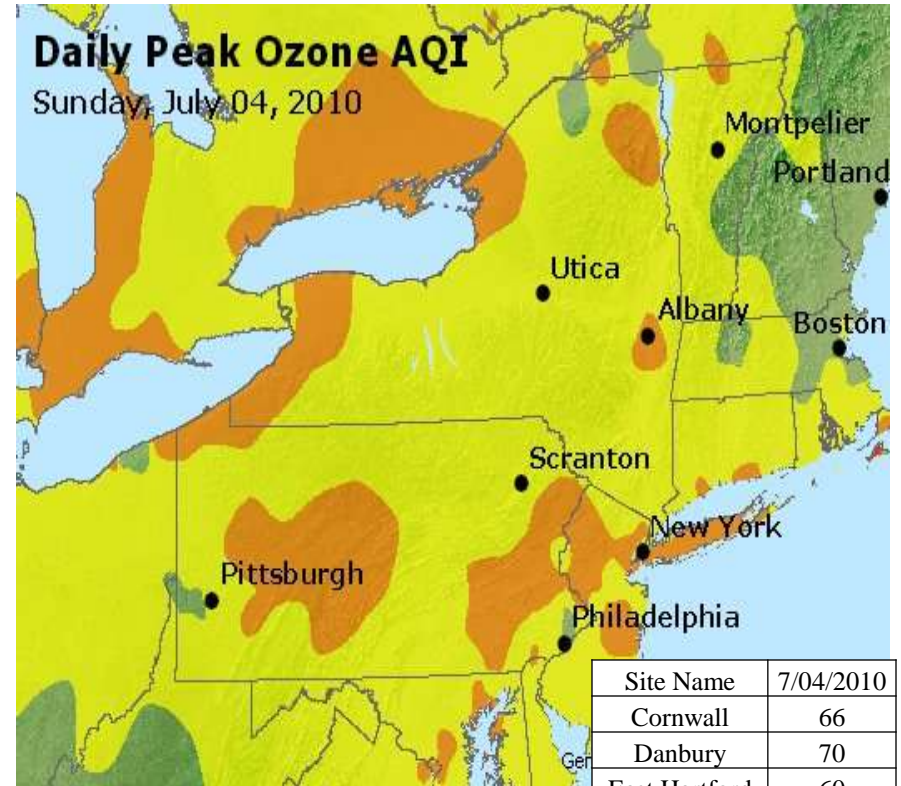
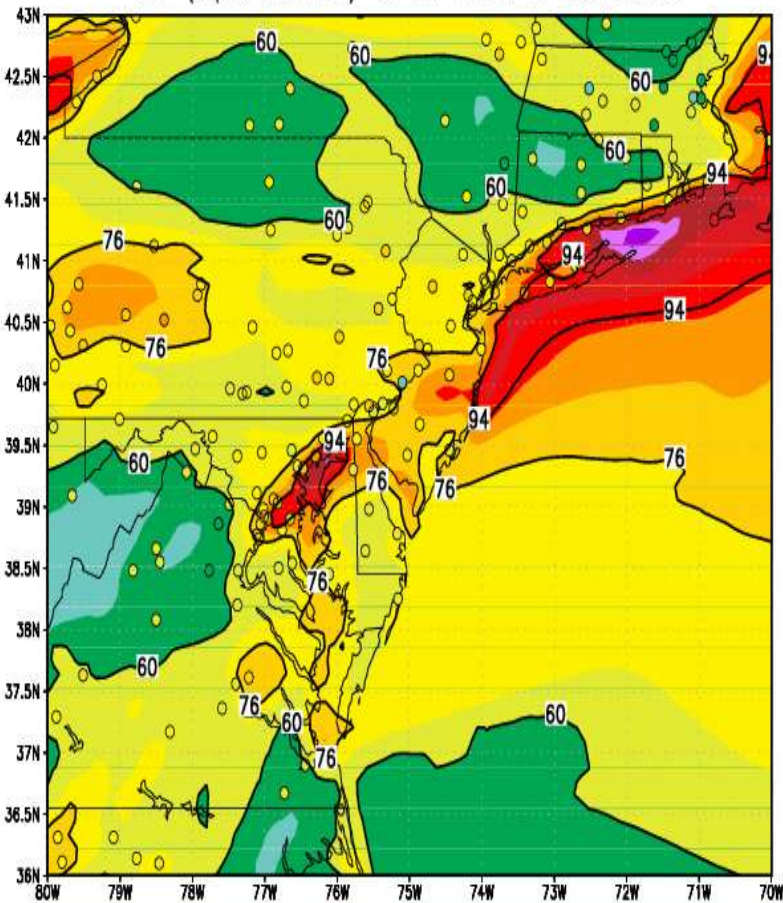


SUN, JUL 04, 2010

500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 04JUL2010

Modeled ozone forecast verses observed data

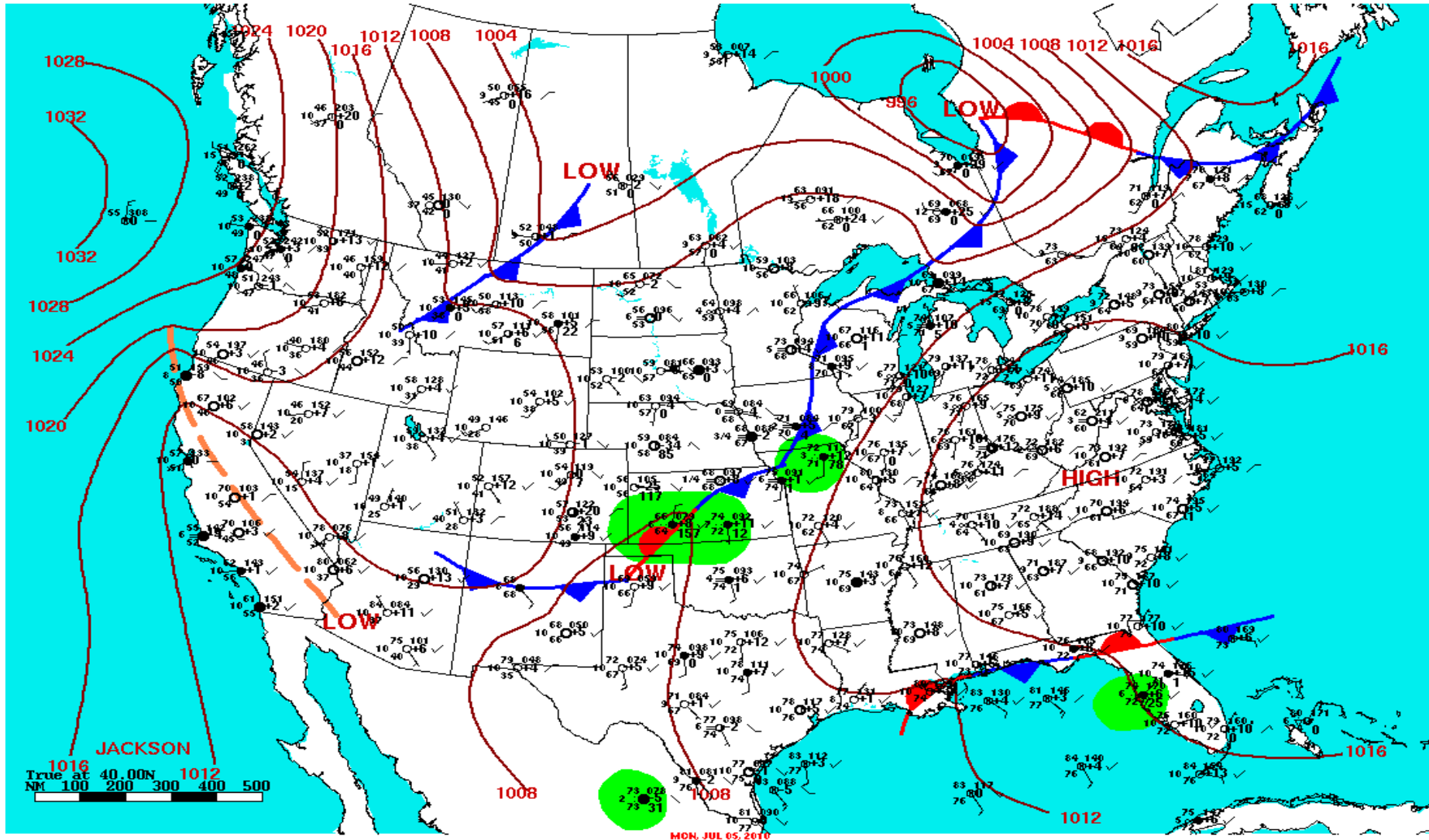


Site Name	7/04/2010
Cornwall	66
Danbury	70
East Hartford	60
Greenwich	66
Groton Fort	70
Madison	82
Middletown	63
New Haven	67
Stafford	65
Stratford	79
Westport	70

Forecasters predicted coastal monitors code orange – due to WNW wind flow.

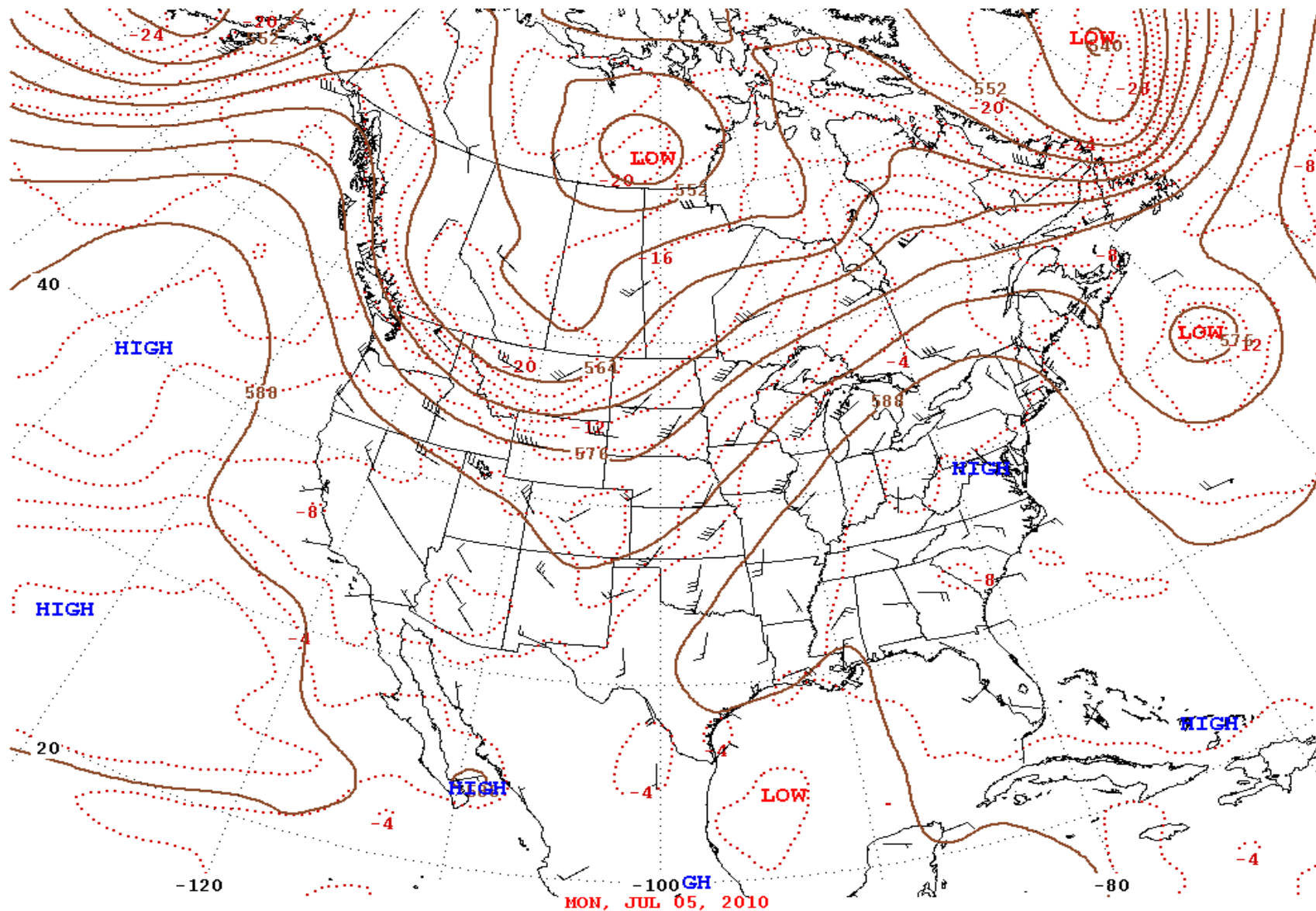


July 5, 2010, 12Z Surface Map



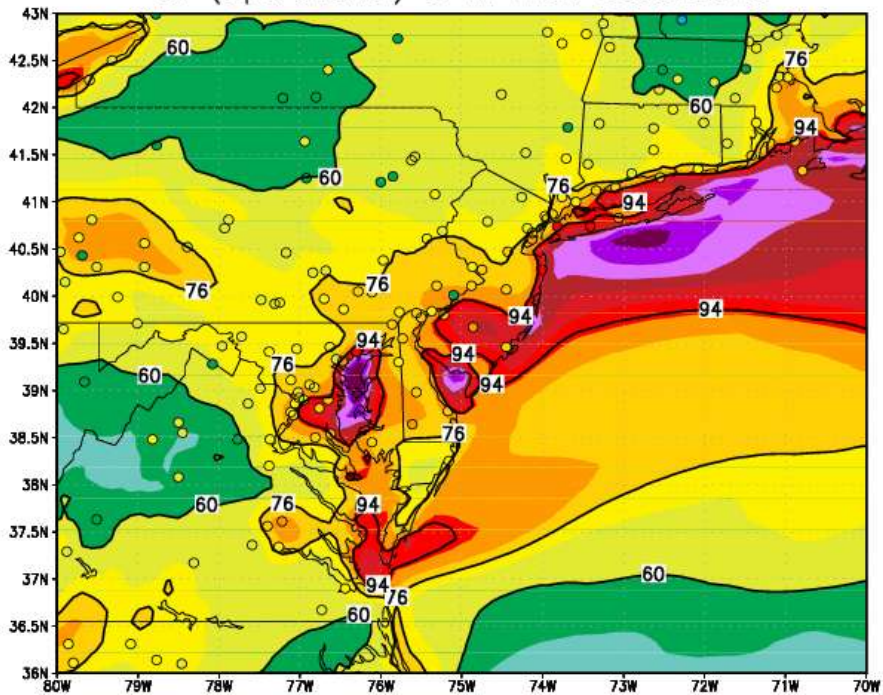
Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

500 Millibar Flow, July 5, 2010, 12Z

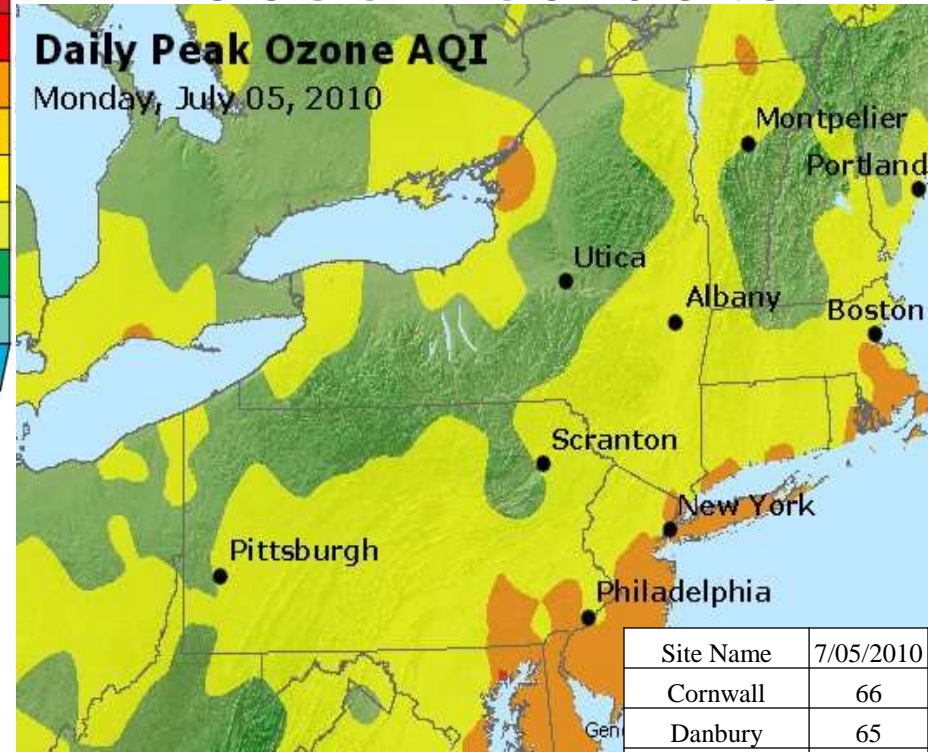


500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 05JUL2010



Modeled ozone forecast verses observed data



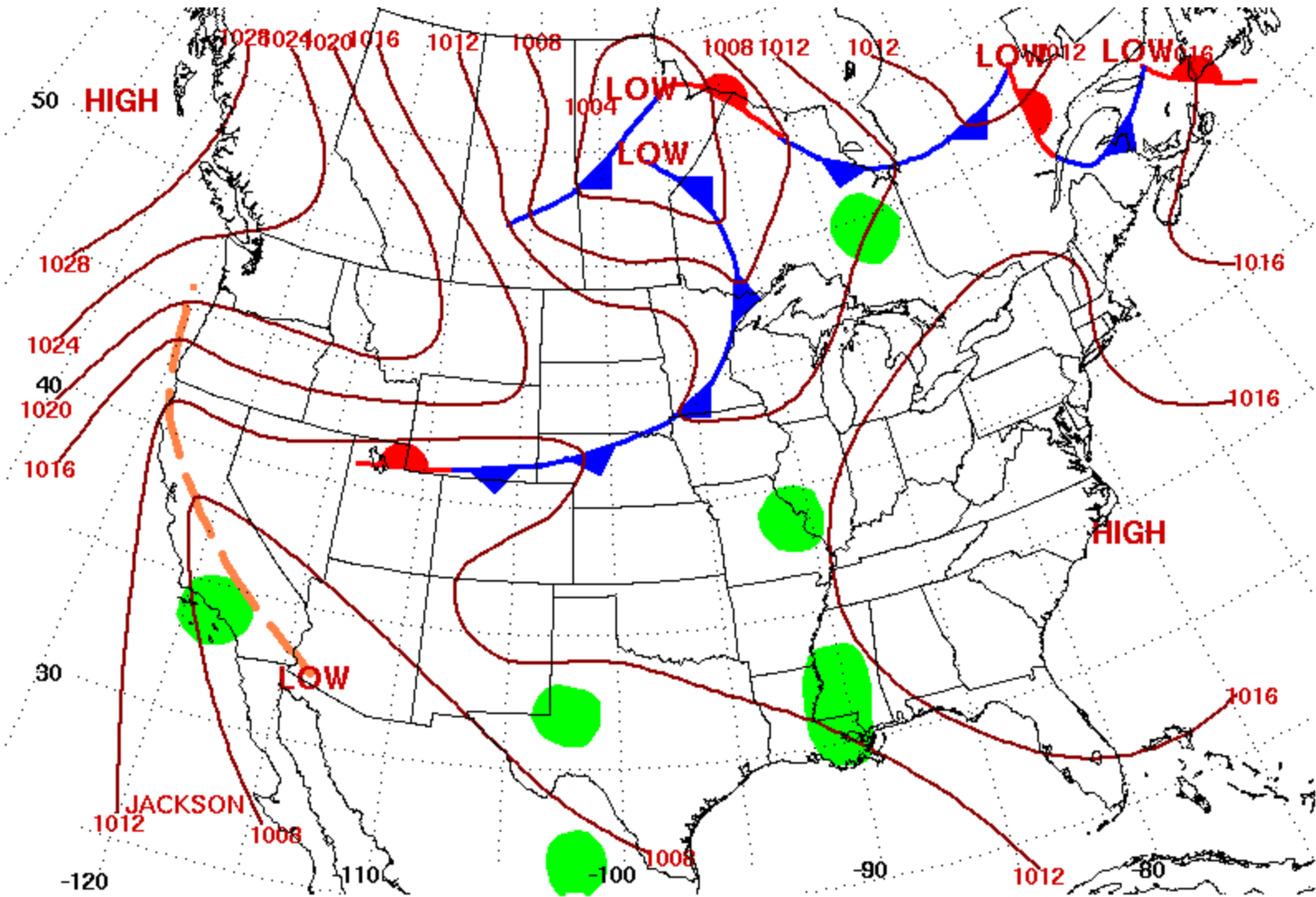
Modeled ozone plume MODERATE across inland Connecticut, to USG coastal Ct. Three coastal exceedences observed, associated with hot WNW transport.

Forecasters predicted MODERATE inland to USG along the coast. Went with the NOAA forecast model. Performed extremely well!



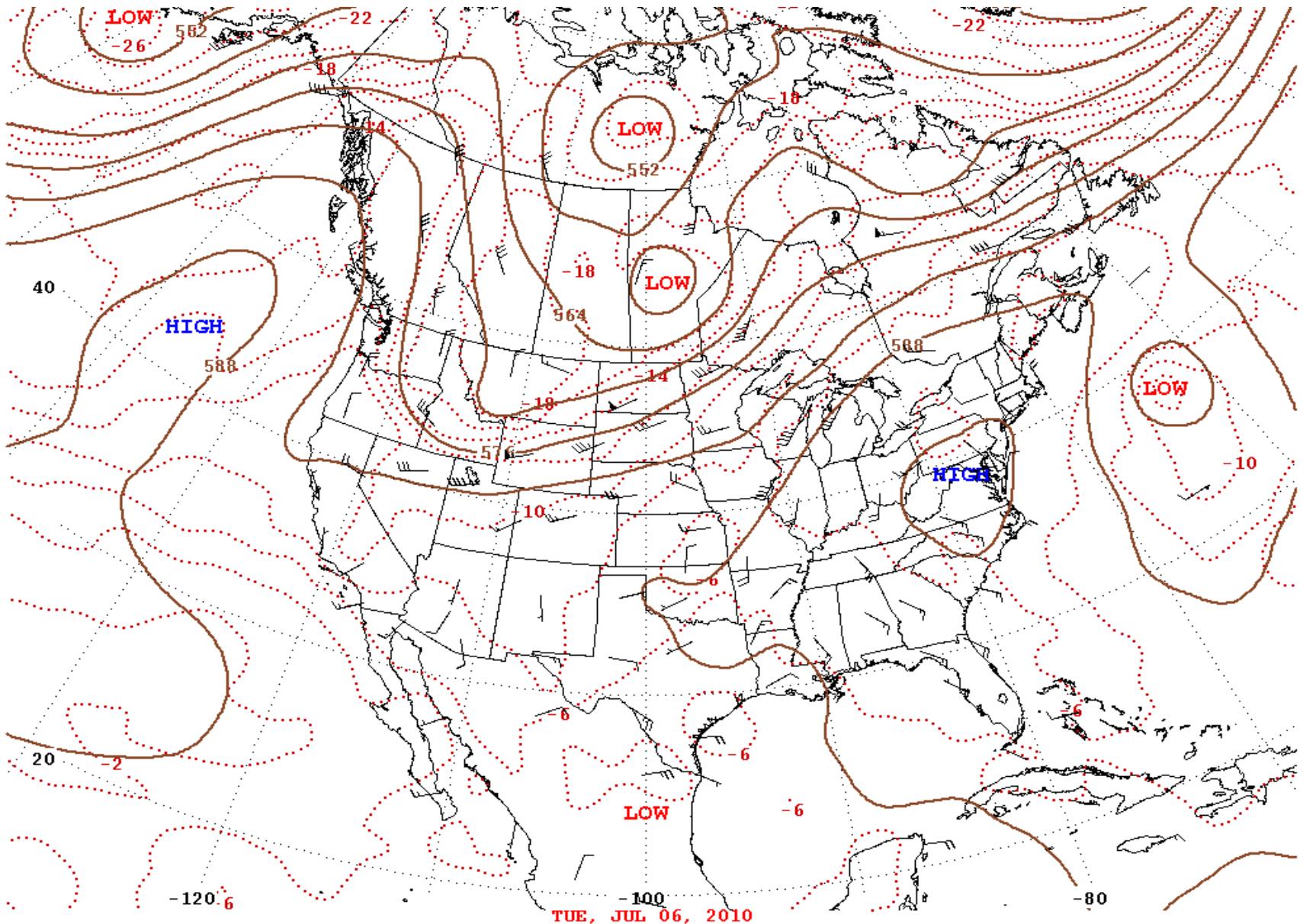
Site Name	7/05/2010
Cornwall	66
Danbury	65
East Hartford	64
Greenwich	74
Groton Fort	73
Madison	79
Middletown	70
New Haven	63
Stafford	69
Stratford	80
Westport	79

July 6, 2010, 12Z Surface Map



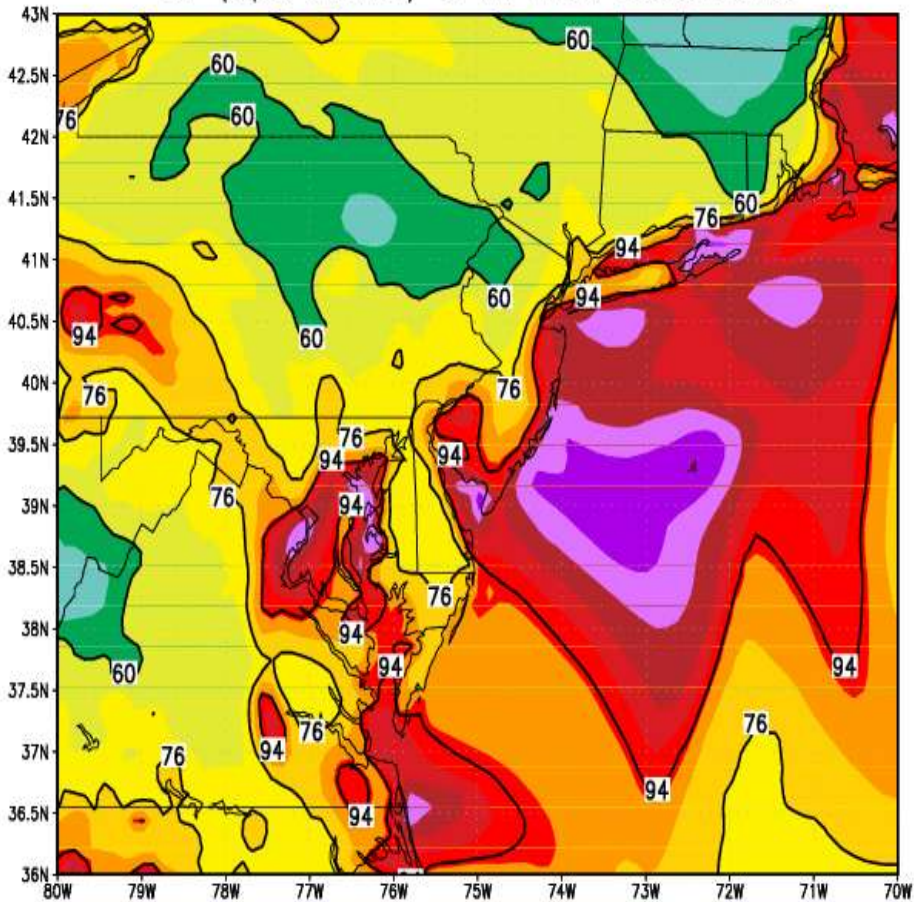
Surface Weather Map at 7:00 A.M. E.S.T.

500 Millibar Flow, July 6, 2010, 12Z

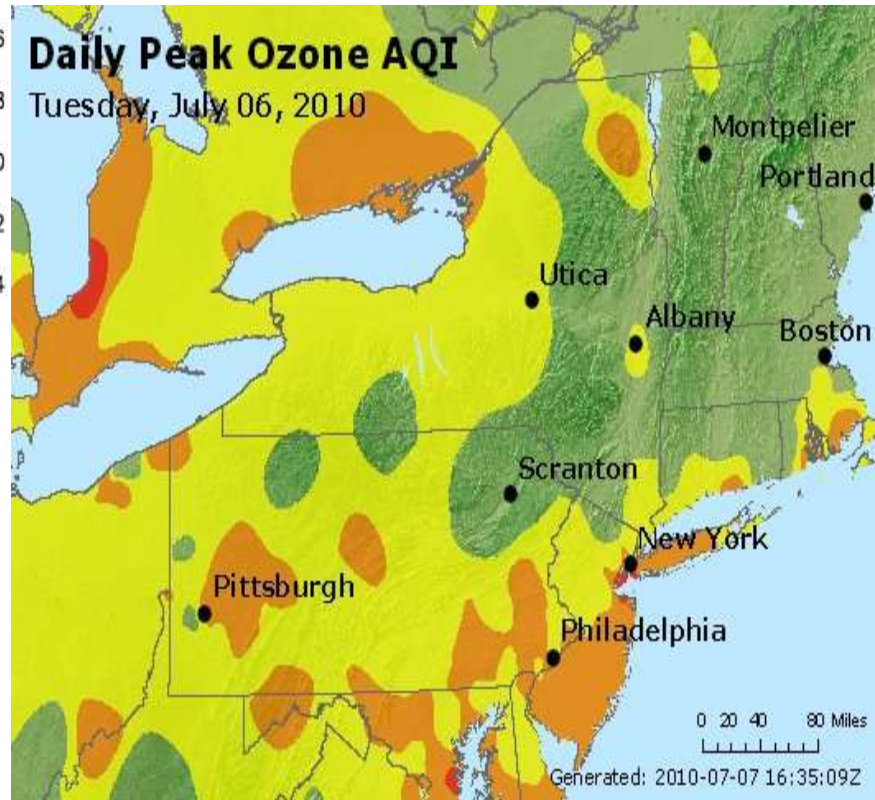
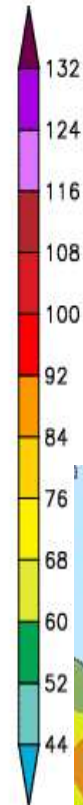


500-millibar Height Contours at 7:00 A.M. E.S.T.

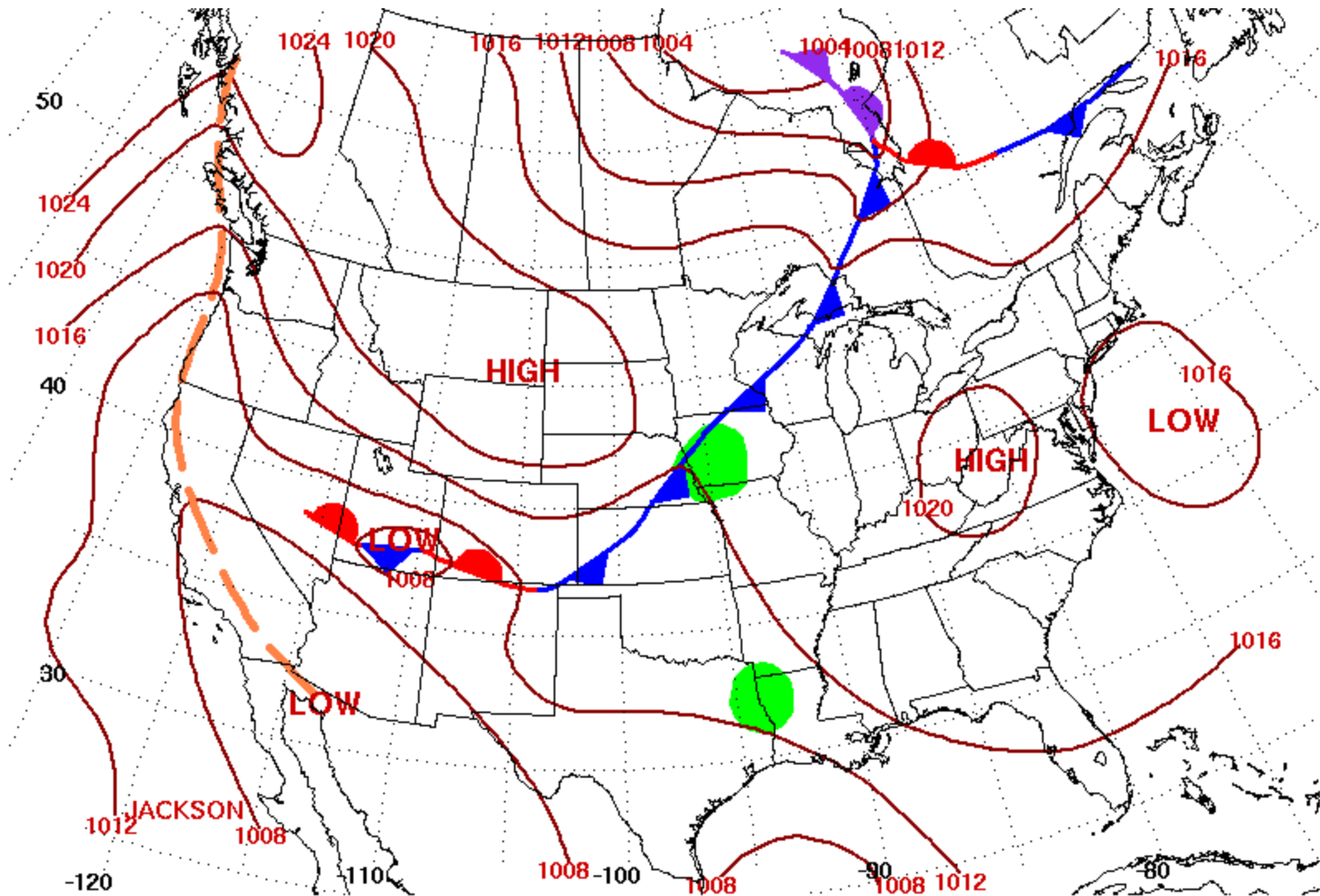
5x (Operational) 8-hr max 06JUL2010



**July 6, 2010
Operational
Vs. Observed
8-hr Ozone ppb**

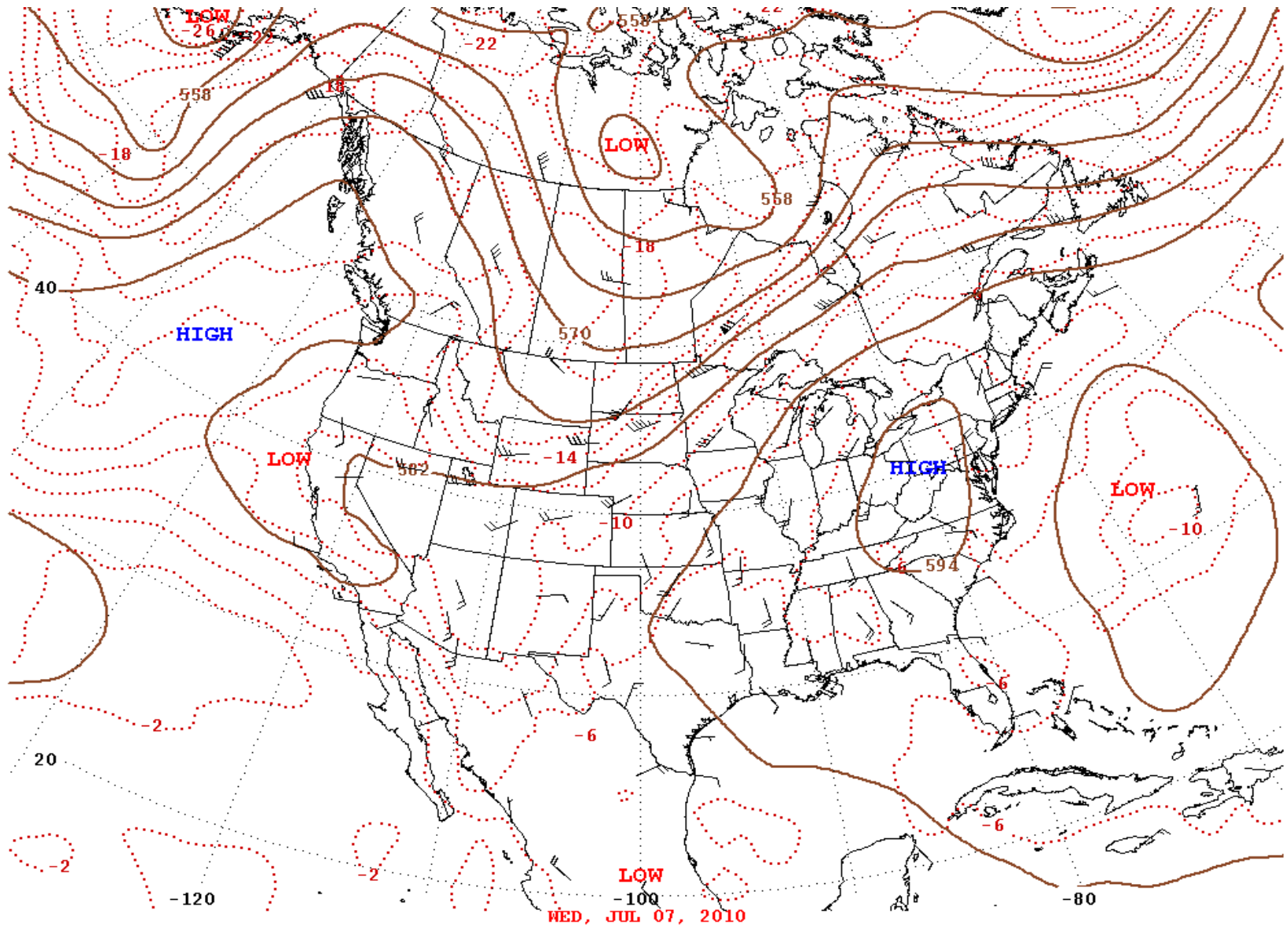


July 7, 2010, 12Z Surface Map



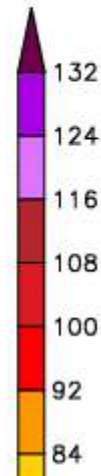
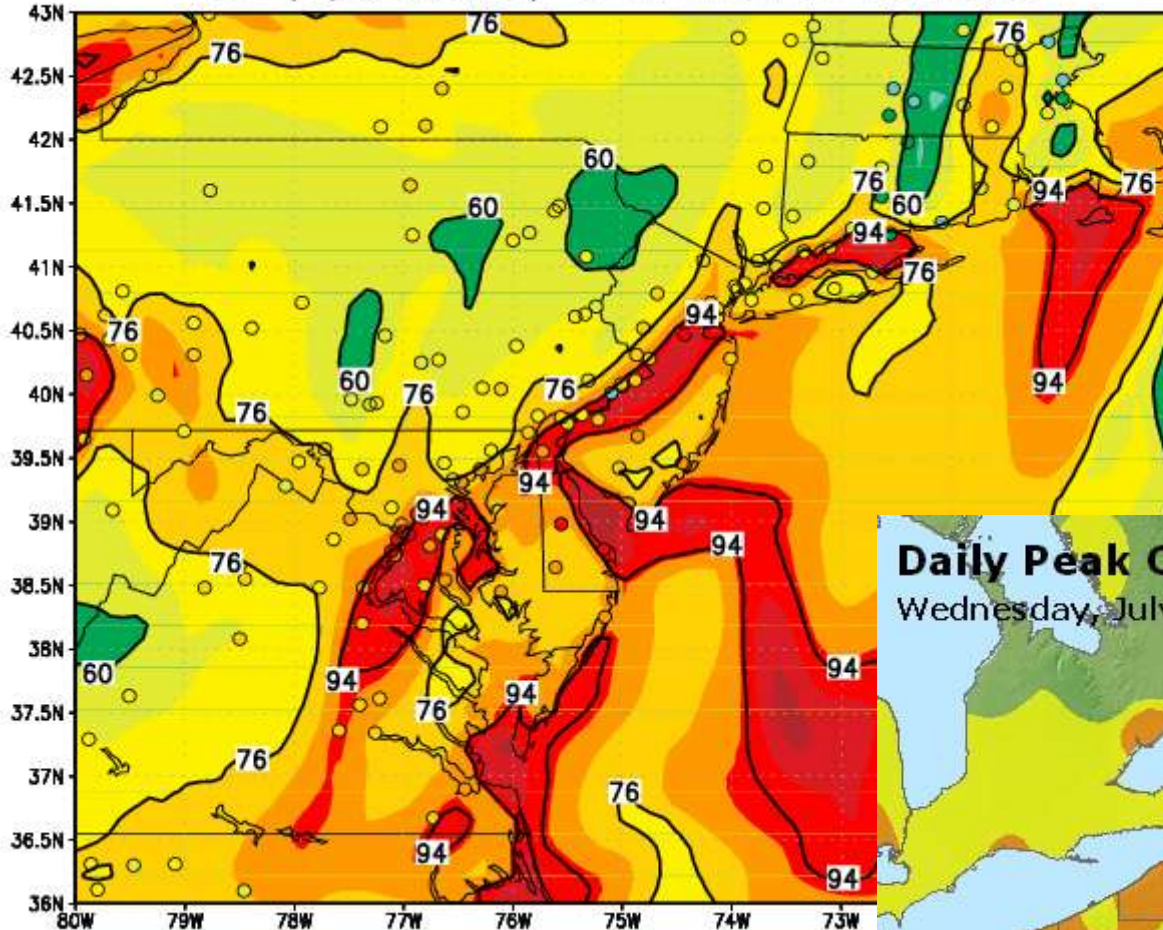
Surface Weather Map at 7:00 A.M. E.S.T.

500 Millibar Flow, July 7, 2010, 12Z



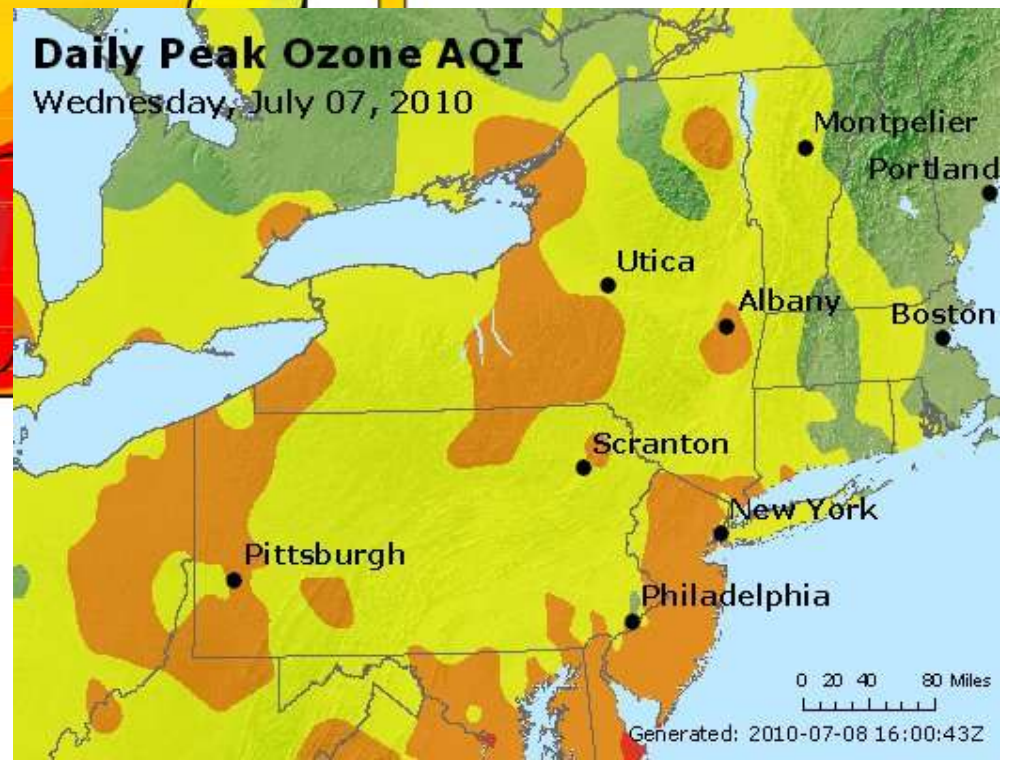
500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 07JUL2010



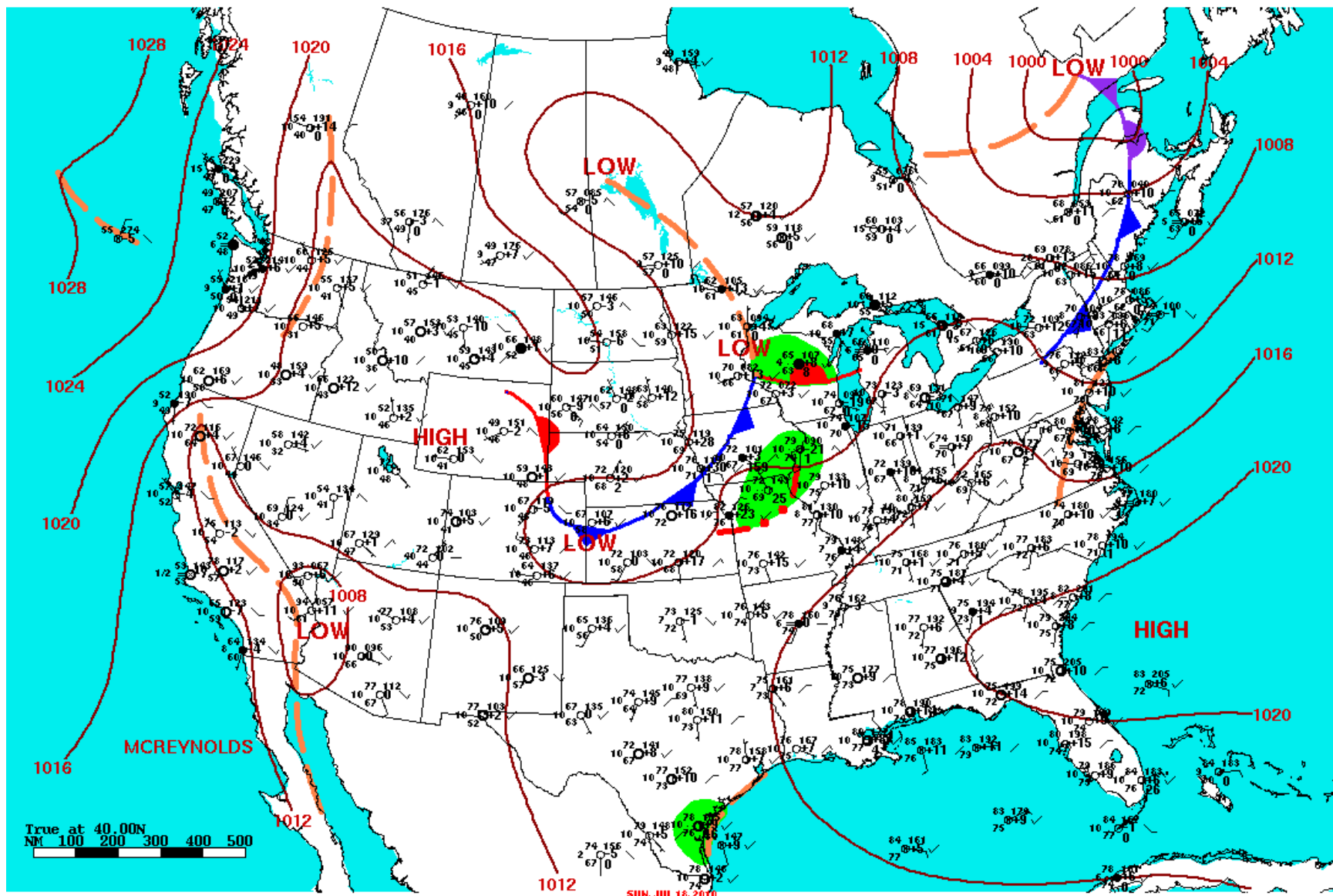
**July 7, 2010
Operational
Vs. Observed
8-hr Ozone ppb**

Greenwich	07/07/10	79
Stratford	07/07/10	77



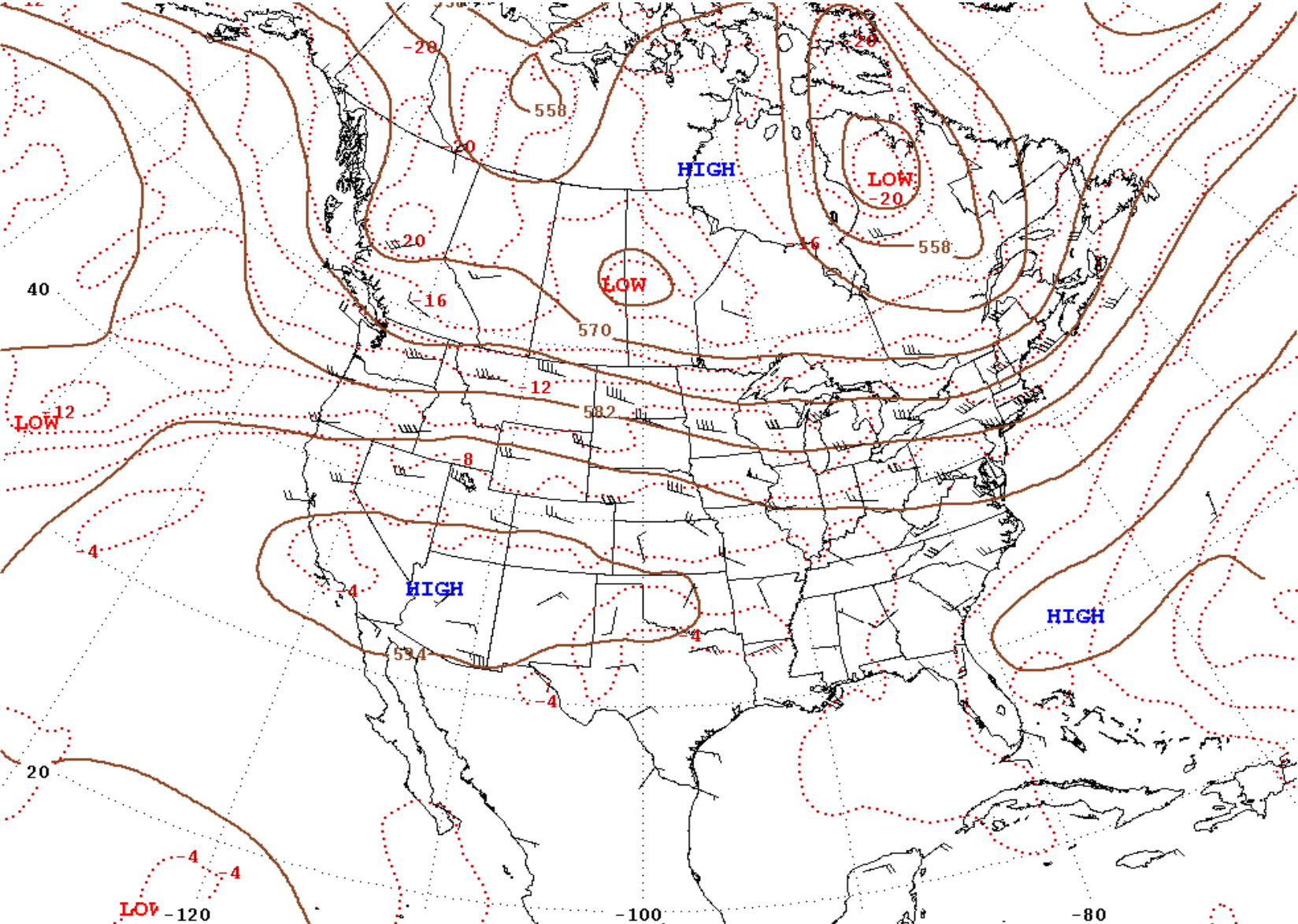
Generated: 2010-07-08 16:00:43Z

July 18, 2010, 12Z Surface Map



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

500 Millibar Flow, July 18, 2010, 12Z

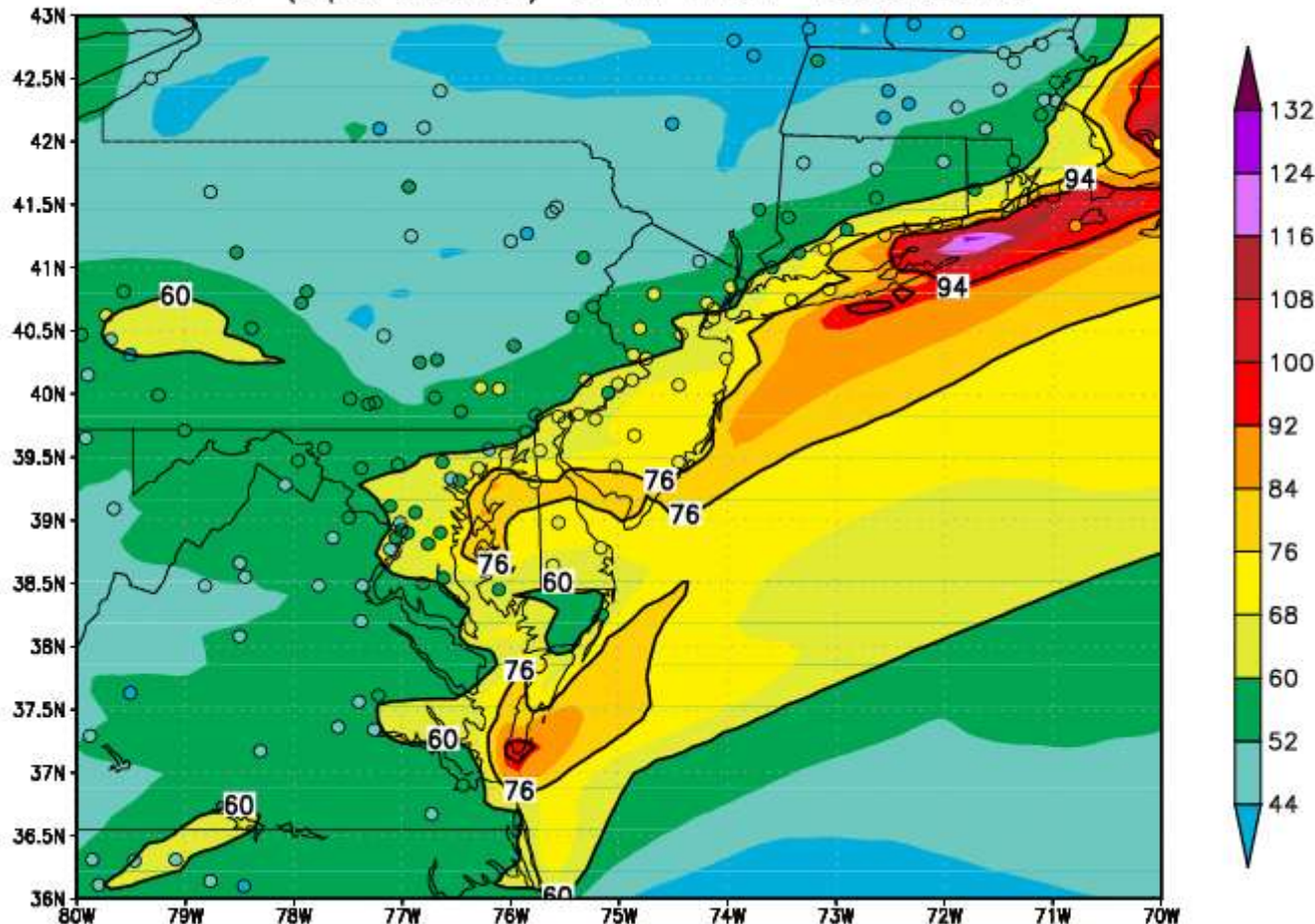


SUN, JUL 18, 2010

500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 18JUL2010

July 18, 2010 Operational Vs. Observed 8-hr Ozone ppb



Madison

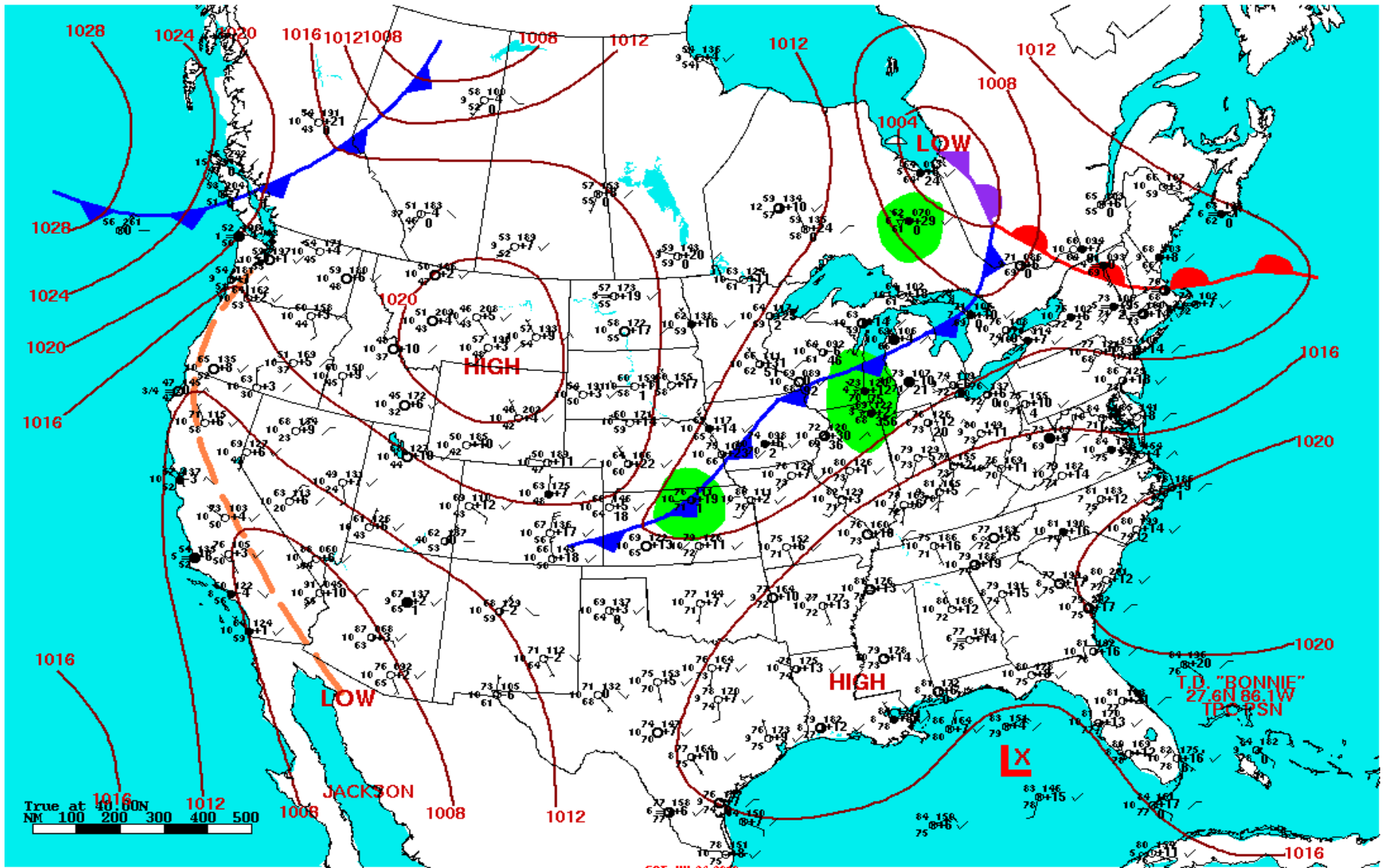
07/18/10

0.077

Modeled ozone plume GOOD across inland Connecticut, MODERATE southern areas to barely USG along extreme SE coastal Ct. Madison exceedence was observed.

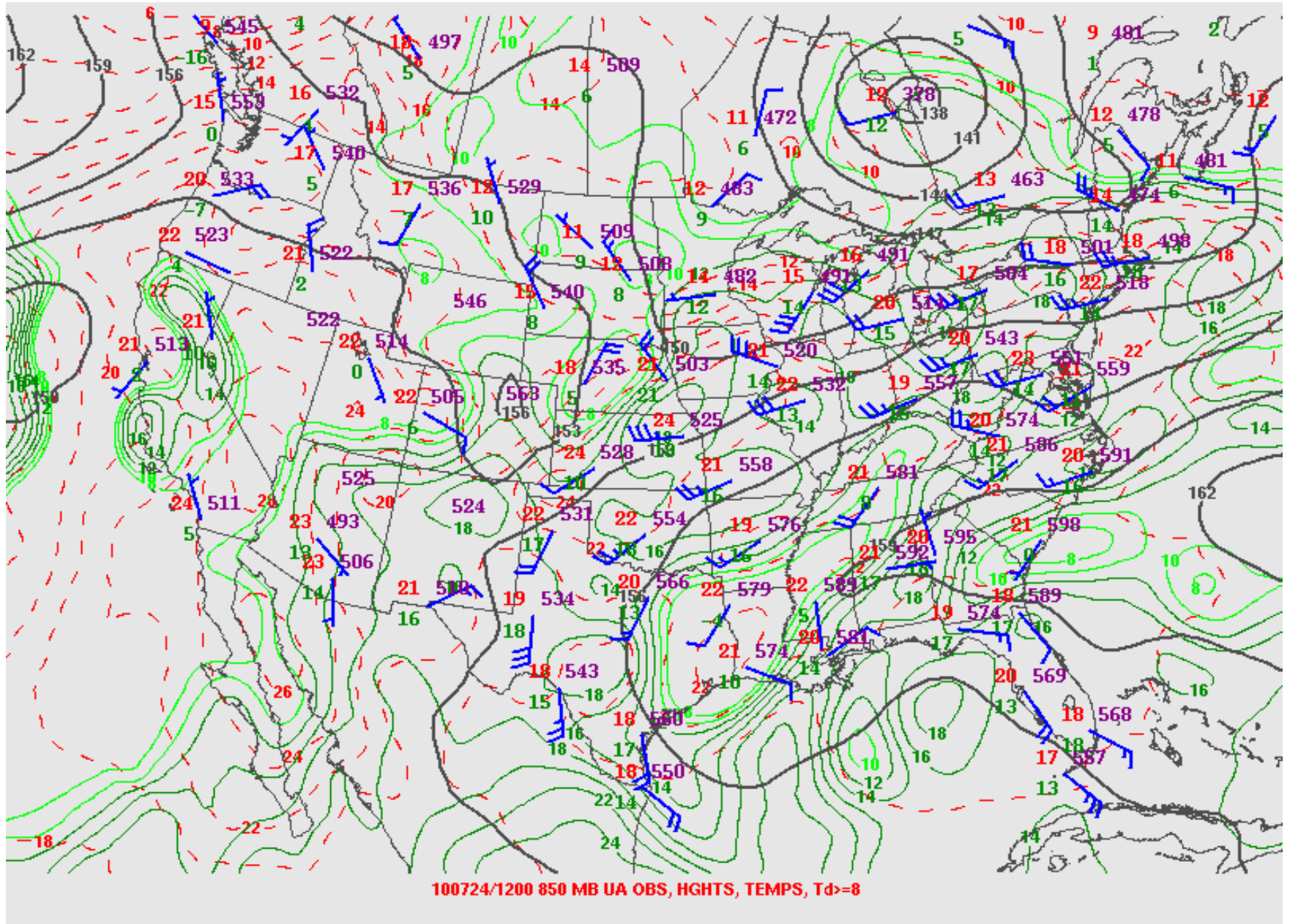
Since front was nearby, forecaster thought clouds and wind shift to NW would keep Ozone below USG levels.

July 24, 2010, 12Z Surface Map

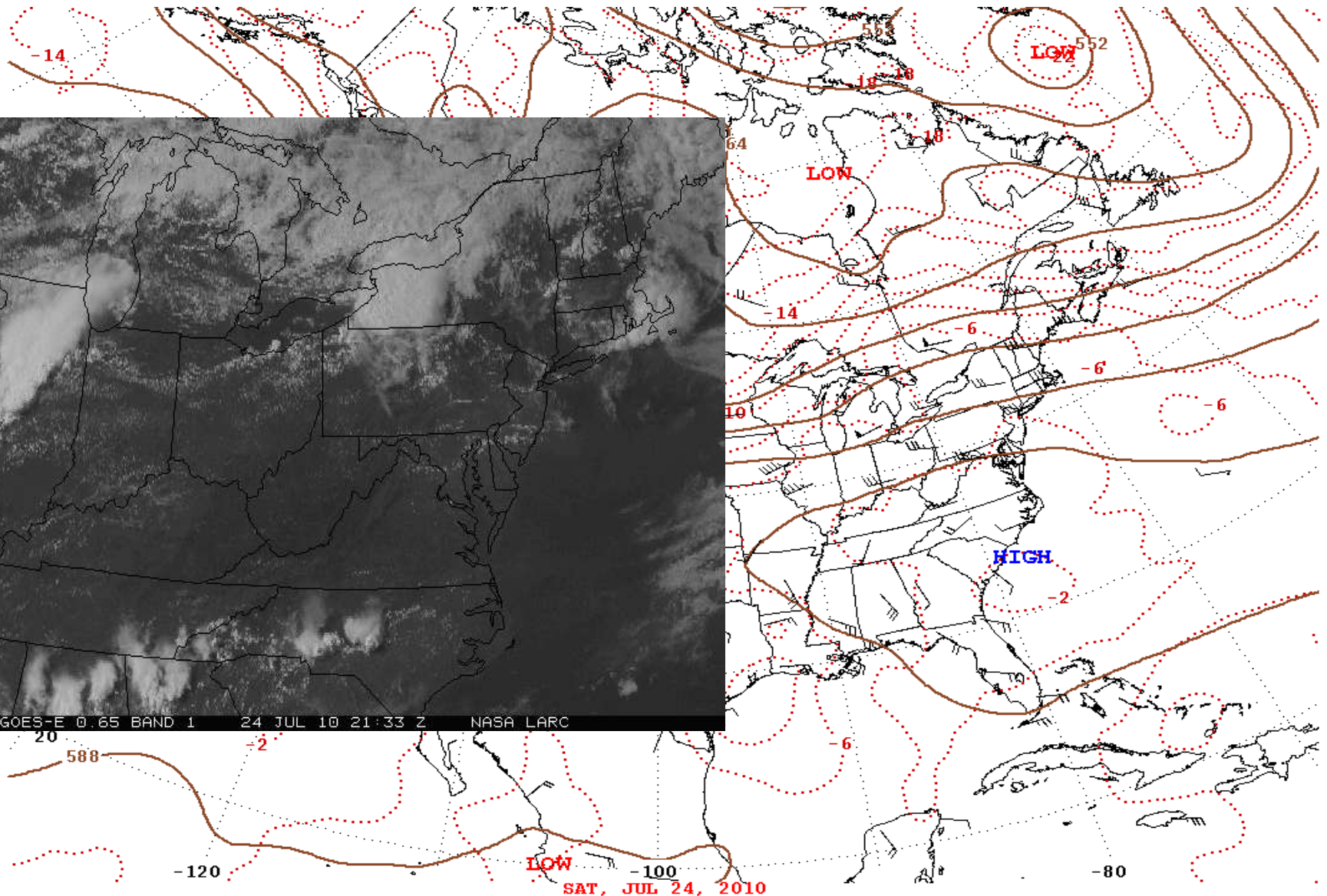


Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

850 Millibar Flow, July 24, 2010, 12Z



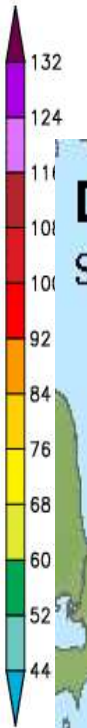
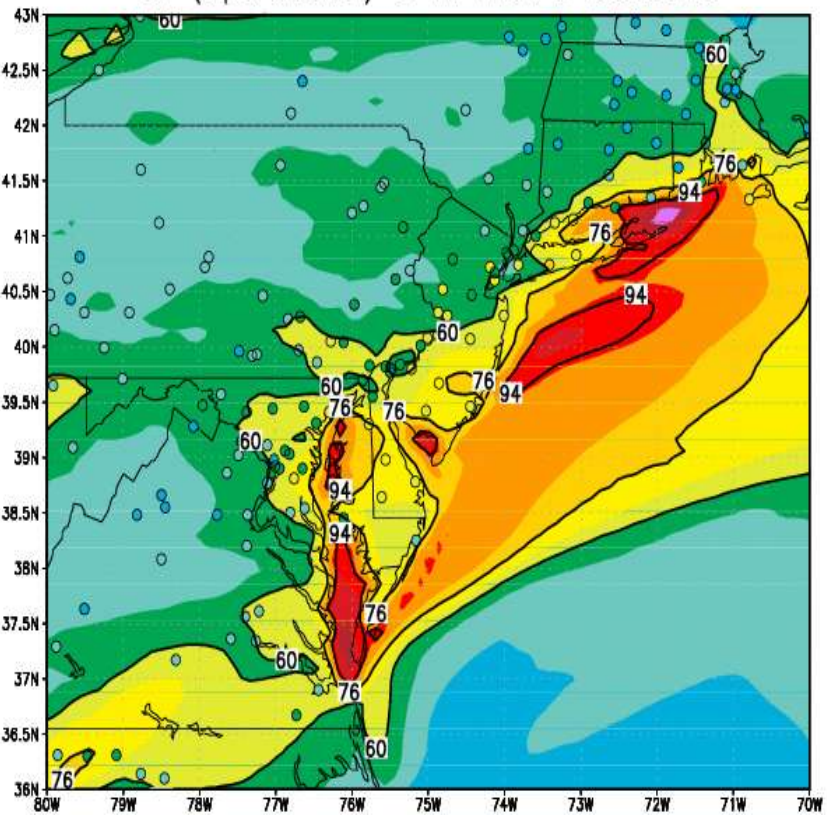
500 Millibar Flow, July 24, 2010, 12Z



500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 24JUL2010

**July 24, 2010
Modeled
Vs. Observed
8-hr Ozone ppb**

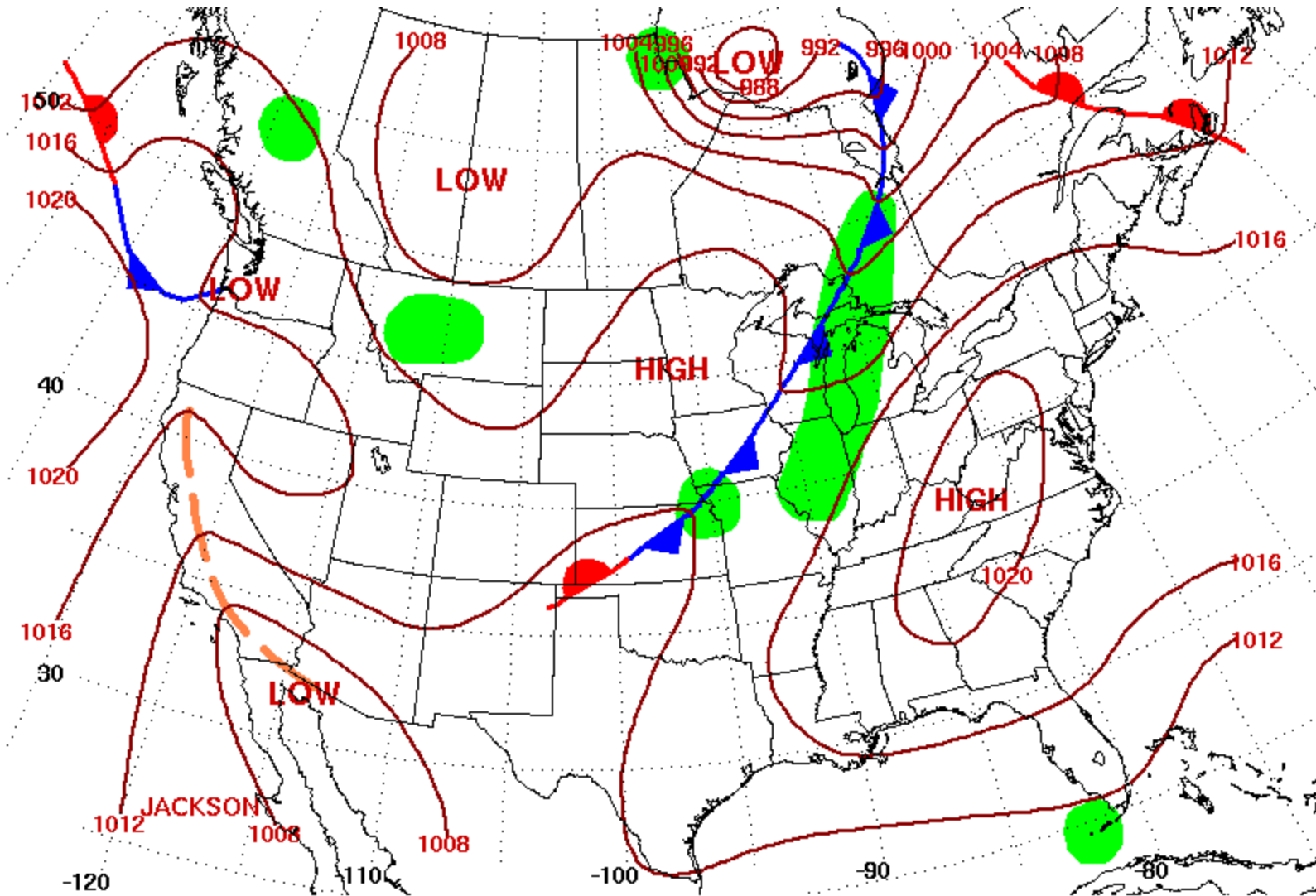


Modeled ozone plume GOOD to MODERATE across inland Connecticut, USG south central and SE coastal Ct. **Clouds** kept levels at the GOOD to MODERATE range

Since warm front had already crossed the region early morning, expected sunshine hot temperatures, SW transport winds, equaled USG levels. **NOT!**

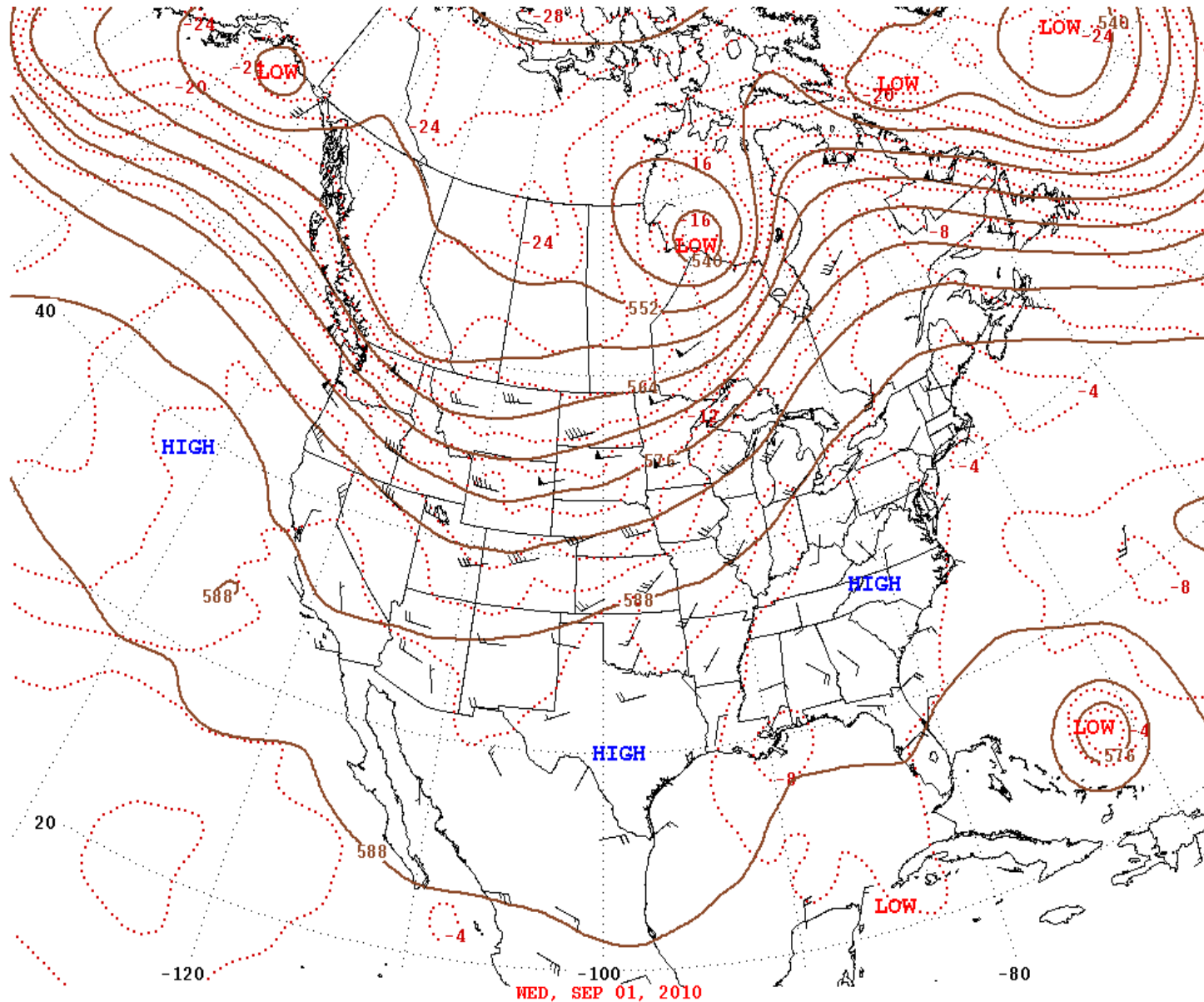
Stratford	07/24/10	0.068
Westport	07/24/10	0.060
Greenwich	07/24/10	0.058

September 1, 2009 12 Z



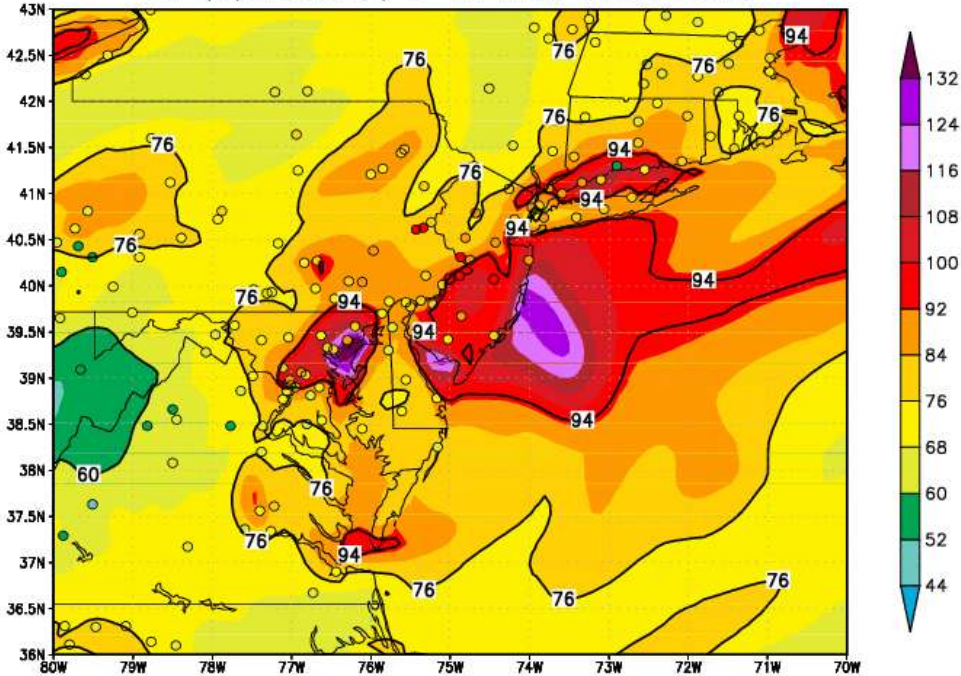
Surface Weather Map at 7:00 A.M. E.S.T.

500 Millibar Flow, September 1, 2010, 12Z

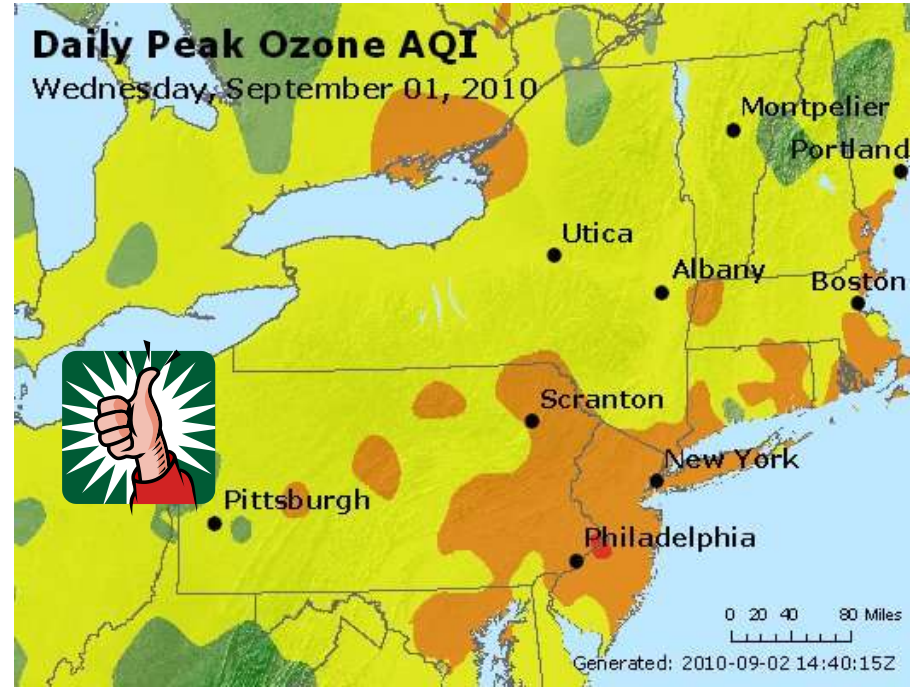


500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 01SEP2010



Modeled ozone forecast verses observed data

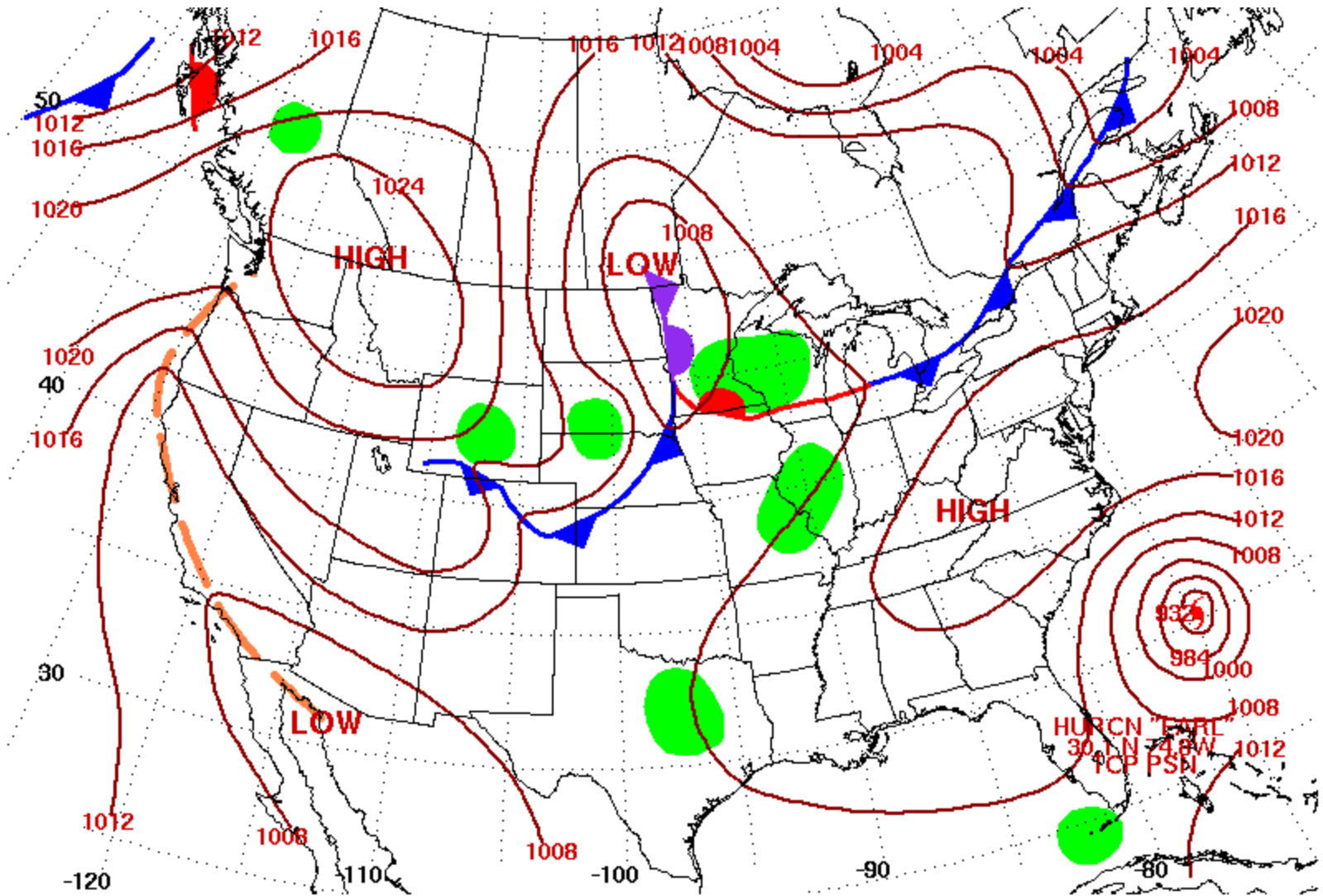


Modeled ozone plume transported into Connecticut, with build-up of heat and the classic southwest flow aloft and at the surface.

This year forecasters took into account good model performance with a slight over-prediction bias. Forecasted USG!

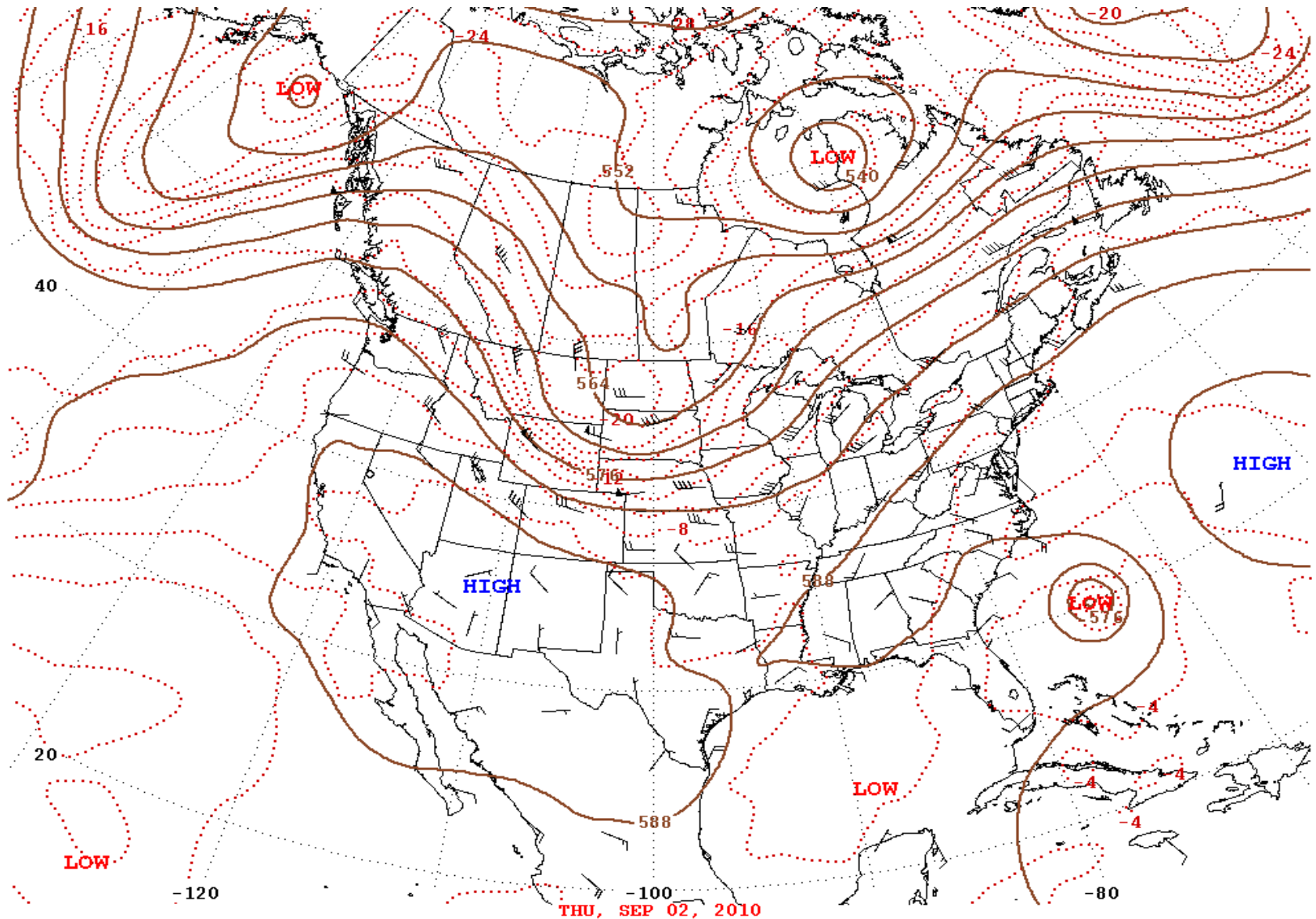
Danbury	09/01/10	76
Greenwich	09/01/10	91
Groton	09/01/10	78
Middletown	09/01/10	79
Stratford	09/01/10	80
Westport	09/01/10	87

September 2, 2009 12 Z



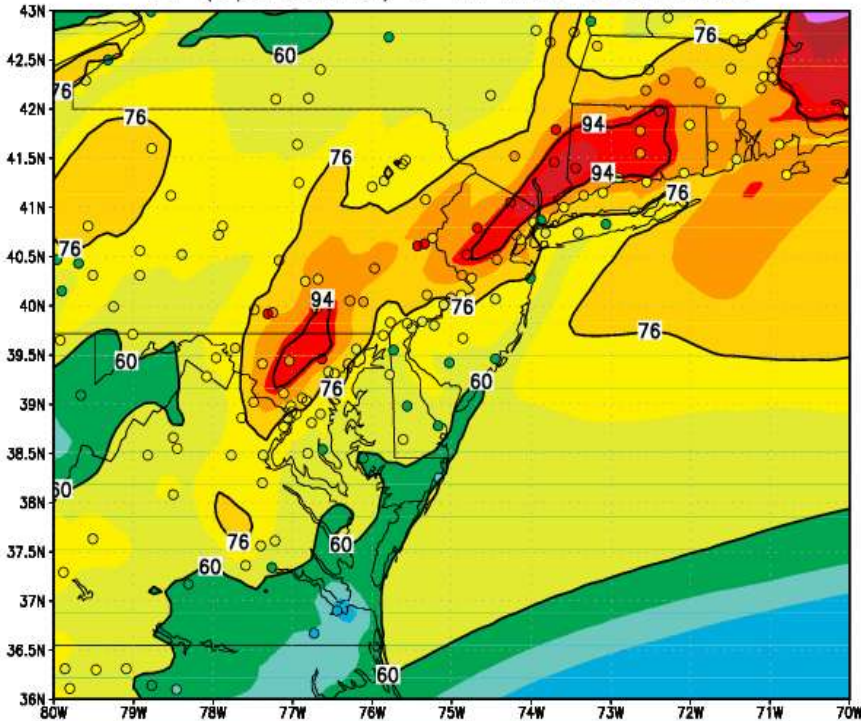
Surface Weather Map at 7:00 A.M. E.S.T.

500 Millibar Flow, September 2, 2010, 12Z

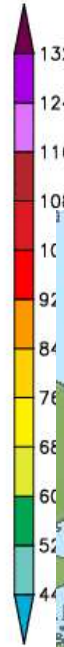


500-Millibar Height Contours at 7:00 A.M. E.S.T.

5x (Operational) 8-hr max 02SEP2010

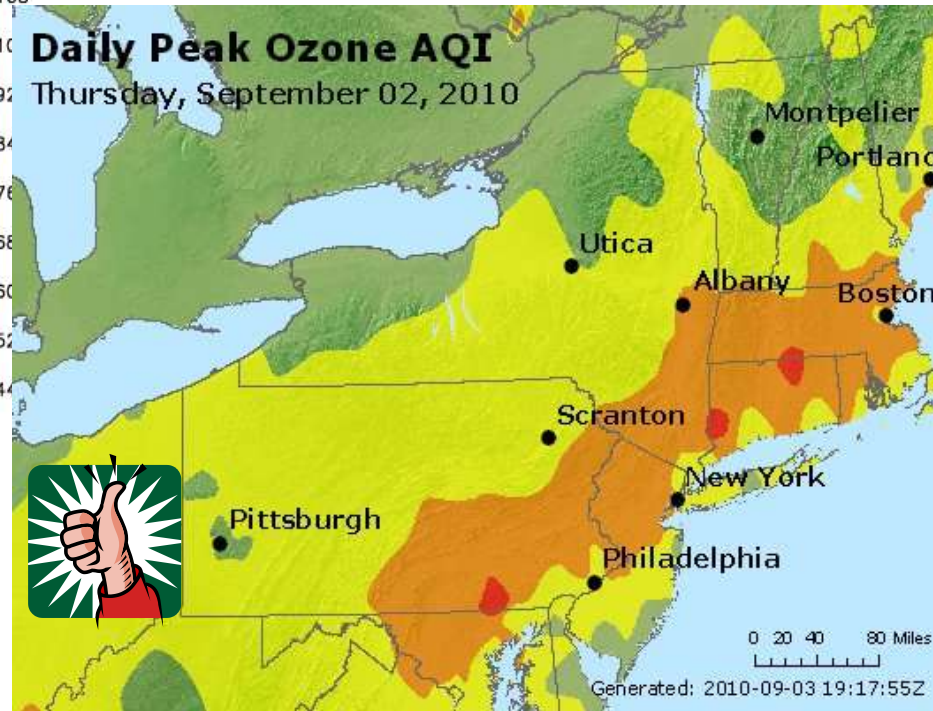


Modeled ozone forecast verses observed data



Daily Peak Ozone AQI

Thursday, September 02, 2010



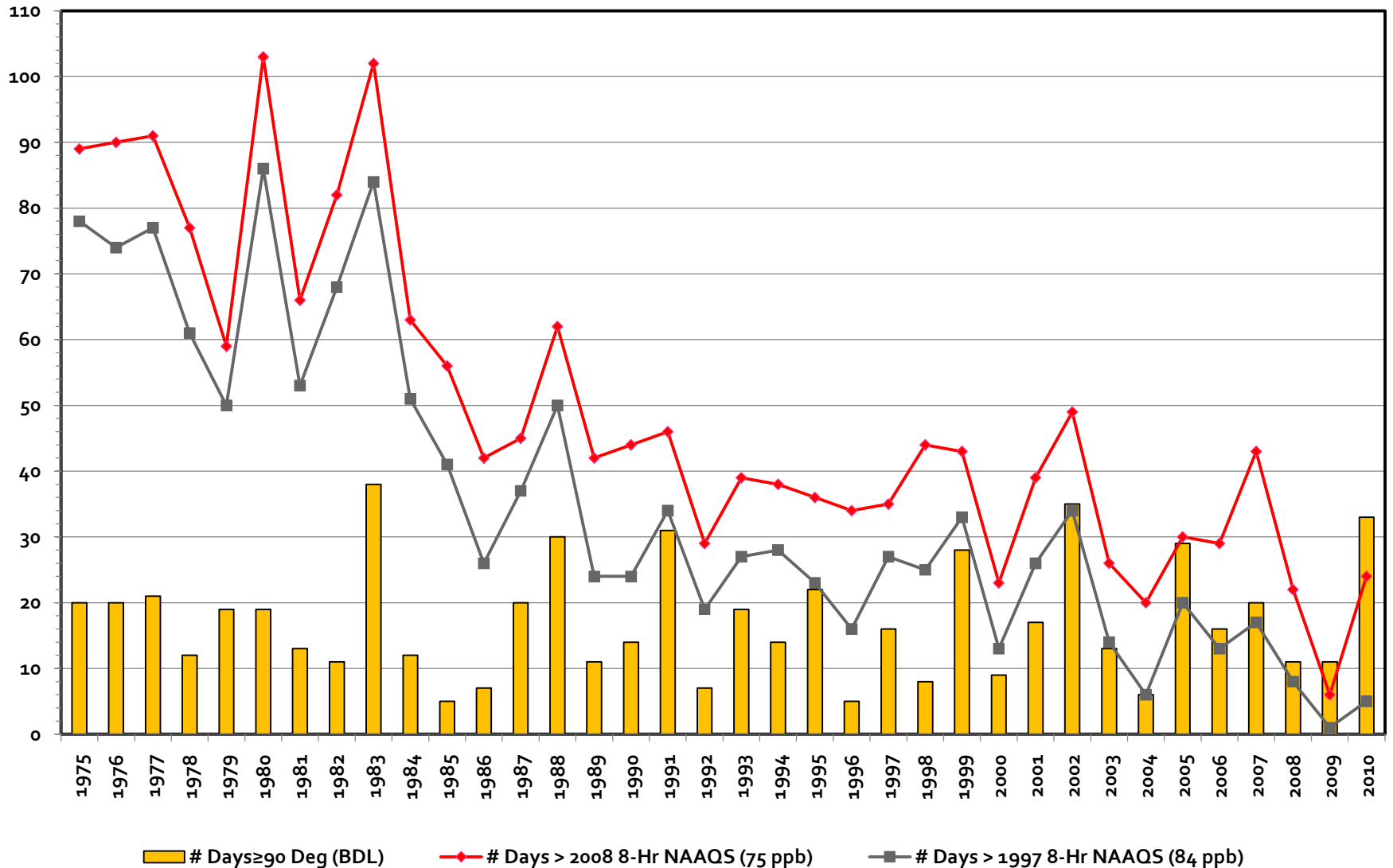
Modeled ozone plume transported and intensified to Code Red along the I-84 Corridor in Connecticut. Code orange across rest the state with the classic set-up!

This year forecasters took into account good modeled performance, therefore predicted exceedences, to code red and orange.

Cornwall	09/02/10	83
Danbury	09/02/10	97
East Hartford	09/02/10	89
Middletown	09/02/10	86
Stafford	09/02/10	101
Westport	09/02/10	79

Unusually warm summer over the northeast states

Number of Ozone Exceedance Days in Connecticut Compared to the Number of "Hot" Days



Summary-2010

- 18 more exceedences in 2010 (**24**) vs. 2009 (**6**).
- Persistent upper level ridge across the east caused the hottest summer since 2002.
- Several heat-waves responsible for 24 USG events.
- Could have been a lot worse with WSW winds
- Lower Emissions Due to NO_x Controls and slow economy?
- 18 days of operating restrictions.

What is expected for 2011 Ozone Season?

- The revised 8-hour ozone standard (60-70 ppb) is expected soon.
- New standard implemented in 2011.
- AQI Index will be revised to match new standard.
- Ozone season will probably be extended from April 1 or April 15th, through September 30, 2011 vs. current May 1 – Sept. 30.
- If a more stringent standard is promulgated, expect more exceedences in 2011 (unless summer is cooler and or wetter).