

2011 Connecticut Ozone Season Forecasting Summary



2011

Not as hot as last summer

14 Exceedences Days

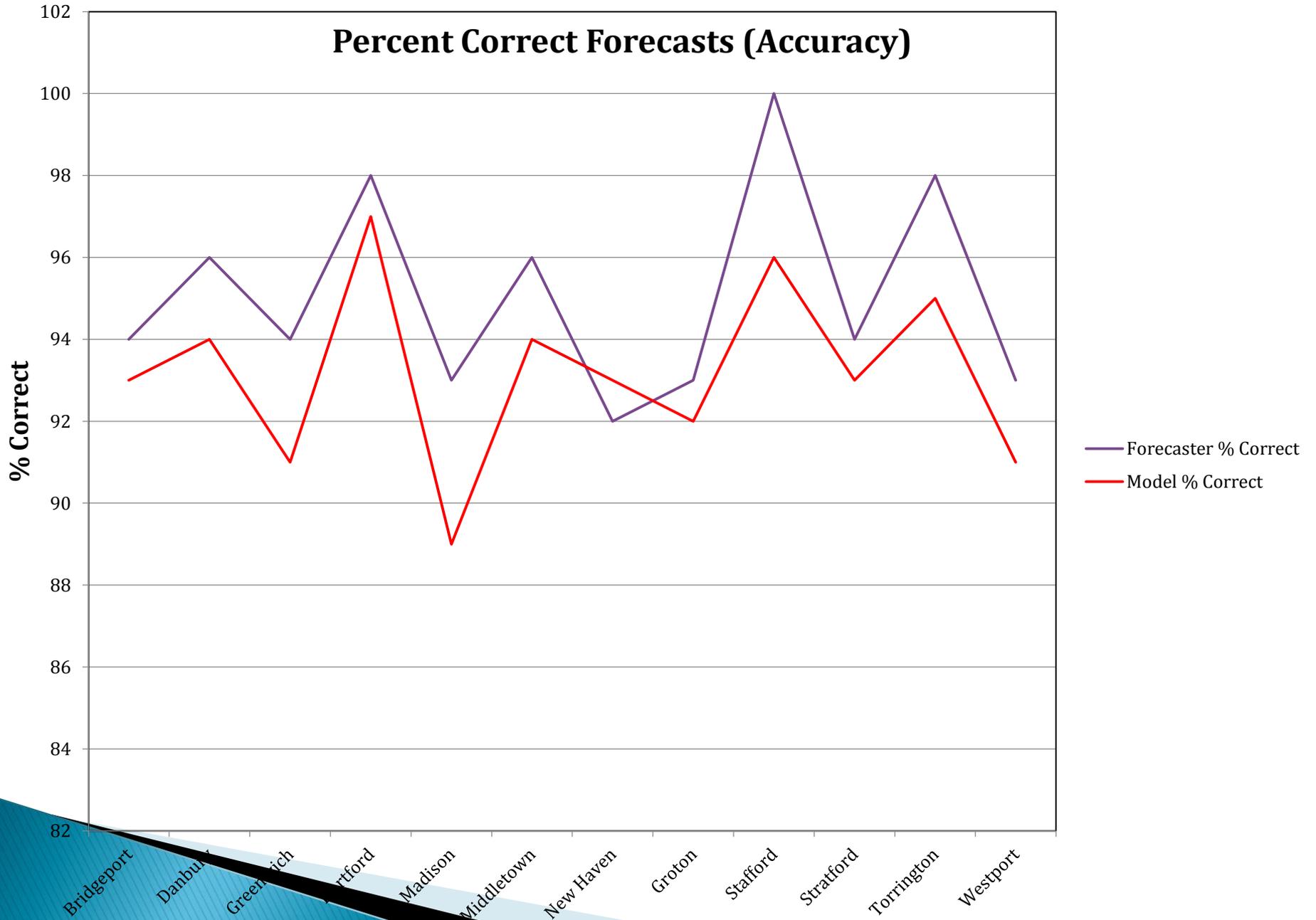
15 Days $\geq 90^\circ$
Windsor Locks

How did we do this past year?

Actual Exceedences Days = 14
Forecast Exceedences Days = 10

Month	Actual Dates	Forecast Dates
May		
June	1,7,8,9 21	7,8,9
July	6,7,11,16,18,21,22,23	6,12,17,18,21,22,23
August	20	
September		
Total	14	10

Percent Correct Forecasts (Accuracy)



**Connecticut forecasters
showed better results
than model alone**



**...But could not have done it
without model guidance**

14 Ozone Exceedance Events (75ppb)

June: 1, 7, 8, 9, 21
July: 6, 7, 11, 16, 18,
21, 22, 23
August: 20

Red dates indicate code red days (unhealthy)

**Connecticut Department of Environmental Protection
8-Hour Ozone Daily Maximums*
May 2011**

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	48	39	56	34	47	57	54	46	38	42	42	48	39	38	36	20	22	23	29	48	37	30	M	M	51	60	65	46	56	48	52	
Danbury	48	35	51	23	44	56	53	45	36	40	40	48	35	39	41	24	15	29	34	49	34	32	34	45	62	61	66	48	55	43	64	
East Hartford	48	35	51	30	38	51	51	49	39	43	38	45	37	35	27	18	16	18	13	38	37	26	32	38	55	50	57	37	43	40	64	
Greenwich	42	37	46	27	49	57	57	50	41	47	41	47	36	36	42	29	24	34	34	43	M	M	M	M	M	M	M	M	M	M	M	
Groton	36	34	44	36	41	52	57	51	38	38	36	42	38	34	41	19	17	30	42	47	38	26	38	39	50	47	39	33	32	44	45	
Madison	40	34	45	33	43	54	58	53	41	45	39	44	45	34	45	25	23	32	44	48	41	34	42	52	53	49	41	32	36	57	50	
Middletown	48	40	51	36	42	58	55	54	40	45	40	48	43	39	41	22	20	20	22	48	37	28	38	47	58	52	55	38	43	46	56	
New Haven	38	32	46	21	41	47	50	52	34	43	37	43	33	35	42	19	11	29	34	40	39	36	35	33	49	54	49	38	40	48	53	
Stafford	48	46	56	38	38	58	57	49	39	44	38	46	47	42	38	22	21	21	22	42	34	29	37	41	54	54	57	37	48	42	60	
Stratford	42	33	44	34	45	57	55	55	36	45	40	49	43	37	47	24	20	33	44	47	44	41	43	52	58	48	46	36	38	55	52	
Westport	41	33	43	23	45	57	57	52	38	46	41	48	41	37	42	25	17	27	34	44	36	36	39	50	62	54	52	39	42	51	53	
# days > Federal Standard																																

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 2011**

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	75	55	51	49	43	53	70	63	58	39	27	26	29	26	41	59	48	51	35	51	74	49	36	28	40	32	46	64	50	40
Danbury	81	53	50	45	42	44	71	66	86	45	25	24	32	27	32	58	51	55	35	54	83	36	29	33	57	38	48	72	47	40
East Hartford	62	40	51	49	34	49	58	62	74	47	24	26	35	25	44	53	43	52	37	48	81	16	30	25	47	34	45	60	45	36
Greenwich	63	55	53	46	31	64	87	93	79	62	33	33	36	37	43	65	54	68	42	49	71	40	36	36	53	48	46	56	53	48
Groton	43	46	49	45	24	53	82	80	63	55	29	26	37	26	46	68	63	64	41	42	77	36	32	31	41	50	43	50	59	50
Madison	50	50	53	52	29	60	97	97	69	61	33	29	45	32	50	65	56	68	49	40	71	38	31	36	44	54	43	46	57	55
Middletown	62	46	54	51	33	56	80	85	79	54	27	25	37	28	47	64	52	62	43	56	79	36	35	25	49	41	47	56	50	39
New Haven	60	44	52	49	29	37	83	85	74	41	27	28	35	30	40	57	51	50	40	36	71	37	29	34	53	52	40	53	50	41
Stafford	62	46	47	48	39	45	60	68	62	35	26	27	37	23	34	54	49	50	32	53	72	36	38	25	44	33	44	56	46	40
Stratford	61	53	52	49	29	57	92	95	84	63	33	34	38	36	48	64	59	72	43	43	73	42	36	40	54	53	45	53	51	52
Westport	62	51	52	48	33	60	92	101	87	65	30	33	37	25	41	69	56	73	38	50	75	36	32	33	54	49	47	54	51	46
# days > Federal Standard	1						2	3	4												5									

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* July 2011

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	39	44	42	37	42	65	60	54	42	45	69	52	37	34	49	62	58	50	40	69	85	62	57	51	23	38	32	46	51	43	43
Danbury	36	48	44	43	55	82	50	54	39	52	78	56	39	33	42	73	60	56	43	71	89	64	59	44	22	49	30	51	51	43	42
East Hartford	39	42	40	37	49	72	48	38	40	49	80	53	34	36	45	61	58	47	52	68	92	58	59	40	17	41	31	52	43	44	36
Greenwich	43	59	47	51	57	75	86	51	45	53	77	60	42	40	64	76	65	68	62	63	72	80	64	45	26	65	37	55	63	48	51
Groton	46	51	60	57	67	76	75	44	45	46	79	61	49	32	62	78	68	83	61	57	54	88	85	39	21	40	38	45	45	45	47
Madison	55	49	63	64	68	78	79	42	44	50	82	65	51	M	65	73	70	92	70	59	59	99	90	43	28	48	46	50	49	47	50
Middletown	43	47	52	45	58	88	58	46	43	48	90	56	38	34	54	66	68	59	57	61	79	67	67	41	21	48	35	50	48	46	45
New Haven	42	48	53	49	39	36	77	54	43	49	98	57	38	38	55	78	70	50	68	61	66	80	71	45	22	41	30	45	41	46	39
Stafford	36	38	48	36	49	72	46	46	38	51	87	53	38	30	45	63	57	47	36	70	82	53	53	41	17	46	29	43	44	38	42
Stratford	49	50	54	59	64	79	87	52	42	54	88	59	42	39	59	74	72	82	75	61	65	87	68	43	29	59	42	52	52	45	46
Westport	40	54	49	56	57	81	87	47	44	53	86	60	41	37	58	79	72	65	65	64	77	76	66	43	28	68	38	52	52	46	47
# days > Federal Standard						6	7				8					9		10			11	12	13								

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*
August 2011

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	51	35	35	43	61	45	43	42	45	42	32	31	55	46	33	30	39	55	58	52	52	31	36	34	42	52	53	M	M	M	52	
Danbury	56	37	40	47	69	47	45	41	47	45	33	32	63	49	26	31	38	61	63	58	51	30	31	34	38	44	23	28	M	33	47	
East Hartford	56	35	45	54	50	48	37	43	34	42	32	31	46	40	27	32	35	58	50	60	49	29	27	33	33	38	19	27	M	37	47	
Greenwich	66	43	37	48	61	41	62	53	50	54	40	44	60	53	40	33	57	54	62	81	47	37	41	49	43	M	M	M	M	M	M	
Groton	71	53	43	47	37	45	37	44	45	63	44	39	60	54	33	35	46	57	49	64	48	36	43	47	45	49	28	M	M	32	57	
Madison	63	58	41	46	41	51	53	47	48	64	44	46	59	52	36	34	51	49	48	67	46	33	46	52	45	58	31	M	M	M	M	
Middletown	62	38	46	51	47	48	47	42	38	50	37	32	52	47	30	34	47	60	49	63	51	31	33	39	41	49	26	M	M	41	53	
New Haven	40	38	31	44	47	48	56	46	43	49	35	30	57	52	30	32	32	34	51	68	48	31	37	38	38	46	25	27	M	35	33	
Stafford	51	39	37	42	47	48	33	36	37	40	32	31	47	42	32	30	37	61	58	55	52	27	28	39	39	42	26	M	M	M	M	
Stratford	67	43	43	53	53	51	61	47	53	61	38	50	61	56	40	32	48	50	59	70	48	34	46	54	43	50	35	M	M	44	52	
Westport	71	42	39	52	57	49	61	48	50	55	38	42	60	53	36	32	54	56	61	73	47	34	43	45	43	50	27	M	M	42	49	
# days > Federal Standard																				14												

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*
September 2011**

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	62	M	57	56	45	50	43	27	38	27	29	47	58	55	27	26	32	35	33	25	41	32	24	25	26	53	51	35	43	48	
Danbury	64	46	65	68	40	44	35	31	29	27	32	50	62	65	24	22	27	34	31	17	39	30	12	20	25	41	57	24	35	52	
East Hartford	45	45	65	56	39	42	35	16	35	36	27	42	59	61	29	25	29	33	31	13	38	25	11	15	21	31	39	36	32	49	
Greenwich	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	M	M	M	M	
Groton	36	41	46	40	30	41	37	21	37	38	24	52	61	56	49	26	29	30	34	30	41	28	21	25	33	43	M	M	M	M	
Madison	45	37	52	45	36	43	37	23	42	44	25	56	68	62	42	27	29	33	37	34	39	34	22	26	40	45	41	32	45	47	
Middletown	44	42	63	56	39	45	37	23	37	36	28	54	67	69	36	23	28	33	32	24	41	34	17	23	27	37	44	35	41	49	
New Haven	47	36	40	50	36	40	29	22	32	39	28	51	57	60	31	25	M	33	27	23	37	29	17	15	29	36	46	30	32	43	
Stafford	M	M	M	M	40	45	40	22	30	25	27	43	64	56	37	23	28	31	32	24	42	31	21	22	17	35	39	40	39	50	
Stratford	48	40	49	46	37	45	37	22	34	39	27	57	61	60	38	25	31	36	35	31	36	33	20	15	31	45	48	37	44	54	
Westport	49	37	57	54	36	40	35	24	33	42	29	55	63	62	32	26	26	35	35	30	32	31	16	16	30	45	44	28	41	55	
# days > Federal Standard																															

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

Several Case Studies

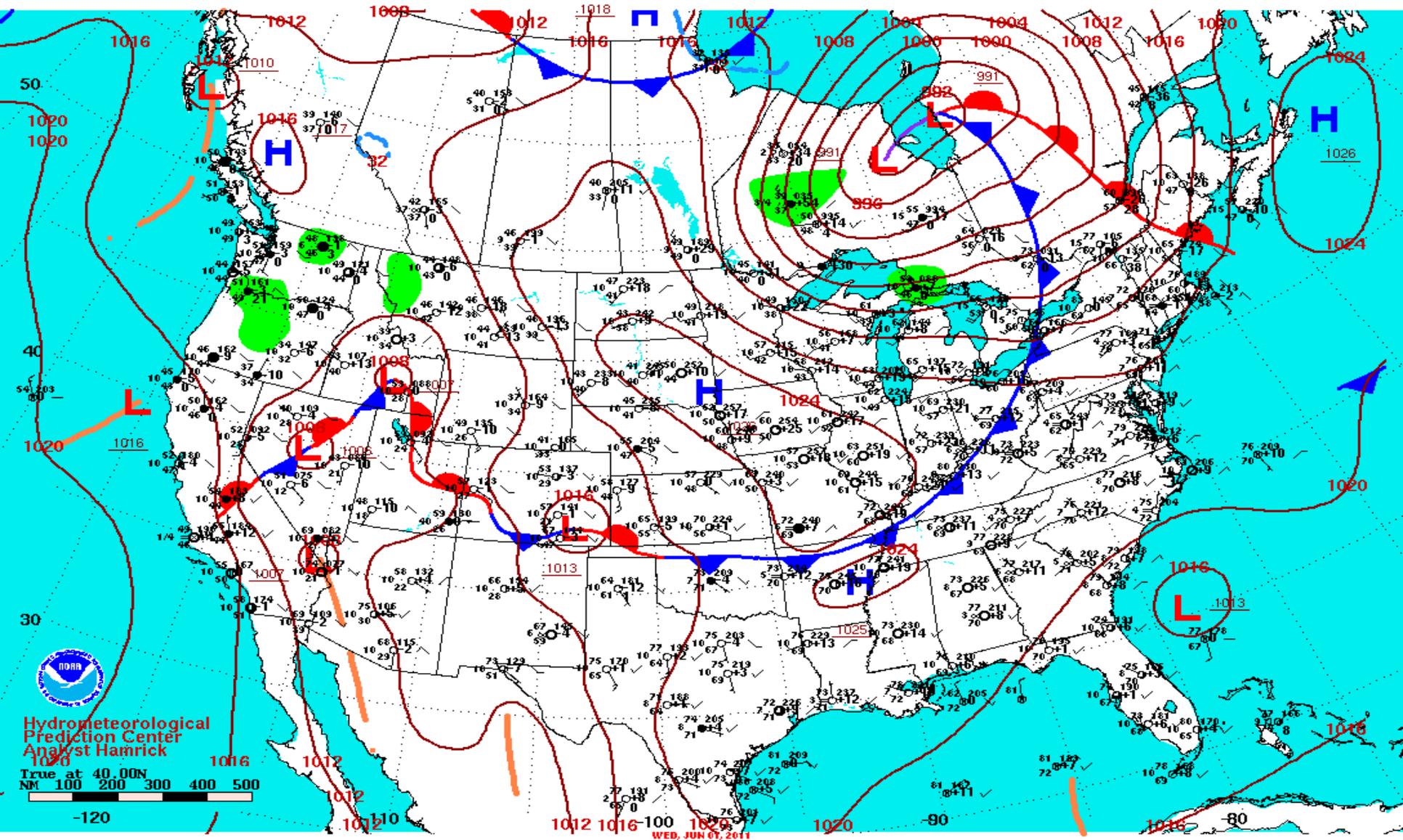
June: 1

July: 11 & 22

August: 20,

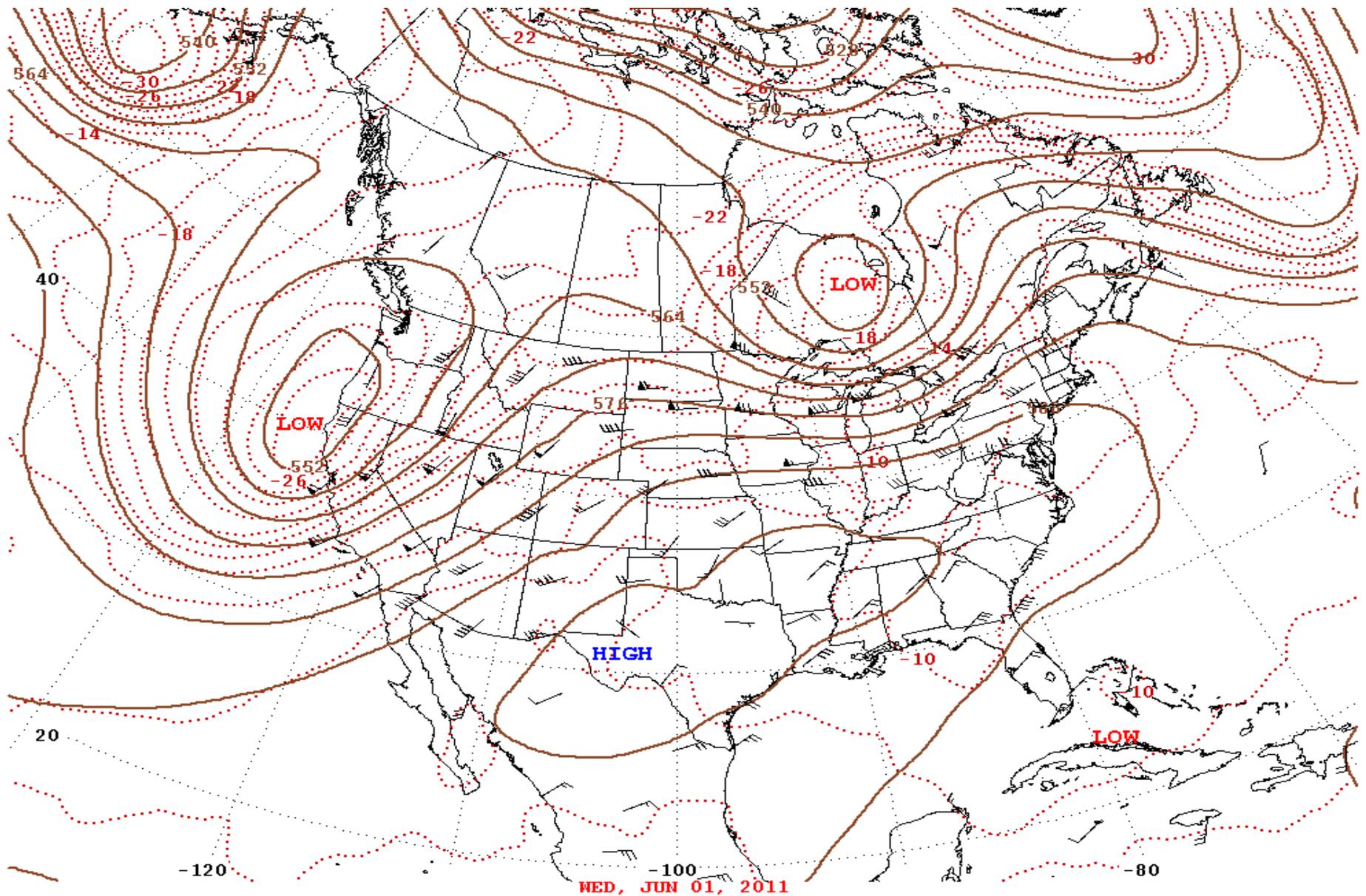
Red dates indicate code red days (unhealthy)

June 1, 2011, Surface Map



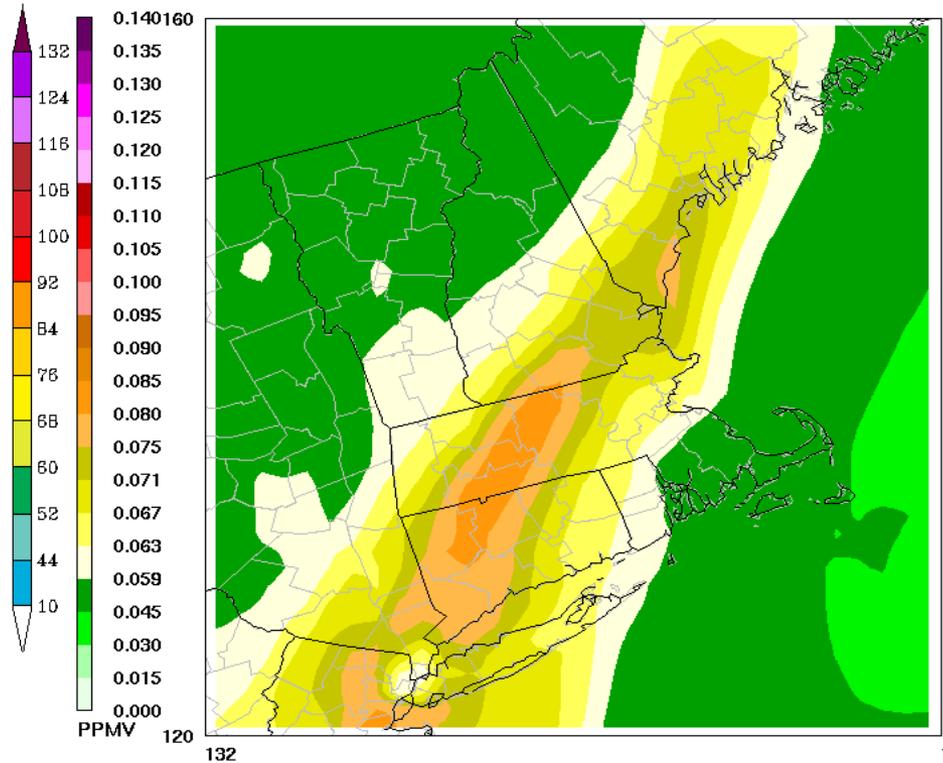
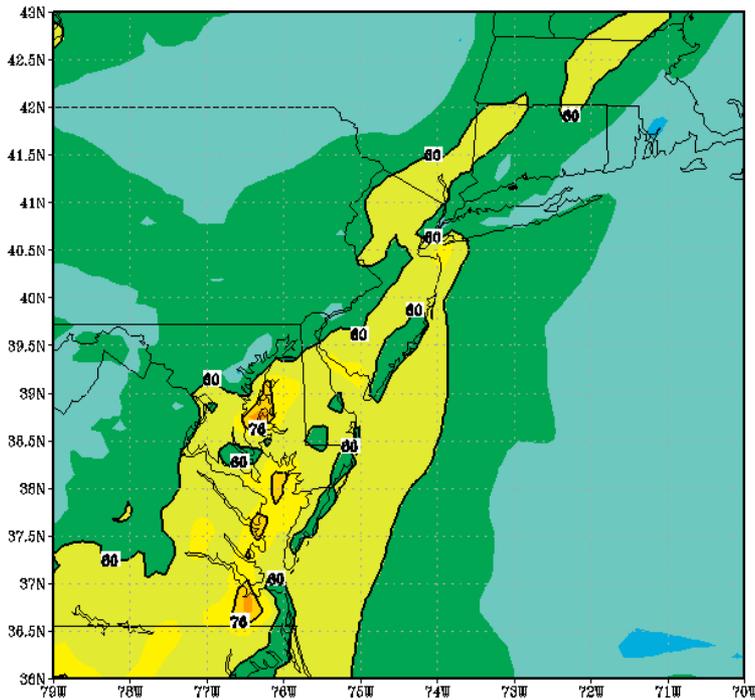
Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

June 1, 2011, Upper Level Map



WED, JUN 01, 2011

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

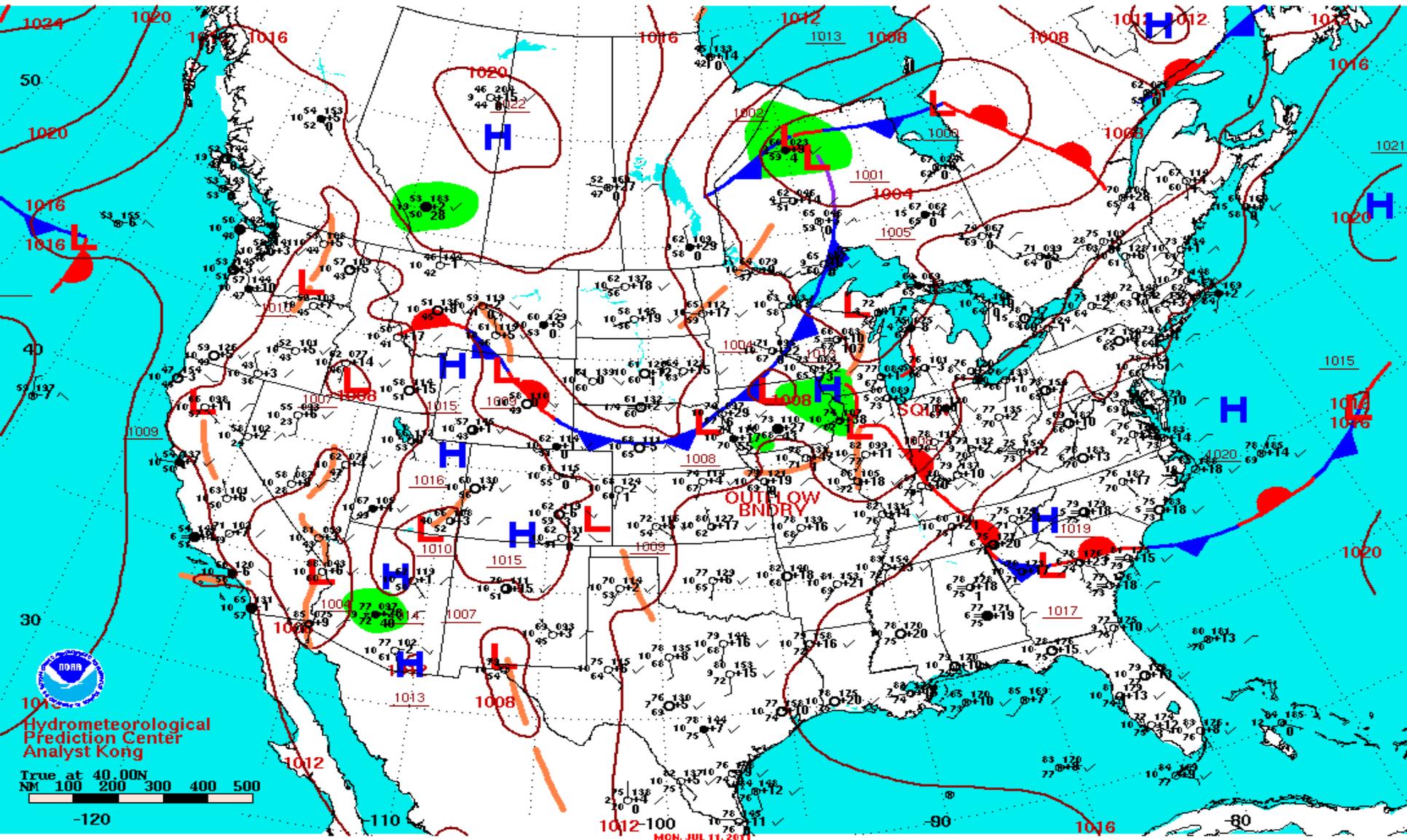


NOAA vs. Barons AQ Models. The NOAA model predicted GOOD to MODERATE Ozone levels across Connecticut, while the Barons Model predicted MODERATE to USG. One exceedences was observed, in Danbury.



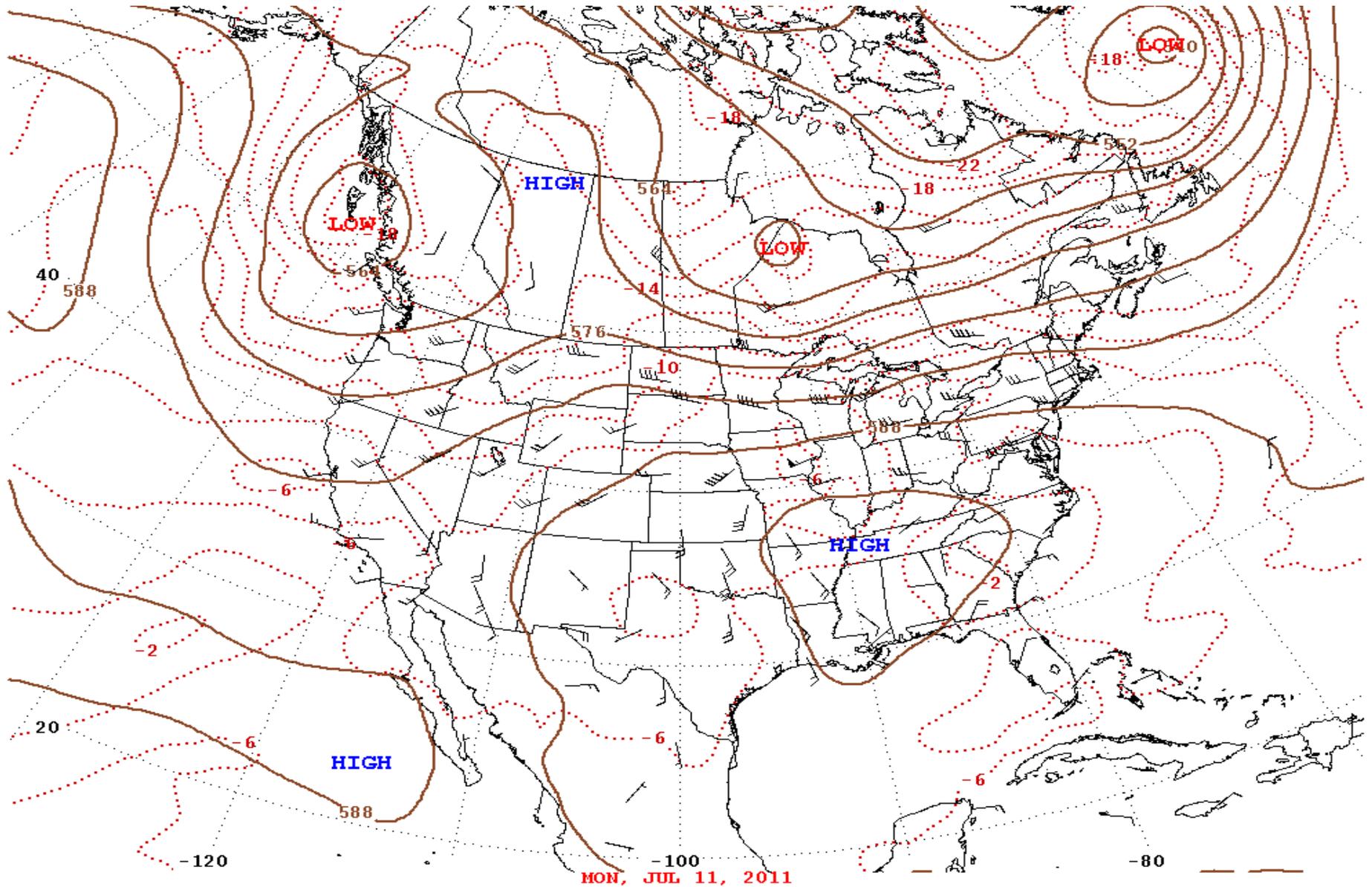
Site Name	6/01/2011
Cornwall	75
Danbury	81
East Hartford	62
Greenwich	63
Groton Fort	43
Madison	50
Middletown	62
New Haven	60
Stafford	62
Stratford	61
Westport	62

July 11, 2011, Surface Map



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

July 11, 2011, Upper Level Map

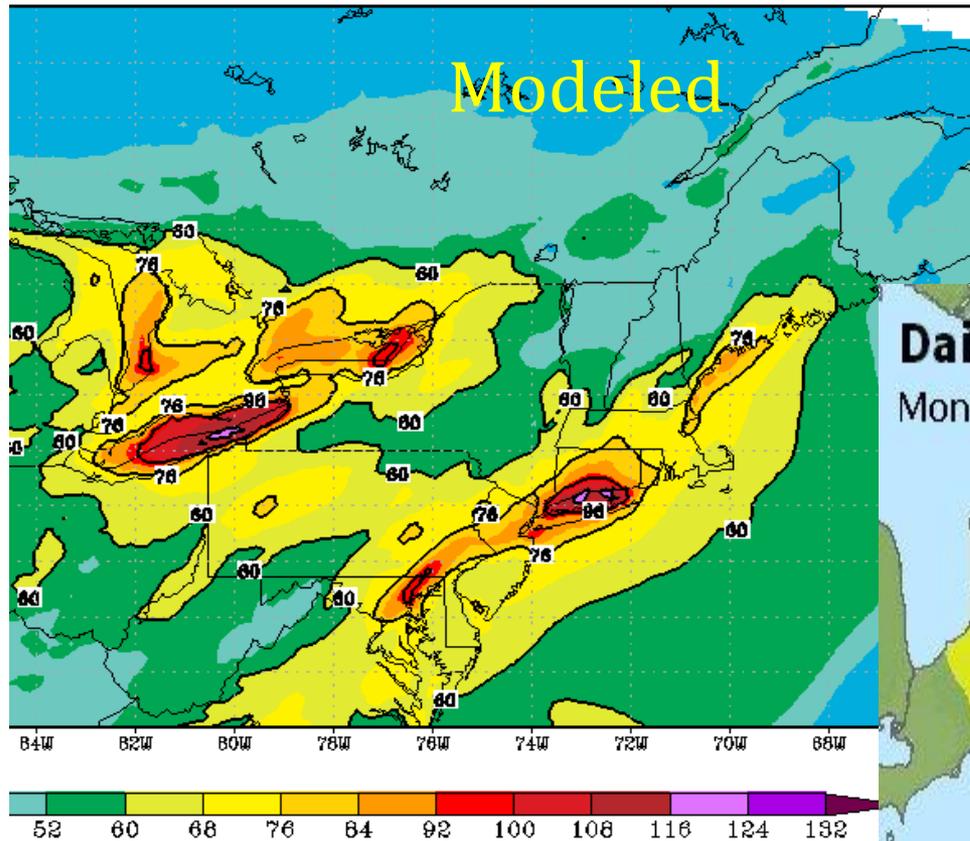


500-Millibar Height Contours at 7:00 A.M. E.S.T.

July 11, 2011 NOAA Operational Ozone Model Analysis

Airnow data vs. July 11, 12z model run

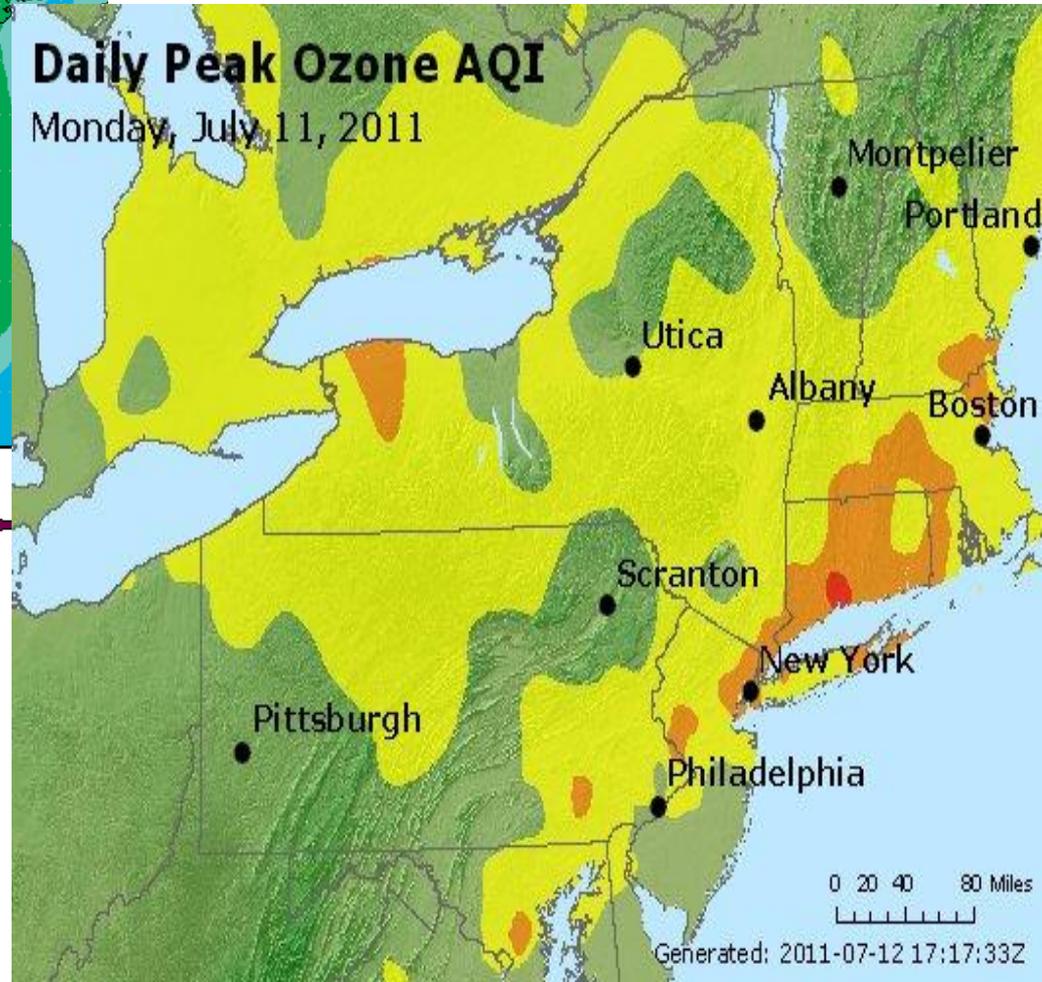
Peak 8-hour Ozone Averages		
Site Name	Actual ppb	Modeled ppb
Cornwall	69	73
Danbury	78	84
East Hartford	80	84
Groton	79	90
Madison	82	120
Middletown	90	93
New Haven	98	113
Stafford	87	82
Stratford	88	120
Westport	86	116



**July 11, 2011
Operational
Vs. Observed
8-hr Ozone ppb**

Daily Peak Ozone AQI

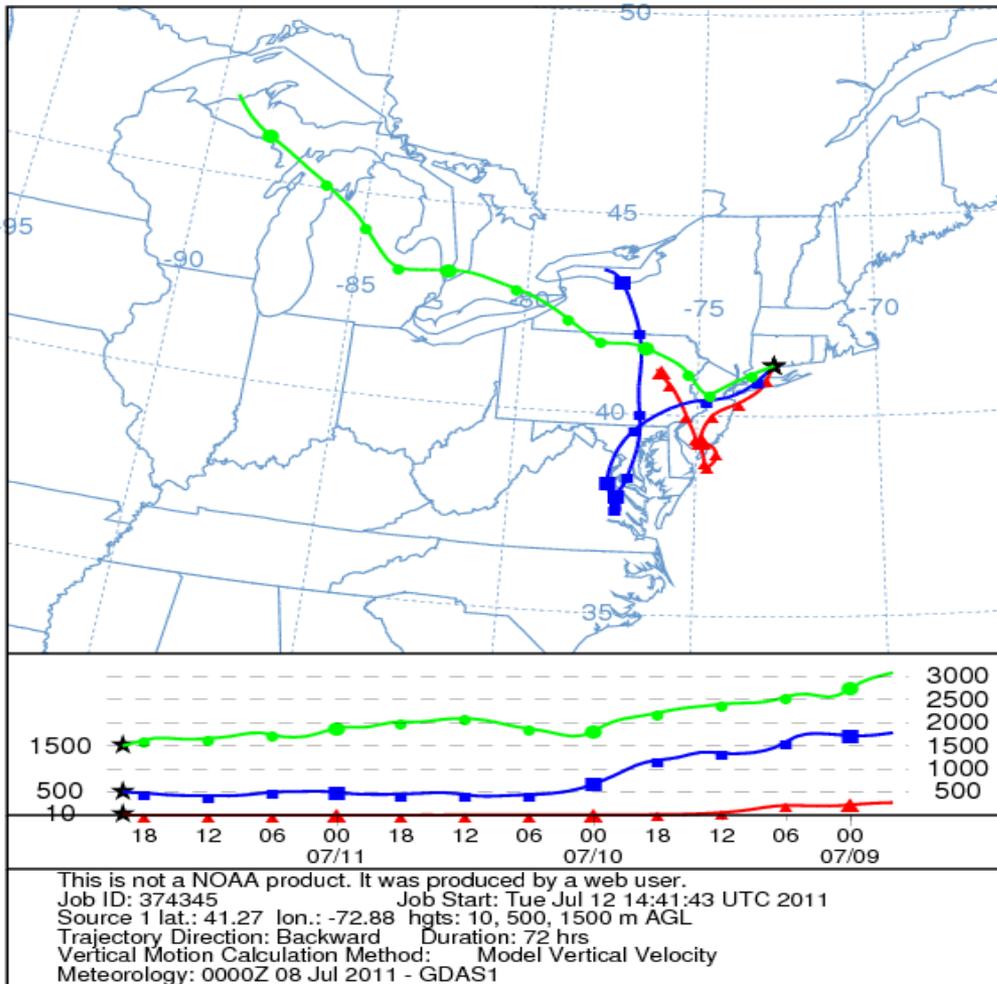
Monday, July 11, 2011



Given the hot wx pattern, forecasters predicted USG. Went with the NOAA forecast model, even though it over-predicted by 10-20 ppb across some monitors.

Source ★ at 41.27 N 72.88 W

Meters AGL

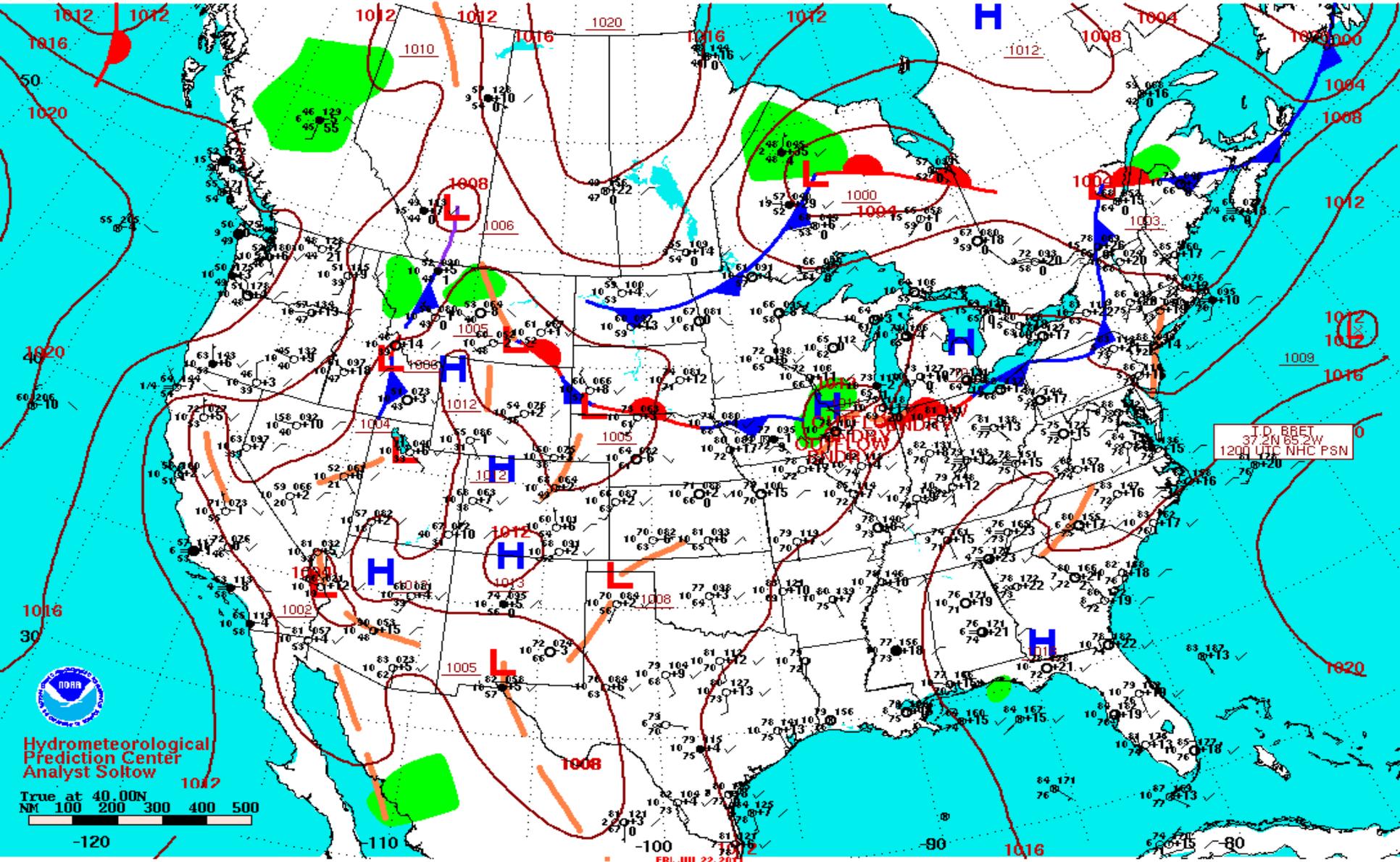


1-hr o3 for 7-11-11

Voc limited sites were the highest for both CT and NYC. New Haven and Pfizer Labs are usually the lowest monitored sites. Sites downwind of NYC were the most adversely affected though.

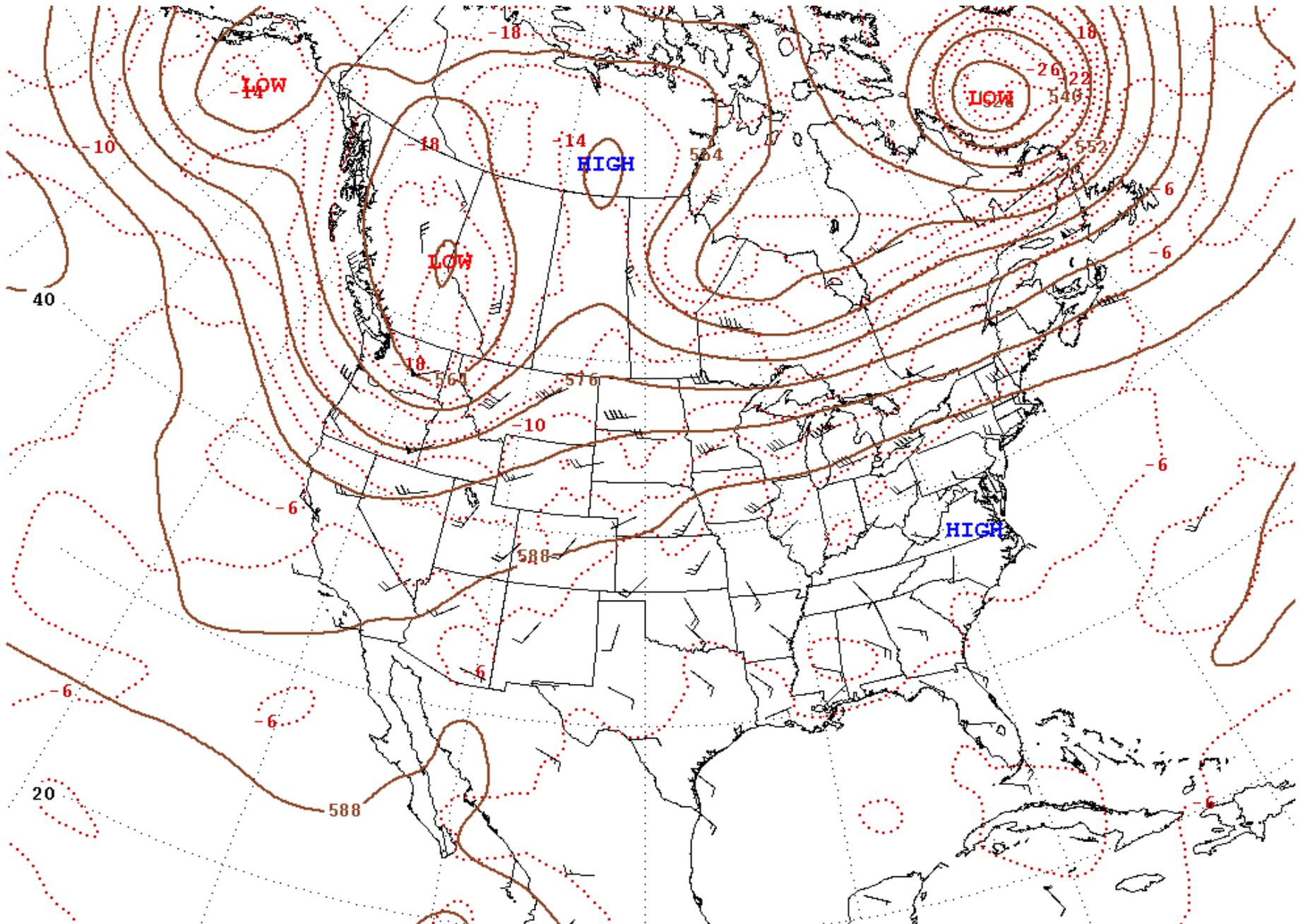
The blue trajectory is likely in part due to the Nocturnal jet up the I-95 corridor transporting extra ozone and precursor NO_x

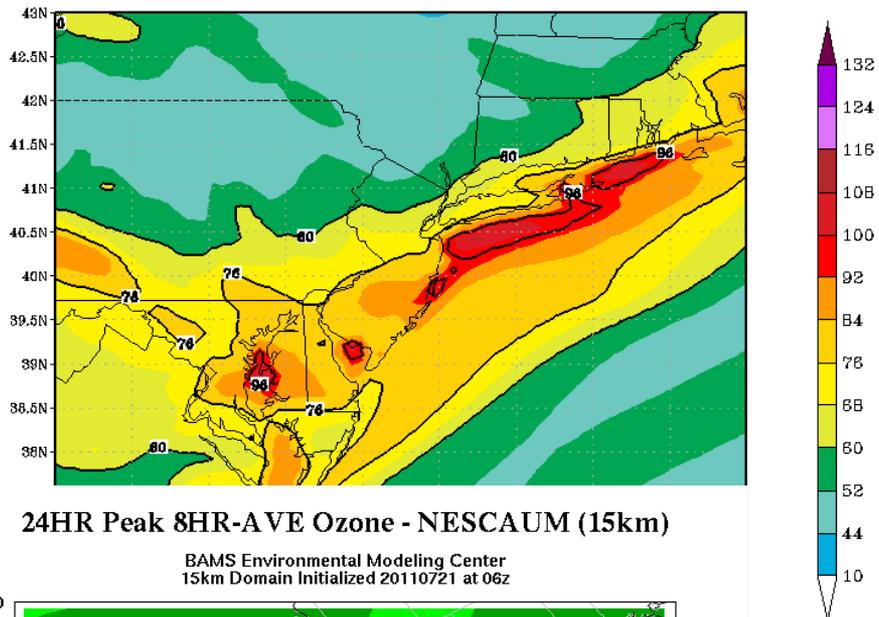
July 22, 2011, Surface Map



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

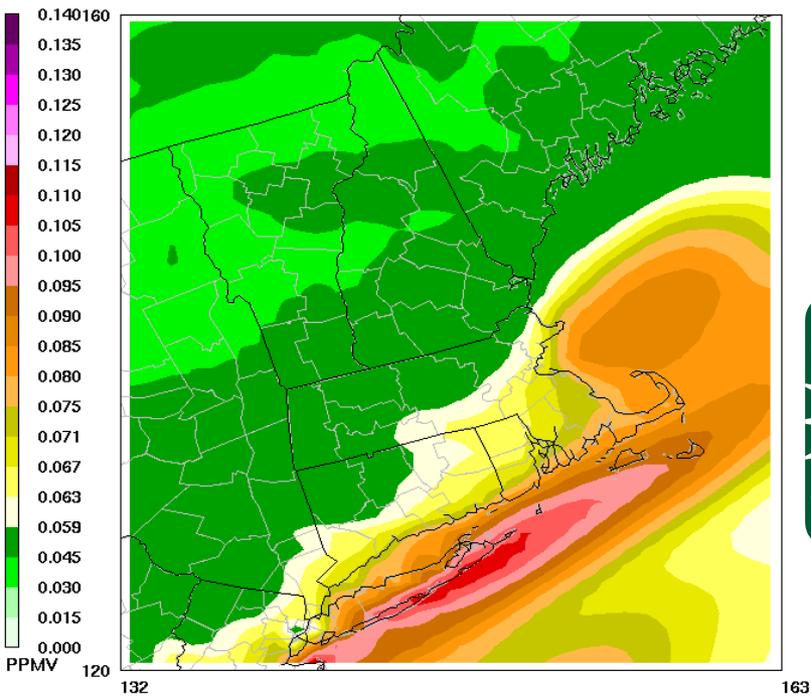
July 22, 2011, Upper Level Map





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

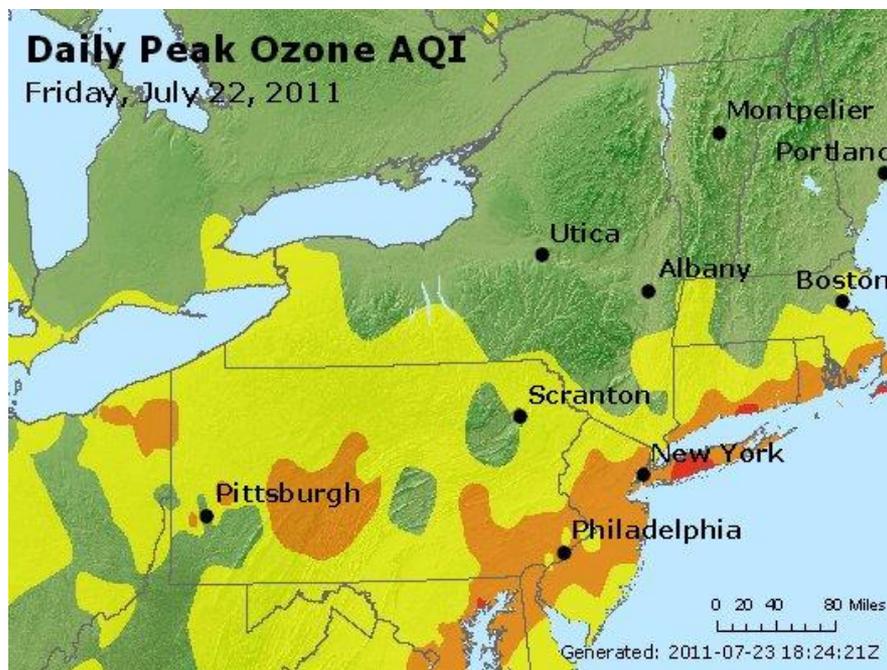
BAMS Environmental Modeling Center
15km Domain Initialized 20110721 at 06z



July 22, 2011 6:00:00
Min= 0.040 at (132,160), Max= 0.112 at (141,120)

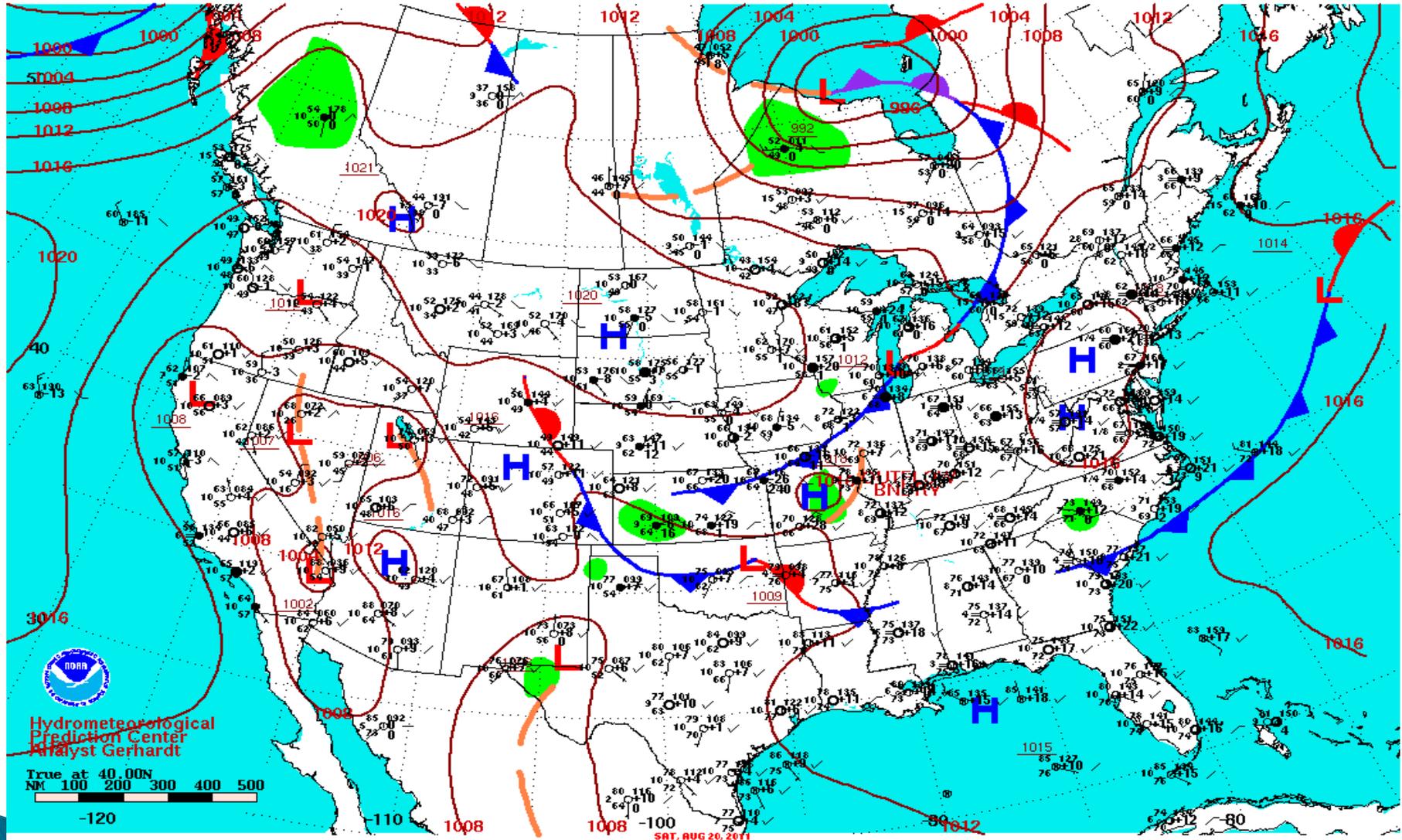


July 22, 2011 NOAA/BARONS Models Vs. Observed 8-hr Ozone Levels



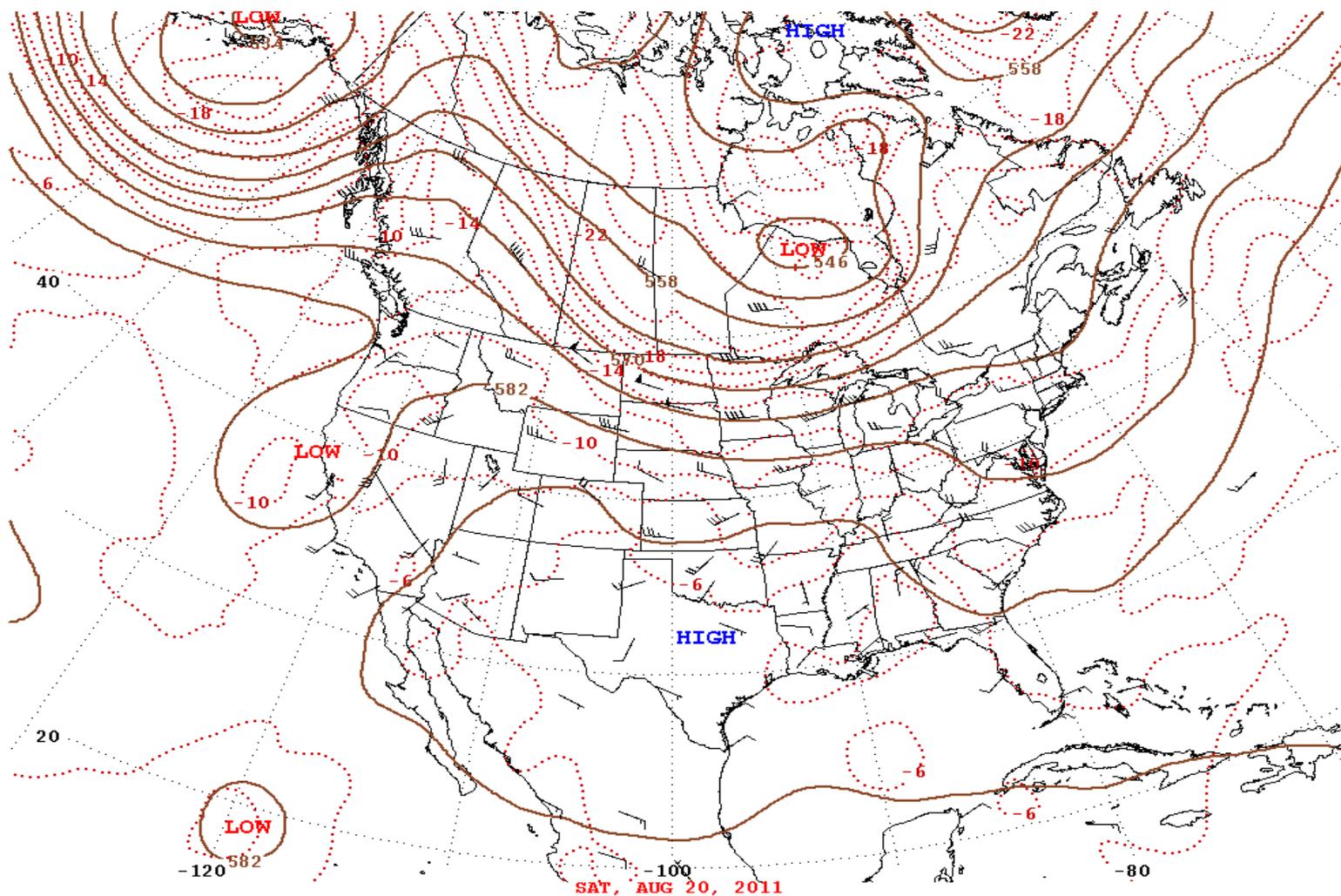
Both the NOAA and Barons models under-predicted Ozone levels with USG levels barely predicted across SE CT.. In this case Forecasters predicted USG as the east was in a major heat wave wx pattern!

August 20, 2011, Surface Map



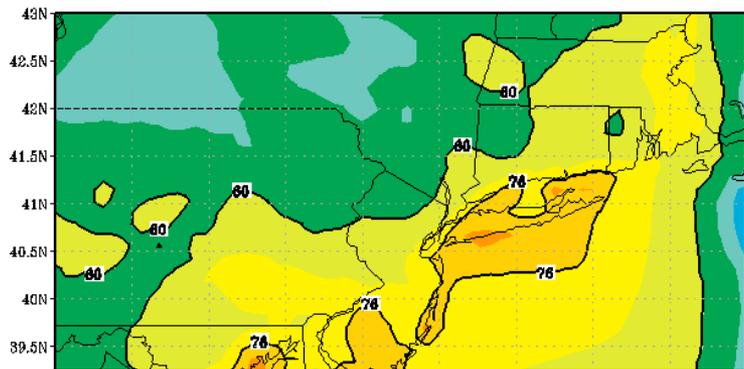
Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

August 20, 2011, Upper Level Map



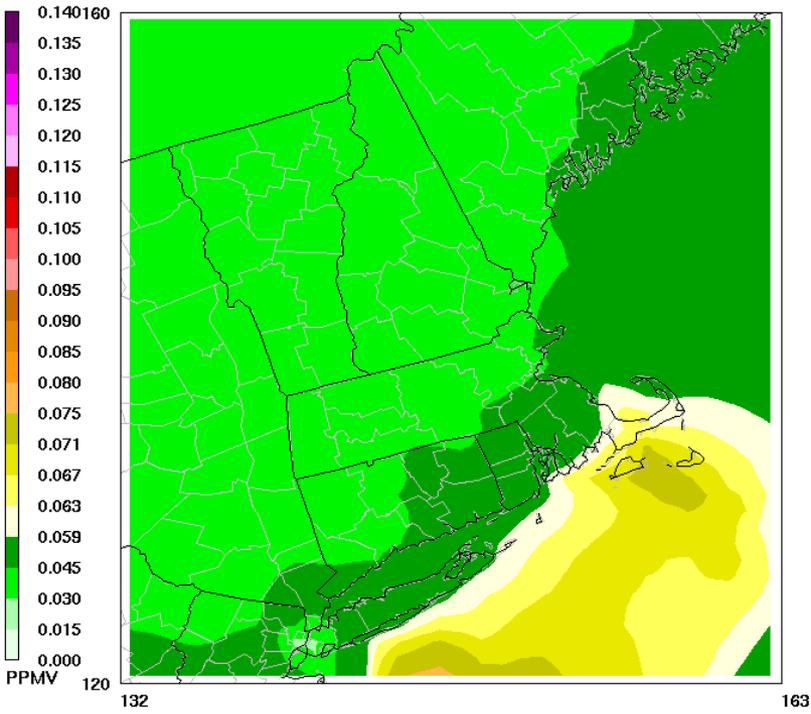
500-millibar Height Contours at 7:00 A.M. E.S.T.

Modeled vs Observed Data

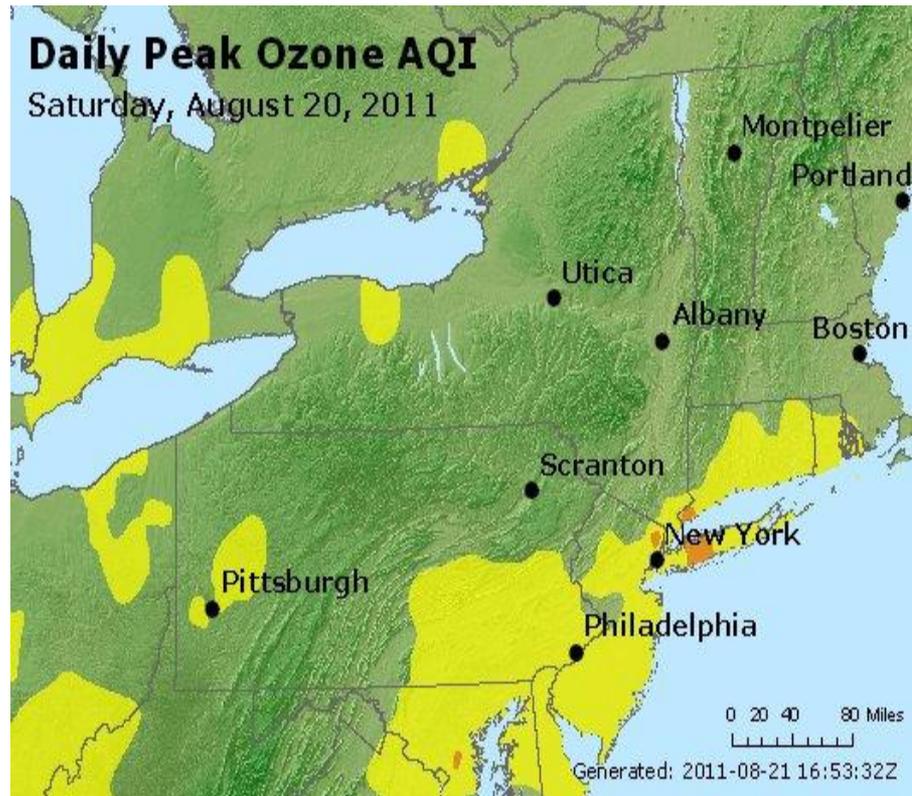
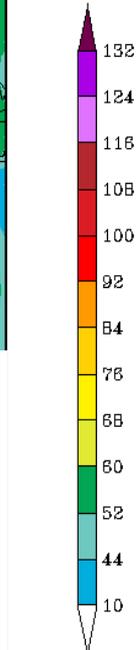


24HR Peak 8HR-AVE Ozone - NESCAUM (15km)

BAMS Environmental Modeling Center
15km Domain Initialized 20100819 at 06z



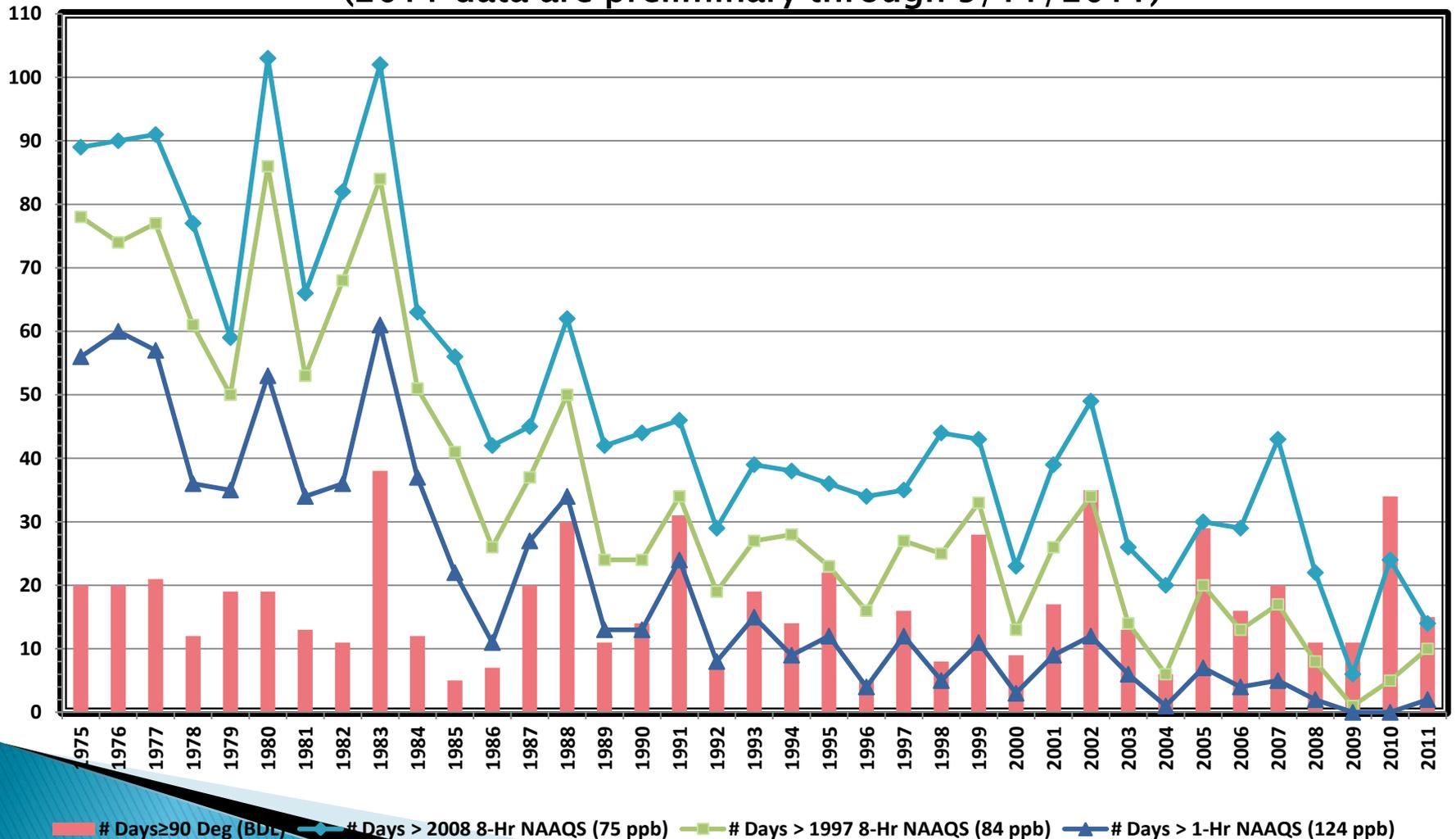
August 20, 2010 6:00:00
Min= 0.027 at (140,122), Max= 0.076 at (147,120)



NOAA Model predicted USG levels just skimming the coast-line. BARONS predicted GOOD levels. Given the recent change in the weather pattern to a cooler wetter regime, forecasters predicted GOOD

Cooler 2011 Summer

Number of Ozone Exceedance Days in Connecticut Compared to the Number of "Hot" Days (2011 data are preliminary through 9/11/2011)



Summary-2011

- 10 less exceedences in 2011 (**14**) vs. 2010 (**24**)
- Several early (June & July) heat-waves responsible for 14 USG events with several monitors reaching Unhealthy levels.
- Battle zone between the upper level ridge across the mid-section of the country and trough just to the north, caused more clouds and heavy rains. Thus, a much wetter August and September with just one USG day on August 20th
- Lower Emissions Due to NOx Controls and continued a slow economy?
- Same Ozone Season for 2012 as the standard stays @ 75ppb