



Connecticut Department of Energy and Environmental Protection



Connecticut Department of
**ENERGY &
ENVIRONMENTAL
PROTECTION**

NOAA Ozone Model Performance State of Connecticut

September 26, 2013
Michael Geigert
Air Quality Focus Group



Connecticut Department of Energy and Environmental Protection

2013 Ozone Exceedance Days

8-Hour Ozone Daily Maximums* May 2013

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	64	61	53	53	61	53	46	40	45	60	42	40	45	48	58	55	45	50	37	47	63	43	37	41	30	M	M	49	63	63	85		
Danbury	60	54	50	50	56	45	36	36	35	60	41	43	43	46	56	52	41	49	37	43	71	43	25	24	31	38	45	40	62	68	81		
East Hartford	54	56	45	50	54	45	35	33	31	57	40	39	41	43	53	48	40	50	35	41	68	44	22	20	27	34	42	49	49	57	79		
Greenwich	54	47	51	47	53	50	40	36	33	53	45	50	47	50	56	54	44	42	37	44	57	34	30	25	34	41	47	41	54	89	76		
Groton	54	46	45	49	50	44	35	37	38	56	48	46	46	48	55	59	43	54	40	45	51	35	25	21	27	34	51	M	49	85	78		
Madison	55	45	46	49	51	48	35	37	37	51	49	51	45	51	58	57	40	53	38	45	51	35	29	21	31	37	53	51	51	85	71		
Middletown	58	56	44	49	52	43	36	36	36	62	46	43	45	46	57	59	43	54	39	49	73	44	28	22	30	37	49	54	58	86	82		
New Haven	60	40	46	51	54	44	38	35	33	44	34	44	44	44	53	50	44	47	38	39	37	33	22	22	29	38	47	46	39	71	82		
Stafford	64	60	47	57	60	54	43	40	40	64	47	41	44	45	58	52	43	53	43	47	70	53	29	23	26	31	48	58	57	58	83		
Stratford	55	45	52	50	54	50	38	40	40	52	50	50	46	50	57	57	44	47	40	45	55	37	31	20	28	39	51	51	48	94	82		
Westport	58	49	52	49	53	49	39	34	35	57	47	49	46	50	56	55	43	47	37	43	58	33	31	21	30	40	52	41	44	95	82		
# days > Federal Standard																																1	2



2013 Ozone Exceedance Days

8-Hour Ozone Daily Maximums* June 2013

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	68	53	41	42	46	55	38	34	47	55	38	46	47	46	43	57	51	48	42	56	66	66	54	58	59	50	56	51	60	45
Danbury	75	63	37	43	49	57	34	32	48	53	46	39	42	41	38	62	54	61	37	62	76	76	57	64	72	42	63	M	M	M
East Hartford	75	47	40	38	45	48	32	30	41	M	35	43	42	43	37	58	62	44	44	62	77	74	64	55	74	37	45	53	61	47
Greenwich	62	46	38	49	41	50	36	38	62	59	52	44	43	42	44	60	59	47	43	58	61	67	45	80	73	56	50	60	60	40
Groton	50	33	41	44	37	52	36	42	57	53	54	41	40	40	47	54	65	50	41	53	55	54	48	86	90	55	42	41	46	40
Madison	55	36	40	48	41	52	38	47	58	56	52	43	40	47	48	56	61	53	49	59	56	55	52	89	88	62	44	51	M	M
Middletown	70	44	42	40	47	53	35	37	46	55	47	43	42	43	39	59	63	45	44	65	82	74	62	69	97	48	47	55	57	44
New Haven	66	40	35	43	41	53	32	40	34	57	41	43	40	38	38	57	60	58	45	58	67	72	45	71	77	44	51	48	59	44
Stafford	81	49	40	38	50	53	38	31	44	39	35	38	42	38	40	58	54	43	38	63	82	74	68	54	70	43	42	53	60	51
Stratford	60	41	40	48	43	56	38	44	60	60	44	41	42	47	49	58	66	55	47	57	63	65	49	88	91	62	54	59	59	43
Westport	65	43	44	46	42	54	34	44	66	58	54	44	40	46	45	62	62	49	43	59	69	72	53	85	87	57	49	59	61	42
# days > Federal Standard	3																				4	5		6	7					



2013 Ozone Exceedance Days

8-Hour Ozone Daily Maximums* July 2013

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	30	36	36	31	42	32	40	53	61	50	42	41	29	34	44	45	47	46	66	51	49	53	40	28	22	36	M	M	47	35	41	
Danbury	25	37	40	41	53	39	62	51	64	61	43	43	22	31	38	45	54	54	75	60	45	48	43	30	17	31	74	52	50	37	44	
East Hartford	26	34	43	41	55	33	51	43	60	50	43	25	8	14	45	52	52	51	78	55	45	48	40	32	17	25	65	52	55	37	46	
Greenwich	27	33	34	42	51	56	74	69	78	68	59	42	31	44	50	46	79	83	82	71	48	50	56	43	18	48	65	50	67	41	60	
Groton	25	25	29	51	54	67	55	66	54	45	48	41	22	43	51	45	55	75	91	83	45	46	59	44	16	45	59	39	41	48	46	
Madison	32	30	36	50	57	73	77	77	57	54	56	43	31	56	52	61	72	80	79	79	47	49	64	38	18	52	67	48	45	53	48	
Middletown	29	29	38	52	64	41	58	64	56	53	51	41	23	41	46	56	67	55	85	67	38	45	54	38	19	39	65	46	56	39	47	
New Haven	31	35	39	47	52	37	75	71	54	57	55	42	21	47	43	44	59	66	77	65	45	41	54	35	17	34	68	50	57	37	41	
Stafford	27	34	46	41	54	35	45	40	47	48	M	M	M	M	45	34	61	56	79	51	41	46	41	35	19	30	61	45	50	39	44	
Stratford	33	35	35	50	57	76	77	81	73	71	55	M	24	37	49	48	74	90	90	81	52	50	72	40	19	51	72	53	68	46	52	
Westport	29	35	37	49	58	57	81	80	75	76	53	41	26	48	41	50	79	86	99	75	49	46	69	41	16	44	70	52	68	45	56	
# days > Federal Standard						8	9	10	11	12							13	14	15	16												



2013 Ozone Exceedance Days

8-Hour Ozone Daily Maximums* August 2013

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	M	42	35	37	52	50	54	37	36	33	44	41	29	36	45	50	51	45	61	68	64	38	41	51	48	44	51	40	44	51
Danbury	49	44	42	32	33	58	53	46	37	39	34	46	46	29	M	42	49	48	48	63	64	37	34	38	44	39	41	51	42	47	57
East Hartford	48	43	42	31	38	48	53	46	25	37	29	51	42	29	32	41	45	44	42	56	57	40	35	39	45	32	49	44	39	45	46
Greenwich	55	59	47	37	37	60	51	41	47	45	43	47	52	33	39	55	54	53	59	63	82	32	34	46	61	53	46	47	49	60	53
Groton	50	63	52	33	44	51	56	38	31	50	39	41	38	32	42	43	54	47	57	70	70	40	38	39	51	50	47	48	38	52	40
Madison	60	66	55	37	42	57	54	42	41	54	51	46	46	27	47	50	55	53	69	67	67	47	37	45	51	54	46	55	41	57	44
Middletown	54	48	45	31	40	49	53	43	39	41	42	48	43	29	34	44	47	40	45	59	66	40	36	39	49	39	51	45	36	57	50
New Haven	52	48	42	33	38	52	57	28	39	44	56	48	48	33	37	49	56	54	52	63	74	38	34	37	38	39	48	55	44	62	54
Stafford	49	43	44	30	35	45	54	49	34	39	30	52	42	29	30	43	42	43	43	53	60	51	30	34	44	40	36	41	39	46	41
Stratford	61	69	51	35	38	59	58	43	49	47	54	56	55	30	42	54	56	55	65	72	75	44	31	45	58	54	43	56	51	63	54
Westport	56	61	49	35	38	60	53	42	52	M	M	48	50	33	39	55	52	52	58	64	82	40	31	46	63	44	45	48	46	67	56
# days > Federal Standard																					17										



2013 Ozone Exceedance Days

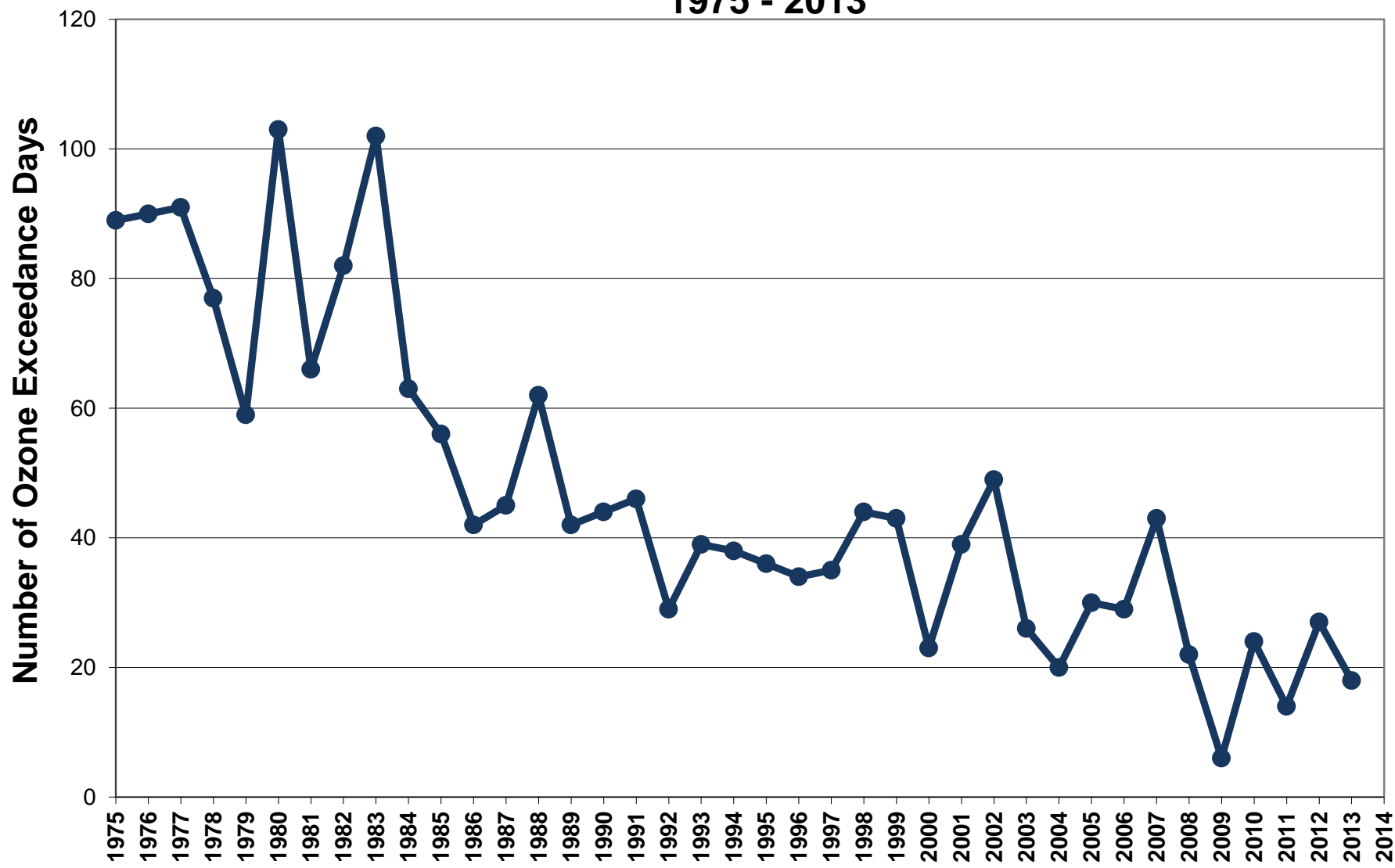
8-Hour Ozone Daily Maximums* September 2013

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	40	52	50	42	35	39	51	44	37	54	81	51	35	M	M	M	34	44												
Danbury	46	45	30	39	32	37	48	40	35	46	88	55	26	18	33	28	30	40												
East Hartford	39	38	28	36	34	34	50	34	37	38	86	57	30	18	32	32	31	39												
Greenwich	45	43	39	48	39	45	59	47	39	48	66	53	30	24	42	37	35	40												
Groton	31	33	36	47	35	41	59	42	36	38	67	44	41	19	37	32	35	43												
Madison	36	38	38	53	36	45	63	45	39	44	66	52	40	21	44	35	35	51												
Middletown	39	41	22	38	35	36	57	36	37	46	79	54	33	19	37	33	32	44												
New Haven	40	41	32	43	39	42	62	43	39	45	55	52	37	22	43	38	35	47												
Stafford	38	35	35	36	30	34	49	34	38	44	84	58	34	16	33	30	31	39												
Stratford	42	44	35	52	37	45	65	47	40	48	67	55	36	20	46	38	35	48												
Westport	44	41	36	48	37	43	63	46	40	51	79	58	33	23	41	36	37	43												
# days > Federal Standard											18																			



Connecticut 8-Hour (75 ppb) Ozone Exceedance Day Trends

1975 - 2013



NOAA model vs. Observed Exceedance Days vs. CT Forecasters

Modeled Exceedance Days 06z NOAA model	Observed Exceedance Days	CT Forecasters
		5/21/2013
		5/22/2013
	5/30/2013	5/30/2013
5/31/2013	5/31/2013	5/31/2013
6/1/2013	6/1/2013	6/1/2013
6/21/2013	6/21/2013	6/21/2013
6/22/2013	6/22/2013	6/22/2013
6/23/2013		
	6/24/2013	6/24/2013
6/25/2013	6/25/2013	6/25/2013
6/27/2013		
6/29/2013		
	7/6/2013	
7/7/2013	7/7/2013	
	7/8/2013	
	7/9/2013	7/9/2013
	7/10/2013	
7/17/2013	7/17/2013	
7/18/2013	7/18/2013	7/18/2013
7/19/2013	7/19/2013	7/19/2013
	7/20/2013	7/20/2013
7/27/2013		7/27/2013
7/31/2013		
8/19/2013		
8/20/2013		
8/21/2013	8/21/2013	8/21/2013
8/22/2013		8/22/2013
8/26/2013		
9/1/2013		
9/11/2013	9/11/2013	9/11/2013

NOAA model:

11/18 hits

10 false alarm days

Mostly under predicted until
August, then many FA's

Forecasters:

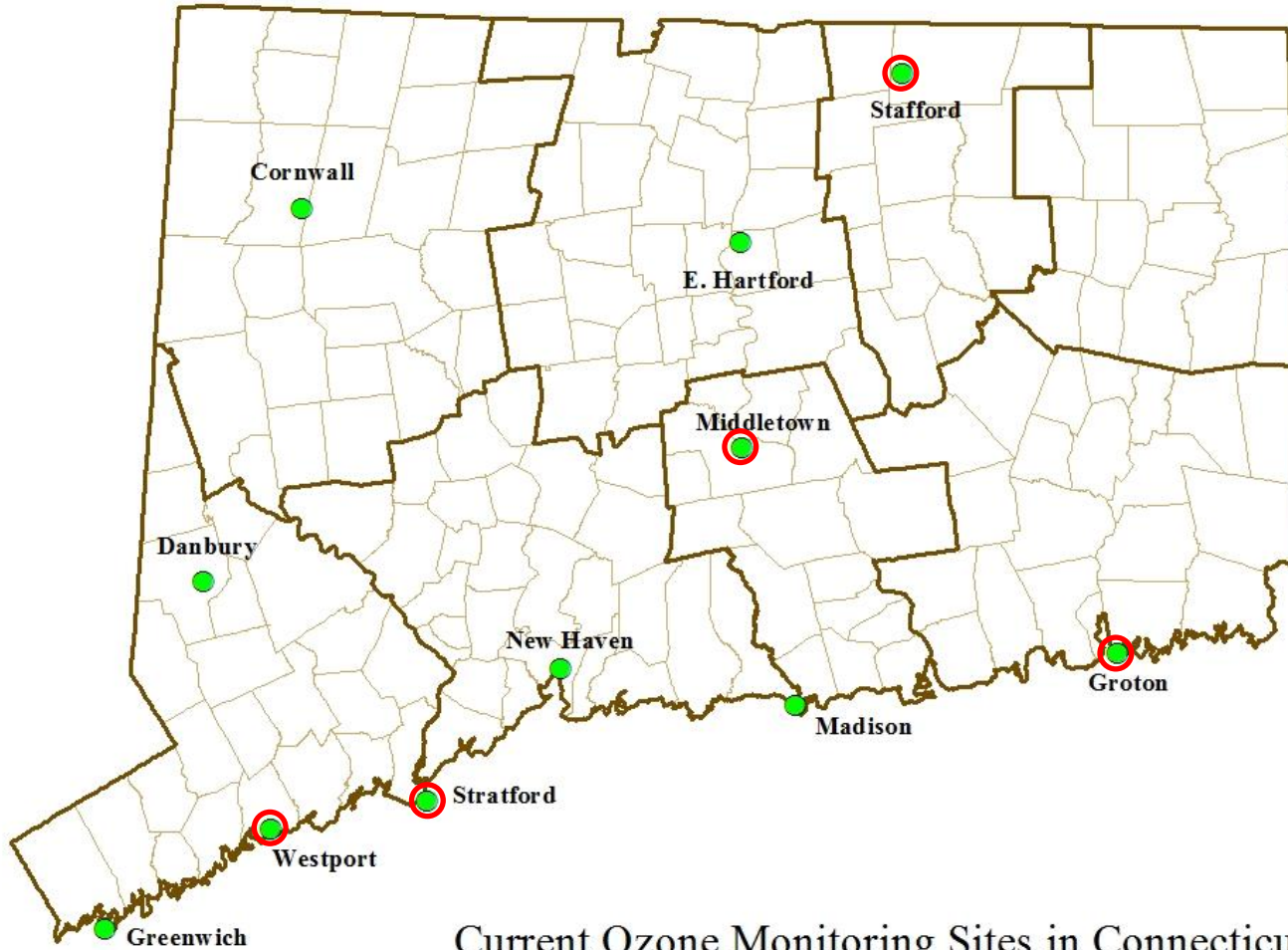
13/18 hits

4 false alarm days



Connecticut's 11 Ozone Monitors

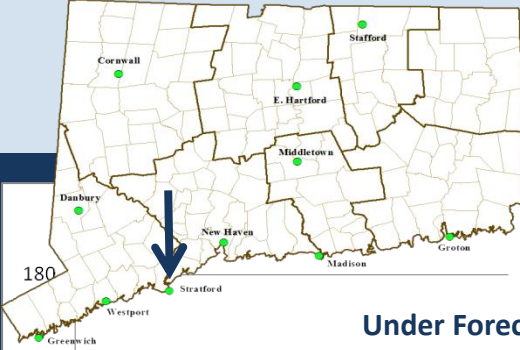
○=Sites to be discussed



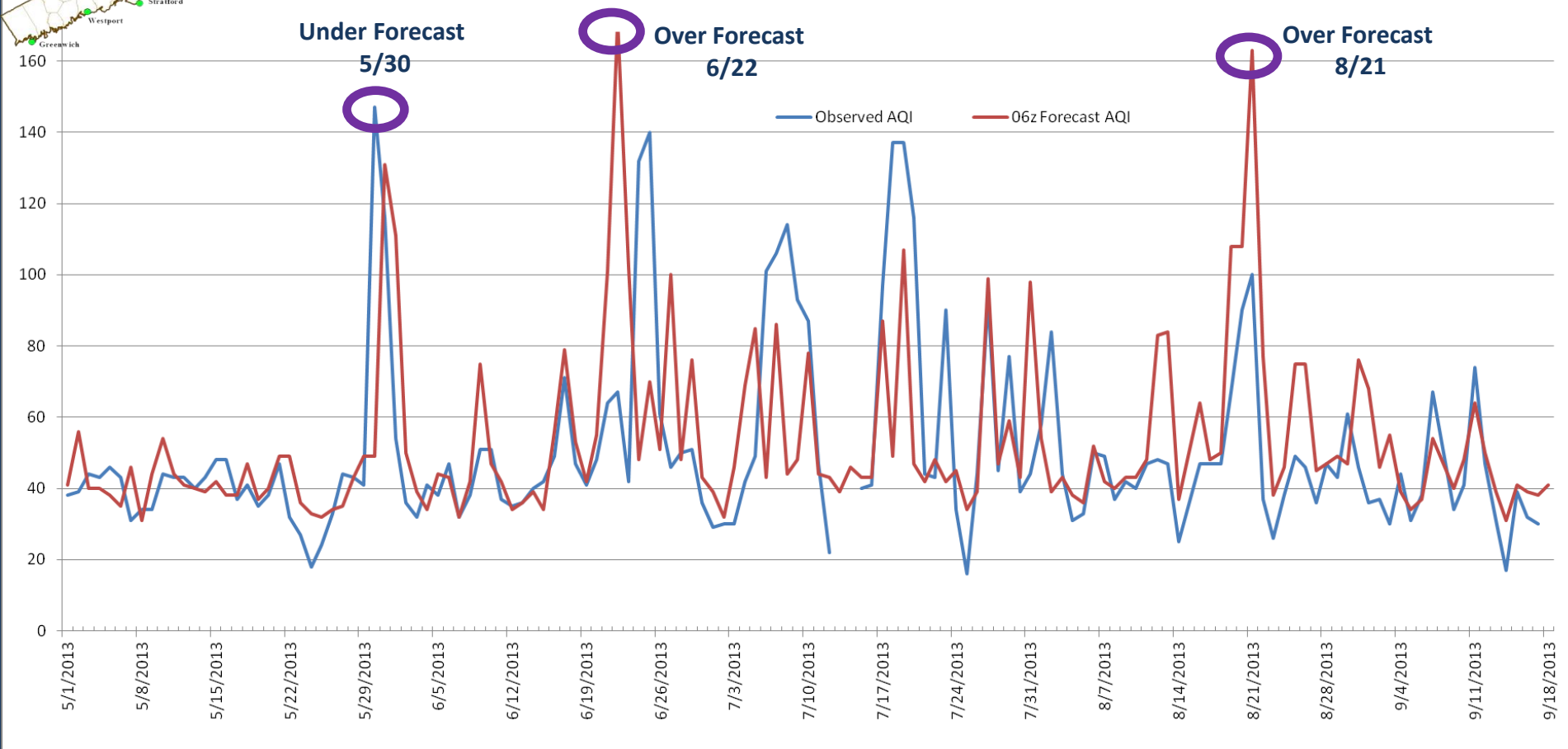
Current Ozone Monitoring Sites in Connecticut



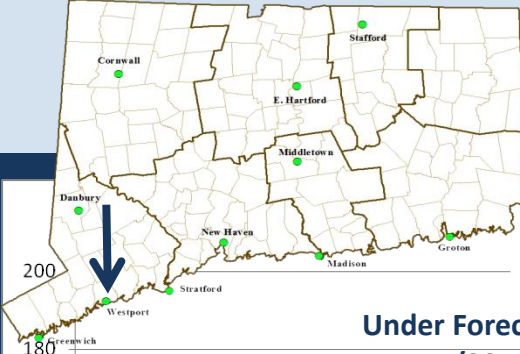
Stratford (coast)



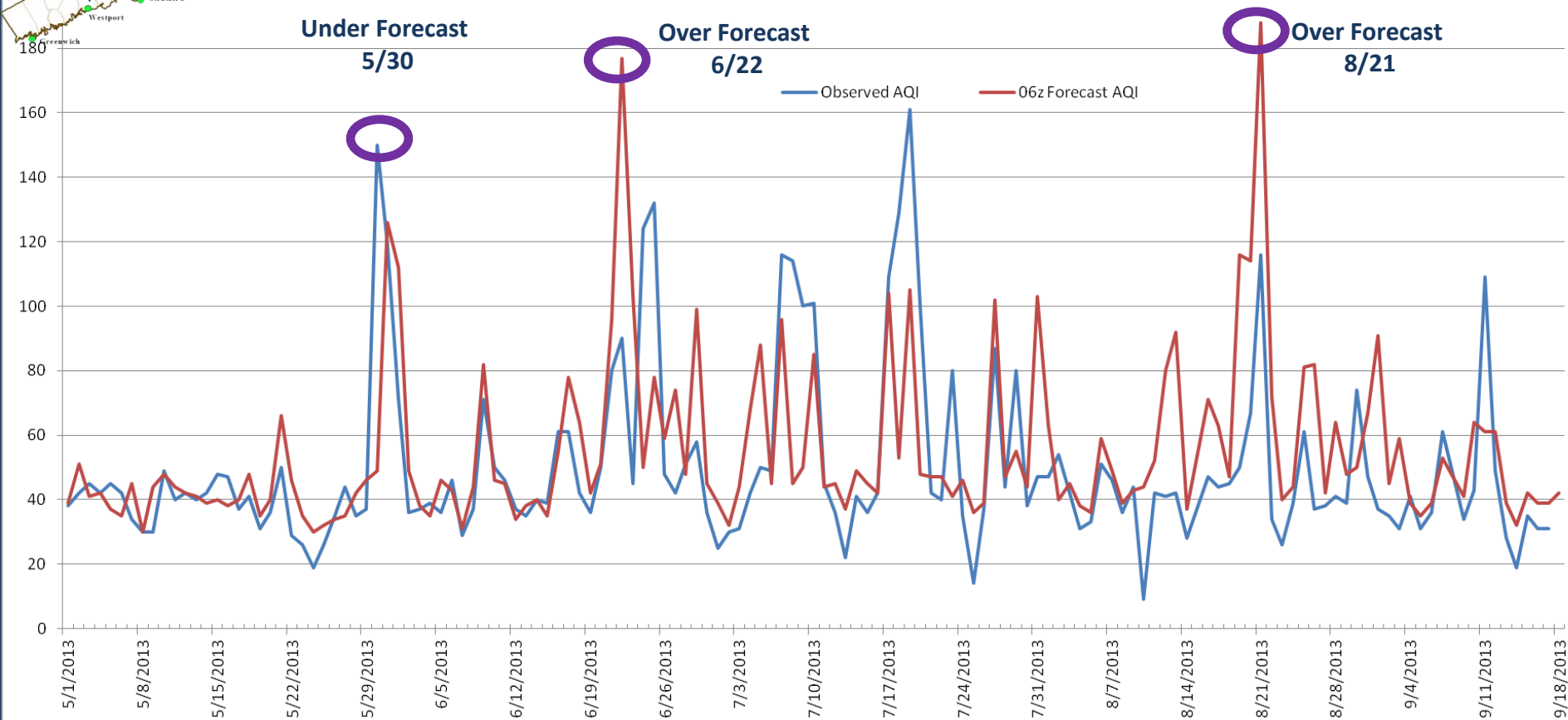
Stratford 06z Ozone Forecast vs. Observed AQI



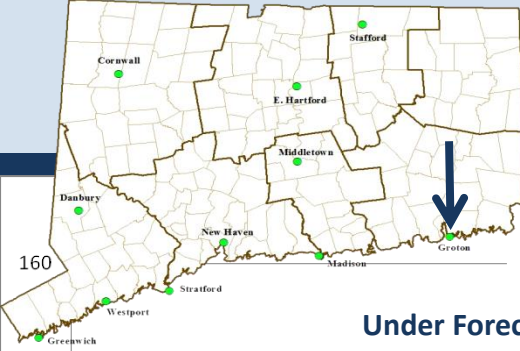
Westport (coast)



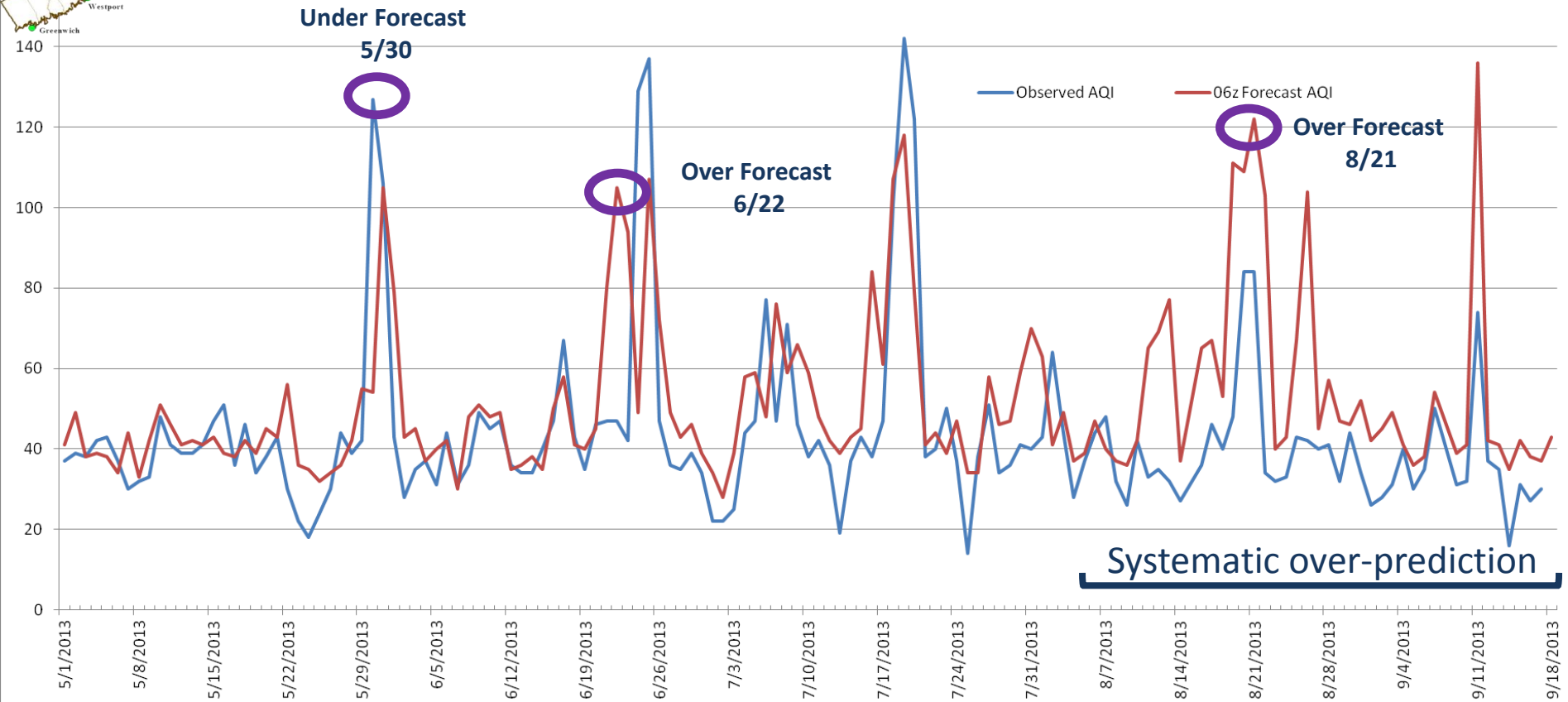
Westport 06z Ozone Forecast vs. Observed AQI



Groton (coast)



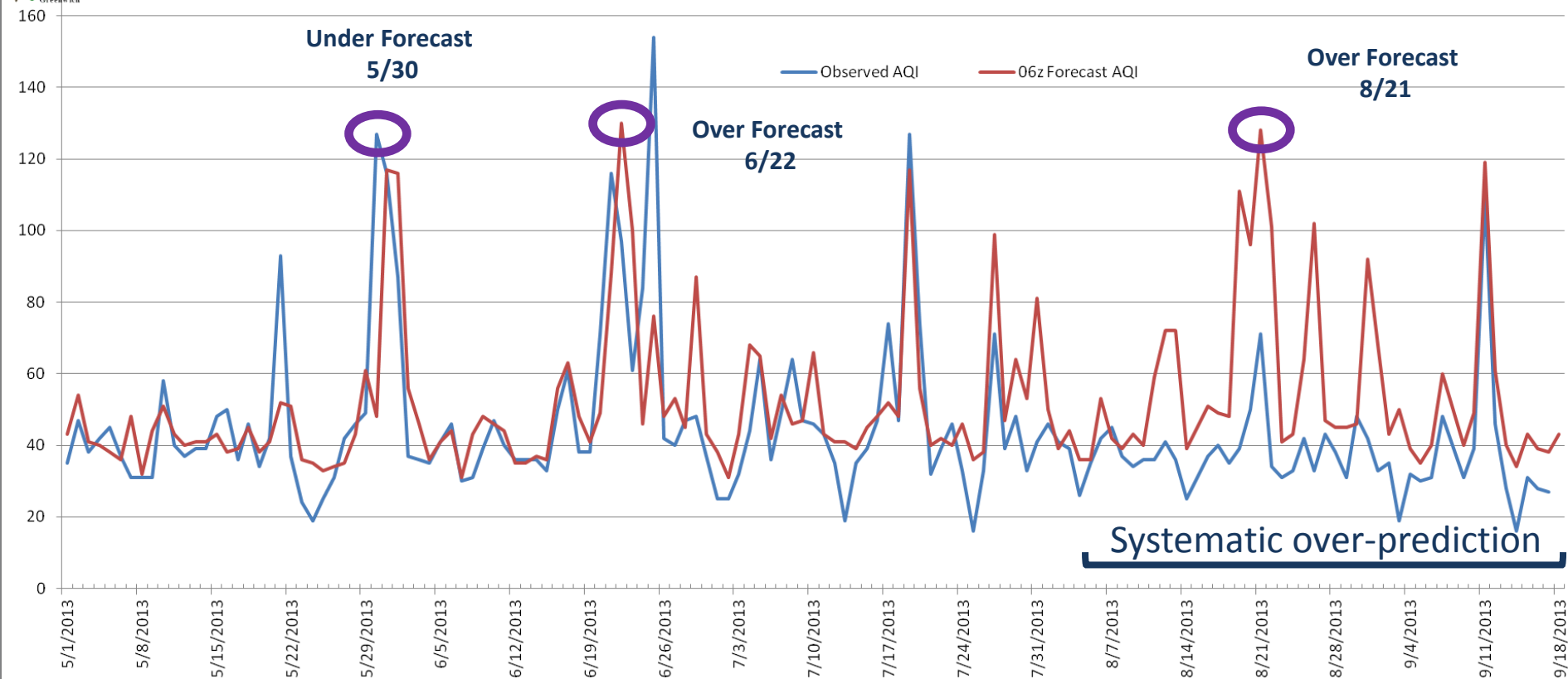
Groton 06z Ozone Forecast vs. Observed AQI



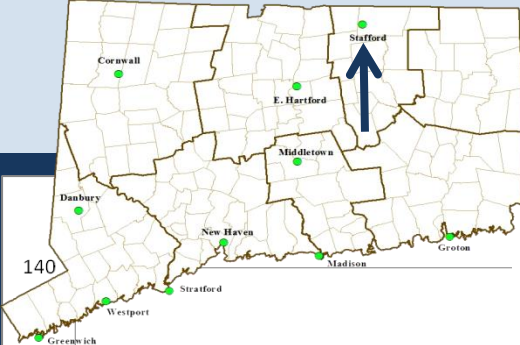
Middletown (inland)



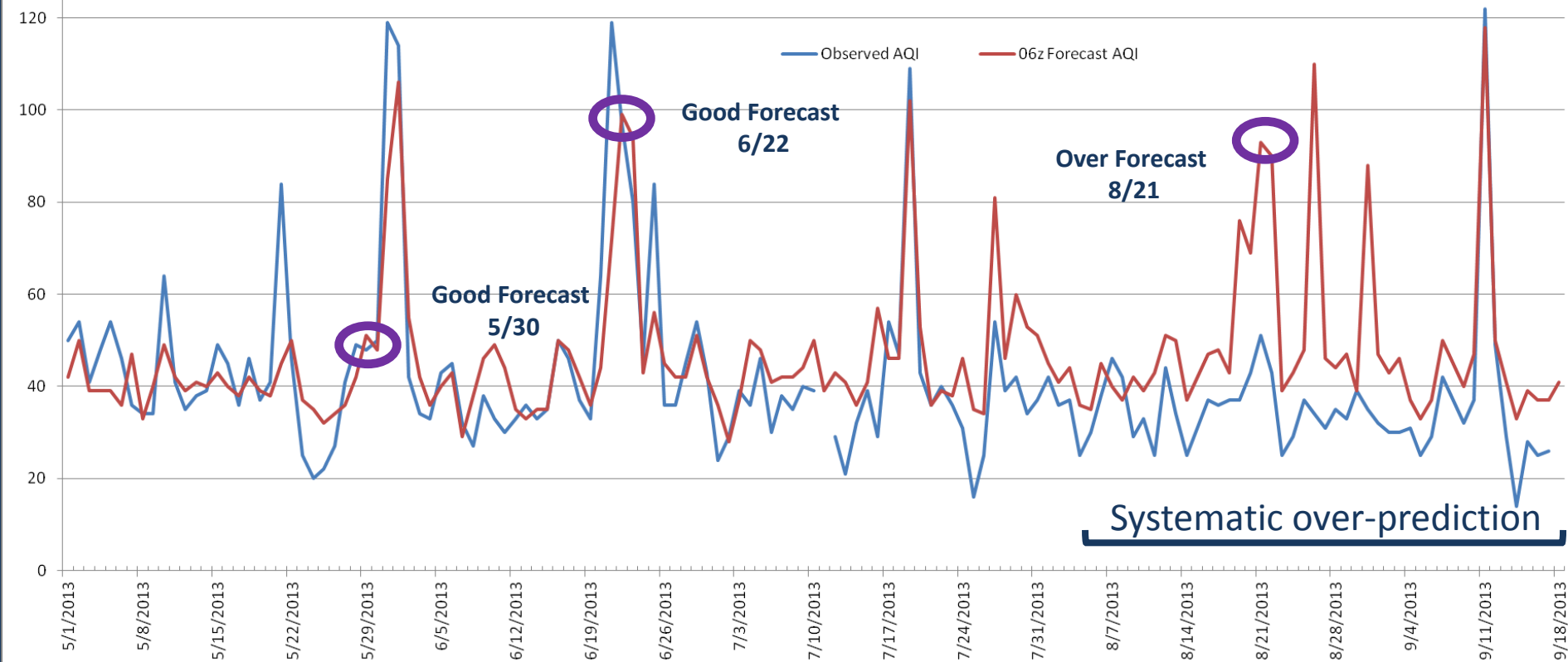
Middletown 06z Ozone Forecast vs. Observed AQI



Stafford site (inland)



Stafford 06z Ozone Forecast vs. Observed AQI

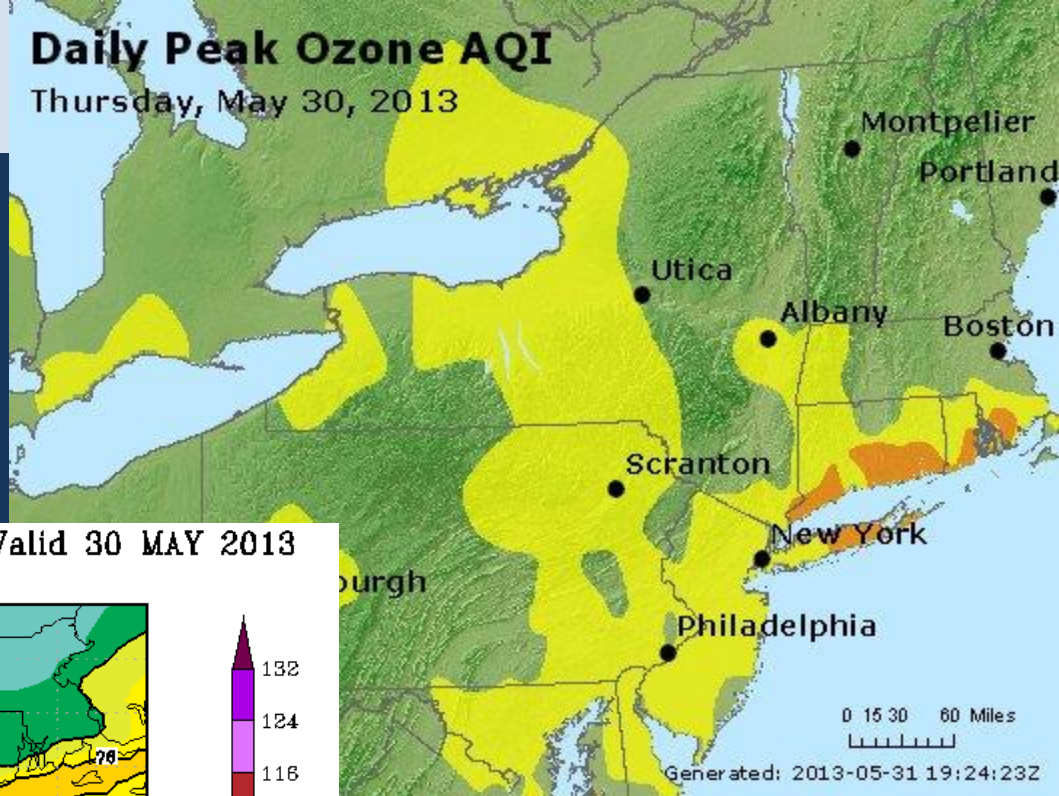


May 30, 2013

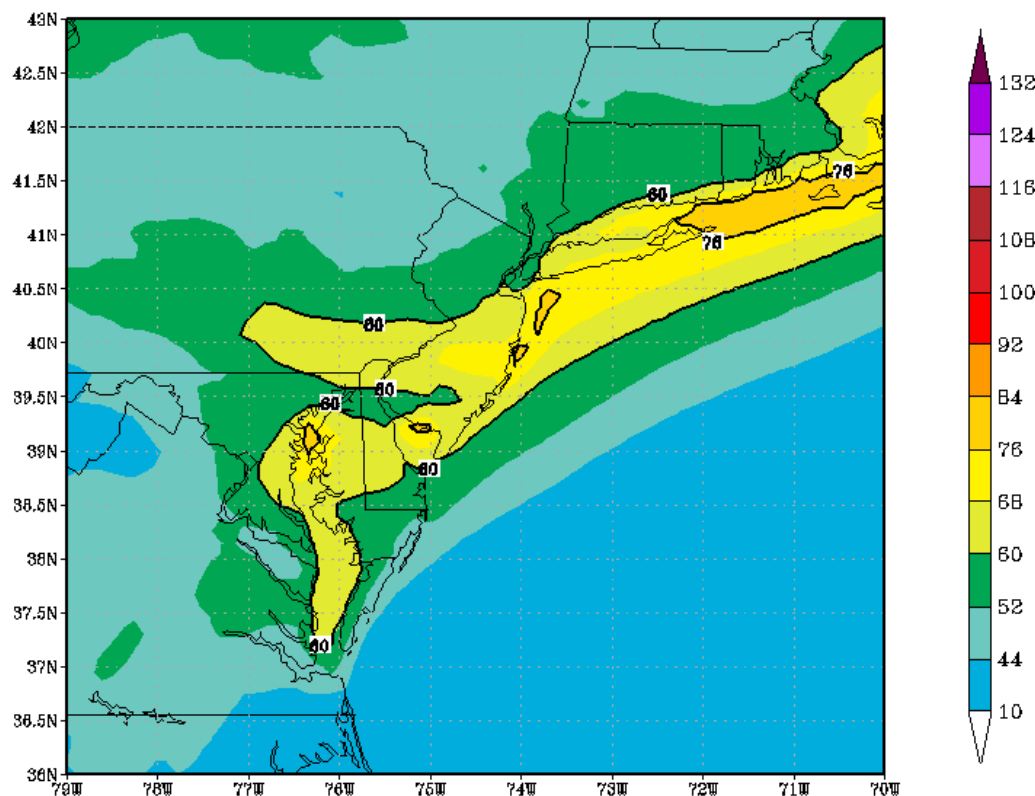
Daily Peak Ozone AQI

Thursday, May 30, 2013

- NOAA Model under predicted significant event for CT
- Same day forecast brought USG to coast
- Performed well for next 2 days (exceedances)

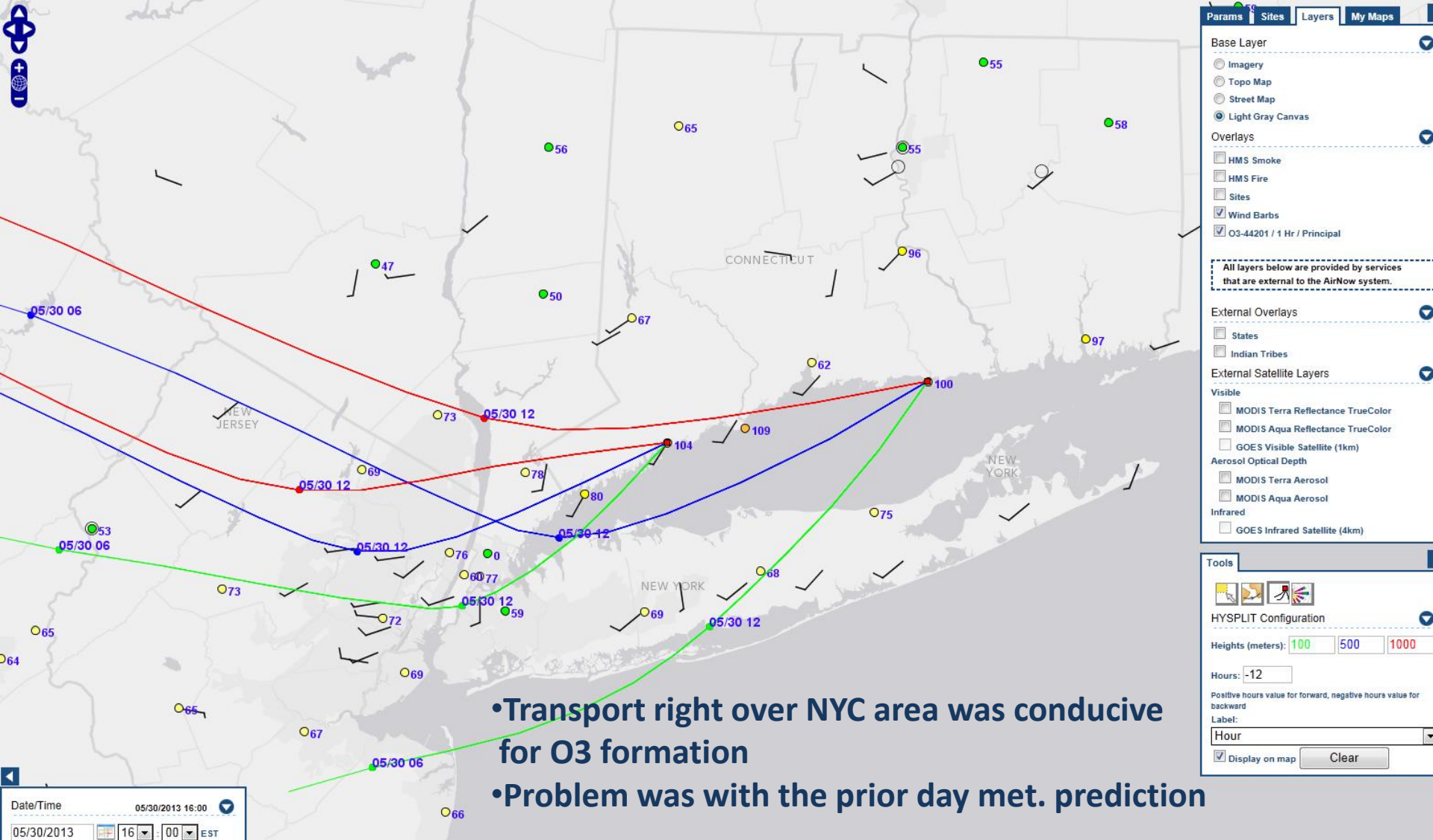


(prd) 06Z 31H-48H 2 day 8h max sf O_3 (ppbv) Valid 30 MAY 2013



Environmental Protection

May 30 Back Trajectory Analysis



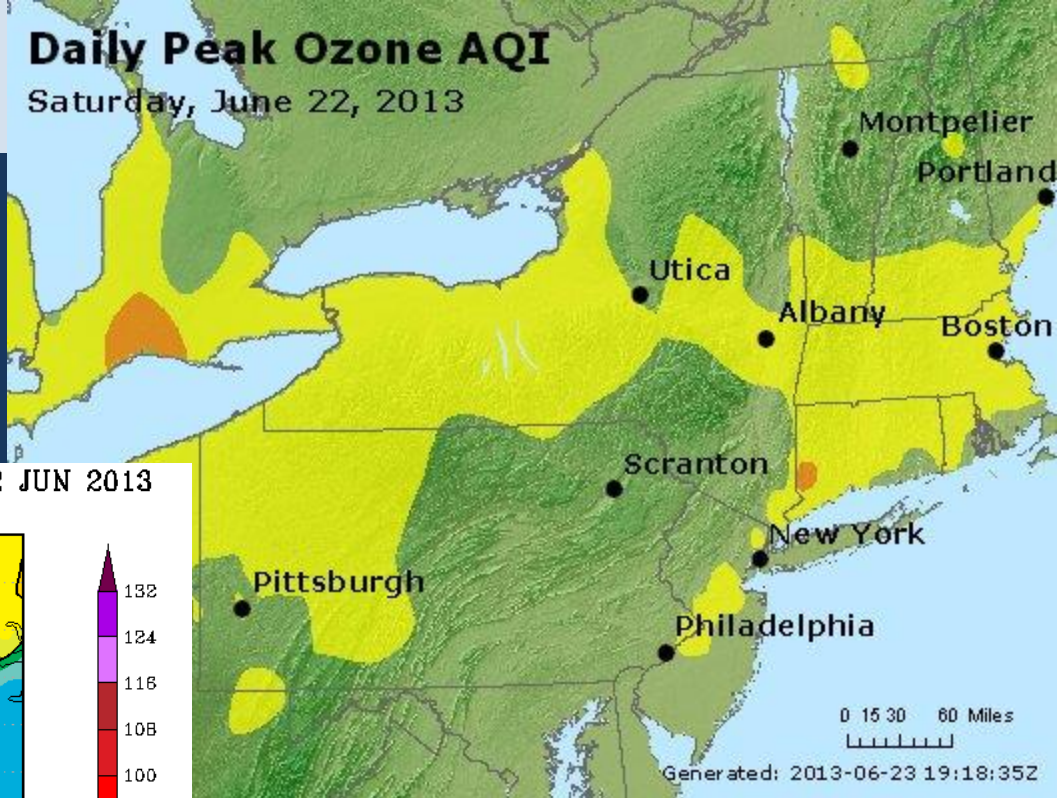
Connecticut Department of Energy and Environmental Protection

June 22, 2013

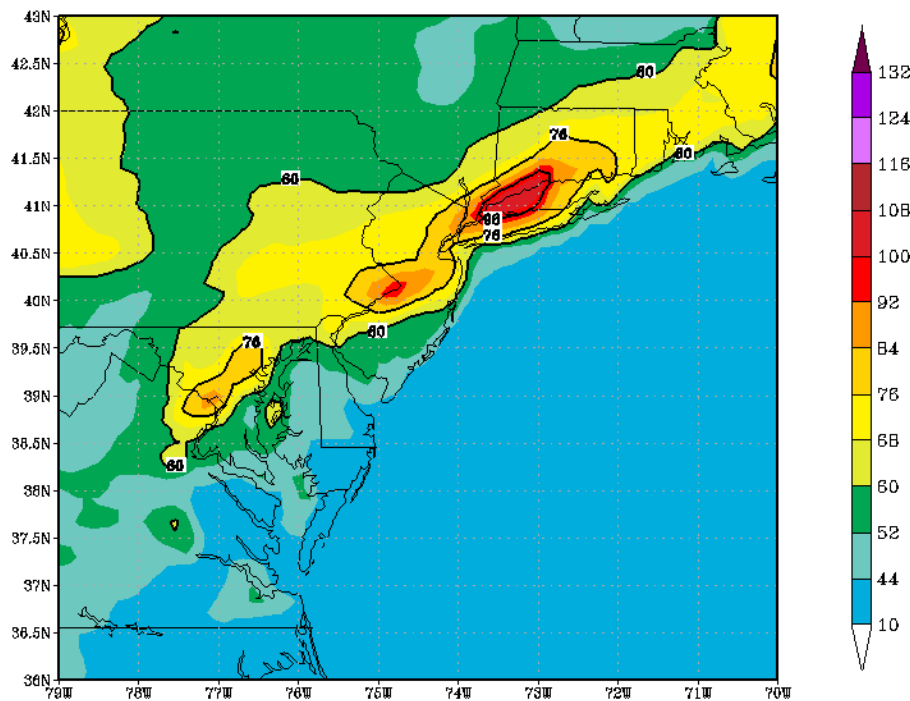
Daily Peak Ozone AQI

Saturday, June 22, 2013

- NOAA Model (over) predicted significant event for NJ-NY-CT
- Only Danbury went USG



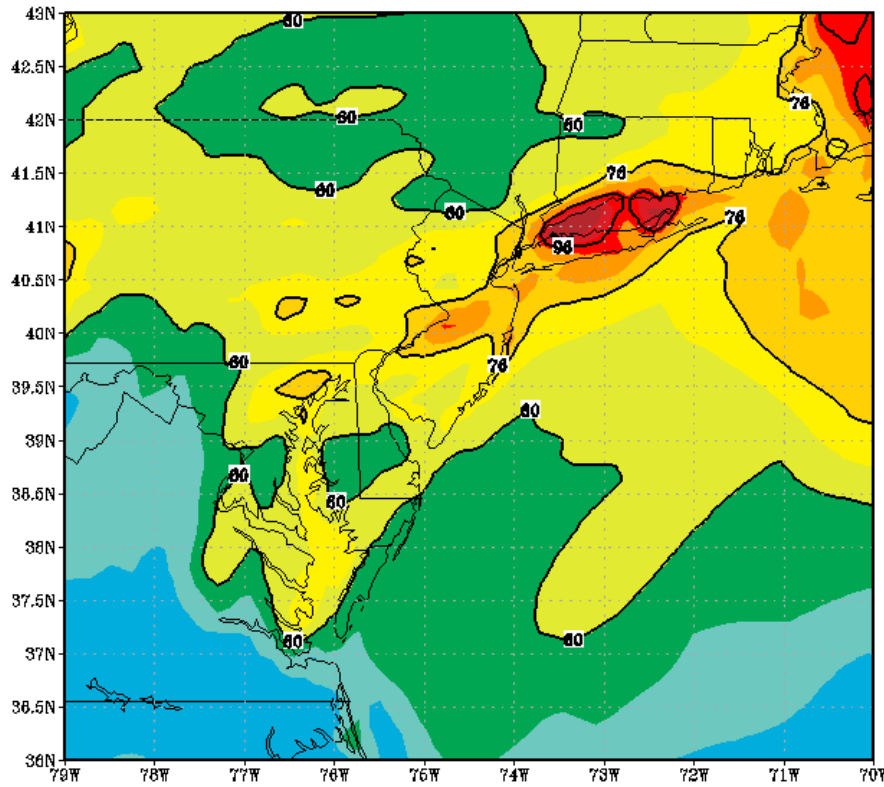
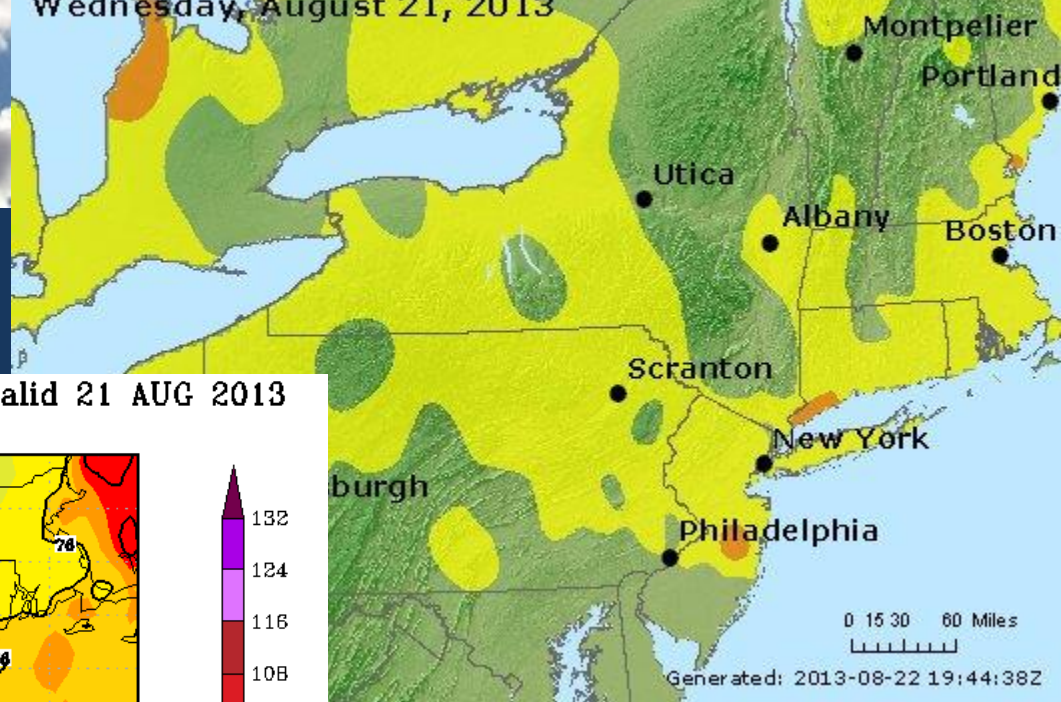
(prd) 06Z 31H-48H 2 day 8h max sf O₃ (ppbv) Valid 22 JUN 2013





August 21, 2013

(prd) 06Z 31H-48H 2 day 8h max sf O₃ (ppbv) Valid 21 AUG 2013

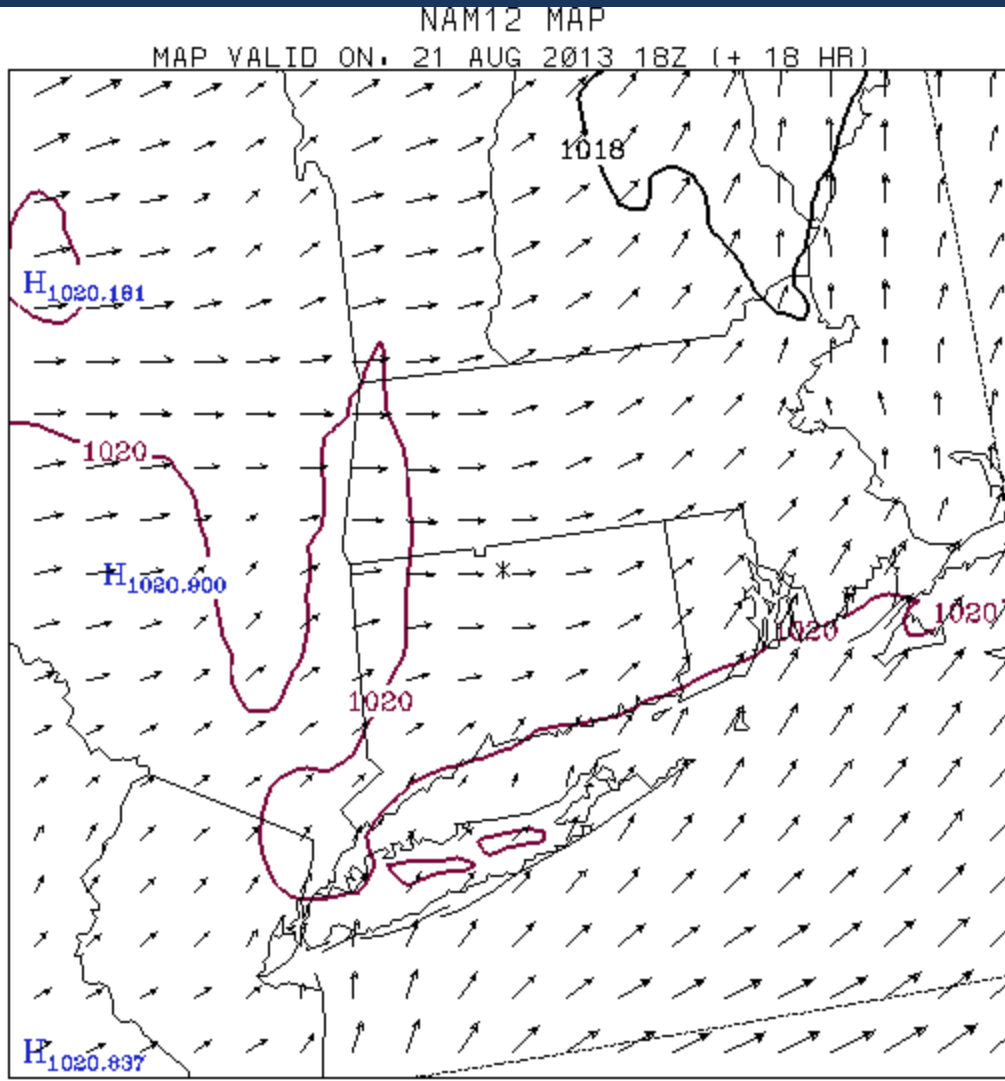


- NOAA Model (over) predicted significant event for NJ-NY-CT
- Even same day 12z similar!



Surface Wind Field August 21, 2013

METEOROLOGICAL DATASET INFORMATION
Initialization time: 00 UTC 21 AUG 2013



NOAA - AIR RESOURCES LABORATORY
READY Web Server

NAM wind flow prediction helps explain high ozone concentration along the CT coast and LIS

Environmental Protection

Conclusions

- NOAA model was a valuable tool for CT forecasters.
- Generally (but not always) under predicted ozone concentrations beginning of summer.
- Started a general over- prediction beginning August.
- CT forecasters showed better skill than model because we understood the tendencies.
- CT forecasters would be at a disadvantage without the NOAA model!

