2015 NOAA AQ Forecaster Focus Group Workshop

2015 Ozone Season - CMAQ Model Feedback

South Carolina Department of Health and Environmental Control

Promoting and Protecting the Health of the Public and the Environment

CMAQ Model Performance Methodology

- NOAA/EPA 12Z model run was used exclusively for this study.
- Day 2 (tomorrow's forecast) CMAQ model maximum 8-hour concentrations are extracted for every day since April 1st at ALL MONITOR LOCATIONS that are used by South Carolina for verification.
- Day 1 (today's forecast) CMAQ model maximum 8-hour concentrations are extracted for every day since April 1st at ONE REPRESENTATIVE MONITOR SITE from each forecast zone. The chosen representative location is the typical maximum monitored concentration site for the zone.

CMAQ Model Performance Methodology (cont.)

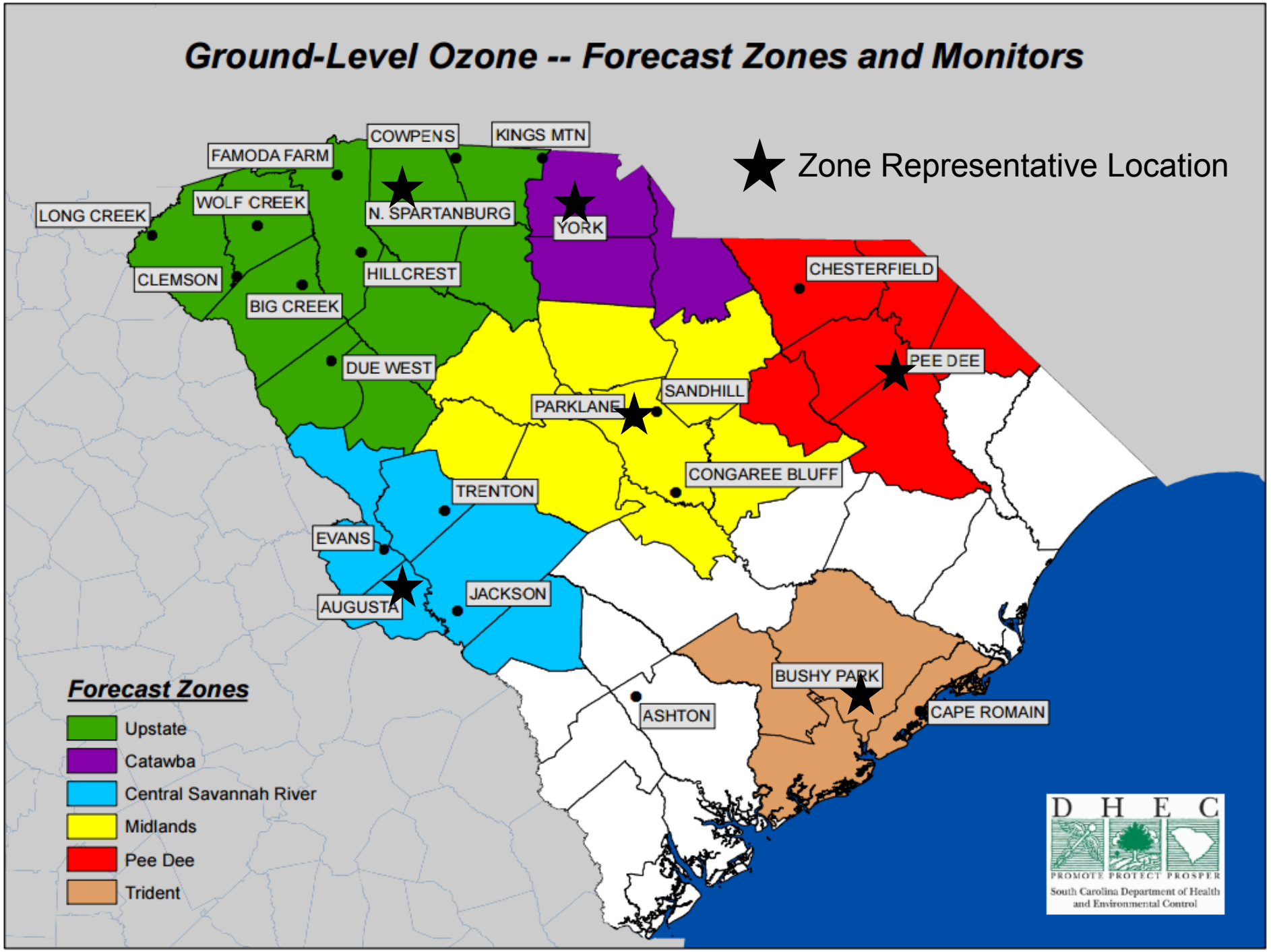
- **"NOAA Value"** {compiled data from ALL monitor locations in each zone}
  (Day 2 zone max 8-hour prediction) **–** (Day 2 zone max 8-hour monitor observation)

- **"NOAA Diff"** {compiled data from a REPRESENTATIVE monitor location in each zone}
  [(Day 2 8-hour max prediction) **–** (Day 1 8-hour max prediction)] **+** (Day 1 zone max 8-hour monitor observation) **–** (Day 2 zone max 8-hour monitor observation)

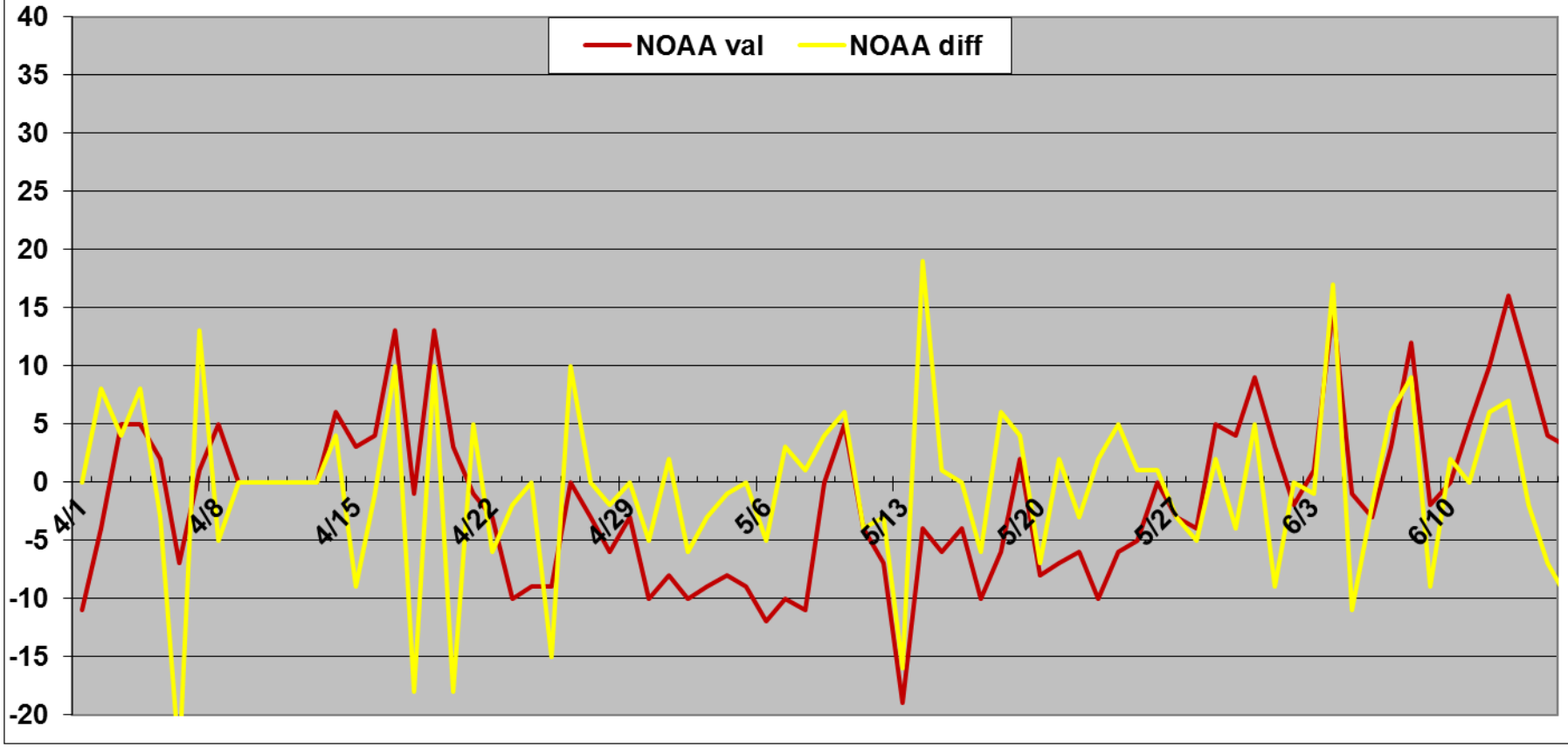
- SC DHEC Bureau of Air Quality "**BAQ**" forecast biases are shown for comparison.

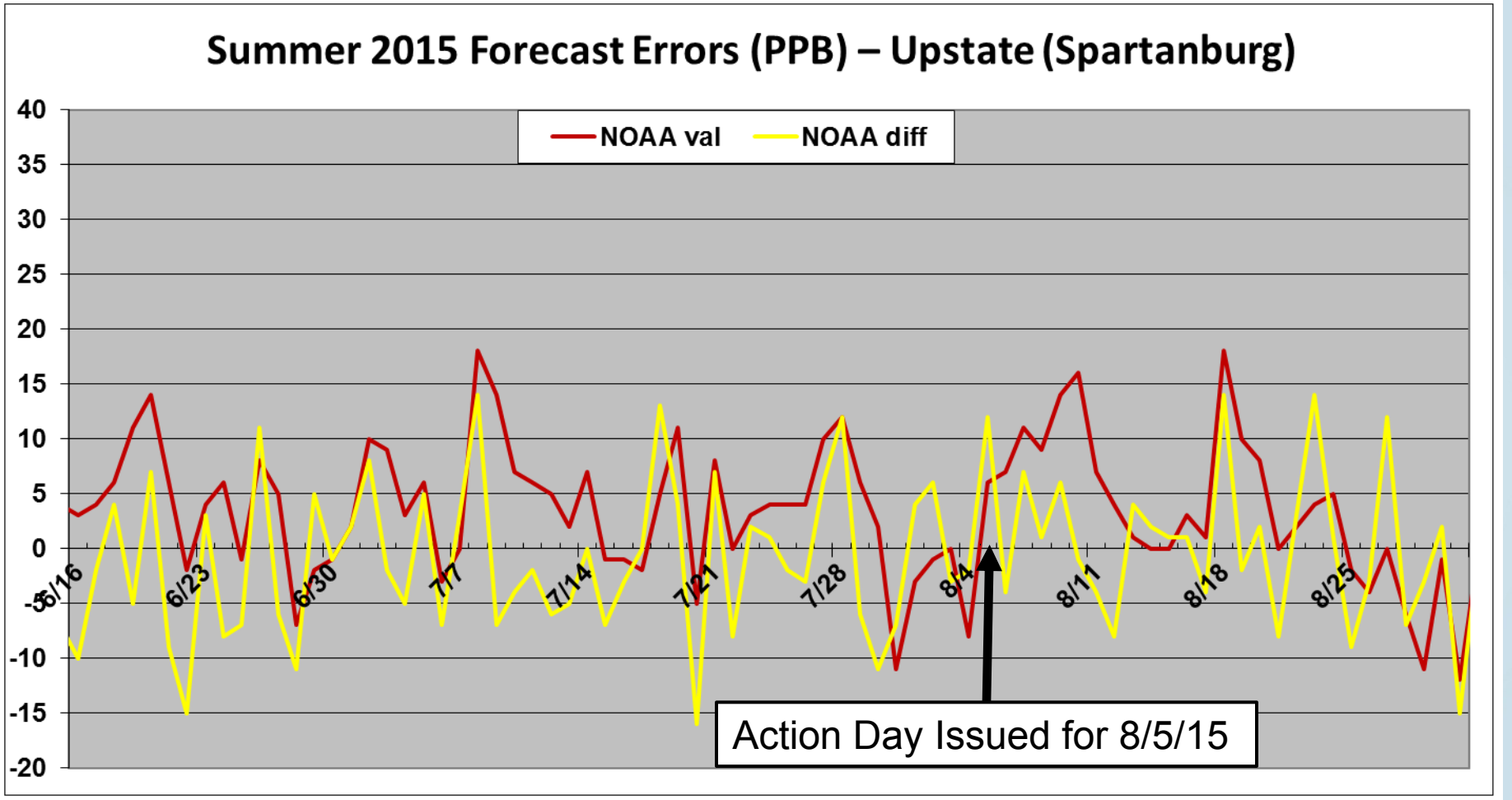
- Missing NOAA CMAQ data from April 9th to April 13th due to SC DHEC Linux downtime.

Ground-Level Ozone -- Forecast Zones and Monitors



Spring 2015 Forecast Errors (PPB) – Upstate (Spartanburg)

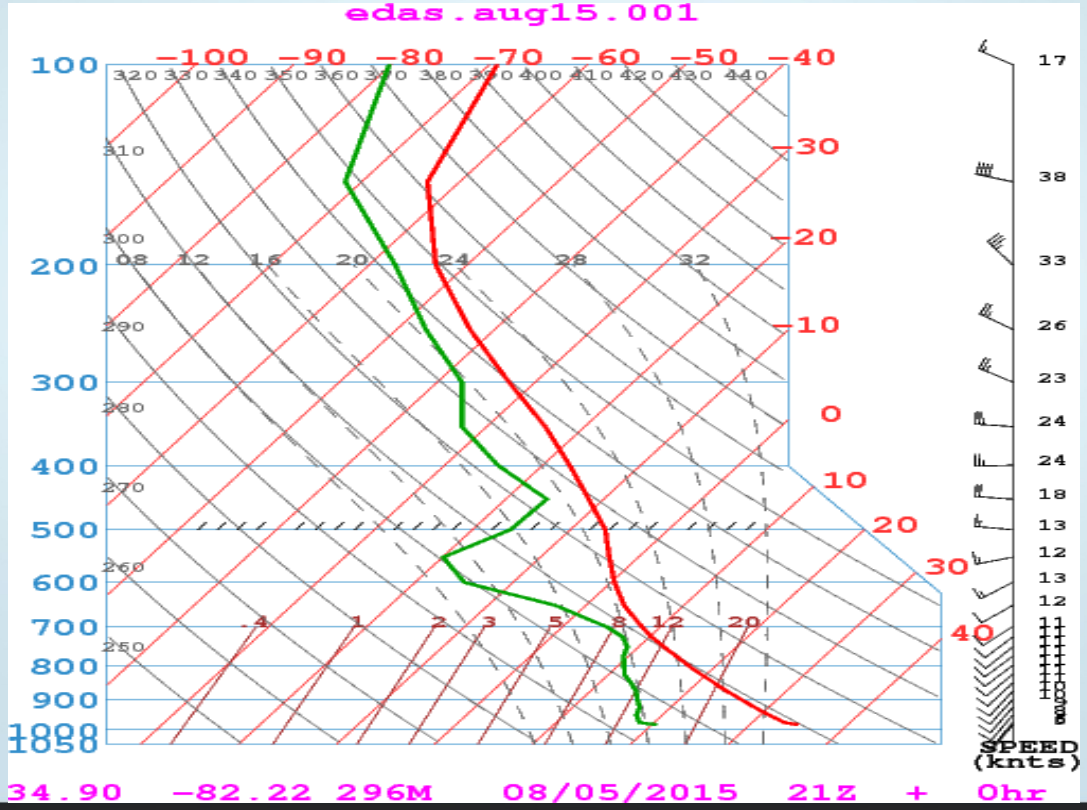



Summer 2015 Forecast Errors (PPB) – Upstate (Spartanburg)
NOAA val
NOAA diff
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
6/16
6/23
6/30
7/7
7/14
7/21
7/28
8/4
8/11
8/18
8/25
Action Day Issued for 8/5/15

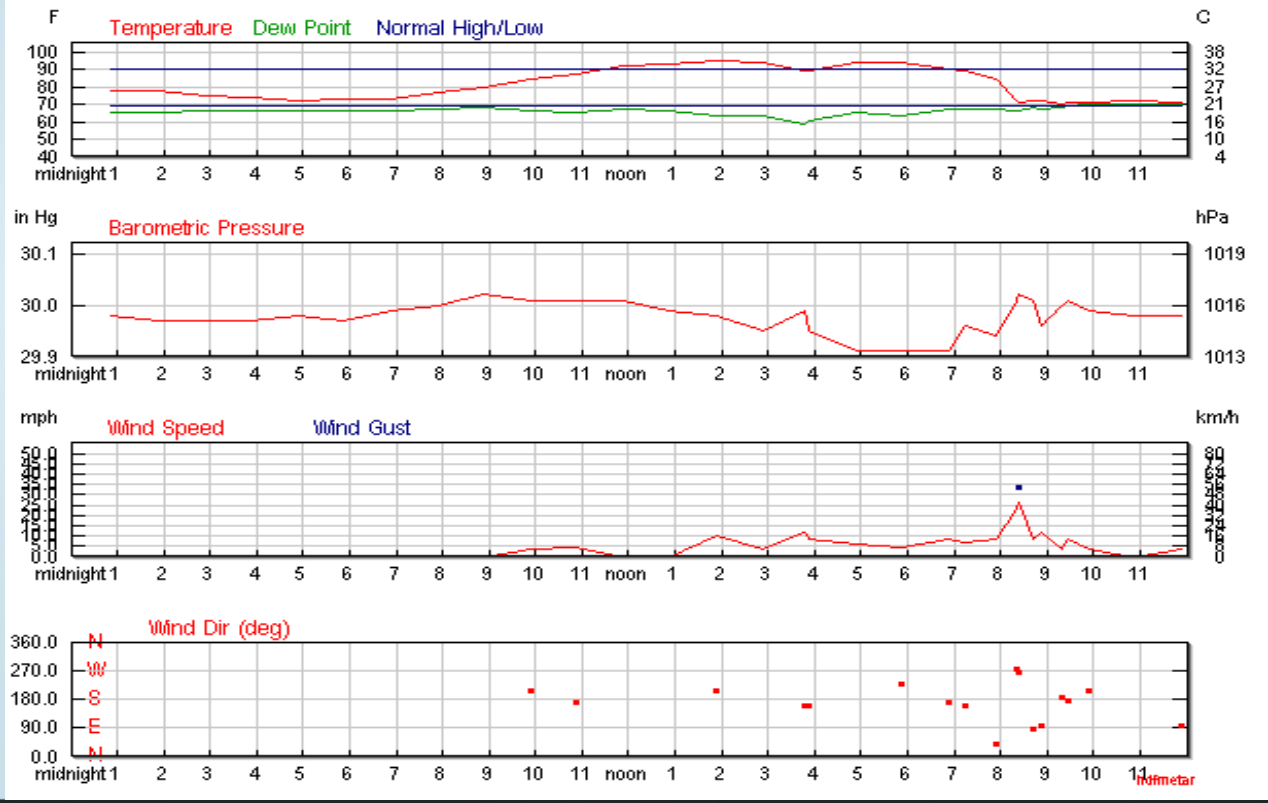
8-hr observed maximums

Obs & Forecasts for 5 Aug 2015 (ppb)						
	Midlands	Upstate	CSRA	Pee Dee	Catawba	Trident
Observed	57	69	60	60	55	42
Forecast	64	76	68	58	60	46

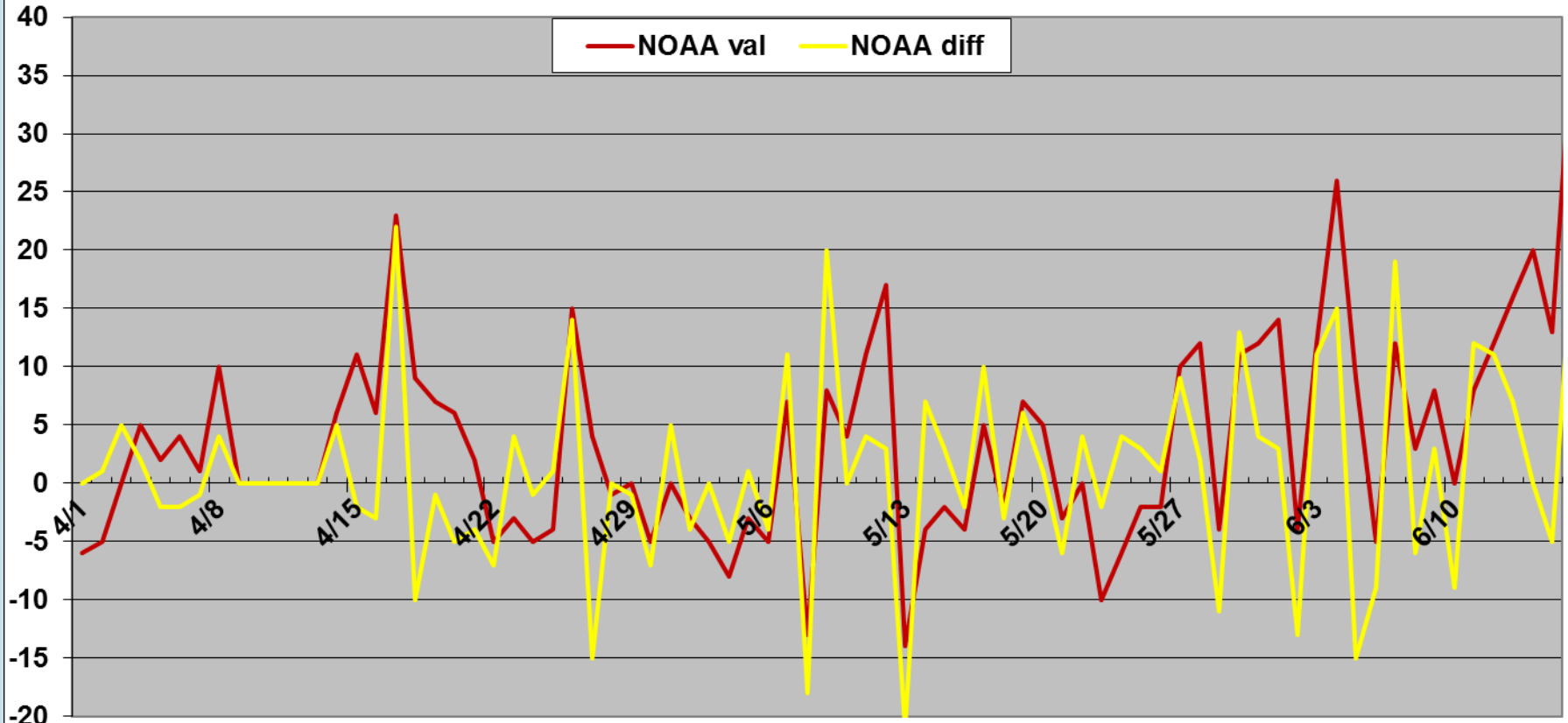
GSP sounding at 21Z for 5 Aug 2015



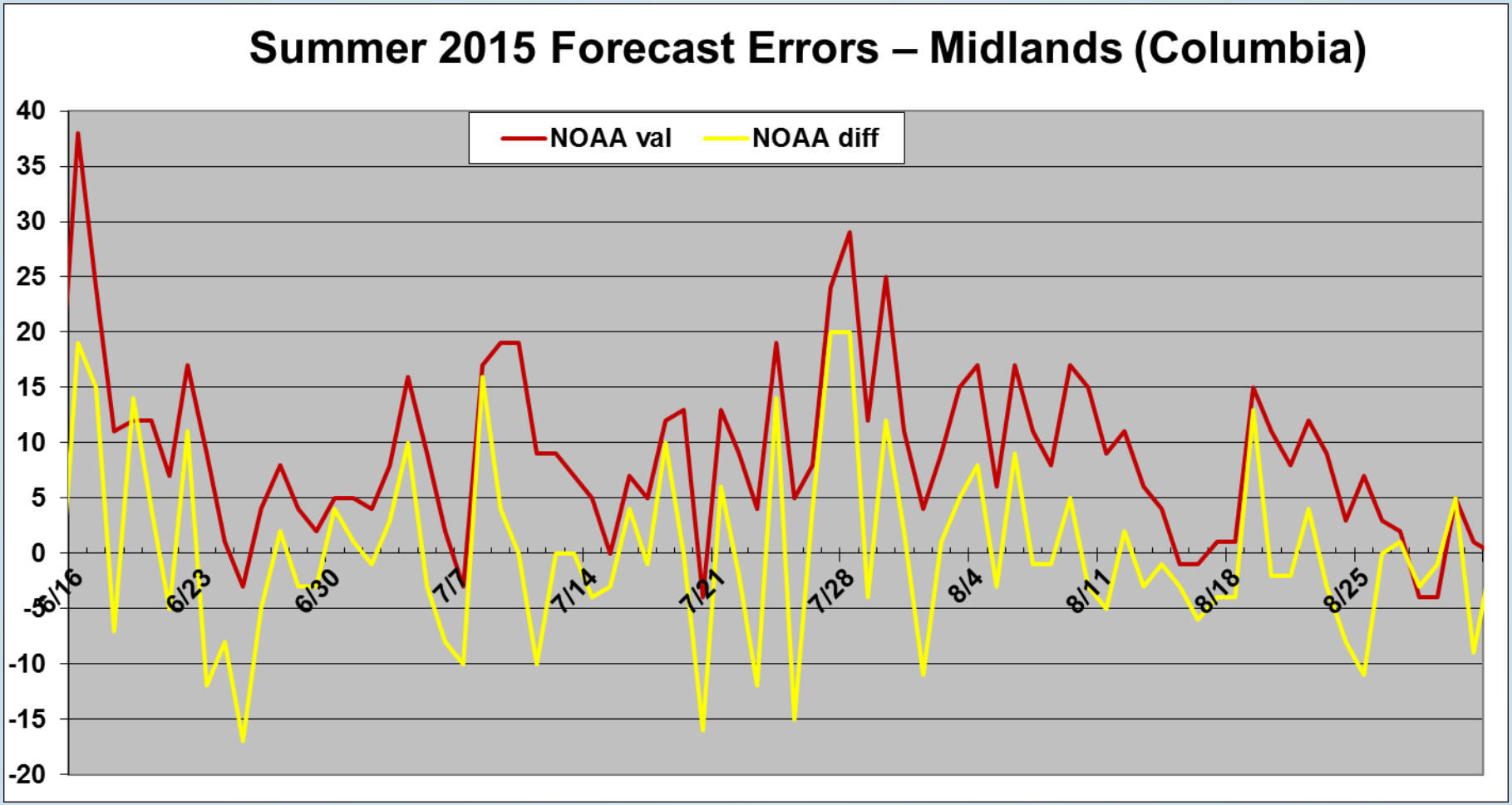
Meteogram of GSP for 5 Aug 2015

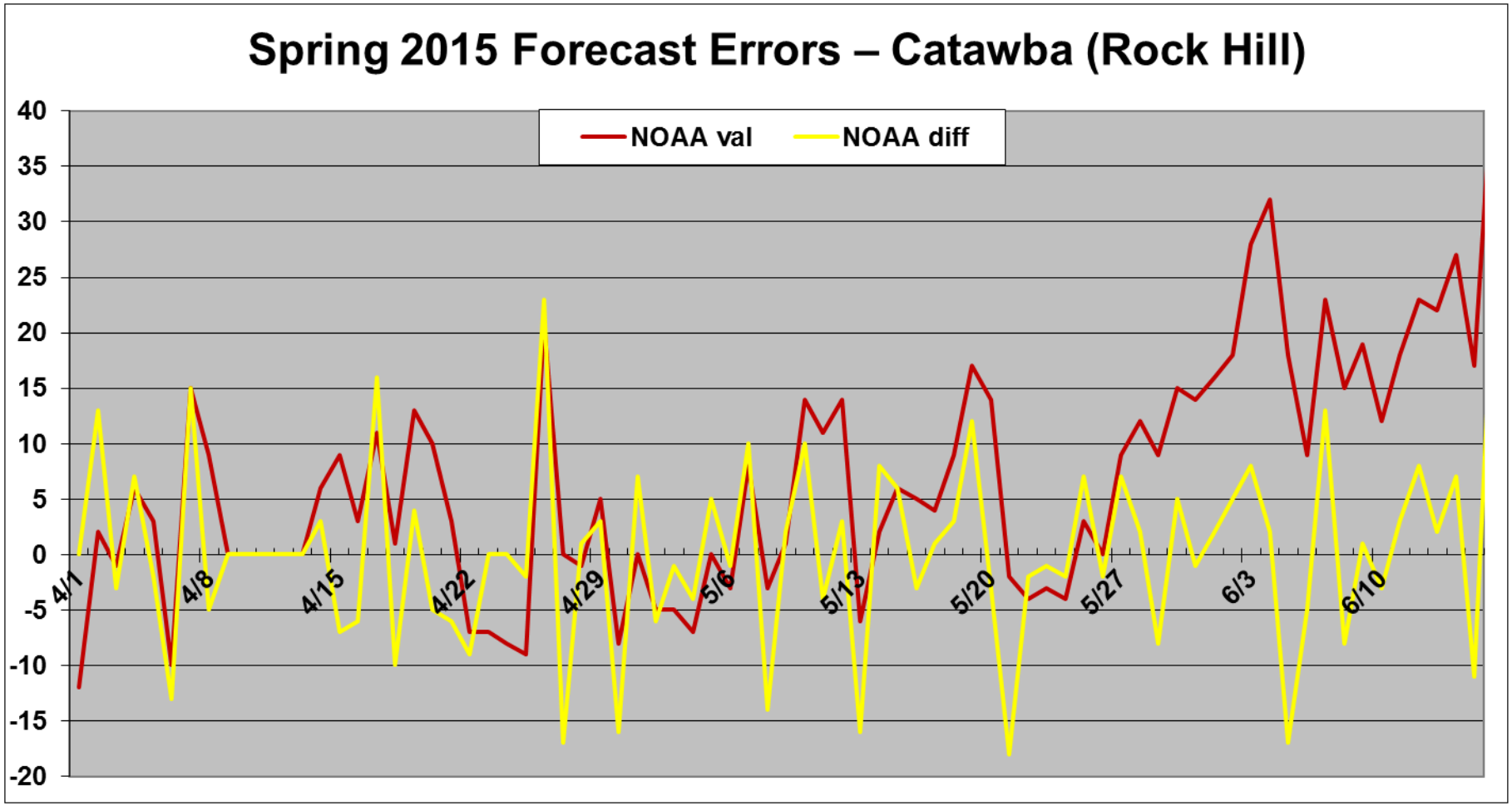


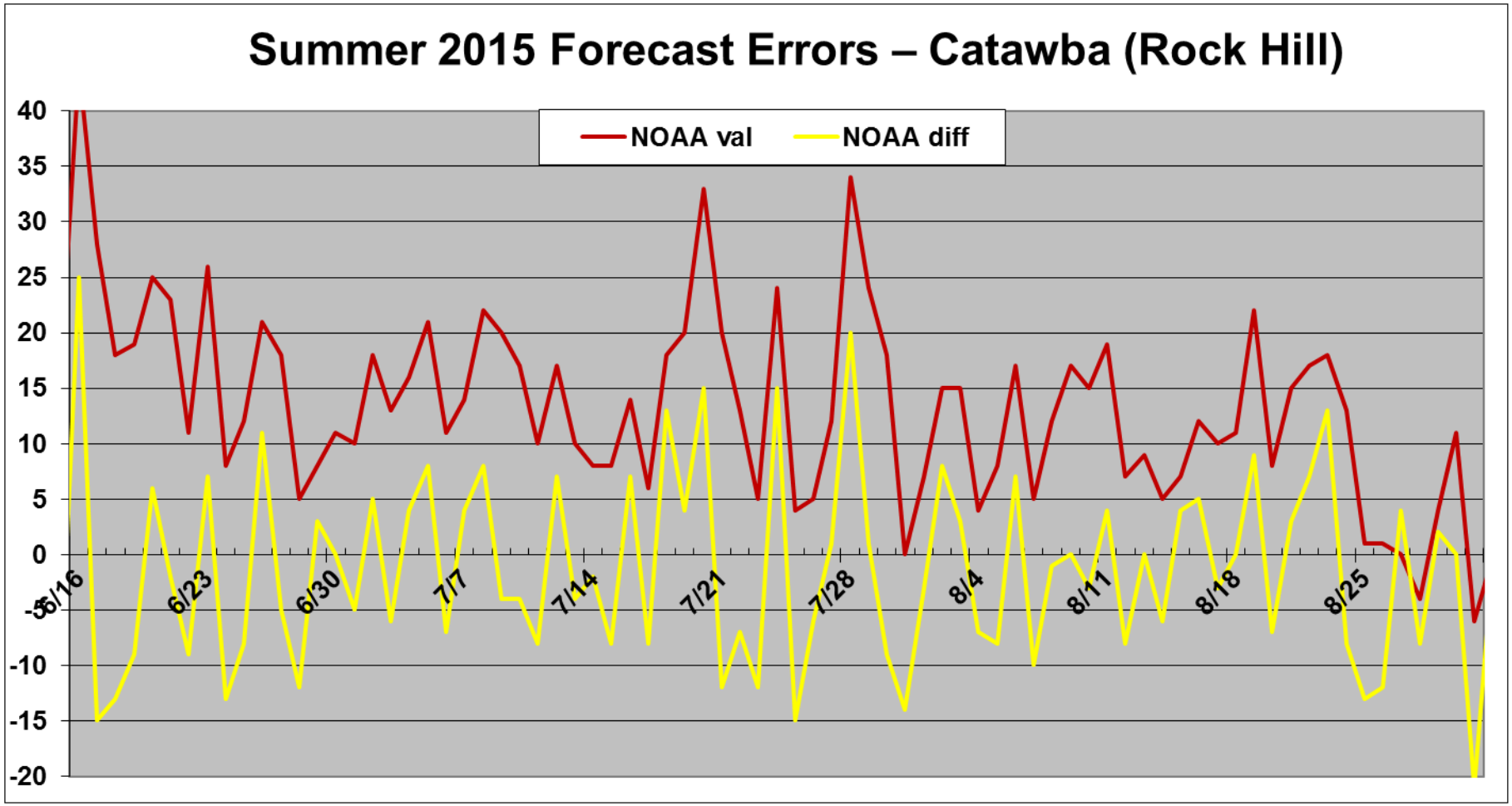
Spring 2015 Forecast Errors – Midlands (Columbia)



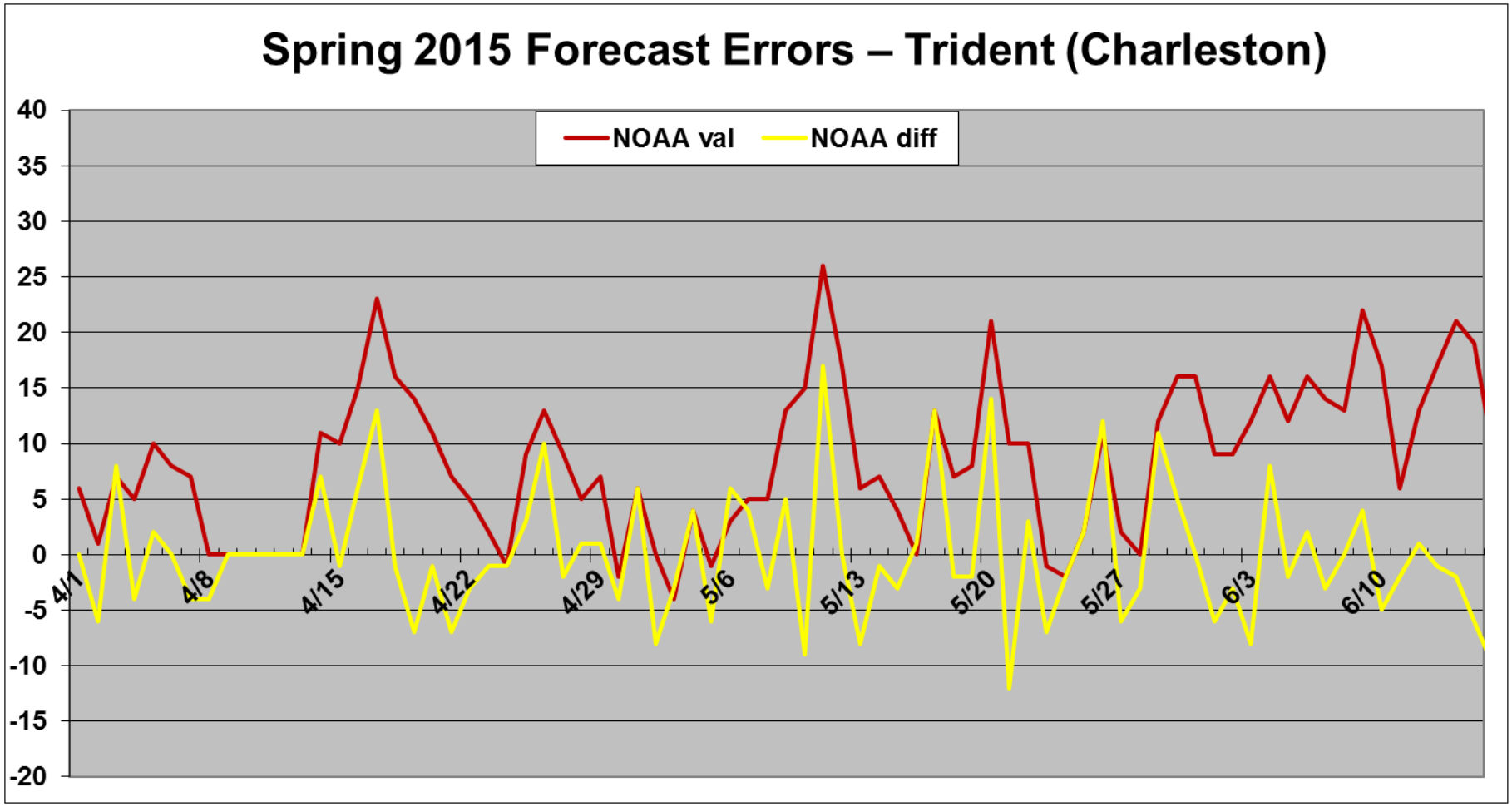
Summer 2015 Forecast Errors – Midlands (Columbia)

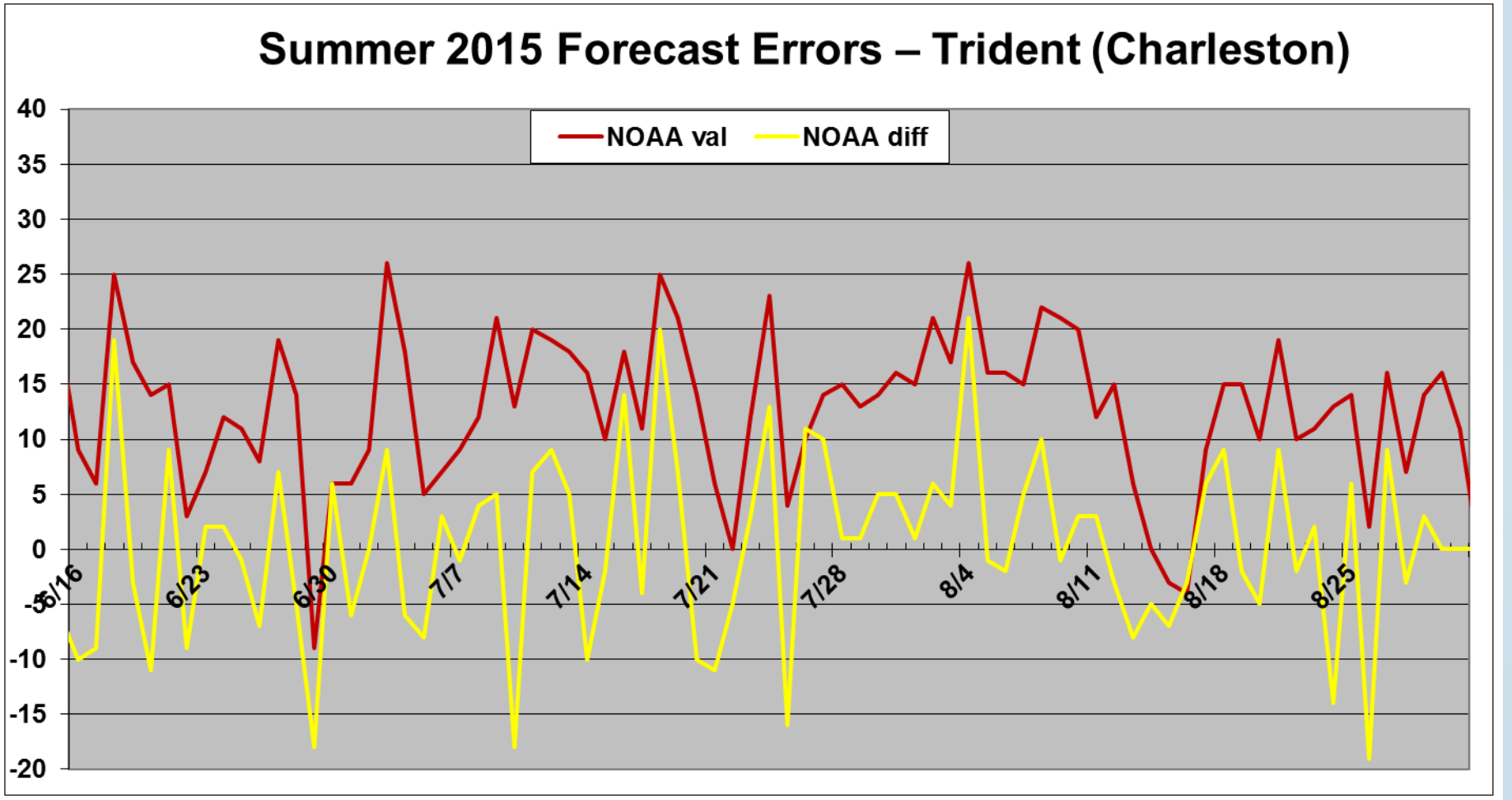



Spring 2015 Forecast Errors – Catawba (Rock Hill)
NOAA val
NOAA diff
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10


Summer 2015 Forecast Errors – Catawba (Rock Hill)
NOAA val
NOAA diff
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
6/16
6/23
6/30
7/7
7/14
7/21
7/28
8/4
8/11
8/18
8/25

Spring 2015 Forecast Errors – Trident (Charleston)




Summer 2015 Forecast Errors – Trident (Charleston)
NOAA val
NOAA diff
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
6/16
6/23
6/30
7/7
7/14
7/21
7/28
8/4
8/11
8/18
8/25

CMAQ Model Performance for SC 2015

Forecast Bias (PPB)	Midlands (Columbia)			Upstate (Spartanburg)			Central Savannah (Augusta, GA)		
	BAQ	NOAA		BAQ	NOAA		BAQ	NOAA	
		Value	Diff		Value	Diff		Value	Diff
2015 Ozone Season (Apr 1 – Aug 31)	3.9	6.3	0.5	2.2	1.1	-0.6	3.2	6.1	0.6
Spring (Apr 1 – June 15)	2.7	3.4	0.8	1.0	-1.5	-0.5	2.0	4.1	0.5
Summer (June 16 – Aug 31)	5.2	8.9	0.2	3.4	3.5	-0.6	4.4	7.9	0.8

Forecast Bias Color Key	<2	2-5	>5

CMAQ Model Performance for SC 2015

Forecast Bias (PPB)	Catawba (Rock Hill)			Pee Dee (Florence)			Trident (Charleston)		
	BAQ	NOAA		BAQ	NOAA		BAQ	NOAA	
		Value	Diff		Value	Diff		Value	Diff
2015 Ozone Season (Apr 1 – Aug 31)	5.7	10.2	-0.7	2.0	4.6	0.1	2.2	11.0	0.3
Spring (Apr 1 – June 15)	5.3	6.7	-0.1	1.7	3.5	0.5	1.6	9.1	0.1
Summer (June 16 – Aug 31)	6.1	13.5	-1.3	2.2	5.7	-0.3	2.8	12.7	0.4

Forecast Bias Color Key	<2	2-5	>5

Summary of SC Comments on NOAA Operational CMAQ Guidance

- "NOAA Value" (Day 2 CMAQ actual value) forecasts generally over-predicted ozone concentrations.
- "NOAA Value" over-predicted more often during Summer months (June-August). The bias was much closer to zero in April and May, but the Upstate zone was under-predicted slightly in Spring months.
- "NOAA Diff" CMAQ forecast daily differences (day 2 CMAQ value – day 1 CMAQ value + day 1 monitor observation) generally removes the day to day model bias on average. However, mean absolute error statistics do not show significant improvement.
- SC forecasters use the "NOAA Diff" methodology to develop a day 2 forecast.

Summary of SC Comments on NOAA Operational CMAQ Guidance

- During Summer months, the model tends to over-predict urban plumes during ideal ozone production conditions (dry, warm, sunny, little or no wind, subsidence, extended periods of a stable atmosphere). This is especially evident in the Augusta, Columbia, and Rock Hill areas.
- The model does fairly well with the Upstate zone, where concentrations are typically highest. Model biases in the Upstate are generally lower than the rest of the state.
- The data shown in this presentation are preliminary.
- Operational CMAQ output is excellent guidance!! Thanks!

The BAQ Meteorology Support Team

- Wes Behrend
- Andrew Kingston
- Greg Quina
- Steve Smutz

South Carolina Department of Health and Environmental Control
Promoting and Protecting the Health of the Public and the Environment

CONTACT US

www.scdhec.gov

(803) 898-DHEC (3432)

Follow us on Twitter.
@scdhec

Like us on Facebook.
www.fb.com/scdhec

Check us out on YouTube.
www.youtube.com/scdhec