MARYLAND

Maryland Ozone Forecasts in 2013

NOAA Air Quality Forecaster Focus Group Workshop
September 26 – 27, 2013

Laura Warren
Joel Dreessen
Meteorologists

Martin O'Malley, *Governor* | Anthony G. Brown, *Lt. Governor* | Robert M. Summers, Ph.D., *Secretary*

Ozone Season 2013

- ❑ 9 Maryland exceedance days, > 75 ppb 8-hour daily max
  - ▪ 9 Unhealthy for Sensitive Groups (USG), or Orange, days
  - ▪ 0 Unhealthy, or Red, days
- ❑ Well below the 5-year average of 29 Maryland exceedance days
  - ▪ 6 out of 9 days were 76 – 78 ppb for the 8-hour daily max
  - ▪ 7 out of 9 days were only measured by 1 monitor
- ❑ July 19, 2013, Maryland's worst day of the season
  - ▪ 83 ppb at the Fairhill monitor was the highest 8-hour daily max
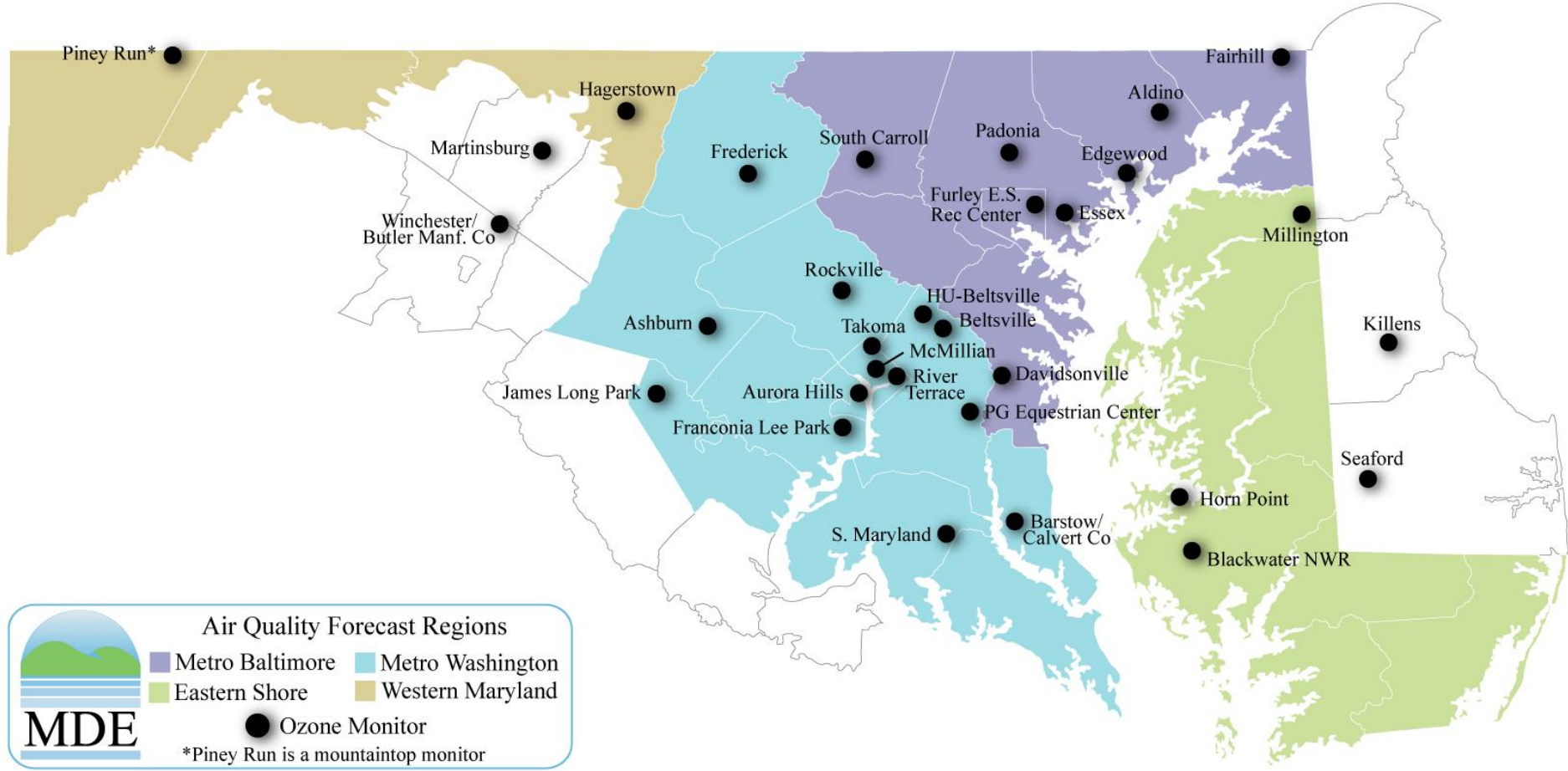 - ▪ Total of 3 monitors observed this exceedance day
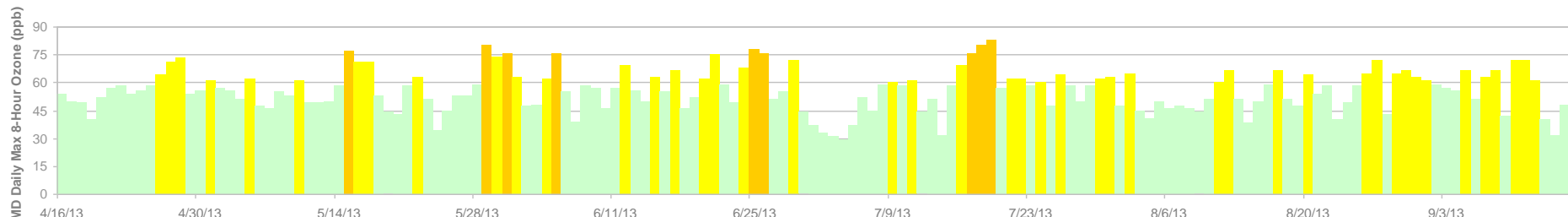
Notes: 2013 data are preliminary. Information above is based on Maryland only monitors.
Forecast verification statistics to follow are based on monitors shown on slide 3.
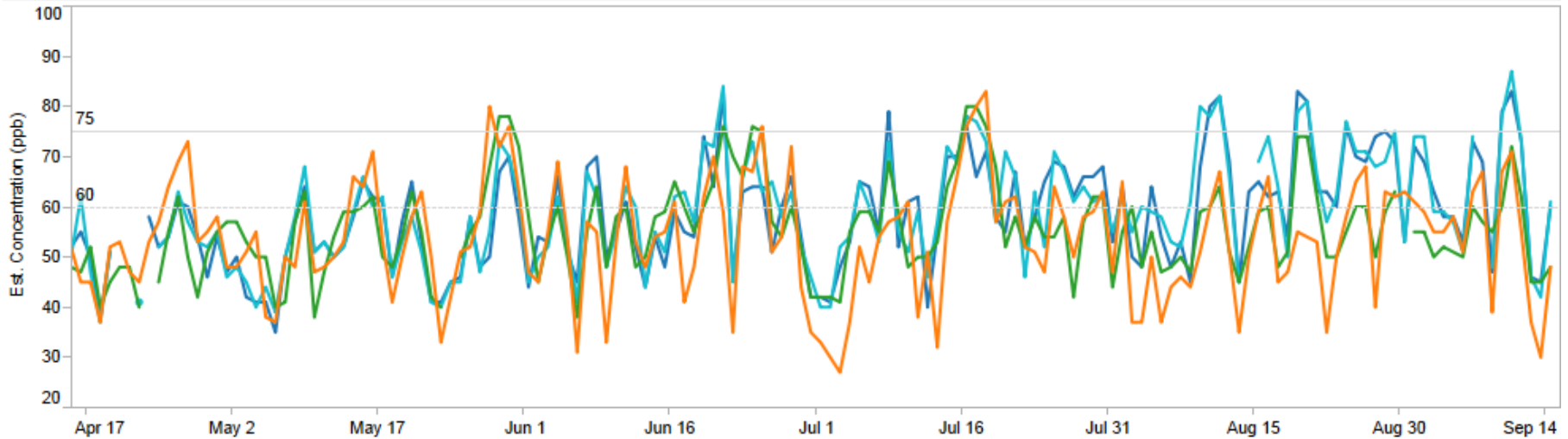Statistics are online at: http://public.tableausoftware.com/views/ForecastVerification2013/O3VerifPPB2
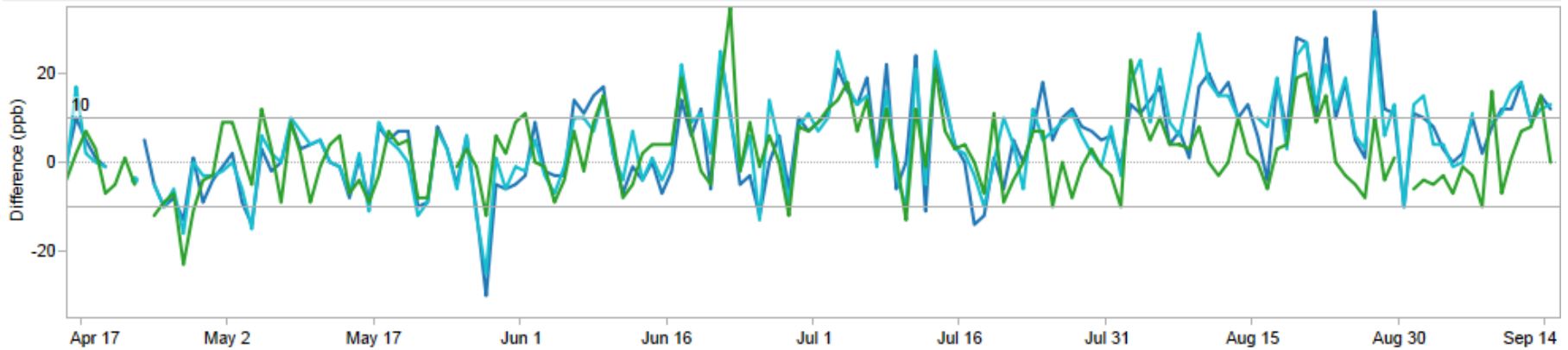
Forecast Regions & Monitors

Maryland & Washington Ozone (O3) Forecast Verification
April - September 2013

USG Days: 6

Comparison of Observed to Forecast Ozone

Forecast Difference from Observed Ozone

Agency	% Correct	POD		FAR		Bias	MAE (ppb)
Official	97	67	**73**	43	**20**	1.17	6.7
NOAA 06z	91	33	**68**	82	**40**	1.83	8.9
NOAA 12z	91	17	**71**	90	**40**	1.67	8.8

Forecast Statistics at USG Threshold   **2012**

Observed/Forecast
- Observed
- Official
- NOAA 06z
- NOAA 12z

Region
- ○ Eastern Shore
- ● Metro Baltimore
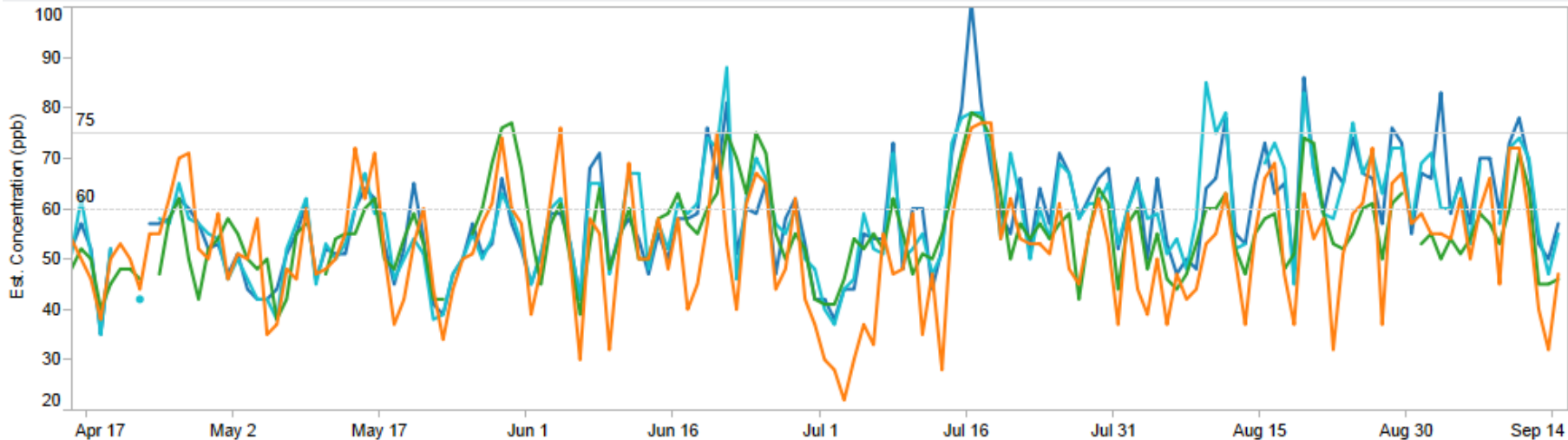- ○ Metro Washington
- ○ Western Maryland

MD had below average O3 with 9 days >75ppb statewide compared to the 5-year average of 29 days.

Est. concentrations are within +/- 2 ppb, derived from AQI.
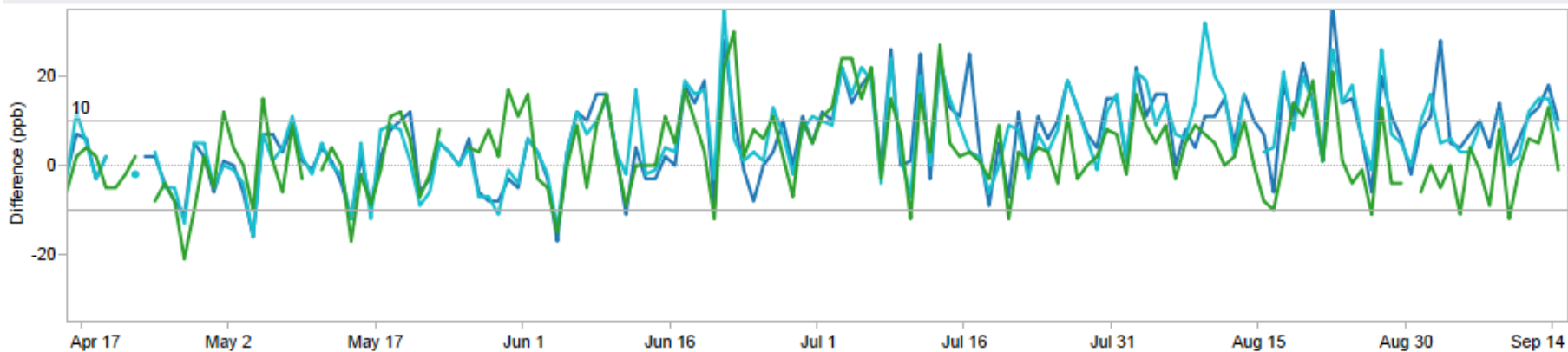*Data: MDE, VA DEQ, MWCOG, Airtow-Tech*

4

Maryland & Washington Ozone (O3) Forecast Verification
April - September 2013

Comparison of Observed to Forecast Ozone

Forecast Difference from Observed Ozone

Forecast Statistics at USG Threshold								2012
Agency	% Correct	POD		FAR		Bias	MAE (ppb)	
Official	97	50	**72**	50	**38**	1	7.3	
NOAA 06z	93	40	**67**	75	**56**	1.6	8.6	
NOAA 12z	93	40	**71**	80	**54**	2	8.9	

Observed/Forecast
- Observed
- Official
- NOAA 06z
- NOAA 12z

Region
- ○ Eastern Shore
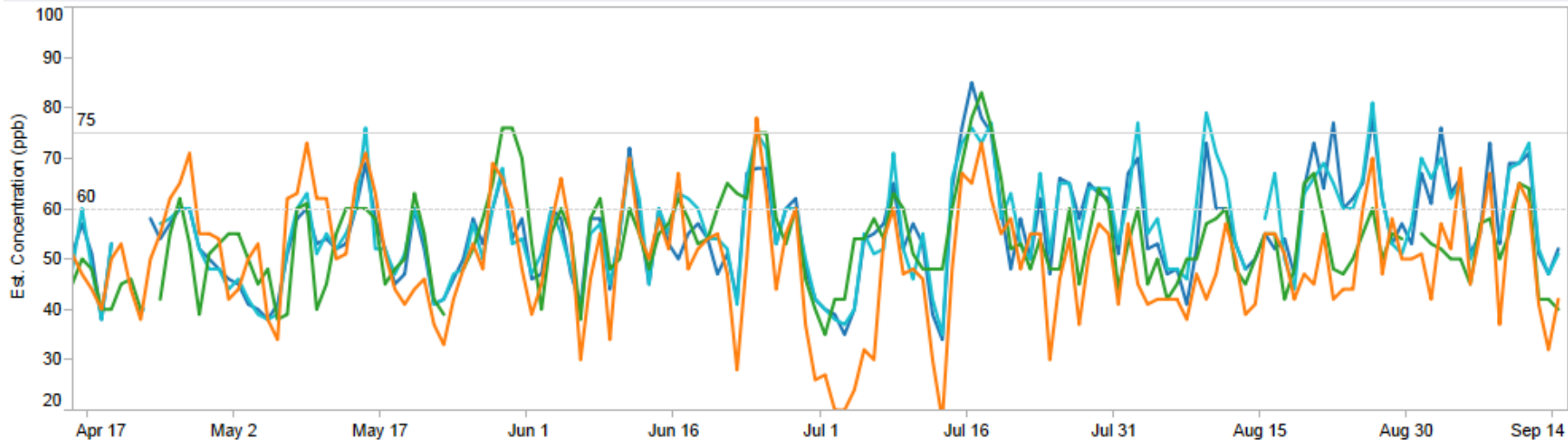- ○ Metro Baltimore
- ⦿ Metro Washington
- ○ Western Maryland

MD had below average O3 with 9 days >75ppb statewide compared to the 5-year average of 29 days.

Est. concentrations are within +/- 2 ppb, derived from AQI.
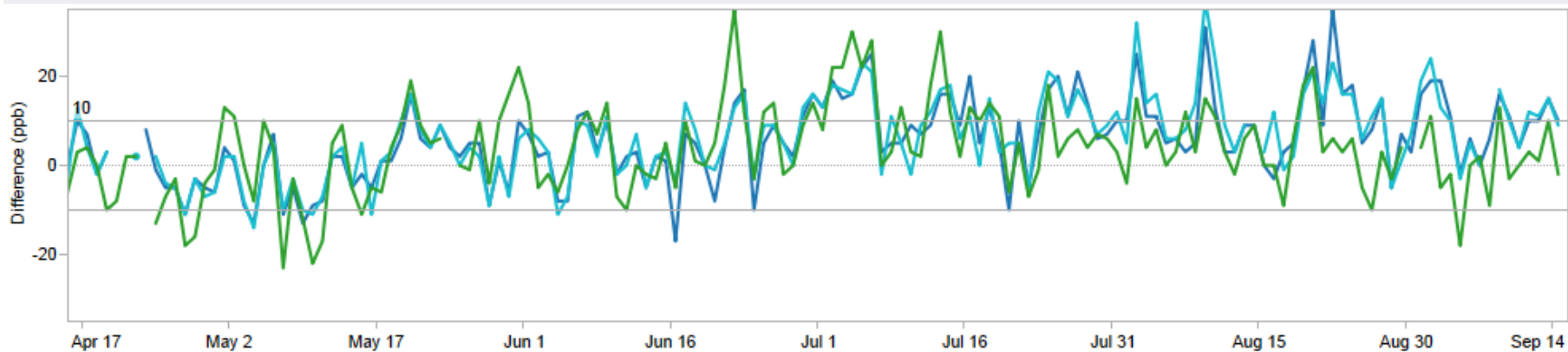*Data: MDE, VA DEQ, MWCOG, AirNow-Tech*

5

Maryland & Washington Ozone (O3) Forecast Verification
April - September 2013

USG Days: 1

Comparison of Observed to Forecast Ozone

Forecast Difference from Observed Ozone

Forecast Statistics at USG Threshold — 2012

Agency	% Correct	POD		FAR		Bias	MAE (ppb)
Official	97	0	**67**	100	**22**	4	8.1
NOAA 06z	93	0	**67**	100	**26**	5	8.9
NOAA 12z	95	0	**65**	100	**19**	6	8.7

Observed/Forecast
- Observed
- Official
- NOAA 06z
- NOAA 12z

Region
- ◉ Eastern Shore
- ○ Metro Baltimore
- ○ Metro Washington
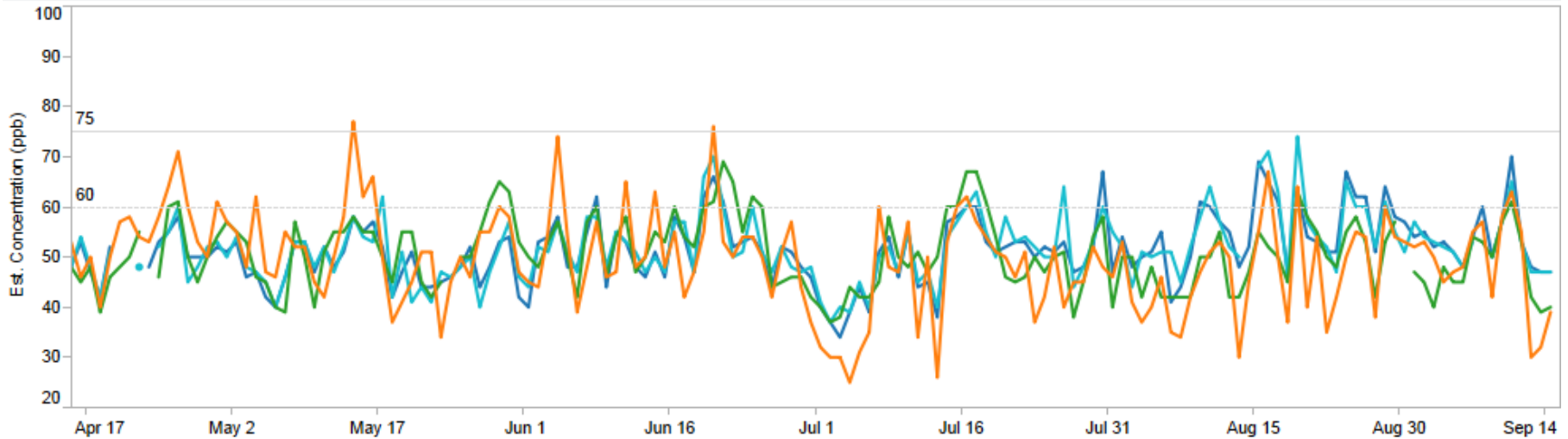- ○ Western Maryland

MD had below average O3 with 9 days >75ppb statewide compared to the 5-year average of 29 days.

Est. concentrations are within +/- 2 ppb, derived from AQI.
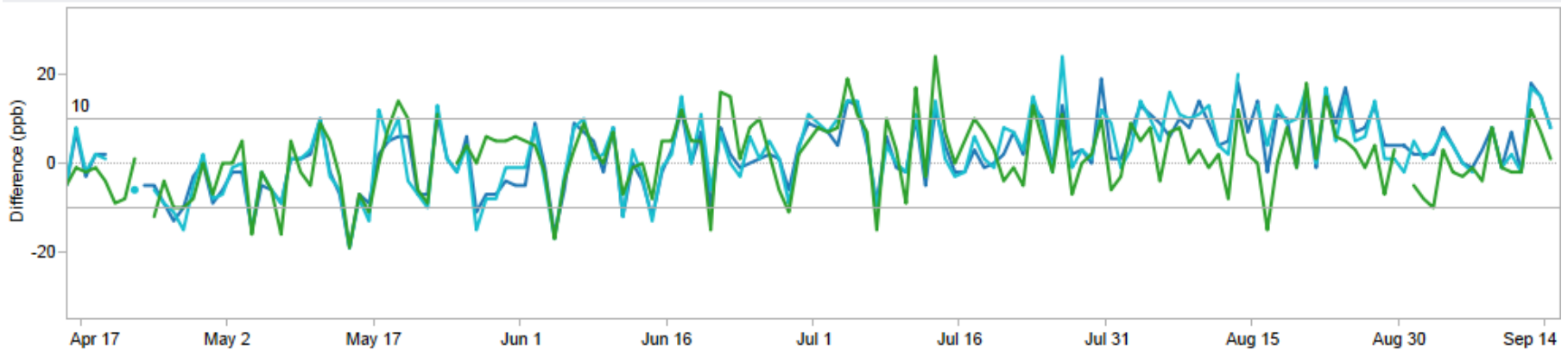*Data: MDE, VA DEQ, MWCOG, Airfow-Tech*

6

Maryland & Washington Ozone (O3) Forecast Verification
April - September 2013

Comparison of Observed to Forecast Ozone

Forecast Difference from Observed Ozone

Forecast Statistics at USG Threshold — **2012**

Agency	% Correct	POD		FAR		Bias	MAE (ppb)
Official	99	0	**25**	0	**33**	0	6.2
NOAA 06z	99	0	**13**	0	**50**	0	6.7
NOAA 12z	99	0	**13**	0	**0**	0	6.3

Observed/Forecast
- Observed
- Official
- NOAA 06z
- NOAA 12z

Region
- Eastern Shore
- Metro Baltimore
- Metro Washington
- (●) Western Maryland

MD had below average O3 with 9 days >75ppb statewide compared to the 5-year average of 29 days.

Est. concentrations are within +/- 2 ppb, derived from AQI.
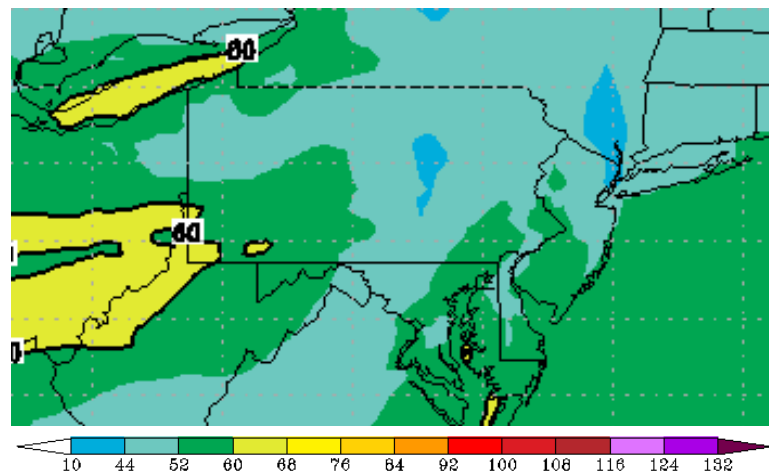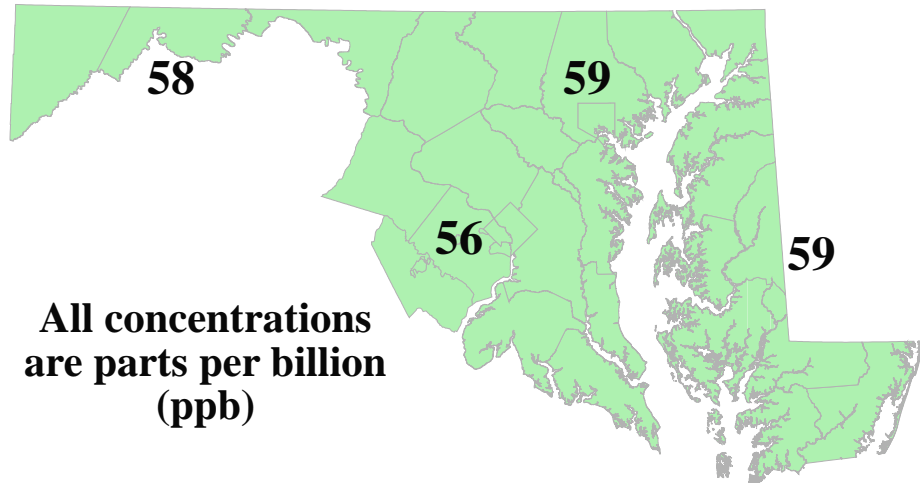*Data: MDE, VA DEQ, MWCOG, Airtow-Tech*
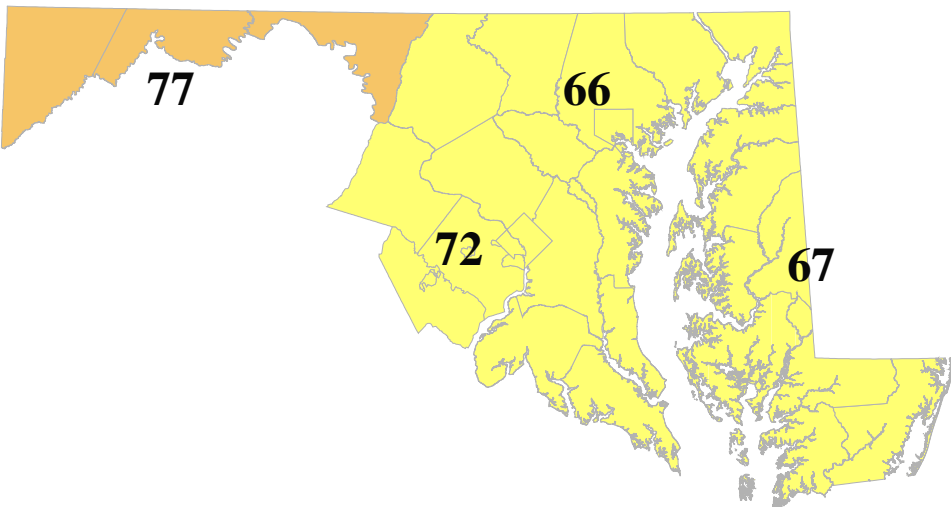
7

Early Season: May 15, 2013

Forecast 5-14-2013 Valid 5-15-2013

Official Forecast

NOAA 12Z

All concentrations are parts per billion (ppb)

58
59
56
59

Verification 5-15-2013

77
66
72
67

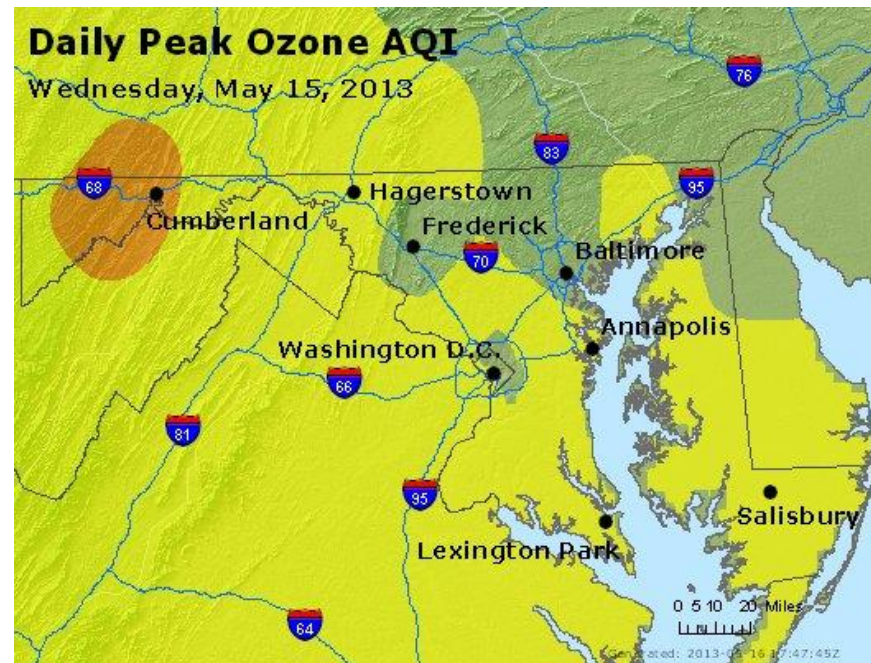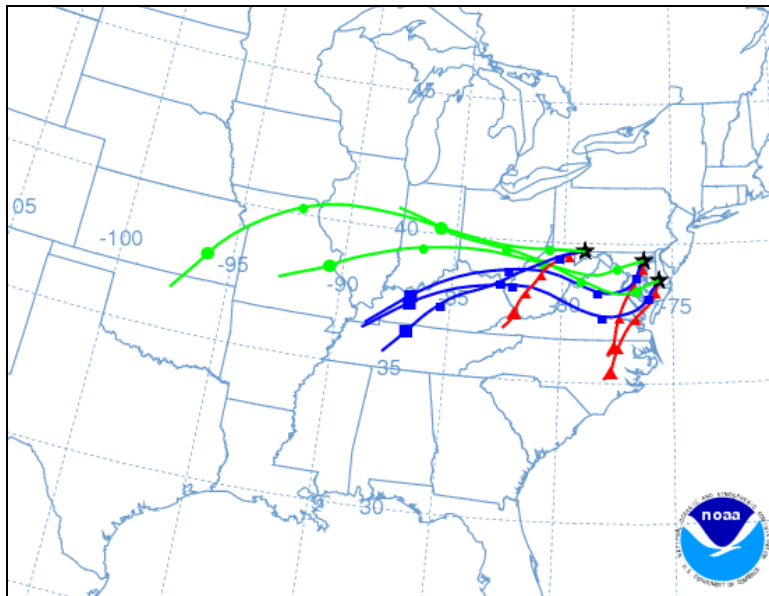| Region	Official	NOAA 12z	Actual	NOAA Diff
WMD	58	58	77	-19
DC	56	59	72	-13
Balt.	59	58	66	-8
E.S.	59	60	67	-7

MARYLAND
DEPARTMENT OF THE ENVIRONMENT

Early Season: May 15, 2013
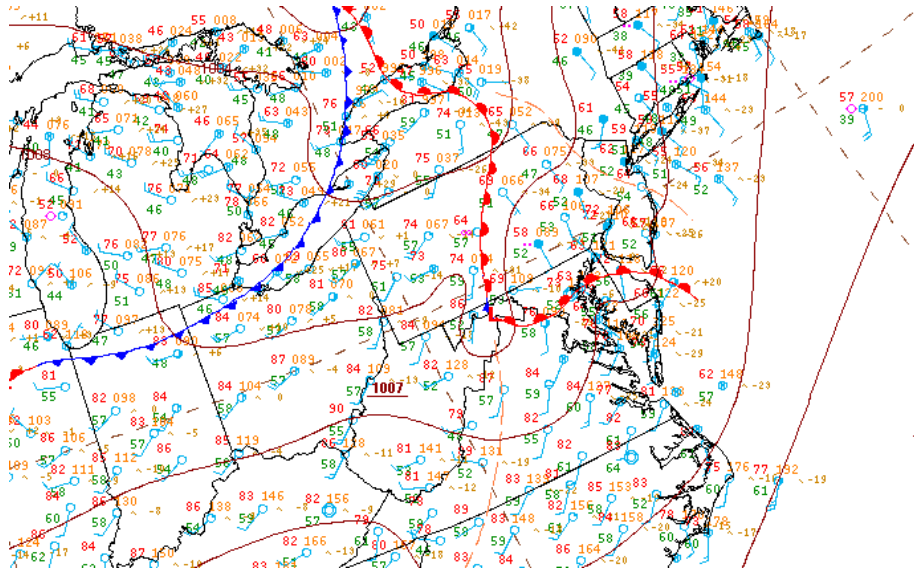
❑ **Meteorological Conditions**

- ▪ Warm front and associated trough along the Appalachians

- ▪ Strong westerly flow aloft

- ▪ Temperatures near 90°F at Piney Run, upper 70s elsewhere

- ▪ Some rain and clouds over eastern MD, dry and clear over Piney Run.
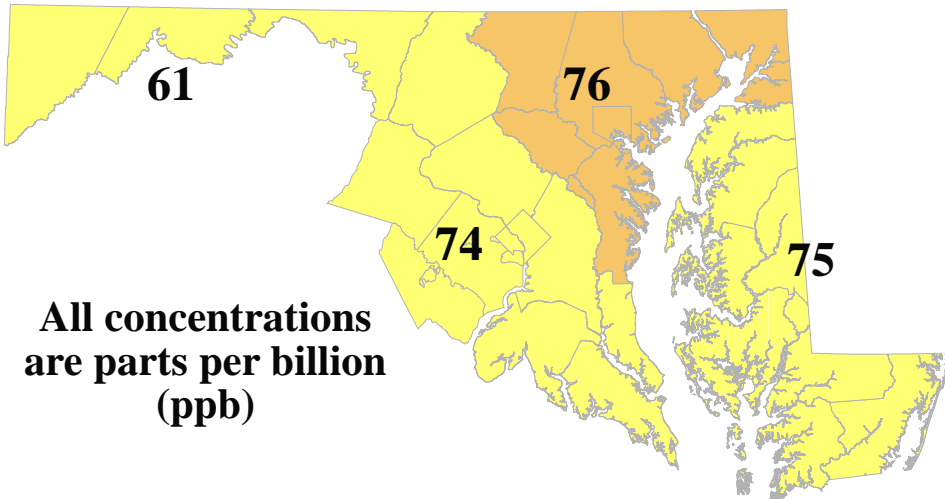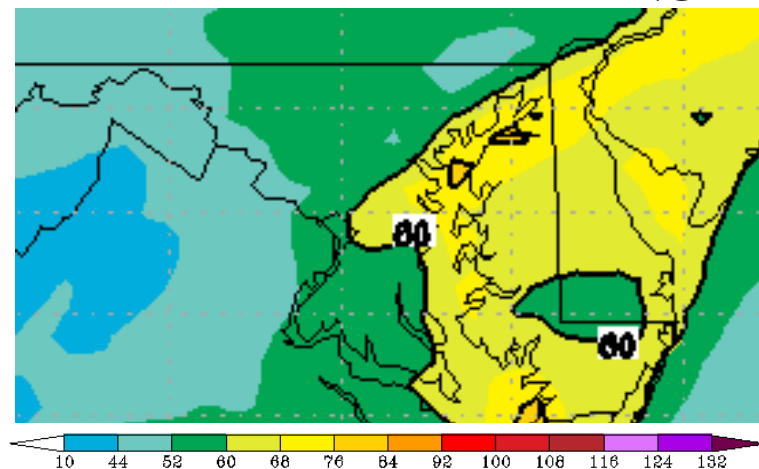

Daily Peak Ozone AQI
Wednesday, May 15, 2013

Source: WPC, HYSPLIT, AirNow

Mid Season: July 19, 2013

Forecast 7-18-2013 Valid 7-19-2013

Official Forecast

61

76

74

75

All concentrations are parts per billion (ppb)

NOAA 12Z

10 44 52 60 68 76 84 92 100 108 116 124 132

Verification 7-19-2013

54

83

77

62
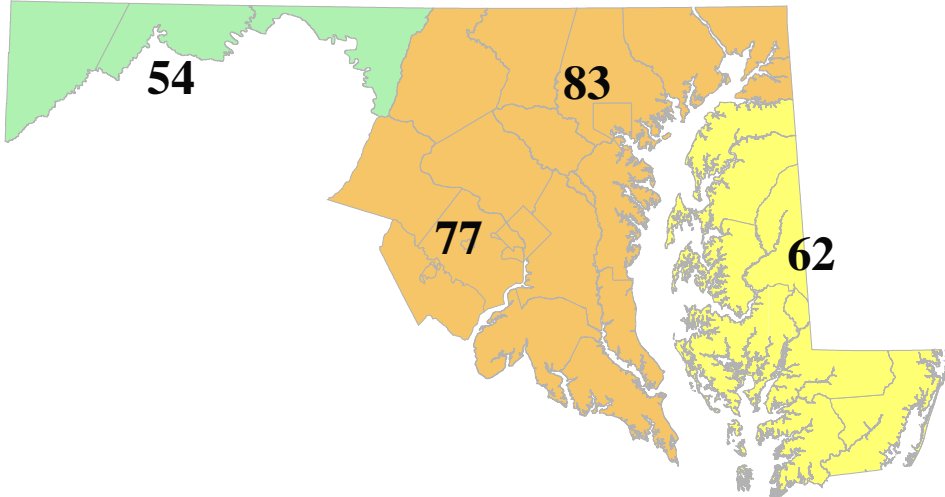
Region	Official	NOAA 12z	Actual	NOAA Diff
WMD	61	58	54	+4
DC	74	68	77	-9
Balt.	76	71	83	-12
E.S.	75	75	62	+13

MDE

MARYLAND
DEPARTMENT OF THE ENVIRONMENT

Source: Airnow; NCEP; MDE

1800Z SURFACE ANALYSIS
DATE: FRI JUL 19 2013
ISSUED: 1923Z FRI JUL 19 2013
BY WPC ANALYST MONARSKI
COLLABORATING CENTERS: WPC, NHC, OPC

❑ **Meteorological Conditions**

- ▪ High pressure over the Mid-West had moved southeast

- ▪ Light south-westerly winds

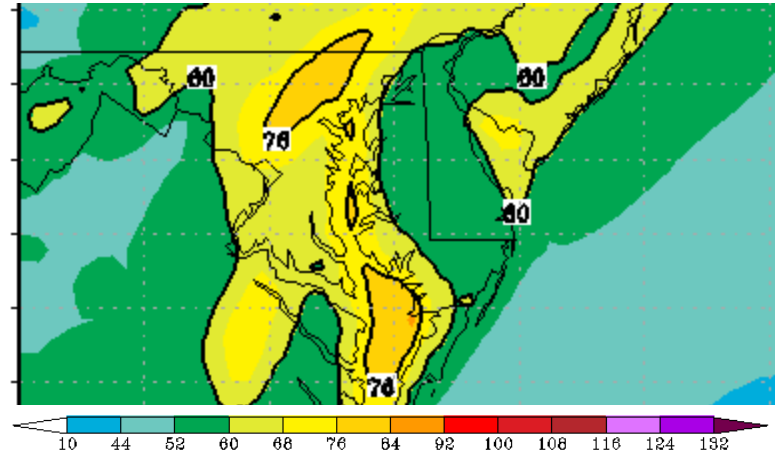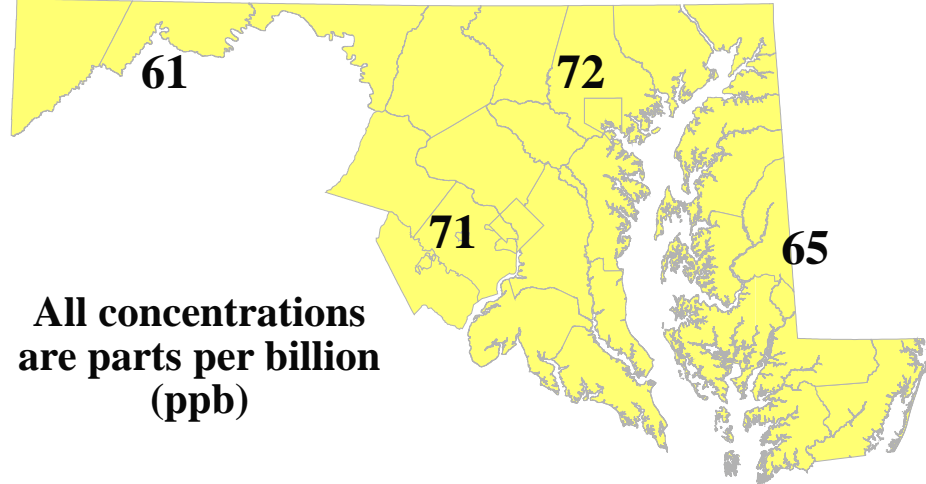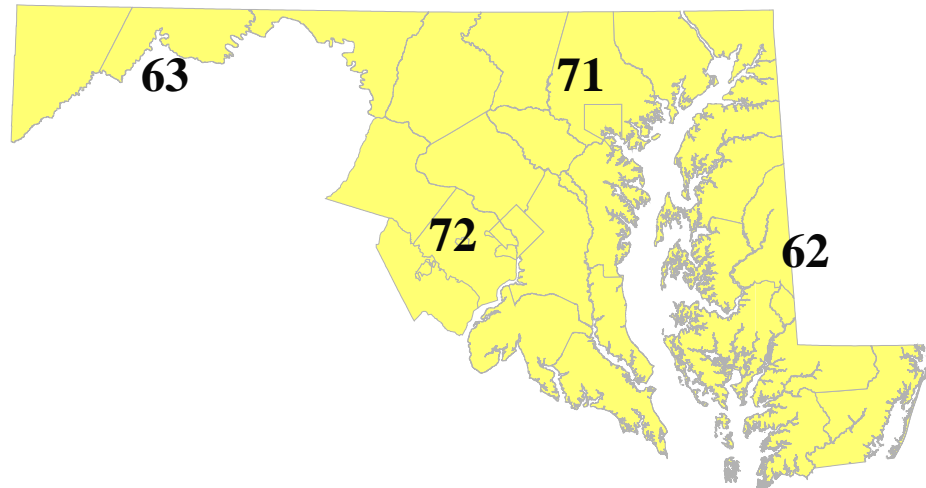- ▪ Temperatures near 96°F at BWI with isolated afternoon thunderstorms

Daily Peak Ozone AQI
Friday, July 19, 2013

Source: WPC, HYSPLIT, AirNow
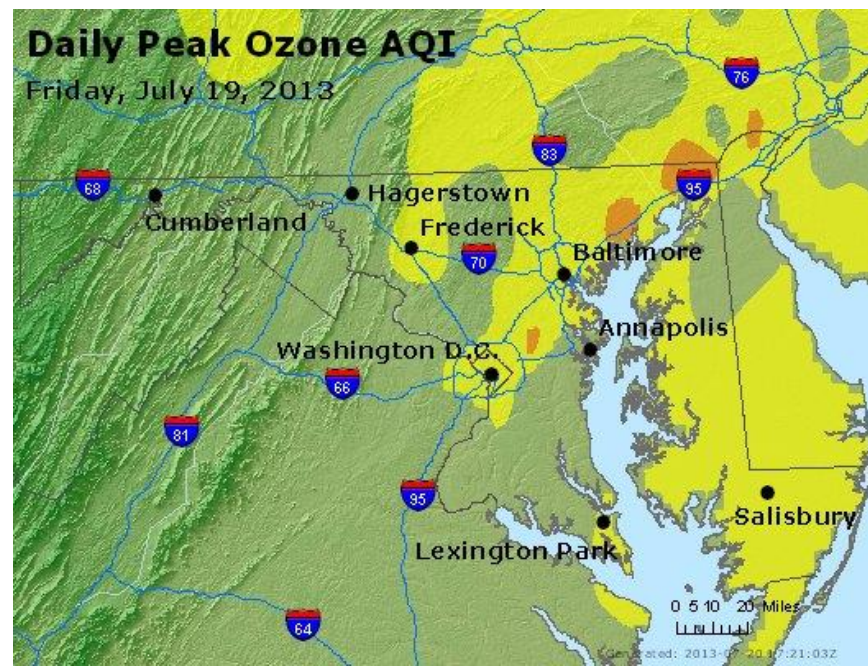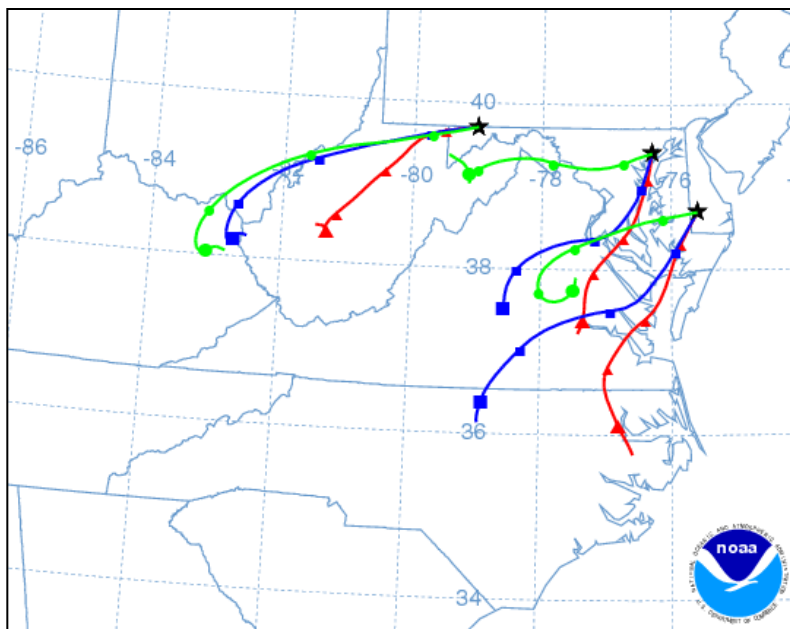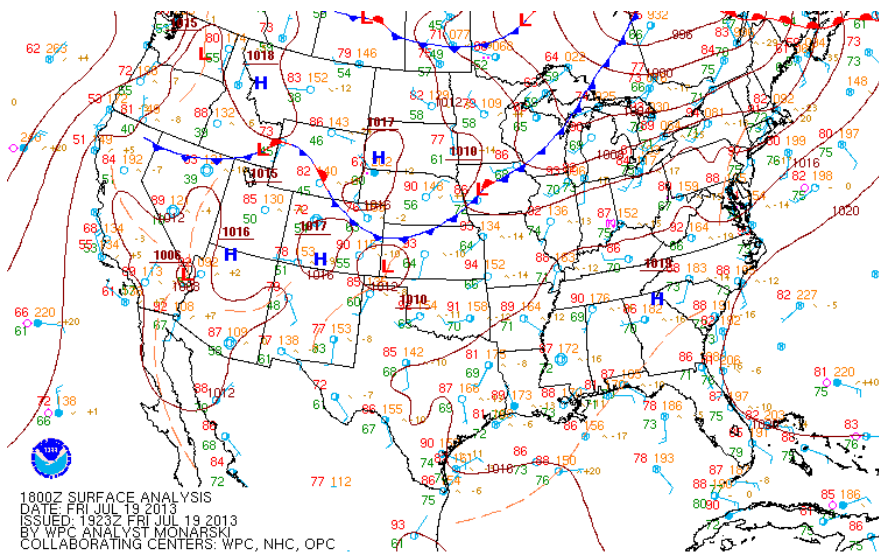
Late Season: September 11, 2013

Forecast 9-10-2013 Valid 9-11-2013

Official Forecast

NOAA 12Z

All concentrations are parts per billion (ppb)

Verification 9-11-2013

Region	Official	NOAA 12z	Actual	NOAA Diff
WMD	61	70	63	+7
DC	71	78	72	+6
Balt.	72	83	71	+12
E.S.	65	69	62	+7

Source: Airnow; NCEP; MDE

Late Season: September 11, 2013

❑ **Meteorological Conditions**

- High pressure with Appalachian Lee-side trough

- Stagnation aloft; southerly sfc. winds

- Temperatures near 95°F at BWI

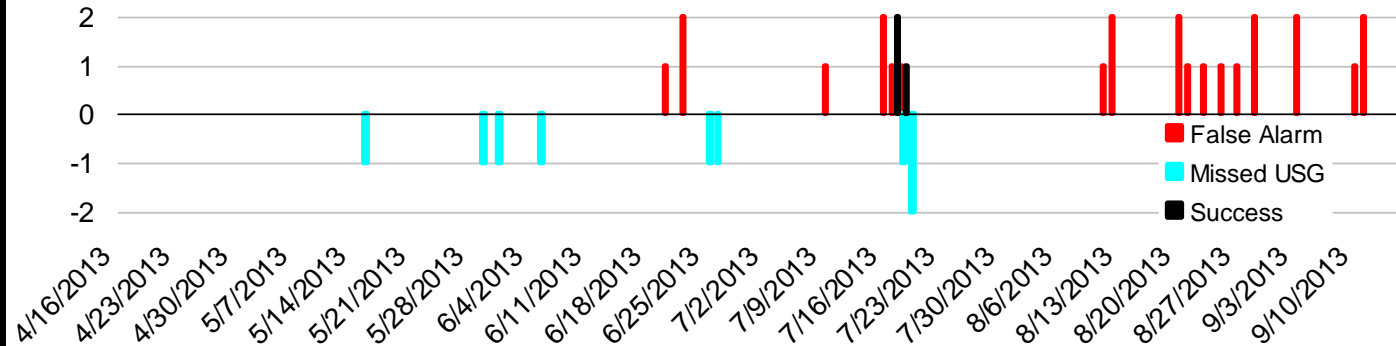- Afternoon thunderstorms over the mountains only

Daily Peak Ozone AQI
Wednesday, September 11, 2013
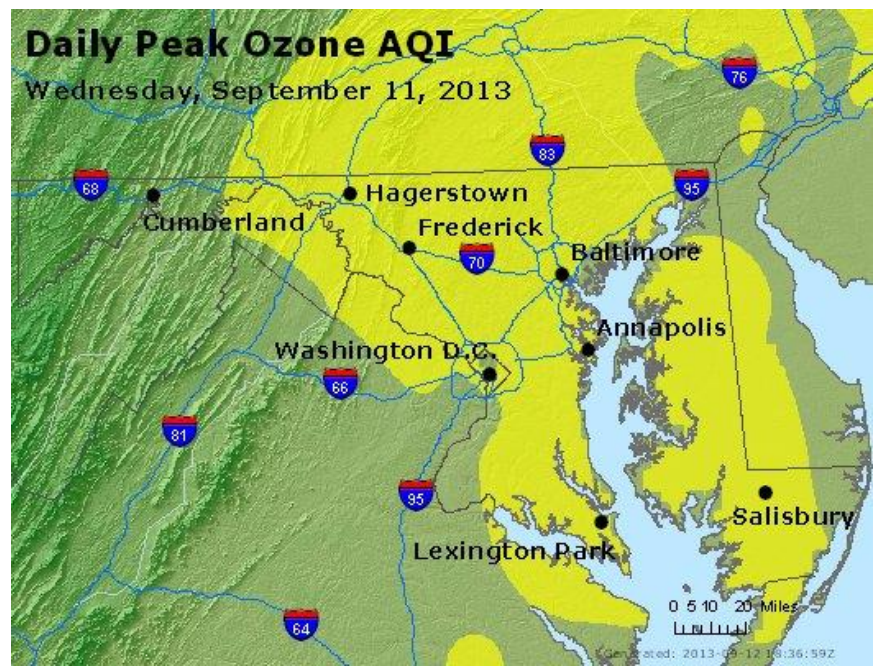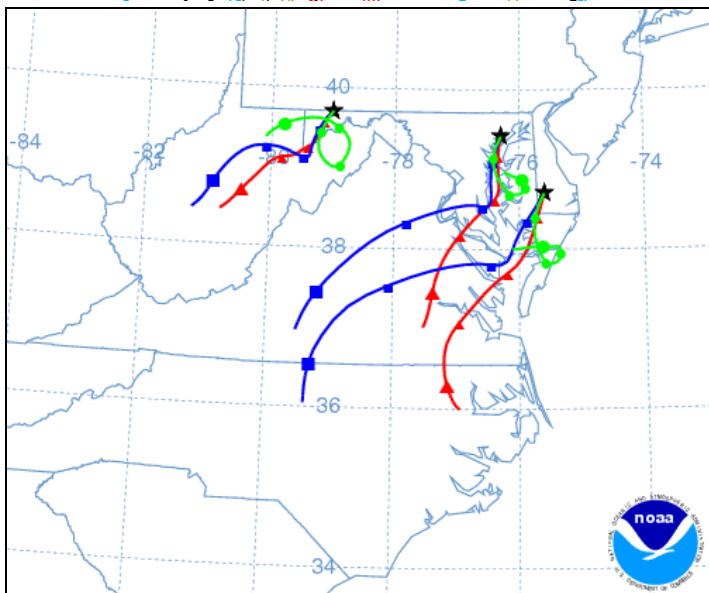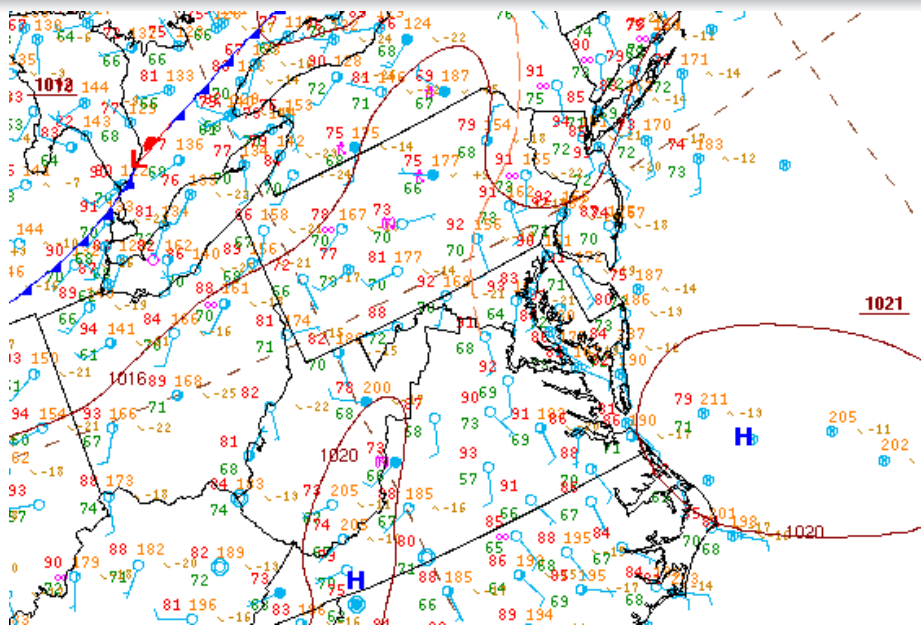
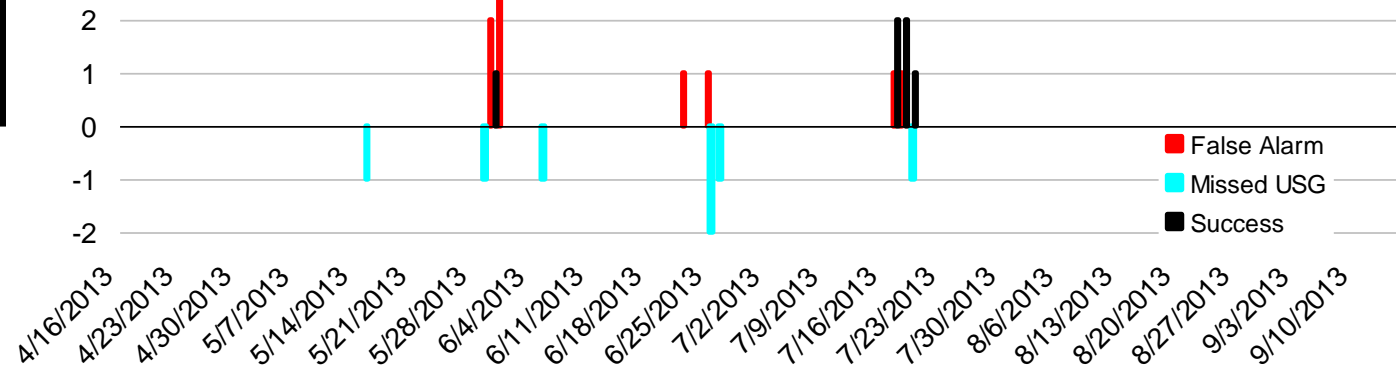**Source: WPC, HYSPLIT, AirNow**

2013 Ozone Season NOAA Model USG False Alarms, Misses and Success in Maryland

Regional	12Z Official	NOAA
USG Forecasts	15	30
False Alarms	9	24
Misses	7	9
Success	6	3

2013 Ozone Season Official Forecast USG False Alarms, Misses and Success in Maryland

14

MARYLAND
DEPARTMENT OF THE ENVIRONMENT

Summary

- ❑ The clean year of 2013 altered forecast statistics from previous years

  - All forecasts were fairly similar in skill level, except for Metro Baltimore and Washington where official forecasts were better than the NOAA model

  - The small sample size of USG days skewed verification statistics

  - 8-hr maximum ozone on USG days ranged 76-78ppb 75% per regional verification (9 of 12) and 66% (6 of 9) Maryland-wide USG days

- ❑ On the whole, the model did well finding trends but:

  - Had trouble catching the early season event

  - False alarms were an issue, especially late season
    - NOAA model's first false alarm was June 20th with increasing frequency towards the end of the season

Contacts

Joel Dreessen
410-537-3296
Joel.Dreessen@maryland.gov

Laura Warren
410-537-3122
Laura.Warren@maryland.gov

Ambient Air Monitoring Program
Air and Radiation Management Administration

www.mde.maryland.gov/air

Maryland Department of the Environment
1800 Washington Boulevard | Baltimore, MD 21230
410-537-3000 | TTY Users: 1-800-735-2258
www.mde.state.md.us
Martin O'Malley, *Governor* | Anthony G. Brown, *Lt. Governor* | Robert M. Summers, Ph.D., *Secretary*

Appendix

Forecast Statistics

Statistic	Units	Definition
Percent Correct	%	Percent of forecasts correctly predicted for event or non-event.
Probability of Detection (POD)	%	Percent of times a forecast of higher pollution verified.
False Alarm Rate (FAR)	%	Percent of times a forecast of higher pollution did not verify.
Bias	AQI	Indicates, on average, if the forecasts are underpredicted or overpredicted. Value closer to 1 are best where values < 1 are underprediction.
Mean Absolute Error (MAE)	ppb	Average "closeness" between the forecast and observed values.

Source: EPA Guidelines for Developing an Air Quality (Ozone and PM2.5) Forecasting Program

MARYLAND
DEPARTMENT OF THE ENVIRONMENT