Maryland’s 2015 Ozone “Season”

Joel Dreessen
September 10-11, 2015
AQ Forecaster Focus Group
Silver Spring, Maryland
2015 SEASON AT A GLANCE

Well above normal temperature period

Single monitor exceedance

Weekend Episode

Smoke Event

Pattern more reminiscent of 2011/2012. Smoke also present in atmosphere

<table>
<thead>
<tr>
<th>Location</th>
<th>06/11/2015</th>
<th>08/07/2015</th>
<th>08/15/2015</th>
<th>09/02/2015</th>
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<tr>
<td>Pine Run</td>
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2014 Design Value: 73 74 75 72 64 72 69 73 76 70 70 75 68 71 77 70 74 73 67 68

Day 5: 09/04/2015 Baltimore
MAY

Divisional Maximum Temperature Ranks
May 2015
Period: 1895–2015

Divisional Precipitation Ranks
May 2015
Period: 1895–2015

Source: NCDC Temperature and Precipitation Maps
JUNE

Divisional Maximum Temperature Ranks
June 2015
Period: 1895–2015

Divisional Precipitation Ranks
June 2015
Period: 1895–2015

Source: NCDC Temperature and Precipitation Maps
JULY

Divisional Maximum Temperature Ranks
July 2015
Period: 1895–2015

Divisional Precipitation Ranks
July 2015
Period: 1895–2015

Source: NCDC Temperature and Precipitation Maps
Emissions of Indiana, Ohio, West Virginia, Virginia, Pennsylvania, Maryland and the District of Columbia were summed together on a monthly basis.
Source region for NOx transport in to Maryland has seen a drastic drop in TOTAL ozone season (April – October) coal NOx emissions. Approximately a 20% to 40% reduction has occurred in the past 2 years, compared to a 160,000 ton level.

**2009:** 45135 fewer NOx tons emitted than in 2011
**2010:** 7011 fewer NOx tons emitted than in 2011
**2012:** 14830 fewer NOx tons emitted than in 2011
**2013:** 40462 fewer NOx tons emitted than in 2011
**2014:** 67983 fewer NOx tons emitted than in 2011
ALL CAMD EGUs (>25MW) NOx Emissions
Model prediction minus observed 8-hour ozone at all monitors (preliminary data from AirnowTech)
BIAS

Very low bias
Region wide

I-95 high bias

AVERAGE ERROR

BIAS
-3.159328 - 0.405771
-0.405770 - 1.361992
1.361993 - 3.281353
3.281354 - 4.879076
4.879077 - 6.938675
6.938676 - 9.310273
9.310274 - 14.324930
RMSE

Low RMSE Region wide

NYC & LI SOUND RMSE

AVERAGE ERROR
RMSE
RMSE

6.854627 - 7.517916
7.517917 - 8.118312
8.118313 - 8.656514
8.656515 - 9.295549
9.295550 - 10.379016
10.379017 - 12.160826
12.160827 - 17.706667

I-95 RMSE

HORN POINT / BAY OVER PREDICTION
2006-2013 MDE Forecast Area Ozone Climatology

Ozone Concentration (ppb)

- Alltime Max
- O3MAX
- Climo_Max
- MEDO3
- MINO3
- USG
- 2015
NOAA: Hourly Forecast Ozone

8-Hour Obs: 100ppb
06Z: 72ppb
12Z: 70ppb

8-Hour Obs: 74
06Z: 78ppb
12Z: 70ppb

8-Hour Obs: 88ppb
06Z: 73ppb
12Z: --ppb
How Much Ozone from Smoke?

NOAA AQ MODEL SERVES AS A “WHAT IF” GUIDE

• Smoke not captured in model

June 10, 2015

Large under-prediction by the NOAA model

June 11, 2015
For Maryland monitors north of DC, ozone contribution from smoke is approximately **14ppb**. Range: 7.6ppb – 30ppb

**Ohio Error: 18-21ppb**

- Model prediction minus observed 8-hour ozone at all monitors
- Compared errors on June 11, 2015 (Smoke Event) with other “hot” days (>90°F)
- Tested the variance of errors between smoke day and non-smoke day
- F-test shows the variances are different with statistical significance at the 95% confidence level
• “..like to use science for policy”… Is the Chesapeake Bay high ozone prediction real or not? Model artifact? Marine vessels? Meteorology?

• MDE is pursuing putting an ozone monitor in the Bay

• The same issues which face the operational model are facing the SIP modelers; (4km on the Bay?)

• Ability to modify the model online and rerun – does Maryland exceed or not with new settings?

• Inventory: are smaller generators being modeled? (distributed generation)
APPENDIX
Forecast Regions & Monitors

Air Quality Forecast Regions
- Metro Baltimore
- Metro Washington
- Eastern Shore
- Western Maryland

Ozone Monitor

*Piney Run is a mountaintop monitor
Essex and Howard University Beltsville

<table>
<thead>
<tr>
<th></th>
<th>June 11</th>
<th>Max 8hr O3</th>
<th>24hr PAMs (ppbc)</th>
<th>24hr Avg NOX</th>
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<tbody>
<tr>
<td>Essex</td>
<td>71 (74)</td>
<td>89.6</td>
<td></td>
<td>13.5</td>
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<tr>
<td>HU-BLT</td>
<td>88</td>
<td>77.4</td>
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Why did Essex (and Edgewood) not exceed the 76ppb ozone NAAQS standard?

BAY BREEZE!