Philadelphia Area Forecast Results 2007 Summer O_3 Season

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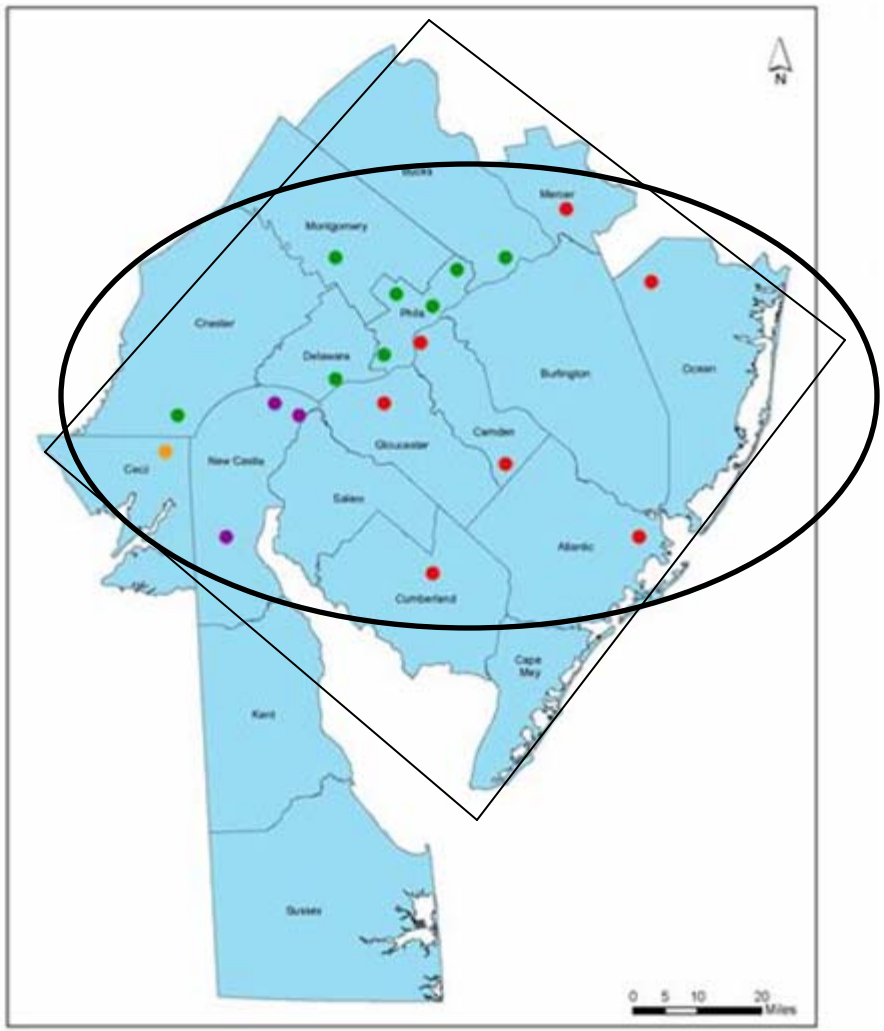
Fall's Church, VA (September, 2007)

PHL Air Quality Forecast Area



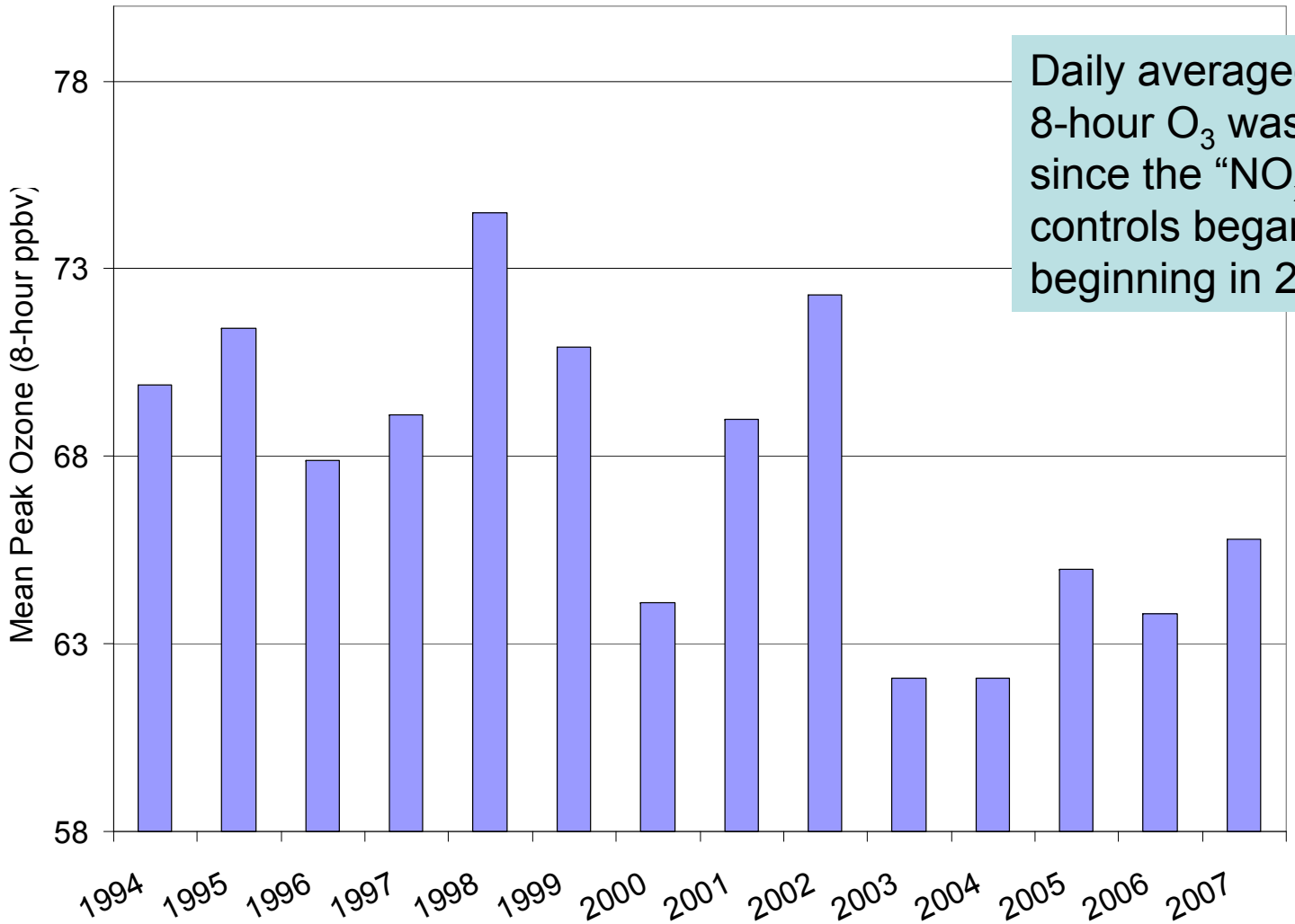
Experimental model evaluation metric is peak 8-h concentration at any of 19 PHL O_3 monitors.

Operational model evaluation is slightly different, used “Point Data” function on weather.gov to find maximum within metro area.

PHL Climatology: Summer, 2007

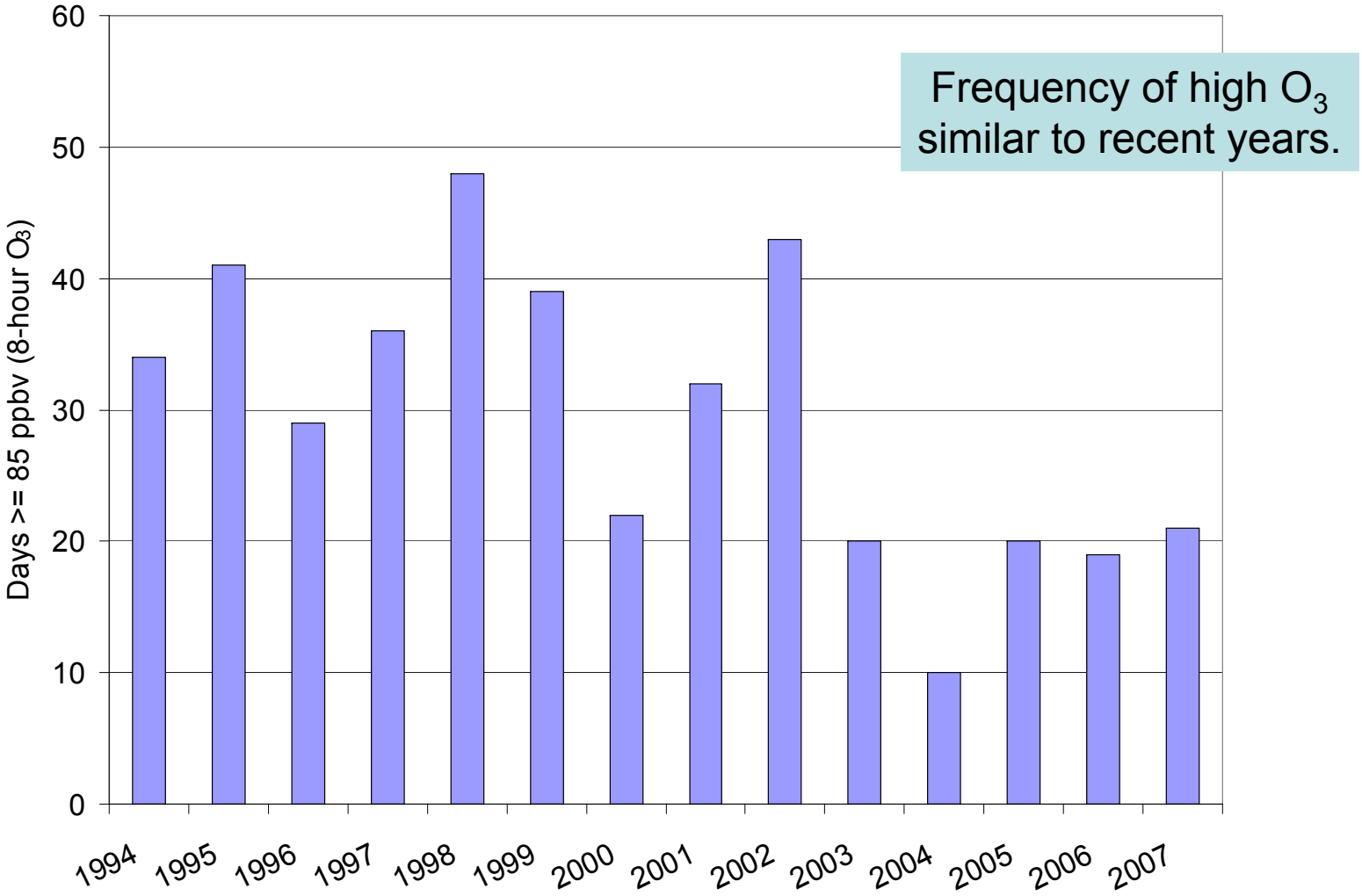
- Average temperature in PHL for May-August, 2007 was above average (+1.1°F). May was the warmest month in relative terms.
- 21 days ≥ 90°F for T_{max}, average for 1997-2006 is 22.8.
- JJA days with measurable precipitation (≥ 0.01”) was 31 compared to 1997-2006 average of 30.
- Precipitation was 2.31” below average for May-August, and 1.10” below average for JJA.
- Anecdotally, a larger number of re-circulation/stagnation cases in PHL.
- Though total number of high O_3 cases (≥ 85 ppbv) was near normal, frequency of very high O_3 cases (≥ 105 ppbv) was higher.

Daily Averaged Mean Peak 8-Hour O_3 PHL Summer

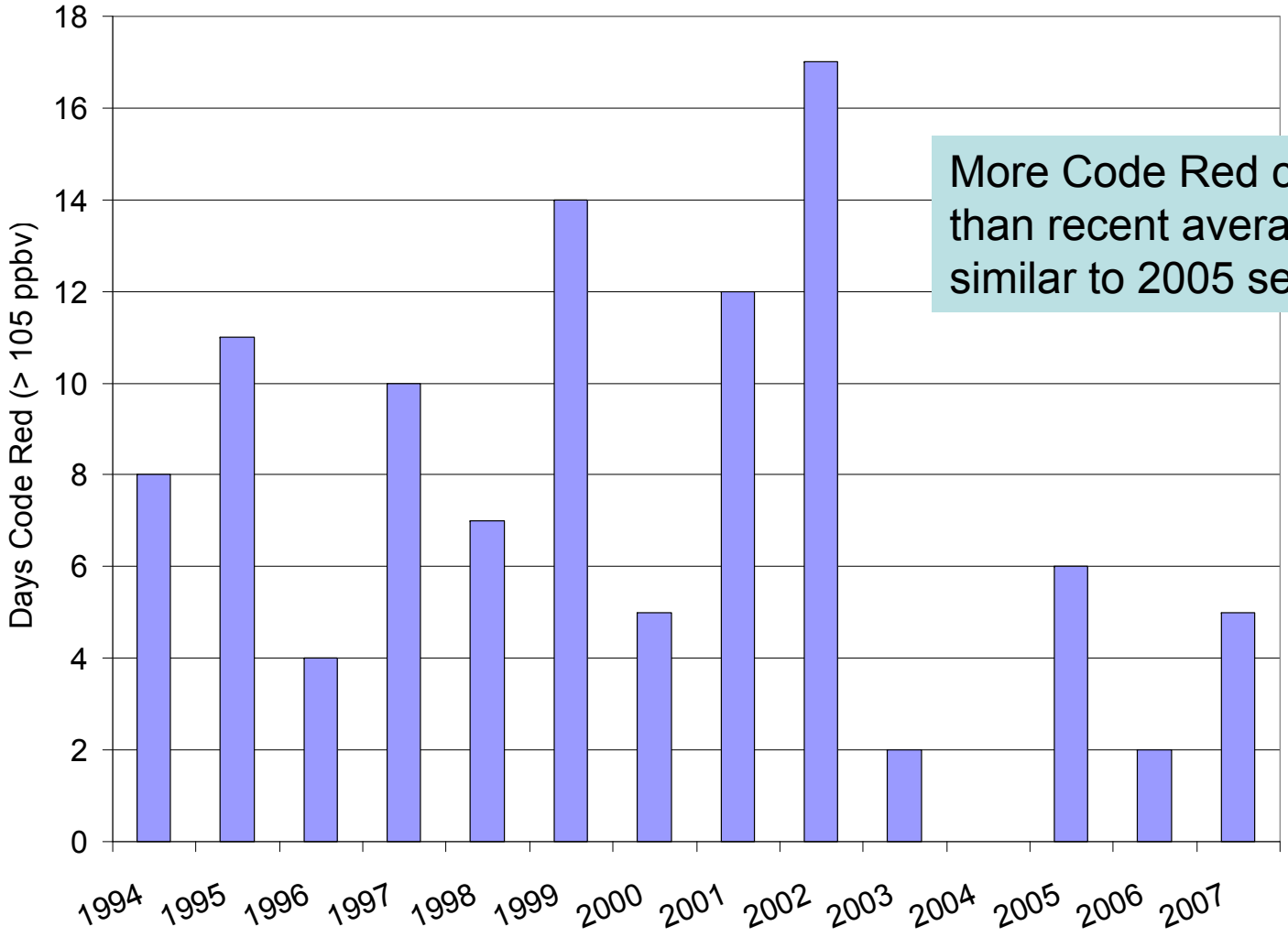


Daily averaged mean peak 8-hour O_3 was the highest since the "NO_x SIP Rule" controls began phasing in beginning in 2003.

Days ≥ 85 ppbv (Code Orange/Code Red)



Days ≥ 105 ppbv (Code Red)
PHL Summer



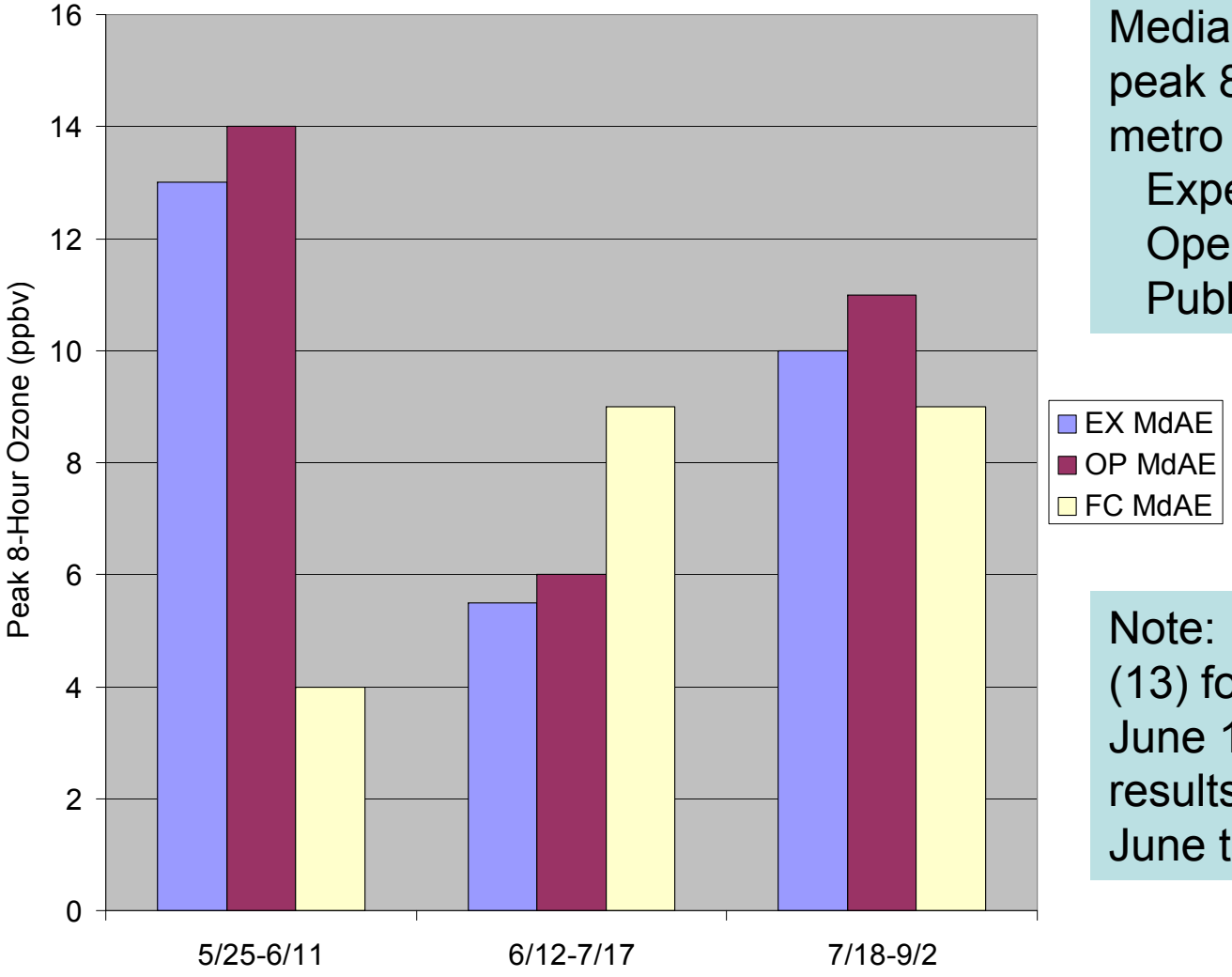
More Code Red cases (5) than recent average and similar to 2005 season.

Experimental Model Change Log: Three Forecast Periods

- **May 29:** Two Summer 2006 changes were not implemented on **5/25/07**. These were the ACM convective and NAM clear sky radiation photolysis attenuation and were implemented today.
- **June 12:** BL mixing scheme in CMAQ has been changed from RADM version 2.6 using the NAM TKE PBL height to Asymmetric Convective Model-2 (ACM-2) using a Richardson calculation in PREMAQ (Jon Pleim, JAM in press). Minimum eddy diffusivity used in ACM-2 reduced from 0.5 to 0.1 m^2/s
- **July 18:** An error in the dry deposition velocity calculation was identified and corrected for selected species (NO, NO_2, and CO). The error is associated with the mesophyll resistance which was erroneously set to zero. The impact is a reduction in deposition velocity and a resultant increase in predicted concentrations of these species. Higher NO_x concentrations then result in higher predicted O_3 concentrations.

http://www.emc.ncep.noaa.gov/mmb/aq/AQChangelogD.html

Forecast Results for 3 Periods: Median Absolute Error



Median absolute error for peak 8-h O_3 in the PHL metro area for:
Experimental (EX),
Operational (OP),
Public Forecast (FC)

Note: Only a few cases (13) for the May 25-June 11 period. Best results for Period 2 (mid-June to mid-July).

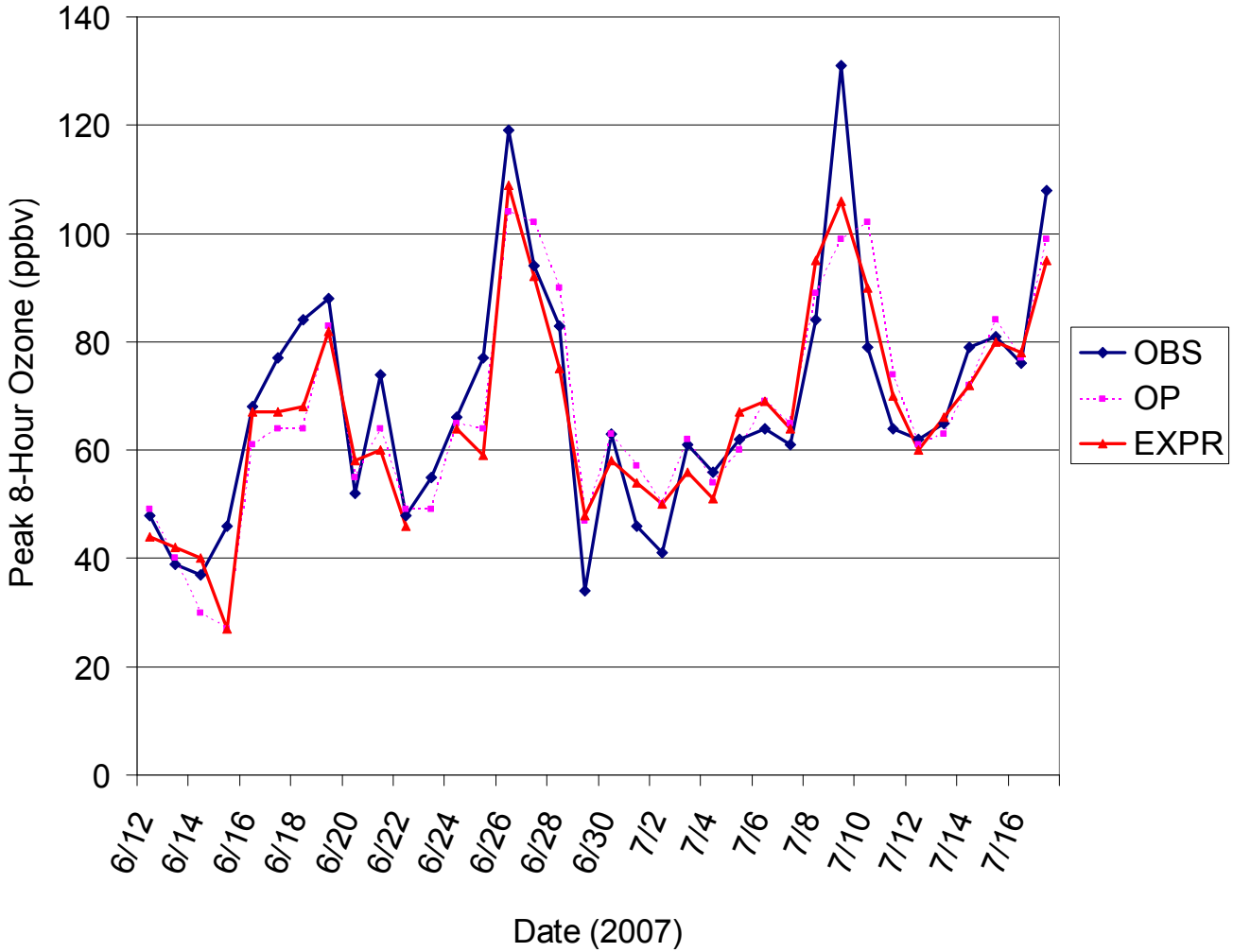
Forecast Results for 3 “Model Change” Periods Bias (Mean Signed Error)

Period 1: Under-prediction for both Operational and Experimental. Public Forecast shows little bias.

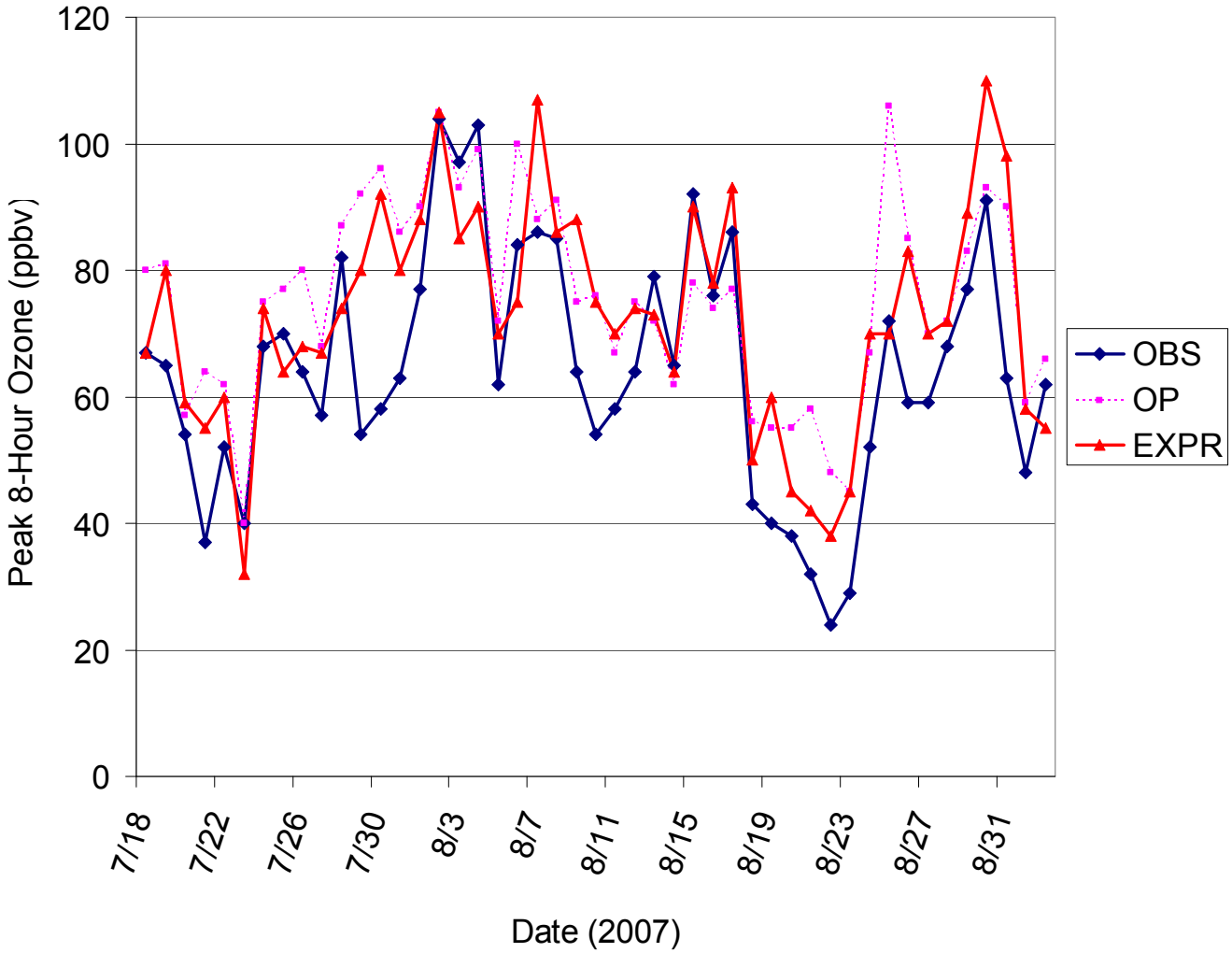
Period 2: Good model performance

Period 3: Trend to over-prediction.

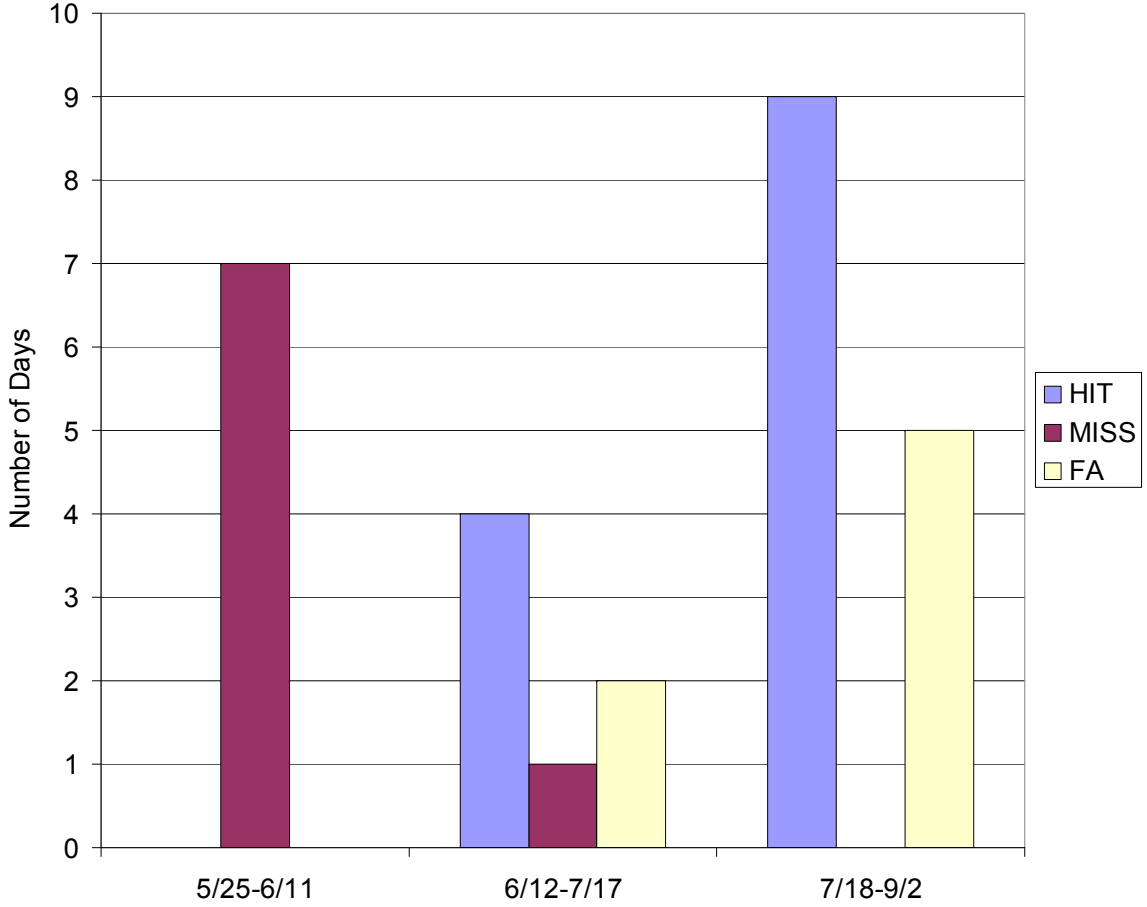
Time Series Forecasts: June 12-July 16



Times Series Forecasts: July 18-Sept 2

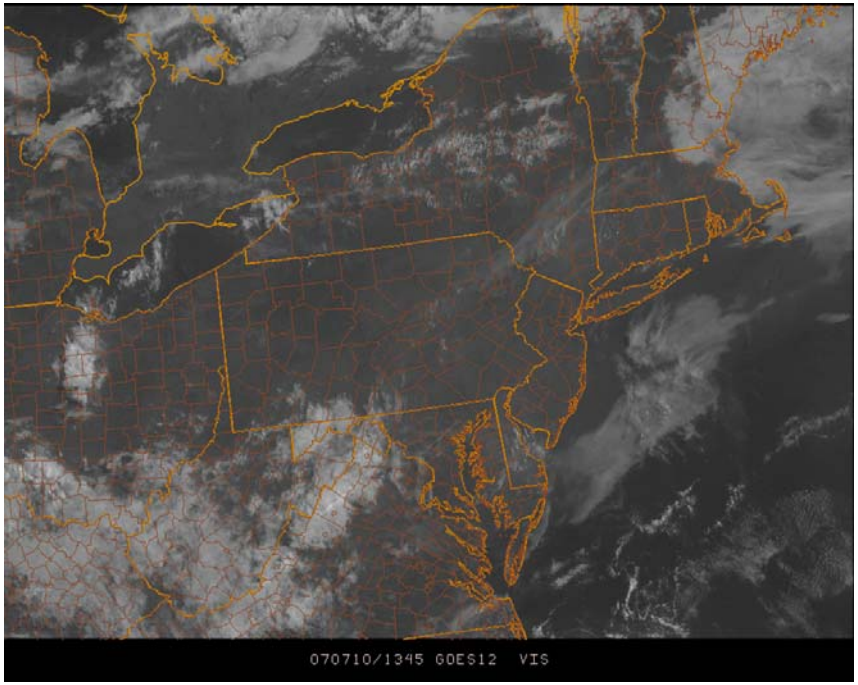


Categorical Performance in High O_3 Cases: Experimental Model

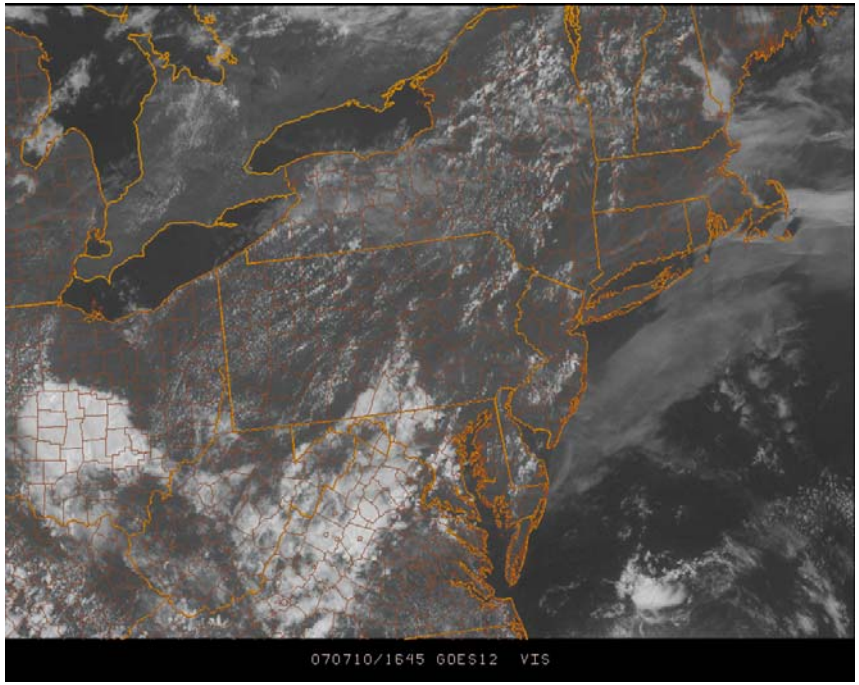


Hit: Obs and Forecast ≥ 85 ppbv, **Miss**: Obs ≥ 85 ppbv but **not** Forecast
FA: Forecast ≥ 85 ppbv but **not** Observed

Some False Alarms You Just Can’t Control

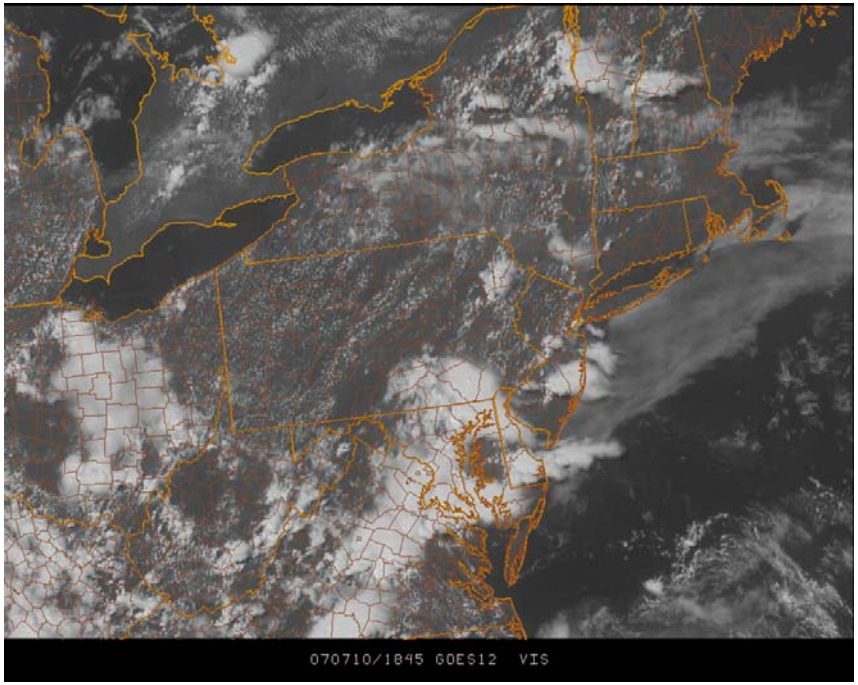


1345 UTC

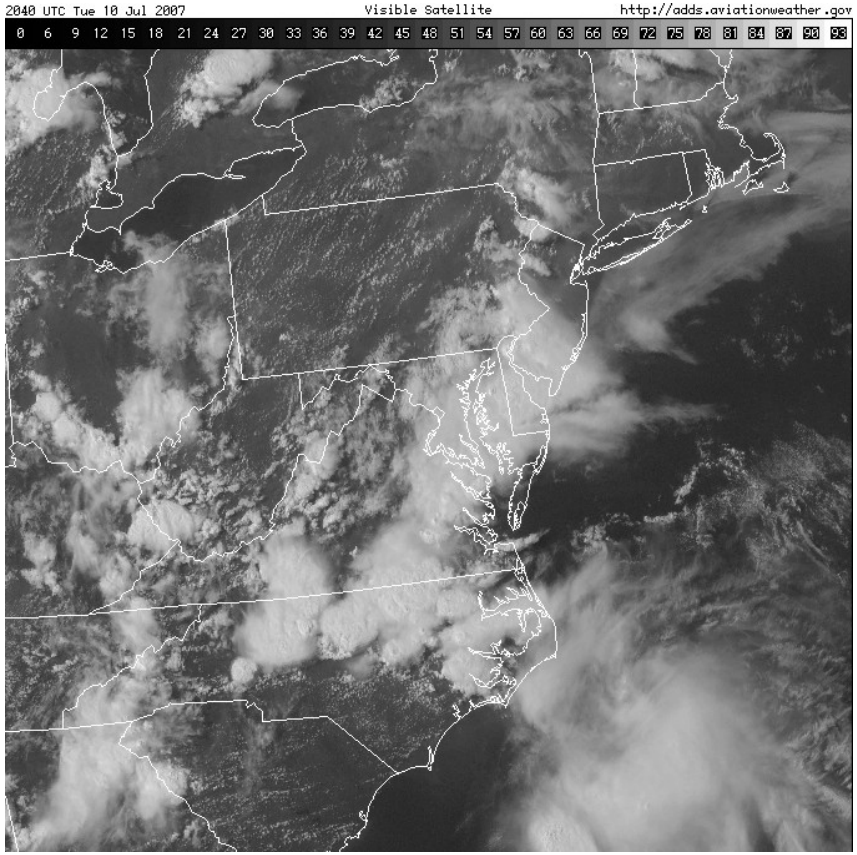


1645 UTC

Sea Breeze Front Gone Wild!

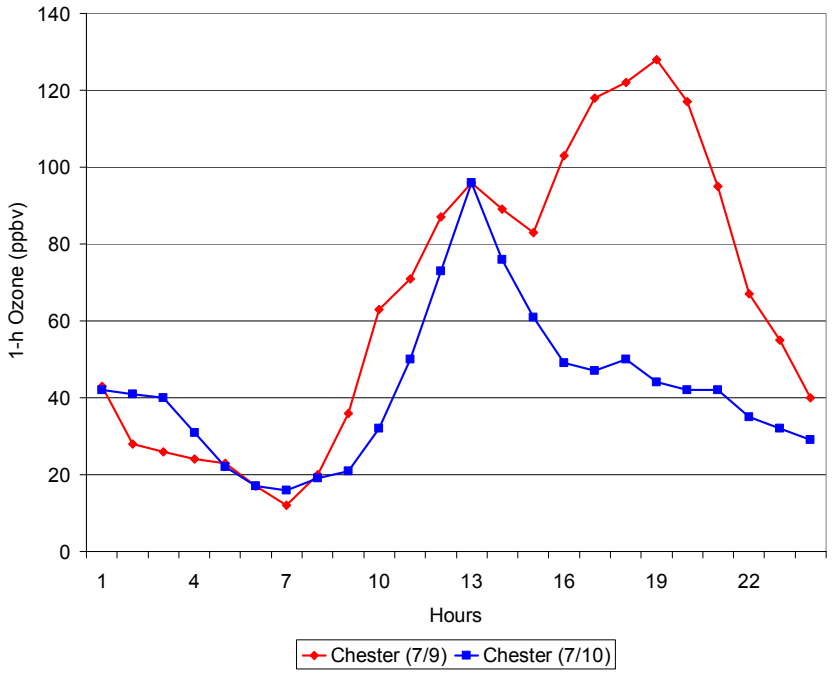


1845 UTC

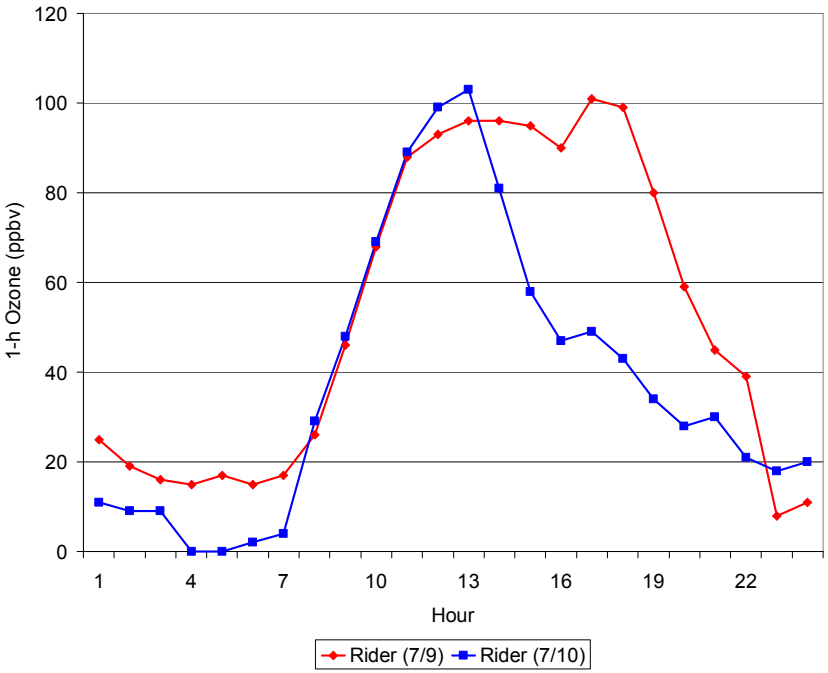


2040 UTC

Effects on Ozone Concentrations



Chester, PA: South of PHL along I-95.



Rider University, NJ: North of PHL along I-95

Operational NAQFS Results:
PHL Metro
May 1-September 2, 2007

	Bias	Mean AE	Median AE
Forecast	+3.1	8.8	8.0
Stat Model	+6.9	10.8	8.8
NAQFS	+2.9	10.1	8.0

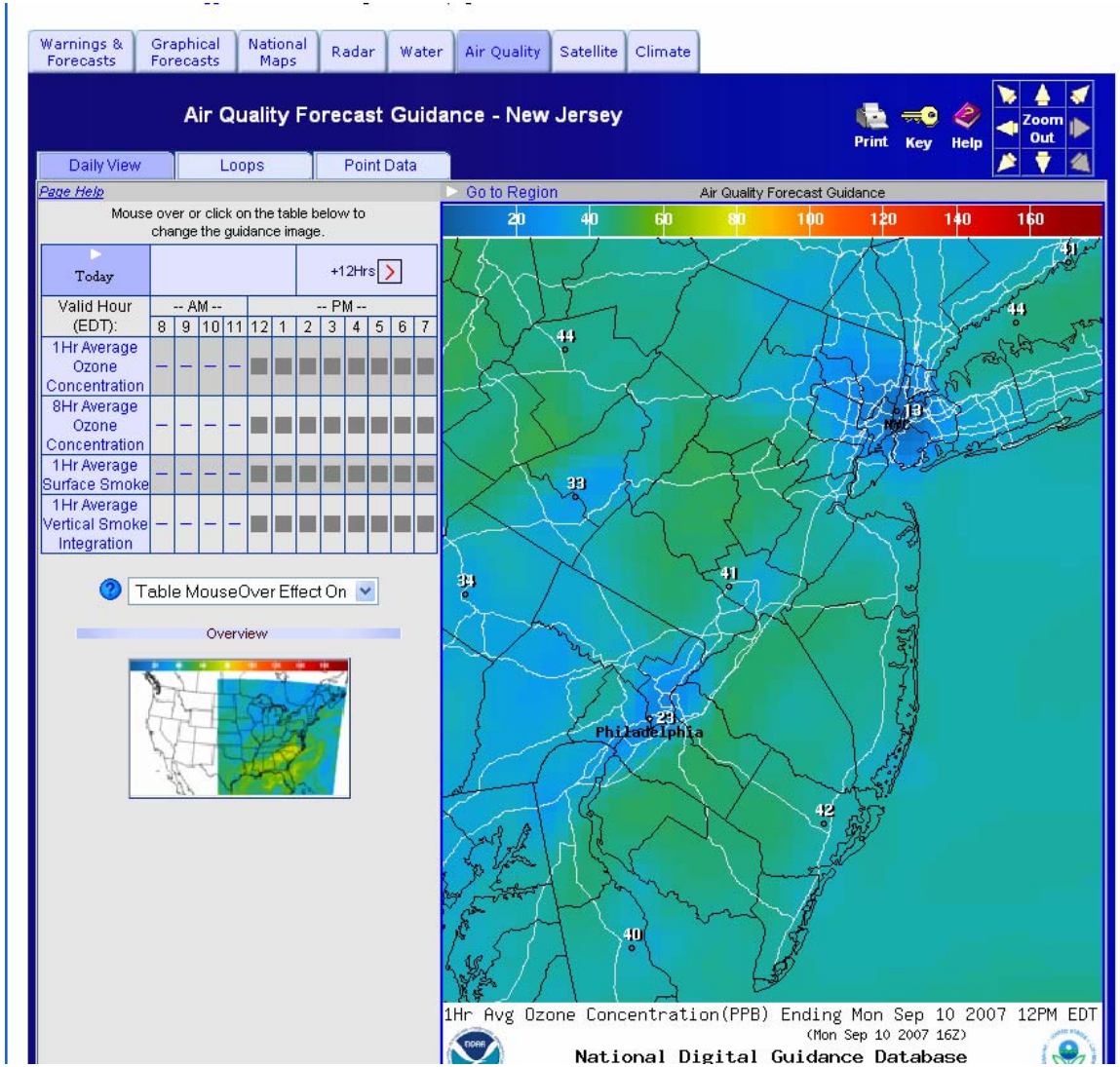
What's There to Like?

- Very few missed high O_3 cases after changes made in late May.
- While False Alarms rose after July changes, they were mainly due to early initiation or late termination of high O_3 episodes.
- Tracked well with operational model which gave good overall results.

What's Not to Like?

- Trend to over-prediction after last model change.
- High false alarm rate in same period. For operational forecasters, false alarms are problematic because we generally assume that numerical forecast models will not well resolve local (small scale) peak concentrations.

www.weather.gov



Comments (www.weather.gov)

- Like the “point data” feature, allows finding local maximum. Is there a better way to display maximum concentrations for set time period, e.g., daylight hours?
- Don’t like cities as concentration display points, this underestimates O_3 due to NO_x titration. Instead, put point data at monitor locations or spread through region.