

Philadelphia Forecast Area:
Performance of the 5X Model During
High O₃ Episodes
(Summer, 2005)

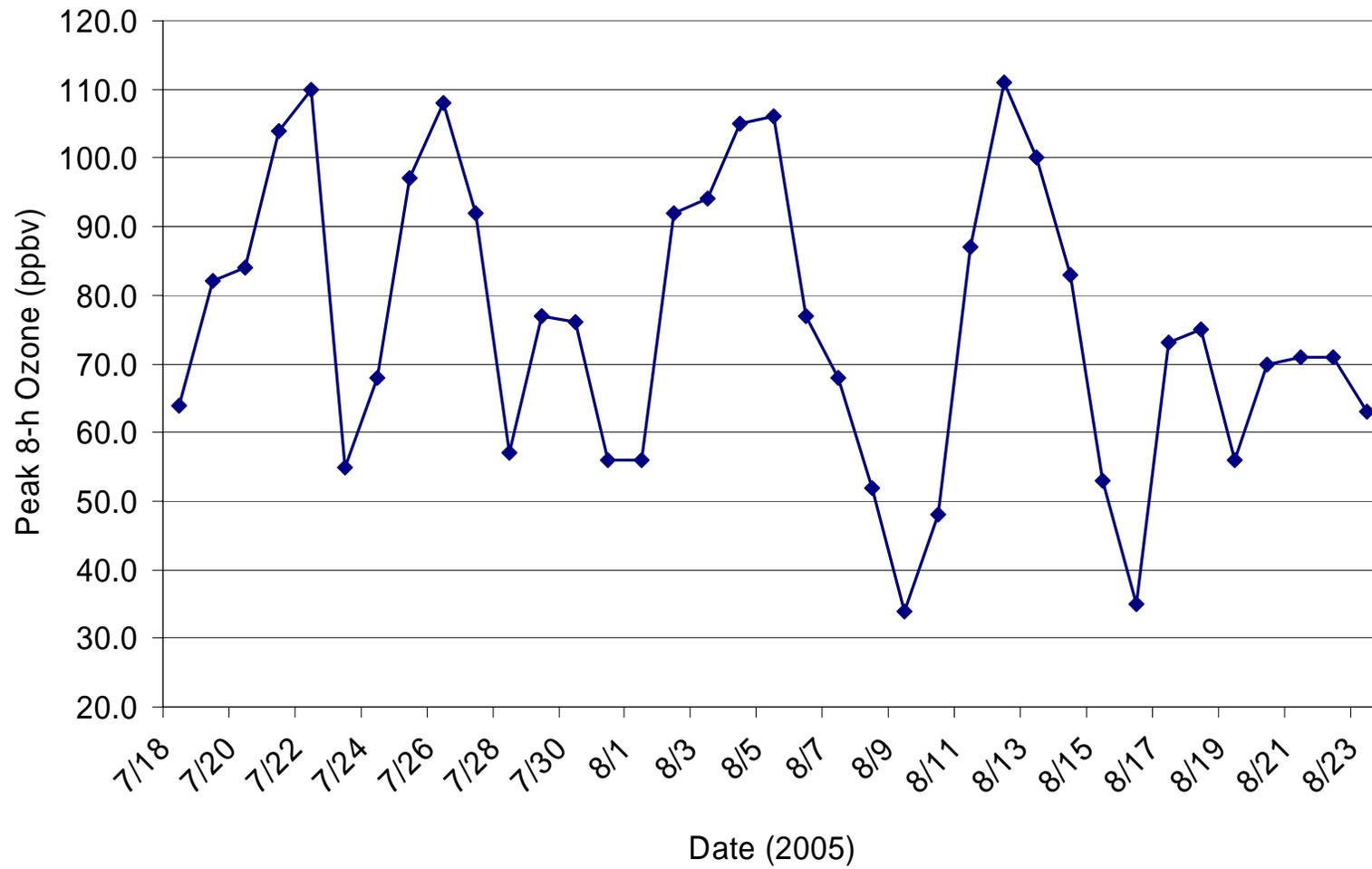
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Air Quality Forecasters Focus Group Workshop
Silver Spring, September, 2005

Four High Ozone Episodes Occurred in PHL During July-August, 2005



O₃ Episodes and Data Availability

- **July 20-22**
 - Missing forecast: July 21
- **July 25-27**
 - Missing forecasts: July 25, 27
- **August 2-5**
 - Missing forecast: August 5
- **August 11-14**
 - No missing forecasts!

Forecast Accuracy for O₃ Episode Days

PHL Domain 8-h Maximum Ozone (ppbv) During High Ozone Episodes (n = 8)

	Bias	MAE	Median	rms
NOAA	-2.4	7	3.5	9.7
PHL-FC	-4.4	7.8	6	9.9
Stat	-3.2	7.2	5.5	8.9

Analysis of Forecast Skill in PHL

- Performance in “Difficult” Cases
 - Onset of high O₃ episode
 - Termination of high O₃ episode
 - “Non-standard” high O₃ cases
 - Code Red Cases
- Large Error Cases
- Systematic Errors
 - Urban core over-prediction
 - High concentrations at sea/land boundary

Rapid Onset Cases

- No forecast fields (in 5X) available for onset cases in July.
- Forecasts were available for both August 2 and August 11
 - Code Orange correctly forecast although error (domain wide maximum) higher than average.
 - Plume placement was good.

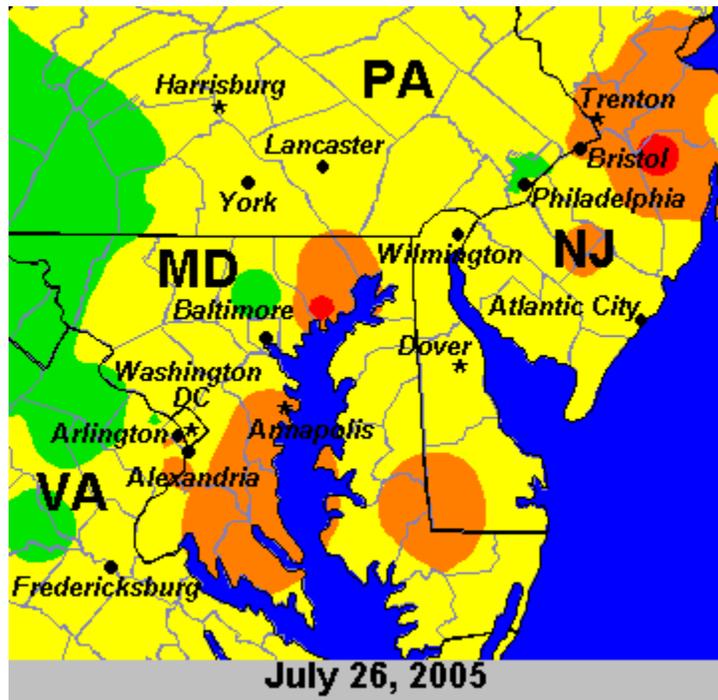
Episode Termination Cases

- Forecasts were available for the termination days of 3 of the 4 episodes (July 28, August 6, August 14)
- Although the skill in predicting domain wide peak concentrations varied, all forecasts predicted a significant fall in O₃ concentrations.

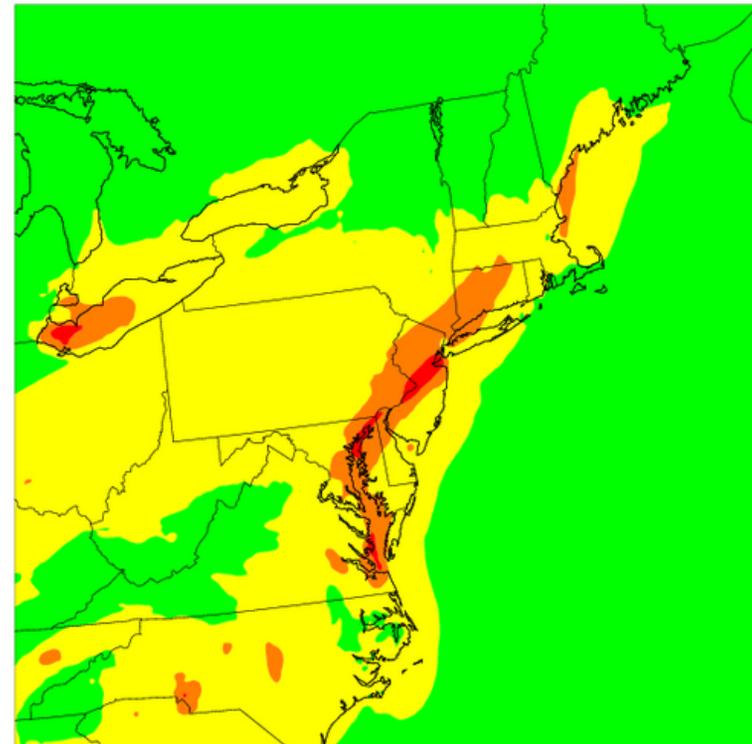
Forecasts in Code Red Cases

- Code Red concentrations were observed on four days. Forecasts of Code Red were made on 2 of the 4 days by the 5X model.
- Placement of plume of highest O₃ generally good.
 - Over-prediction in urban core
- Missed cases:
 - Placement of Baltimore plume
 - Convection timing

July 26: Code Red Forecast Verifies



24hr Max 08 hr Avg Ozone Concentration Ending 0300 UTC Wed 27 Jul 2005



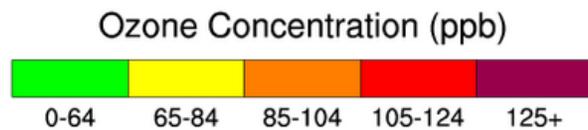
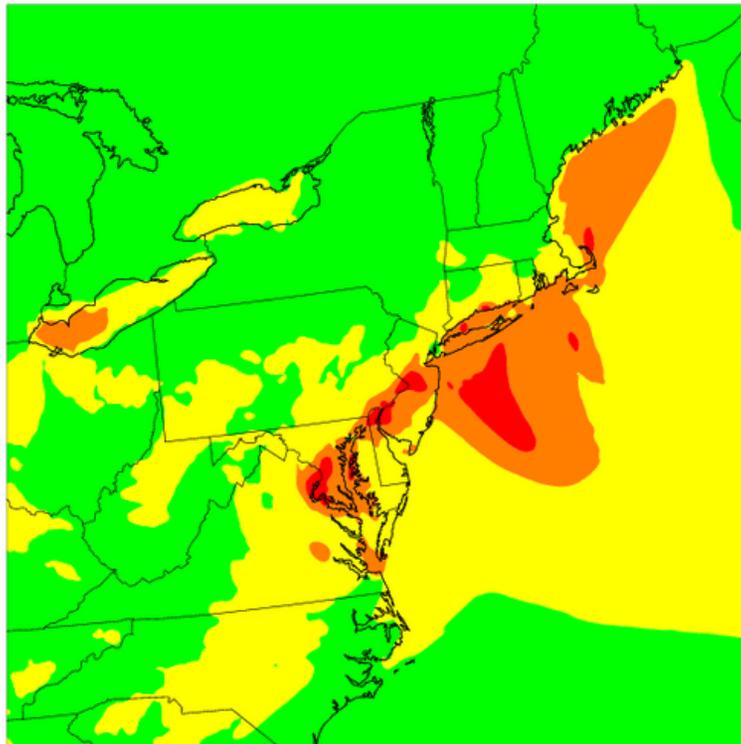
Ozone Concentration (ppb)



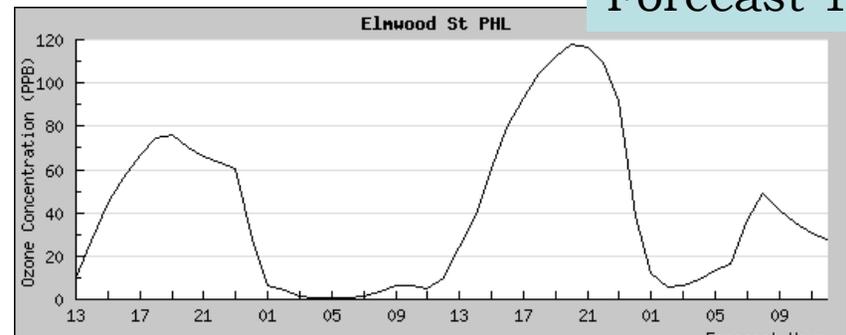
But over-prediction in the urban corridor from Wilmington through Philadelphia.

July 22: Code Red Forecast Verifies

24hr Max 08 hr Avg Ozone Concentration Ending 0300 UTC Sat 23 Jul 2005

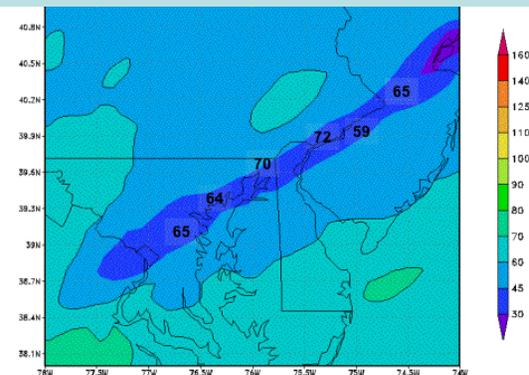


Forecast 1-h

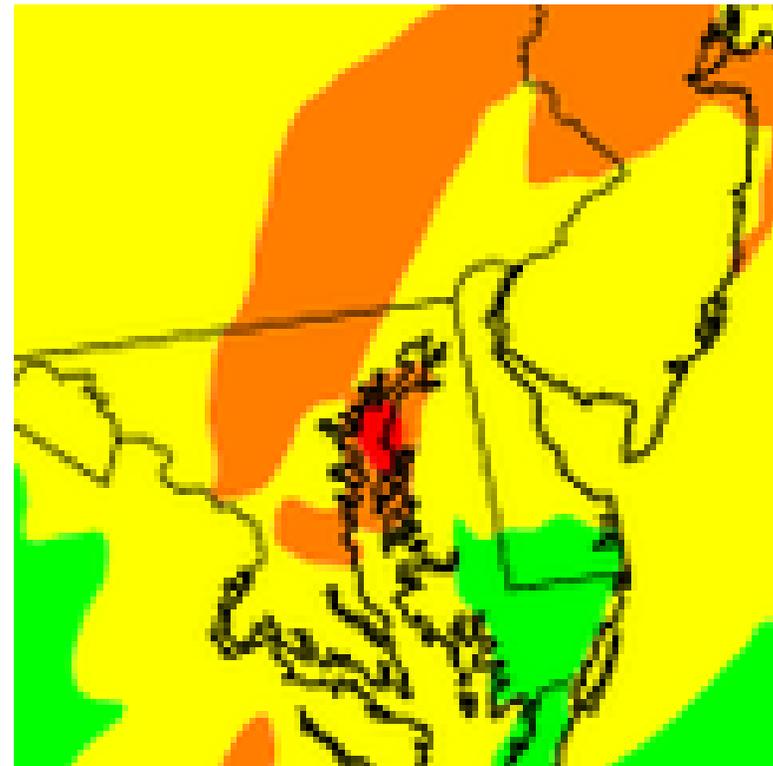
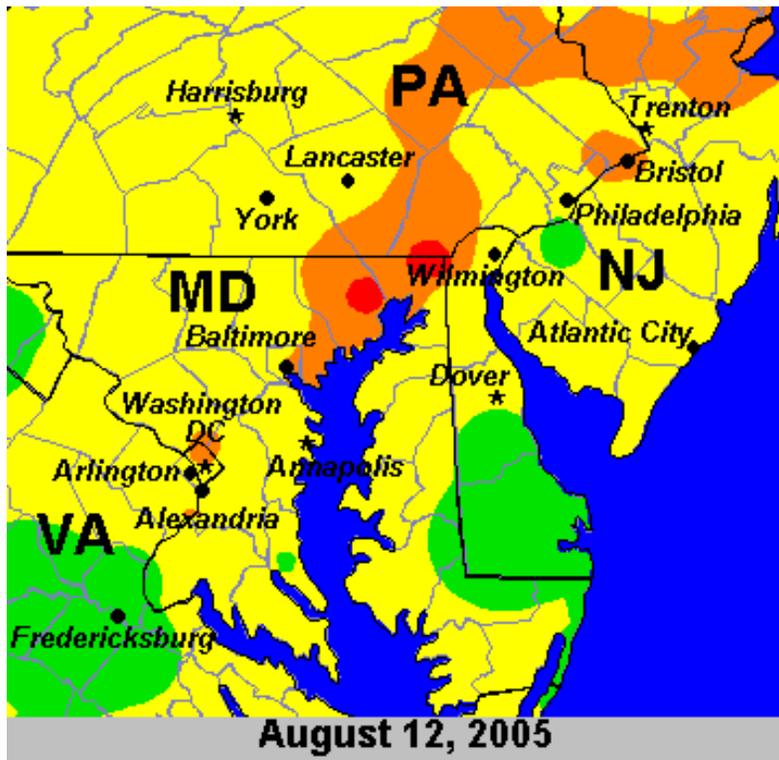


Downtown PHL: 61-90 ppbv observed

The opposite problem was found in 2003 (see below).



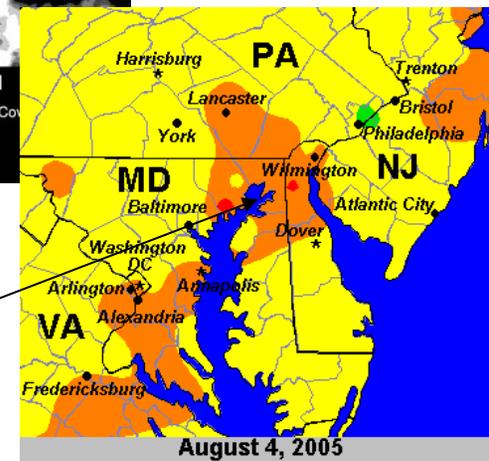
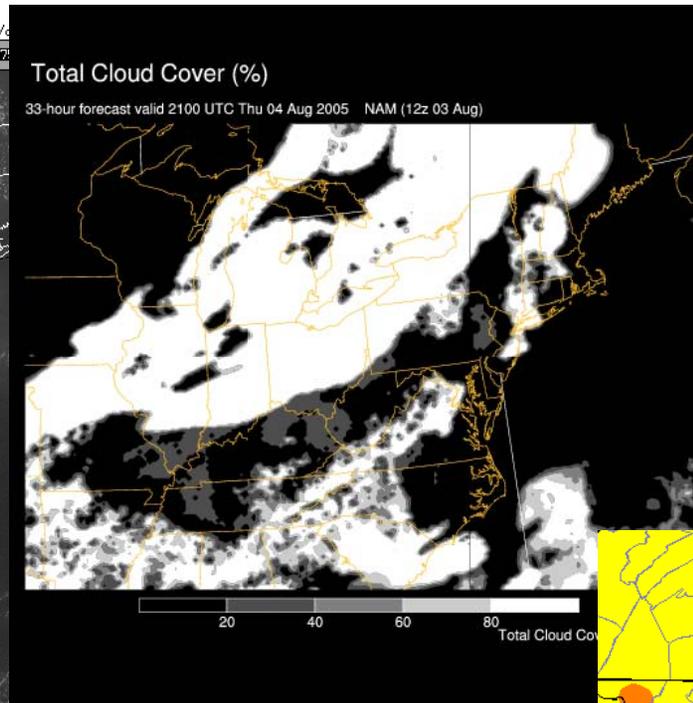
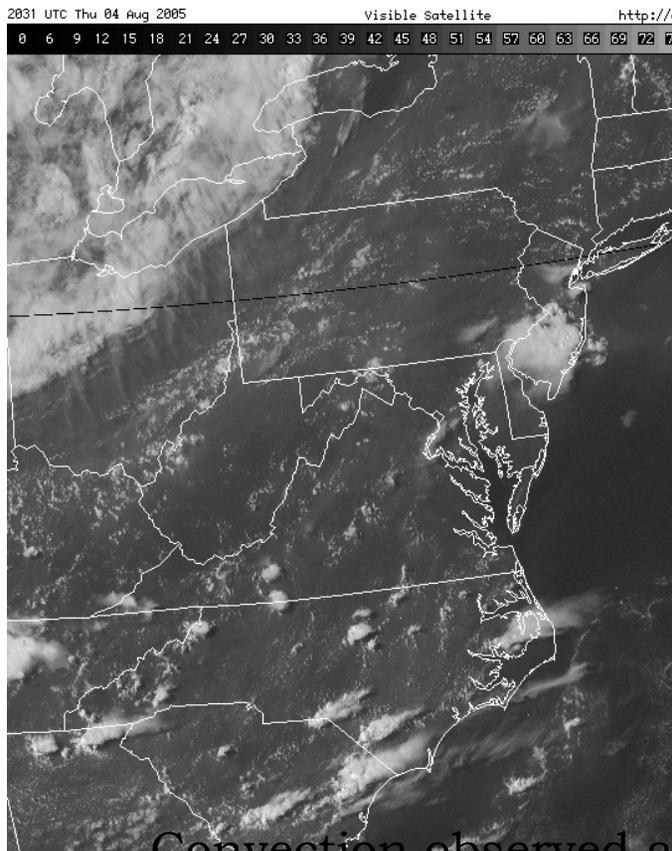
August 12: Missed Code Red Slight Westward Displacement of High O₃ Plume



Ozone Concentration (ppb)

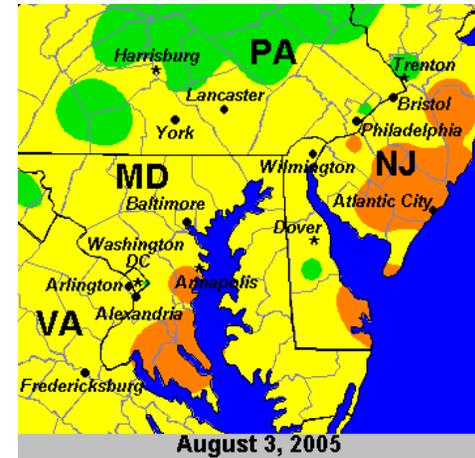
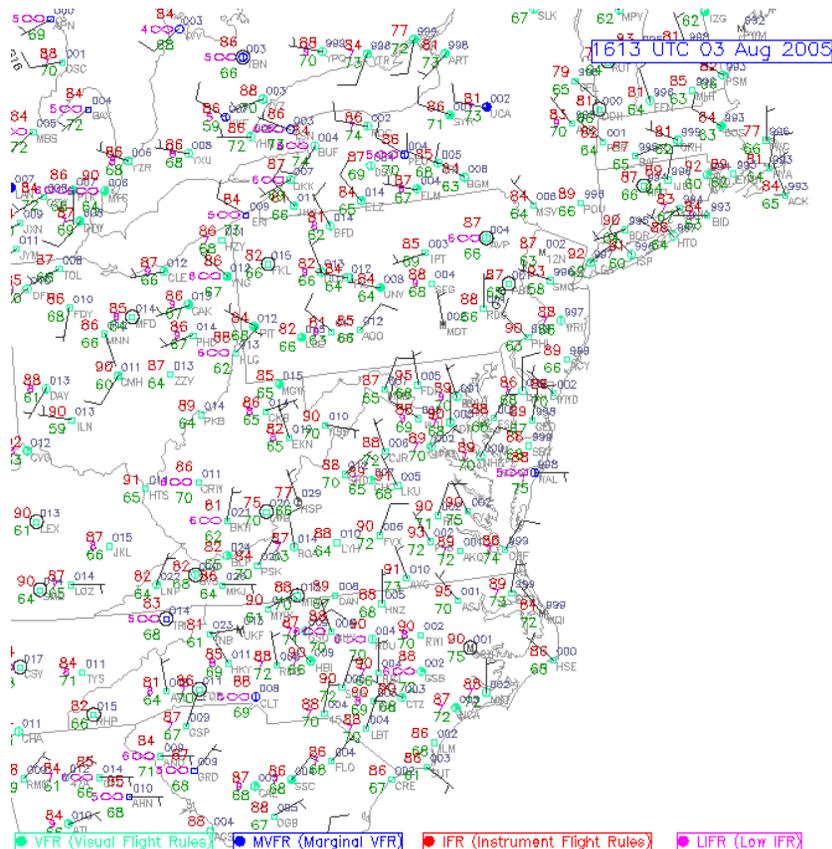


August 4: Missed Code Red – Convection in NJ Forecast

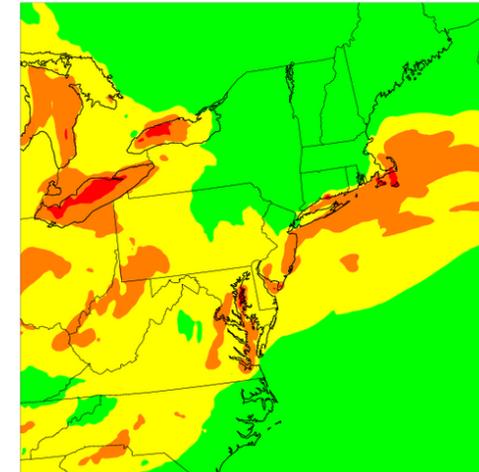


Convection observed as forecast, no one told northern Delaware though.....

“Non-Standard” Case: Low level winds drain from north to south



24hr Max 08 hr Avg Ozone Concentration Ending 0300 UTC Thu 04 Aug 2005



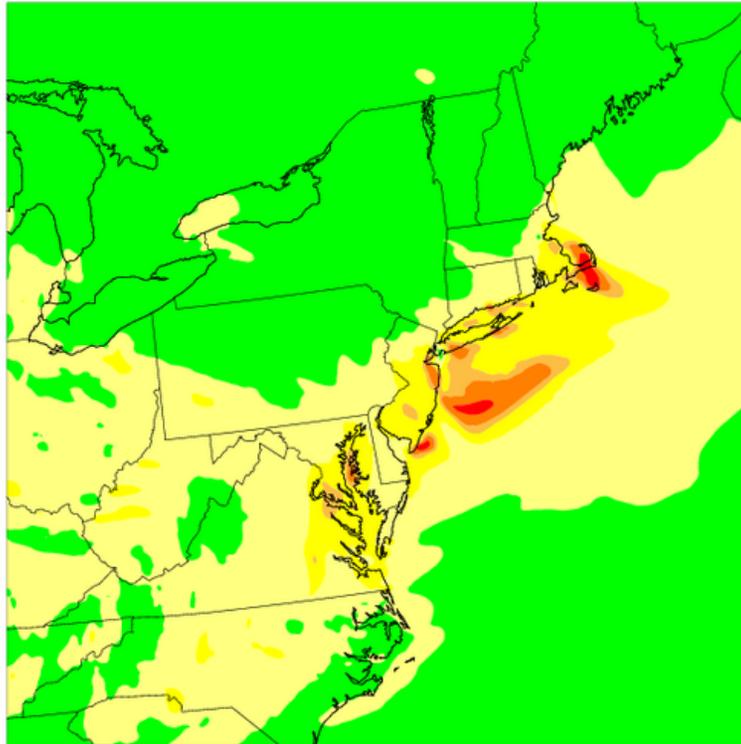
Ozone Concentration (ppb)



Systematic Errors: Abnormally high O_3 at bay/land interfaces

01 hr Avg Ozone Concentration

Valid 2000 UTC Wed 20 Jul 2005

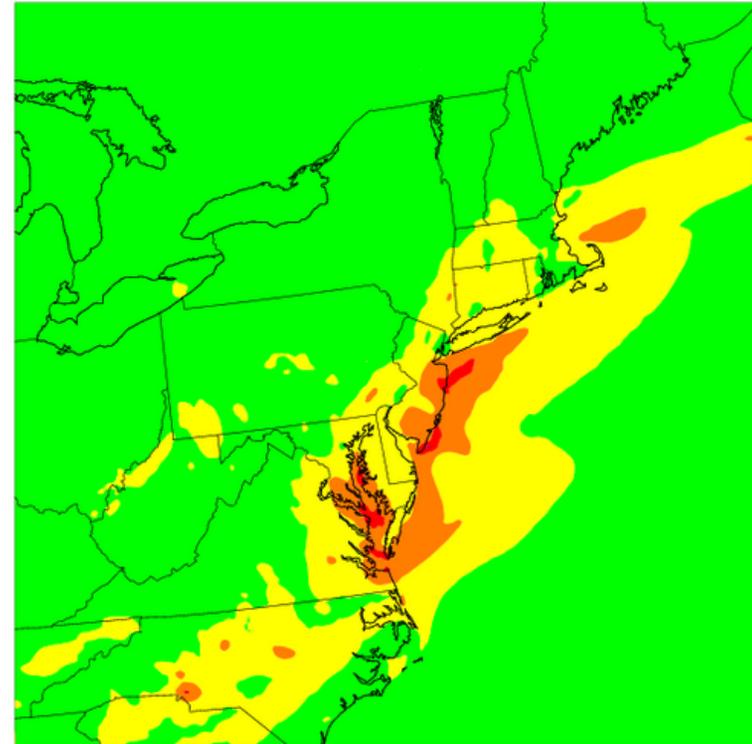


Ozone Concentration (ppb)



24hr Max 08 hr Avg Ozone Concentration

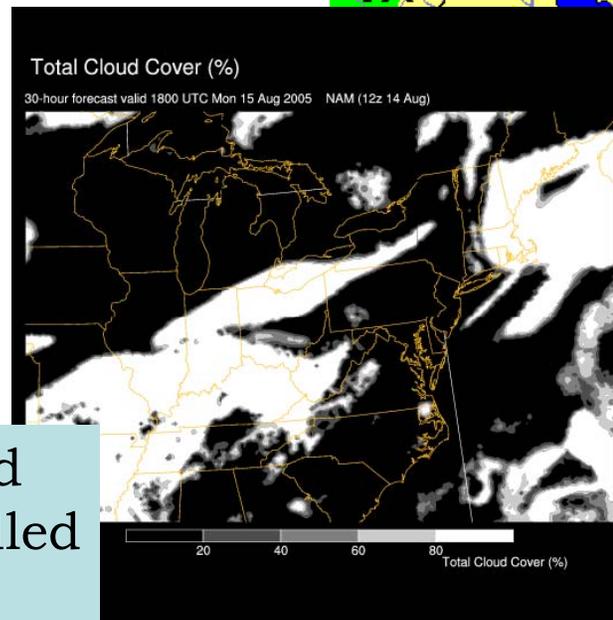
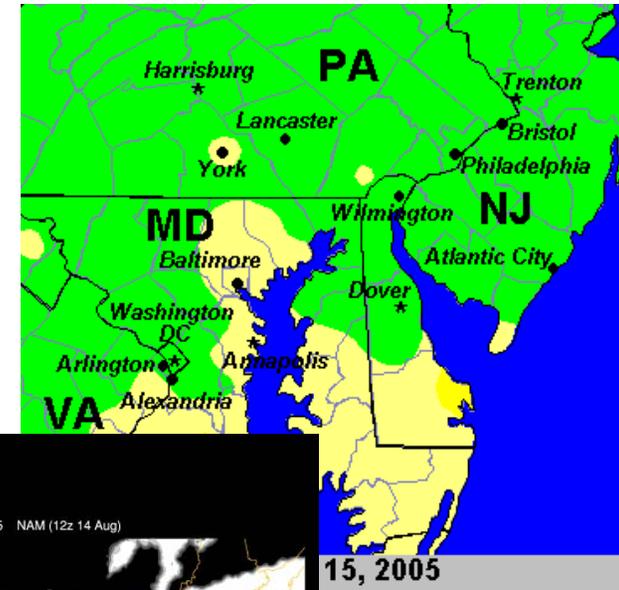
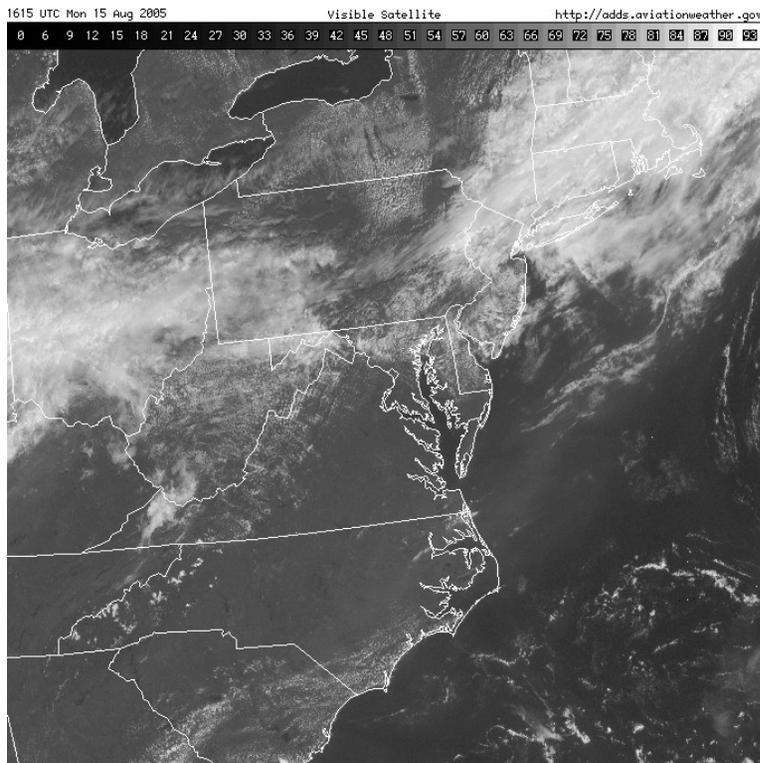
Ending 0300 UTC Tue 16 Aug 2005



Ozone Concentration (ppb)

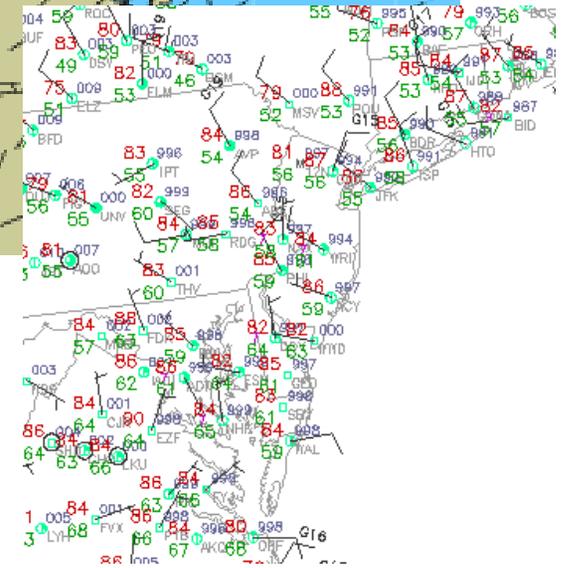
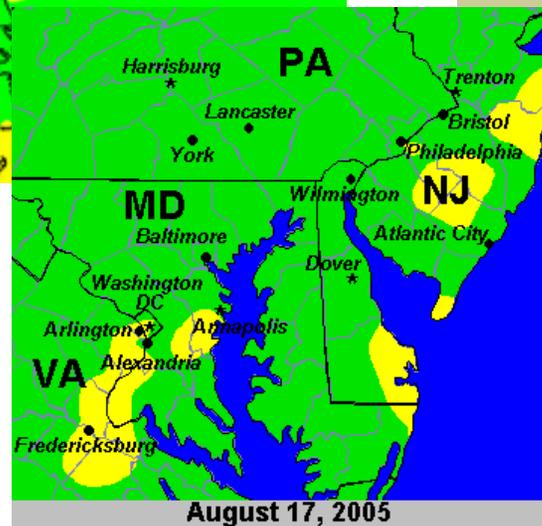
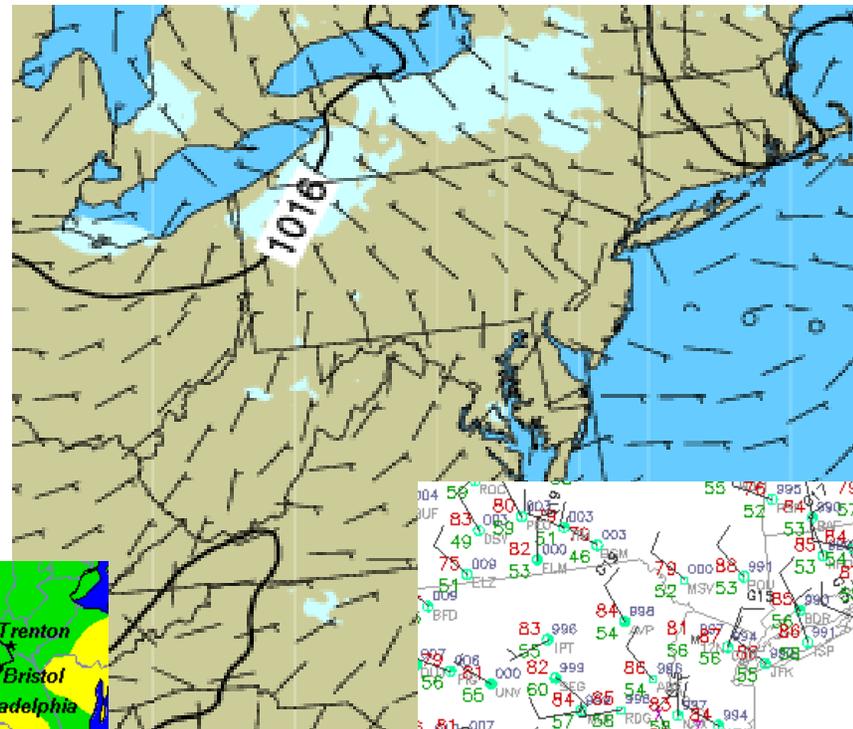
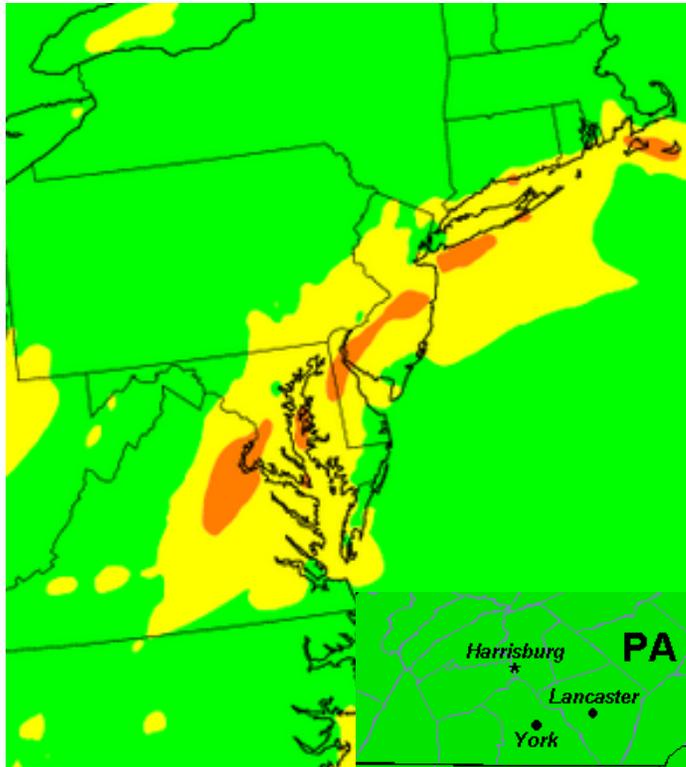


Large Error Case: False Alarm of Code Orange



NAM-12 did not forecast cloud cover, statistical models handled case well.

Large Error Case: Offshore circulation causes stagnation near I-95



Conclusions

- 5X availability limited but did retrieve a good sample of high O₃ cases (n = 8)
- Performance in high O₃ episodes very promising:
 - Onset and termination of high O₃ episodes well forecast
 - Code Red cases identified
 - Over-prediction in near-urban environment, adjusted for by post-processing?
- Large error cases occurred but caught by other forecasting approaches (e.g., statistical models) so didn't impact operational forecasting
- Problems remain with water surfaces: Atlantic coast and Chesapeake and Delaware Bays