Modeling Committee Update

OTC Committee Meeting

September 24th, 2014

Washington, DC

Overview

1. 2014 Ozone Season
2. 2011 Modeling Platform
    1. Development Plan and Schedule
    2. Emission Inventory
    3. Boundary Conditions

2014 Ozone Season

Preliminary 2012-14 Ozone Exceedances and Violations

Only 4 states in the OTR have Preliminary 2012-14 Design Values Exceeding 75 ppb.

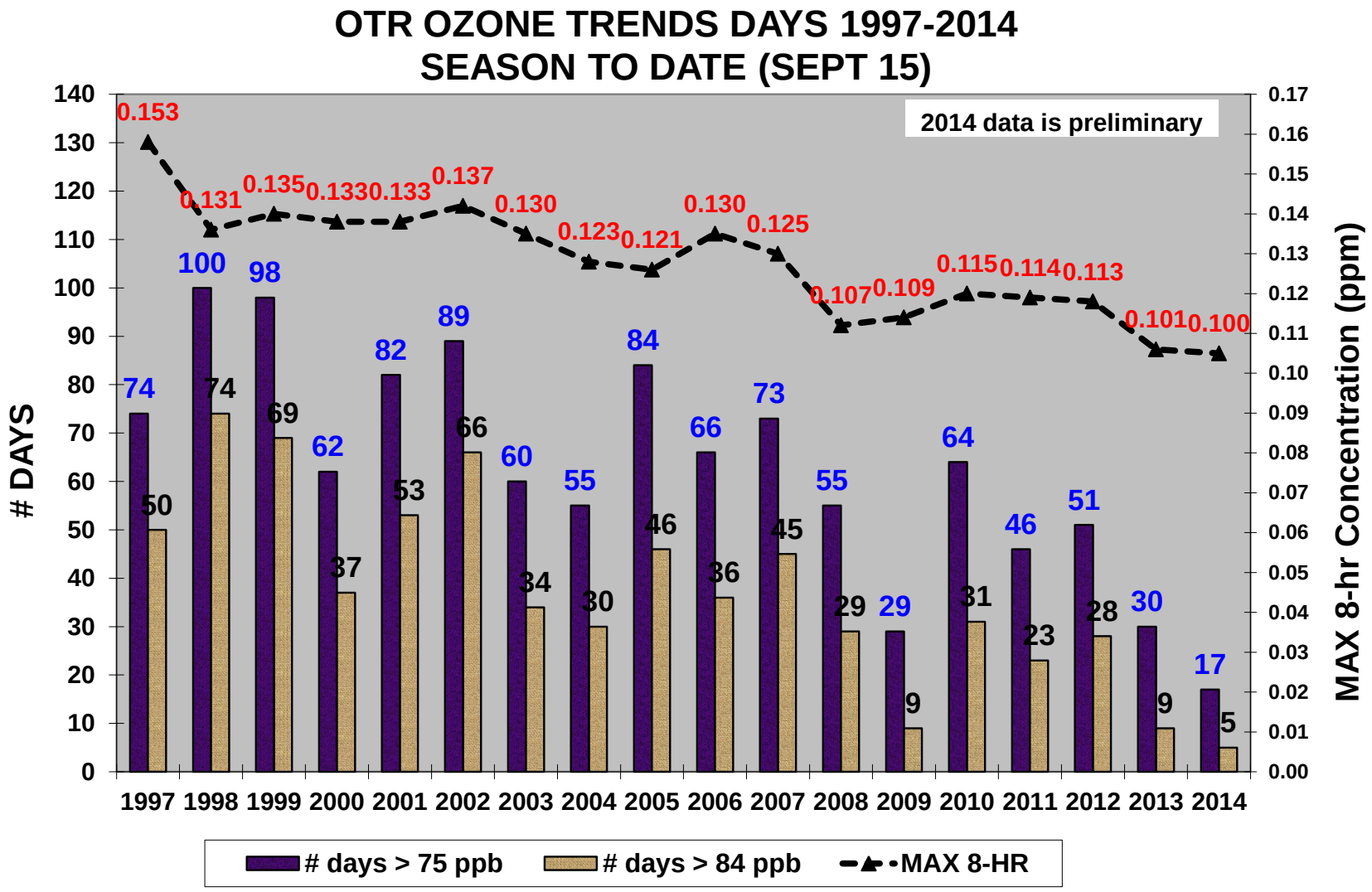
Sites
DV > 75 ppb
TX - 14
CT - 10
WI - 4
IL - 4
GA - 3
MI - 3
MO - 2
NJ - 2
MD - 2
IN - 1
OH - 1
PA - 1

2014 EXCEEDANCE DAYS BY STATE IN THE OTR

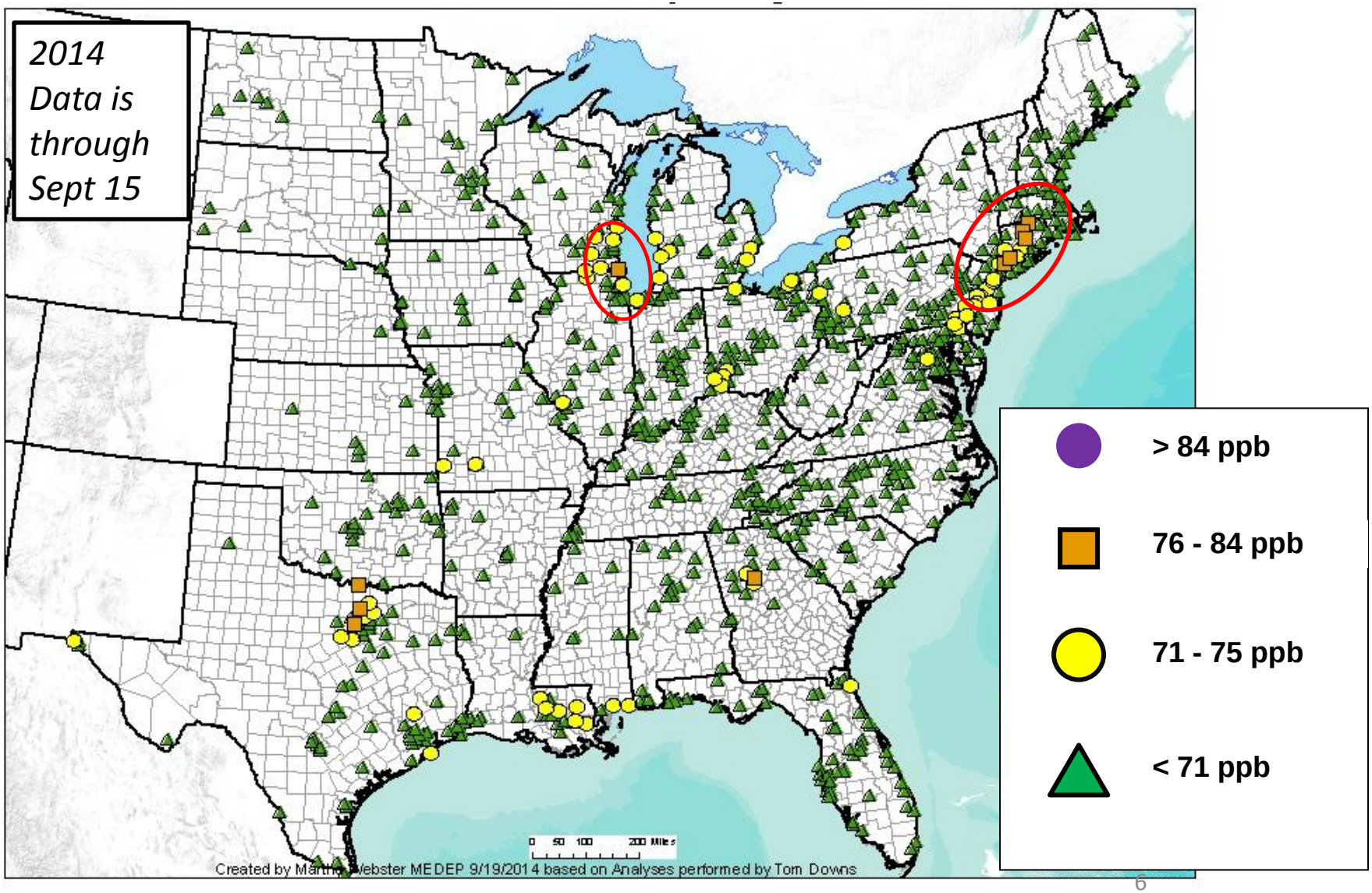
	# exceedances
MA, ME, VT and RI	0
DC and NH	1
DE, NJ and VA-OTC	3
MD	5
NY and PA	7
CT	8
OTR	17

2014 data through September 15

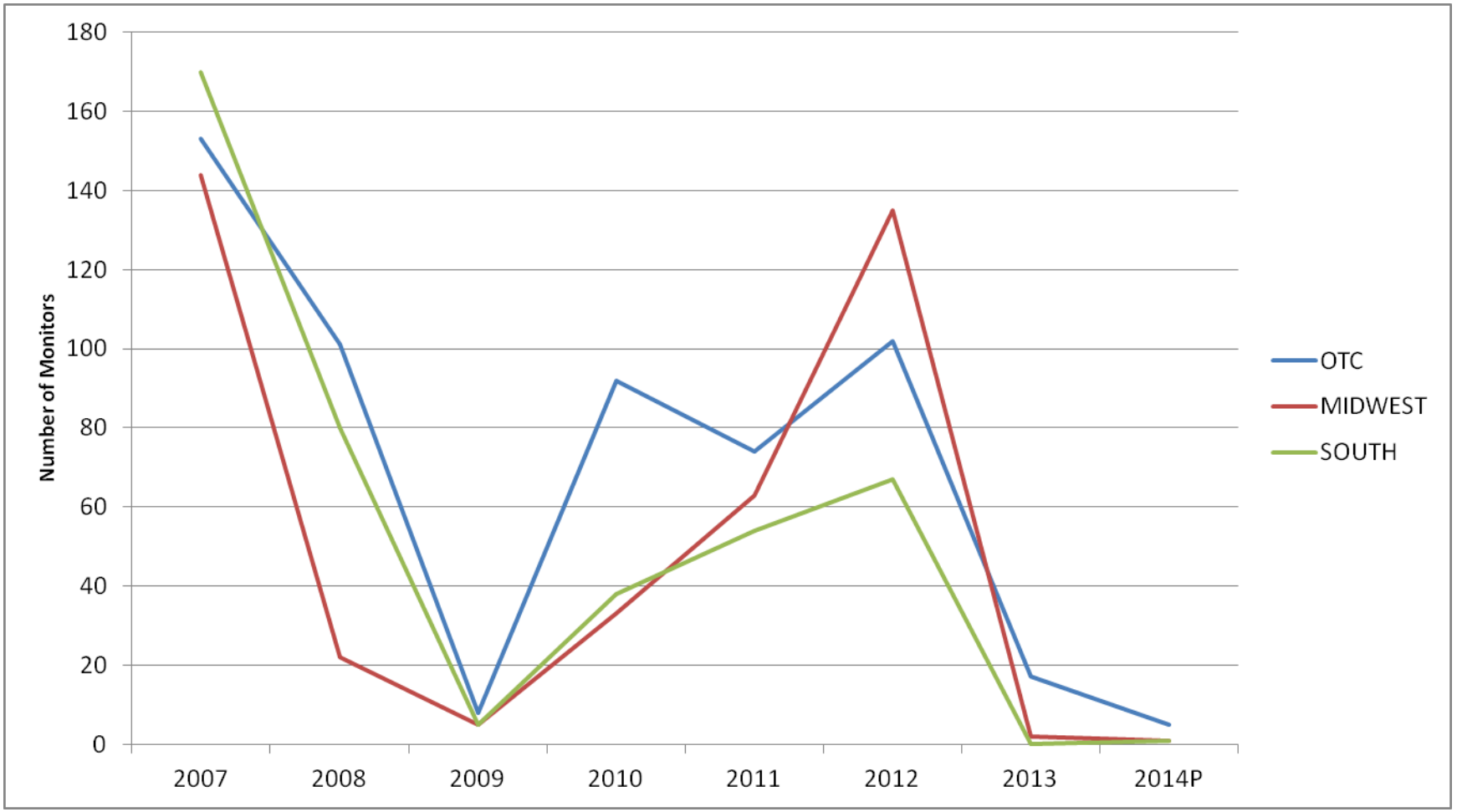
Ozone Trend Days 1997-2014 **(OTR)**



Preliminary 2014 Ozone 4th Highest 8-hr Value



Number of Locations with 4th High Ozone Exceeding 75ppb by Year



Number of monitors in OTR 200-220

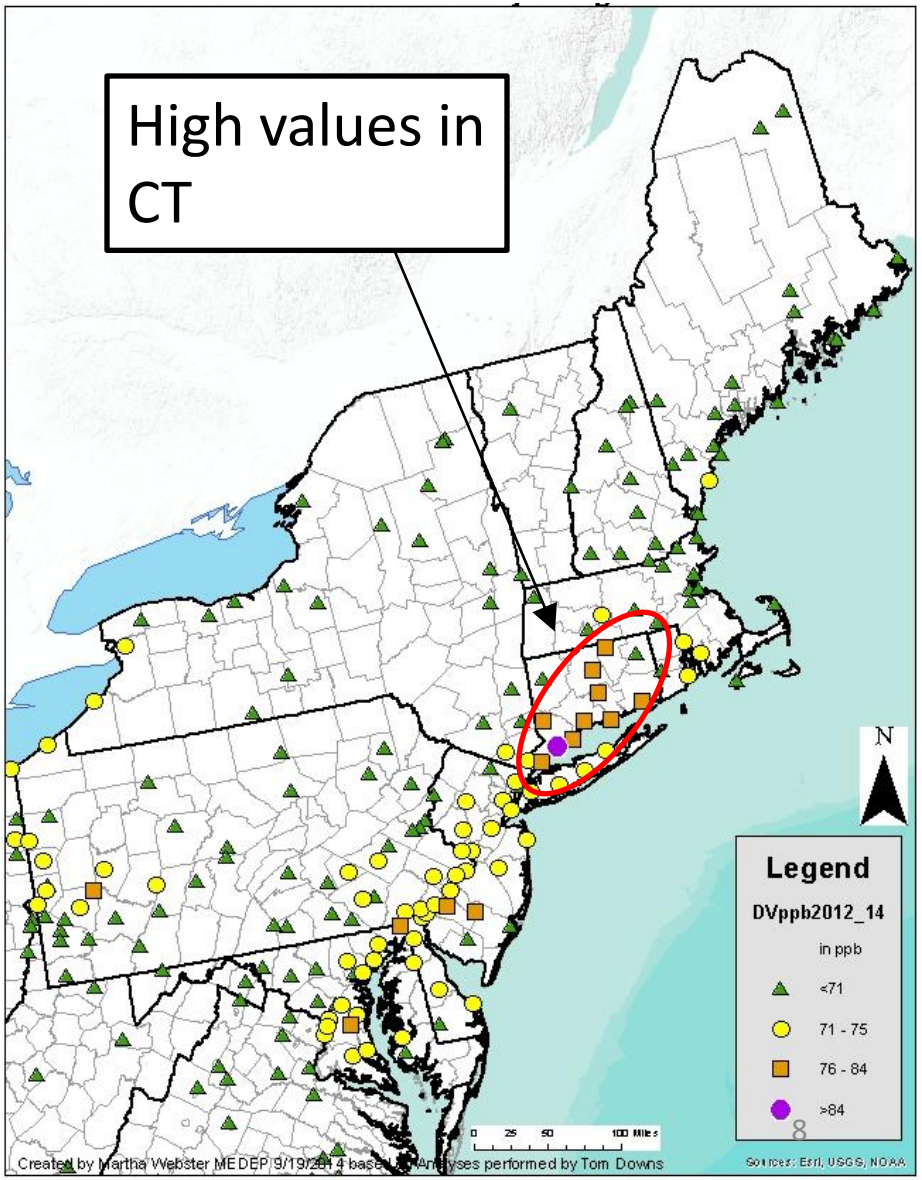
2014 Data is through Sept 15

Preliminary 2014 Ozone Design Values

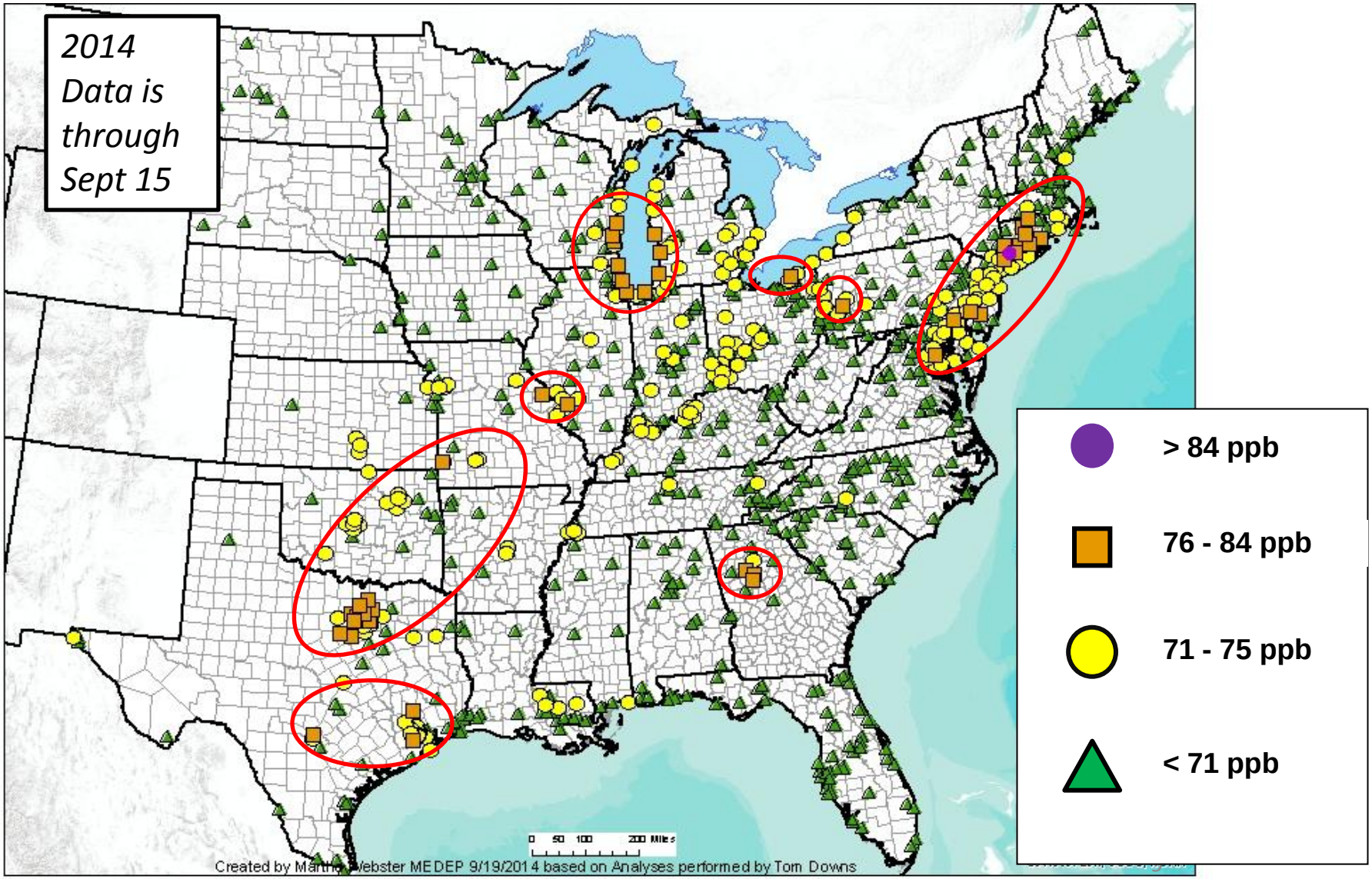
3-Year average of the 4th high concentration for 2012, 2013, 2014

- > 84 ppb
- 76 - 84 ppb
- 71 - 75 ppb
- < 71 ppb

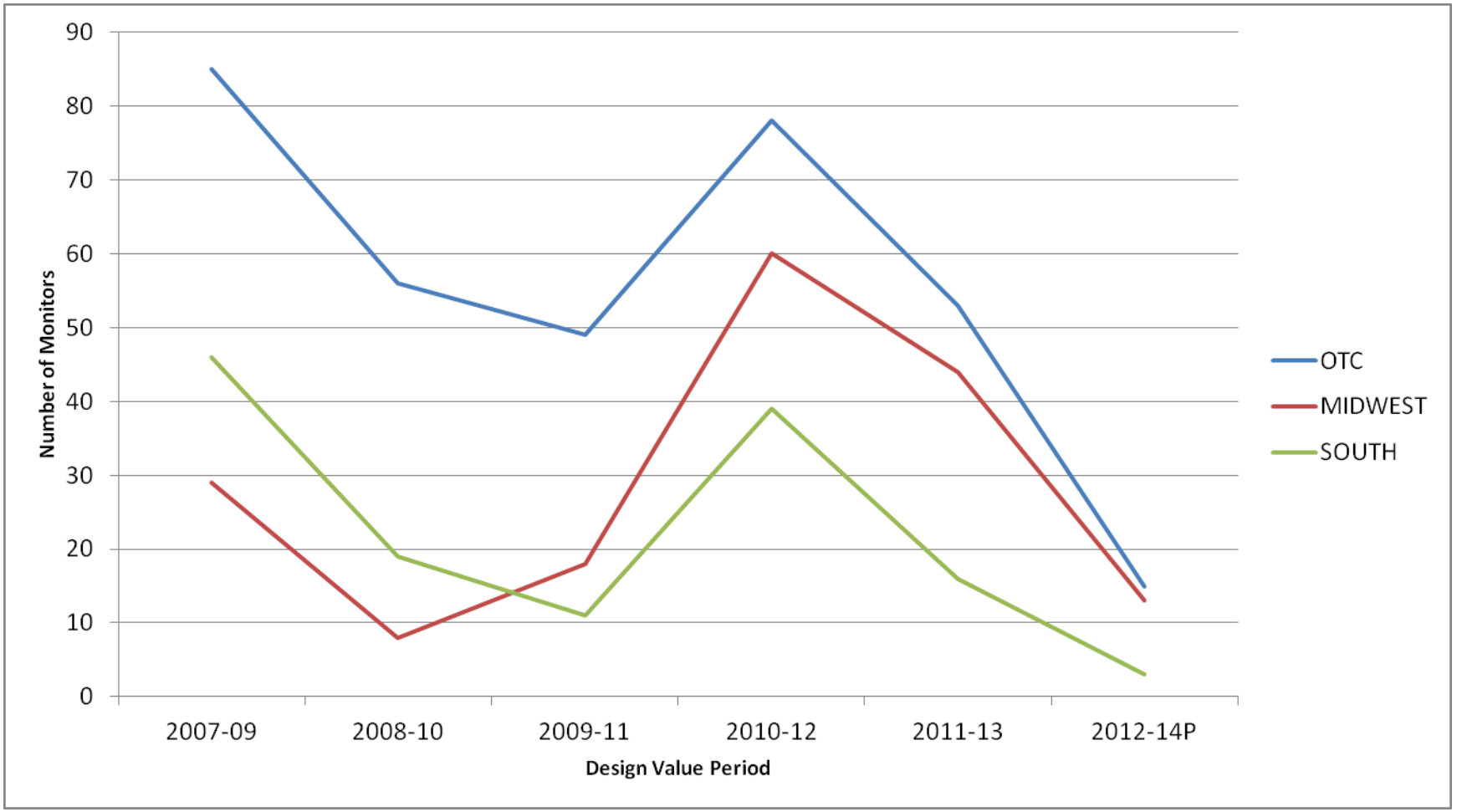
2014 Data is through Sept 15



Preliminary 2014 Ozone Design Values



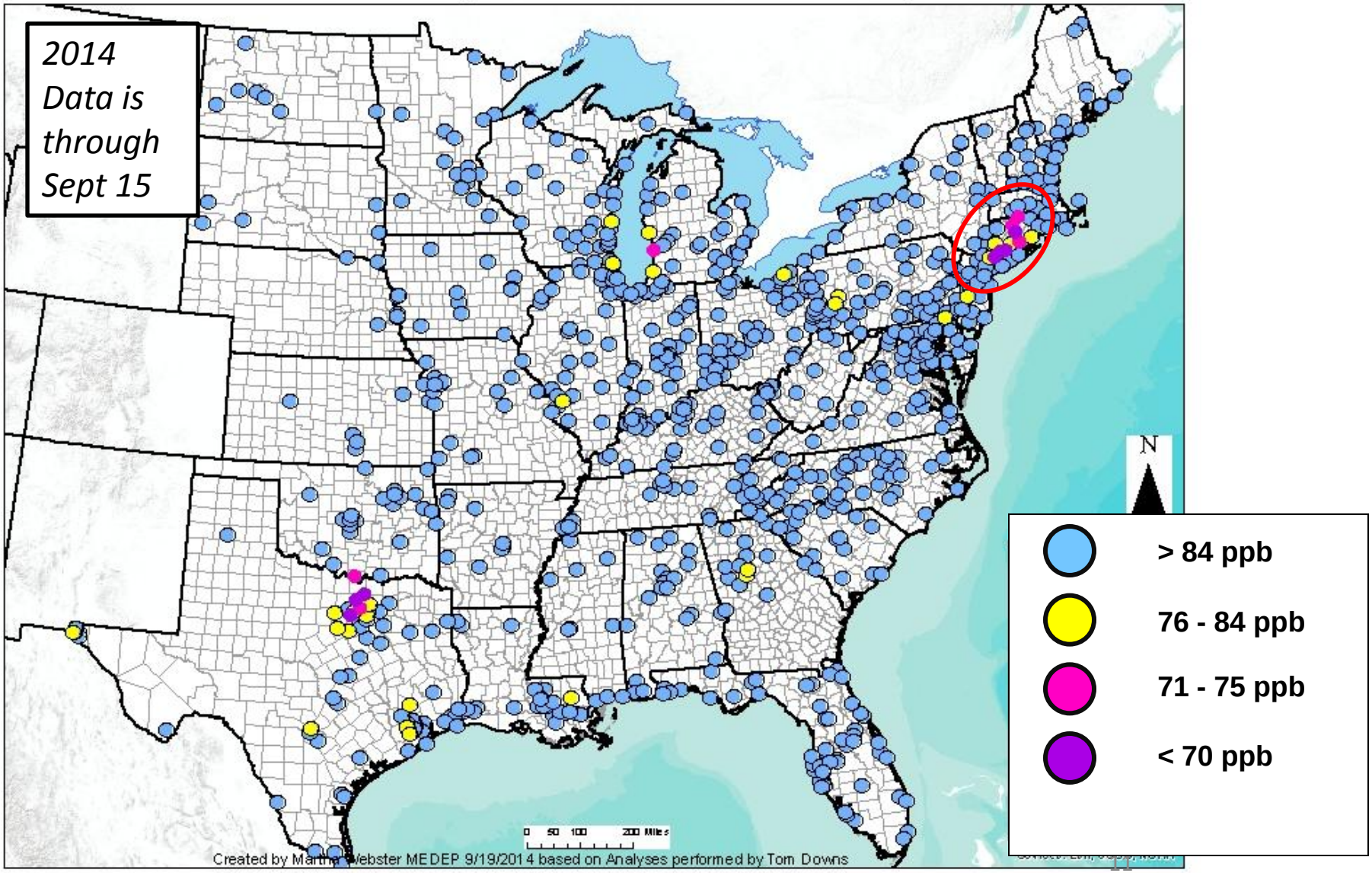
Number of Locations with Ozone Design Values >75ppb



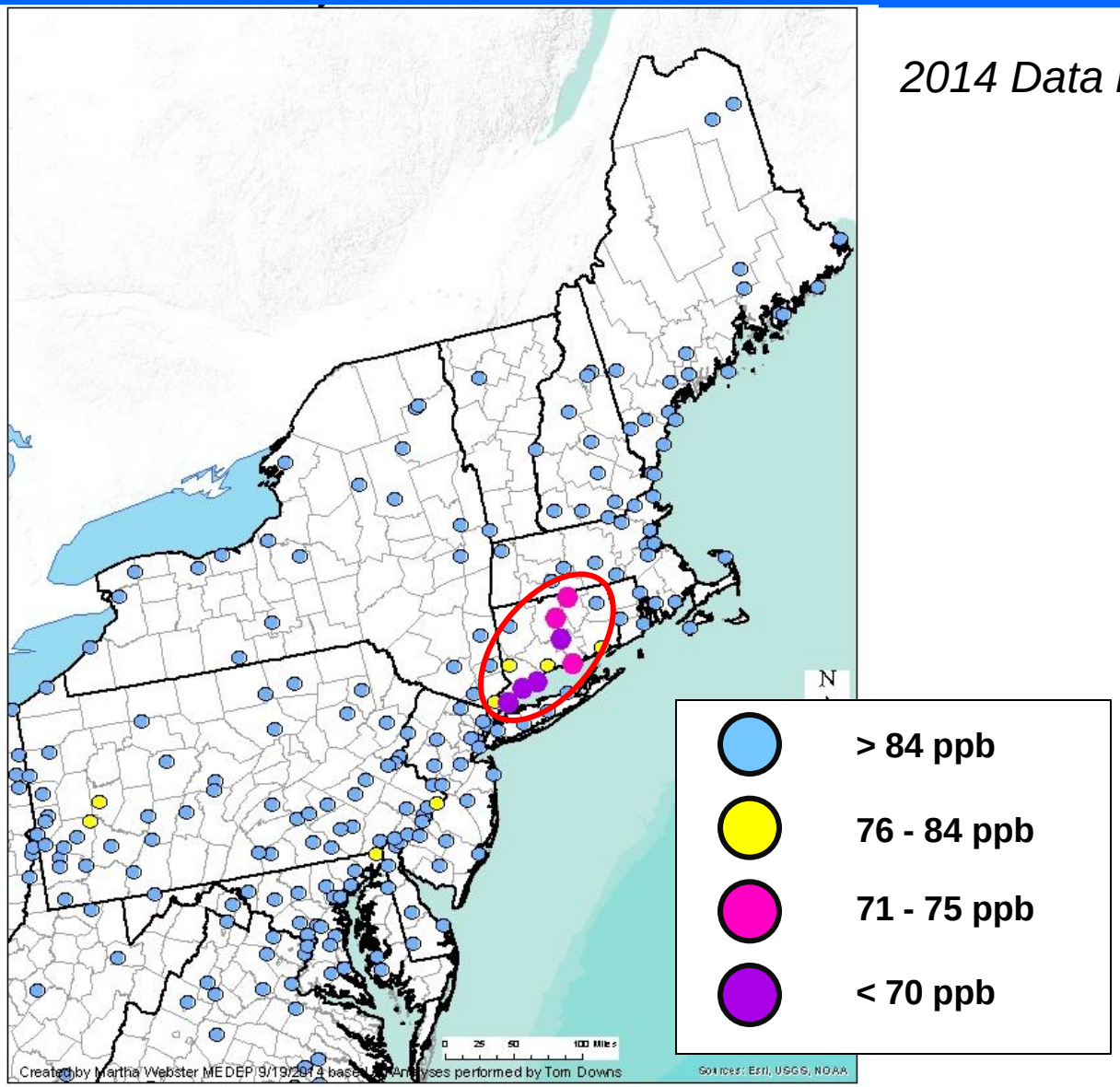
Number of monitors in OTR 200-220

2014 Data is through Sept 15

2015 Ozone 75ppb Thresholds

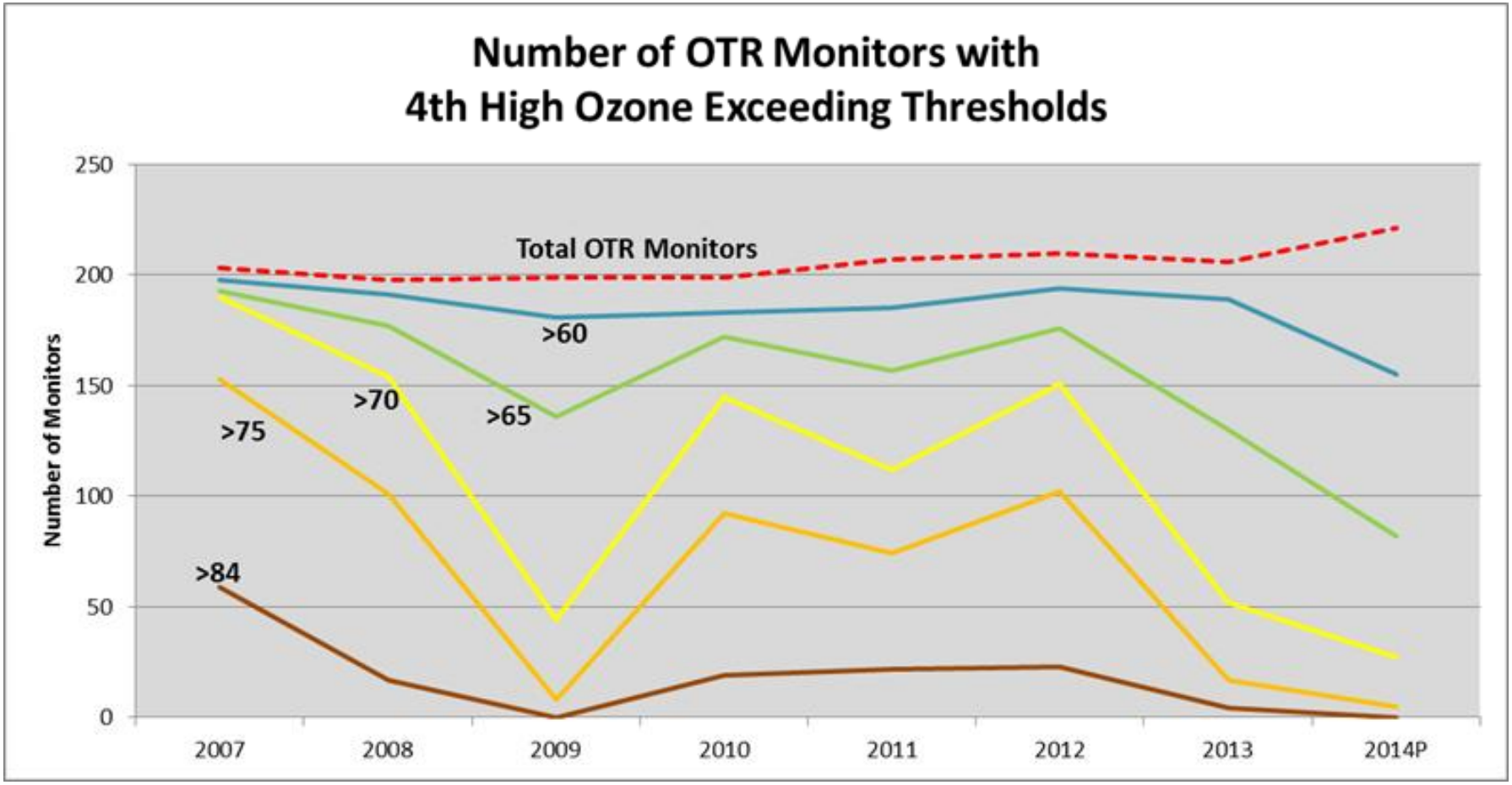


2015 Ozone 75ppb Thresholds



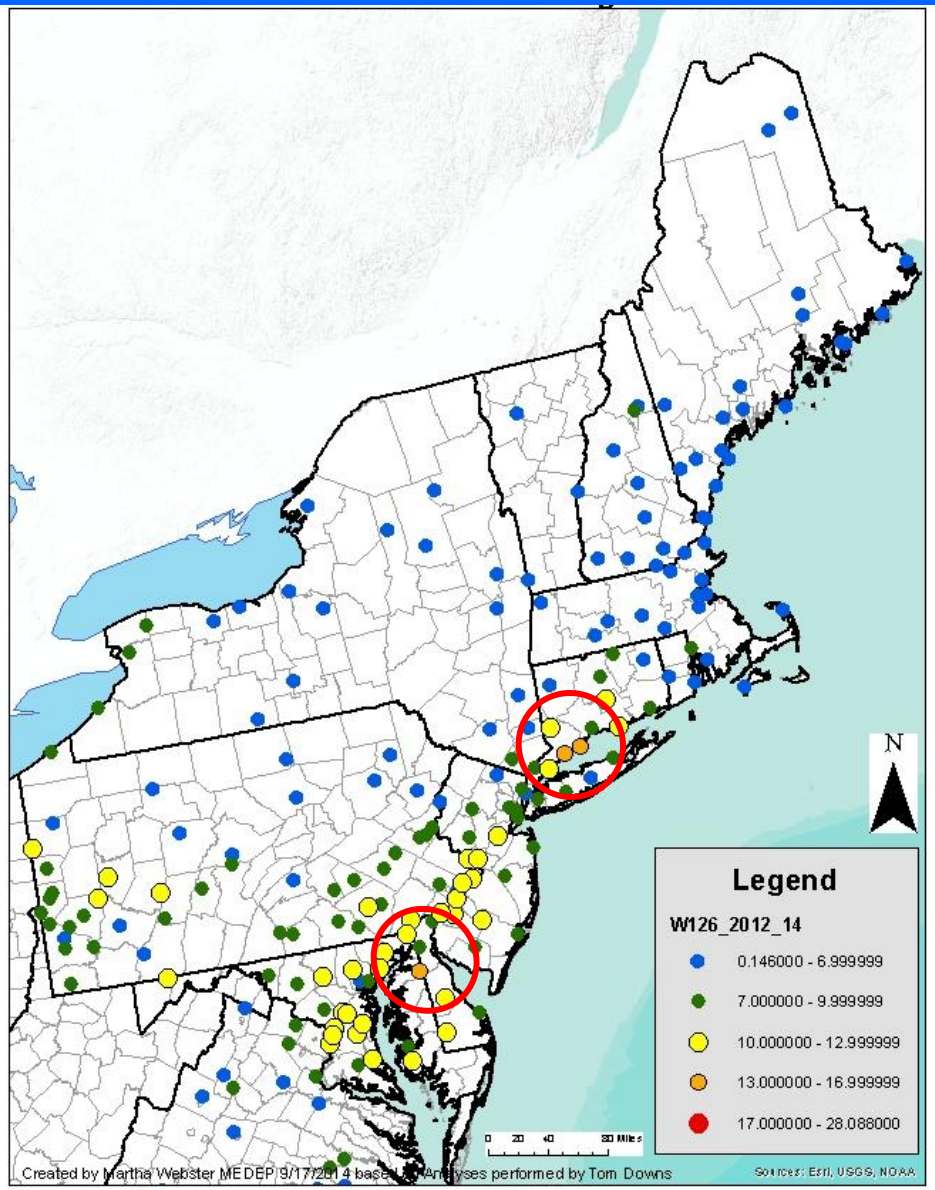
2014 Data is through Sept 15

Potential Effect of New Standards



Note: The dashed red line represents the total # of monitors in the OTR

Preliminary W126 Design Values



Proposed CASAC range for secondary ozone NAAQS = 7 to 15ppm-hrsc

W-126
2012-14 Design Value

- < 7 ppm-hrs
- 7 – 10 ppm-hrs
- 10 –13 ppm-hrs
- 13 – 17 ppm-hrs

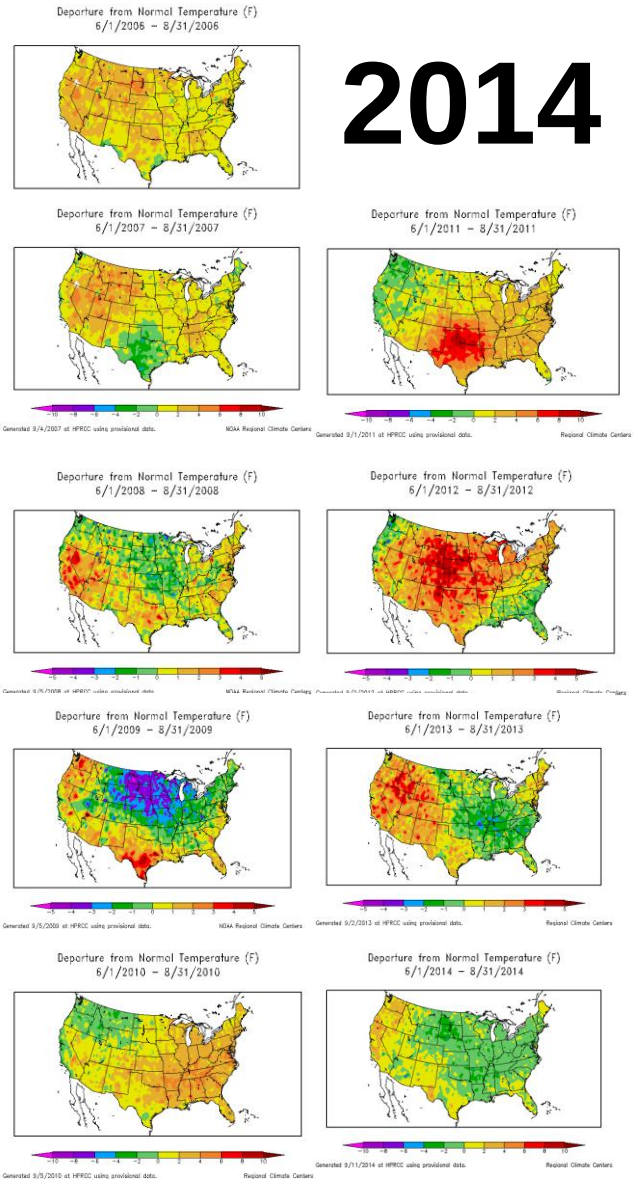
Highest - 14.2 ppm-hrs

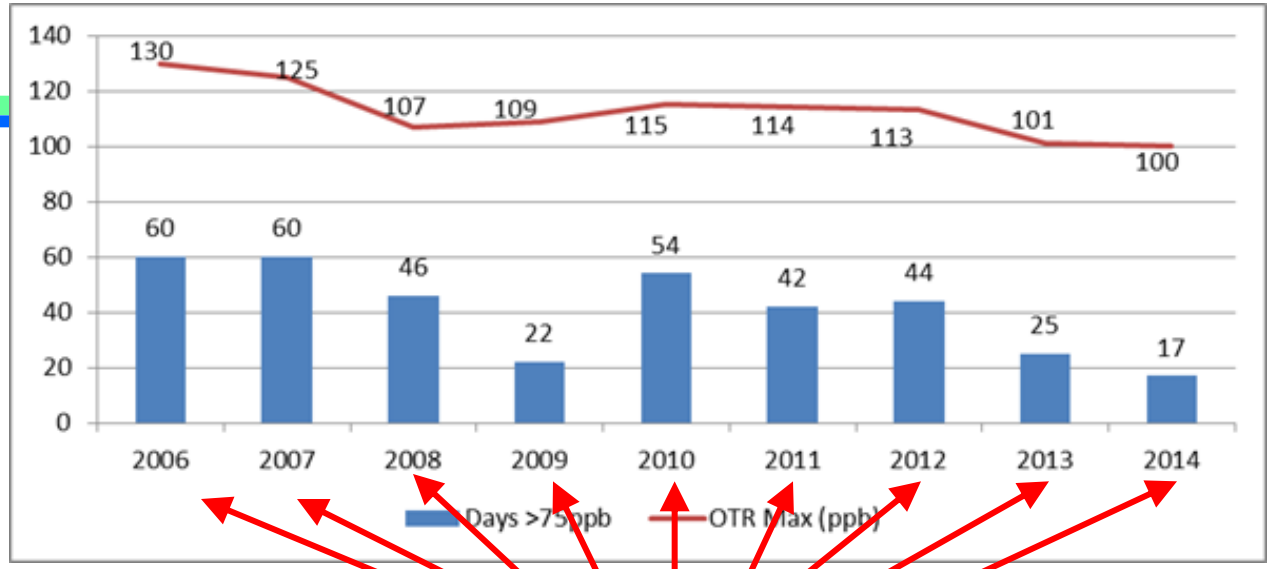
Warm Weather and Ozone

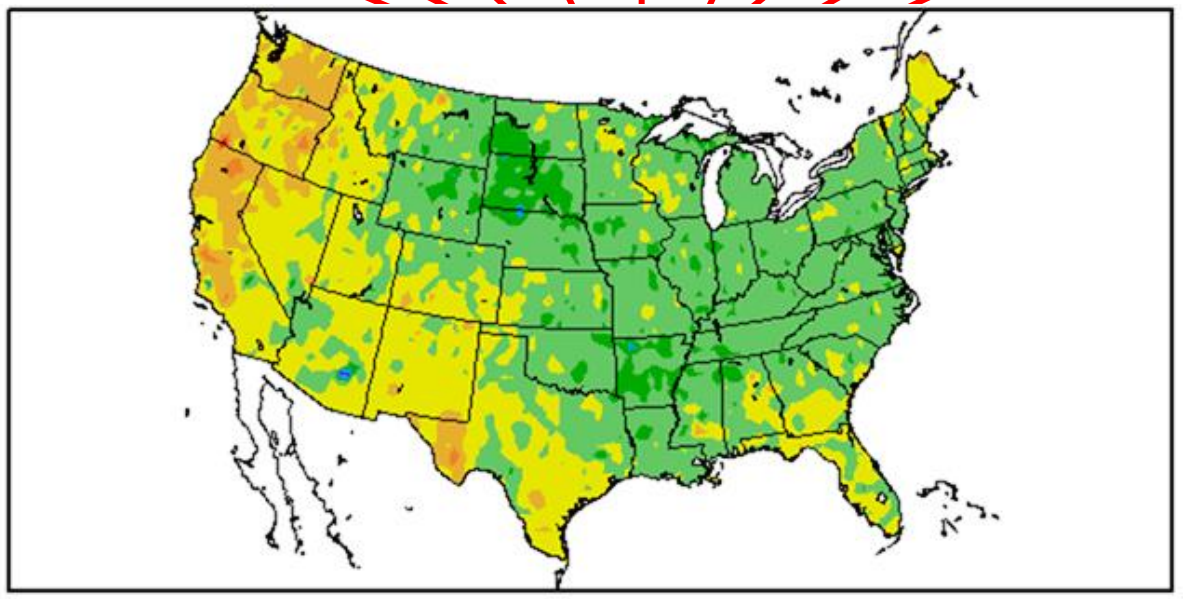
- Warm weather and high ozone often go together. Warm weather provides:
  - Increased energy demands
  - Faster ozone production chemistry
  - Favorable wind patterns for ozone build-up and transport
- Highest ozone in the OTR is often associated with hot weather locally and in upwind areas

Temperature Patterns

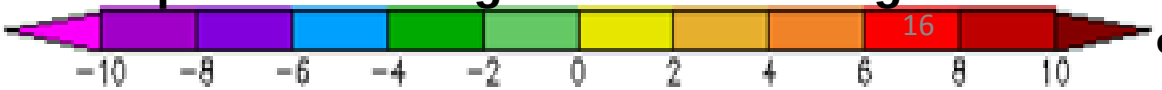
2014

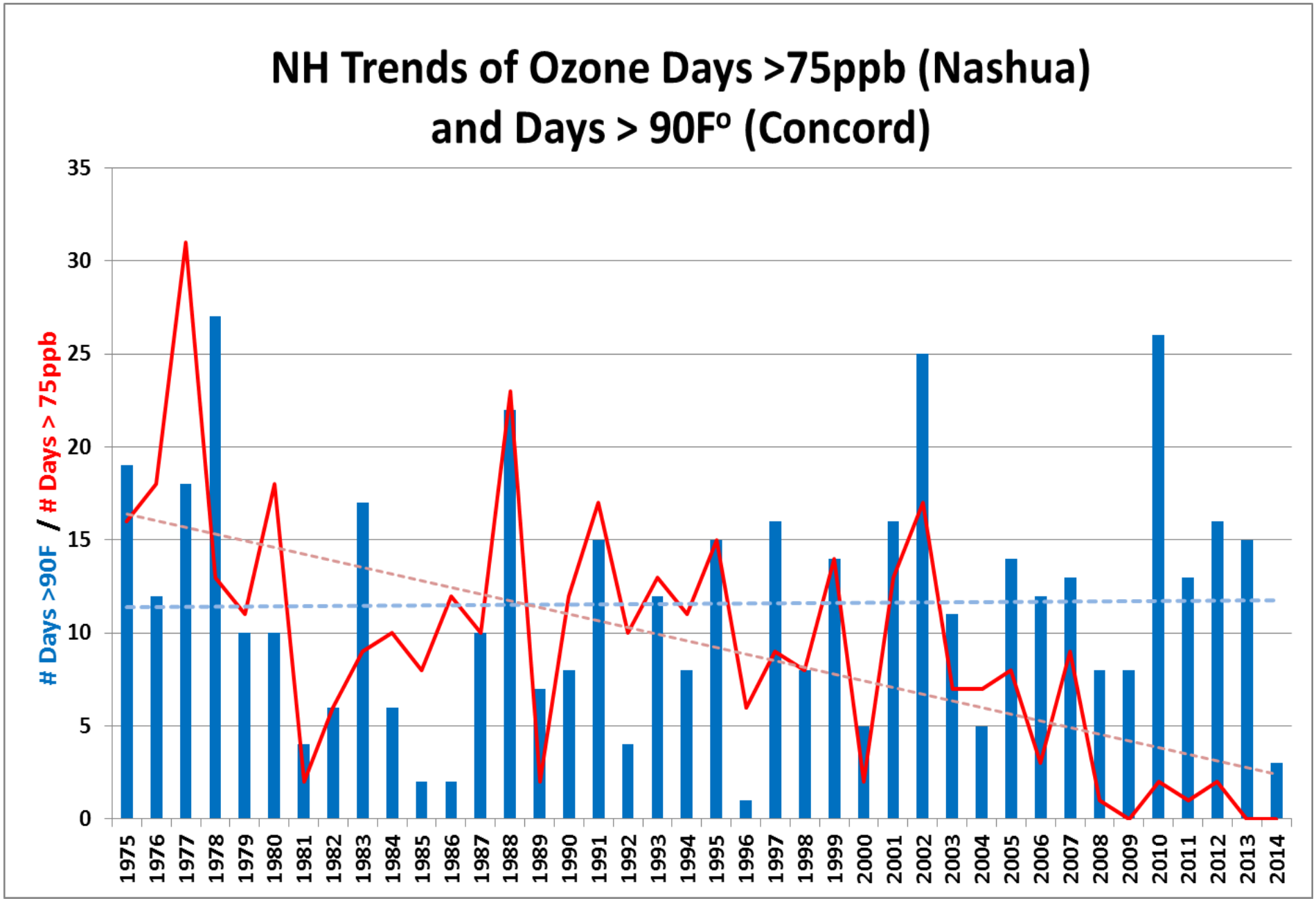






Temperature change from climatological norm





2014 Data is through September 17

2011 Platform Schedule

Fall 2014

- 2011 EPA Modeling Meteorology and Inventory (version 2)
- ERTAC 2018 Integration
- Research Boundary Conditions
- Biogenics (Inter-regional)

Winter 2014-2015

- Level 1B Screening 2018 Emission Projection using EMF
- Nested Grids

Spring 2015

- 2018 EPA Modeling Inventory (version 2)
- Level 1B Screening Modeling begins for Base Cases

2011 Platform Screening

Level 1A (testing):

- EPA 2011 & 2018 (v1)
  - Canada / Mexico emissions from 2006/1999
  - IPM V5.13,
  - Tier 3 Mobile Standards,
  - State/Federal On-the-books for other sectors

Level 1B:

- EGUs: ERTAC v2.3
- Onroad: EPA 2018 (version 1)
- Other sectors: MARAMA EMF emissions

Levels 2 and 3 will reflect platform improvements

Level 1B Emission Inventory Development Plan

Sector	2011 Base	Future (2018/28)
Biogenics	MEGAN	MEGAN
EGU	CEM Data	ERTAC v2.3
Non-EGU Point, Area, M/A/R, Nonroad	USEPA v2	*OTR:* EMF Projections *Outside OTR:* USEPA v2
Onroad Mobile	USEPA v1	USEPA v1

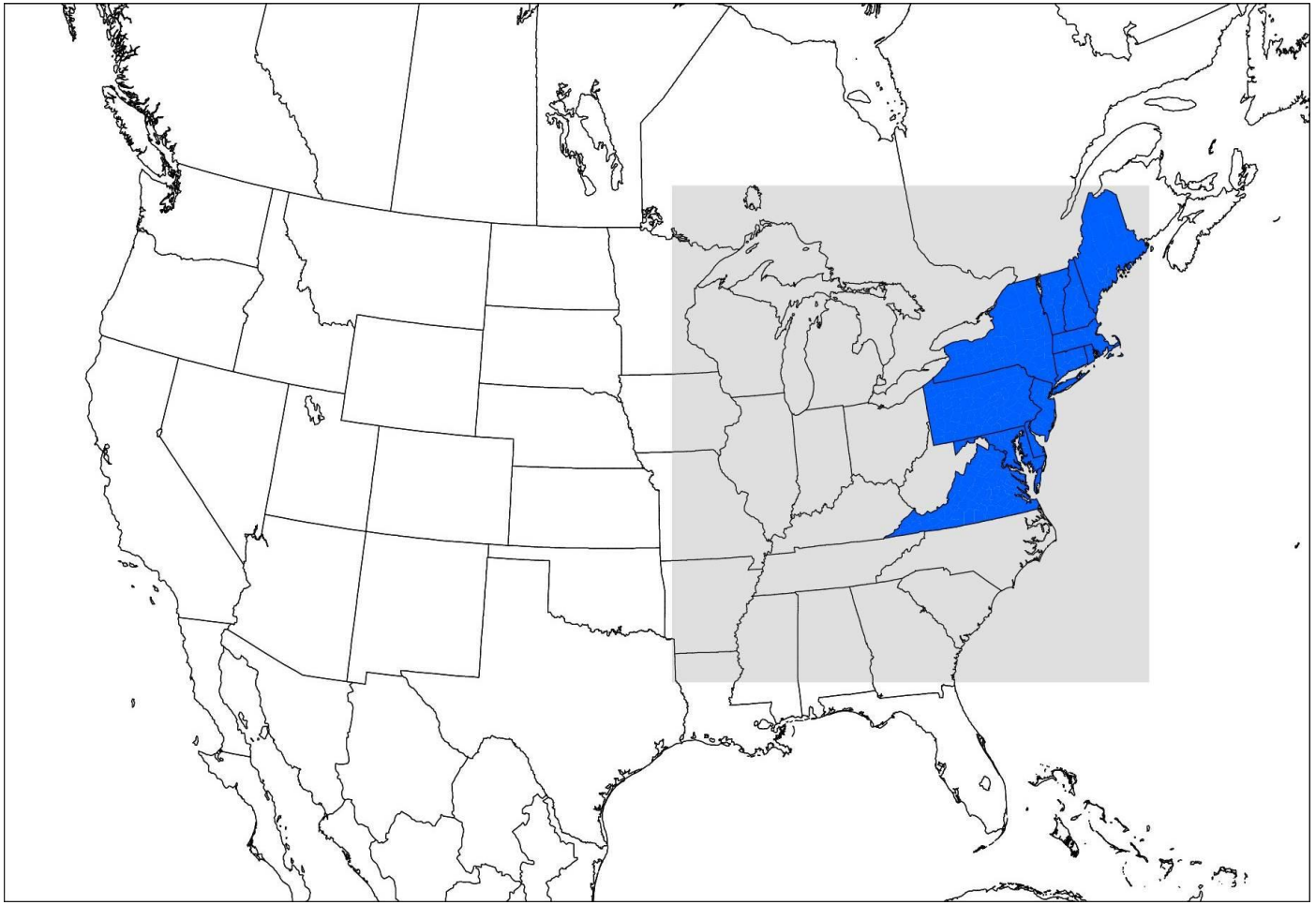
MARAMA

ERTAC EGU Emission Projection Progress

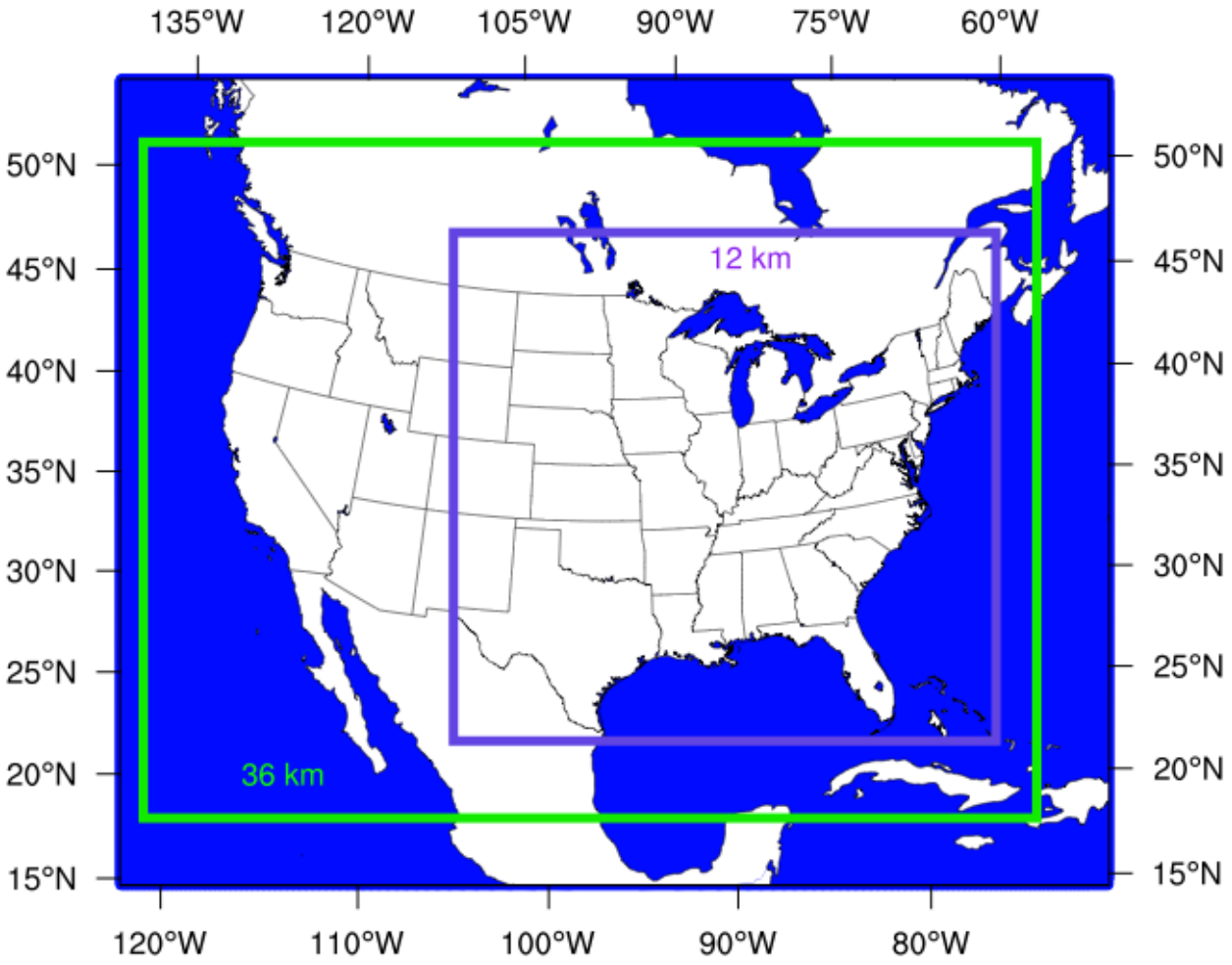
- ✔ Improved model code
- ✔ 2018 v2.2 projected from a 2011 base
- ✔ State and stakeholder review of results
- January 2015 – v2.3 (including stakeholder feedback)

MARAMA

OTC Modeling Domain



LADCO Domain



Preliminary LADCO 2018 Modeling (CAMx)

Monitor	2018 IPM	2018 ERTAC
Harford, MD	81.5	82.7
Babylon, NY	78.6	78.8
Westport, CT	78.2	78.4
Philadelphia, PA	77.5	77.8
Clarksboro, NJ	77.2	77.8

EPA Version 1 emissions inventory with:
IPM (CAIR), or
ERTAC Version 2.1L

A Focus on Boundary Conditions

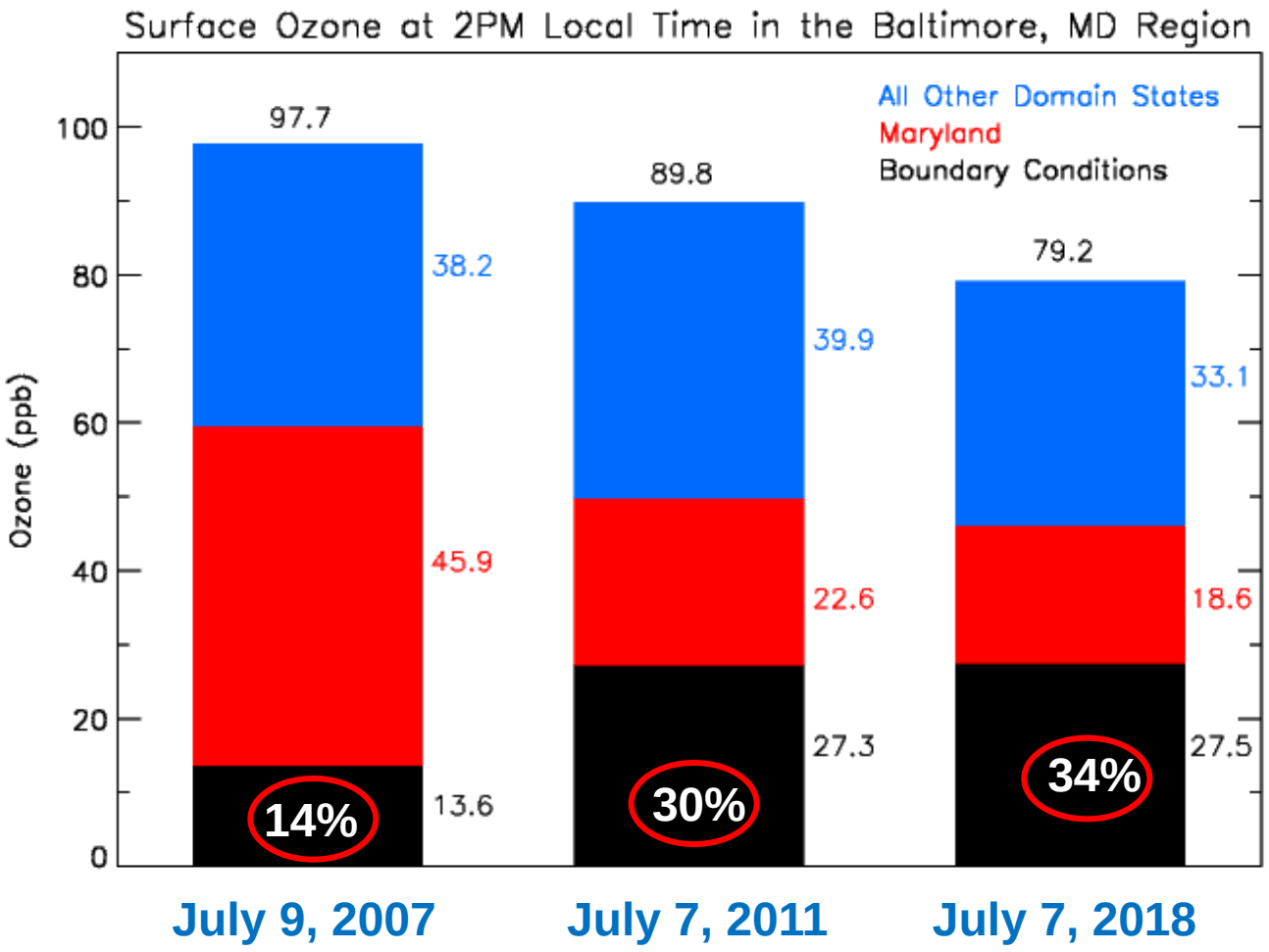
What are Boundary Conditions?

- **Boundary Conditions** are what transports across the edges of the modeling domain
  - Western US
  - Portions of Canada
  - Inter-continental transport
  - Global background levels
  - In-domain emissions that leave the domain and re-enter
  - Stratospheric intrusions
- **Background** is what is outside of your control.
  - May include biogenics and anything outside your jurisdiction.
- **Initial Conditions** are the starting point inside and at the edges of the modeling domain at hour 0
  - Normally not a factor in contributions for longer term modeling analyses – flushes through.

Establishing Boundary Conditions

- Global transport models, such as GeosChem, are often used to estimate timing, location, and magnitude of certain air pollutants
- Ideally, regional photochemical modelers will use data from a national domain modeling analysis to develop boundary conditions for a smaller regional domain
- Optimizing boundary condition data becomes increasingly important when ozone NAAQS are lowered
  - Becomes a larger percentage of the ozone total

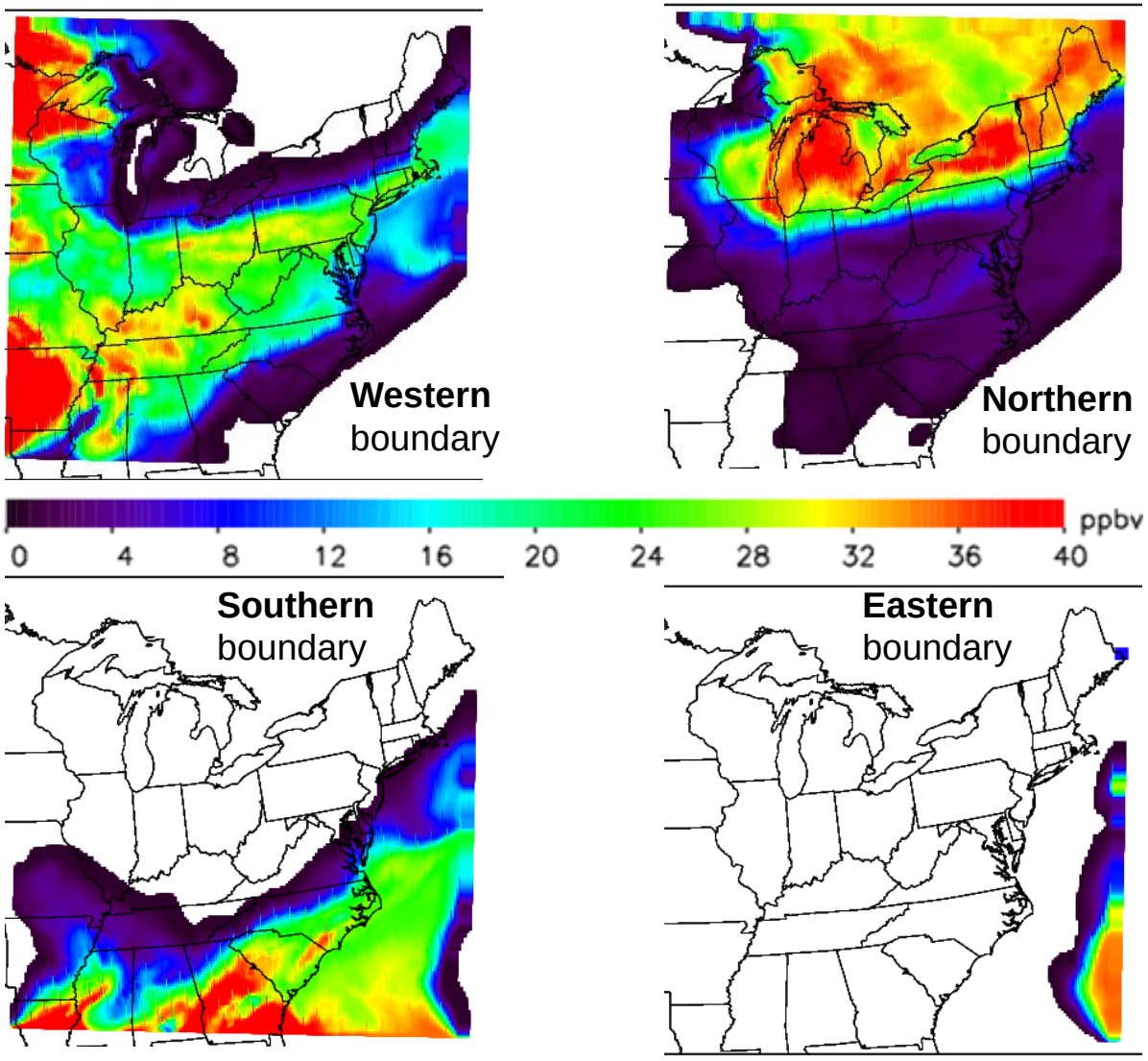
Importance of Boundary Conditions



Emissions at the model domain boundaries, are becoming more important when trying to show future attainment

Preliminary results from CAMx v6.10 installed at the University of Maryland, Dan Goldberg

2011 Modeling Platform: July 7 Boundary Conditions



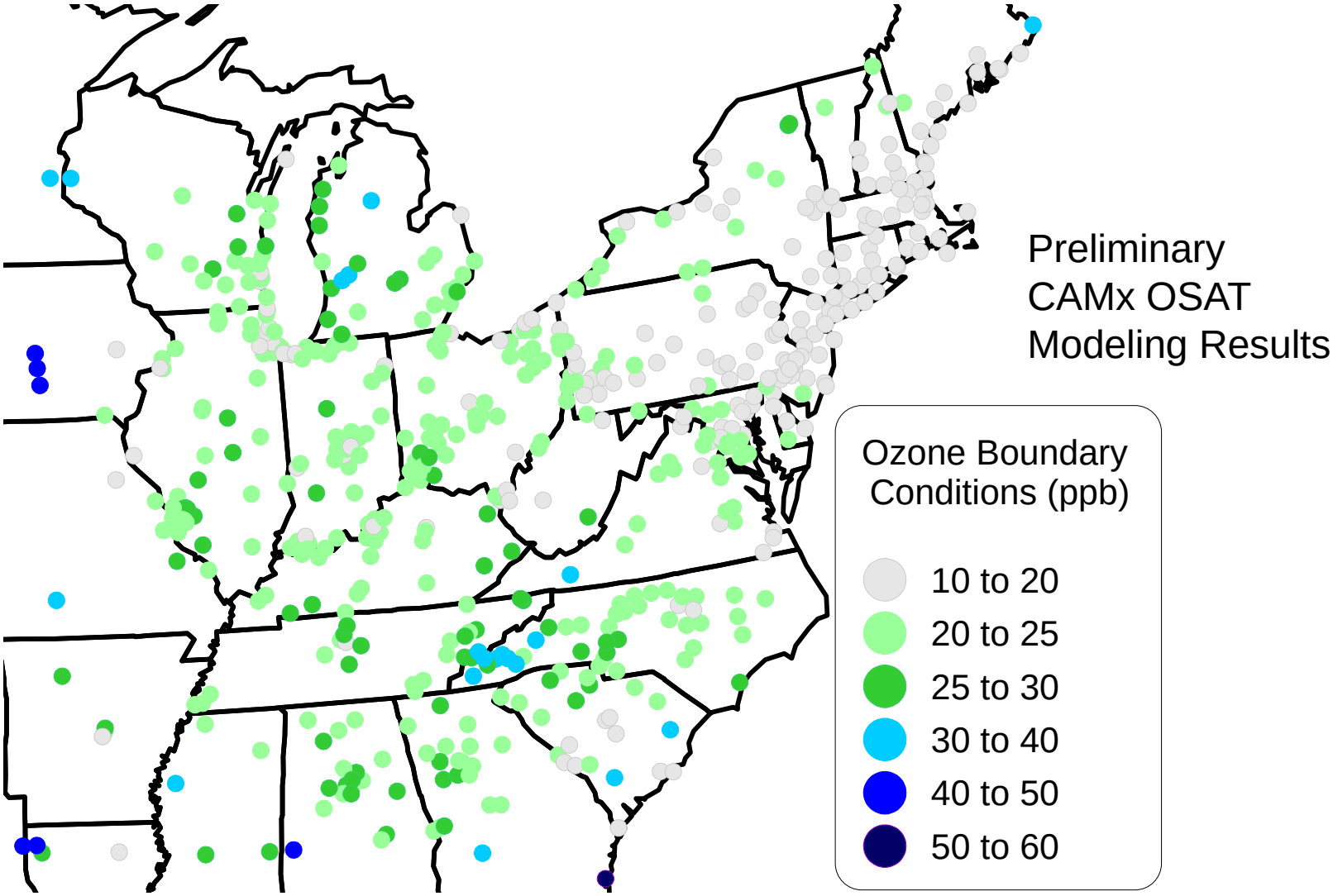
On July 7th, 2011, generally had westerly winds

Boundary conditions affect the entire modeling domain

Plots showing ozone attributed to each boundary at 2 PM local time

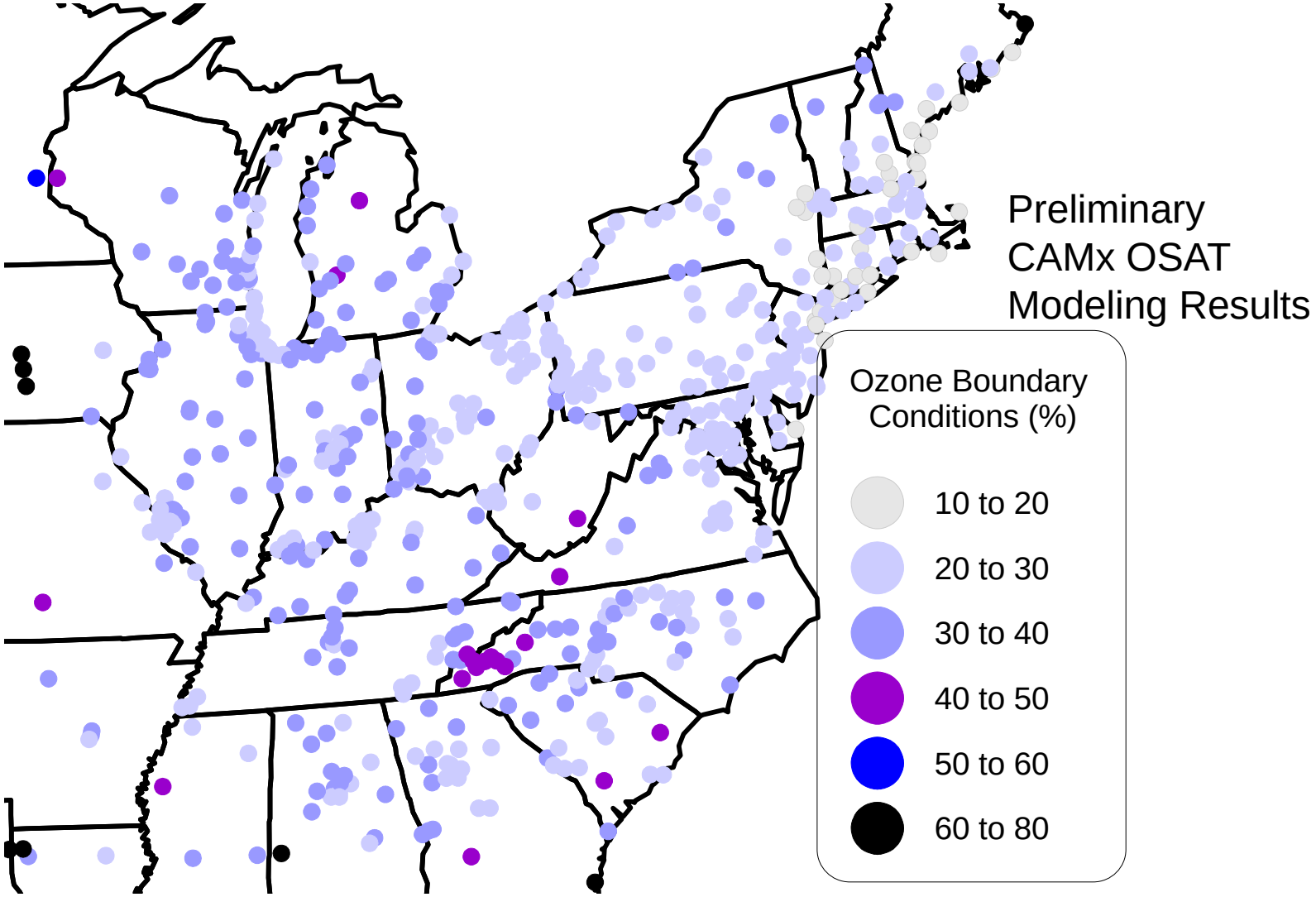
Preliminary CAMx v6.10 (University of Maryland, Dan Goldberg)

Boundary Contribution Ozone (ppb) on High Ozone Days - 2007



Based on monitored data applicable to the Relative Reduction Factor technique

Boundary Contribution Ozone (%) on High Ozone Days - 2007



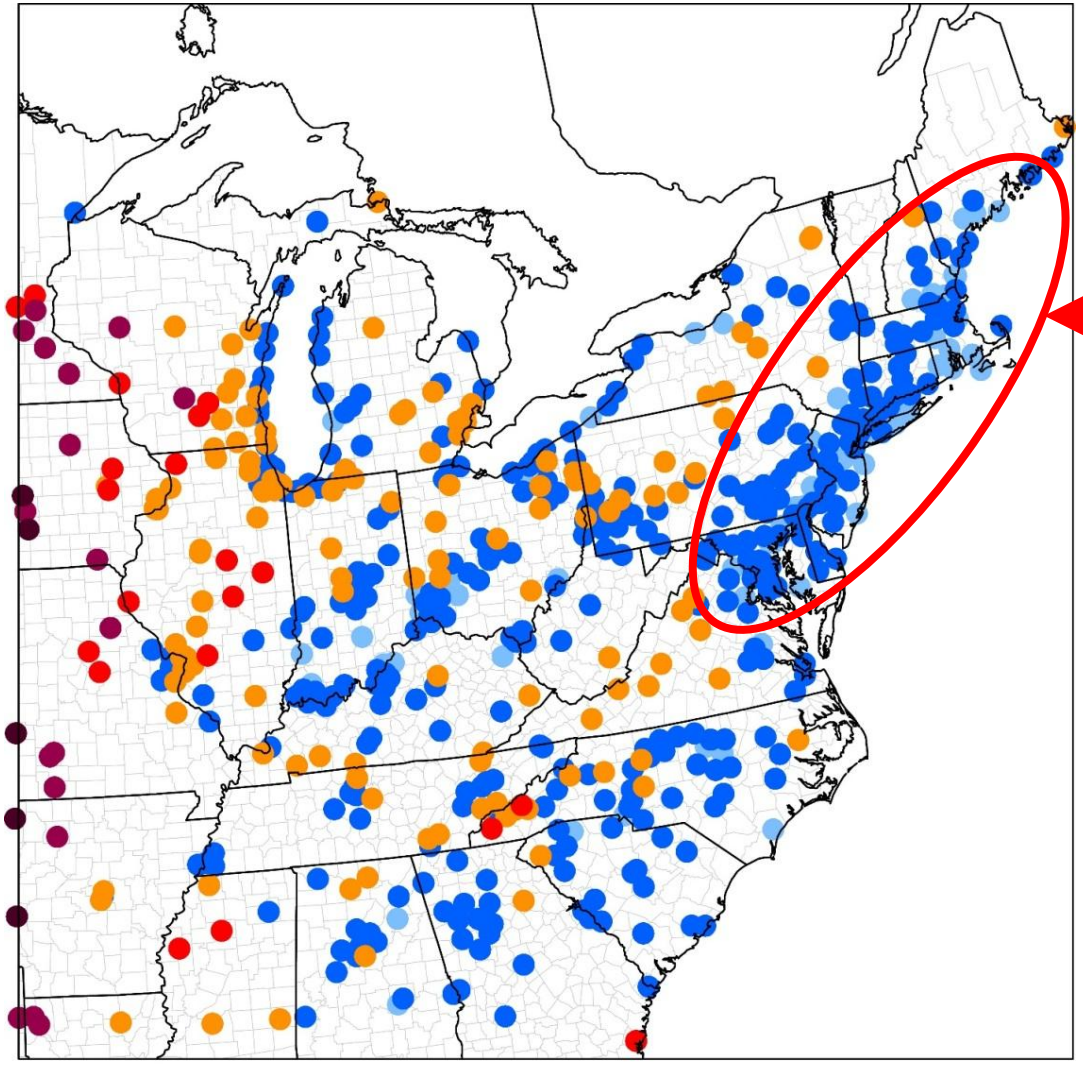
Based on monitored data applicable to the Relative Reduction Factor technique

Boundary Condition Sensitivity Testing

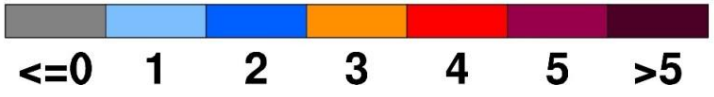
1. Adjusted base case (GEOS-Chem) boundary conditions by (-10%) across the board
2. Compared performances GEOS-Chem and climatological profile boundary conditions

- Simulation periods: Apr. 15 – Oct. 30, 2011

1. Ozone Effect Reducing Boundary Conditions by 10%



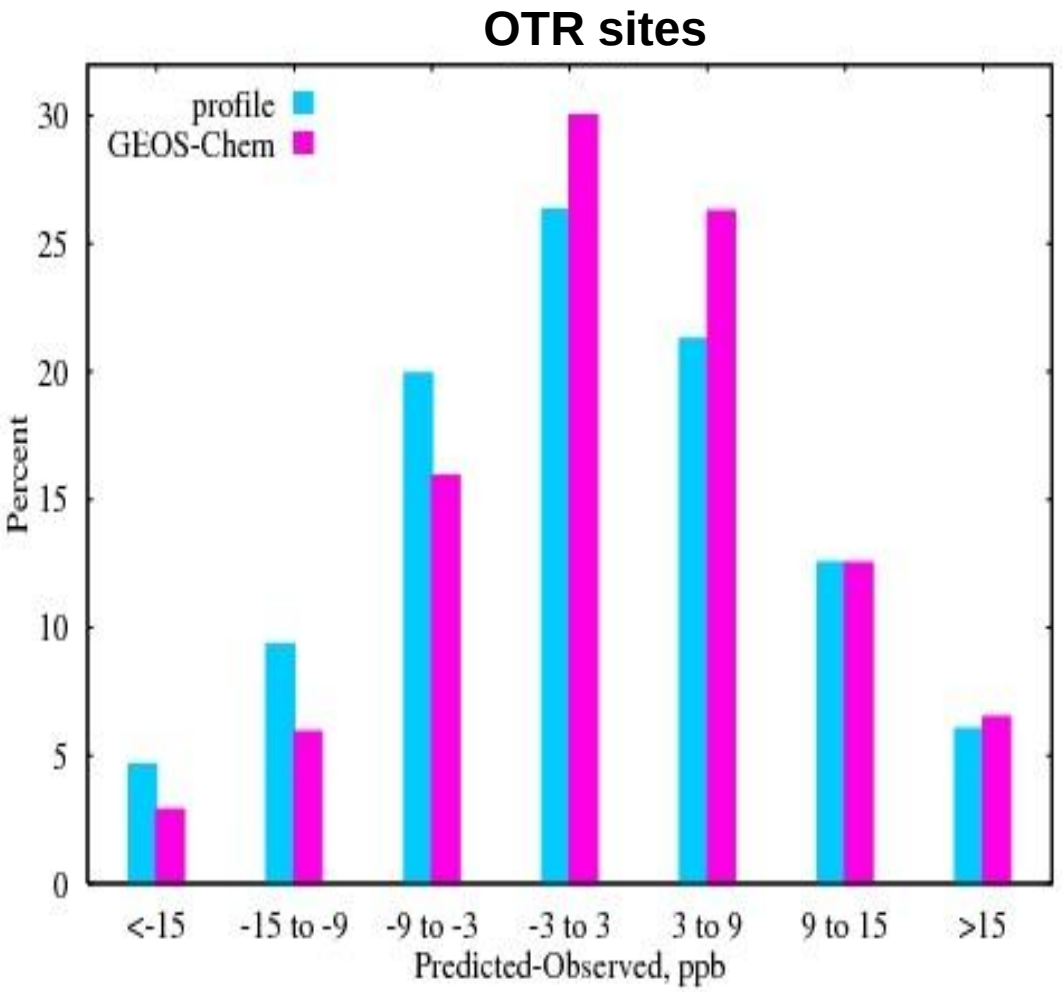
Mostly 1-2ppb lower along Northeast corridor



8-Hour Ozone Reduction (ppb)

2. Boundary Condition Sensitivity Testing

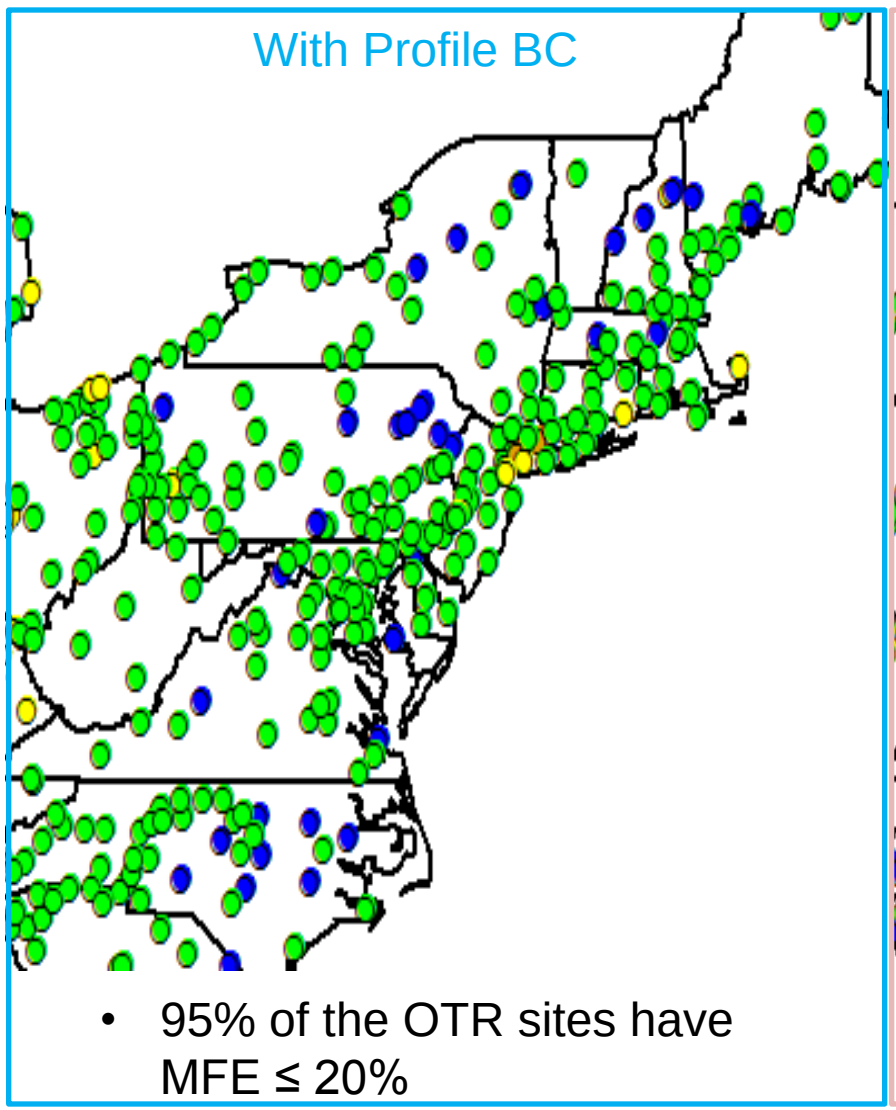
GEOS-Chem vs. Climatological Profile



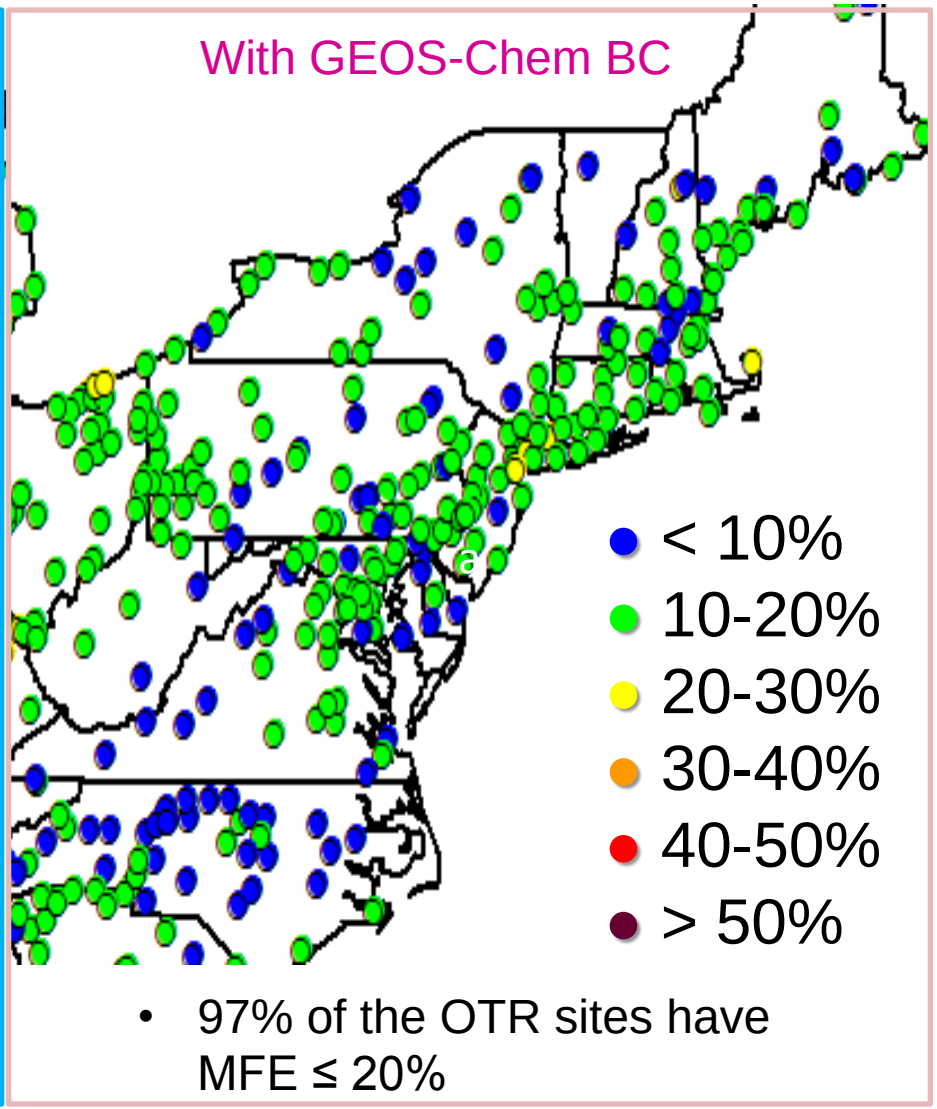
At OTR sites:

- ~70% predictions within ±9 ppb of observations regardless of BC used.
- 42% predictions within ±5 ppb of observed with profile BC
- 47% predictions were within ±5 ppb of observed with GEOS-Chem BC
- GEOS-Chem BC use produced higher O_3 values than the corresponding profile BC use in 66% percent of days
- Generally, profile BC tends to under predict daily maximum O_3 and GEOS-Chem BC tends to over predict O_3

2. Mean Fractional Error (MFE) Testing



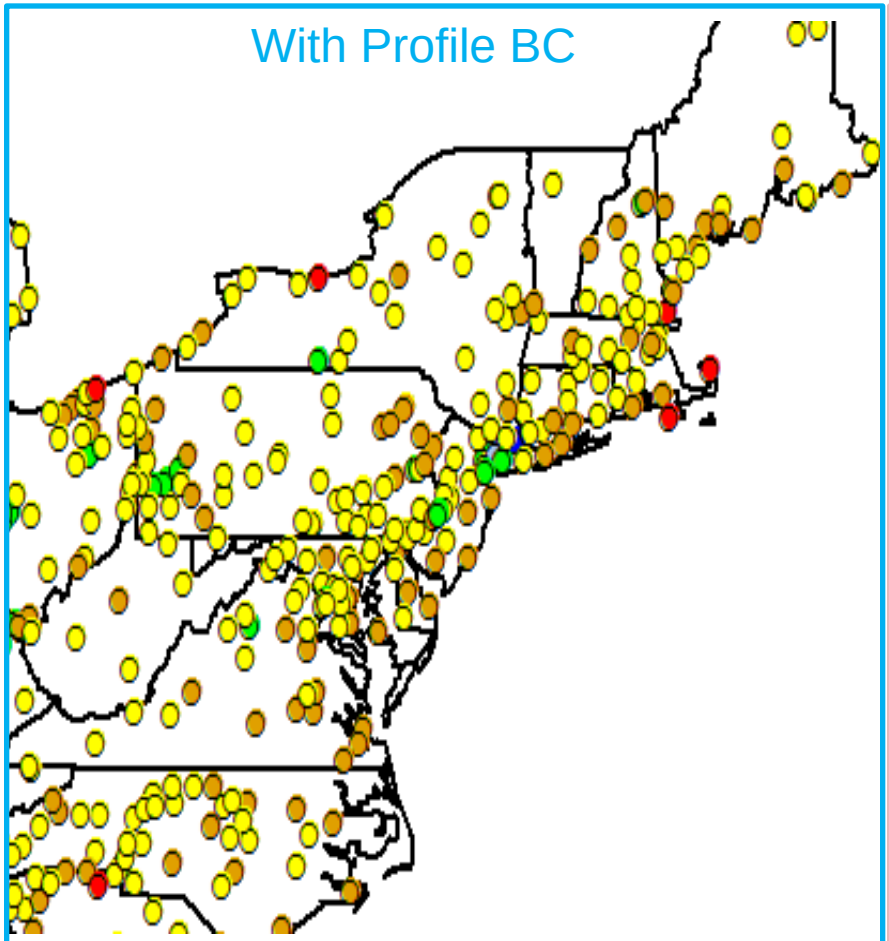
- 95% of the OTR sites have MFE ≤ 20%



- 97% of the OTR sites have MFE ≤ 20%

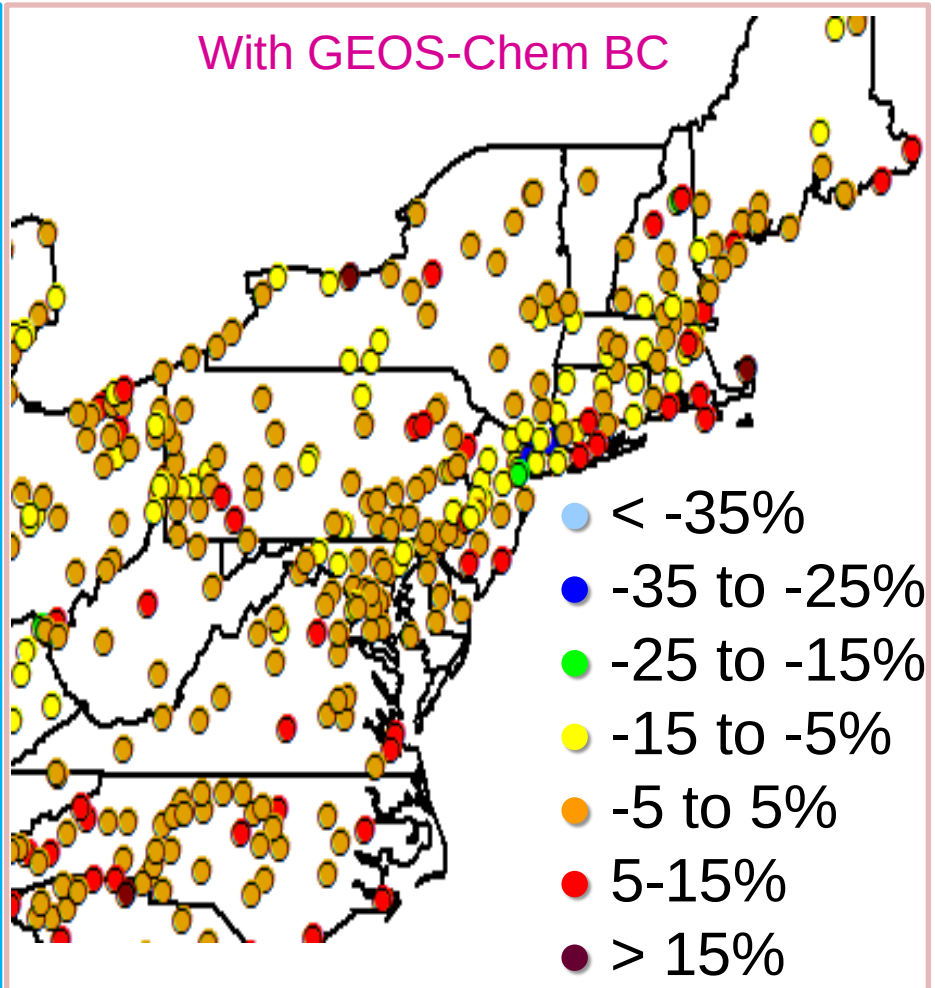
2. Mean Fractional Bias (MFB) Testing

With Profile BC



- 92% of the OTR sites have MFB ≤ 20%

With GEOS-Chem BC



- 97% of the OTR sites have MFB ≤ 20%

New 2011 platform modeling results anticipated in time for 2015 spring meetings

Questions

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