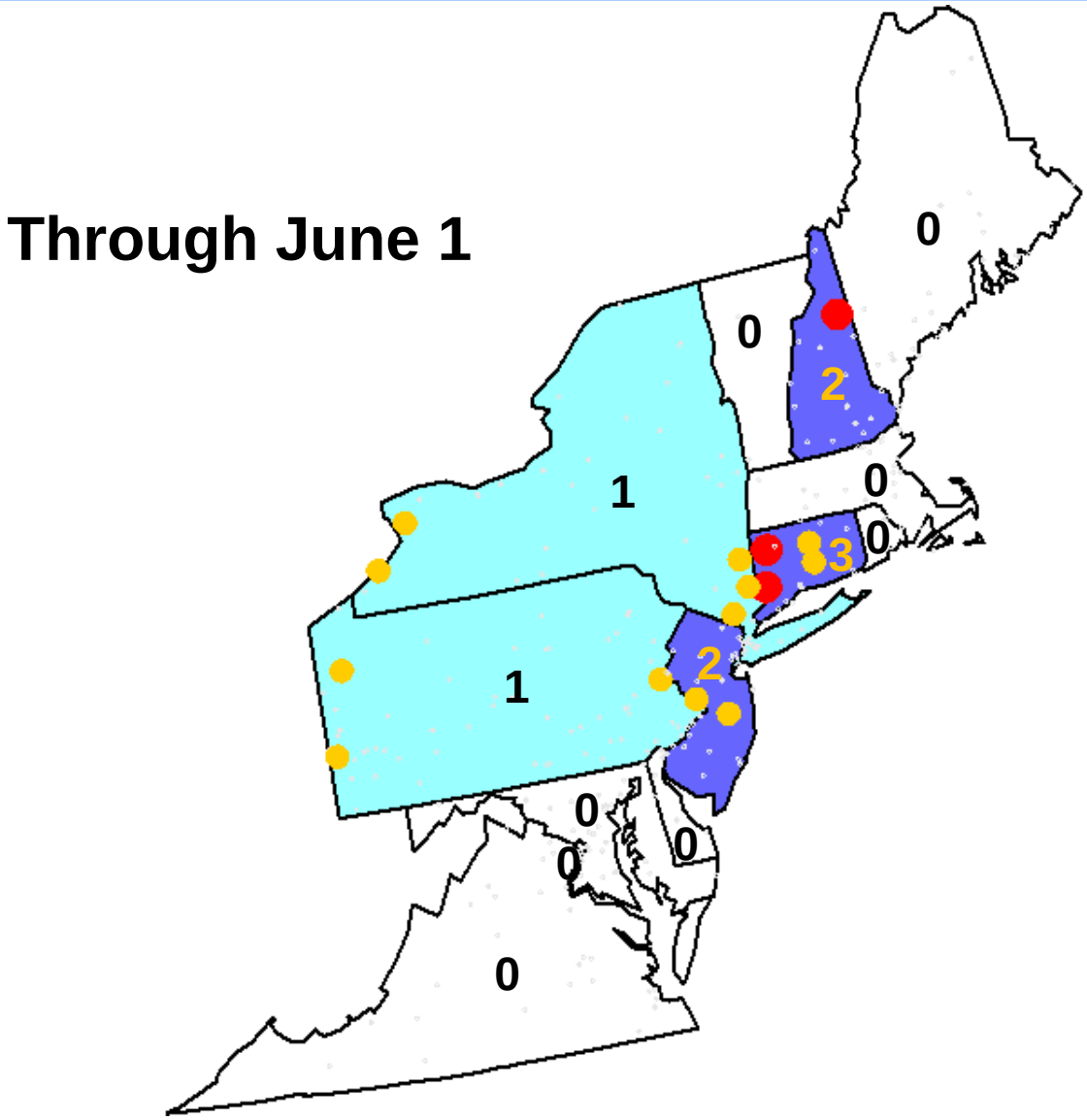
OTC Modeling Committee Update 2015

OTC Annual Meeting

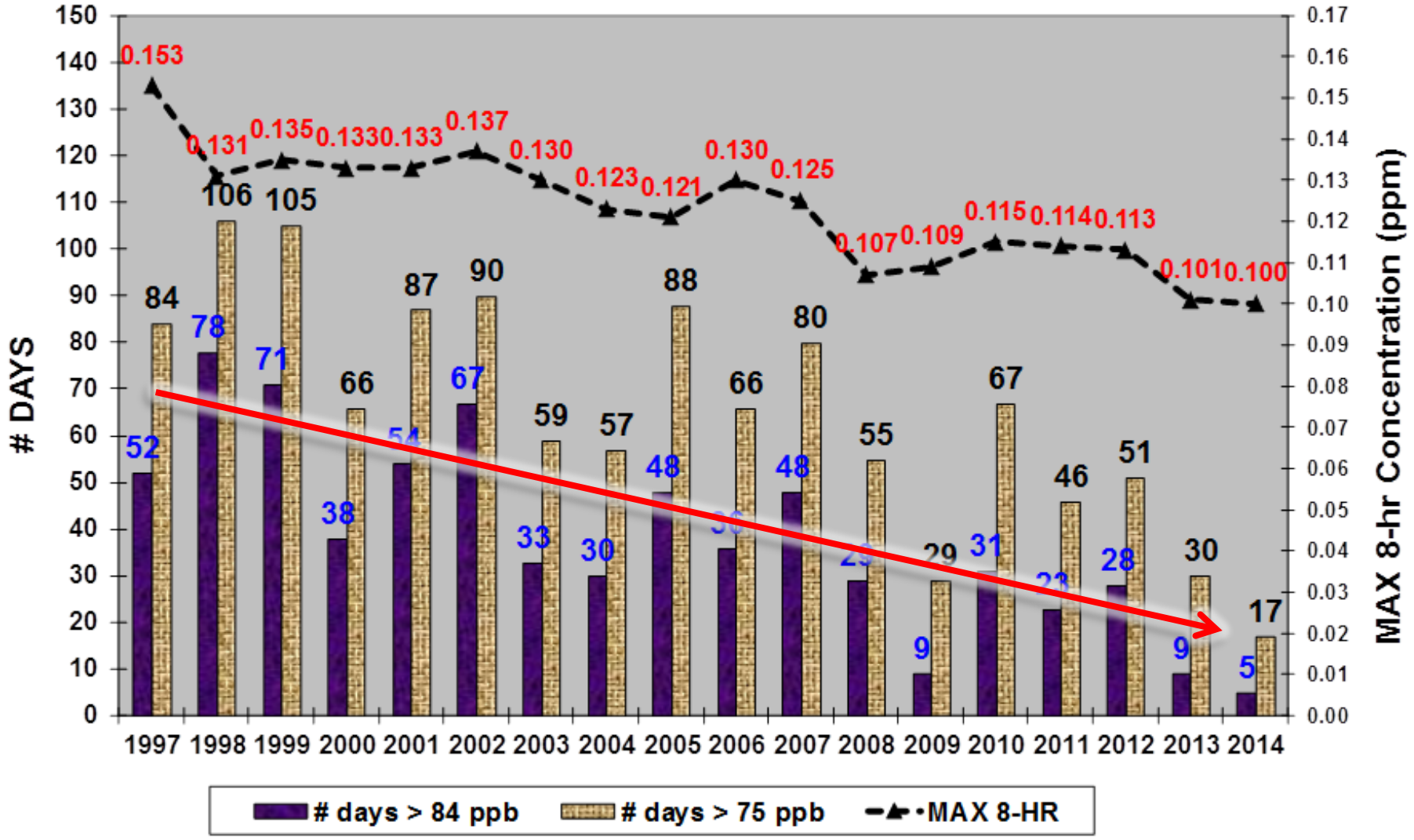
June 4, 2015

Princeton, New Jersey

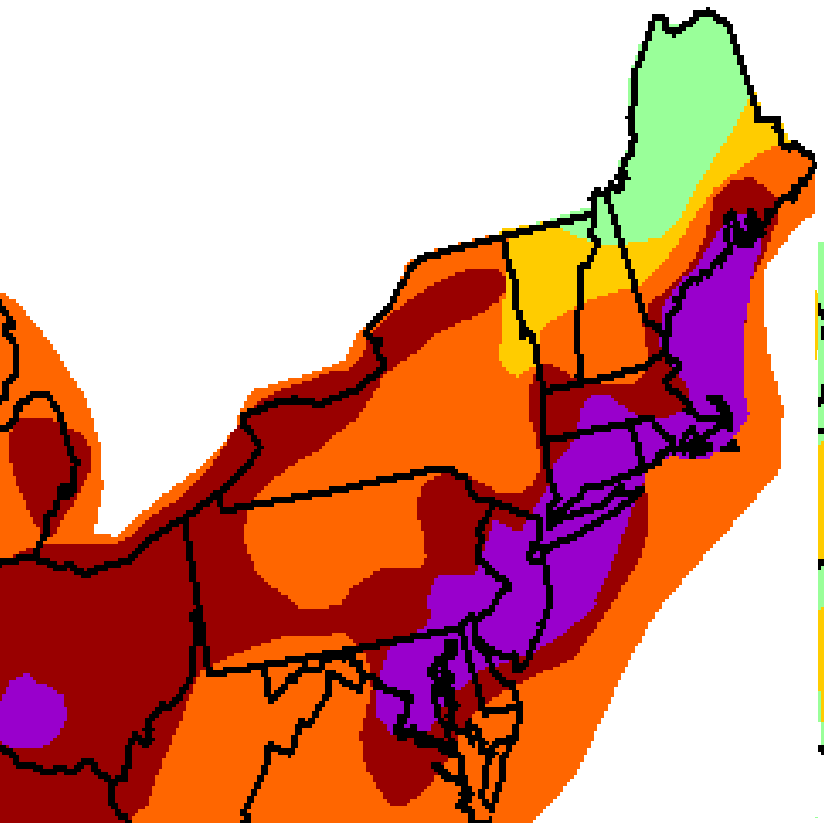
2015 Ozone Exceedance Days



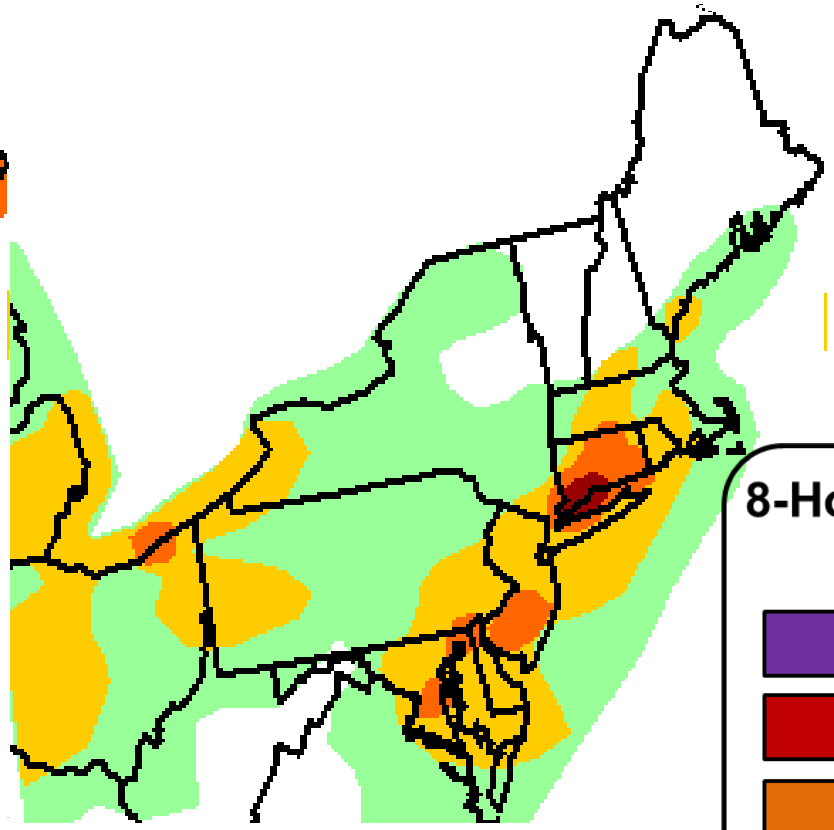
The OTR Ozone Trend



Historical Ozone Design Values - OTR



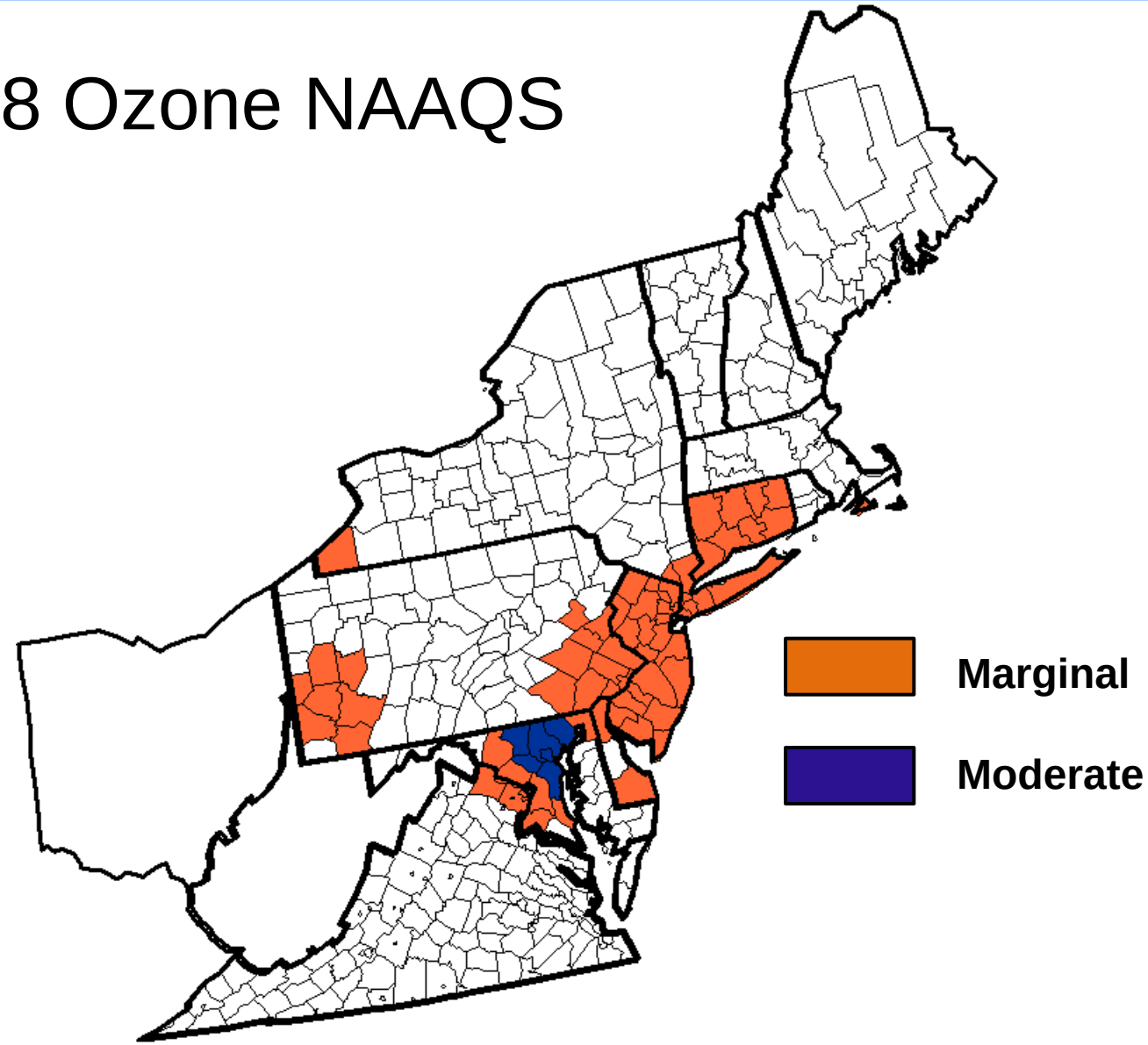
1989-1991



2012-2014

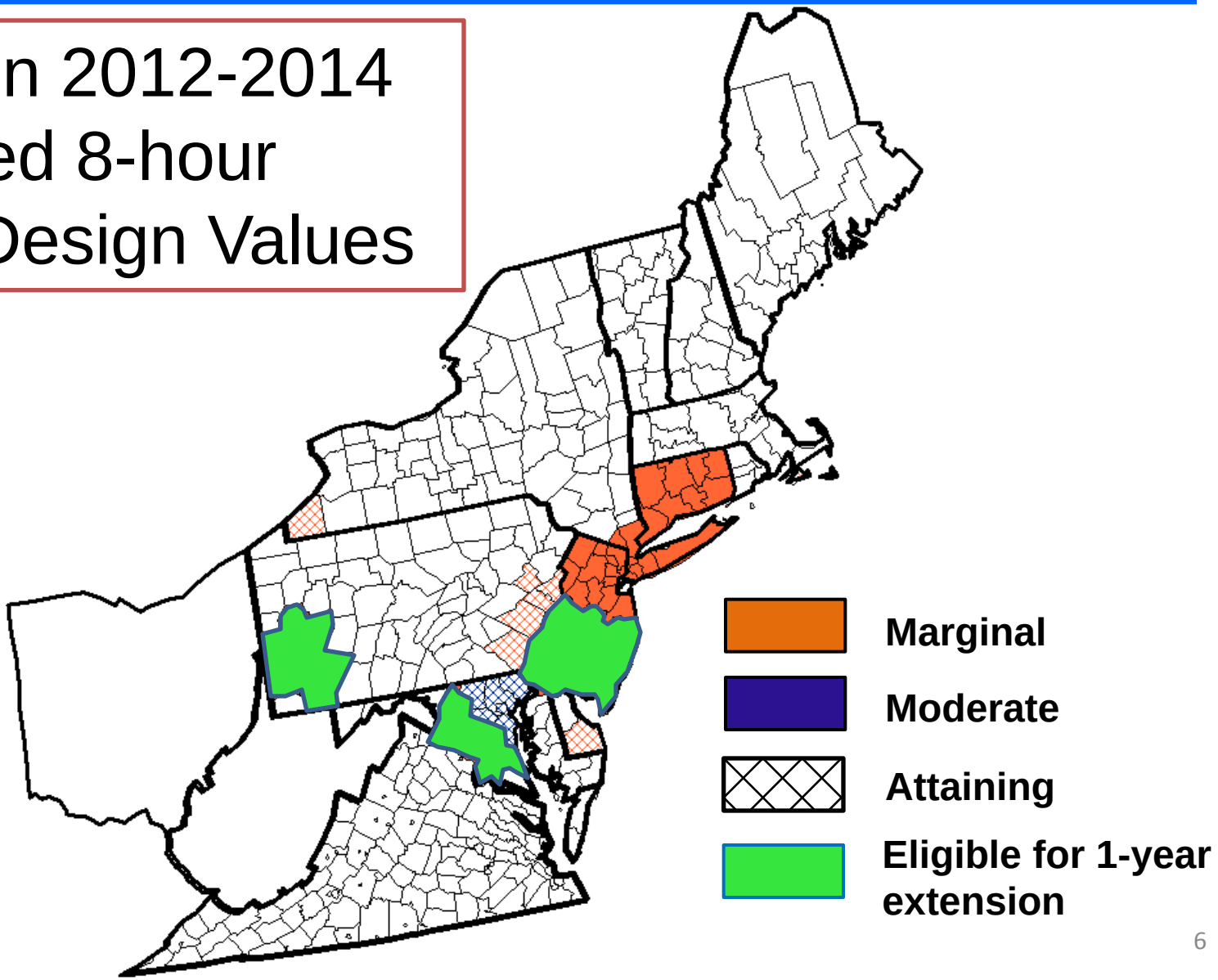
Currently Designated Nonattainment

2008 Ozone NAAQS

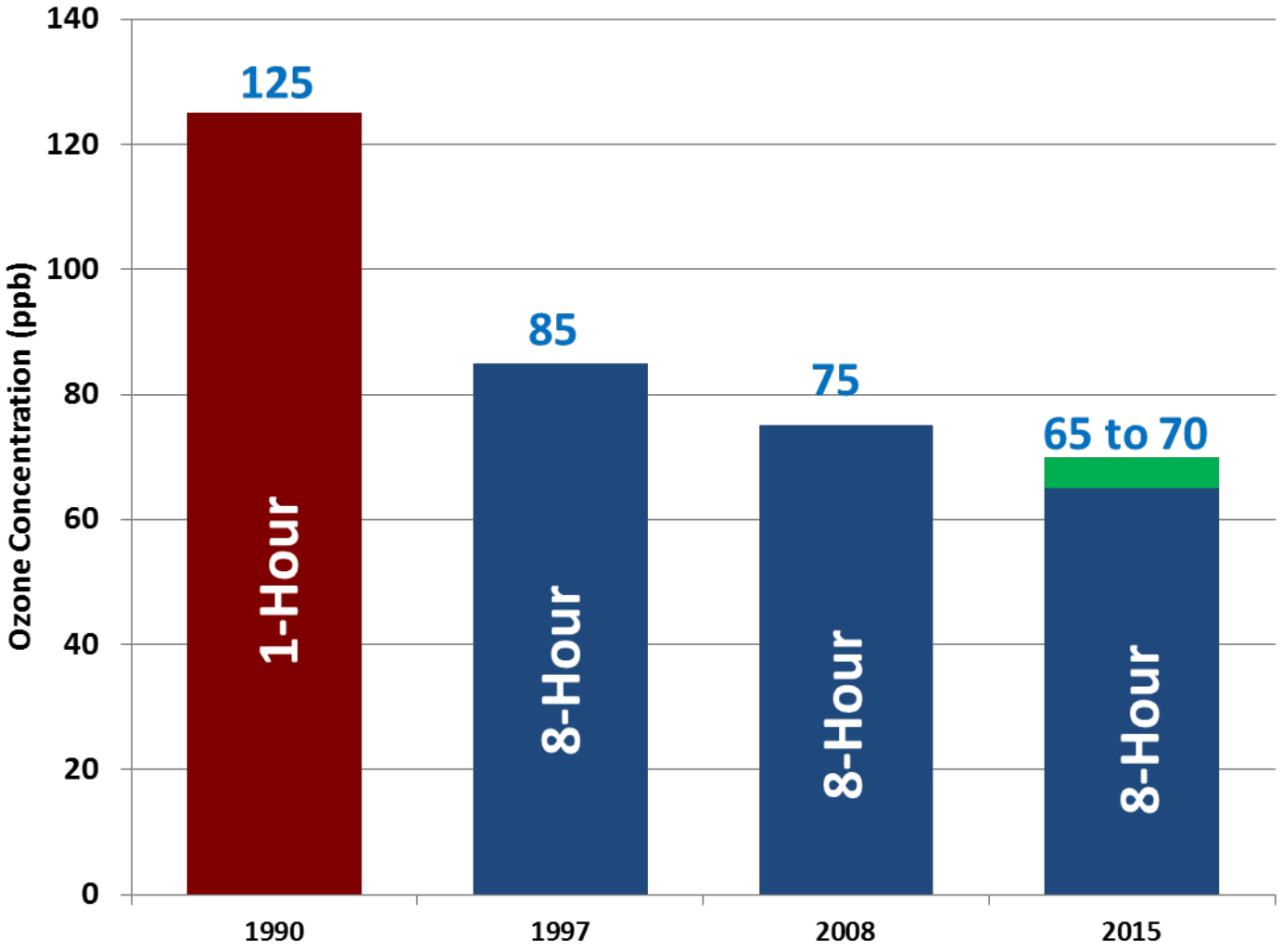


Designated Areas Not Yet Attaining

Based on 2012-2014 Monitored 8-hour Ozone Design Values

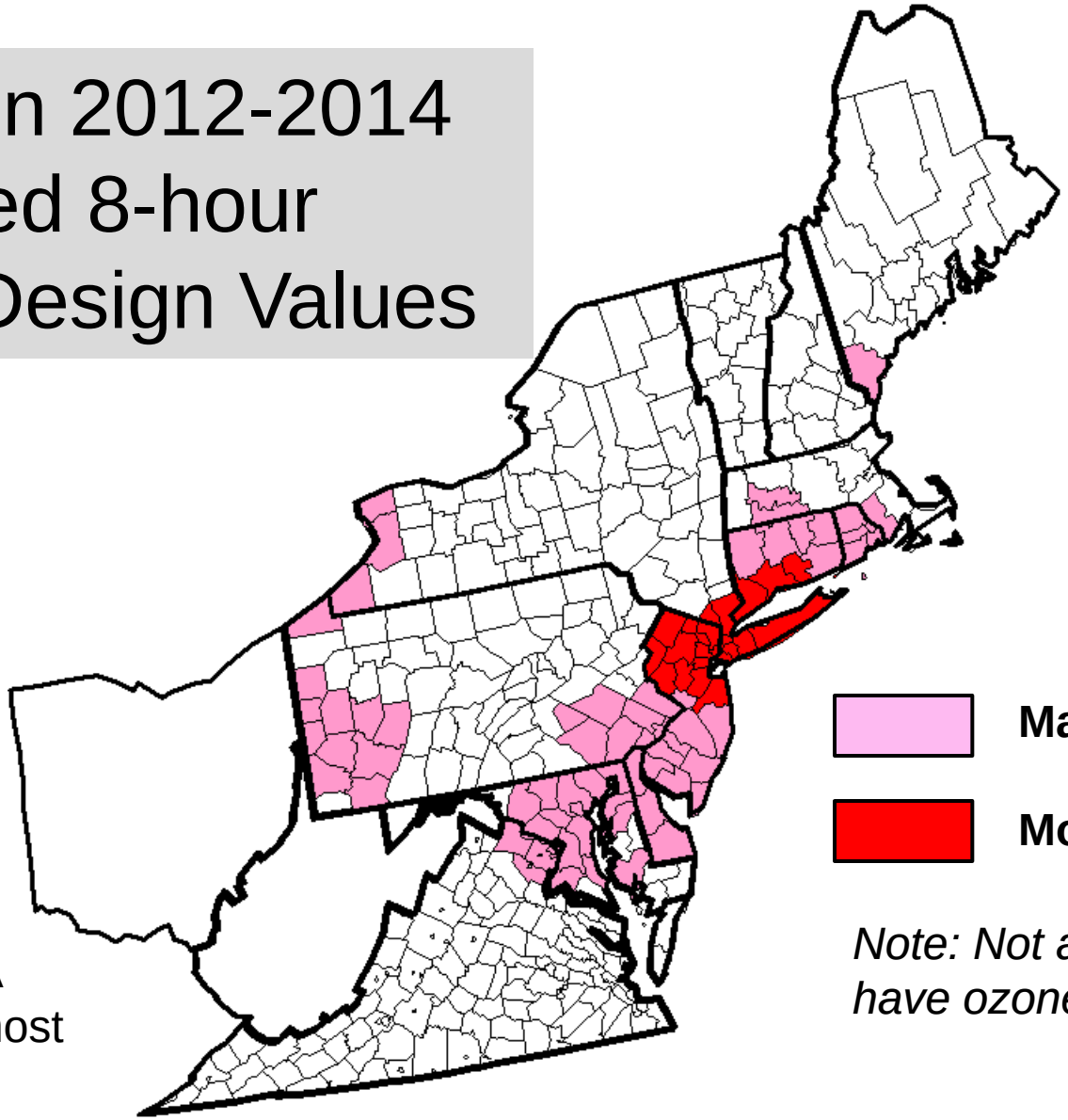


Proposed 2015 Ozone NAAQS



Potential Nonattainment – 70ppb NAAQS

Based on 2012-2014 Monitored 8-hour Ozone Design Values

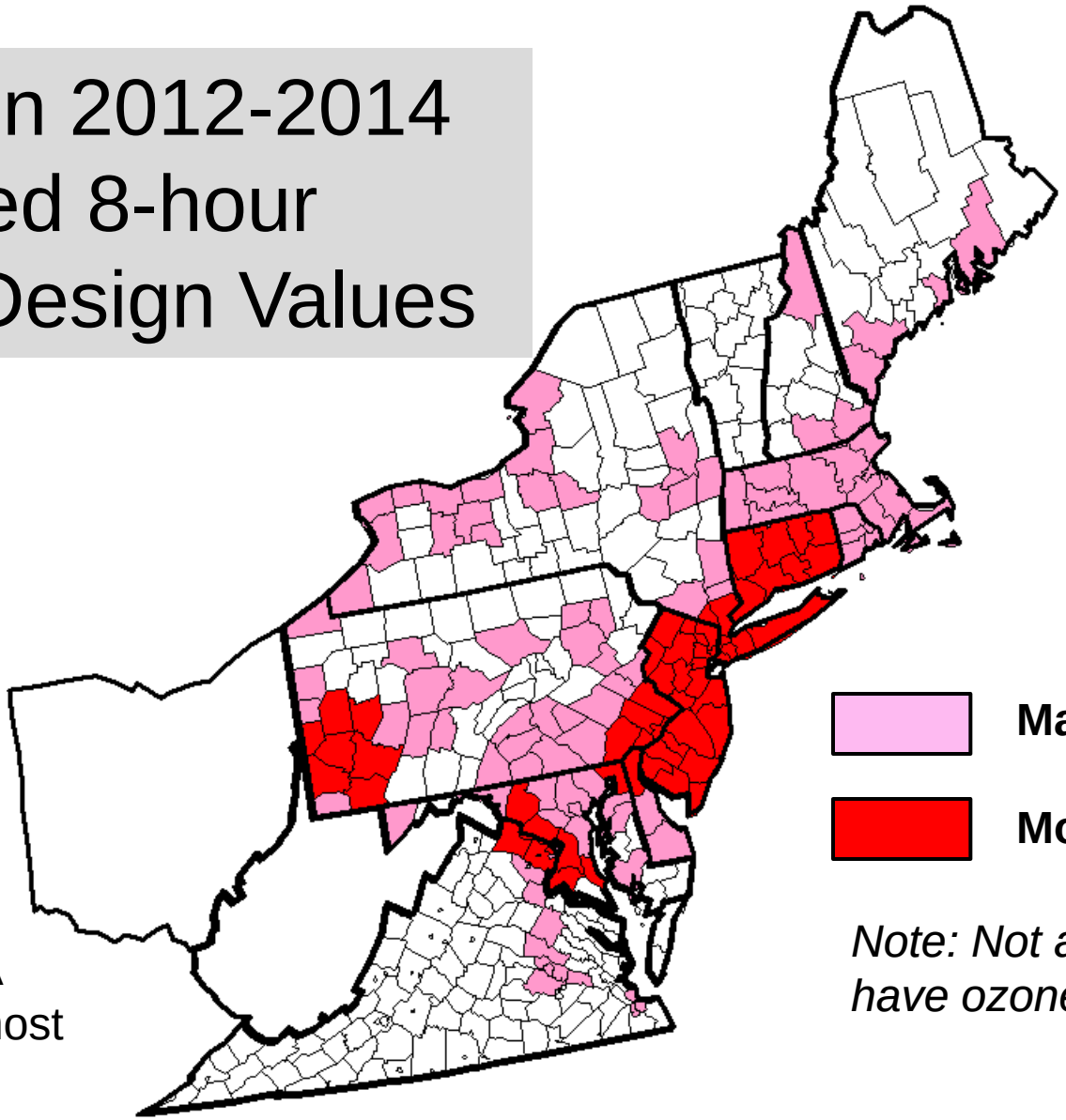


Based on CBSA Boundaries in most cases

Note: Not all counties have ozone monitoring

Potential Nonattainment – 65ppb NAAQS

Based on 2012-2014 Monitored 8-hour Ozone Design Values

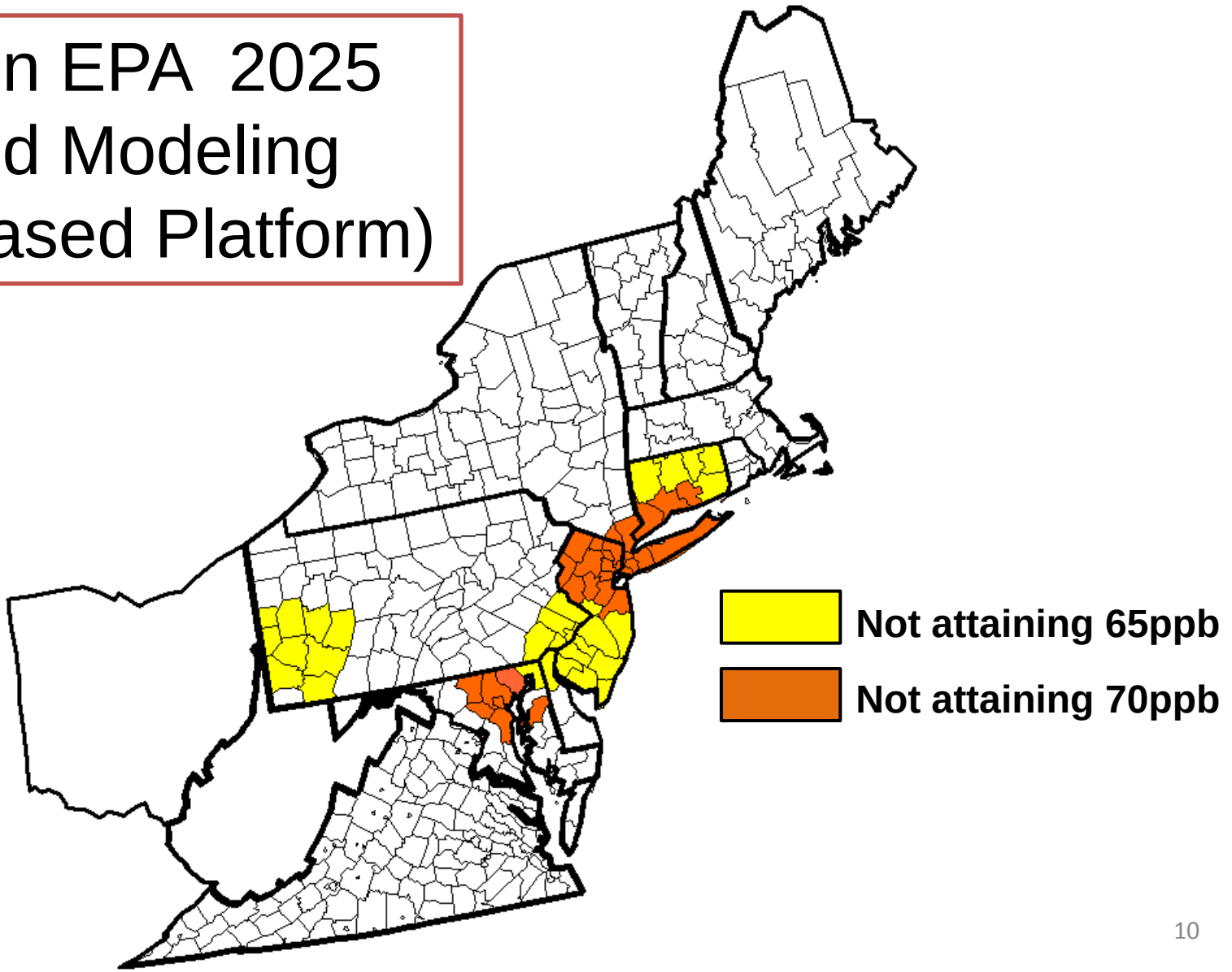


Based on CBSA Boundaries in most cases

Note: Not all counties have ozone monitoring

2025 Projected Nonattainment

Based on EPA 2025 Projected Modeling (2011 Based Platform)



Costs & Benefits of the Ozone Proposal

Metric	2014 Proposed Ozone (65 – 70 ppb)	
Health Benefit	70 ppb	$6.4 – 13 B
	65 ppb	$19 – 38 B
Overall Cost	70 ppb	$3.9 B
	65 ppb	$15 B
Benefit/Cost	70 ppb	2.5 - 3
	65 ppb	1.3 – 2.5
Avoided		
Premature Deaths	710 – 4,300	
Children Asthma Attacks	320,00 – 960,000	
Missed Work Days	65,000 – 180,000	
Asthma-Related ER Visits	1,400 – 4,300	
Children Acute Bronchitis Cases	790 – 2,300	

http://www.epa.gov/ttn/ecas/regdata/RIAs/20141125ria.pdf, November 2014, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711

2015 Ozone NAAQS Timeline

October 2015

Final Rule

December 2015

Effective Date for NAAQS

October 2016

Submit Nonattainment Designation Recommendations (2013-15)

October 2017

EPA Nonattainment Area Designations

October 2018

Infrastructure/Transport SIP Due

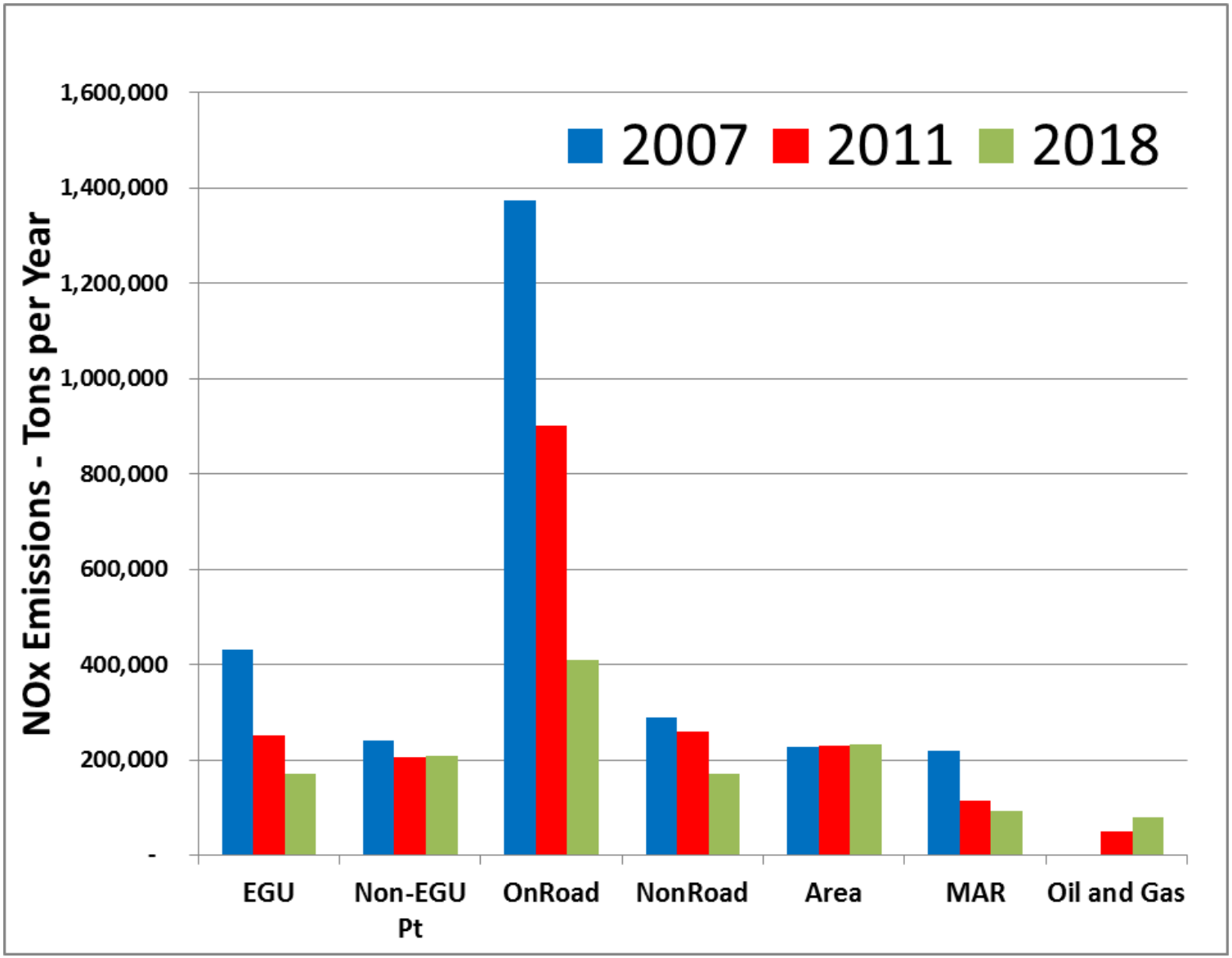
Attainment by (October):

2020 - Marginal	**2023** - Moderate	**2026** - Serious

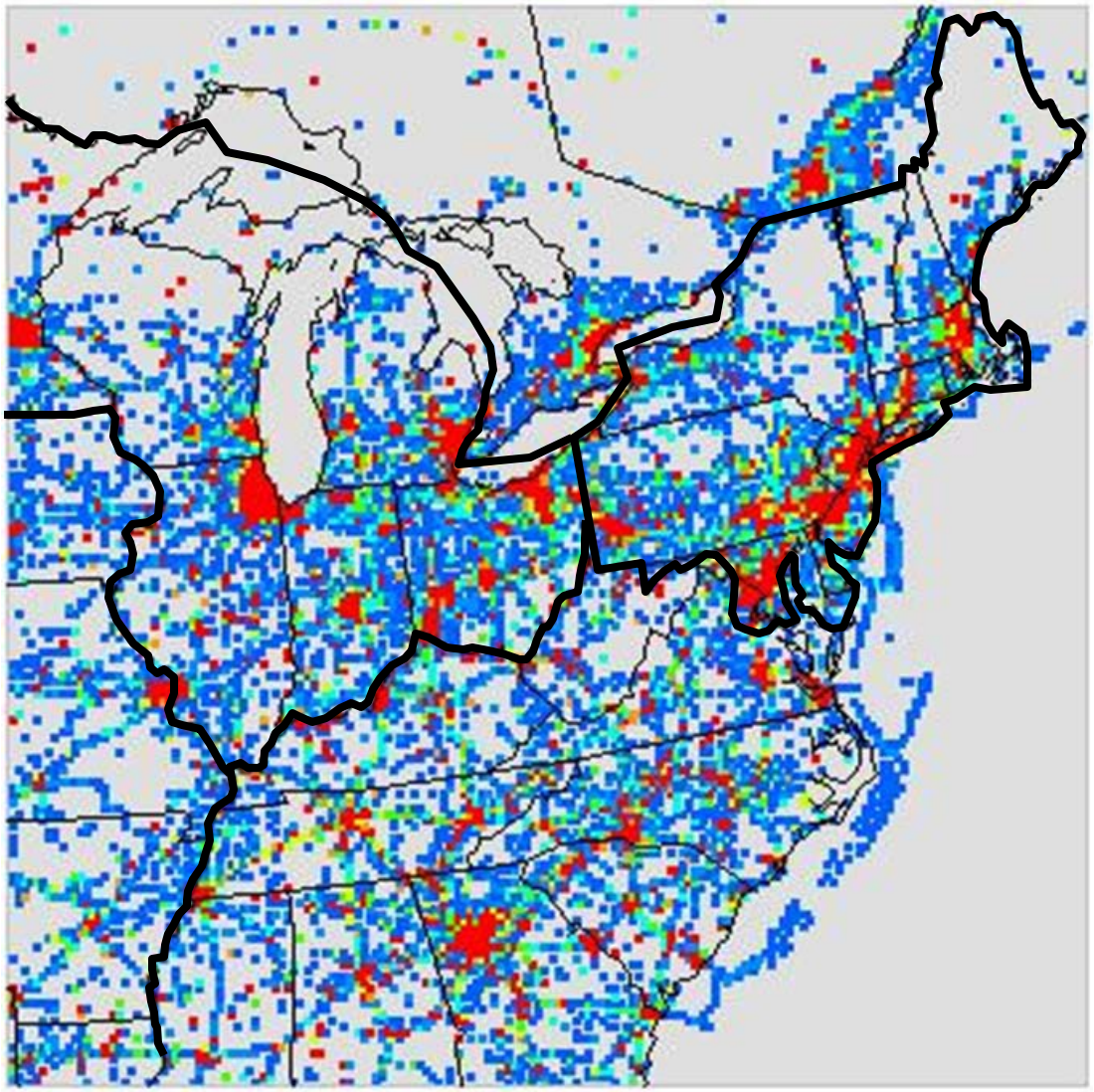
OTC 2011-Based Modeling Platform

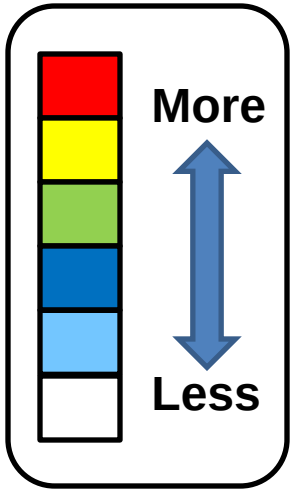
- Designed for modeling 2008 and 2015 ozone NAAQS and for 2018 Regional Haze SIPs
- OTC states working collaboratively with states in other regions and EPA to improve modeling platform
- Builds from EPA 2011 based modeling platform
- Replaces IPM EGU projections with State ERTAC data
- Upgrades emissions with state EMF grown data for most emission sectors
- Improving spatial resolution, emissions of natural sources, and emissions at edges of modeling boundaries

OTR+VA NOx Emission Changes

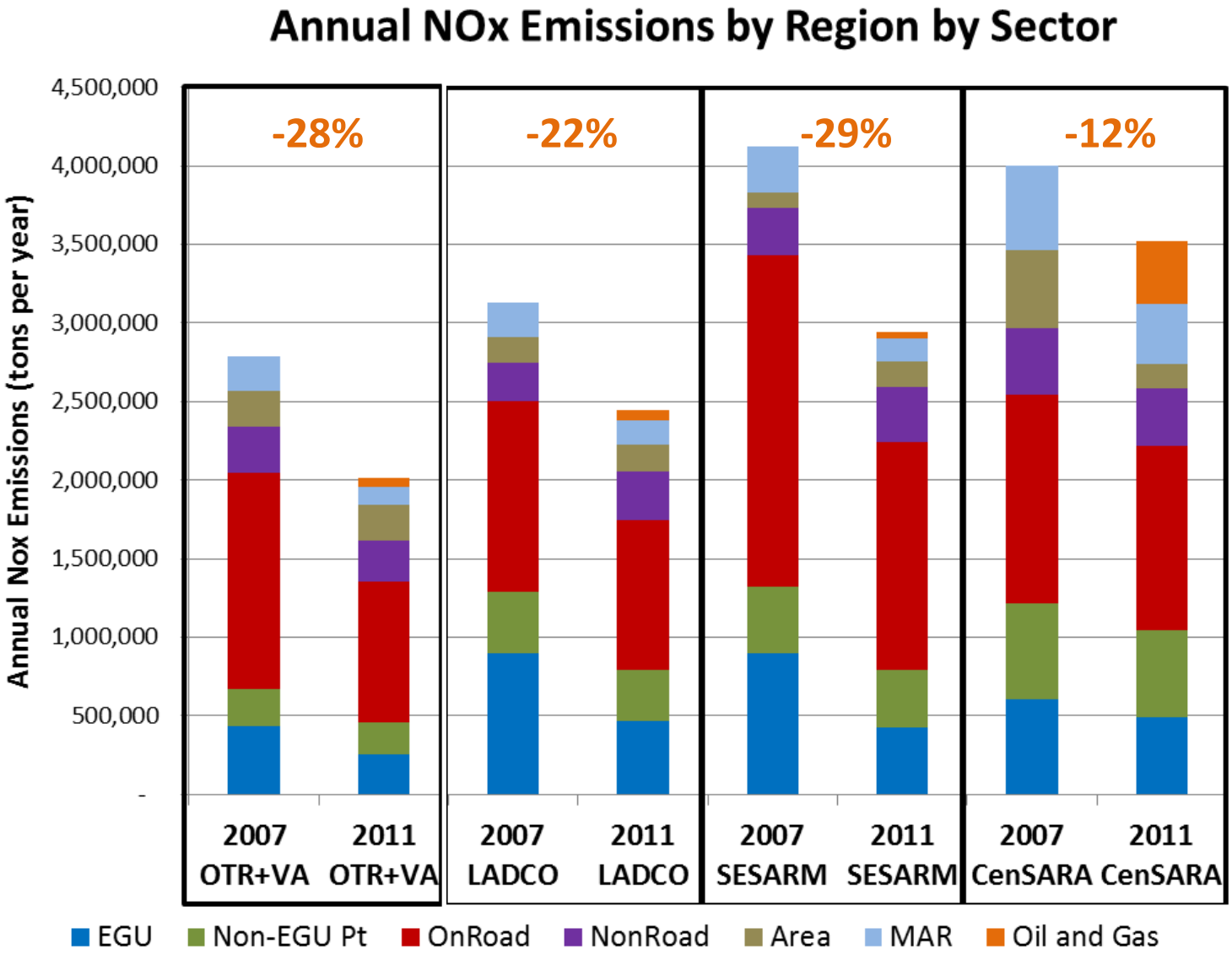


Total NOx Relative Emissions





MANE-VU Base Case NOx Inventories



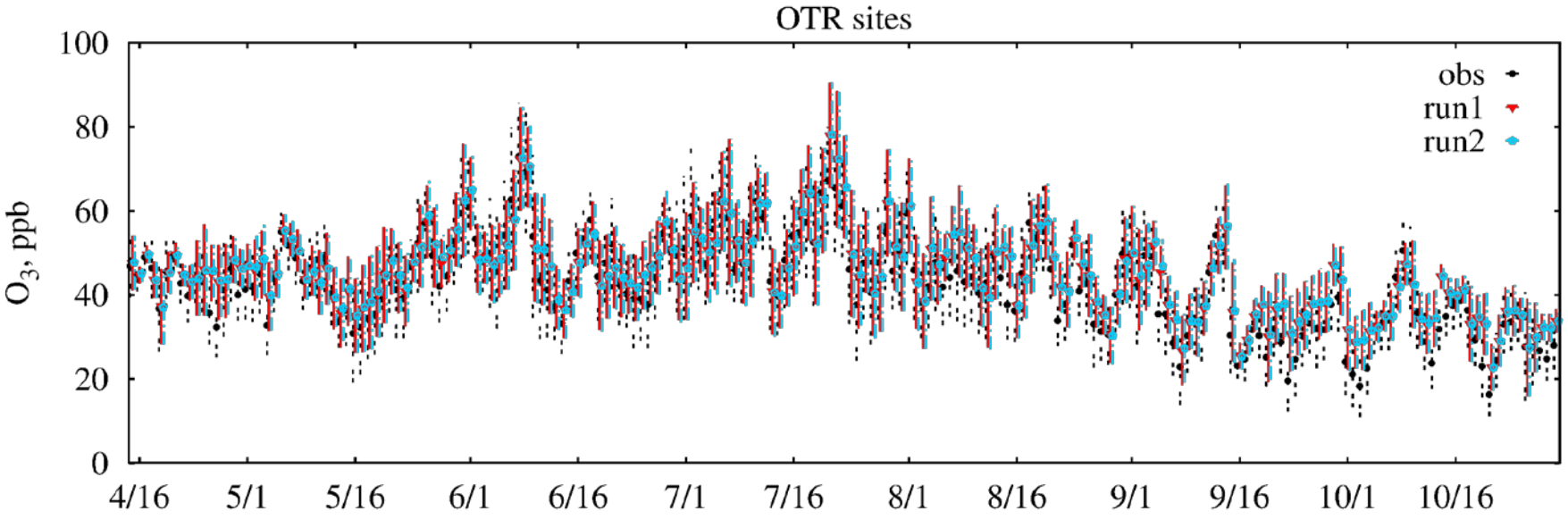
New OTC Modeling Results

1. 2011 Level 1B Base Case
   - Uses improved emission inventories
   - Meets model performance goals
2. 2018 Level 1B Base Case
   - Uses improved emission inventories (ERTAC and MARAMA EMF grown version 2 emissions

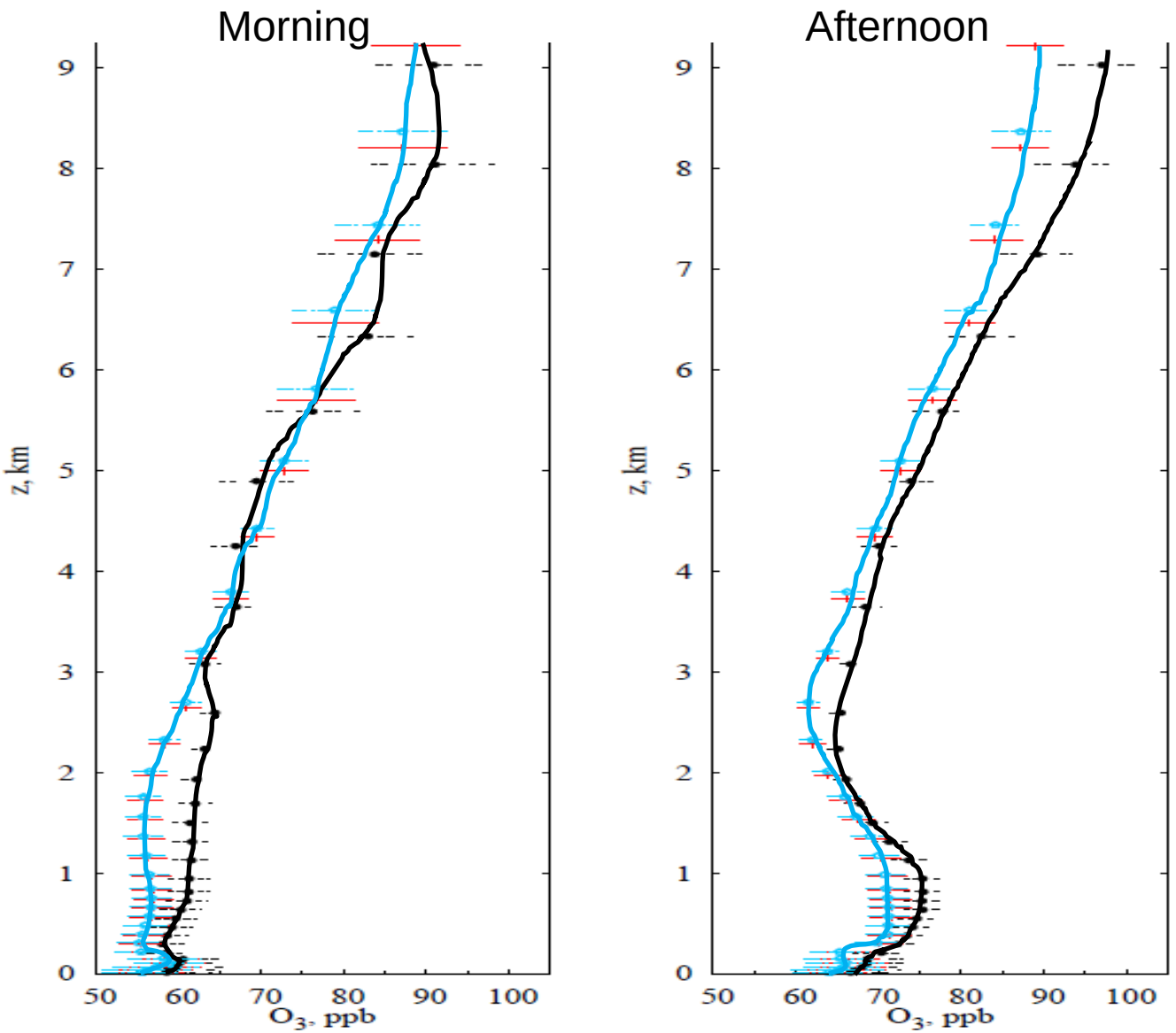
Evaluation of CMAQ V2 over OTC modeling domain

2011 Model vs Observed

Good job replicating the diurnal changes on an on-going basis at locations in the OTR



2011 Aloft - Model vs Observed



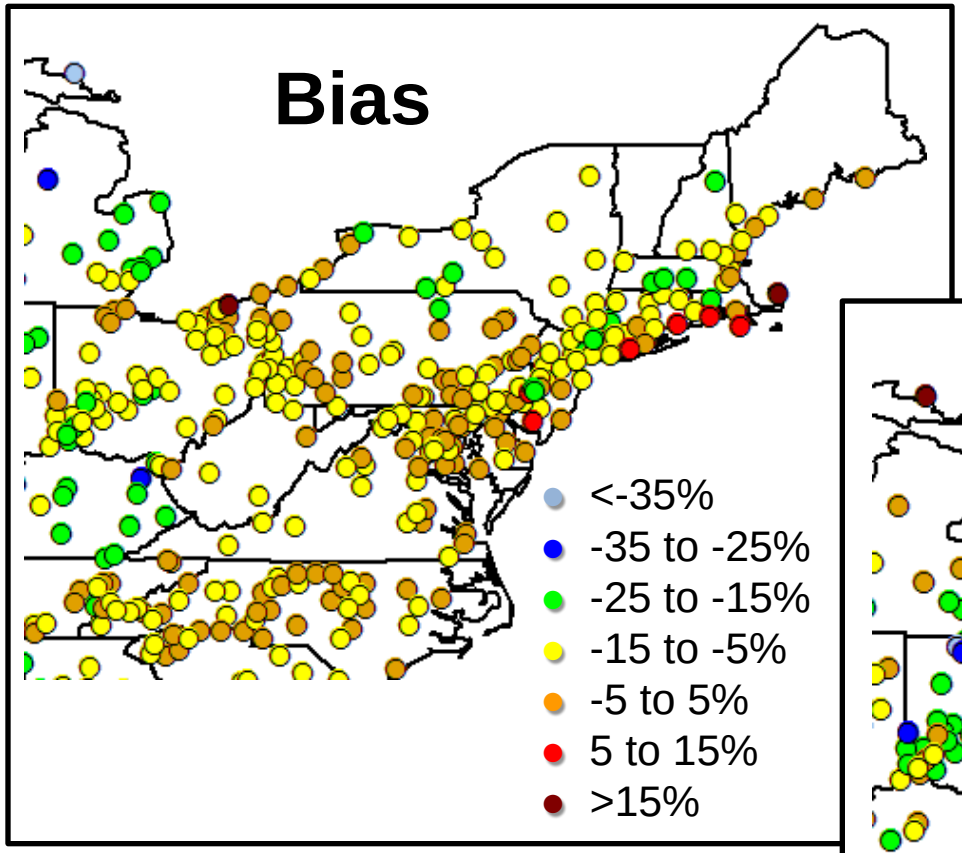
Does well replicating the vertical profile, although a bit below observations

Observed:

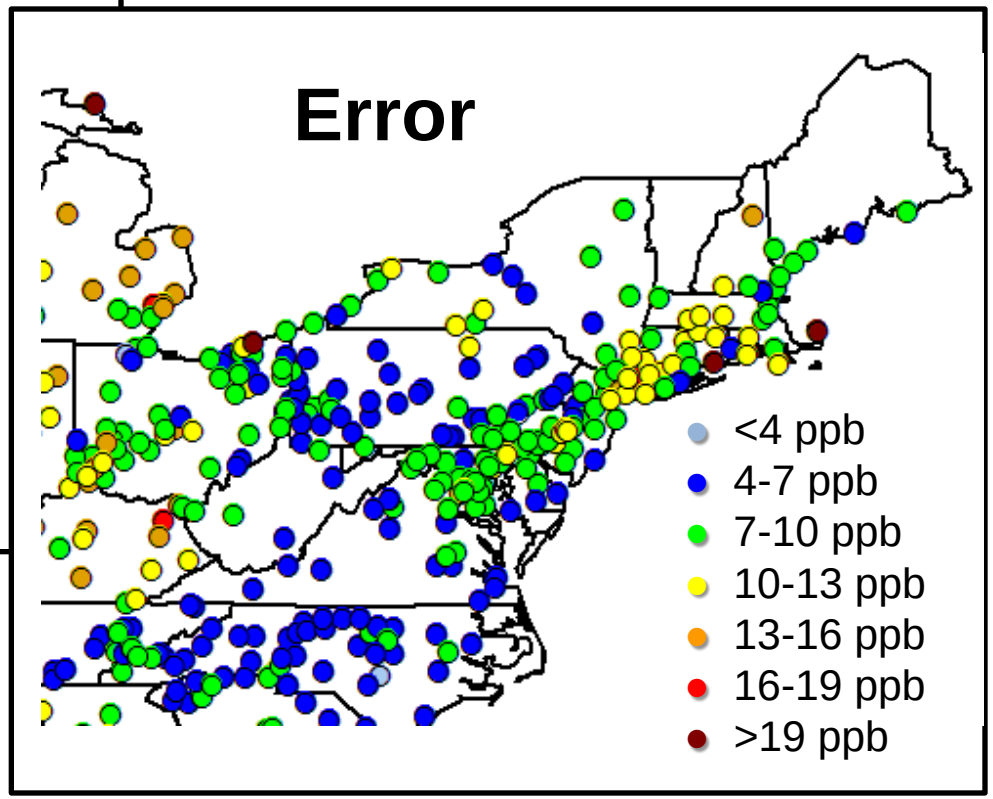
- Sondes
- UMD aircraft spirals
- NASA P3 spirals

Observed
Run 1
Run 2

2011 Model Error & Bias

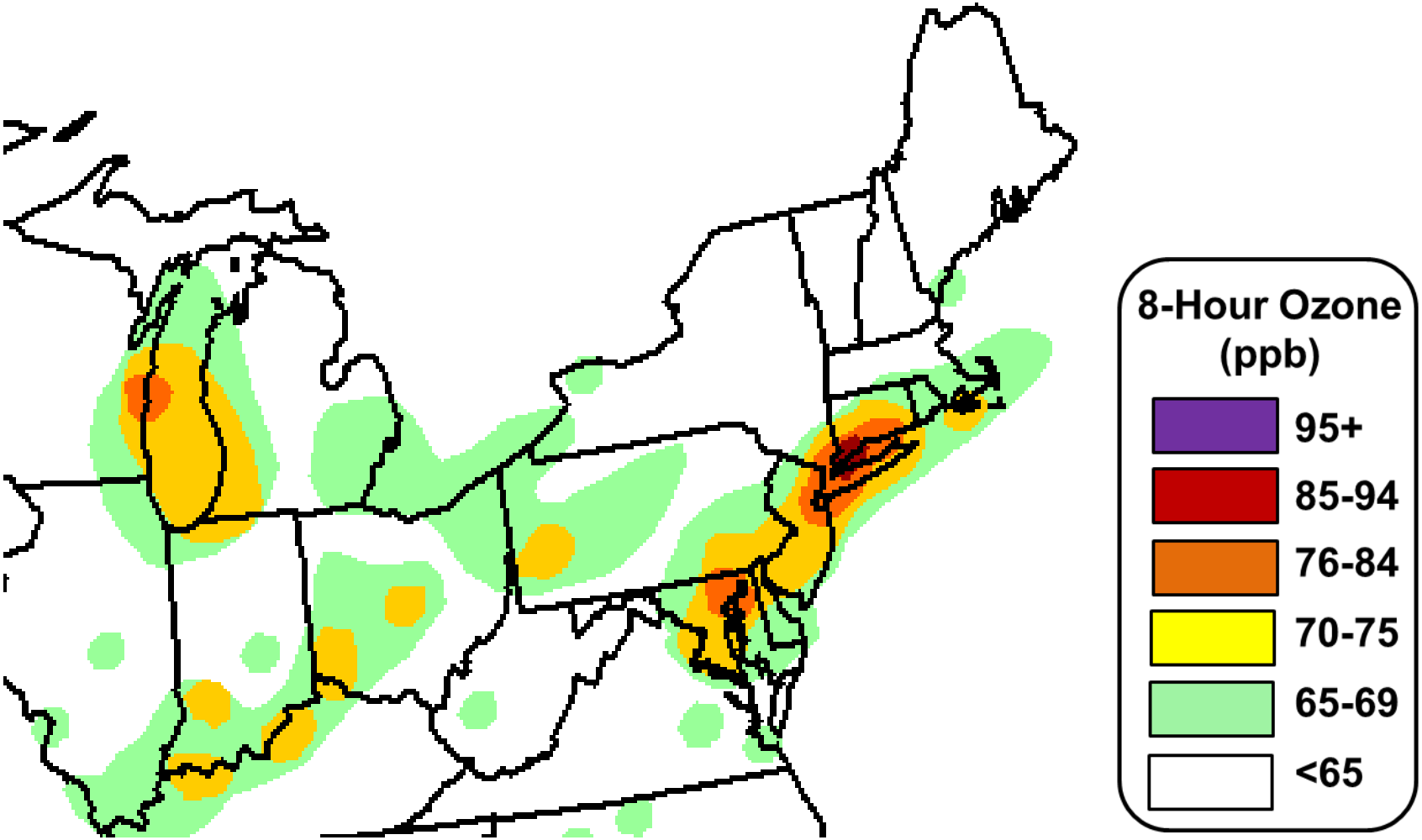


Mean Fractional Bias



Mean Absolute Gross Error

2018 Base Case – Level 1B

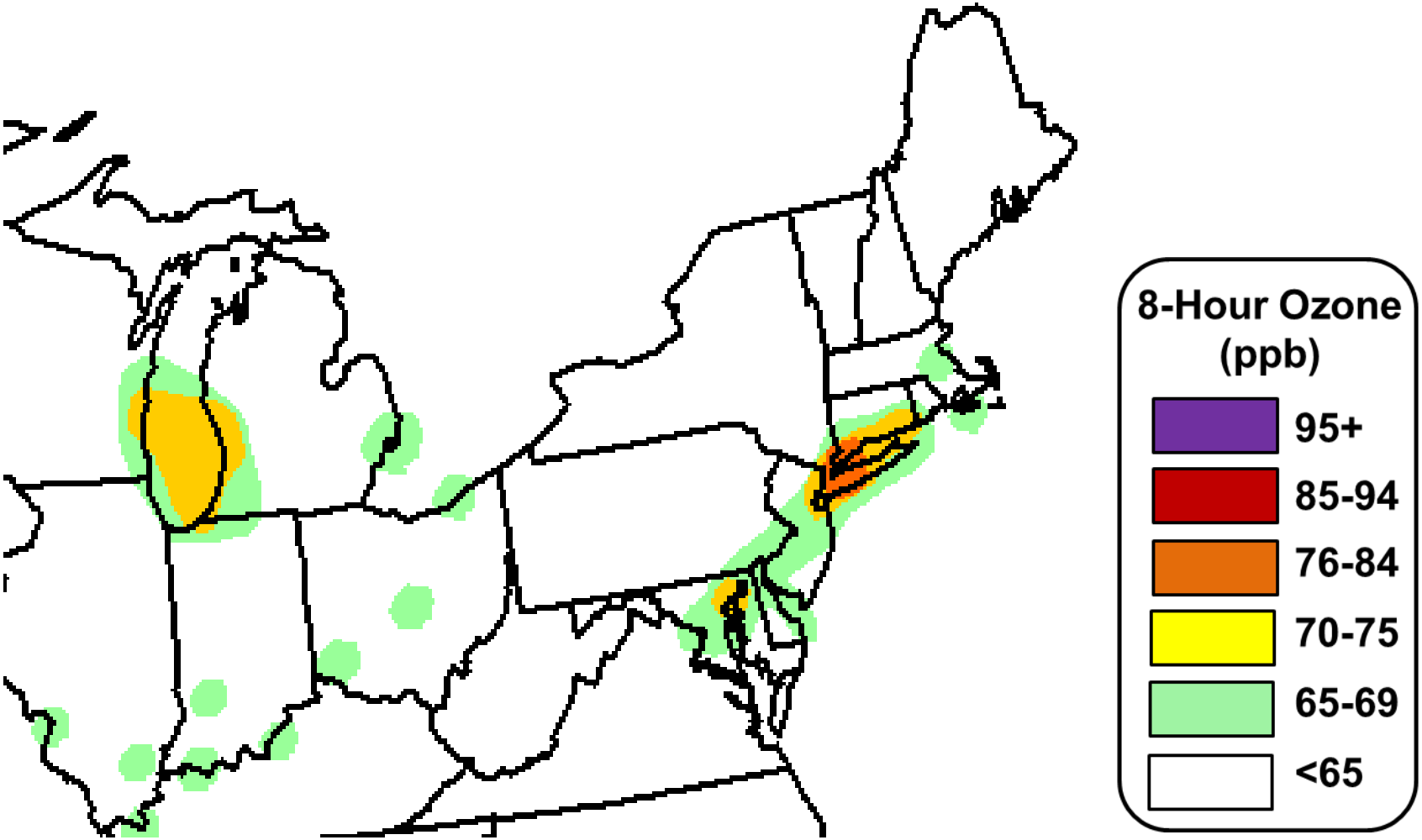


MARAMA Alpha emission inventories with noted marine emission issue

New OTC Modeling Results

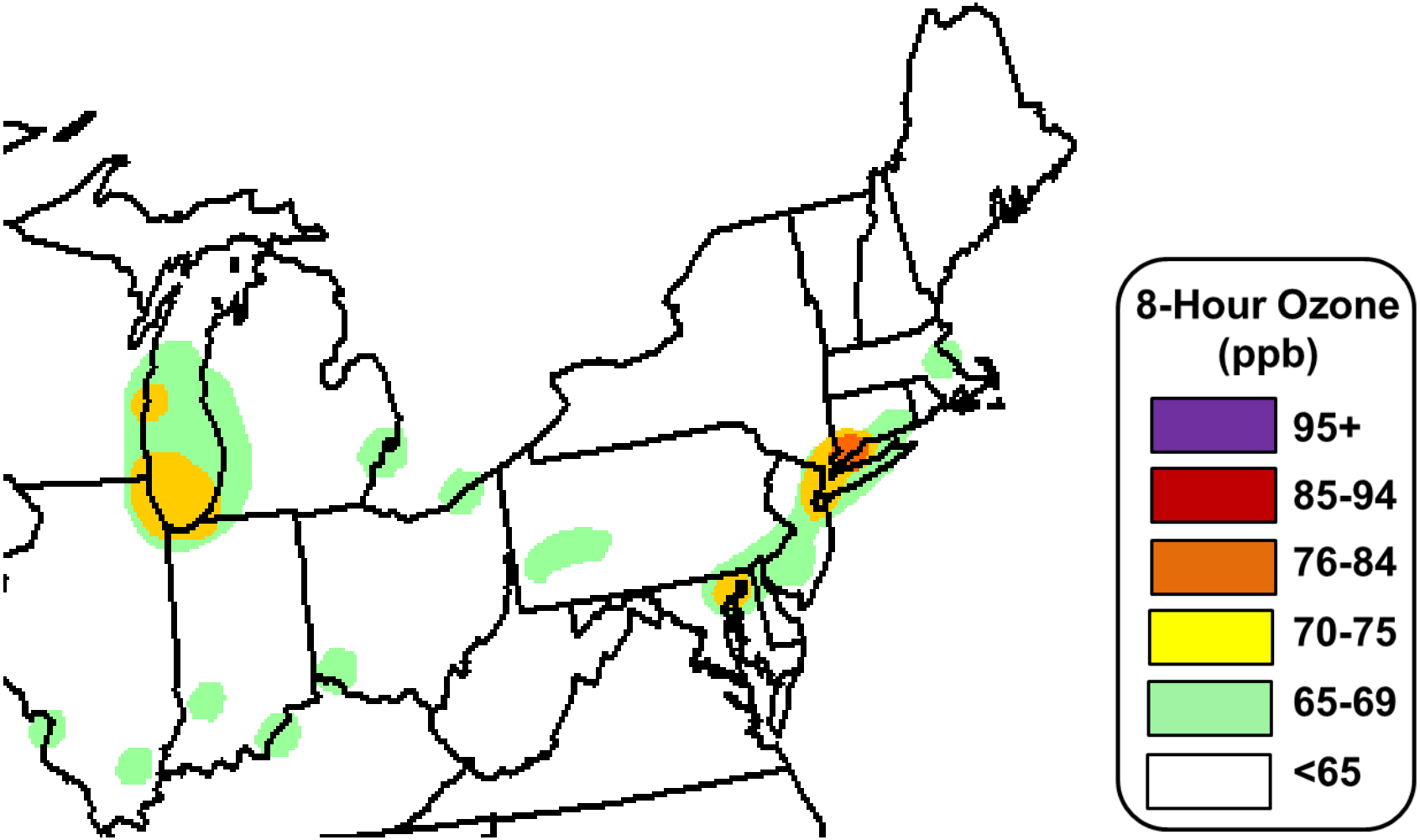
3. 2018 25% NOx Reduction Sensitivity
   - 25% NOx reduction for all sectors in all locations
   - Provides a guide for meeting 2015 ozone NAAQS
4. 2028 Mobile Sensitivity Run
   - Will on the way measures along with enhanced 2028 mobile emission reductions be enough?

2018 Additional 25% NOx Reduction



MARAMA Alpha emission inventories with noted marine emission issue

2028 Proxy with Mobile Measures



MARAMA Alpha emission inventories with noted marine emission issue

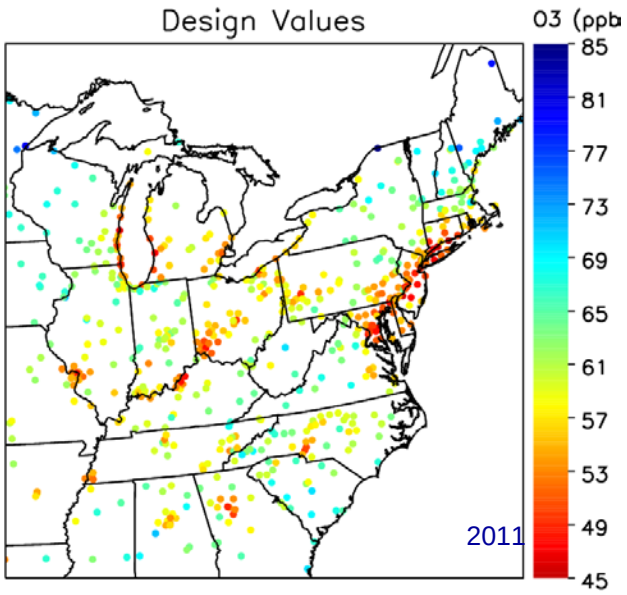
OTC Modeling Maxima by State

State	2018 Base L1B	2018 w/25%	2028 Proxy w/Mobile
Connecticut	85	83	78
Delaware	69	65	63
District of Columbia	70	64	61
Maine	66	61	59
Maryland	81	74	70
Massachusetts	70	66	66
New Hampshire	60	55	60
New Jersey	75	69	66
New York	82	80	75
Pennsylvania	74	68	67
Rhode Island	67	63	59
Vermont	<55	<55	<55
Virginia	72	66	61

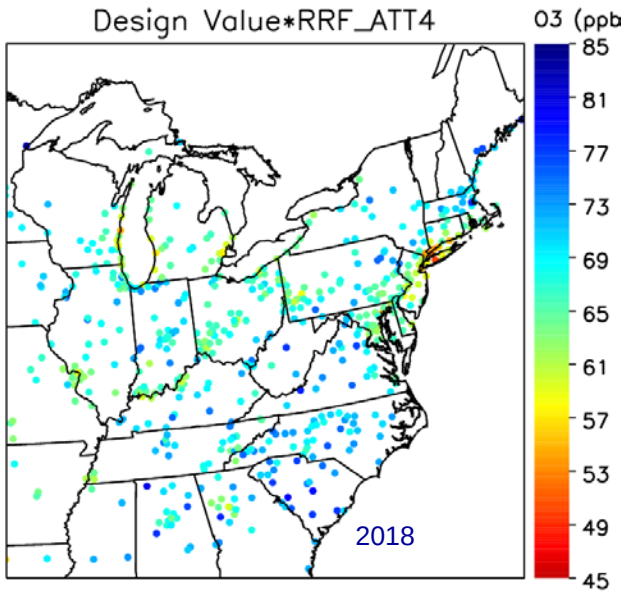
MARAMA Alpha emission inventories with noted marine emission issue

Maryland's Modeling Analyses of Good Neighbor SIPs

Before



After

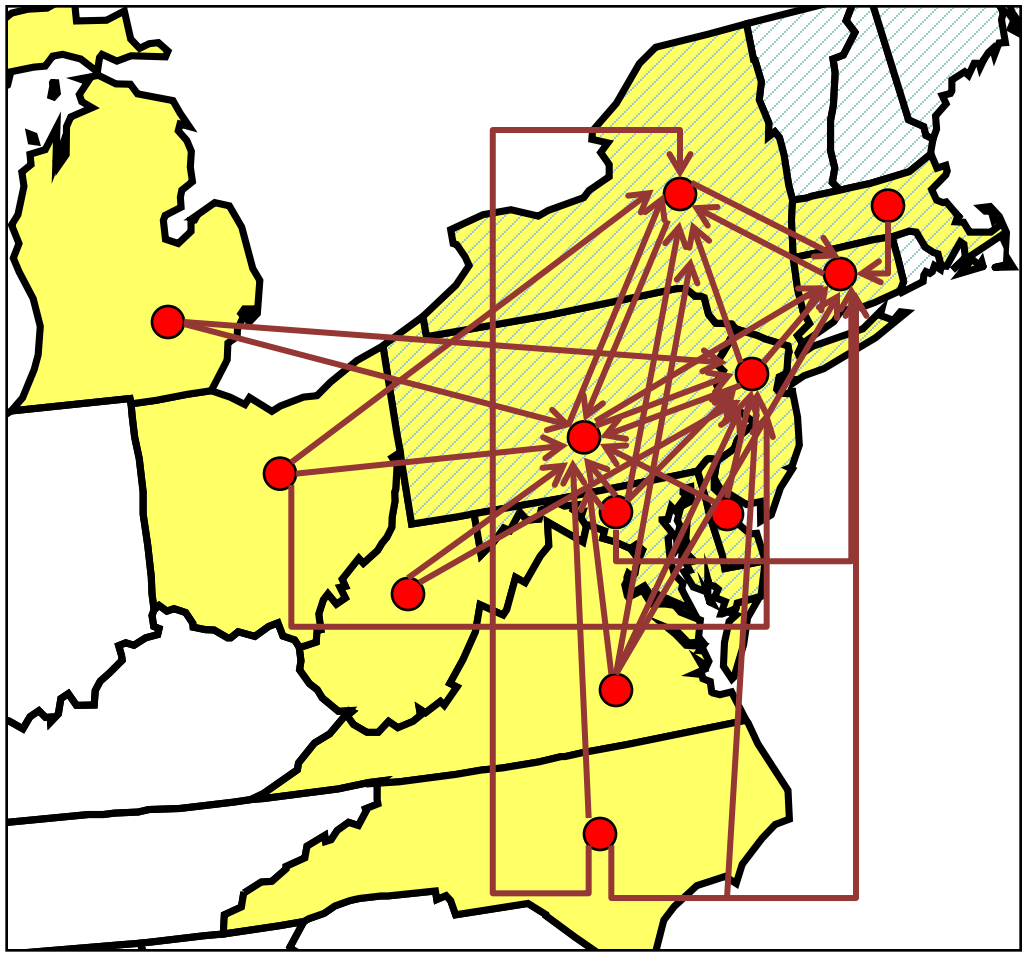


The Maryland Modeling Analyses

- Maryland owes EPA an ozone SIP in 2015
- Only OTC State with a designated "Moderate" nonattainment area … Baltimore
  - Only state in the East required to perform photochemical modeling and submit an attainment SIP for the 75 ppb standard
- In 2014 the Baltimore area measured attainment with the 75 ppb standard
  - Very kind … unusual … weather
- Maryland has conducted a significant amount of photochemical modeling
  - Still not final, but getting close

Who Contributes to Whom

States Contributing 1% or more of 75ppb Ozone to an OTR State



Based on Modeling for 2018 Emissions

Who Contributes to Whom

- EPA has performed preliminary modeling to identify which states may owe Good Neighbor SIPs for selected downwind problem areas … Future problems for **nonattainment** and **maintenance** both identified. Problem areas outside of the OTR not included.

	Contributing States from Preliminary EPA Analyses														
Problem Monitors	**DE**	**IL**	**IN**	**KY**	**MD**	**MI**	**MO**	**NJ**	**NY**	**OH**	**PA**	**TN**	**TX**	**VA**	**WV**
Harford, MD			x	x		x				x	x		x	x	x
Fairfield, CT					x	x		x	x	x	x			x	x
Fairfield, CT					x			x	x	x	x			x	x
Suffolk, NY		x	x		x	x		x		x	x		x	x	x
Fairfield, CT		x	x		x			x	x	x	x			x	x
New Haven, CT			x		x			x	x	x	x			x	x
Camden, NJ	x	x	x	x		x	x		x	x	x		x		x
Gloucester, NJ	x	x	x	x	x	x			x	x	x		x	x	x
Richmond, NY	x		x	x	x			x		x	x			x	x
Philadelphia, PA	x	x	x	x	x			x		x		x	x	x	x

States Owe Good Neighbor SIPs

MD suggests that contributing states may consider including:

- **Optimized EGU controls**
- **Aftermarket Catalyst requirements**
- **On- and off-road idling**
- **OTC VOC initiatives**
- **SmartWay**
- **Smaller combustion unit regulation**

Maryland modeled the benefits of all these programs in MD, and Optimized EGU controls across the East

Key Controls in MD Modeling

- "Optimized" Electric Generating Unit (EGU) reductions include:
  - All coal-fired units in eastern states running controls in the summertime consistent with emission rates measured in earlier years when controls where being run more efficiently
  - Retirements and other changes at EGUs reported by states by 2018
- New OTC measures include:
  - Nine new Ozone Transport Commission (OTC) model reduction programs for mobile sources and other sources implemented in just the OTC states
    - Model programs for aftermarket catalysts, onroad and offroad idling, heavy duty I & M, consumer products, AIM, auto coatings and ultra low-NOx burners. ZEV/CALEV and Smartways efforts in some states

Will It Work - Modeling Preliminary Problem Areas

County, State	Design Value 2011	2018 Future Projections		
		Measures "on the way"	Add in Optimized EGUs	Add new OTC & local MD measures
Attainment Problems - 2018				
Harford, MD	90	76	74	73
Fairfield, CT	84	73	72	71
Fairfield, CT	83	75	75	74
Suffolk, NY	83	78	 77	 76
Maintenance Problems - 2018				
Fairfield, CT	80	76	75	74
New Haven, CT	85	74	73	72
Camden, NJ	82	70	69	68
Gloucester, NJ	84	72	70	69
Richmond, NY	81	74	74	73
Philadelphia, PA	83	72	71	70

Modeled with EPA V1 Emissions

All values in parts per billion (ppb)

Other Difficult Monitors in the OTR

County, State	Design Value 2011	2018 Measures "on the way"	2018 – Add in Optimized EGUs	2018 – Add new OTC and local MD measures
Prince Georges, MD	82	68	67	66
New Castle, DE	78	66	65	64
Bucks, PA	80	69	68	67
Fairfax, VA	82	69	68	67

Modeled with EPA V1 Emissions

All values in ppb

Next Steps

- The OTC Modeling committee and member states will continue to refine the modeling platform emissions inventories and resolution
- Maryland will refine its modeling and submit its SIP in late 2015
- Connecticut, New Jersey and New York will work to define modeling to meet their SIP needs
- New modeling will investigate emissions on high electricity demand days, including demand response and behind the meter emissions sources
- The committee is also working to develop episodic modeling of key 2011 (and maybe 2007) ozone periods.