Briefing for States on Alpine Modeling of Ozone Transport

Gregory Stella
Alpine Geophysics, LLC

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Welcome and Overview

- Significant efforts being undertaken to support development of approvable GNS

- Alpine's latest 4km modeling* data to address coastal sites

* 4km modeling sponsored by Midwest Ozone Group (MOG)

Support for States

- Using information available from EPA and Alpine, how can States develop Good Neighbor SIP revisions based on recent potential flexibilities documented in EPA memorandum*?

- MOG is making available to the states a TSD with data supporting approvable Good Neighbor SIPs to address EPA-identified nonattainment / maintenance monitors in the eastern US**

* March 27, 2018 memo from Peter Tsirogotis, OAQPS.
** http://www.midwestozonegroup.com/files/FinalTSD-OzoneModelingSupportingGNSIPObligationsJune2018.pdf

Potential Outcome

- Approval of Good Neighbor SIP for 2008 and 2015 ozone NAAQS would obviate new transport rules, 126 petitions, and the 176A petition
- Good Neighbor SIPs can be approvable with existing OTB/OTW controls for all states in the East with recognition of the following:
  - Use of the accepted modeling platforms that are appropriate to assess transport, including 12km and 4 km
  - International emissions
  - Proration of upwind state responsibility based upon ppb contribution to downwind monitor
  - Maintenance monitors to be addressed through a no emission increase demonstration
  - Significant contribution to be based on 1 ppb (not 1 %)
- Consideration of legally mandated local controls in modeling would likely demonstrate even better air quality

Ozone Modeling TSD Development

- Address the four-step process identified by EPA to address the requirements of the good neighbor provision for each monitor group based on issues related to each
  - Step 1 – Identify problem monitors
  - Step 2 – Determine state linkages
  - Step 3 – Determine required response
  - Step 4 – Establish enforceable measures
- The object of the good neighbor provision is not for upwind states to assure attainment (which is the responsibility of downwind states) but rather to address significant contribution/interference
- Use directly or as weight of evidence to support SIP revisions
- Examples provided for four (4) sets of monitors
  - Connecticut/New York, Maryland, Wisconsin/Michigan, Texas

Modeling Platforms Discussed

- All based on EPA's 2011/2023en platform
- "Original 12km"
  - EPA's 12km "3x3" grid cell approach
    - EPA = Oct 2017/Mar 2018; Alpine = KY 2008 GNS
- "Updated 12km"
  - EPA's 12km "No Water" grid cell approach
    - EPA = Oct 2017/Mar 2018
- "4km Modeling"
  - Alpine: 4km "3x3" approach
  - Lake Michigan and Mid-Atlantic 4km domains

CSAPR Nonattainment / Maintenance ID

- Nonattainment monitors identified as both 2023 average MDA8 ozone design value and current 2014-2016 DV > 70.9 ppb

- Maintenance monitors identified as either:
  - 2023 average DV < 71.0 ppb and 2023 maximum DV ≥ 71.0 ppb; or
  - 2023 average DV ≥ 71.0 ppb and current 2014-2016 DV < 71.0 ppb

Connecticut / New York

Step 1 – Identify Problem Monitors

Maintenance only w/ 4km Modeling

				DVf (2023) Average (ppb) - Nonattainment		
Monitor	State	County	DVb (2011)	Original 12km Modeling	Updated 12km Modeling	4km Modeling
361030002	New York	Suffolk	83.3	72.5	74.0	70.7
90019003	Connecticut	Fairfield	83.7	72.7	73.0	69.9
90013007	Connecticut	Fairfield	84.3	71.2	71.0	69.7
360810124	New York	Queens	78.0	70.1	70.2	68.0
90099002	Connecticut	New Haven	85.7	71.2	69.9	70.3
90010017	Connecticut	Fairfield	80.3	69.8	68.9	69.2

				DVf (2023) Maximum (ppb) - Maintenance		
Monitor	State	County	DVb (2011)	Original 12km Modeling	Updated 12km Modeling	4km Modeling
361030002	New York	Suffolk	83.3	74.0	75.5	72.1
90019003	Connecticut	Fairfield	83.7	75.6	75.9	72.7
90013007	Connecticut	Fairfield	84.3	75.2	75.0	73.6
360810124	New York	Queens	78.0	71.9	72.0	69.8
90099002	Connecticut	New Haven	85.7	73.9	72.6	73.0
90010017	Connecticut	Fairfield	80.3	72.1	71.2	71.5

Original 12km modeling = “3x3” approach (Oct 2017 memo)

Updated 12km modeling = “No water” approach (March 2018 memo)

Step 2: Linkage assessment (1%)

- Using the Alpine/OSAT linkage calculations from the “Original” 12km simulation, states (orange highlight) are identified with linkage to problem receptors (based on the 1% of 70 ppb NAAQS)

Monitor	Name	PA	VA/DC	IL	IN	OH	MD	NJ	NY	WV	KY	MI	CT	DE	TX
90019003	Fairfield, CT	x	x	x	x	x	x	x	x						
361030002	Suffolk, NY	x	x	x	x	x	x	x			x	x	x		x
360850067	Richmond, NY	x	x	x	x	x	x	x		x	x	x		x	x
90013007	Fairfield, CT	x	x	x	x	x	x	x	x						
90099002	New Haven, CT	x	x	x	x	x	x	x	x						

1% Contribution Threshold

- Some states and stakeholders argue that 1% (0.70 ppb) is not scientifically supported and is more stringent than current 2016 EPA Significant Impact Level (SIL) guidance of 1.0 ppb

- Potential for states to submit SIP revision citing SIL as acceptable for total state anthropogenic contribution threshold

- Allow as an alternative that significance occurs if greater than 1 ppb and eliminate linkage with upwind states

Step 2: Linkage assessment (>1 ppb)

- Using the Alpine/OSAT linkage calculations from the "Original" 12km simulation, identified states with linkage to problem receptors > 1 ppb
- Eliminates link to WV, KY, MI, CT, and TX

Monitor	Name	PA	VA/DC	IL	IN	OH	MD	NJ	NY	DE
90019003	Fairfield, CT	x	x			x	x	x	x	
361030002	Suffolk, NY	x	x	x	x	x	x	x		
360850067	Richmond, NY	x	x	x	x	x	x	x		x
90013007	Fairfield, CT	x	x			x	x	x	x	
90099002	New Haven, CT	x	x	x		x	x	x	x	

Step 3 – Determine Required Response

- No nonattainment receptors: no response needed
- Only problem monitors: maintenance
- Alternative maintenance approaches
  - Demonstrate cost effective controls in place; or
  - 10 year projection with no emission increase

Step 3: Maintenance Alternative: 10 Year Reduction Demonstration

Section 175A of the Clean Air Act provides:

"(a) Plan revision

Each State which submits a request under section 7407 (d) of this title for redesignation of a nonattainment area for any air pollutant as an area which has attained the national primary ambient air quality standard for that air pollutant shall also submit a revision of the applicable State implementation plan to provide for the maintenance of the national primary ambient air quality standard for such air pollutant in the area concerned for at least 10 years after the redesignation. The plan shall contain such additional measures, if any, as may be necessary to ensure such maintenance."

"Procedures for Processing Requests to Redesignate Areas to Attainment", John Calcagni memorandum, 4 September 1992, which contains the following statement on page 9:

"A State may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of source and emission rates will not cause a violation of the NAAQS. Under the Clean Air Act, many areas are required to submit modeled attainment demonstrations to show that proposed reductions in emissions will be sufficient to attain the applicable NAAQS. For these areas, the maintenance demonstration should be based upon the same level of modeling. In areas where no such modeling was required, the State should be able to rely on the attainment inventory approach. In both instances, the demonstration should be for a period of 10 years following the redesignation."

Maryland

Step 1: Identify Problem Monitors

- Utilize SIP approvable modeling to demonstrate attainment (EPA Updated 12km)

				DVf (2023) Average (ppb) - Nonattainment		
Monitor	**State**	**County**	**DVb (2011)**	**Original 12km Modeling**	**Updated 12km Modeling**	**4km Modeling**
240251001	Maryland	Harford	90.0	71.4	70.9	71.1

				DVf (2023) Maximum (ppb) - Maintenance		
Monitor	**State**	**County**	**DVb (2011)**	**Original 12km Modeling**	**Updated 12km Modeling**	**4km Modeling**
240251001	Maryland	Harford	90.0	73.8	73.3	73.5

Original 12km modeling = “3x3” approach (Oct 2017 memo)
Updated 12km modeling = “No water” approach (March 2018 memo)

International Emissions

- **EPA Response: *…** The EPA encourages affected air agencies to coordinate with their EPA Regional office to identify approaches to evaluate the potential impacts of international transport and to determine the most appropriate information and analytical methods for each area's unique situation.

* EPA Final 2015 ozone NAAQS Designations
https://www.epa.gov/sites/production/files/2018-04/documents/placeholder.pdf

Step 1 : International Contribution

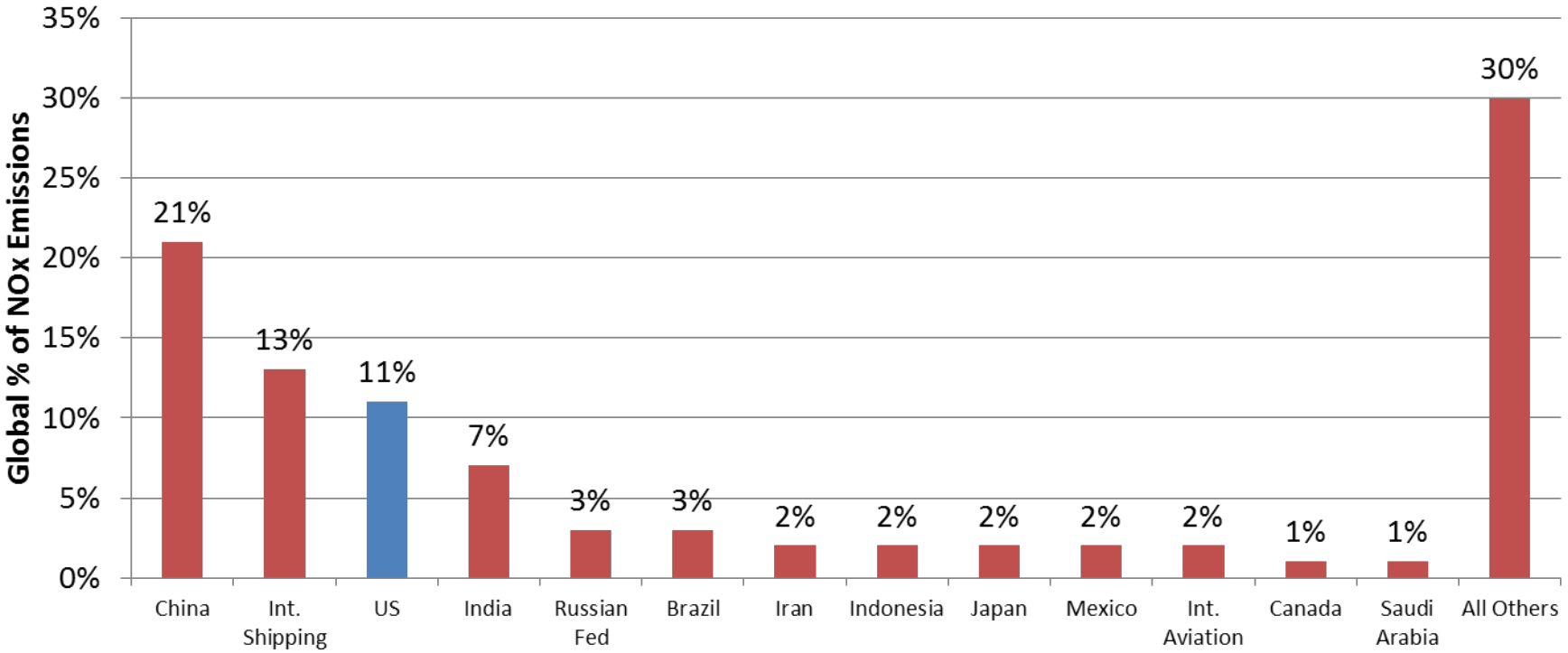
Harford: (only nonattainment monitor at 4km) – 71.1 ppb

- Reduction needed to achieve attainment: 0.2 ppb
- International contribution
  - Canada/Mexico: 0.43 ppb (assumed to be 100% international anthropogenic)
  - Boundary Conditions: no credit for any portion of the 11.34 ppb BC needed to bring monitor into attainment
    - 89% of global NOx emissions are generated outside U.S.
- Weight of Evidence: Harford is likely to be in attainment of the 2015 ozone NAAQS "but for" international emissions

4km Modeling - 8hr Ozone Concentration and OSAT Contribution (ppb)												
2011 DVb	2023 DVf (Avg)	VA/DC	PA	WV	OH	KY	IN	IL	TX	Can/ Mex	BC	Other
90	71.1	3.92	2.7	2.52	3.02	2.07	1.81	1.05	0.9	0.43	11.34	17.1

Step 1: International Emissions

- NOx Emissions influencing boundary condition ozone are overwhelmingly (89%) from international sources



Source: "European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR)"

Step 1: International Emissions Impact on Over-Control

"And if, as this Court held, 'section 110(a)(2)(D)(i)(I) gives EPA no authority to force an upwind state to share the burden of reducing other upwind states' emissions,' *North Carolina*, 531 F.3d at 921, the CAA surely does not require upwind states to offset downwind air-quality impacts attributable to other *countries*' emissions." *

"CAA section 179B(a) bars EPA from disapproving SIPs to the extent non-U.S. emissions cause nonattainment. EPA must approve a SIP if it meets all

> requirements applicable to it under the [CAA] other than a requirement that [it] … demonstrate attainment and maintenance of the relevant [NAAQS] by the [applicable] attainment date . . . and . . . the submitting State establishes . . . that [its] implementation plan . . . would be adequate to attain and maintain the relevant [NAAQS] by the attainment date . . . *but for emissions emanating from outside of the United States*.*

"... EPA over-controls a state if the state must continue reducing emissions *after* its linked receptors would attain in the absent of international emissions." **

*Joint Opening Brief of Industry Petitioners, September 18, 2017, Wisconsin et al v. EPA, Case No. 16-1406 et al

** Joint Reply Brief of Industry Petitioners, March 19, 2018, Wisconsin et al v. EPA, Case No. 16-1406 et al

Step 2: Linkage assessment (1% v 1 ppb)

- Using the linkage calculations from the 4km OSAT simulation, states with linkage to problem receptors (based on the 1% of 70 pbb NAAQS [orange + blue] or > 1 ppb [orange only])

240251001		4km Modeling - 8hr Ozone Concentration / Contribution (ppb)									
Monitor	County	2011 DVb	2023 DVf (Avg)	VA/DC	PA	WV	OH	KY	IN	IL	TX
240251001	Harford	90	71.1	3.92	2.7	2.52	3.02	2.07	1.81	1.05	0.9

1% Contribution Threshold

- Some states and stakeholders argue that 1% (0.70 ppb) is not scientifically supported and is more stringent than current 2016 EPA Significant Impact Level (SIL) guidance of 1.0 ppb

- Potential for states to submit SIP revision citing SIL as acceptable for total state anthropogenic contribution threshold

- Allow as an alternative that significance occurs if greater than 1 ppb and eliminate linkage with upwind states

Step 3 – Determine Required Response for Maintenance

- No nonattainment receptors (if emissions from Canada/Mexico are recognized)
- If only maintenance, allow the following alternatives
  - Show cost effective controls in place, or
  - 10 year projection with no emission increase

Step 3: Maintenance Alternative: 10 Year Reduction Demonstration

Section 175A of the Clean Air Act provides:

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Each State which submits a request under section 7407 (d) of this title for redesignation of a nonattainment area for any air pollutant as an area which has attained the national primary ambient air quality standard for that air pollutant shall also submit a revision of the applicable State implementation plan to provide for the maintenance of the national primary ambient air quality standard for such air pollutant in the area concerned for at least 10 years after the redesignation. The plan shall contain such additional measures, if any, as may be necessary to ensure such maintenance."

"Procedures for Processing Requests to Redesignate Areas to Attainment", John Calcagni memorandum, 4 September 1992, which contains the following statement on page 9:

"A State may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of source and emission rates will not cause a violation of the NAAQS. Under the Clean Air Act, many areas are required to submit modeled attainment demonstrations to show that proposed reductions in emissions will be sufficient to attain the applicable NAAQS. For these areas, the maintenance demonstration should be based upon the same level of modeling. In areas where no such modeling was required, the State should be able to rely on the attainment inventory approach. In both instances, the demonstration should be for a period of 10 years following the redesignation."

Step 3 – Determine Required Response to Nonattainment

- If Harford is designated as nonattainment allow the following alternatives
  - Show cost effective controls in place, or
  - Proportional contribution (a.k.a., ‘red lines’ approach)

Step 3: “Red Lines” Allocation Alternative

- Upwind states are obligated to reduce emissions but no more than necessary to achieve attainment (< 71.0 ppb at monitor) or eliminate linkage (< 0.70 ppb at upwind state)
- CAA does not specify how to allocate among upwind states
- EPA’s CSAPR cost based allocation method was upheld by the Supreme Court in part because of the complexity of other approaches
- This approach is much simpler

Step 3: Red Lines Alternative Harford, MD

240251001		4km Modeling - 8hr Ozone Concentration / Contribution (ppb)									
Monitor	County	2011 DVb	2023 DVf (Avg)	VA/DC	PA	WV	OH	KY	IN	IL	TX
240251001	Harford	90	71.1	3.92	2.7	2.52	3.02	2.07	1.81	1.05	0.9

Anthropogenic Contribution (ppb) from 2023 Base Case – 4km OSAT Modeling

Redlines Reduction Contribution Calculation – Harford, MD
Upwind State must achieve less than 0.70 ppb significant contribution or monitor must achieve attainment
Reduction Necessary for Attainment = 0.2 ppb from 71.1 ppb

	Relative Contribution of Significant Upwind States (ppb and %)		Proportional Reduction Requirement (ppb)
VA/DC	3.92	22%	0.04
OH	3.02	17%	0.03
PA	2.70	15%	0.03
WV	2.52	14%	0.03
KY	2.07	12%	0.02
IN	1.81	10%	0.02
IL	1.05	6%	0.01
TX	0.90	5%	0.01
Total	**17.99**	**100%**	**0.20**

Wisconsin/Michigan

Step 1: Identify Problem Monitors

				Original 12km Modeling		Updated 12km Modeling		4km Modeling	
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max
260050003	Michigan	Allegan	82.7	69.0	71.8	69.0	71.7	70.3	73.1
550790085	Wisconsin	Milwaukee	80.0	65.4	67.0	71.2	73.0	67.4	70.5
551170006	Wisconsin	Sheboygan	84.3	70.8	73.1	72.8	75.1	71.7	74.0

Original 12km modeling = “3x3” approach (Oct 2017 memo)
Updated 12km modeling = “No water” approach (March 2018 memo)

Step 1 (cont.): International Contribution

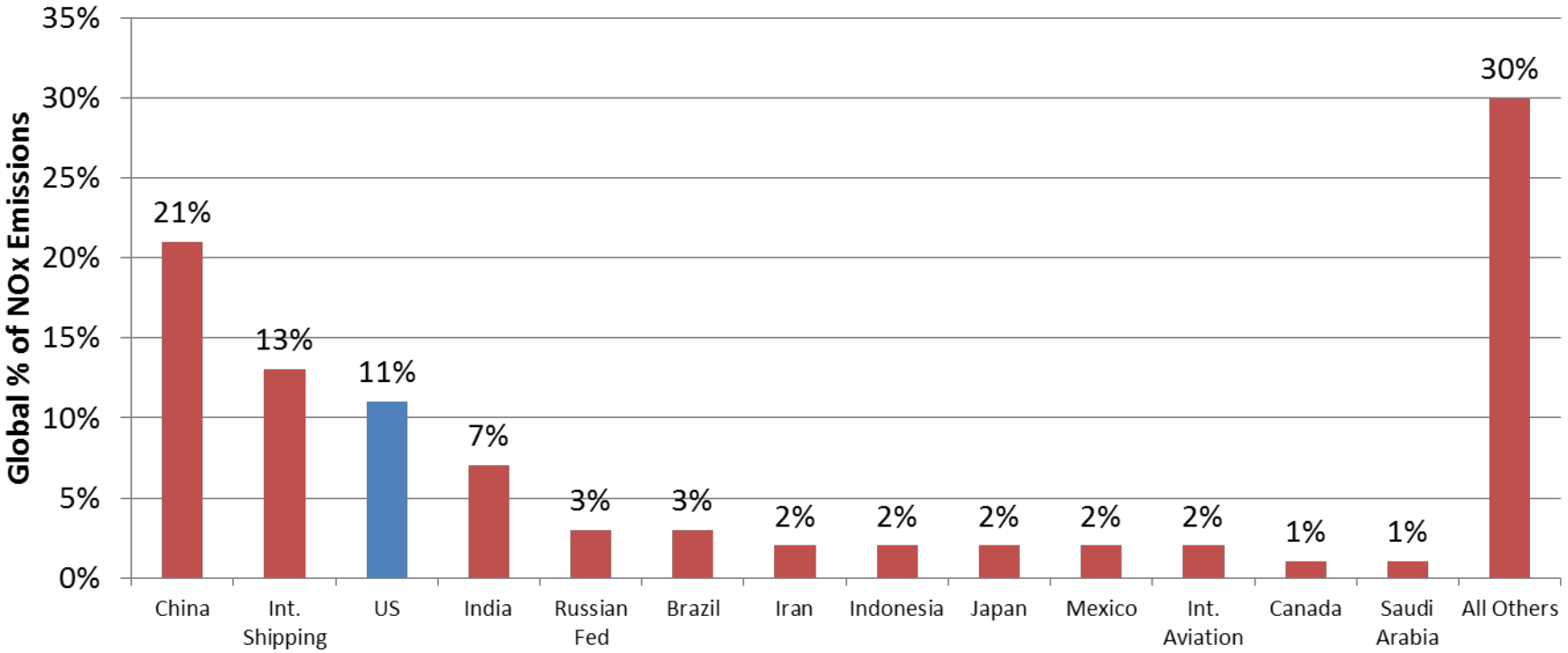
Sheboygan: (only nonattainment monitor at 4km) – 71.7 ppb

- Reduction needed to achieve attainment: 0.8 ppb
- International contribution (Ex: from 12km modeling*)
  - Canada/Mexico: 0.69 ppb (assumed to be 100% international anthropogenic)
  - Boundary Conditions: 17.53 ppb (only need credit for 0.11 ppb – less than 1% of BC (in addition to Can/Mex) to bring monitor into attainment
    - 89% of global NOx emissions are generated outside U.S.
- Weight of Evidence: Sheboygan is likely to be in attainment of the 2015 ozone NAAQS "but for" international emissions

*Note: 4km OSAT modeling not conducted on Lake Michigan domain. Likely similar international contribution from 4km.

Step 1: International Emissions

- NOx Emissions influencing boundary condition ozone are overwhelmingly (89%) from international sources



Source: "European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR)"

Relief From Percentage of Boundary Condition Contribution

- It is recognized that the boundary condition category is comprised of some international anthropogenic emission contribution
- Assuming a non-zero percentage of boundary conditions are from international anthropogenic sources, a state may reasonably consider accounting for these contributions

Step 1: International Emissions Impact on Over-Control

"And if, as this Court held, 'section 110(a)(2)(D)(i)(I) gives EPA no authority to force an upwind state to share the burden of reducing other upwind states' emissions,' *North Carolina*, 531 F.3d at 921, the CAA surely does not require upwind states to offset downwind air-quality impacts attributable to other *countries*' emissions." *

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> requirements applicable to it under the [CAA] other than a requirement that [it] … demonstrate attainment and maintenance of the relevant [NAAQS] by the [applicable] attainment date . . . and . . . the submitting State establishes . . . that [its] implementation plan . . . would be adequate to attain and maintain the relevant [NAAQS] by the attainment date . . . *but for emissions emanating from outside of the United States*.*

"... EPA over-controls a state if the state must continue reducing emissions *after* its linked receptors would attain in the absent of international emissions." **

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Step 1 (cont.): Problem Monitors

- Sheboygan, Wisconsin: Maintenance (assuming international emissions are recognized)

- Allegan, Michigan: Maintenance

Step 2: Linkage assessment (1%)

Site ID	State	County	2023 Avg DV	2023 Max DV	AR	IL	IN	IA	KS	KY
551170006	Wisconsin	Sheboygan	72.8	75.1	0.51	15.73	7.11	0.45	0.46	0.81
260050003	Michigan	Allegan	69.0	71.7	1.64	19.62	7.11	0.77	0.77	0.58

Site ID	State	County	LA	MI	MO	OH	OK	TX	WI
551170006	Wisconsin	Sheboygan	0.84	2.06	1.37	1.10	0.95	1.65	9.09
260050003	Michigan	Allegan	0.70	3.32	2.61	0.19	1.31	2.39	1.95

Site ID	State	County	Can + Mex	Offshore	Fire	Initial & Boundary	Biogenic
551170006	Wisconsin	Sheboygan	0.69	0.55	0.64	17.53	7.51
260050003	Michigan	Allegan	0.54	0.36	0.93	11.85	8.91

EPA 12km APCA contribution calculations with “no water” design values

1% Contribution Threshold

- Some states and stakeholders argue that 1% (0.70 ppb) is not scientifically supported and is more stringent than current 2016 EPA Significant Impact Level (SIL) guidance of 1.0 ppb

- Potential for states to submit SIP revision citing SIL as acceptable for total state anthropogenic contribution threshold

- Allow as an alternative that significance occurs if greater than 1 ppb and eliminate linkage with upwind states

Step 2: Linkage assessment (> 1 ppb)

Eliminates link to IA, KS, KY, and LA

Site ID	State	County	2023 Avg DV	2023 Max DV	AR	IL	IN	MI
551170006	Wisconsin	Sheboygan	72.8	75.1	0.51	15.73	7.11	2.06
260050003	Michigan	Allegan	69.0	71.7	1.64	19.62	7.11	3.32

Site ID	State	County	MO	OH	OK	TX	WI
551170006	Wisconsin	Sheboygan	1.37	1.10	0.95	1.65	9.09
260050003	Michigan	Allegan	2.61	0.19	1.31	2.39	1.95

Site ID	State	County	Can + Mex	Offshore	Fire	Initial & Boundary	Biogenic
551170006	Wisconsin	Sheboygan	0.69	0.55	0.64	17.53	7.51
260050003	Michigan	Allegan	0.54	0.36	0.93	11.85	8.91

EPA 12km APCA contribution calculations with “no water” design values

Step 3 – Determine Required Response

- No nonattainment receptors (if international emissions are recognized)
- Only problem monitors: maintenance
- Alternative maintenance approaches
  - Show cost effective controls in place;or
  - 10 year projection with no emission increase

Step 3: Maintenance Alternative: 10 Year Reduction Demonstration

Section 175A of the Clean Air Act provides:

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Step 3 – Determine Required Response to Nonattainment

- If Sheboygan is deemed to be nonattainment allow the following alternatives
  - Show cost effective controls in place, or
  - Proportional contribution (a.k.a., ‘red lines’ approach)

Step 3: “Red Lines” Allocation Alternative

- Upwind states are obligated to reduce emissions but no more than necessary to achieve attainment (< 71.0 ppb at monitor) or eliminate linkage (< 0.70 ppb at upwind state)
- CAA does not specify how to allocate among upwind states
- EPA’s CSAPR cost based allocation method was upheld by the Supreme Court in part because of the complexity of other approaches
- This approach is much simpler

Step 3: Red Lines Alternative

Redlines Reduction Contribution Calculation - Sheboygan, WI
Upwind State must achieve less than 0.70 ppb significant contribution or monitor must achieve attainment
Reduction Necessary for Attainment = 1.90 ppb from 72.8 ppb

	Relative Contribution of Significant Upwind States (ppb and %)			Proportional Reduction Requirement (ppb)
IL	15.73	50%		0.95
IN	7.11	22%		0.43
MI	2.06	7%		0.12
TX	1.65	5%		0.10
MO	1.37	4%		0.08
OH	1.10	3%		0.07
OK	0.95	3%		0.06
LA	0.84	3%		0.05
KY	0.81	3%		0.05
Total	**31.62**	**100%**		**1.90**

EPA 12km APCA contribution calculations with “no water” design values

Texas

Step 1: Identify Problem Monitors

Site ID	State	County	2023 Avg DV	2023 Max DV
480391004	Texas	Brazoria	74.0	74.9
484392003	Texas	Tarrant	72.5	74.8
482011039	Texas	Harris	71.8	73.5
482010024	Texas	Harris	70.4	72.8
481210034	Texas	Denton	69.7	72.0
482011034	Texas	Harris	70.8	71.6

EPA 12km APCA contribution calculations with “no water” design values

Step 1: State Specific Platforms

- TCEQ recent ran a 2012 base year platform with 2023 projections

			EPA CSAPR DVf		TCEQ SIP Revision	
Site ID	**State**	**County**	**2023 Avg**	**2023 Max**	**2012 DVb**	**2023 DVf**
480391004	Texas	Brazoria	74.0	74.9	85	78
484392003	Texas	Tarrant	72.5	74.8	83	66
482011039	Texas	Harris	71.8	73.5	78.33	74
482010024	Texas	Harris	70.4	72.8	76.67	68
481210034	Texas	Denton	69.7	72.0	83.67	68
482011034	Texas	Harris	70.8	71.6	78	71

Step 1: International Contribution

Site ID	State	County	2023 Avg DV	Mex/Can Contrib.	Boundary Contrib.	2023 DV 2% Relief	2023 DV 5% Relief	2023 DV 7% Relief	2023 DV 11% Relief
480391004	Texas	Brazoria	74.0	0.44	24.02	73.0	72.3	71.8	70.9
484392003	Texas	Tarrant	72.5	1.24	24.38	70.7	70.0	69.5	68.5
482011039	Texas	Harris	71.8	0.47	24.67	70.8	70.0	69.6	68.6

EPA 12km APCA contribution calculations with “no water” design values

Step 1 (cont.): International Contribution

Tarrant (484392003) – 72.5 ppb (12km modeling)

- Reduction needed to achieve attainment: 1.6 ppb
- International contribution
  - Canada/Mexico: 1.24 ppb (assumed to be 100% international anthropogenic)
  - Boundary Conditions: 24.38 ppb (only need credit for 0.36 ppb – 1.5 % of BC -in addition to Can/Mex - to bring monitor into attainment)
    - 89% of global NOx emissions are generated outside U.S.
- Weight of Evidence: This monitor is likely to be in attainment of the 2015 ozone NAAQS “but for” international emissions

Step 1 (cont.): International Contribution

Harris (482011039) – 71.8 ppb (12km modeling)

- Reduction needed to achieve attainment: 0.9 ppb
- International contribution
  - Canada/Mexico: 0.47 ppb (assumed to be 100% international anthropogenic)
  - Boundary Conditions: 24.67 ppb (only need credit for 0.43 ppb – 1.7 % of BC - in addition to Can/Mex - to bring monitor into attainment)
    - 89% of global NOx emissions are generated outside U.S.
- Weight of Evidence: This monitor is likely to be in attainment of the 2015 ozone NAAQS “but for” international emissions

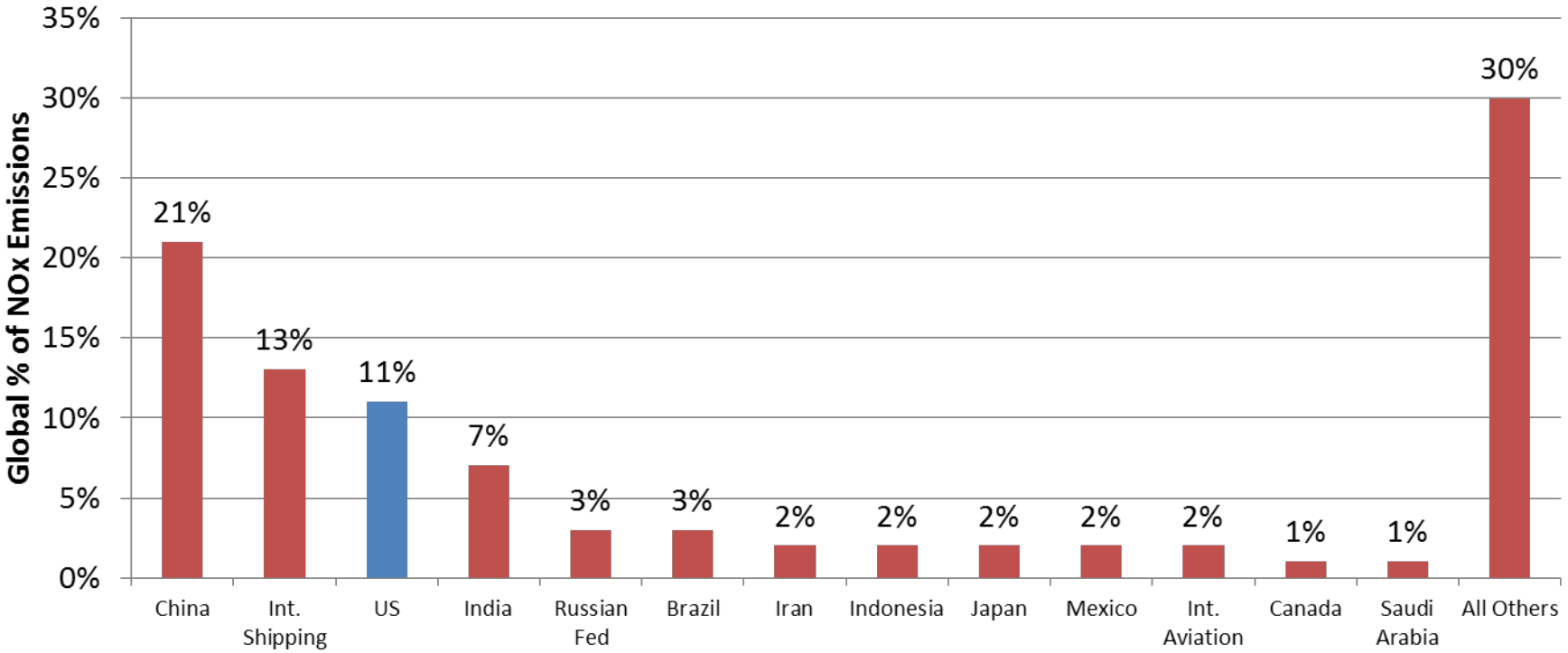
Step 1 (cont.): International Contribution

Brazoria (480391004) – 74.0 ppb (12km modeling)

- Reduction needed to achieve attainment: 3.1 ppb
- International contribution
  - Canada/Mexico: 0.44 ppb (assumed to be 100% international anthropogenic)
  - Boundary Conditions: 24.02 ppb (only need credit for 2.66 ppb – 11% of BC - in addition to Can/Mex - to bring monitor into attainment)
    - 89% of global NOx emissions are generated outside U.S.
- Weight of Evidence: This monitor is likely to be in attainment of the 2015 ozone NAAQS “but for” international emissions

Step 1: International Emissions

- NOx Emissions influencing boundary condition ozone are overwhelmingly (89%) from international sources



Source: "European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR)"

Relief From Percentage of Boundary Condition Contribution

- It is recognized that the boundary condition category is comprised of some international anthropogenic emission contribution
- Assuming a non-zero percentage of boundary conditions are from international anthropogenic sources, a state may reasonably consider accounting for a these contributions

Step 1: International Emissions Impact on Over-Control

"And if, as this Court held, 'section 110(a)(2)(D)(i)(I) gives EPA no authority to force an upwind state to share the burden of reducing other upwind states' emissions,' *North Carolina*, 531 F.3d at 921, the CAA surely does not require upwind states to offset downwind air-quality impacts attributable to other *countries*' emissions." *

"CAA section 179B(a) bars EPA from disapproving SIPs to the extent non-U.S. emissions cause nonattainment. EPA must approve a SIP if it meets all

> requirements applicable to it under the [CAA] other than a requirement that [it] … demonstrate attainment and maintenance of the relevant [NAAQS] by the [applicable] attainment date . . . and . . . the submitting State establishes . . . that [its] implementation plan . . . would be adequate to attain and maintain the relevant [NAAQS] by the attainment date . . . *but for emissions emanating from outside of the United States*.*

"... EPA over-controls a state if the state must continue reducing emissions *after* its linked receptors would attain in the absent of international emissions." **

*Joint Opening Brief of Industry Petitioners, September 18, 2017, Wisconsin et al v. EPA, Case No. 16-1406 et al

** Joint Reply Brief of Industry Petitioners, March 19, 2018, Wisconsin et al v. EPA, Case No. 16-1406 et al

Step 2: Linkage assessment (1%)

Site ID	State	County	2023 Avg DV	2023 Max DV	AR	IL	LA	MS	MO	OK
480391004	Texas	Brazoria	74.0	74.9	0.90	1.00	3.80	0.63	0.88	0.90
484392003	Texas	Tarrant	72.5	74.8	0.78	0.29	1.71	0.27	0.38	1.71
482011039	Texas	Harris	71.8	73.5	0.99	0.88	4.72	0.79	0.88	0.58
482010024	Texas	Harris	70.4	72.8	0.29	0.34	3.06	0.50	0.38	0.20
481210034	Texas	Denton	69.7	72.0	0.58	0.23	1.92	0.33	0.24	1.23
482011034	Texas	Harris	70.8	71.6	0.54	0.51	3.38	0.39	0.63	0.68

Site ID	State	County	TX	Can + Mex	Offshore	Fire	Initial & Boundary	Biogenic
480391004	Texas	Brazoria	26.00	0.44	2.31	2.05	24.02	5.60
484392003	Texas	Tarrant	27.64	1.24	1.18	1.34	24.38	6.44
482011039	Texas	Harris	22.82	0.47	4.04	2.09	24.67	4.50
482010024	Texas	Harris	25.62	0.28	4.83	0.77	27.83	2.66
481210034	Texas	Denton	26.69	0.92	1.23	0.87	24.69	6.42
482011034	Texas	Harris	25.66	0.24	3.91	1.75	25.71	3.44

EPA 12km APCA contribution calculations with “no water” design values

1% Contribution Threshold

- Some states and stakeholders argue that 1% (0.70 ppb) is not scientifically supported and is more stringent than current 2016 EPA Significant Impact Level (SIL) guidance of 1.0 ppb

- Potential for states to submit SIP revision citing SIL as acceptable for total state anthropogenic contribution threshold

- Allow as an alternative that significance occurs if greater than 1 ppb and eliminate linkage with upwind states

Step 2: Linkage assessment (> 1 ppb)

Eliminates link to AR, IL, MS, and MO

Site ID	State	County	2023 Avg DV	2023 Max DV	LA	OK	TX
480391004	Texas	Brazoria	74.0	74.9	3.80	0.90	26.00
484392003	Texas	Tarrant	72.5	74.8	1.71	1.71	27.64
482011039	Texas	Harris	71.8	73.5	4.72	0.58	22.82
482010024	Texas	Harris	70.4	72.8	3.06	0.20	25.62
481210034	Texas	Denton	69.7	72.0	1.92	1.23	26.69
482011034	Texas	Harris	70.8	71.6	3.38	0.68	25.66

Site ID	State	County	Can + Mex	Offshore	Fire	Initial & Boundary	Biogenic
480391004	Texas	Brazoria	0.44	2.31	2.05	24.02	5.60
484392003	Texas	Tarrant	1.24	1.18	1.34	24.38	6.44
482011039	Texas	Harris	0.47	4.04	2.09	24.67	4.50
482010024	Texas	Harris	0.28	4.83	0.77	27.83	2.66
481210034	Texas	Denton	0.92	1.23	0.87	24.69	6.42
482011034	Texas	Harris	0.24	3.91	1.75	25.71	3.44

EPA 12km APCA contribution calculations with “no water” design values

Step 3 – Determine Required Response

- No nonattainment receptors (if international emissions are recognized)
- Only problem monitors: maintenance
- Alternative maintenance approaches
  - Show cost effective controls in place; or
  - 10 year projection with no emission increase

Step 3: Maintenance Alternative: 10 Year Reduction Demonstration

Section 175A of the Clean Air Act provides:

"(a) Plan revision

Each State which submits a request under section 7407 (d) of this title for redesignation of a nonattainment area for any air pollutant as an area which has attained the national primary ambient air quality standard for that air pollutant shall also submit a revision of the applicable State implementation plan to provide for the maintenance of the national primary ambient air quality standard for such air pollutant in the area concerned for at least 10 years after the redesignation. The plan shall contain such additional measures, if any, as may be necessary to ensure such maintenance."

"Procedures for Processing Requests to Redesignate Areas to Attainment", John Calcagni memorandum, 4 September 1992, which contains the following statement on page 9:

"A State may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of source and emission rates will not cause a violation of the NAAQS. Under the Clean Air Act, many areas are required to submit modeled attainment demonstrations to show that proposed reductions in emissions will be sufficient to attain the applicable NAAQS. For these areas, the maintenance demonstration should be based upon the same level of modeling. In areas where no such modeling was required, the State should be able to rely on the attainment inventory approach. In both instances, the demonstration should be for a period of 10 years following the redesignation."

Step 3 – Determine Required Response to Nonattainment

If Tarrant, Harris and/or Brazoria are deemed to be nonattainment, allow the following alternatives

- Show cost effective controls in place, or
- Proportional contribution (a.k.a., ‘red lines’ approach)

Example Application Conclusions

- Good Neighbor SIPs can be approved without new controls for all states in the East with recognition of the following:

- Step 1:
  - Alternative modeling platforms
    - Recognition of the several modeling platforms that are known to be appropriate to assess transport, including 12km and 4 km, as well as state specific platforms
    - MOG 4 km modeling alone predicts all NY and CT monitors to be in attainment by 2023

Conclusion (cont.)

- Step 1 (cont.):
  - Recognition of international emissions
    - None needed for NY and CT
    - Allowing credit for only Can/Mex resolves MD
    - Allowing additional credit for 1% of BC resolves all monitors in East other than TX
    - Allowing additional credit for 2% of BC resolves all monitors in East other than 1 monitor in TX
    - Allowing additional credit for 11% of BC resolves all of East, including TX

Conclusion (cont.)

- Step 2:
  - Allowing linkage to be based on impacts greater than 1 ppb eliminates linkages with TX for the states of AR, MS, MO, OK, IL

- Step 3:
  - Allow “maintenance” to be addressed through a no emission increase demonstration - helps all upwind states
  - For nonattainment, allow states to allocate proportional responsibility for new control
    - This works particularly well in MD and WI which have only 1 potential nonattainment monitor (if international is not considered) and in Texas if only 2% of BC recognized as international
    - Once ppb contribution to nonattainment is determined, states can calculate the extent to which emissions would need to be reduced or cost-justified

NEW 4KM MODELING DATA

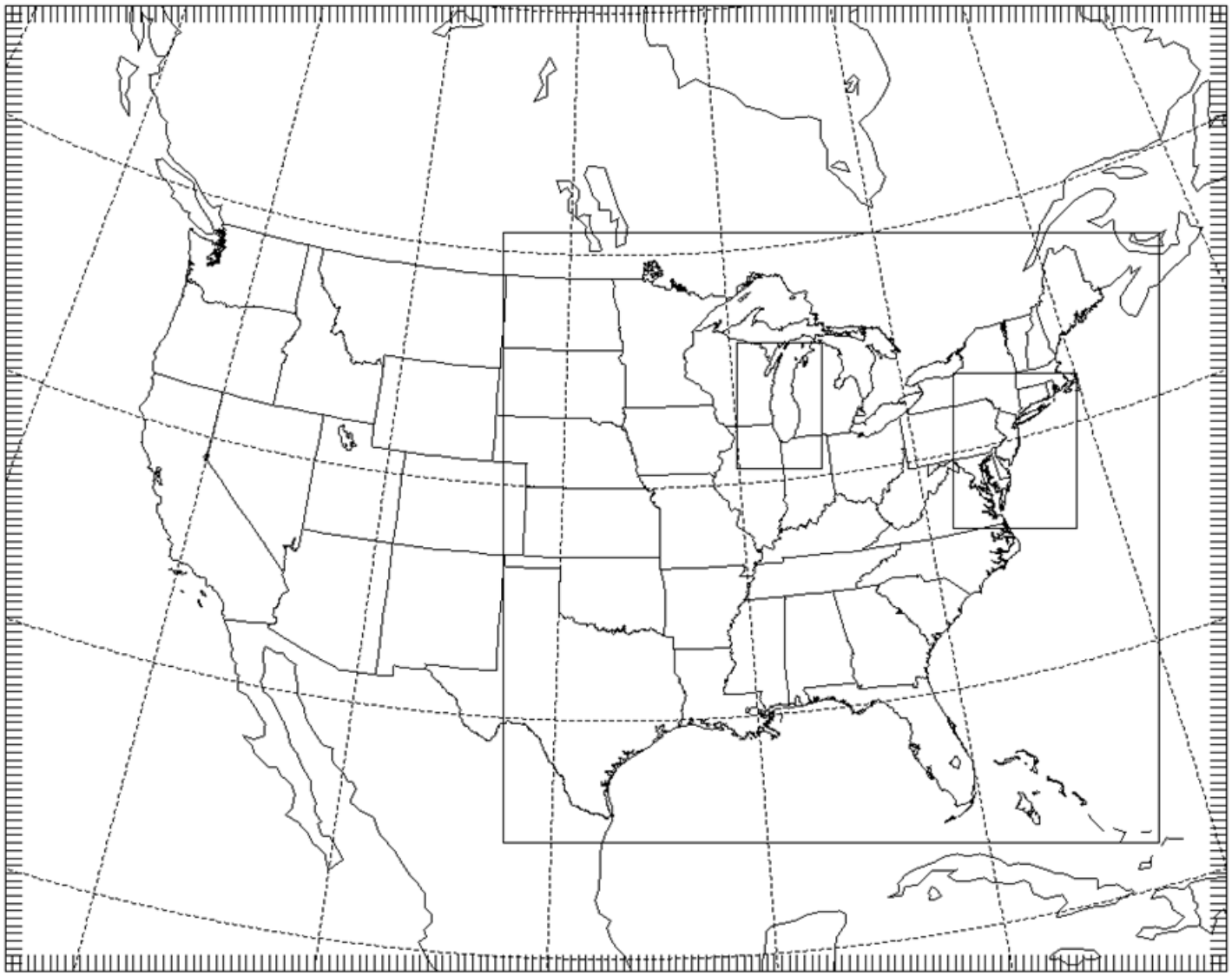
Motivation for 4km Modeling

- Land-water breezes are important in urban coastal settings
- WRF meteorological model develops more reasonable flows at 4km than at 12km resolution
- Use of 4km grid size consistent with EPA recommended SIP guidance* for these coastal receptor sites

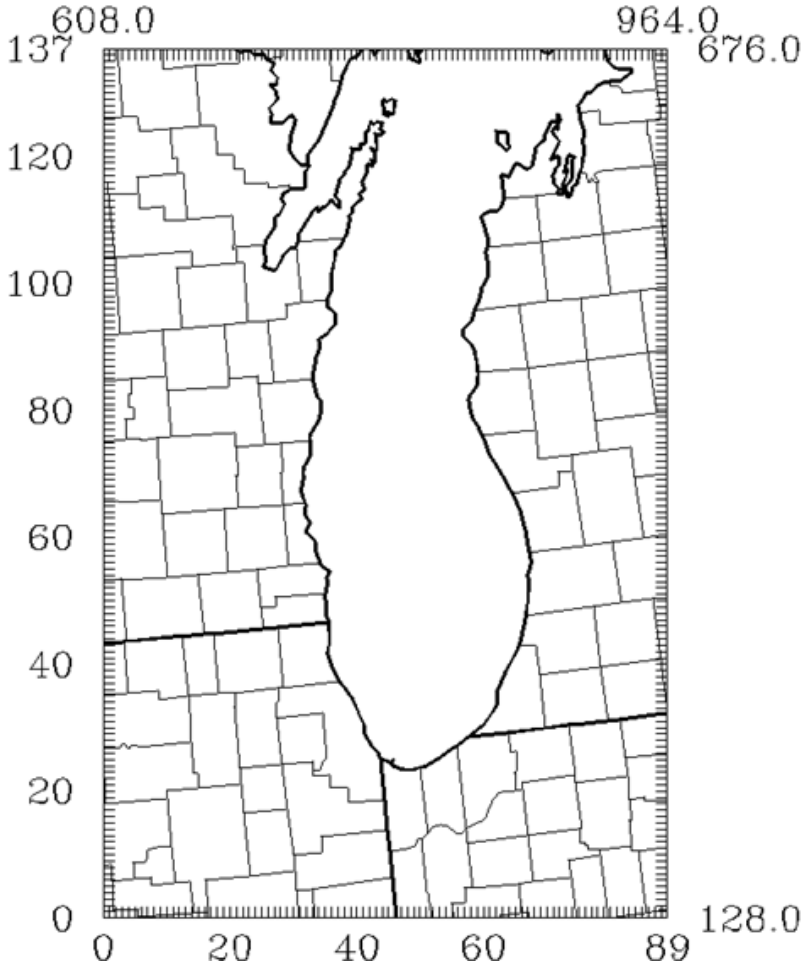
> *"The use of grid resolution finer than 12 km would generally be more appropriate for areas with a combination of complex meteorology, strong gradients in emissions sources, and/or land-water interfaces in or near the nonattainment area(s)."*

*http://www3.epa.gov/scram001/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

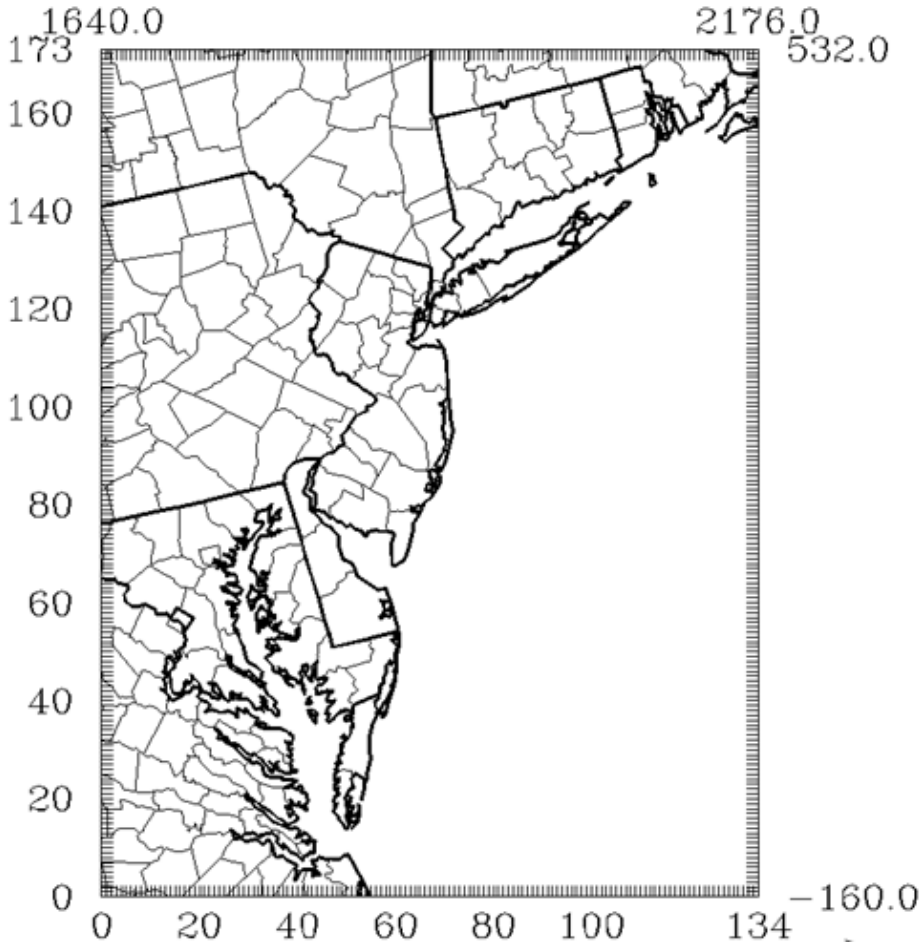
WRF Domains (36/12/4km)



4km CAMx Domains



Lake Michigan



Mid-Atlantic

4km Configurations

- Emissions
  - EPA merged 2011en and 2023en platform
  - Flexi-nested to 4km grid (in CAMx)
  - Windowed to 4km grid (in OSAT)
    - Mid-Atlantic 4km domain only
- Photochemical Modeling
  - CAMx 6.40 run as two-way interactive nest
- Meteorology
  - 12km from EPA platform
  - New 4km WRF simulation
    - WRFCAMx conversion
    - Kv patch
- All Other Inputs
  - BC, IC, etc. from EPA 2023en platform

MOG 4km Nonattainment and Maintenance Monitors – 2015 NAAQS

Nonattainment Monitors			Ozone Design Value (ppb)					
				EPA "No Water" 12km Modeling		Alpine 4km Modeling		
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	2014-2016 DV
240251001	MD	Harford	90.0	70.9	73.3	71.1	73.5	73
551170006	WI	Sheboygan	84.3	72.8	75.1	71.7	74.0	79

Maintenance Monitors			Ozone Design Value (ppb)					
				EPA "No Water" 12km Modeling		Alpine 4km Modeling		
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	2014-2016 DV
90010017	CT	Fairfield	80.3	68.9	71.2	69.2	71.5	80
90013007	CT	Fairfield	84.3	71.0	75.0	69.7	73.6	81
90019003	CT	Fairfield	83.7	73.0	75.9	69.9	72.7	83
90099002	CT	New Haven	85.7	69.9	72.6	70.3	73.0	76
90110124	CT	New London	80.3	67.3	70.4	68.2	71.3	72
260050003	MI	Allegan	82.7	69.0	71.7	70.3	73.1	75
340150002	NJ	Gloucester	84.3	68.2	70.4	68.8	71.0	74
360850067	NY	Richmond	81.3	67.1	68.5	69.6	71.0	76
361030002	NY	Suffolk	83.3	74.0	75.5	70.7	72.1	72
421010024	PA	Philadelphia	83.3	67.3	70.3	68.0	71.0	77

MOG 4km Attainment Monitors – 2015 NAAQS (EPA Designated Other)

4km Modeled Attainment			Ozone Design Value (ppb)					
				EPA "No Water" 12km Modeling		Alpine 4km Modeling		
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	2014-2016 DV
360810124	NY	Queens	78.0	70.2	72.0	68.0	69.8	69
550790085	WI	Milwaukee	80.0	71.2	73.0	67.4	70.5	71

Available Supporting Documents

- MET Performance Evaluation
- Ozone Model Performance Evaluation
- Good Neighbor SIP Technical Support Document

Key Conclusions

- Overall, the ozone model performance results for the 2011 CAMx simulations are within the range found in other recent peer-reviewed and regulatory applications

- The model performance results demonstrate that the predictions from the 4km domains using the 2011en modeling platform correspond closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum ozone

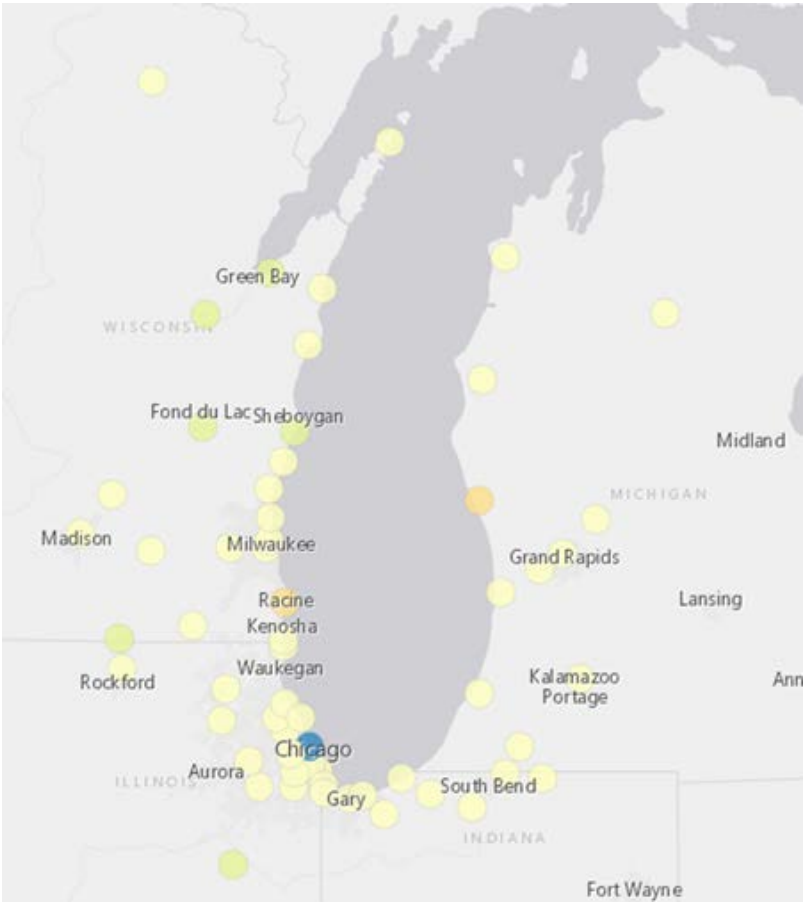
4km MPE Comparison to 12km – 2011en

- As is often seen, the model simulation at 12km resolution occasionally shows better statistical performance than the same region simulated at 4km resolution
- This is likely a result of the 12km results smoothing the results and not capturing the steep concentration gradients that are often present in higher resolution simulations
- Averaged over the modeling period, the model statistically performs better at 12km for the Mid-Atlantic domain and better at 4km for the Lake Michigan domain

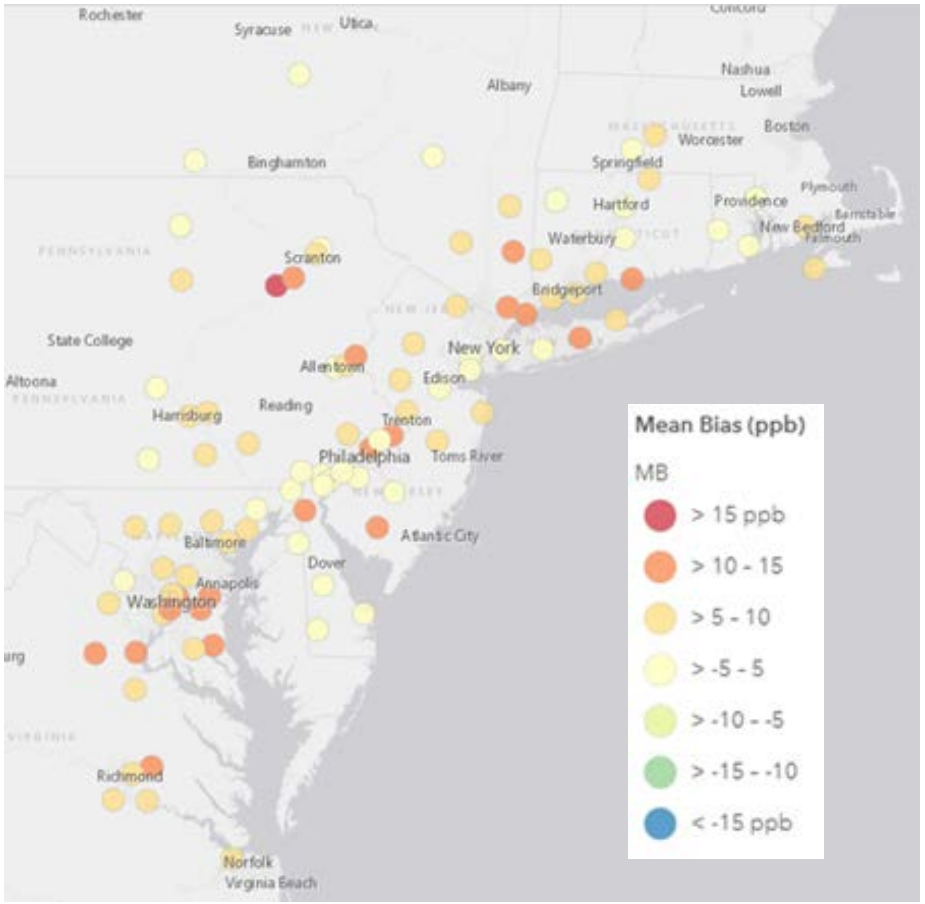
4km MPE Statistics						
Region	**Month**	**# of Obs**	**MB (ppb)**	**ME (ppb)**	**NMB (%)**	**NME (%)**
Mid-Atlantic	05	239	5.33	8.12	7.96	12.11
Mid-Atlantic	06	820	4.31	9.11	6.08	12.85
Mid-Atlantic	07	1247	6.59	10.72	9.37	15.25
Mid-Atlantic	08	339	6.79	8.78	10.28	13.29
Mid-Atlantic	09	93	6.35	8.21	9.96	12.89
Mid-Atlantic	**All**		**5.81**	**9.69**	**8.39**	**13.93**
Lake Michigan	05	50	-3.14	9.34	-5	14.86
Lake Michigan	06	381	-1.47	6.94	-2.18	10.24
Lake Michigan	07	487	-1.71	10.65	-2.51	15.61
Lake Michigan	08	101	-2.32	7.36	-3.55	11.26
Lake Michigan	09	112	-10.62	13	-13.87	16.98
Lake Michigan	**All**		**-2.63**	**9.28**	**-3.73**	**13.52**

12km MPE Statistics						
Region	**Month**	**# of Obs**	**MB (ppb)**	**ME (ppb)**	**NMB (%)**	**NME (%)**
Mid-Atlantic	05	229	5.74	8.14	8.55	12.12
Mid-Atlantic	06	794	0.72	8.63	1.01	12.14
Mid-Atlantic	07	1196	2.5	8.81	3.55	12.5
Mid-Atlantic	08	318	1.19	7.63	1.8	11.52
Mid-Atlantic	09	90	2.36	8.33	3.69	13.06
Mid-Atlantic	**All**		**2.08**	**8.54**	**3.01**	**12.26**
Lake Michigan	05	47	-6.69	12.33	-10.67	19.66
Lake Michigan	06	367	-2.08	8.29	-3.06	12.22
Lake Michigan	07	479	-3.37	10.03	-4.94	14.68
Lake Michigan	08	100	-6.8	10.36	-10.39	15.83
Lake Michigan	09	111	-11.33	14.67	-14.77	19.14
Lake Michigan	**All**		**-4.19**	**10.05**	**-6.04**	**14.63**

Mean Bias (ppb) of MDA8 ozone AQS monitoring sites in 4km Domains

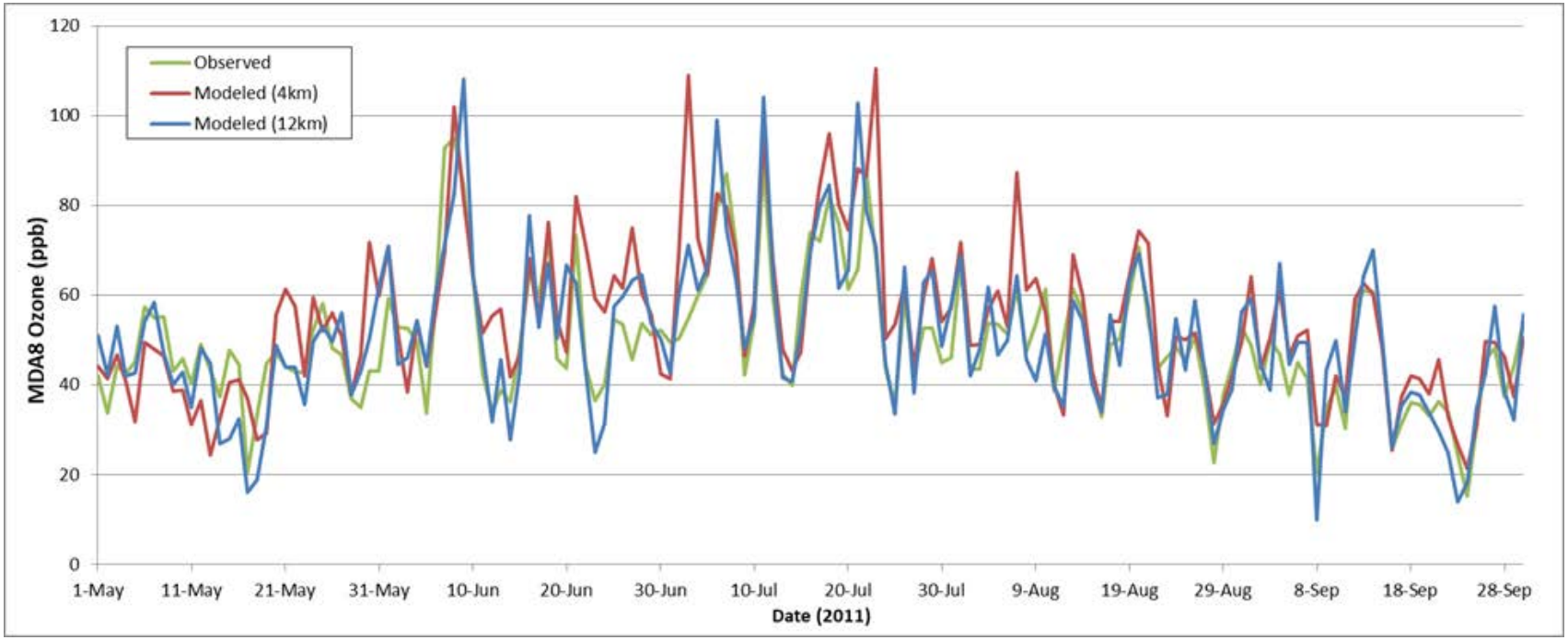


Lake Michigan



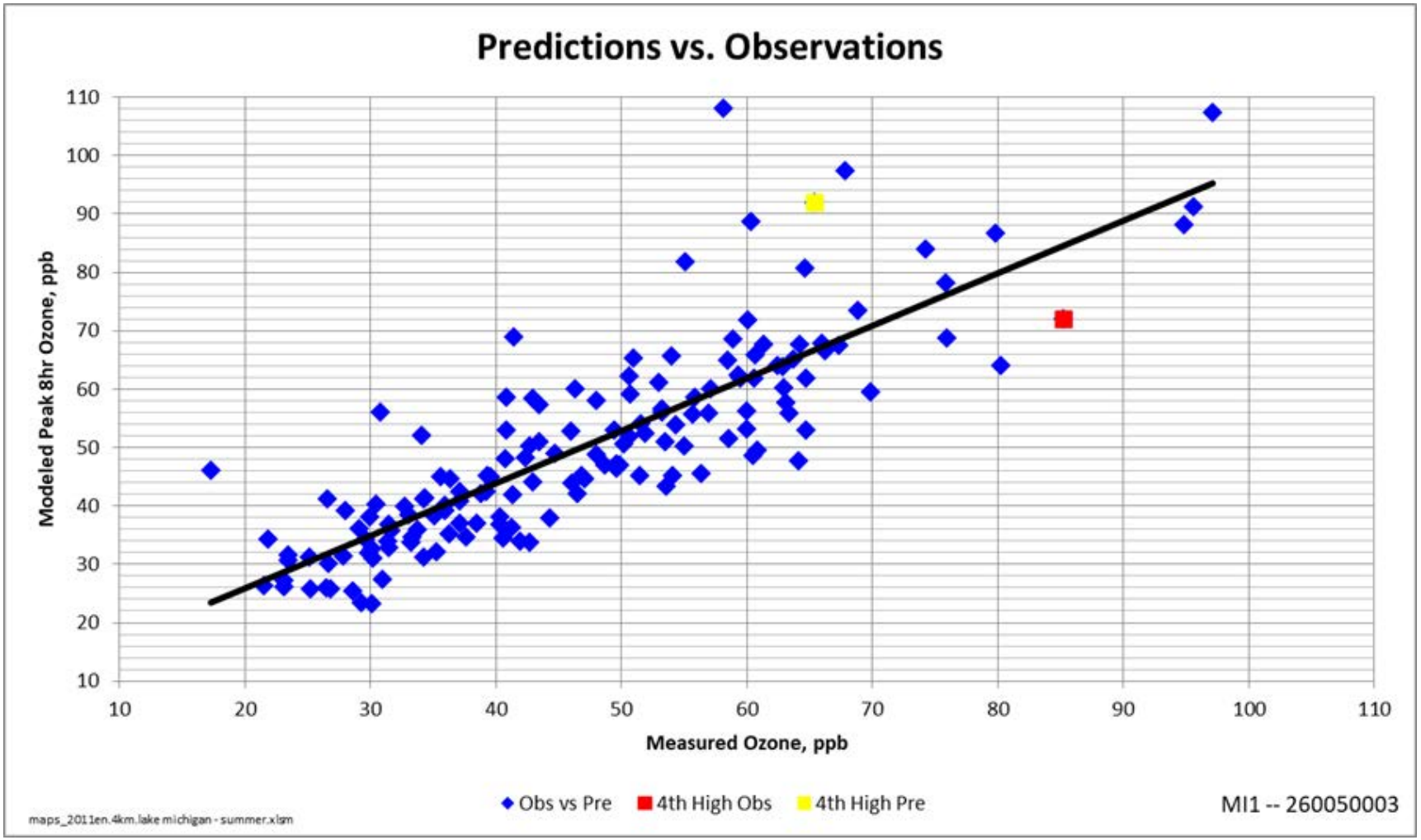
Mid-Atlantic

Time Series of MDA8 ozone for site 90013007 in Fairfield Co., Connecticut



The 4km modeling platform generally replicates the day-to-day variability in ozone during this time period at these sites and is consistent with the predicted MDA8 concentrations from the 12km modeling.

Correlation of MDA8 ozone at site 260050003 in Allegan Co., Michigan



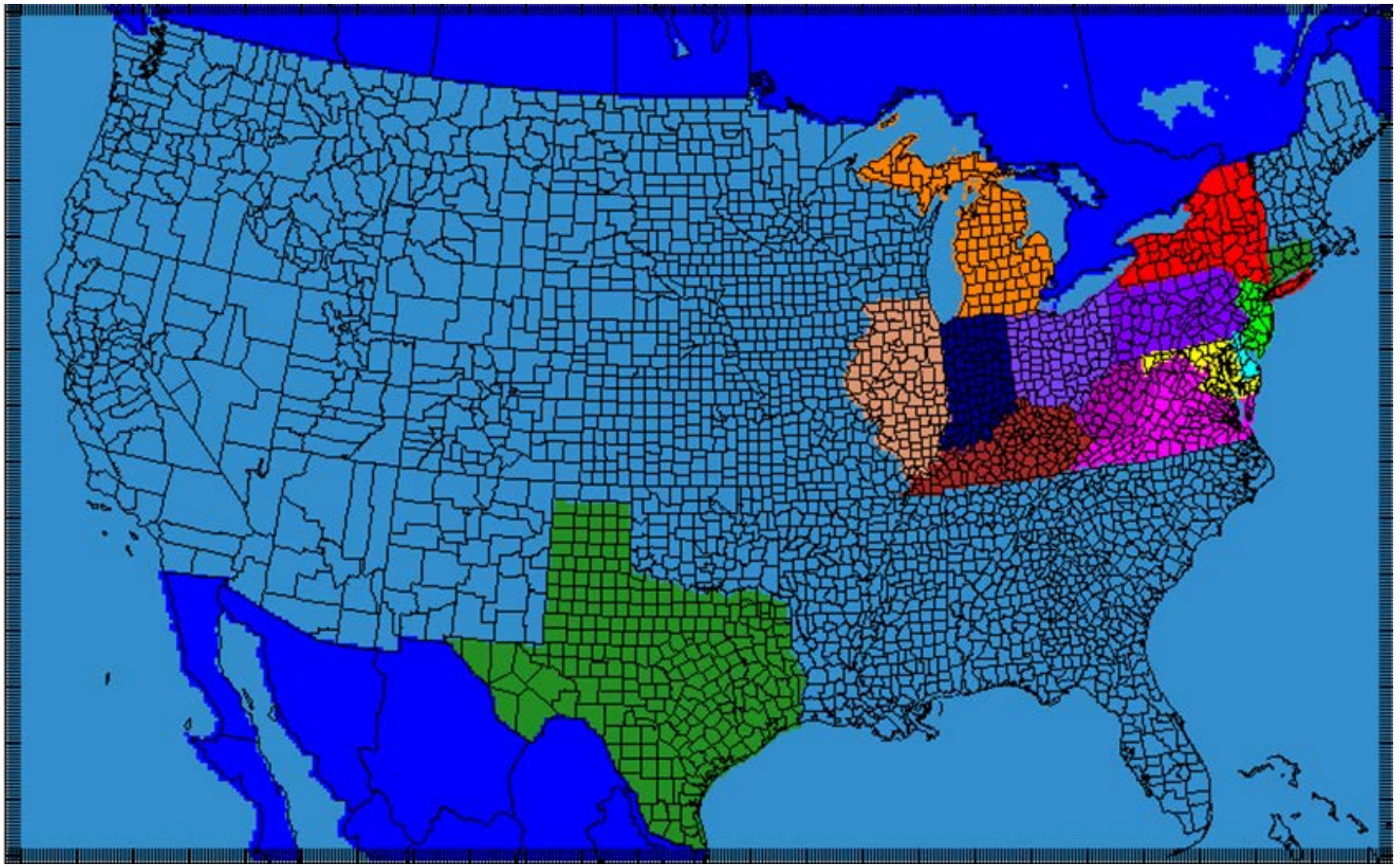
Results Used to Inform 4km Processing

- Using the significant contribution calculations from the 12km OSAT simulation, Alpine selected the states with “significant contribution” (based on the 1% of 70 pbb NAAQS) to define source regions in 4km OSAT simulation

Monitor	Name	PA	VA/DC	IL	IN	OH	MD	NJ	NY	WV	KY	MI	CT	DE	TX
90019003	Fairfield, CT	x	x	x	x	x	x	x	x						
361030002	Suffolk, NY	x	x	x	x	x	x	x			x	x	x		x
360850067	Richmond, NY	x	x	x	x	x	x	x		x	x	x		x	x
240251001	Harford, MD	x	x	x	x	x				x	x	x			x
90013007	Fairfield, CT	x	x	x	x	x	x	x	x						
90099002	New Haven, CT	x	x	x	x	x	x	x	x						

4km Mid-Atlantic Modeling Domain

- OSAT was run with noted source states (all other states were grouped as “other” for contribution purposes) and anthropogenic source contribution calculations were generated by source category for monitors in Mid-Atlantic 4km domain



Design Value and Source Apportionment Comparisons

- Four simulations with MDA8 concentration and anthropogenic source contribution data (in ppb) for MOG 4km mid-Atlantic domain presented in following table

DVb (2011)
- modeling base case (2009-2013)

EPA 12km APCA (2023)
- Primary results from EPA March 27, 2018 memo
- Includes estimates of DVf using “no water” calculation

MOG 12km OSAT (2023)
- Primary results from EPA October 27, 2017 memo and KY GNS modeling
- DVfs consistent with EPA “3x3” results

MOG 4km OSAT (2023)
- Latest results of 4km mid-Atlantic domain

EPA DV and Contribution Calculations

- "No water" DVf calculation
  - Modeling data in grid cells that are dominated by water (i.e., more than 50 percent of the area in the grid cell is water) and that do not contain a monitoring site were excluded from the calculation of RRFs
  - Used as alternative to guidance recommended 4km modeling
    - resource intensive

- Contributions to individual monitoring sites are calculated based on concentration and contribution data on the top 10 model-predicted 8-hour ozone concentration days *in the 2023 modeling* in the grid cell containing the monitoring site
  - Previously this calculation was based on 2011 modeled days
  - MOG 4km OSAT results presented here were calculated using this new EPA method

4km OSAT Contribution Results

State	County	Monitor		MDA8 DV (ppb)	MDA8 Modeled Contribution (ppb) - 2023 Base Case (Average)						
					IL	IN	KY	MI	OH	PA	WV
Connecticut	Fairfield	90013007	DVb (2011)	84.3							
			EPA 12km APCA*	71.0	0.72	0.97	0.89	0.70	1.84	6.32	1.10
			MOG 12km OSAT	71.2	0.81	0.84	0.56	0.48	1.21	4.98	0.47
			MOG 4km OSAT	69.7	1.04	0.87	0.52	1.32	2.20	3.07	0.44
Connecticut	Fairfield	90019003	DVb (2011)	83.7							
			EPA 12km APCA*	73.0	0.67	0.83	0.79	0.63	1.60	6.56	1.14
			MOG 12km OSAT	72.7	0.89	0.87	0.56	0.57	1.49	5.24	0.55
			MOG 4km OSAT	69.9	1.09	0.95	0.64	1.28	2.35	3.51	0.53
Connecticut	New Haven	90099002	DVb (2011)	85.7							
			EPA 12km APCA*	69.9	0.46	0.50	0.32	0.73	1.17	4.87	0.61
			MOG 12km OSAT	71.2	1.04	0.99	0.58	0.48	1.84	4.73	0.51
			MOG 4km OSAT	70.3	0.81	0.76	0.41	1.10	1.77	2.55	0.35
Maryland	Harford	240251001	DVb (2011)	90.0							
			EPA 12km APCA*	70.9	0.84	1.35	1.52	0.79	2.77	4.32	2.78
			MOG 12km OSAT	71.4	1.23	1.76	1.54	0.78	3.29	4.52	1.76
			MOG 4km OSAT	71.1	1.05	1.81	2.07	0.27	3.02	2.70	2.52
New York	Richmond	360850067	DVb (2011)	81.3							
			EPA 12km APCA*	67.1	0.80	0.92	0.84	0.98	2.05	10.41	1.54
			MOG 12km OSAT	71.9	1.26	1.22	0.95	0.97	2.38	6.71	0.93
			MOG 4km OSAT	69.6	1.34	1.29	0.93	1.15	2.97	5.73	0.71
New York	Suffolk	361030002	DVb (2011)	83.3							
			EPA 12km APCA*	74.0	0.64	0.69	0.49	0.94	1.76	6.86	0.81
			MOG 12km OSAT	72.5	1.09	1.12	0.78	0.81	2.00	5.23	0.61
			MOG 4km OSAT	70.7	1.15	0.93	0.64	1.20	2.34	4.32	0.65

*"No water" design value calculation

4km OSAT Contribution Results (2)

				MDA8 DV	MDA8 Modeled Contribution (ppb) - 2023 Base Case (Average)							2023 DV (ppb)
State	County	Monitor		(ppb)	MD	NJ	NY	VA/DC	Can/Mex	IC/BC	All Other	w/o Can/Mex
Connecticut	Fairfield	90013007	DVb (2011)	84.3								
			EPA 12km APCA*	71.0	1.80	6.94	14.12	1.57	1.35	17.17	15.07	69.6
			MOG 12km OSAT	71.2	2.15	8.14	9.53	1.83	1.33	15.98	22.47	69.8
			MOG 4km OSAT	69.7	1.11	3.74	9.56	1.00	1.39	12.89	29.86	68.3
Connecticut	Fairfield	90019003	DVb (2011)	83.7								
			EPA 12km APCA*	73.0	2.17	7.75	15.80	2.02	1.37	17.00	14.22	71.6
			MOG 12km OSAT	72.7	2.10	9.01	8.93	1.79	1.34	16.71	22.18	71.3
			MOG 4km OSAT	69.9	1.20	5.23	10.40	1.06	1.29	12.74	26.92	68.6
Connecticut	New Haven	90099002	DVb (2011)	85.7								
			EPA 12km APCA*	69.9	1.37	5.06	15.03	1.30	1.58	17.17	19.32	68.3
			MOG 12km OSAT	71.2	1.44	6.44	10.56	1.00	1.17	15.54	24.27	70.0
			MOG 4km OSAT	70.3	0.86	2.35	10.13	0.71	1.49	12.59	33.85	68.8
Maryland	Harford	240251001	DVb (2011)	90.0								
			EPA 12km APCA*	70.9	22.60	0.07	0.16	5.05	0.79	15.28	11.84	70.1
			MOG 12km OSAT	71.4	19.90	0.09	0.13	5.18	0.72	15.15	14.55	70.6
			MOG 4km OSAT	71.1	23.97	0.02	0.01	3.92	0.43	11.34	17.07	70.6
New York	Richmond	360850067	DVb (2011)	81.3								
			EPA 12km APCA*	67.1	1.74	10.53	6.57	1.72	1.44	15.46	11.40	65.6
			MOG 12km OSAT	71.9	2.16	14.26	2.45	1.89	1.33	16.04	18.57	70.5
			MOG 4km OSAT	69.6	1.39	11.59	3.19	1.18	0.85	14.54	21.85	68.7
New York	Suffolk	361030002	DVb (2011)	83.3								
			EPA 12km APCA*	74.0	1.24	8.88	18.11	1.03	1.85	18.94	11.16	72.1
			MOG 12km OSAT	72.5	1.14	11.11	8.55	1.05	1.35	16.03	20.91	71.1
			MOG 4km OSAT	70.7	1.57	7.84	10.10	1.43	0.90	14.57	22.27	69.8

*"No water" design value calculation

4km Preliminary Observations Mid-Atlantic Domain

- 5 of the 6 originally identified nonattainment monitors in the Mid-Atlantic using 12km “3x3” modeling are shown to be in attainment with the 2015 ozone NAAQS based upon MOG’s 4km modeling
  - The one remaining monitor (Harford MD) is shown by EPA’s 12km new “no water” data calculation to be in attainment with the 2015 ozone NAAQS

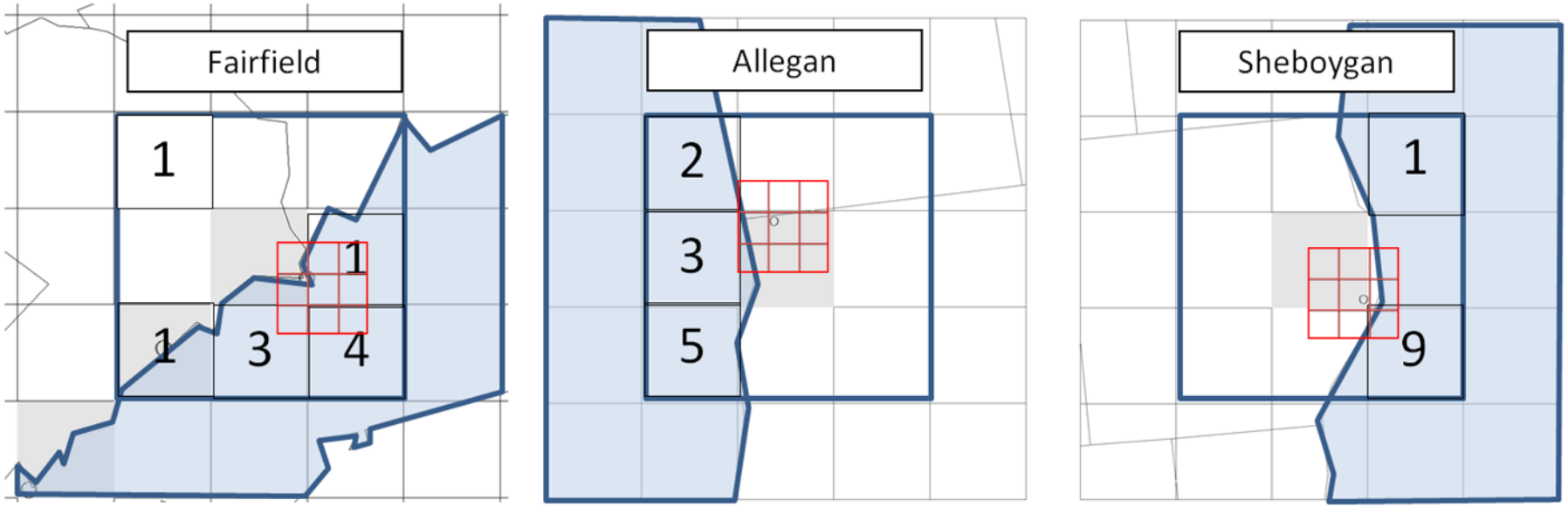
- No upwind state is relieved of its significant contribution to all remaining EPA identified downwind nonattainment monitors

Comparison of Modeling Techniques

- “No Water” 12km v “3x3” 4km
- APCA v OSAT
- 12km v 4km
  - RRF days selected
  - Source apportionment days selected

“No Water” Calculation v 4km

- Large blue box outlines 12km “3x3”
  - Number in grid cell indicates the # of times that grid cell had the highest MDA8 used in 12km “3x3” RRF
- “No Water” calculation excludes grids > 50% blue
- Small red boxes indicate ~ 4km “3x3” location



APCA v OSAT

- Sometimes multiple, equally acceptable tools and tests are available – choosing the most appropriate one is important
- MOG findings indicate selection of appropriate model for contribution of anthropogenic source calculation can mean difference between significant or not
  - Selection of APCA v OSAT can significantly alter the modeled contribution of upwind anthropogenic emissions on downwind monitors

APCA v OSAT (2)

Monitor 361030002 Suffolk, New York

APCA Technique (EPA Method)

Category	Bio/Fire	Total Anthro	Motor Vehicle	Area/NR/ MAR	EGU Point	NonEGU Point	Can/Mex /Water	Boundary	Total
DVf Contribution (ppb)	4.78	50.23	13.68	25.03	7.54	3.97	1.4	16.09	72.5
% Contribution	7%	69%	19%	35%	10%	5%	2%	22%	

OSAT Method (Alternate Method)

Category	Bio/Fire	Total Anthro	Motor Vehicle	Area/NR/ MAR	EGU Point	NonEGU Point	Can/Mex /Water	Boundary	Total
DVf Contribution (ppb)	13.91	41.22	10.74	21.09	5.94	3.45	1.35	16.03	72.5
% Contribution	19%	57%	15%	29%	8%	5%	2%	22%	

Total anthropogenic emissions are allocated among contributing states. APCA method has higher values (some biogenics included) and therefore more to allocate. OSAT does not always translate to lower contribution from individual upwind states.

RRF Selection Days for Attainment Test

- Modeling guidance recommends using top 10 base year modeled concentration days in 3x3 neighborhood to determine relative response factor (RRF) for attainment demonstration

Base Case Attainment

$$DV_f = DV_b * (Conc_{Future} / Conc_{Base})$$

Where,

DV_f = future year design value (ppb)

DV_b = base year design value (observed, ppb)

$Conc_j$ = model ozone concentration for year j

Differences Based on Domain 2011/2023en RRF – Harford, MD

4km "3x3" Domain

Date	Base	Future	RRF
0608	135.79	108.17	0.7966
0722	124.73	101.09	0.8105
0723*	**118.02**	**89.21**	**0.7559**
0729	116.79	86.87	0.7439
0609	111.26	90.10	0.8098
0618*	**110.50**	**90.74**	**0.8212**
0719*	**107.13**	**81.48**	**0.7606**
0707	106.30	83.47	0.7852
0601	106.08	84.20	0.7937
0612*	**103.81**	**86.06**	**0.8290**
Mean	**114.04**	**90.14**	**0.7904**

12km "3x3" Domain

Date	Base	Future	RRF
0608	128.26	99.98	0.7795
0722	118.85	90.92	0.7650
0609	118.49	93.99	0.7932
0721*	**114.09**	**90.50**	**0.7932**
0707	108.53	84.64	0.7798
0729	105.71	82.43	0.7798
0820*	**104.21**	**86.30**	**0.8282**
0531*	**101.68**	**81.69**	**0.8034**
0607*	**100.40**	**82.19**	**0.8187**
0601	98.53	79.66	0.8085
Mean	**109.88**	**87.23**	**0.7939**

***Bold** = Date unique to platform

Selection Days for Source Apportionment

- New method uses top 10 future year modeled concentration days in 3x3 neighborhood to determine days in source apportionment calculation

- Difference in method (now better) has impact on contribution calculations
  - Previously based on the 2023 future year exceedance days, or the top 5 days

Differences Based on Domain Base v Future – Harford, MD

4km "3x3" Domain - RRF

Date	Base	Future	RRF
0608	135.79	108.17	0.7966
0722	124.73	101.09	0.8105
0723	118.02	89.21	0.7559
0729	116.79	86.87	0.7439
0609	111.26	90.10	0.8098
0618	110.50	90.74	0.8212
0719*	**107.13**	**81.48**	**0.7606**
0707	106.30	83.47	0.7852
0601	106.08	84.20	0.7937
0612	103.81	86.06	0.8290
Mean	**114.04**	**90.14**	**0.7904**

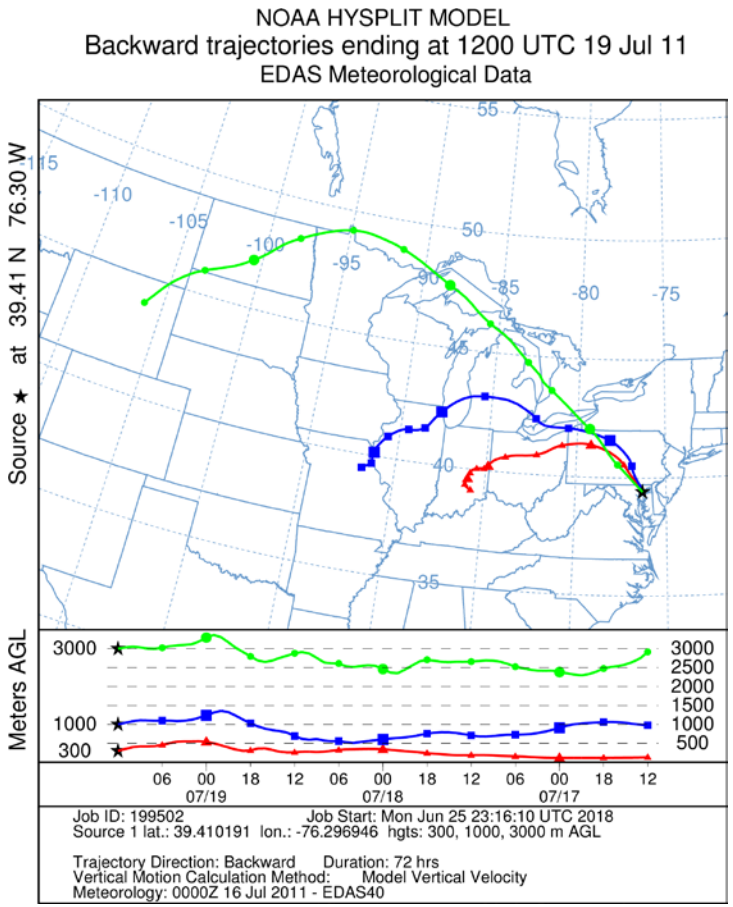
4km "3x3" Domain - OSAT

Date	Future	Base
0608	108.17	135.79
0722	101.09	124.73
0618	90.74	110.50
0609	90.10	111.26
0723	89.21	118.02
0729	86.87	116.79
0612	86.06	103.81
0601	84.50	105.55
0707	83.47	106.30
0807*	**83.31**	**100.70**
Mean	**90.35**	**113.34**

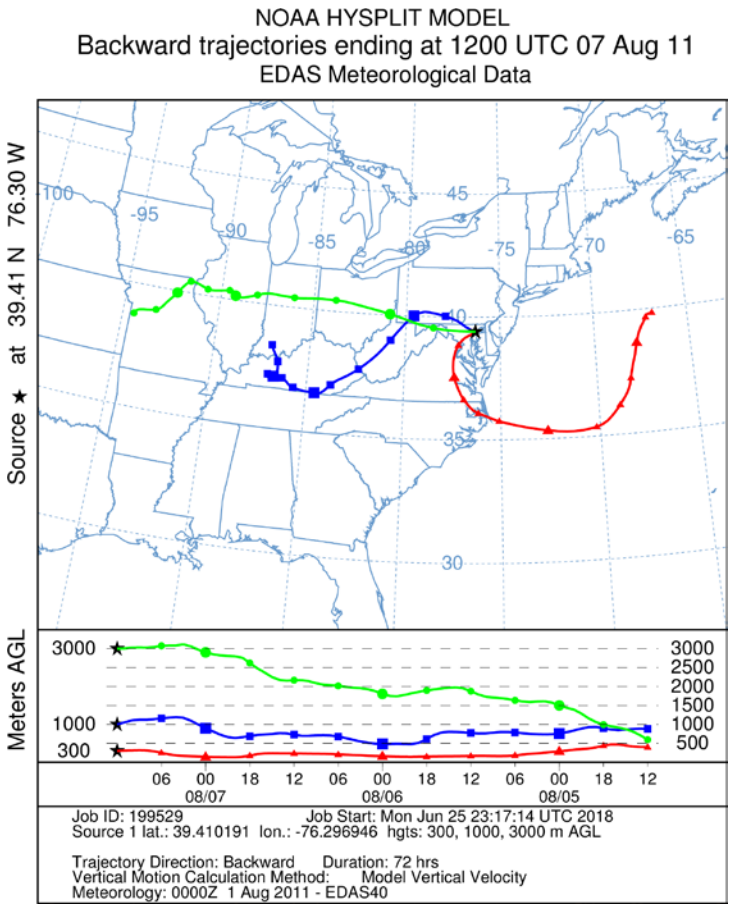
***Bold** = Date unique to platform

Differences Based on Domain Base v Future – Harford, MD

4km "3x3" Domain
July 19, 2011



4km "3x3" Domain
Aug 7, 2011



Alpine's Next Steps

- 4km OSAT results also available at the category level for each upwind state (e.g., EGU, non-EGU point, mobile, area, etc.)
  - Data will be prepared in standard formats upon decision for additional need
  - Possibility of 4km OSAT for Lake Michigan
  - Impact factor metrics can be calculated using OSAT data (ppb/ton) for control strategies
- States will be briefed on GNS TSD on July 9th

Contact Information

Gregory M. Stella

Alpine Geophysics, LLC

(828) 675-9045

gms@alpinegeophysics.com