

Sources Contribution to Ozone in Connecticut

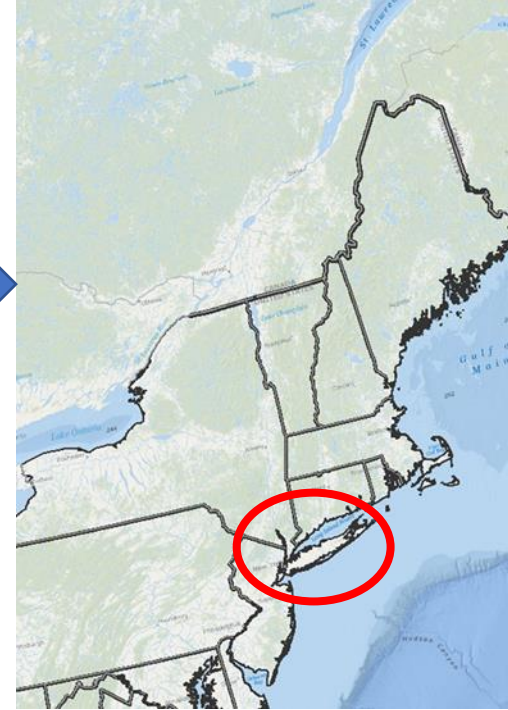
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Objective

Connecticut continues to have ozone Air Quality Index (AQI) levels of Unhealthy for Sensitive Groups (USG), or worse (Department of Energy and Environmental Protection forecasted ozone 2021)

Month	Total Unhealthy Days
May	26
June	18

Modeling Tools and Settings



Analysis Domain:
Northeastern US,
67X102 grid cells

CAMx v6.50: Comprehensive Air Quality
Model with Extension

OSAT: Ozone Source Apportionment Technology

DDM: The Decoupled Direct Method

CMAQ v5.3.1: Community Multiscale Air Quality

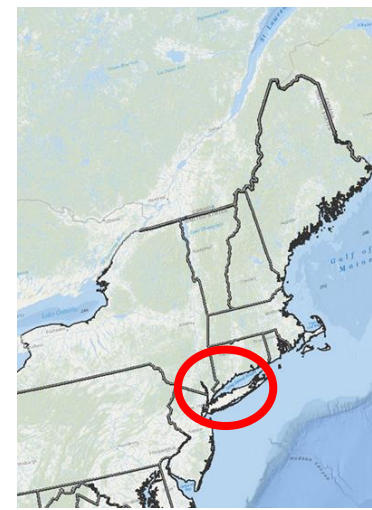
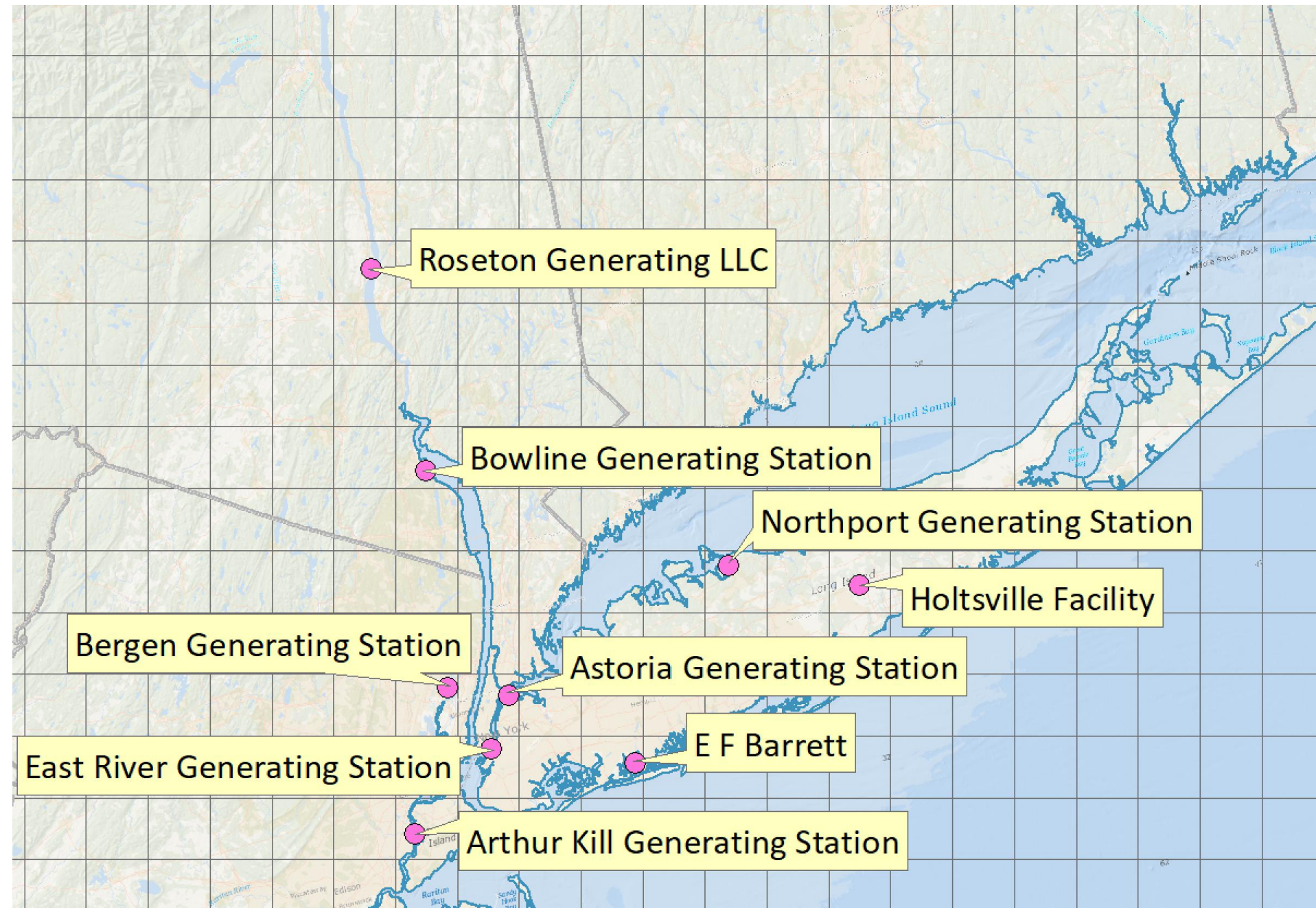
ISAM: The Integrated Source Apportionment Method

Spatial Domain & Resolution: 12US2, 396X246 grid cells;
12 x 12 km

Temporal Domain & Resolution: 2016; *Hourly*

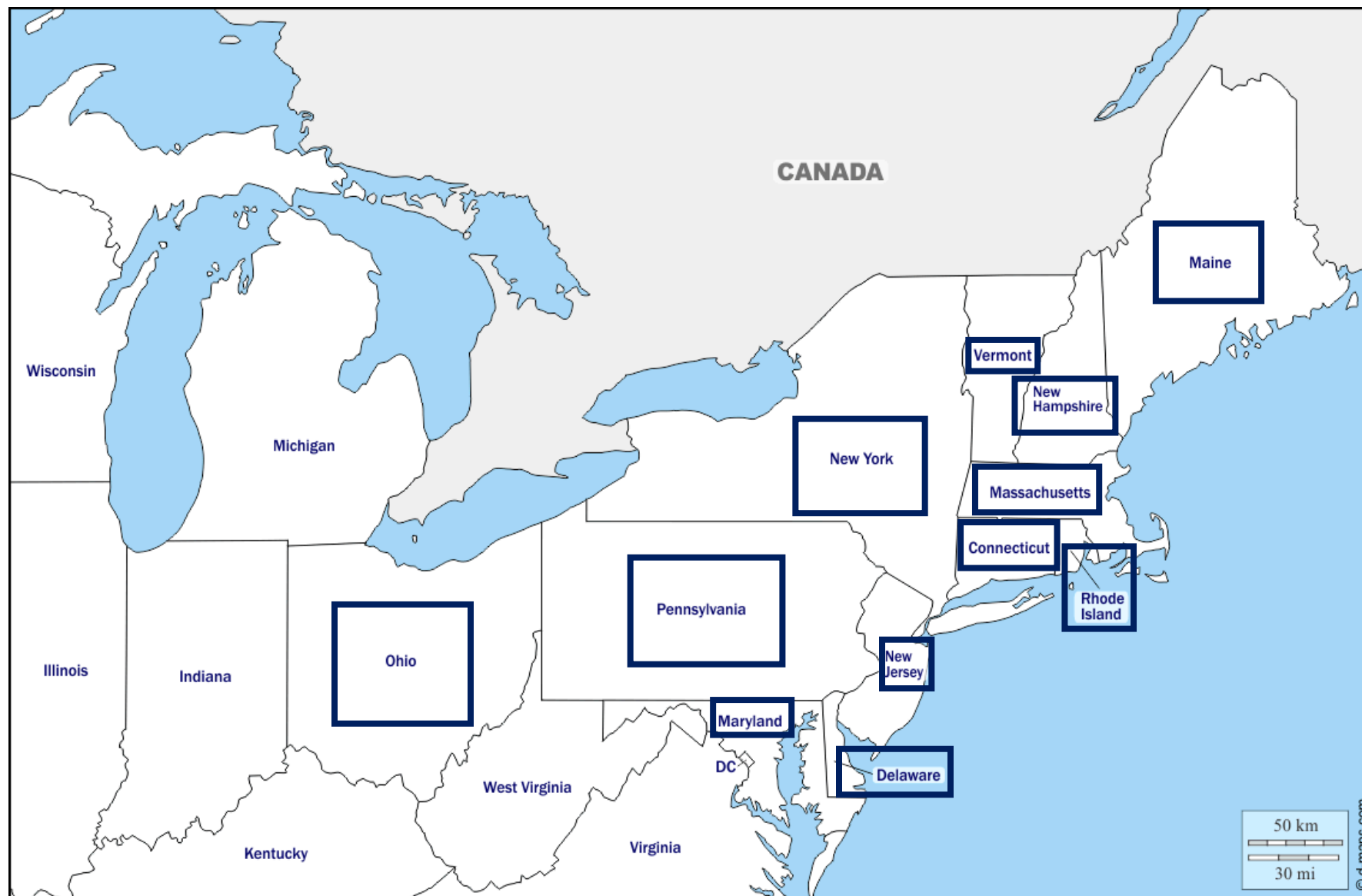
Inputs: NEIC 2016 beta (2016ff) - Beta version of the
National Emission Inventory Collaborative's 2016 modeling
platform.

Selected Sources



Selected sources:
emissions from facilities
located grid

Unapportioned sources:
all emission within the
domain except for the nine
selected grid cells



CT
DE
MA
MD
ME
NH
NJ
NY
OH
PA
RI
VT

CAMx v6.50: Comprehensive air quality model with extension
OSAT: Ozone Source Apportionment Technology

Model evaluation

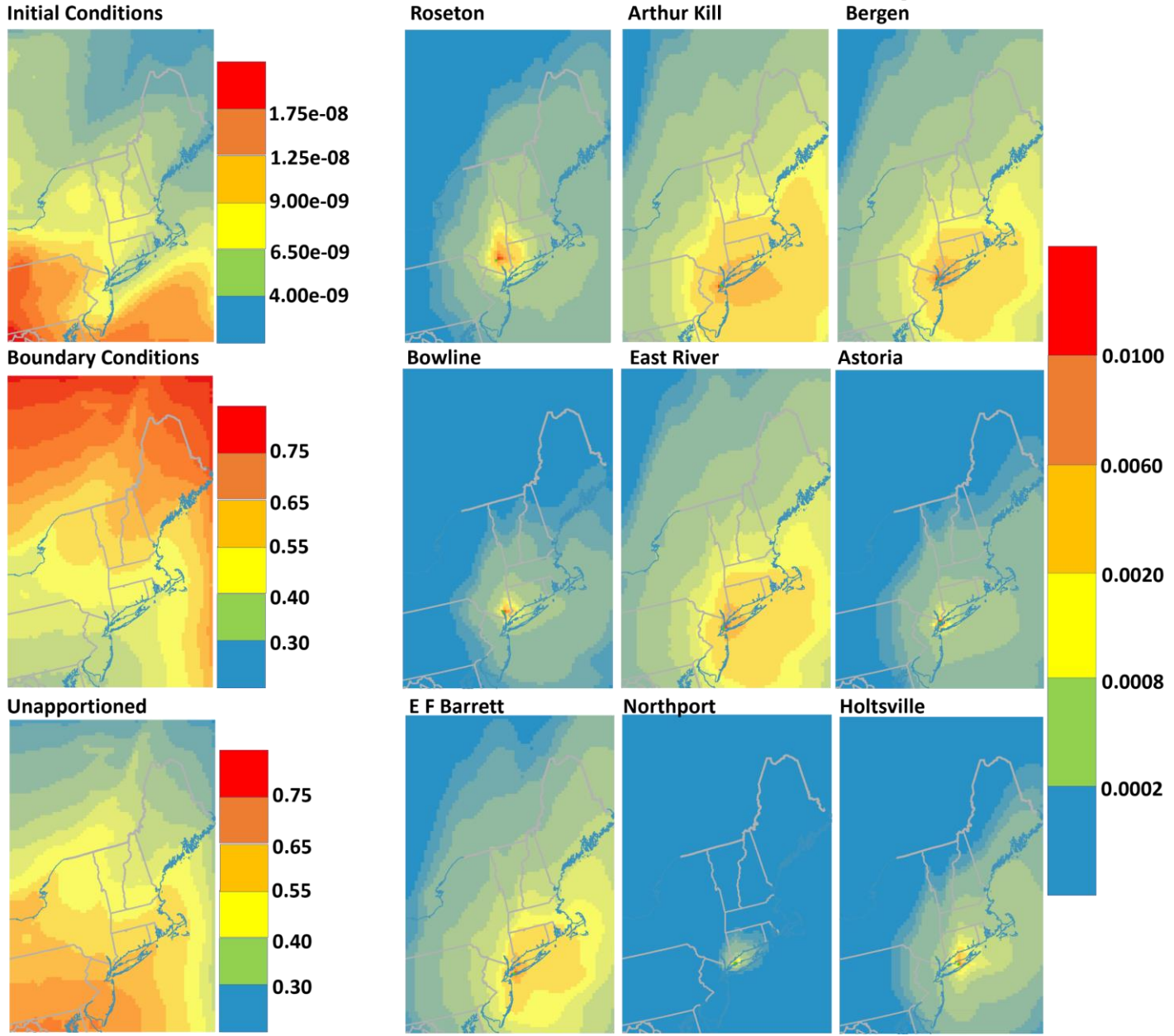
	CAMx		CMAQ	
	April to October	June to August	April to October	June to August
Mean Bias (ppb)	+1.81	+4.43	+2.86	+6.09
Mean Error (ppb)	9.06	9.00	9.84	10.84
Mean Fraction Bias	+0.12	+0.19	+0.11	+0.19
Mean Fraction Error	0.37	0.34	0.39	0.38

Observed ozone data for model evaluation is from U.S. EPA (AQS Data, 2016)

Comment	excellent	good	average	fundamental problem
Mean Fraction Bias	$\leq \pm 15\%$	$\leq \pm 30\%$	$\leq \pm 60\%$	$> \pm 60\%$
Mean Fraction Error	$\leq \pm 35\%$	$\leq \pm 50\%$	$\leq \pm 75\%$	$> \pm 75\%$

Morris, R. E. et al. J. Air Waste Manag. Assoc. 55, 1694–1708 (2005).

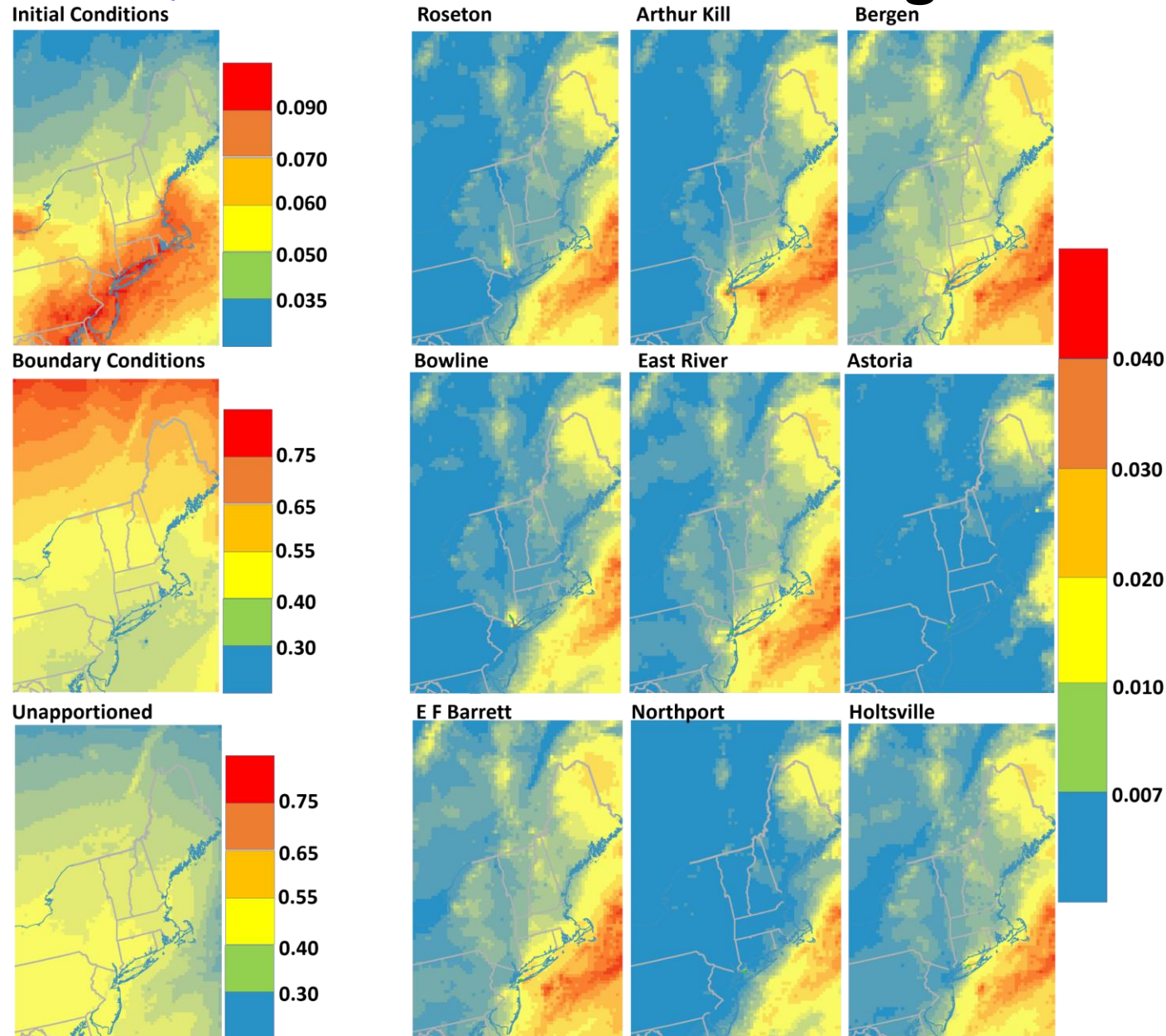
CAMx OSAT Summertime Average Fractional Source Apportionment



- Boundary conditions have largest impact to the edge of US domain.
- Unapportioned sources have largest impact in southern part of the Northeastern US.
- Selected sources have high impact in nearby vicinity.

Unapportioned sources: all emissions within the domain except for the nine selected grid cells

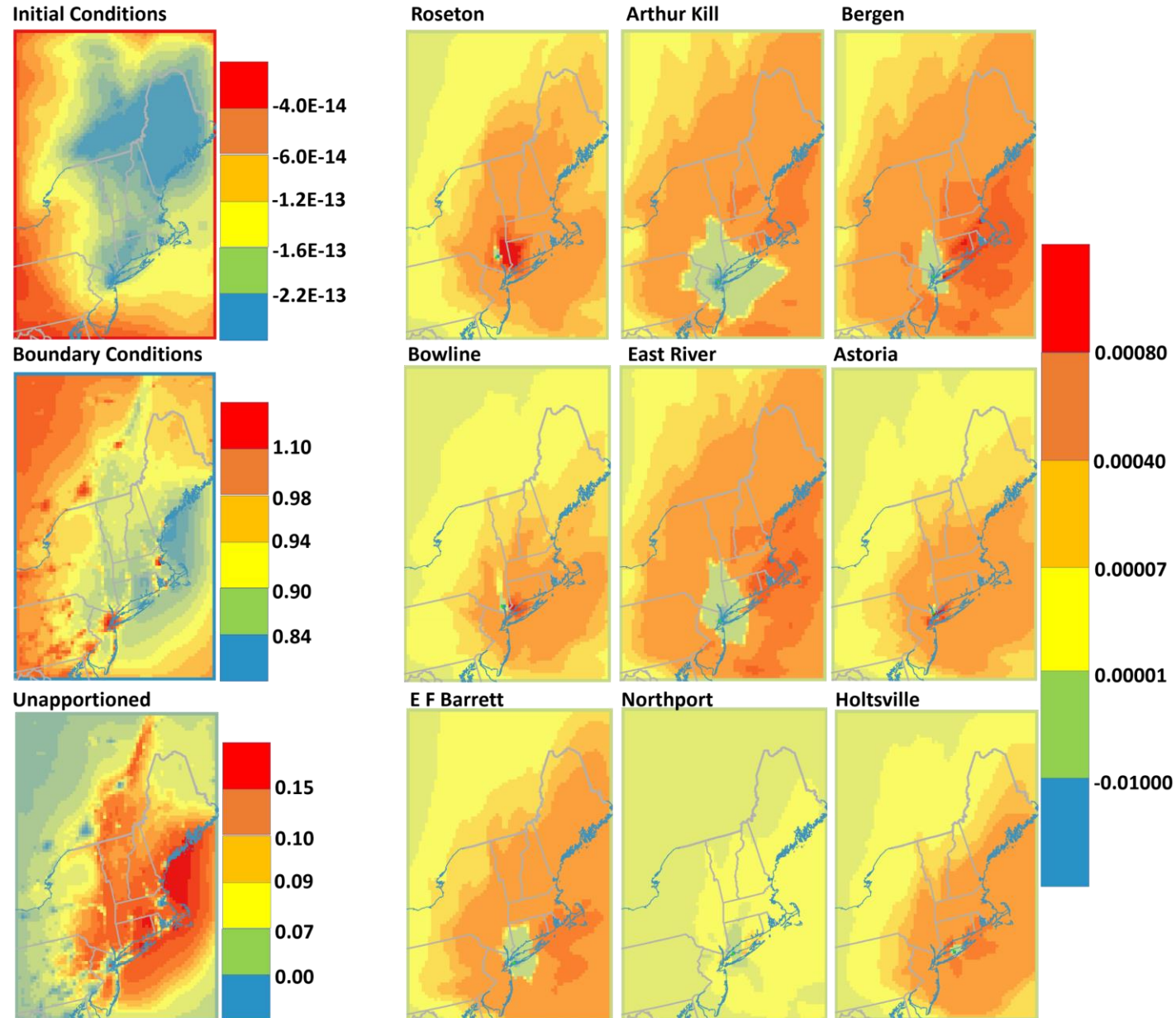
CMAQ ISAM Summertime Average Fractional Source Apportionment



- Boundary conditions have largest impact in the Northern part of the Northeastern US.
- Unapportioned sources have largest impact in southern part of the Northeastern US.
- Selected sources have high impact in ocean areas.

Unapportioned sources: all emissions within the domain except for the nine selected grid cells

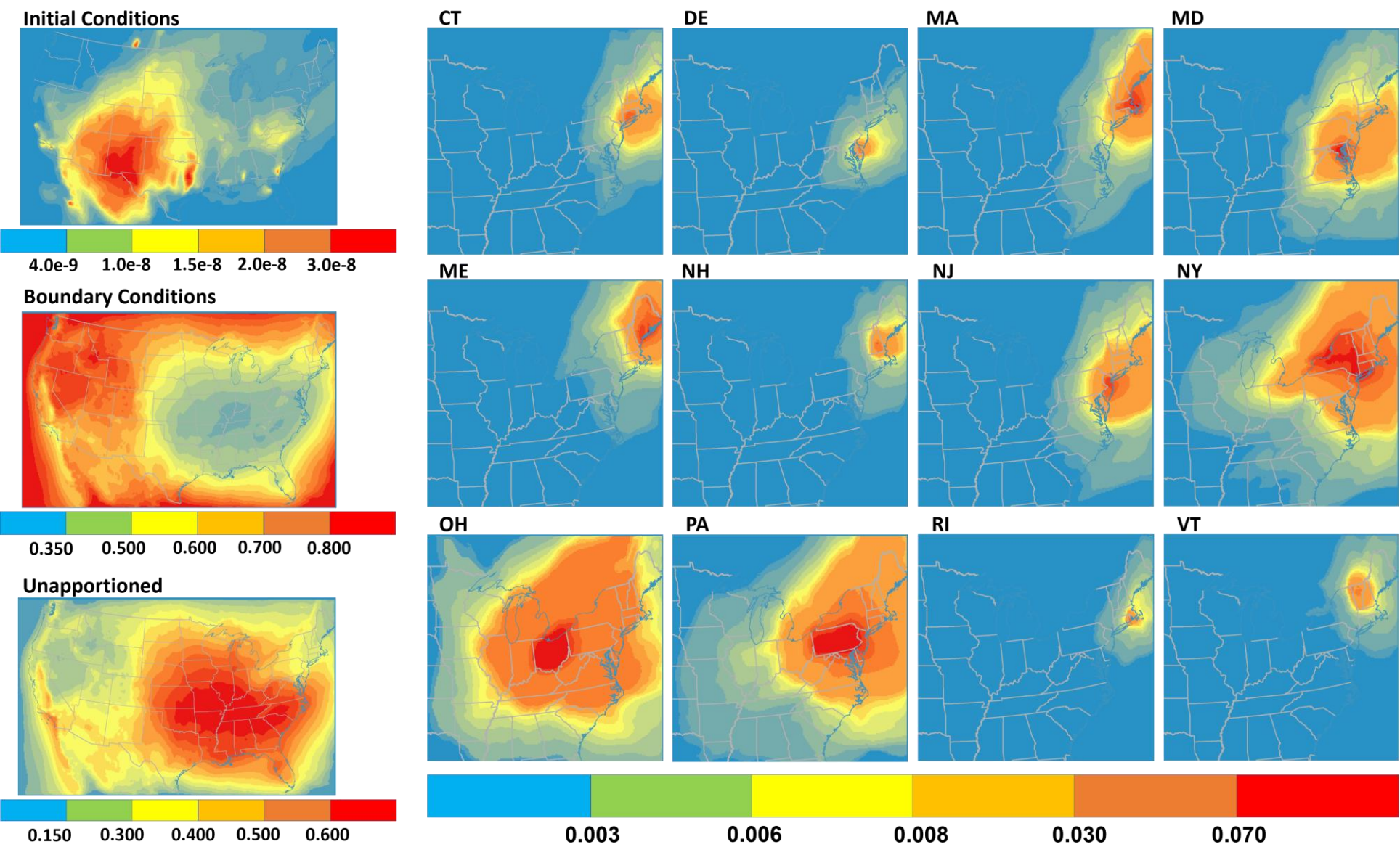
CAMx DDM Summertime Average Fractional Source Apportionment



- Boundary conditions have largest impact in the western and have smallest impact in coastal areas of the Northeastern US.
- Unapportioned sources have largest impact over ocean and coastal areas.
- Selected sources have low or negative sensitivity in the areas nearest to the source and have highest positive sensitivities in surrounding areas.

Unapportioned sources: all emissions within the domain except for the nine selected grid cells

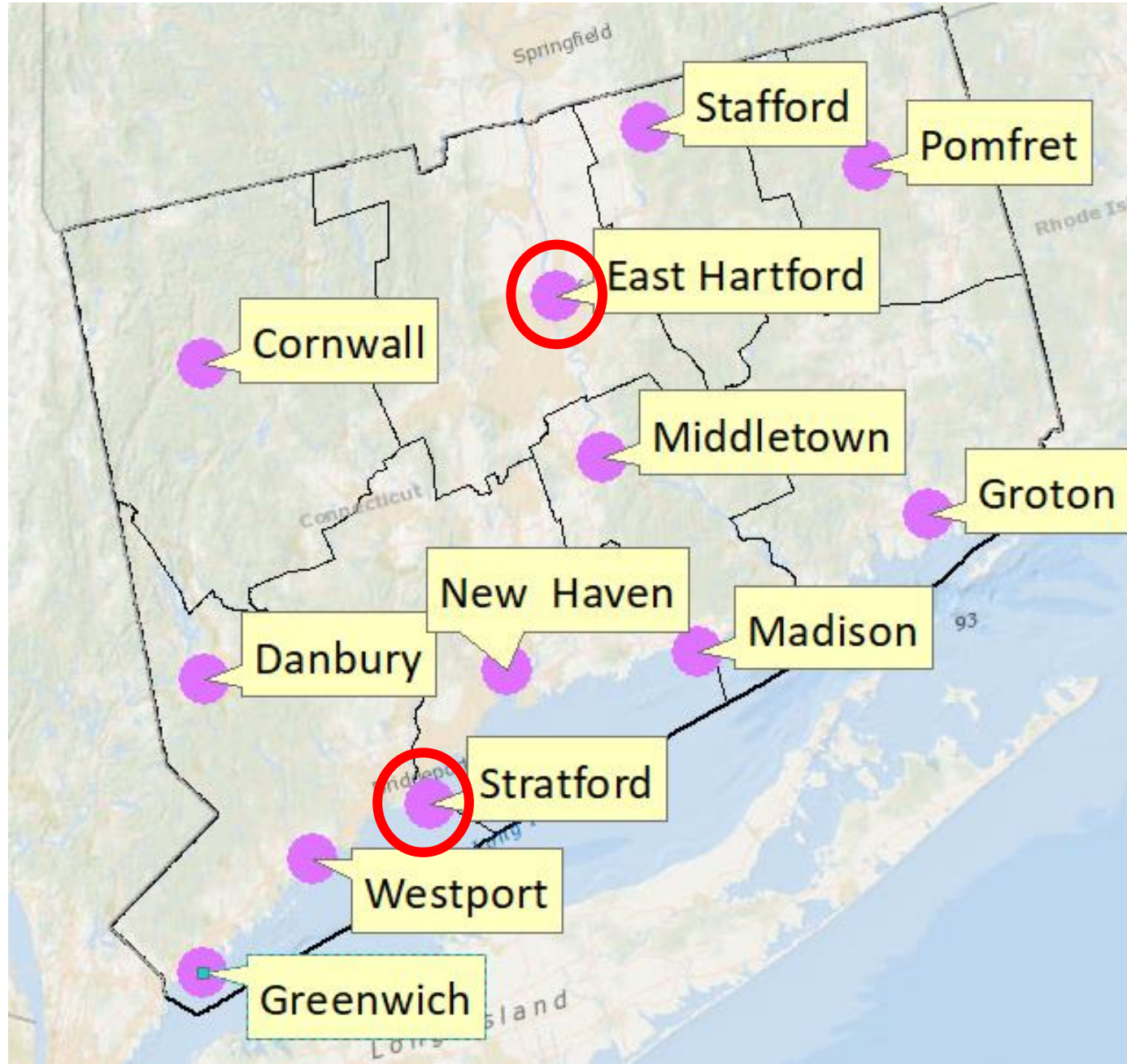
CAMx OSAT Summertime Average Fractional Source Apportionment



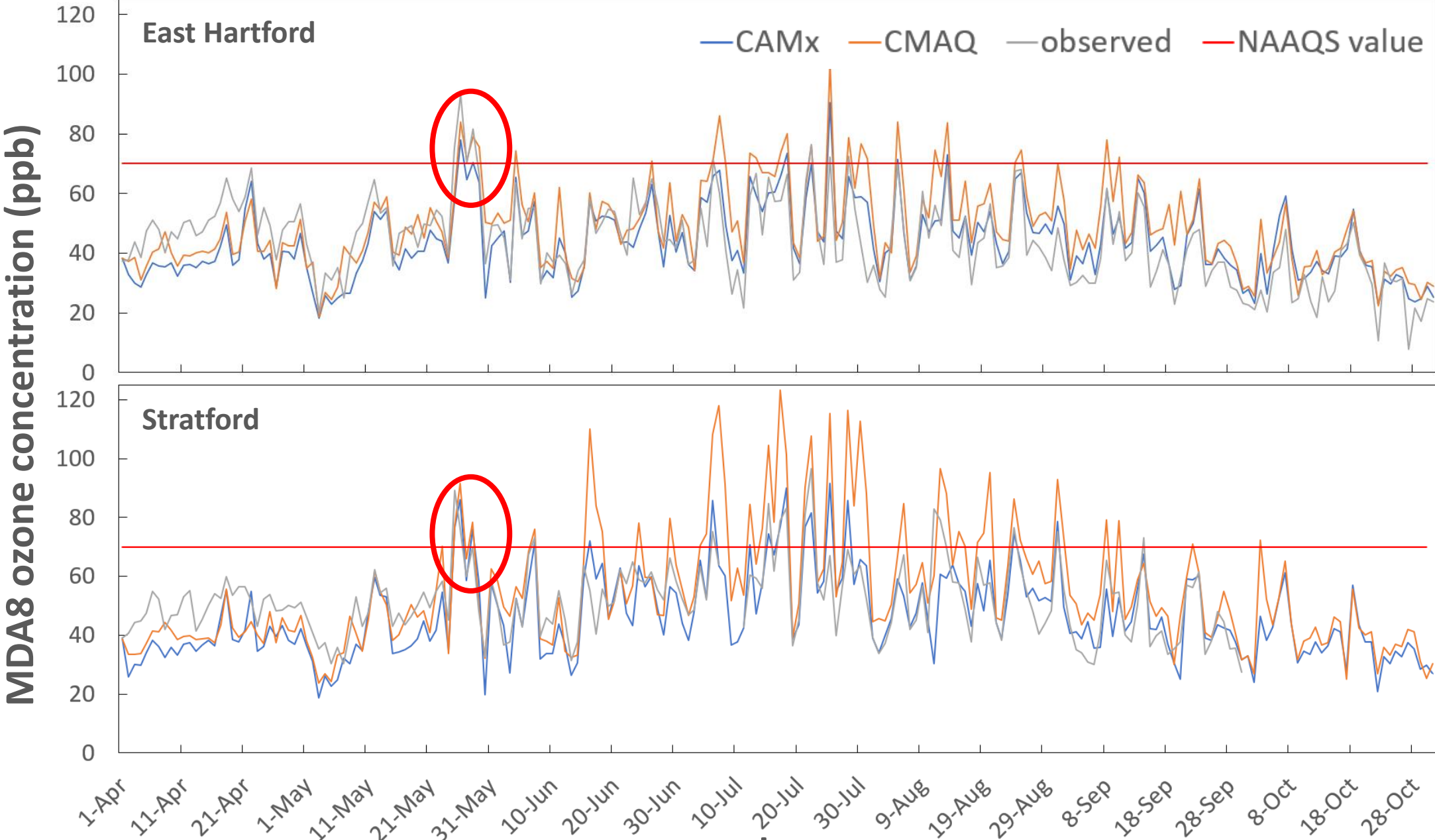
- Boundary conditions have higher impact in Western US
- Unapportioned sources have higher impact in Mid Eastern part of the US
- Twelve states sources have high impact in the nearby source areas
- NY, OH, PA have large impact in a larger areas

Unapportioned sources: all emissions within the domain except for the twelve states

Ozone Monitoring Sites in CT

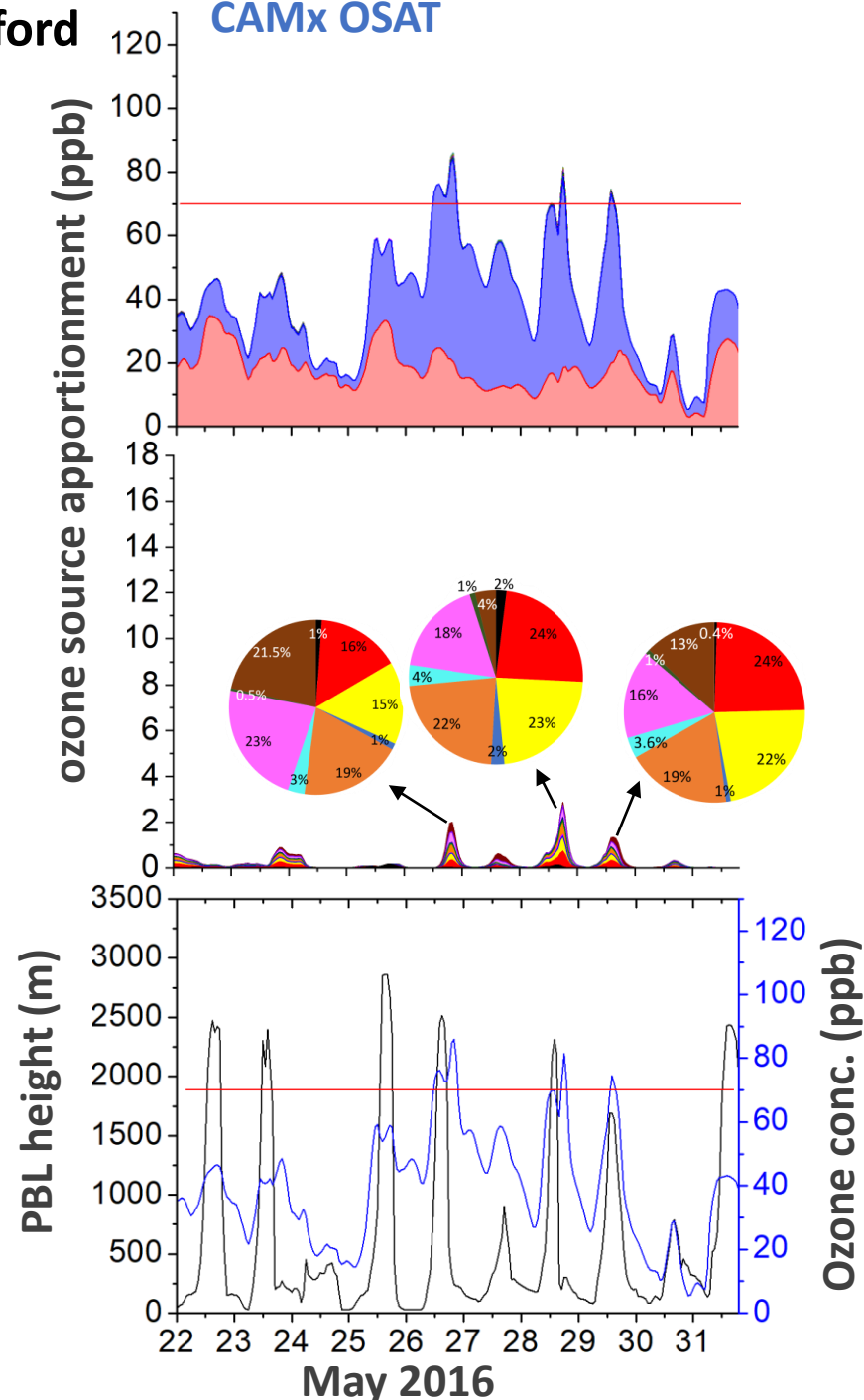


Time Series Plots of MDA8 ozone for April through October 2016

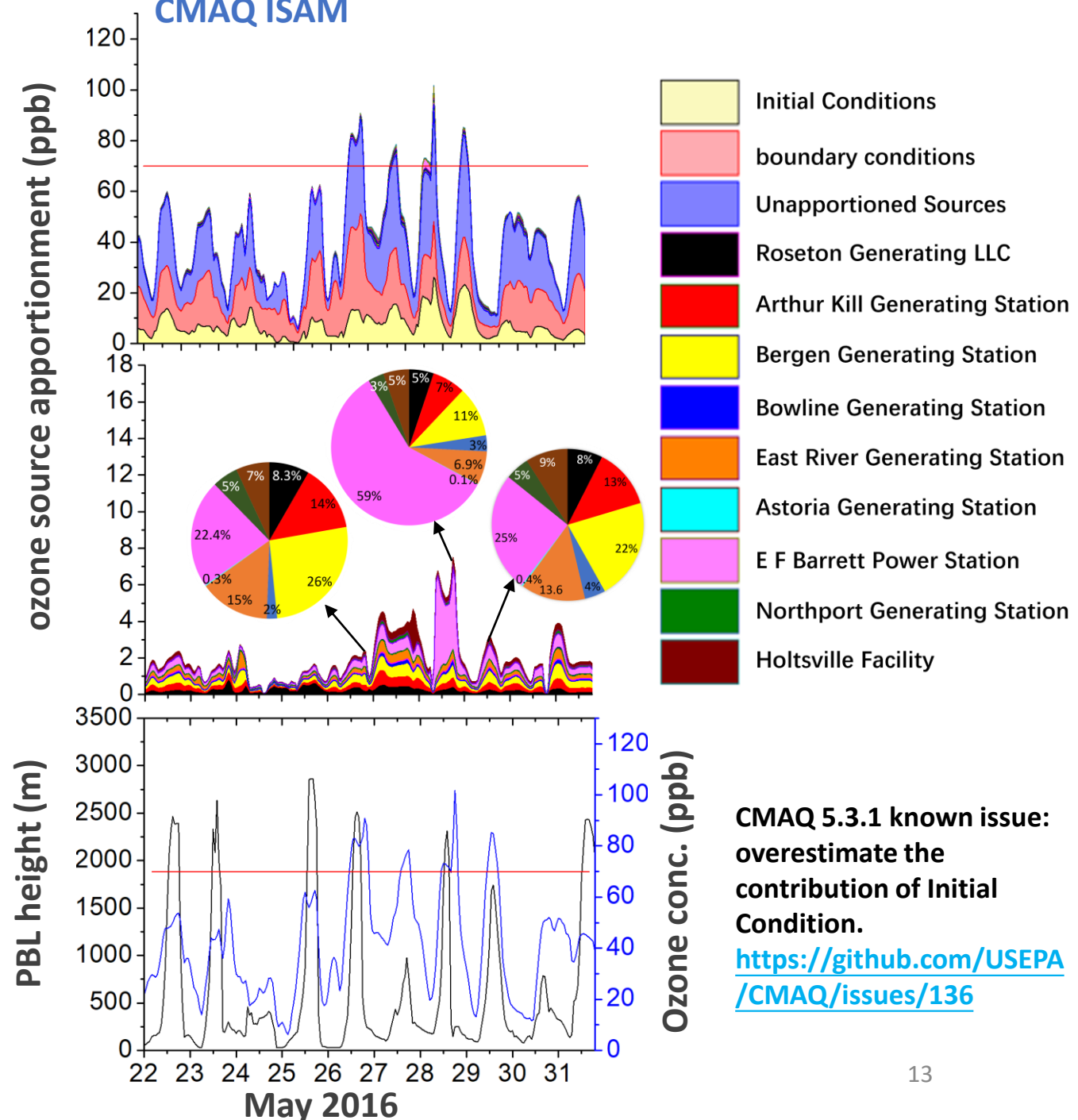


East Hartford

CAMx OSAT

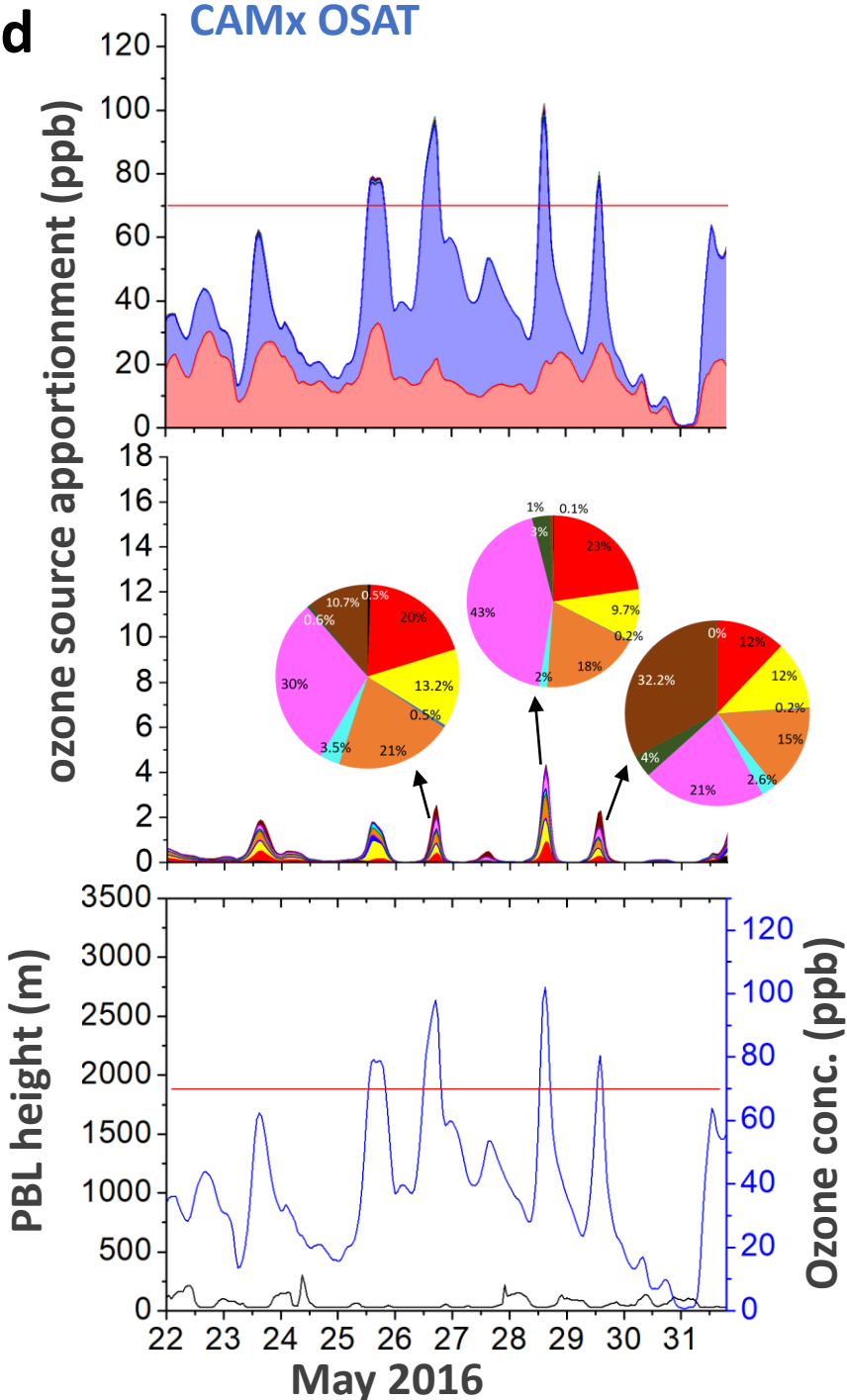


CMAQ ISAM

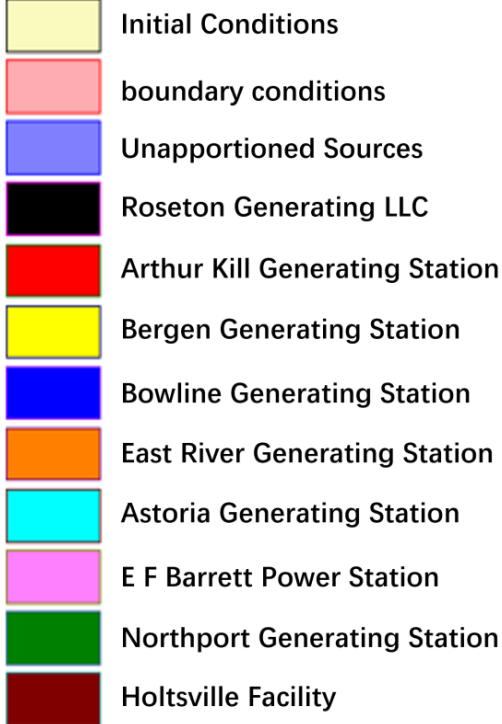
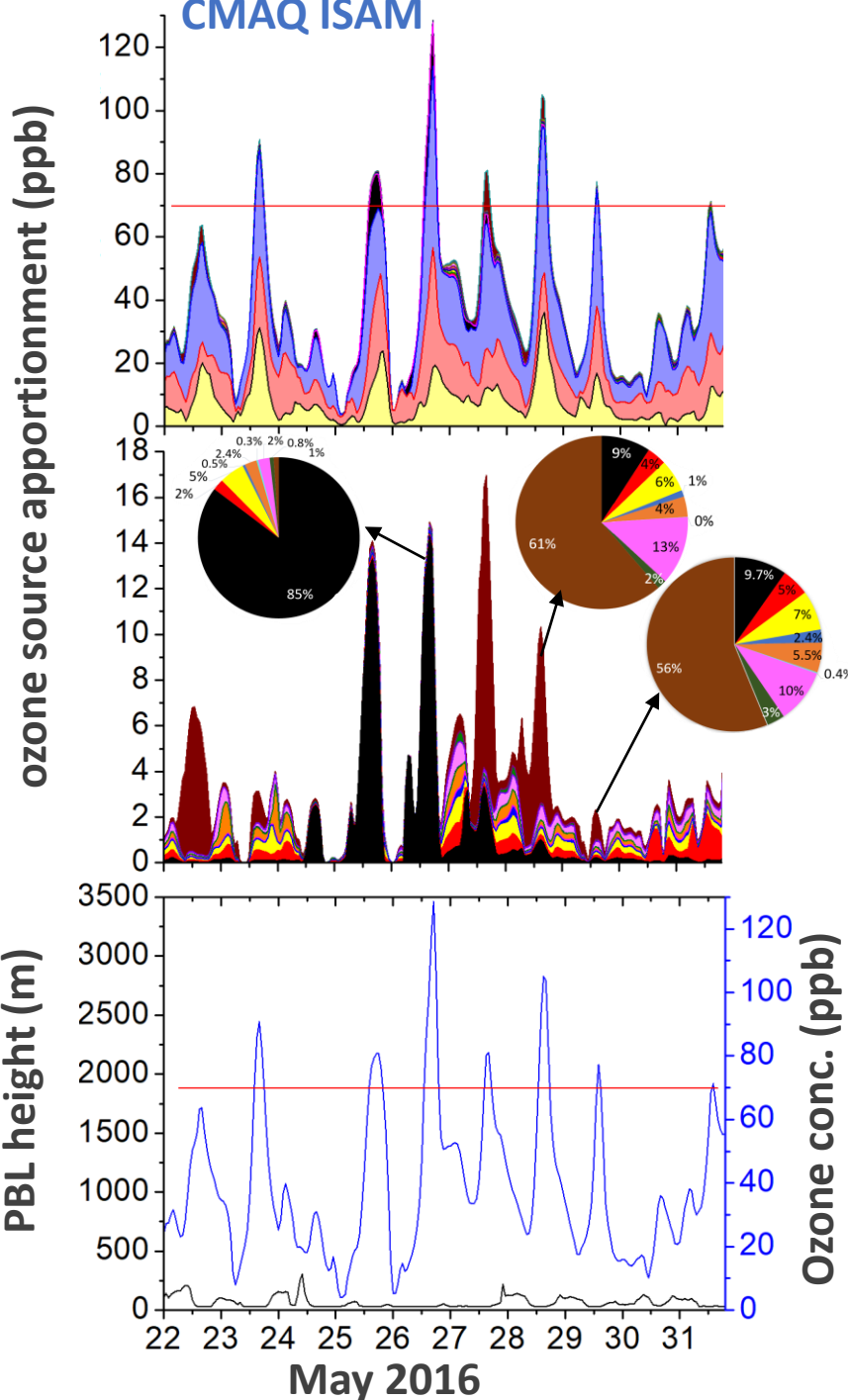


Stratford

CAMx OSAT



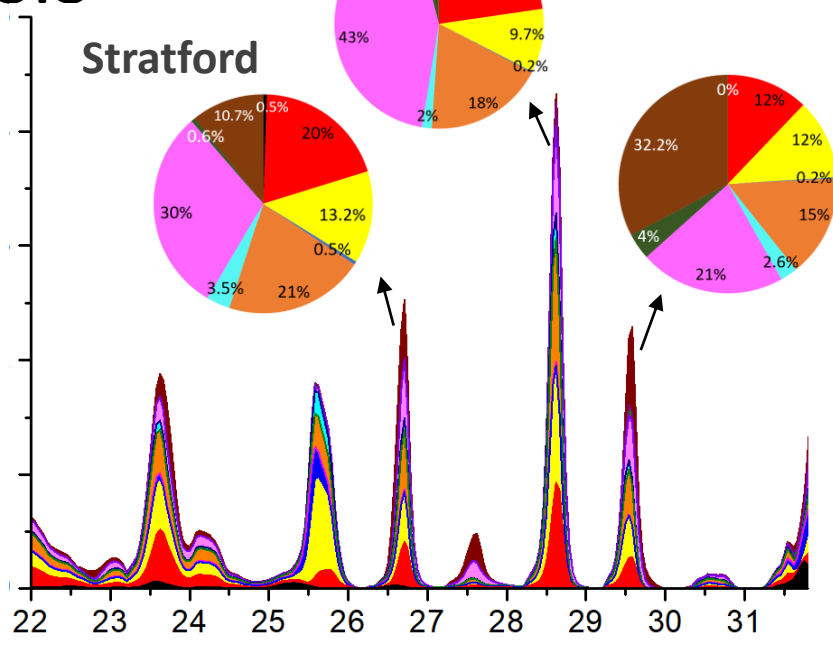
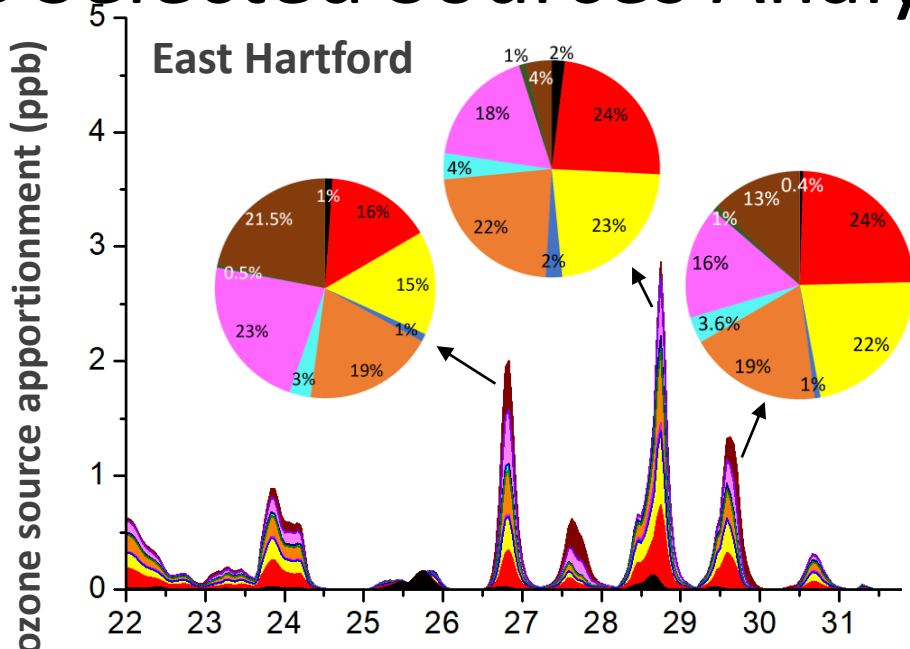
CMAQ ISAM



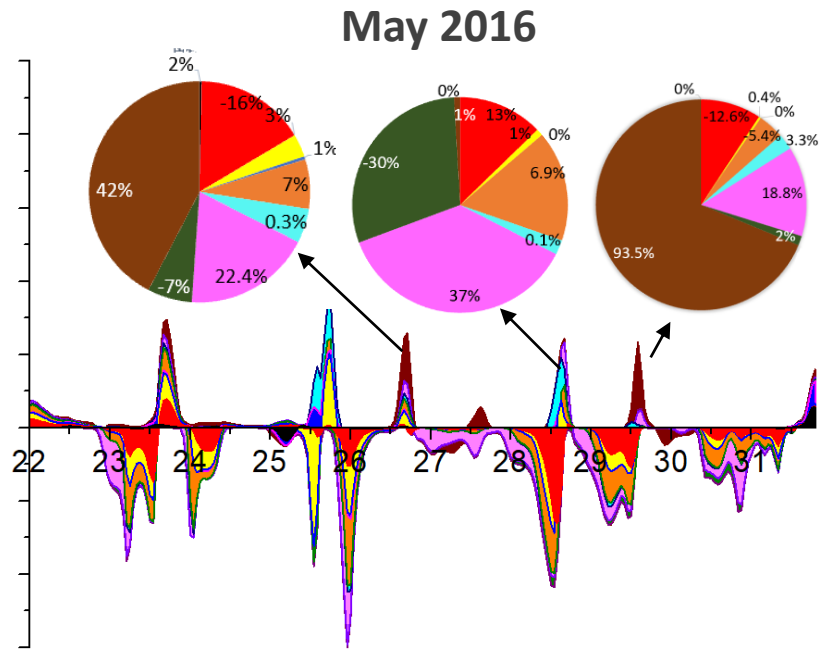
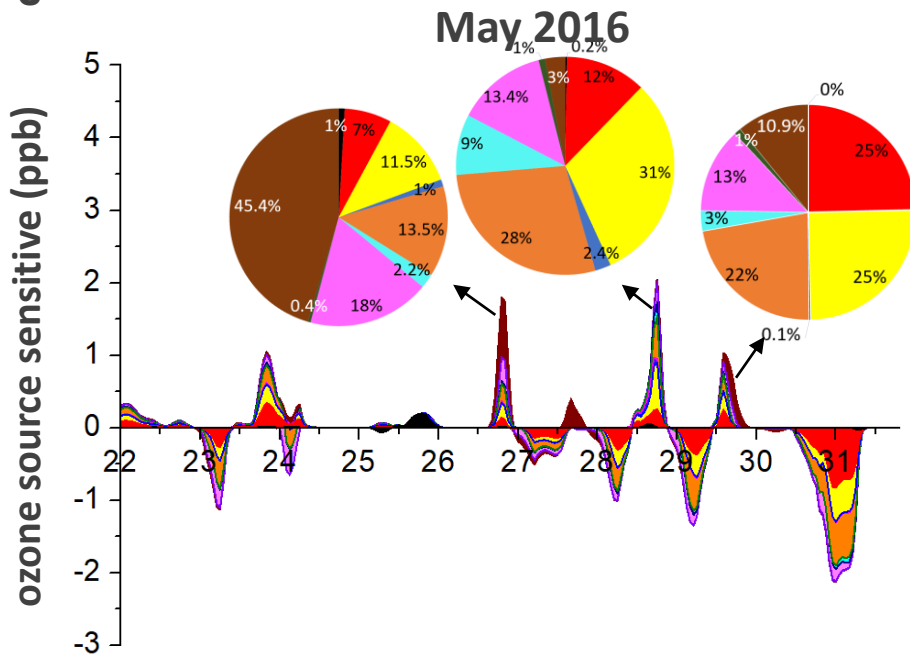
CMAQ 5.3.1 known issue:
overestimate the
contribution of Initial
Condition.
<https://github.com/USEPA/CMAQ/issues/136>

Ozone Selected Sources Analysis

CAMx
OSAT

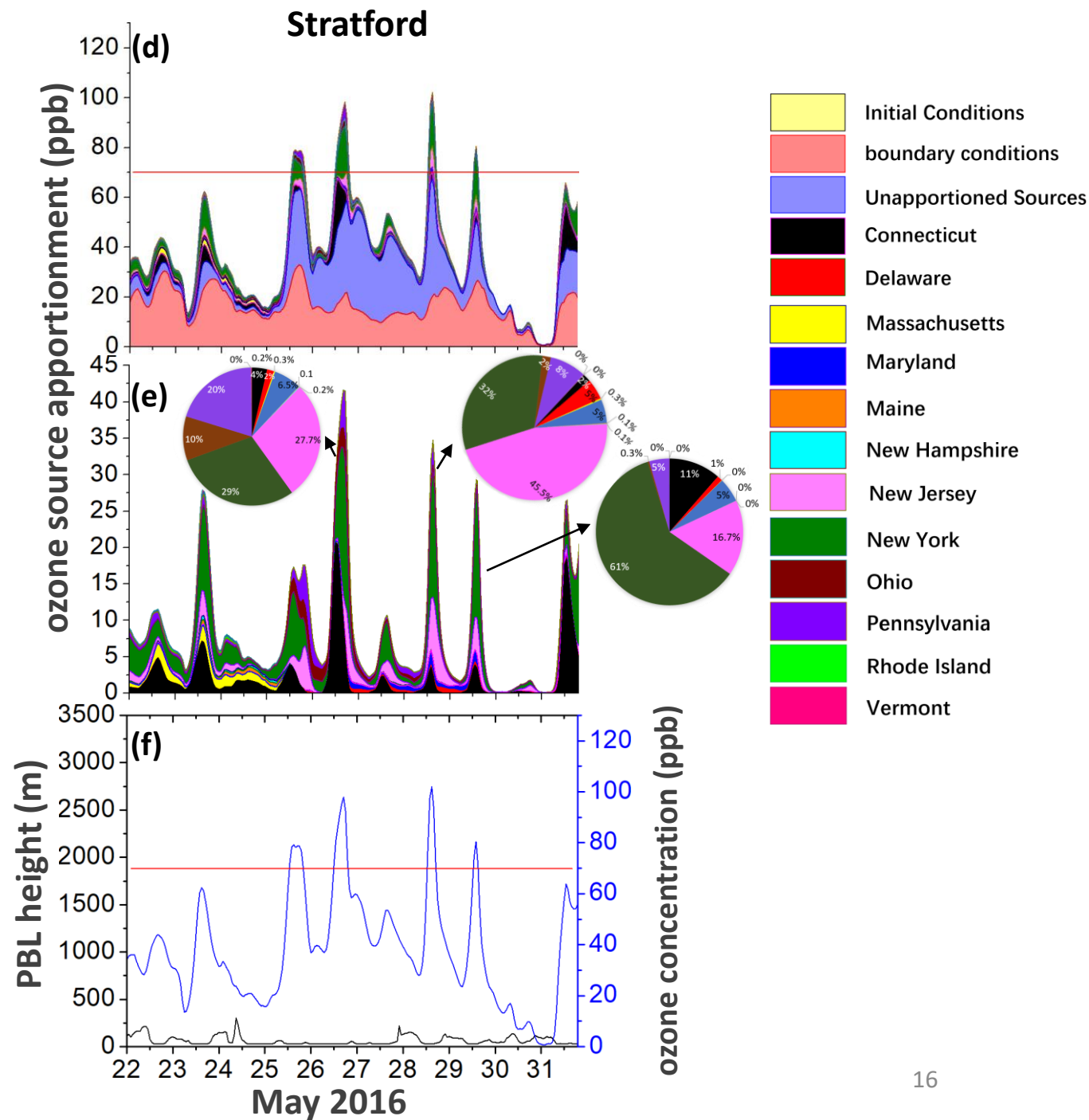
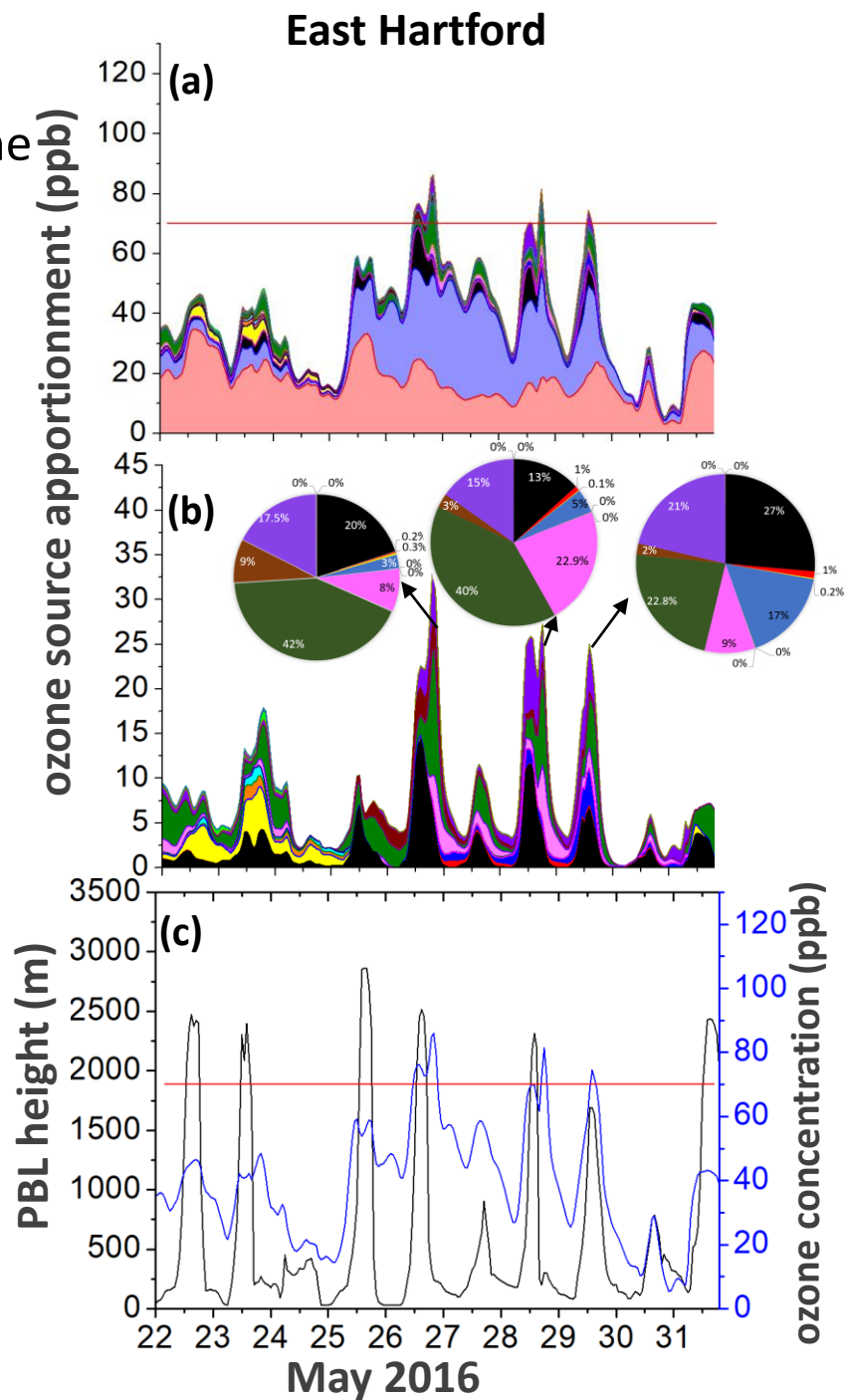


CAMx
DDM



- Roseton Generating LLC
- Arthur Kill Generating Station
- Bergen Generating Station
- Bowline Generating Station
- East River Generating Station
- Astoria Generating Station
- E F Barrett Power Station
- Northport Generating Station
- Holtsville Facility

CAMx-OSAT
May high Ozone



Conclusion

- Boundary conditions and Unapportioned Sources contribute the most to ozone concentration.
- Boundary conditions contribute to a baseline of ozone around 20ppb, (20-40ppb by US EPA)
- The contribution of boundary conditions to ozone is relative constant. But Unapportioned Sources and Selected Sources contribute a lot more when ozone concentration is in a very high level.
- Nine selected sources add up contribute to very less ozone concentration in CT. Unapportioned Sources and twelve States (CT, DE, MA, MD, ME, NH, NJ, NY, OH, PA, RI, VT) contribute a lot more when ozone concentration is in a very high level.

End

Thank you