

Impact of Improved Temporal Profiles for Point Sources on Air Quality

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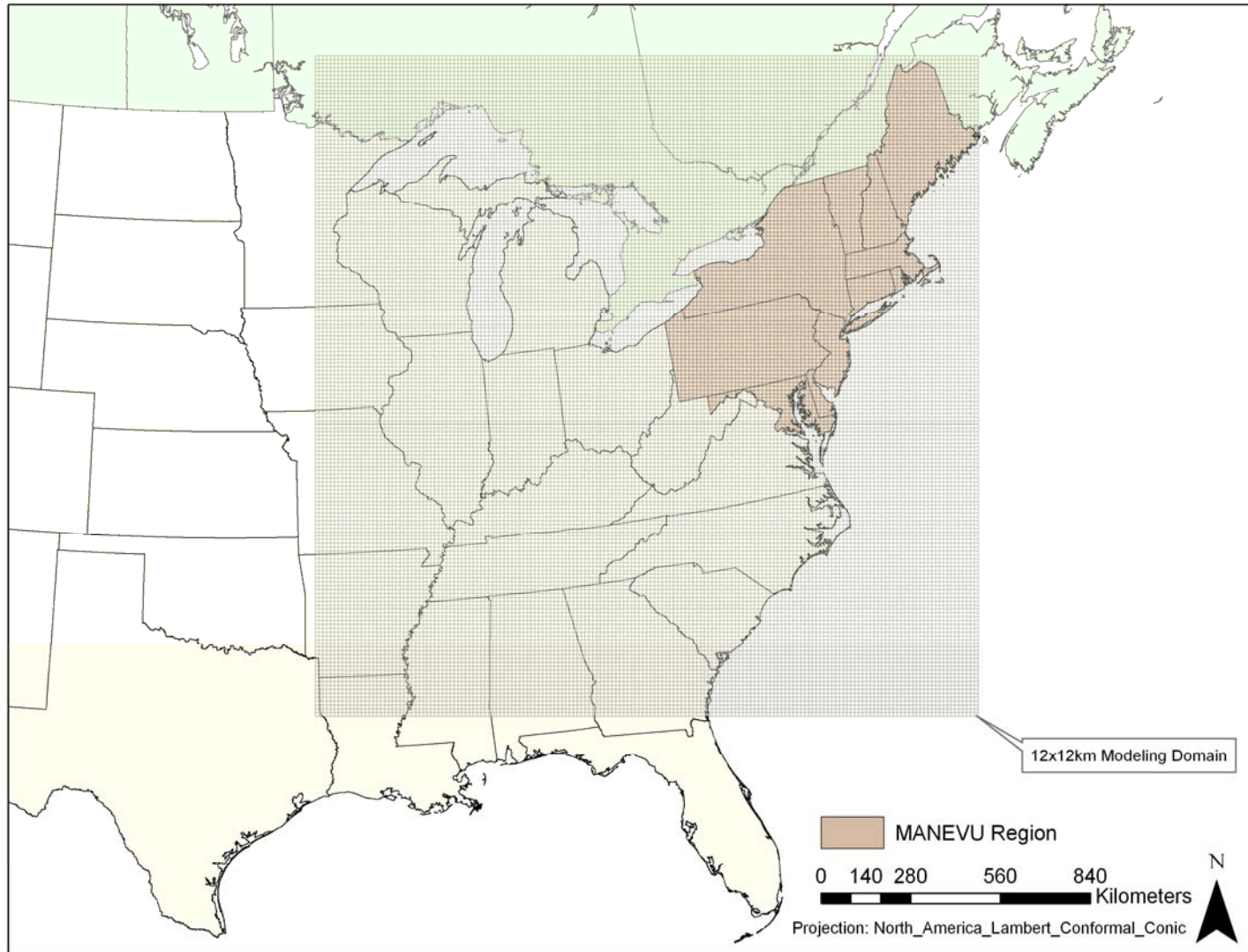
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⁴School of Civil & Environmental Engineering, Georgia Institute of Technology

Objectives

- Electric Generating Units (EGUs) are significant contributors to NO_x and SO_2
 - 16 percent of NO_x (MANE-VU Region)
 - 68 percent of SO_2 (MANE-VU Region)
- Improve Emissions Estimation and Processing for EGUs
 - Temporal Profiles
 - Continuous Emissions Monitoring (CEM) Data

Modeling Domain



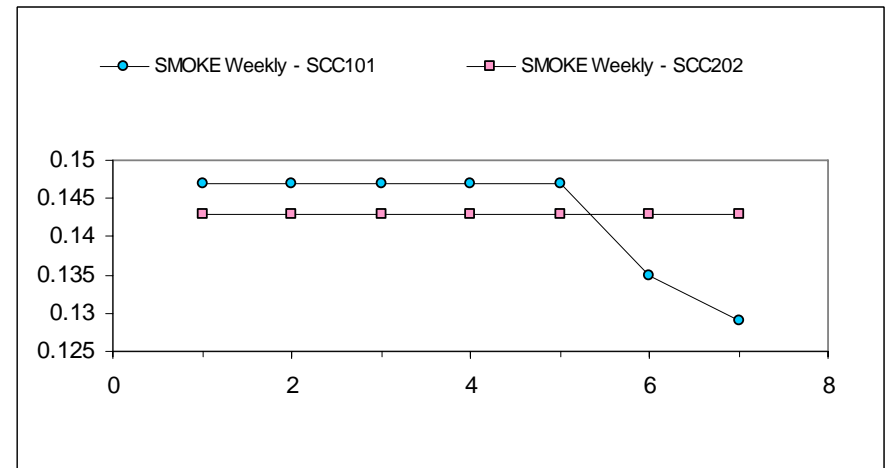
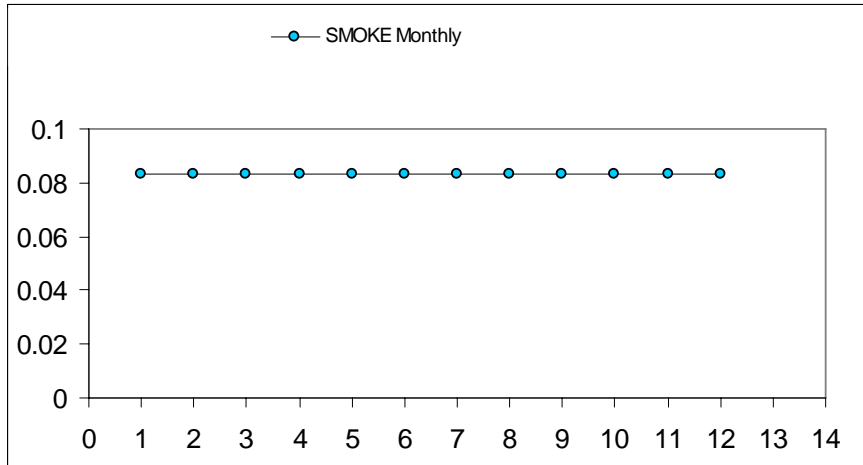
Modeling

- Air Quality Study [August 6th -13th 2002]
 - Meteorological data: MM5 (UMD)
 - Emissions Data / Emissions Processing:
 - EI (RPO)+SMOKE (v2.1)
 - CMAQ: CMAQ v4.4

Emissions Processing

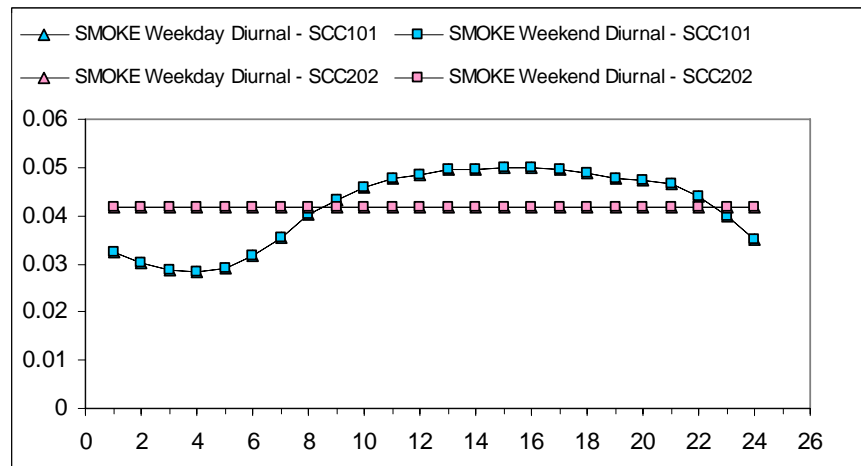
- Point Source Emissions
 - SMOKE Default Temporal Profile
 - Temporal Profile based upon CEM data
 - Hourly CEM data

Temporal Distribution: SMOKE Default



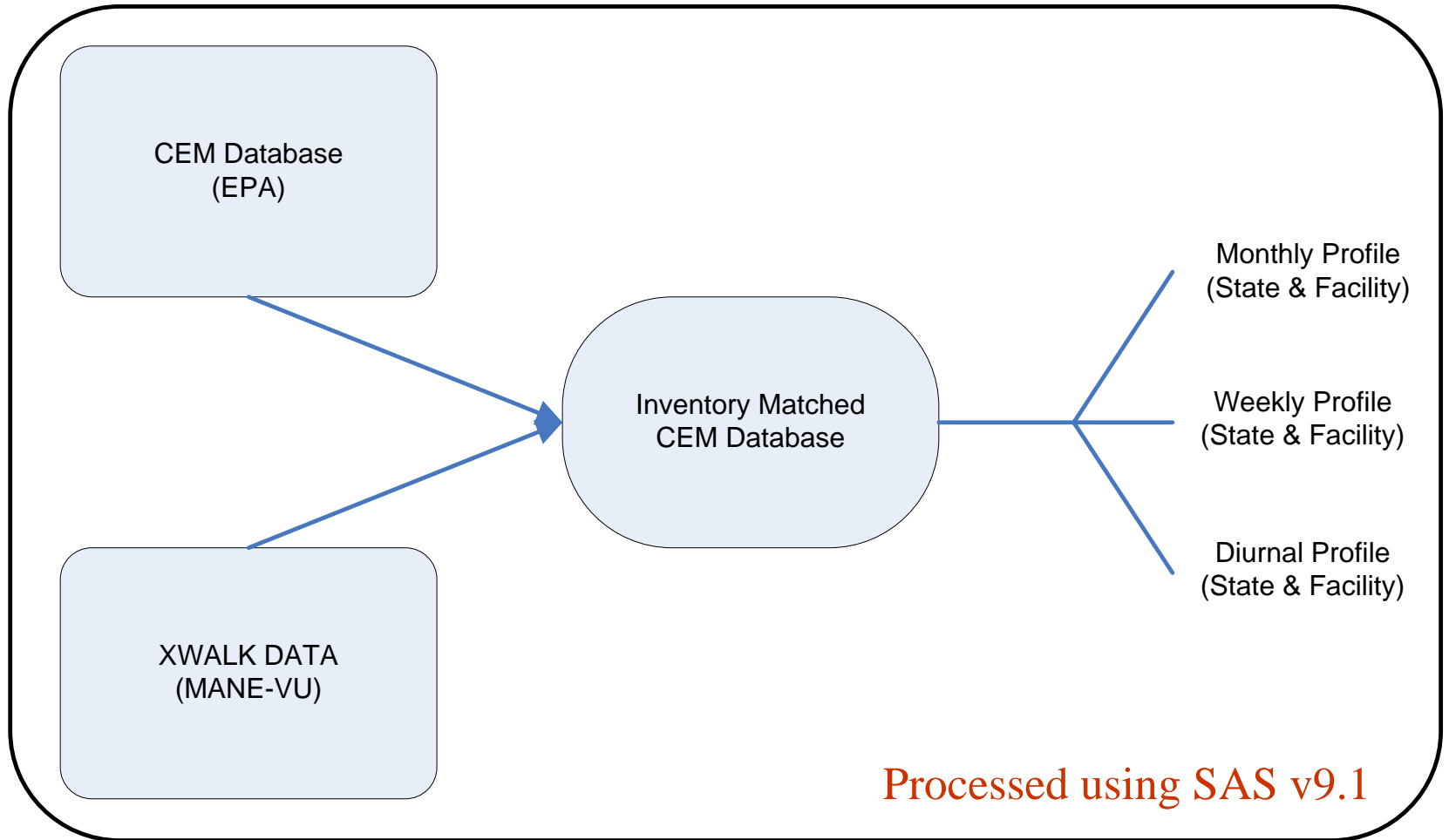
Monthly

Weekly

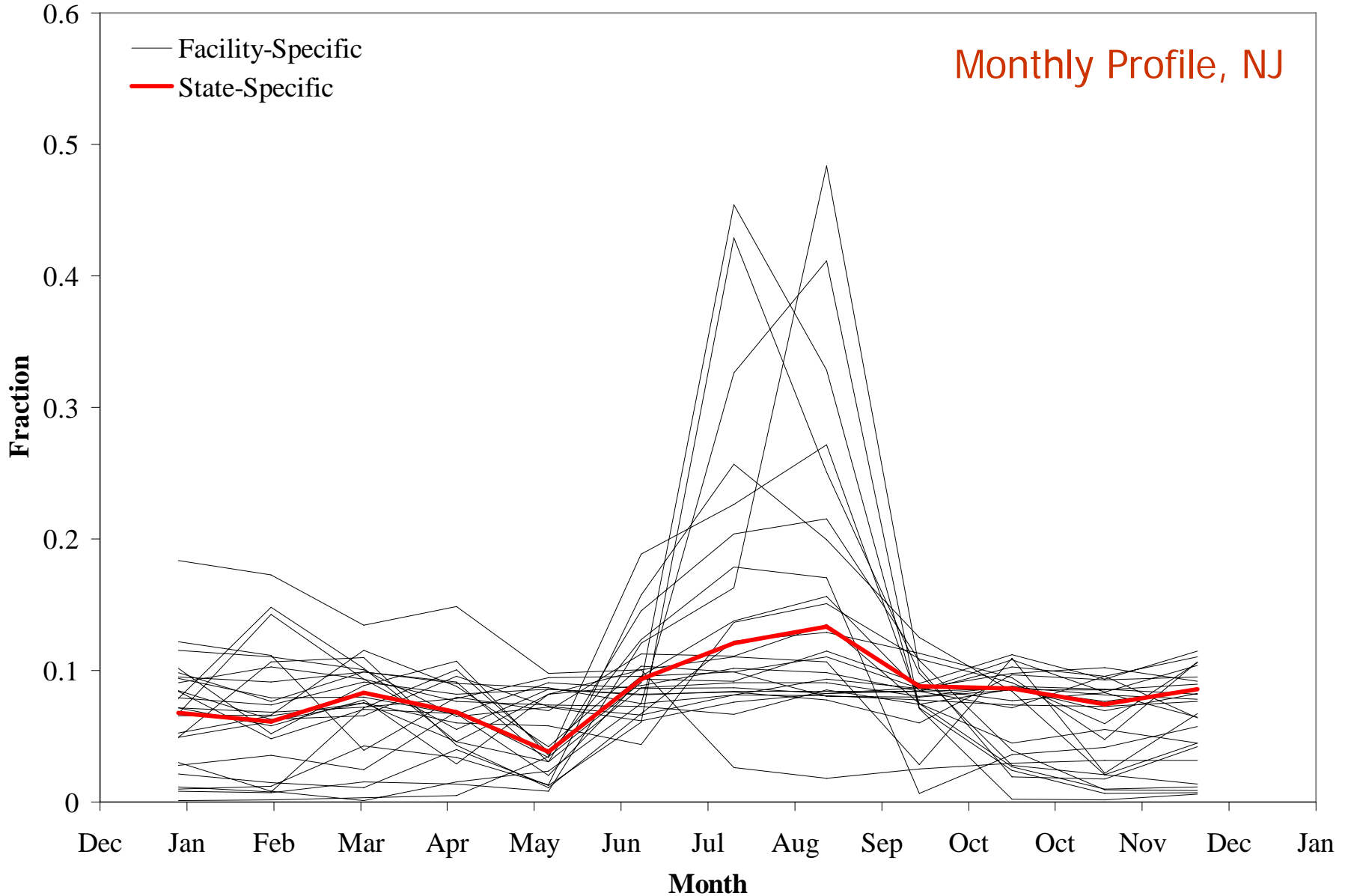


Diurnal

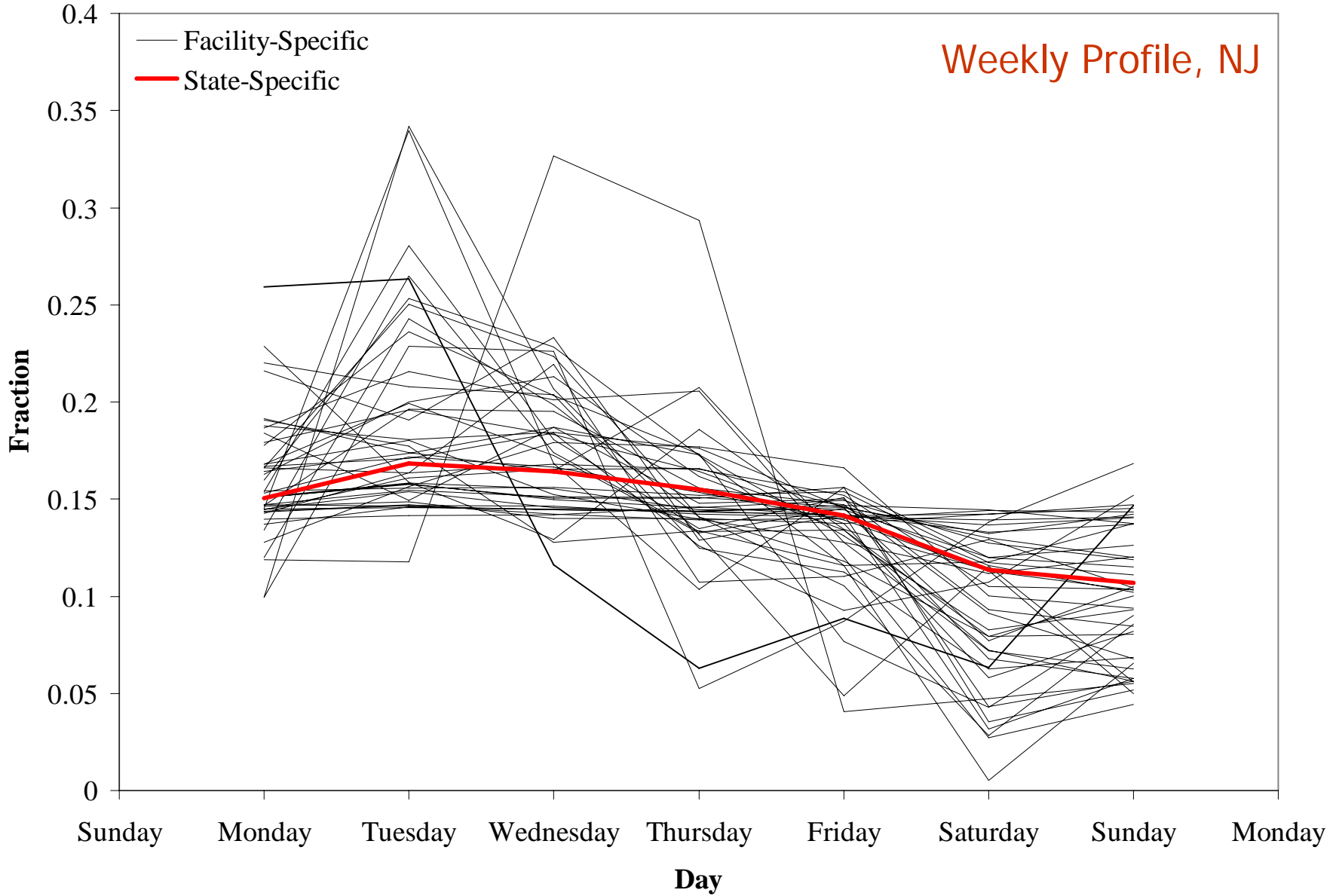
Temporal Distribution: CEM-Based



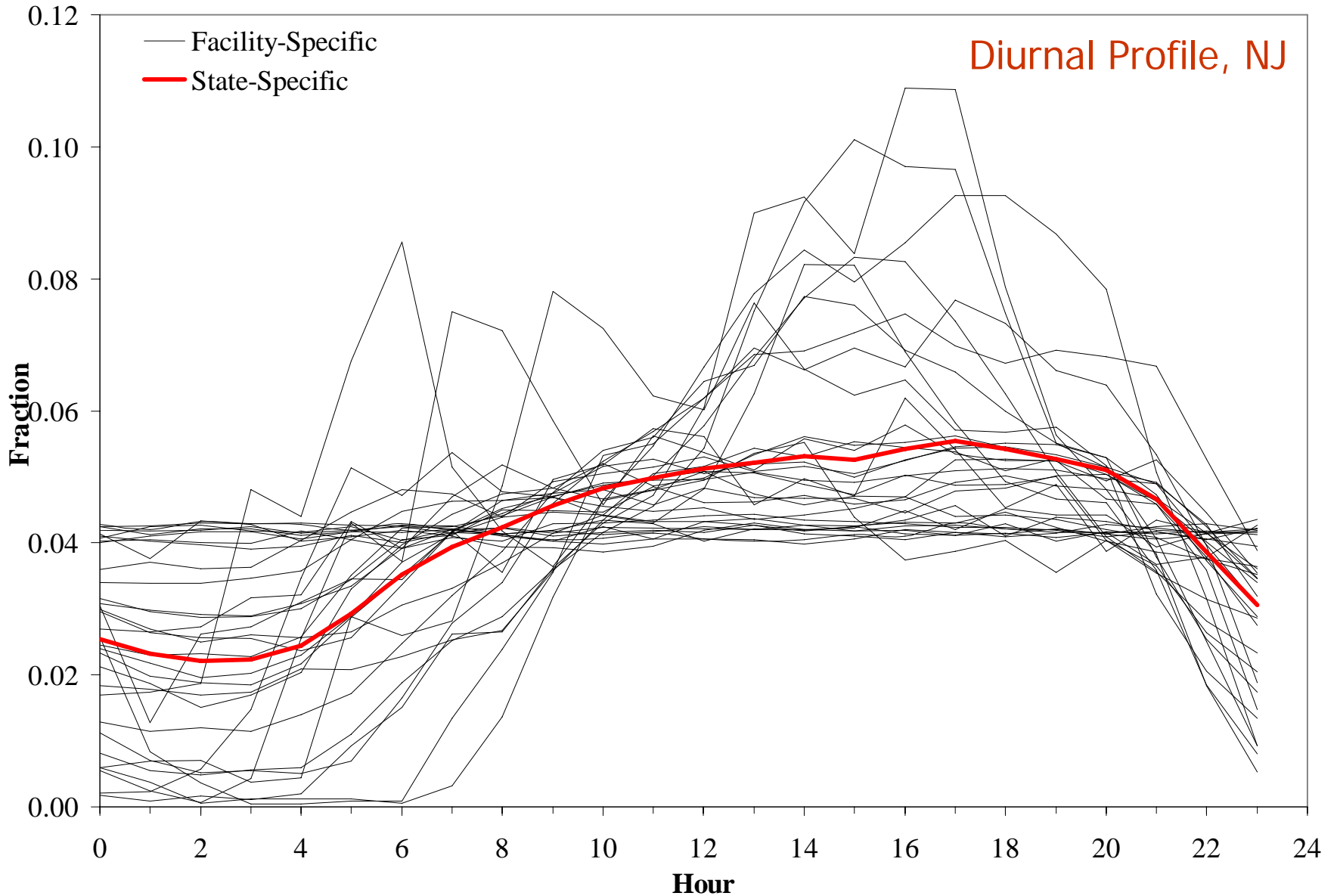
Temporal Distribution: CEM-Based



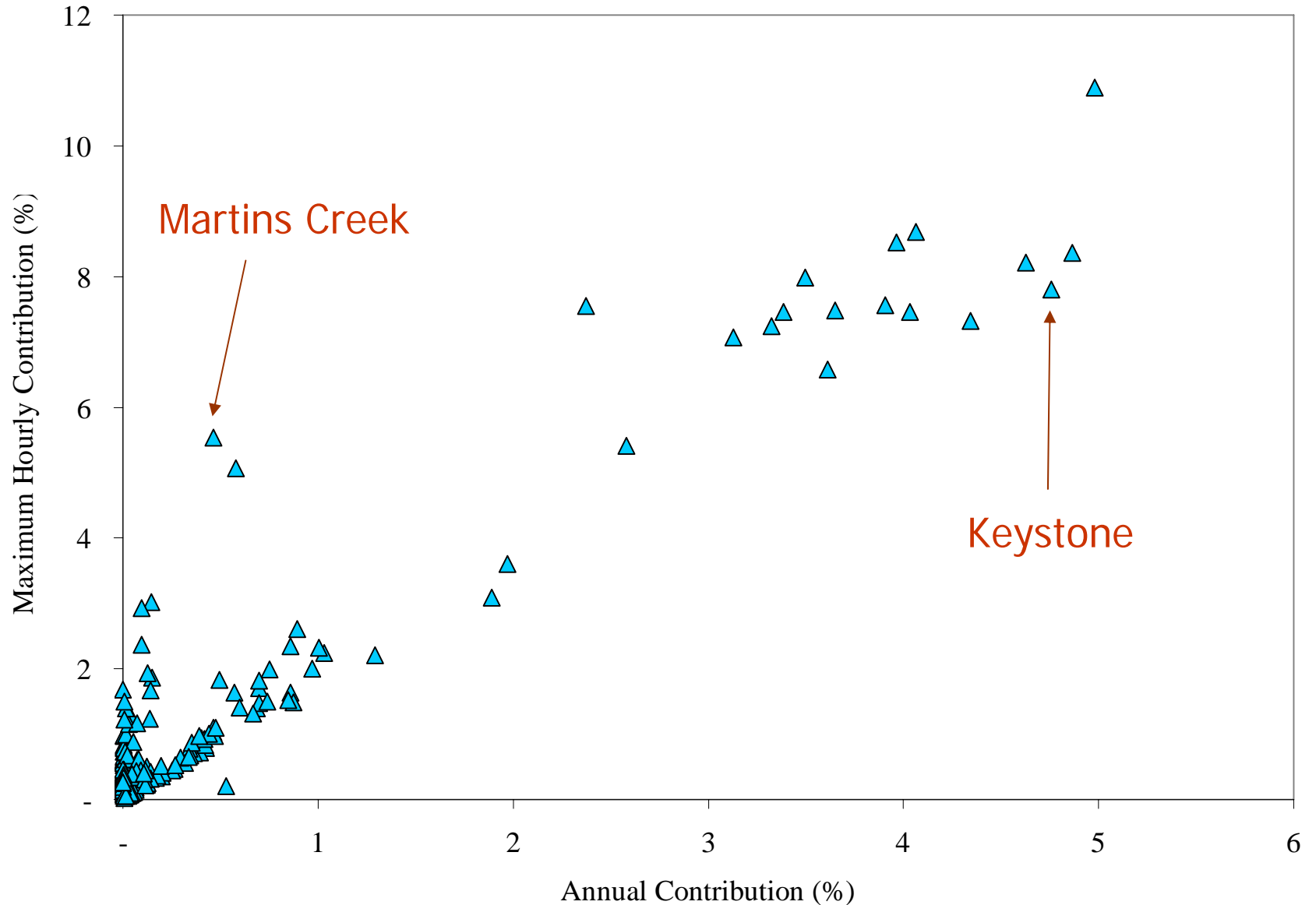
Temporal Distribution: CEM-Based



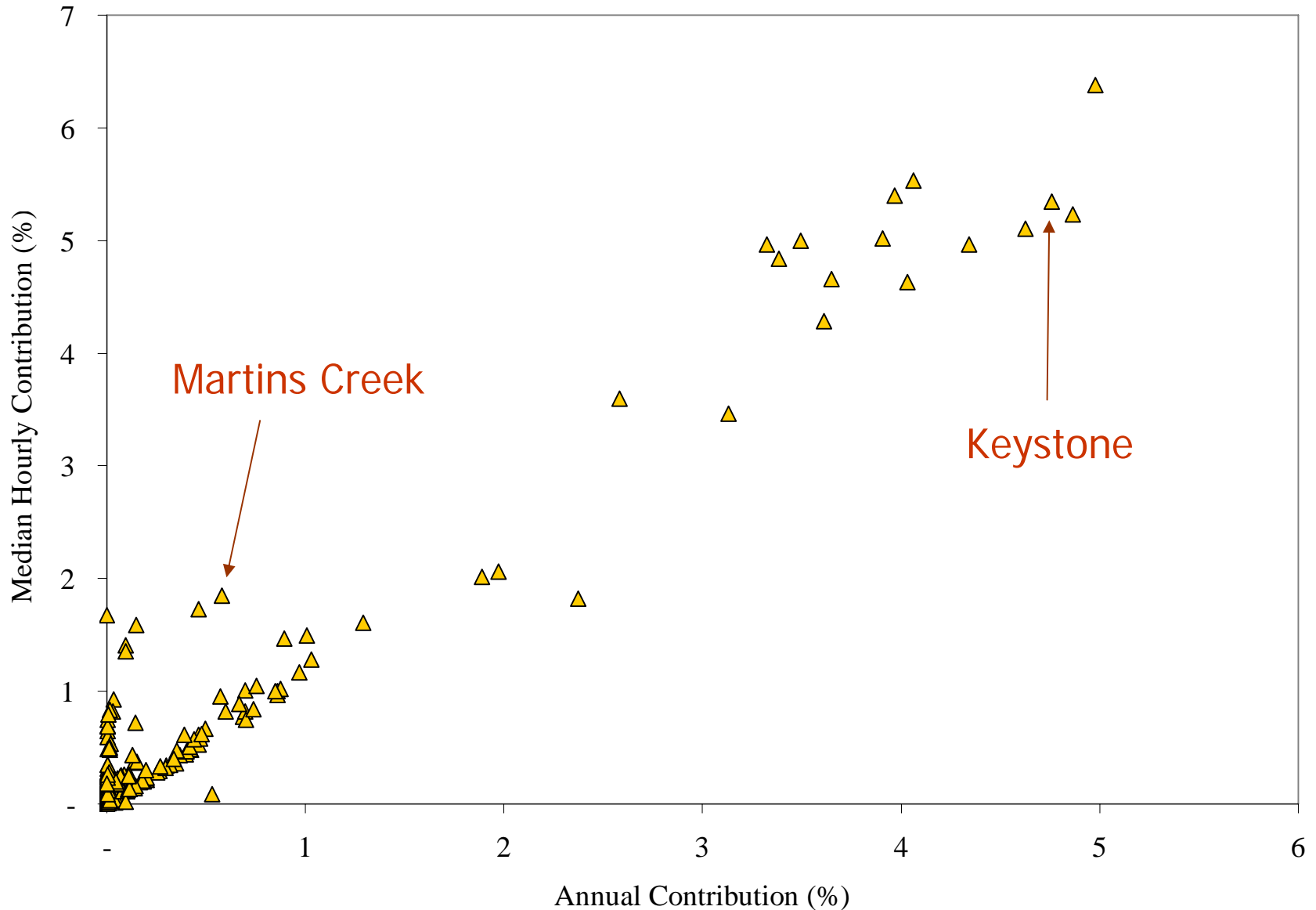
Temporal Distribution: CEM-Based



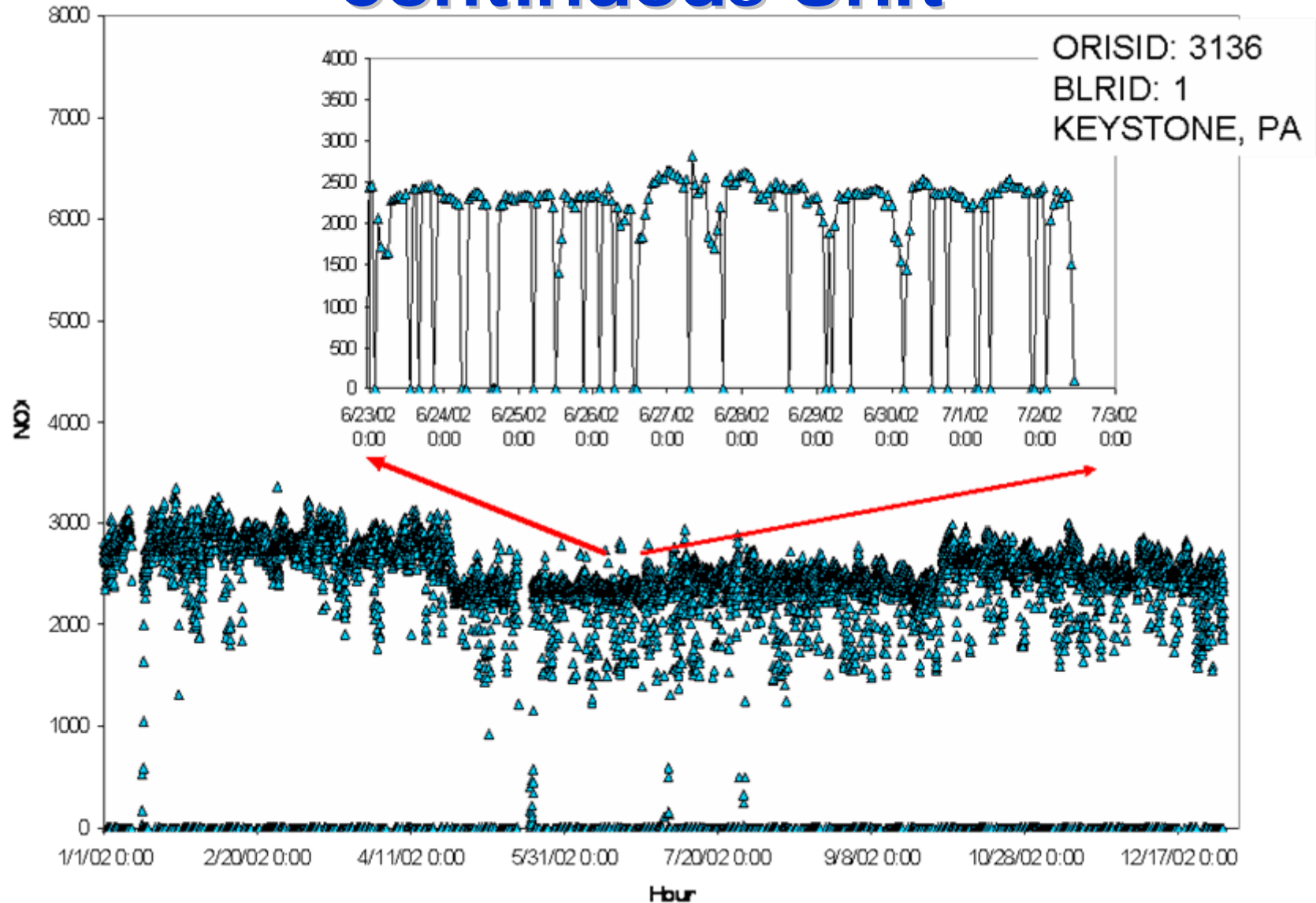
NO_x Contribution: PA Units



NO_x Contribution: PA Units

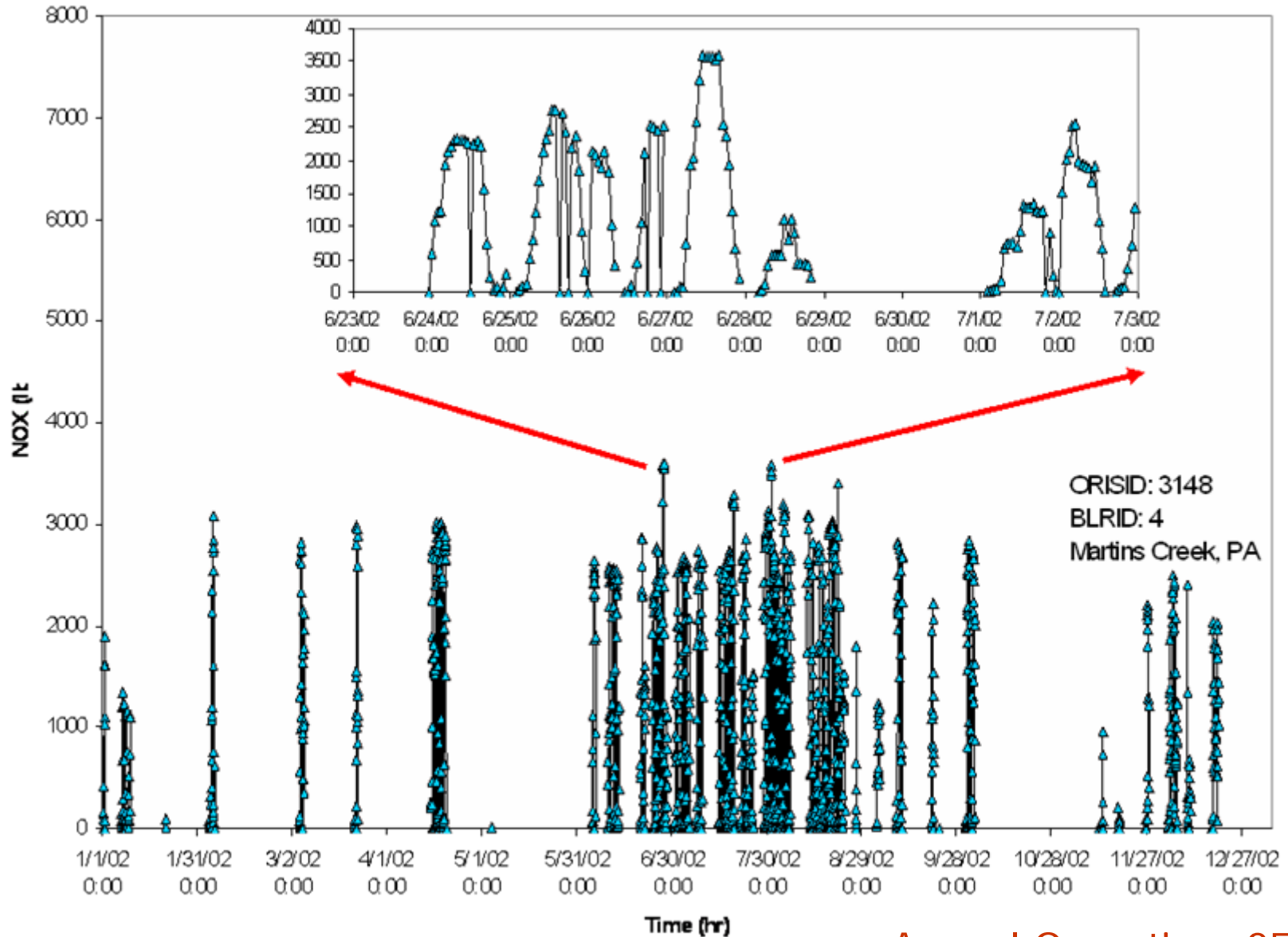


NO_x Contribution: Continuous Unit



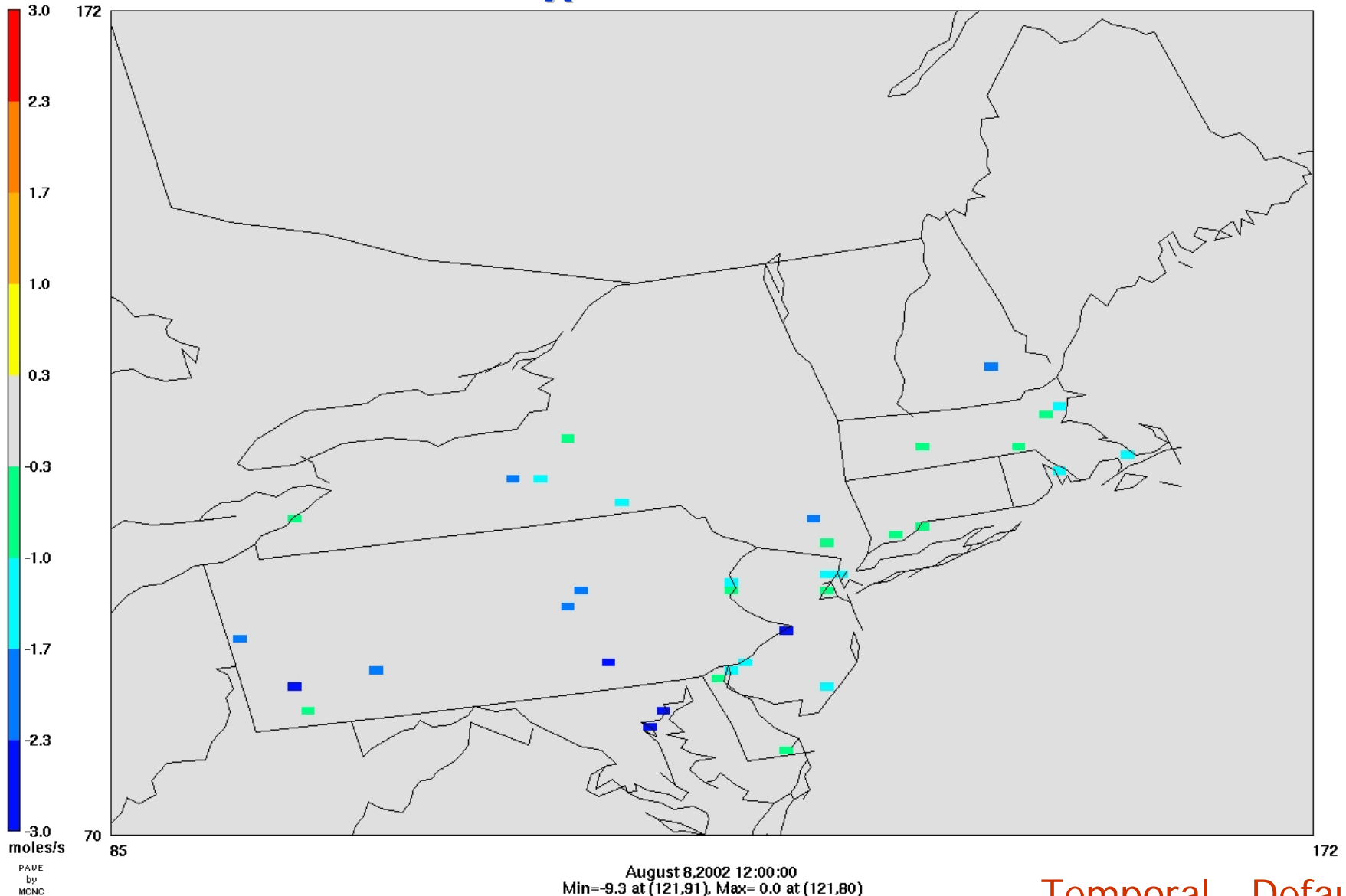
Annual Operation: 97 %

NO_x Contribution: Peaking Unit

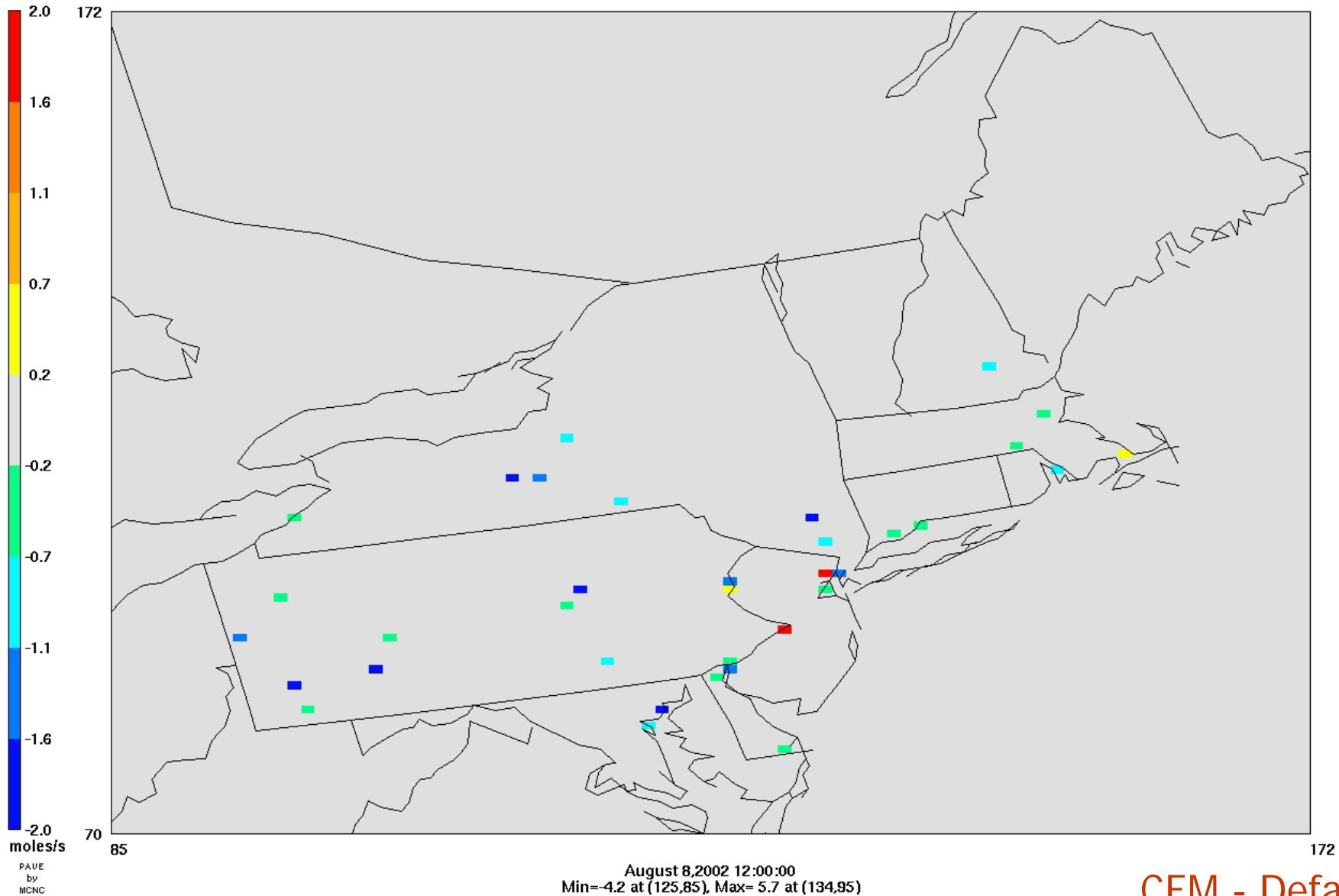


Annual Operation: 25 %

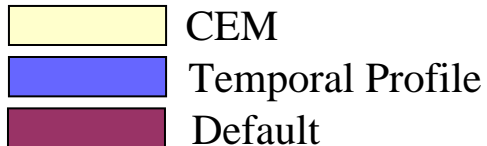
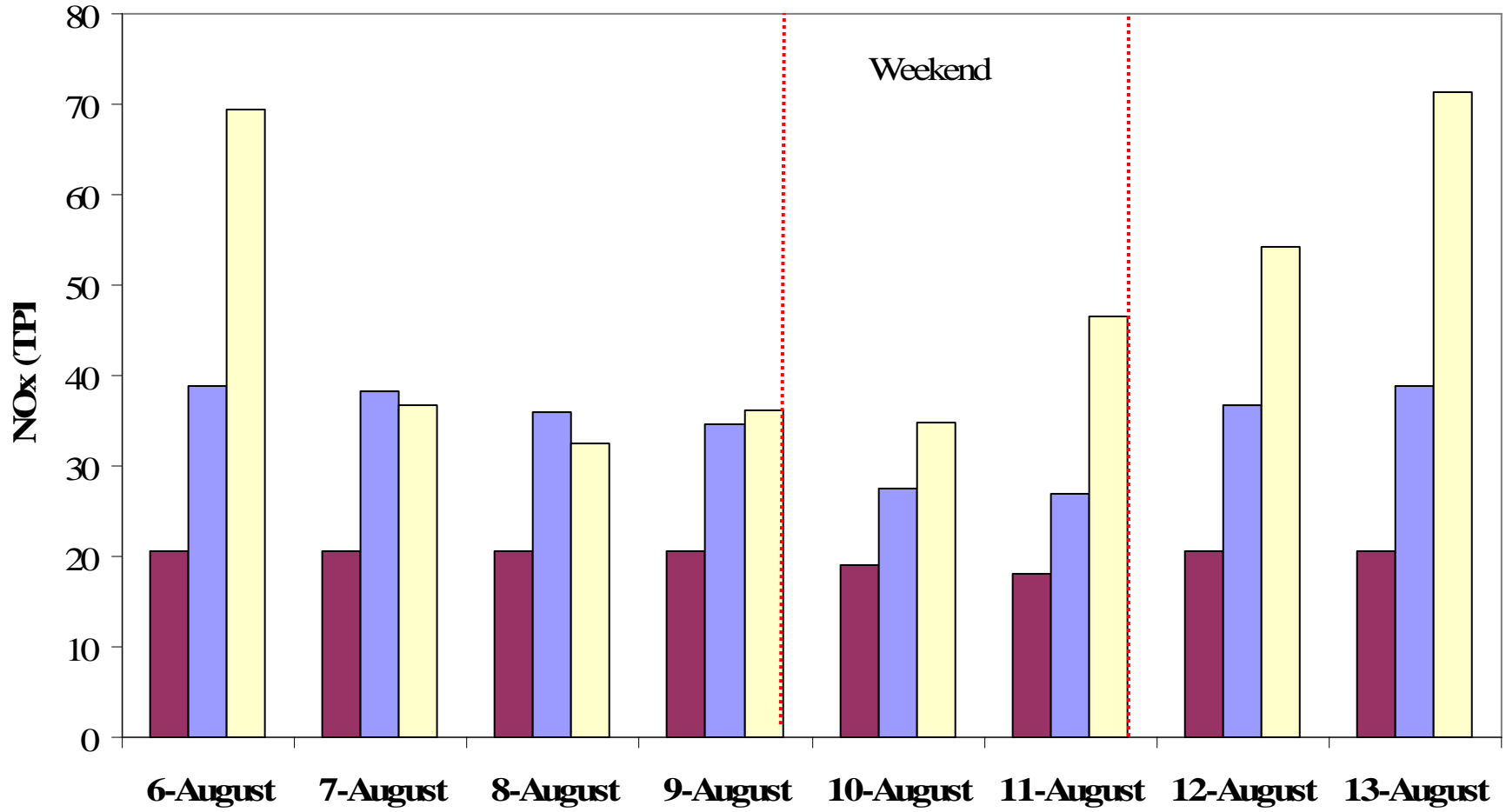
Impact of Temporal Profile: NO_x Emissions



Impact of CEM: NO_x Emissions

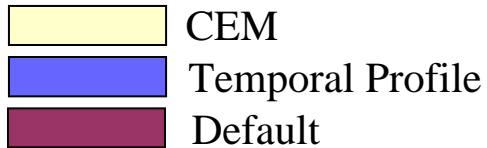
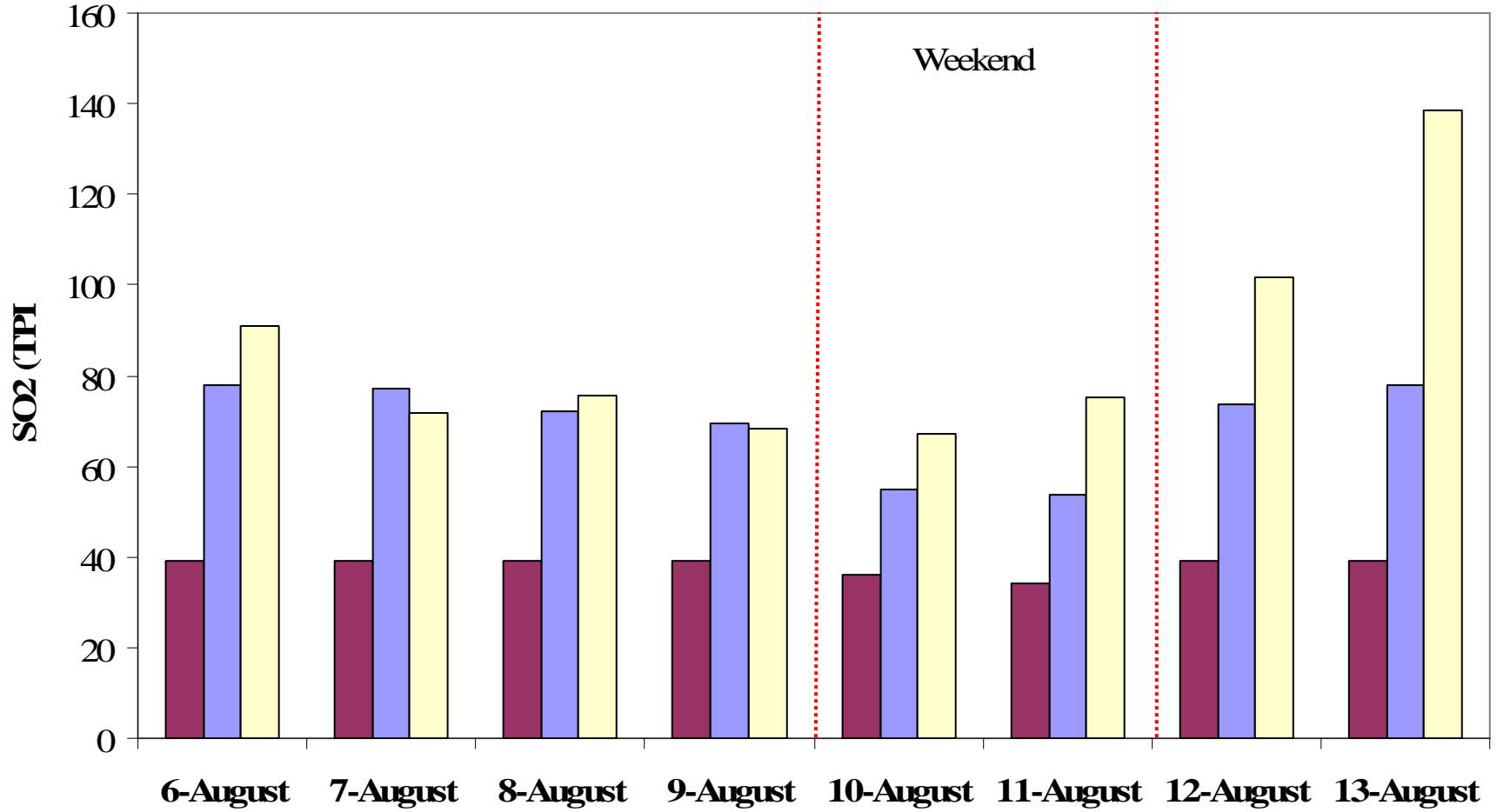


Impact on NO_x Emissions



Hudson County, NJ

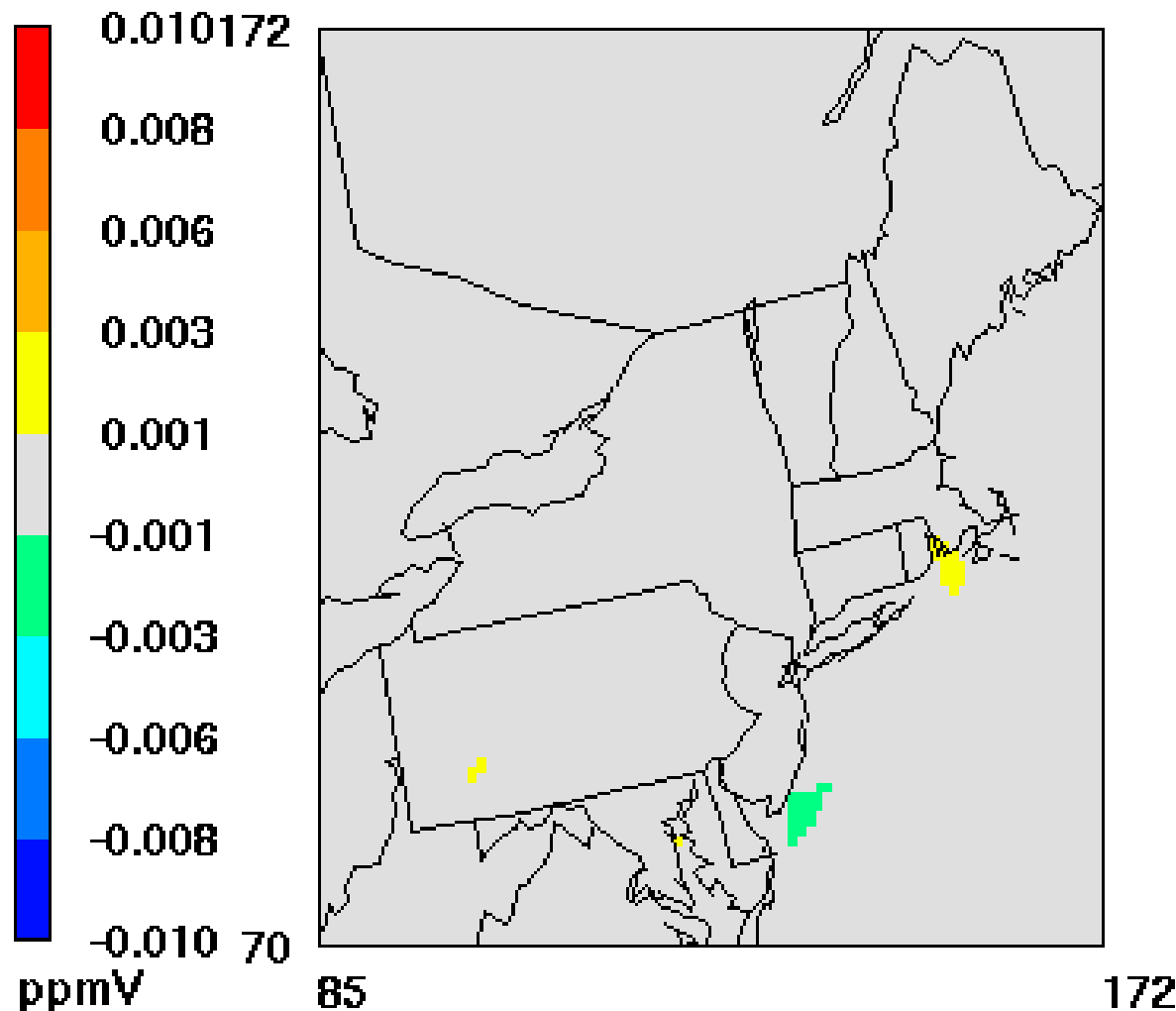
Impact on SO₂ Emissions



Hudson County, NJ

O3_Difference_Plot

Temporal-Default
MANE-VU



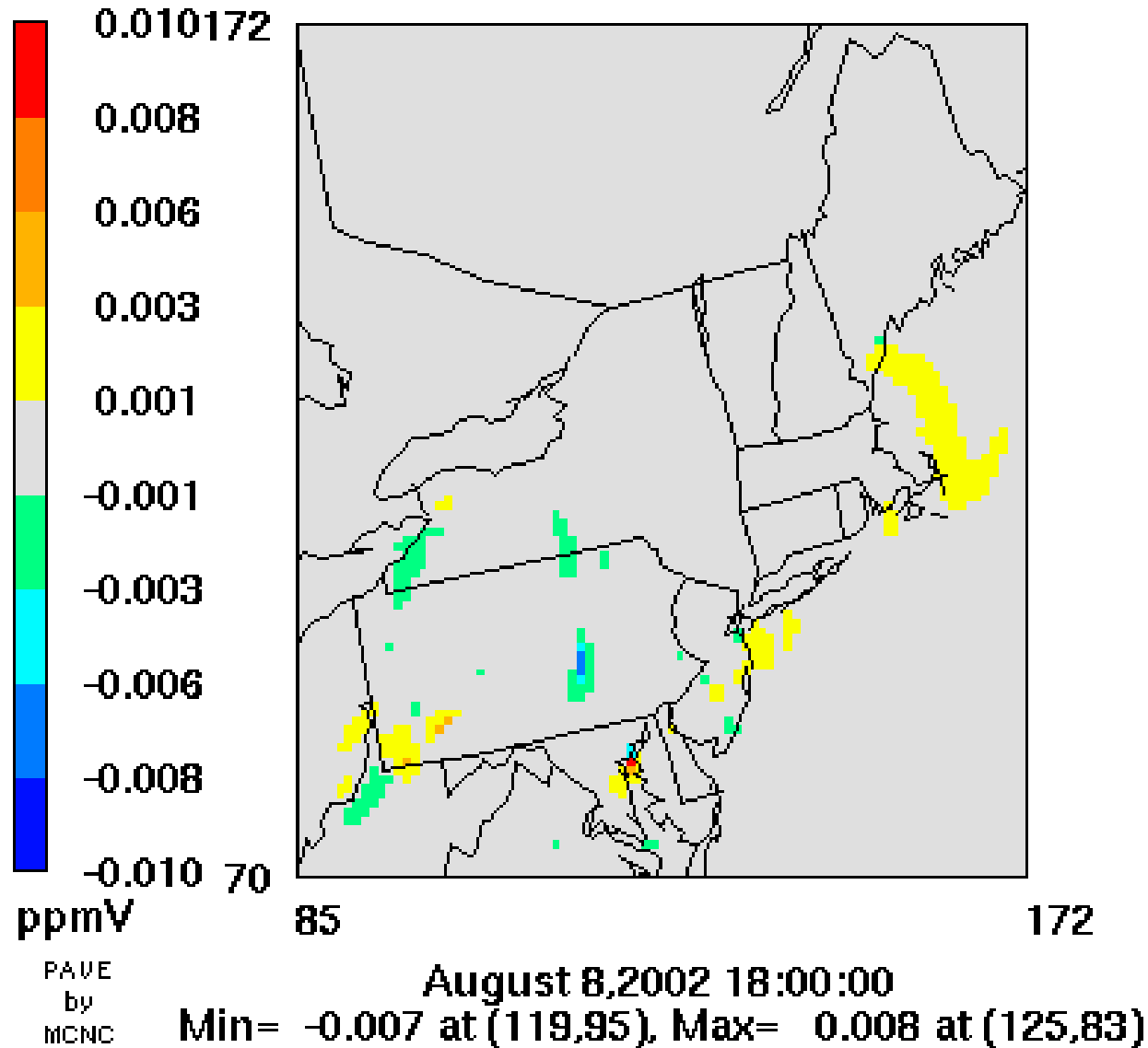
PAVE
by
MCNC

August 8, 2002 12:00:00

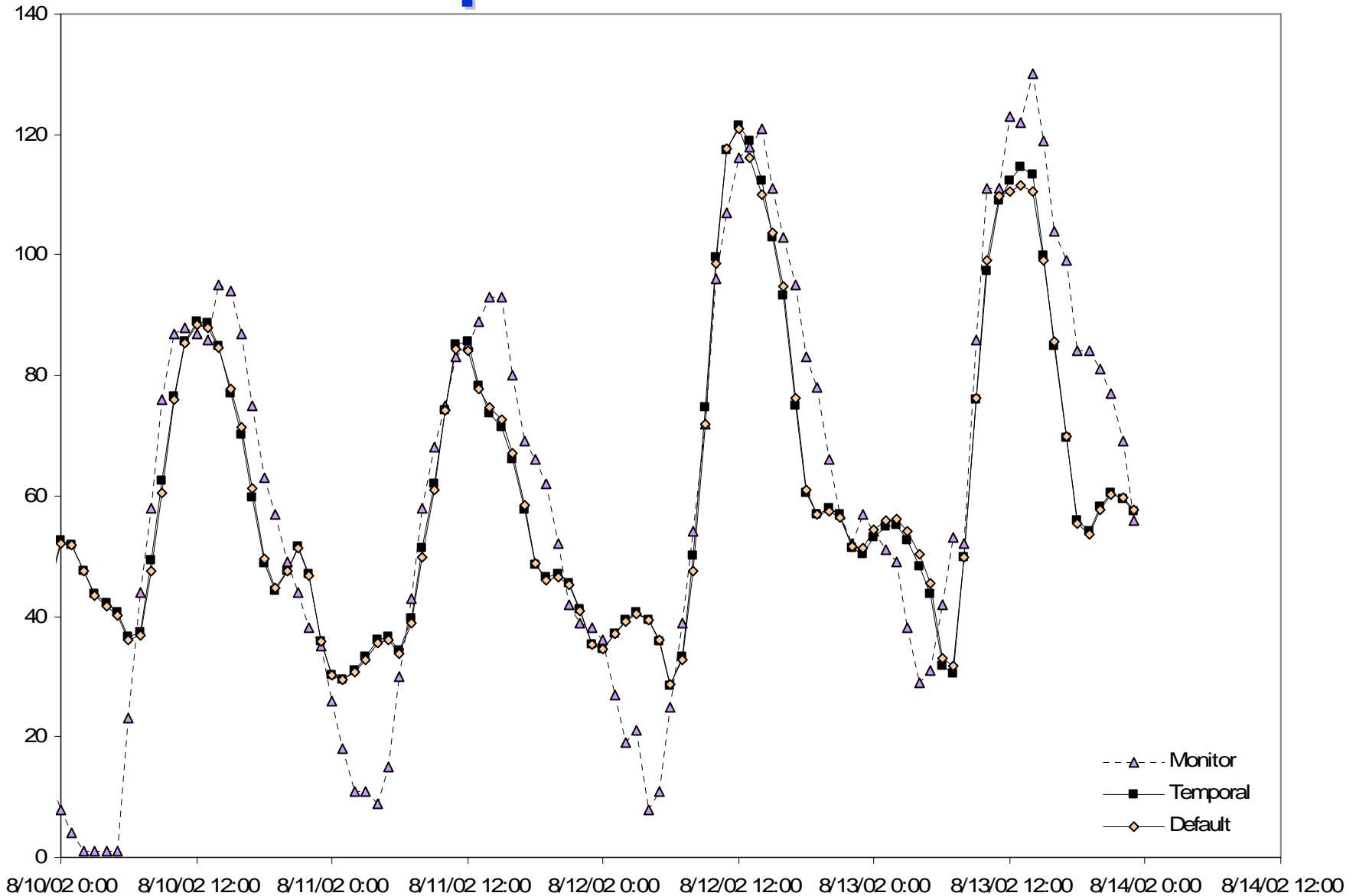
Min= -0.002 at (139,85), Max= 0.002 at (156,111)

O3_Difference_Plot

CEM_Temporal-Default
MANE-VU



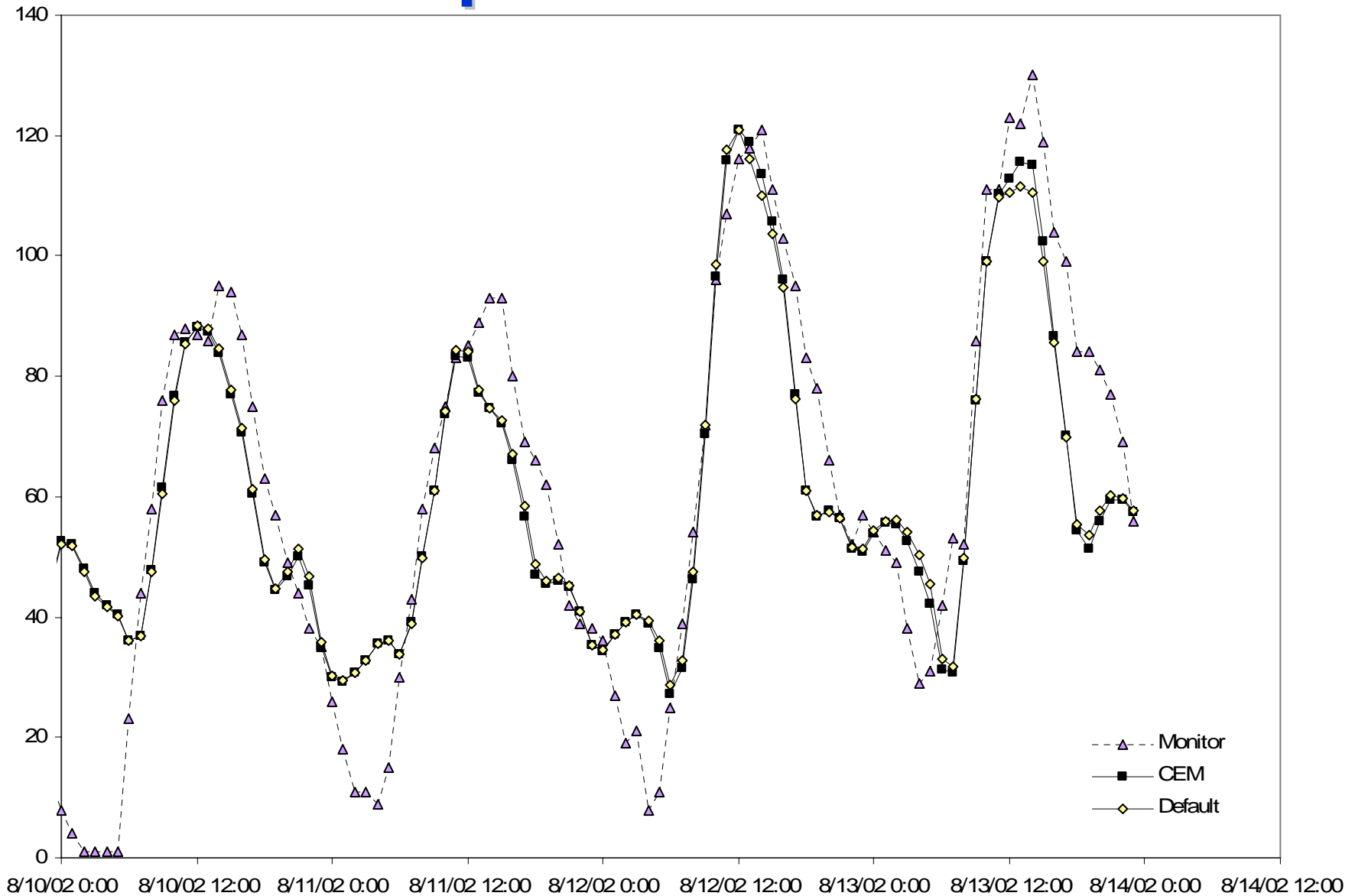
Impact on Ozone



AQS Monitor at Gloucester (340150002)

Temporal - Default

Impact on Ozone



AQS Monitor at Gloucester (340150002)

CEM - Default

Findings

- Preliminary results:
 - Temporal profiles and CEM data changes emissions distributions: In some locations difference in emissions can be as high as high as 3-4 times, especially with CEM
 - Impact on ozone is higher when using CEM data along with state-specific temporal profiles : ± 8 ppb.

Future Work

- Comparison with observed data
- Domainwide Statistics
- Impact on $PM_{2.5}$ (Different episode)
- Facility Specific Temporal Profiles

Acknowledgements

- New Jersey Department Environmental Protection (NJDEP)
- U.S. EPA Center for Exposure and Risk Modeling (CERM)
- New York Department of Environmental Conservation (NYDEC)
- University of Maryland (UMD)
- Mid-Atlantic Regional Air Management Association (MARAMA)
- MANE-VU States

SMOKE Source Code changes to process CEM data

[\\$EDSS_ROOT/subsys/smoke/src/smkinven/rdcempd.f](#)

Line 170

```
CHARACTER(5)  BBUF      ! tmp boiler ID from CEM data
change to
CHARACTER(6)  BBUF      ! tmp boiler ID from CEM data
```

[\\$EDSS_ROOT/subsys/smoke/src/inc/EMSTRG3.EXT](#)

Line 15

```
INTEGER, PARAMETER :: BLRLEN3 = 3 ! boiler field
change to
INTEGER, PARAMETER :: BLRLEN3 = 6 ! boiler field
```

[\\$EDSS_ROOT/subsys/smoke/src/lib/genuslst.f](#)

Addition of following Lines to adjust ORIS and Boiler ID after reading Emissions IDA data

Add at 527-528

```
CORS = ADJUSTR(CORS)
BLID = ADJUSTR(BLID)
```

We made changes in above files based on following code that is reading CEM data.

[\\$EDSS_ROOT/subsys/smoke/src/smkinven/rdcempd.f](#)

Line 303-306

```
C..... There is no error checking to help speed things up
      READ( FDEV, *, ERR=1001, END=299 )
      &   CORS, BBUF, YMMDD, HH, CEMEMIS( CO2IDX ),
      &   CEMEMIS( SO2IDX ), CEMEMIS( NOXIDX ), OPTIME,
      &   GLOAD, SLOAD, HTINPUT
```

Line 333-338

```
C..... Format strings properly. Assumed BLRLEN3 < 5.
      CORS = ADJUSTR( CORS )
      BBUF = ADJUSTL( BBUF )
      BLID = BBUF( 1:BLRLEN3 )
      BLID = ADJUSTR( BLID )
      PNT = BBUF
      PNT = ADJUSTR( PNT )
```

CEM data in
comma delimited format

Table 8.44. CEM Format for individual hour-specific data files

Position	Name	Type	Description
A	ORISID	Char	DOE Plant ID (required) (should match the same field in the PTINV file in IDA format)
B	BLRID	Char	Boiler Identification Code (required) (should match the same field in the PTINV file in IDA format)
C	YMMDD	Int	Date of data in YMMDD format (required)
D	HOUR	Integer	Hour value from 0 to 23
E	CO2	Real	Carbon dioxide emissions (lb/h)
F	SO2	Real	Sulfur dioxide emissions (lb/h)
G	NOXRATE	Real	Nitrogen dioxide emissions (lbMMBtu)
H	OPTIME	Real	Operating time (not used by SMOKE)
I	GLOAD	Real	Not used by SMOKE, but some real number must be in the field
J	SLOAD	Real	Not used by SMOKE, but some real number must be in the field
K	HTINPUT	Real	Heat input (MMBtu)

Adapted from SMOKE Manual v2.1 (U.S. EPA)