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Development of REMSAD emissions tagging scheme in support of MANE-VU contribution assessment

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What's REMSAD model?

- 3-D Eulerian grid model developed by Systems Applications International, Inc. (SAI)
- Nested-grid capabilities and user defined vertical layers
- Simulate both inert and chemically reactive pollutants (micro-CB-IV chemical mechanism)
- Parameterized aerosol chemistry and dynamics for fine and coarse particles
- Tagging scheme for sulfur, nitrogen, cadmium and mercury

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Role of REMSAD modeling

- MANE-VU is building a weight of evidence approach looking at monitoring data, emissions inventory data, regional air-quality modeling and key data analysis findings

- All these techniques have been synthesized and interpreted in an interim "contribution assessment" or pollution apportionment report

- REMSAD is the 2nd most comprehensive model (to CMAQ) with source tagging capability

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REMSAD modeling in Weight of Evidence Approach

Analytical technique	**Approach**
Emissions/distance	Empirical
Incremental Probability	“Receptor”-based trajectory technique
Cluster-weighted Probability	“Receptor”-based trajectory technique
Emissions x upwind probability	Empirical/trajectory hybrid
Source Apportionment Approaches	Receptor model/trajectory hybrid
REMSAD tagged species	“Source”-based grid model
CALPUFF with MM5-based meteorology	“Source”-based dispersion model
CALPUFF with observation based meteorology	“Source”-based dispersion model

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Previous REMSAD modeling

- Sulfur tagging: Elevated point sources from 32 eastern states only
- USEPA Clear Skies [2003] 2001 “proxy” inventory
- USEPA 1996 MM5 meteorology
- National domain with 36km grid

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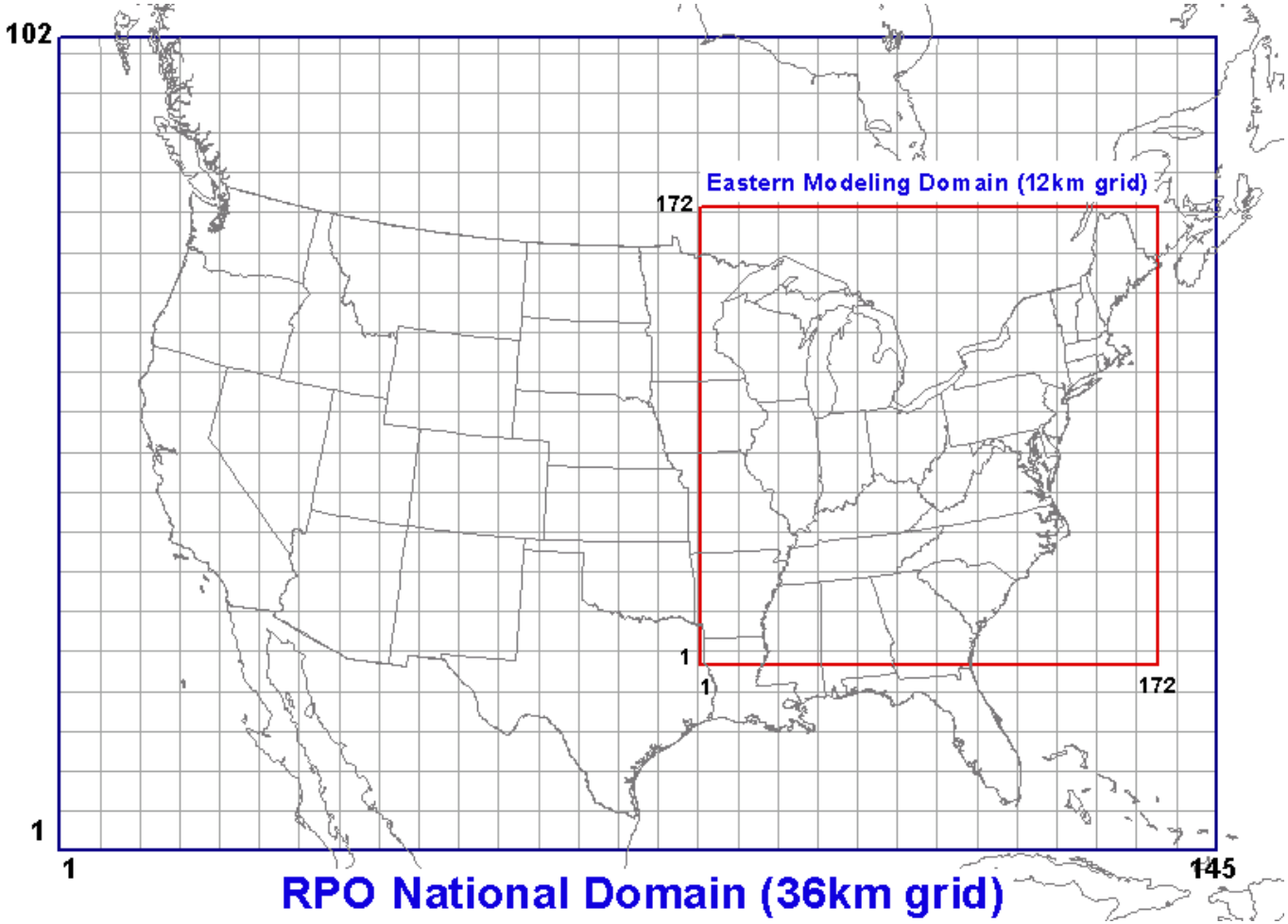
"New" REMSAD modeling platform

- Sulfur source tagging:
  - Elevated & Low level sources from 31 eastern states and Canada (Run 1, 2, 3)
- Boundary Conditions are tagged
- RPO 2002 EI (MANE-VU/VISTAS/MRPO/CENRAP) and 2000/2002 Canadian Inventory
- UMD 2002 MM5 meteorology
- Eastern US domain with 12km grid

REMSAD modeling domain



- 12km Eastern US domain
- 36km National Domain CMAQ run served as BC

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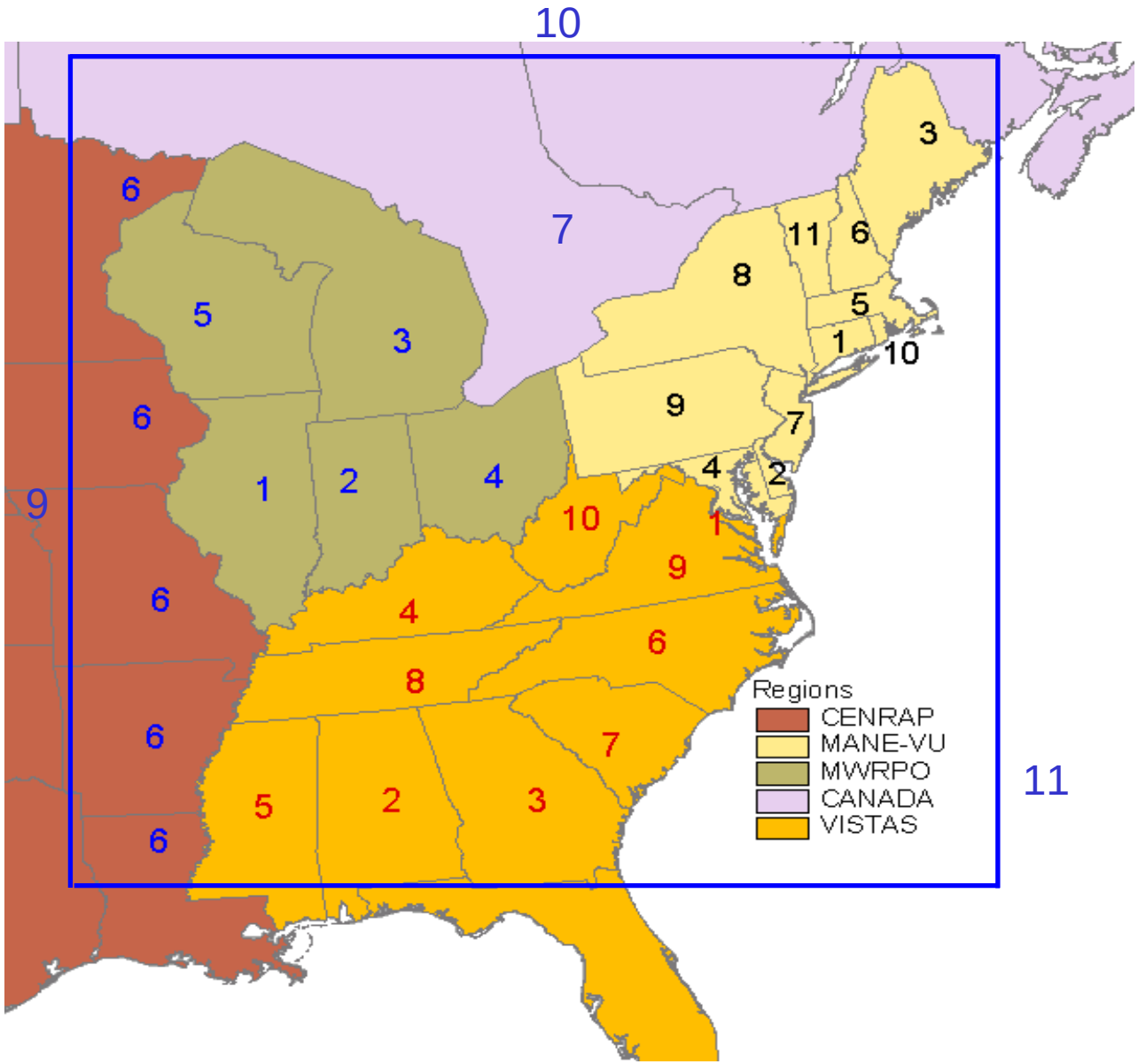
Emissions Inventory Used

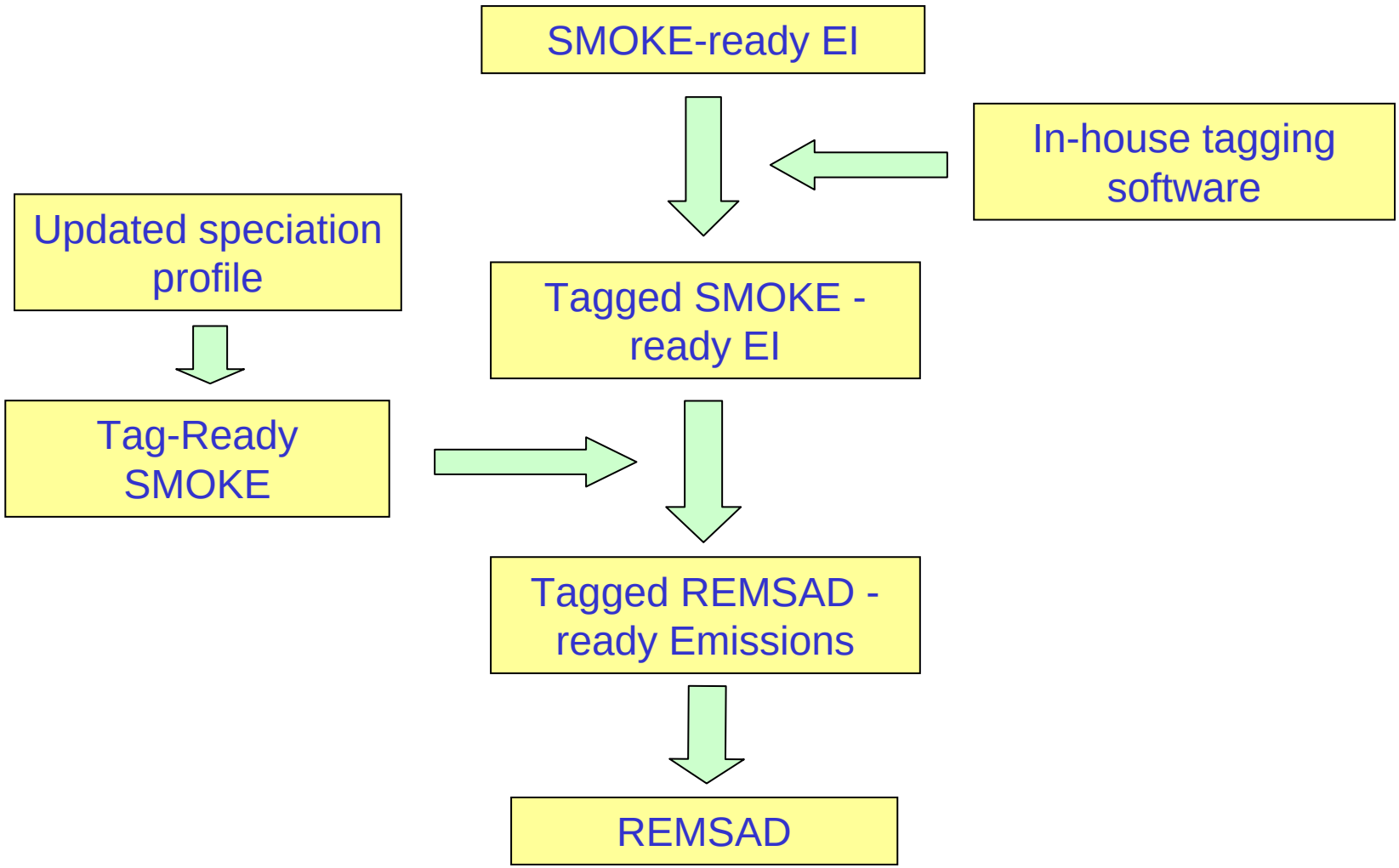
- MANE-VU: Ver. 2
- Other RPOs : VISTAS/MRPO/CENRAP (EI utilized for the VISTAS revised Phase II modeling)
- CANADA : Y2000 EC emissions, 2002 NPRI (from NYSDEC)
- Biogenic : BEIS3.12 through SMOKE

REMSAD Emission Tags (Run 1, 2, 3)

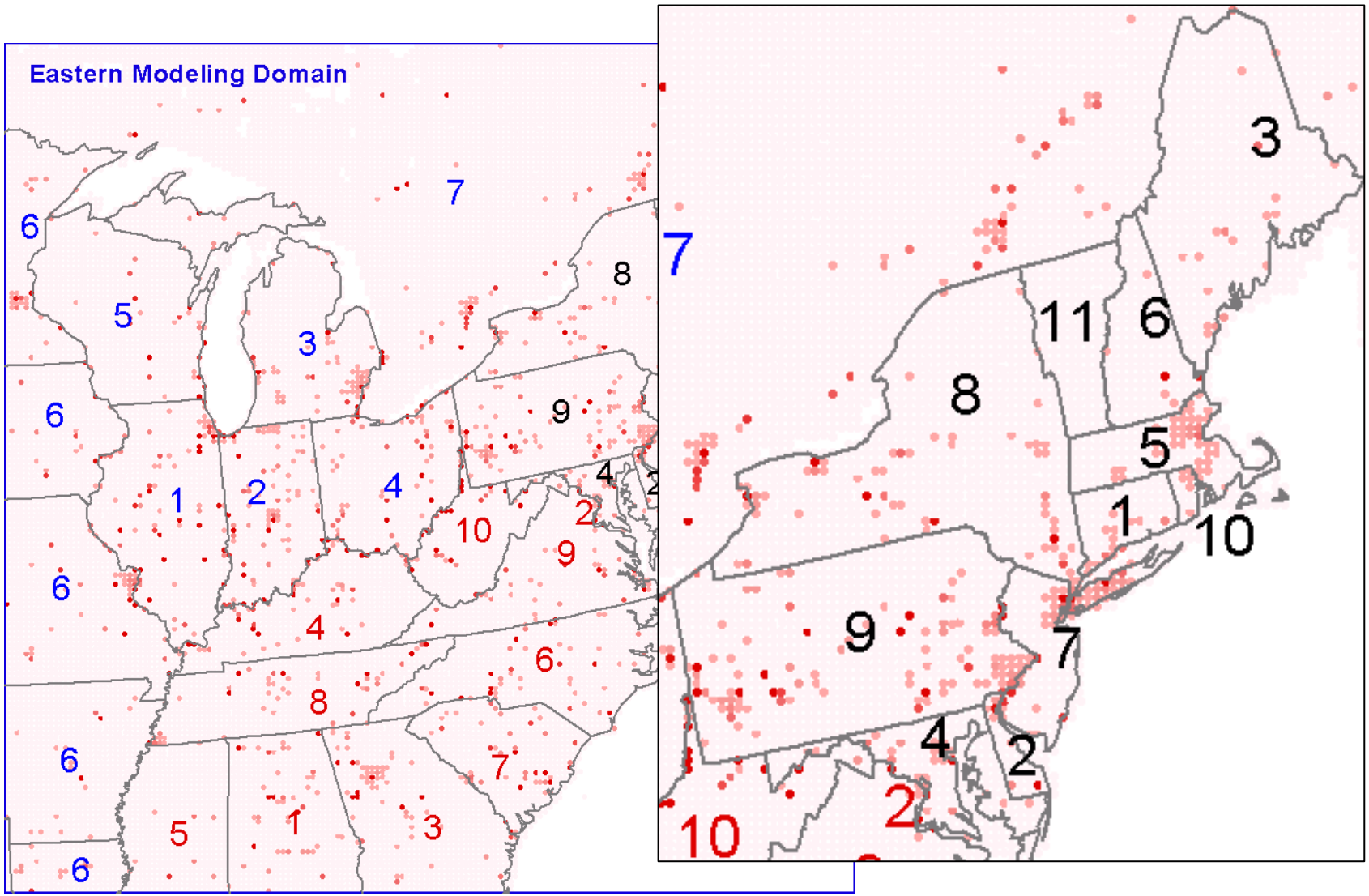


Black : Run 1
Red : Run 2
Blue : Run 3

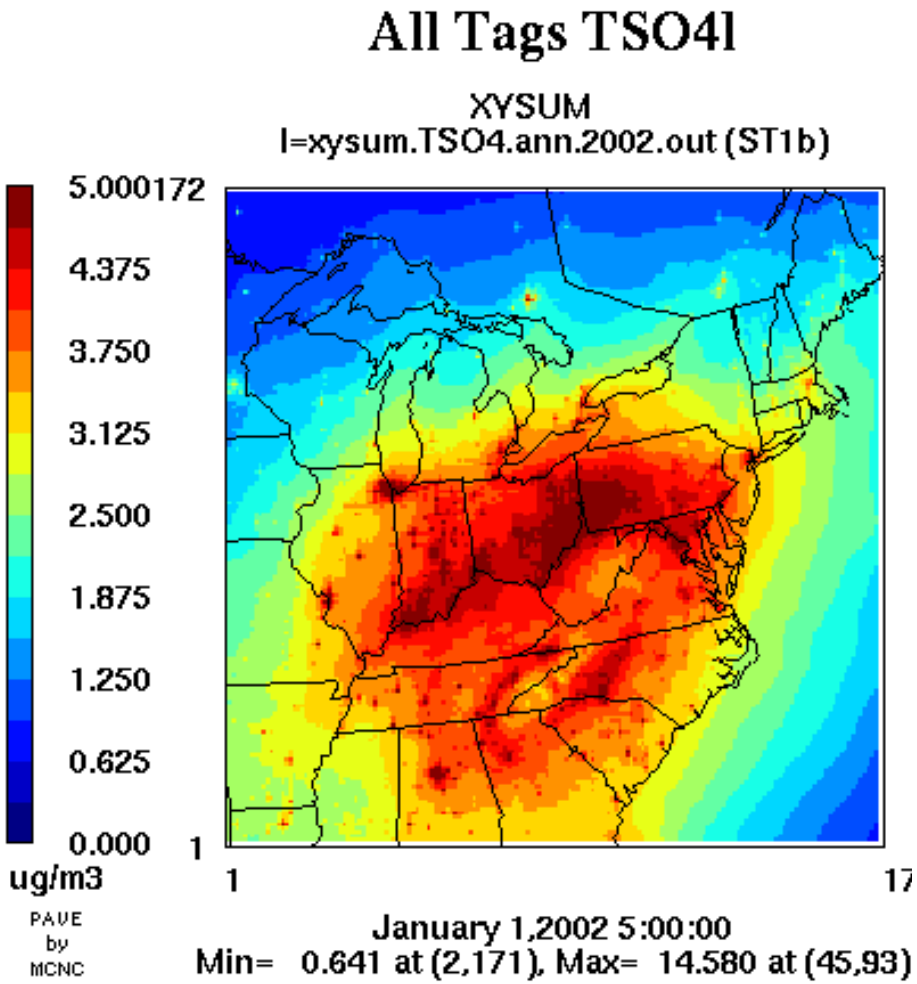
REMSAD Emissions Tagging

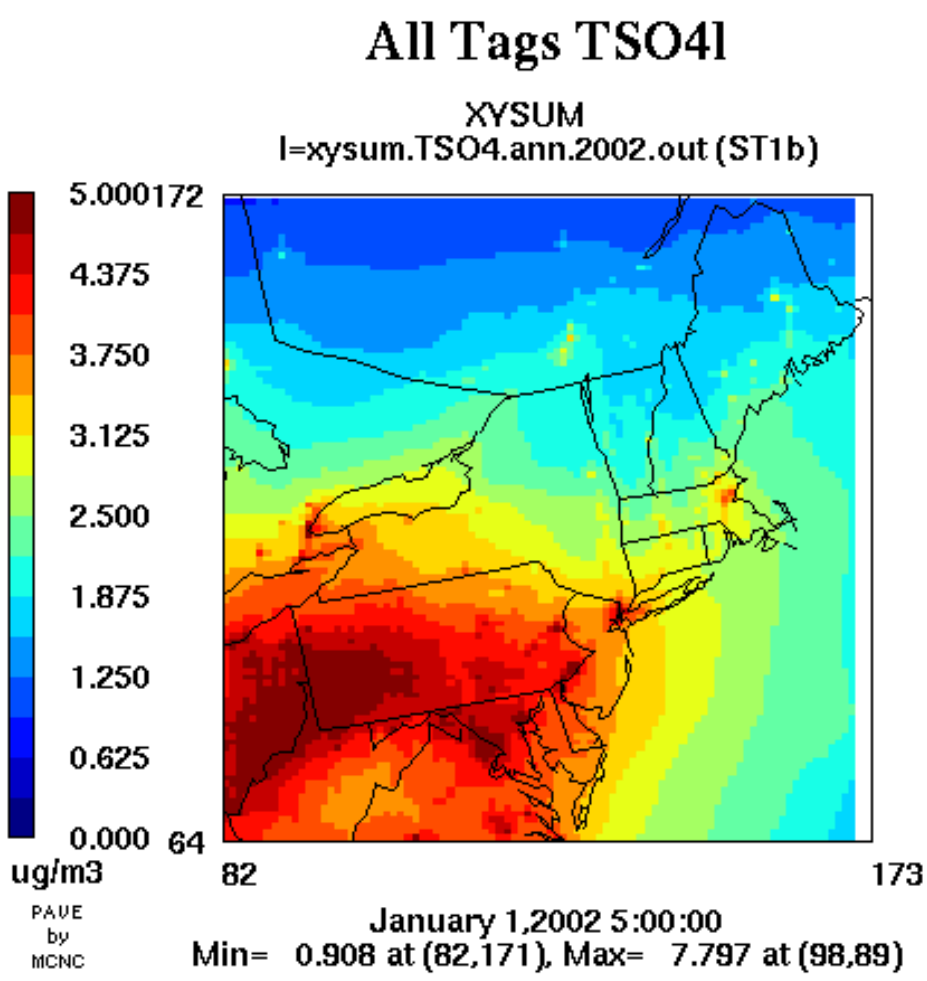


Tagged Emissions

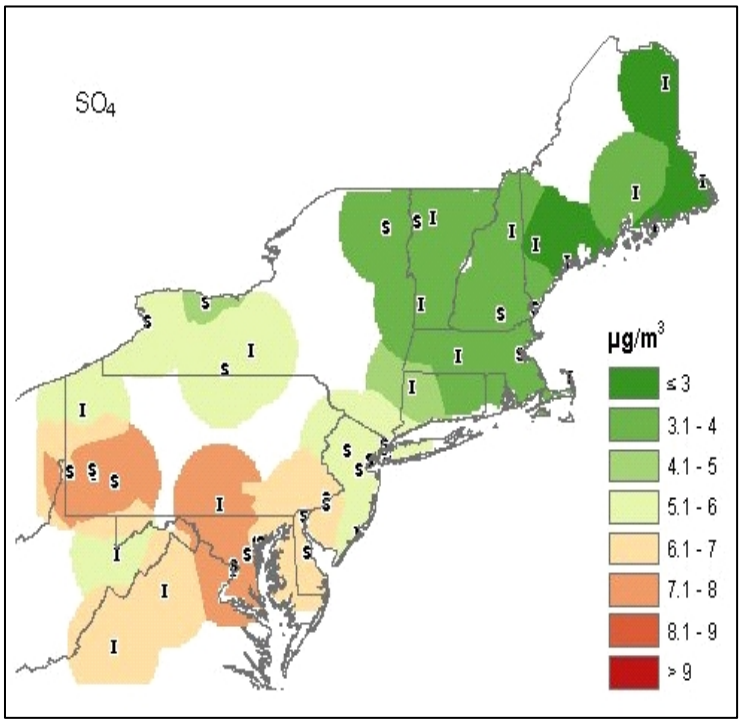


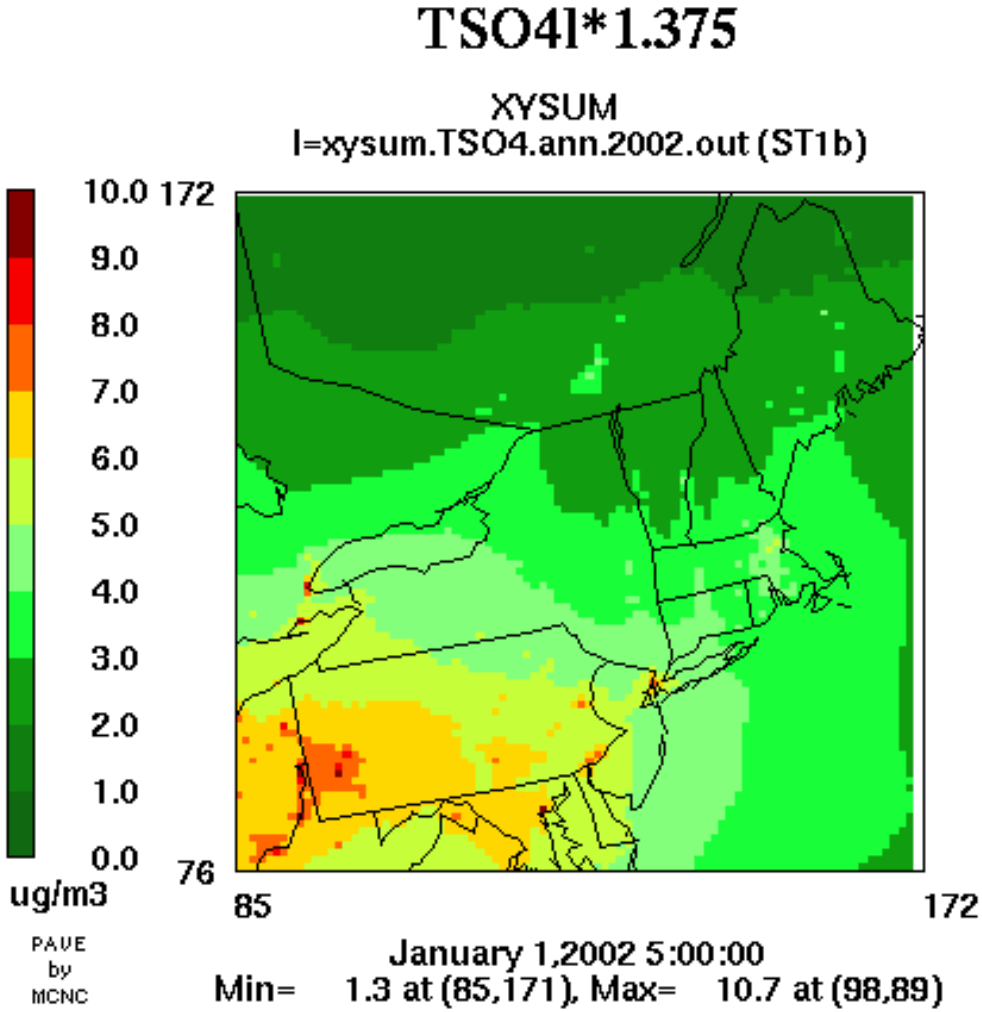
REMSAD concentration





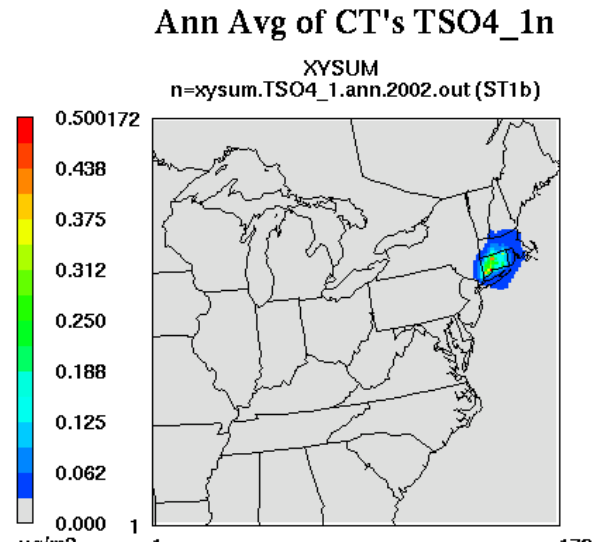
REMSAD performance

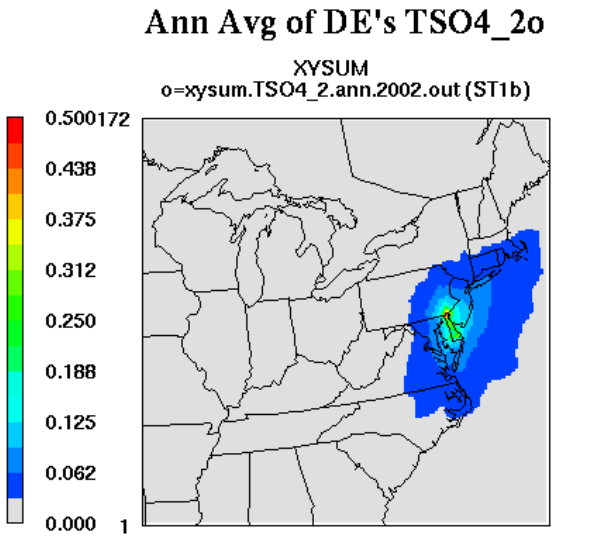


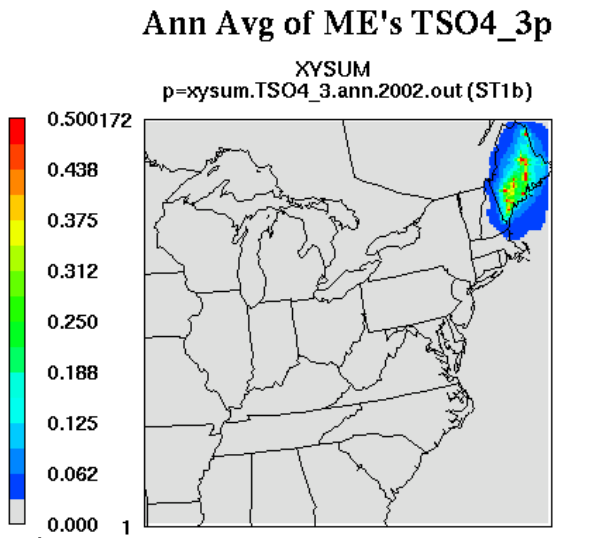


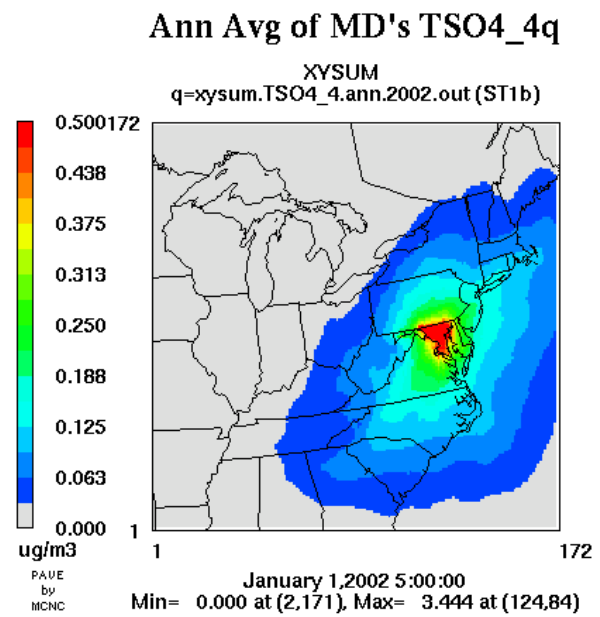
IMPROVE/STN measurement vs. REMSAD (SO4)

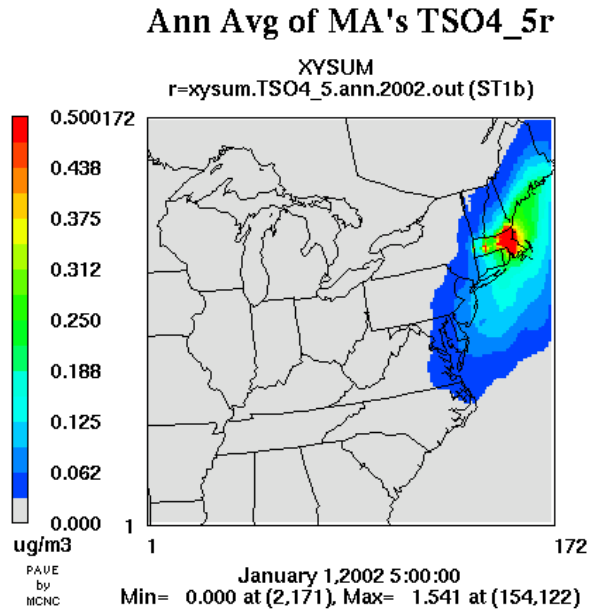
REMSAD tagged concentration

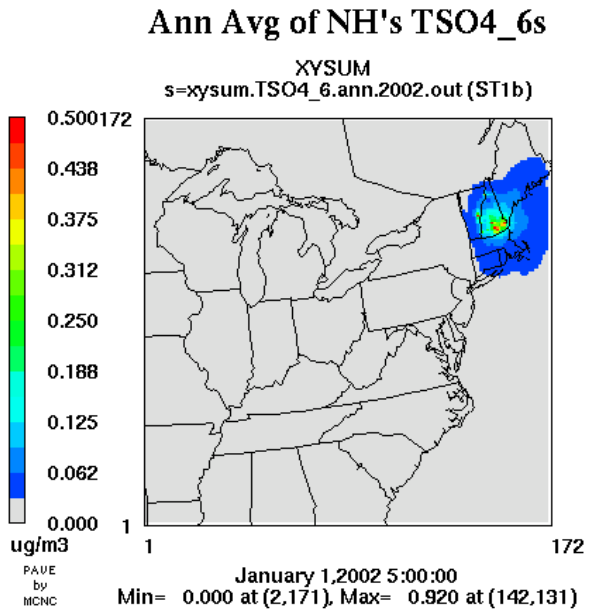




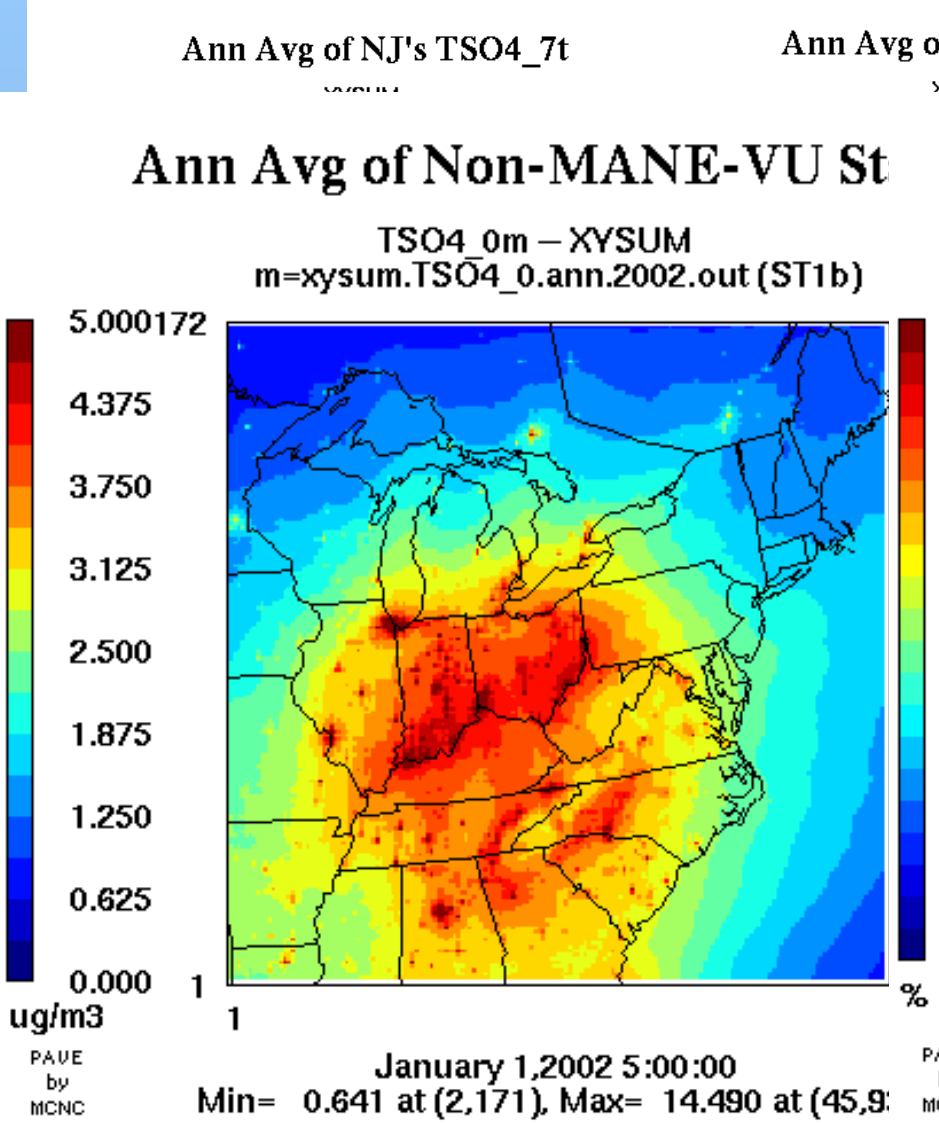








REMSAD tagged concentration



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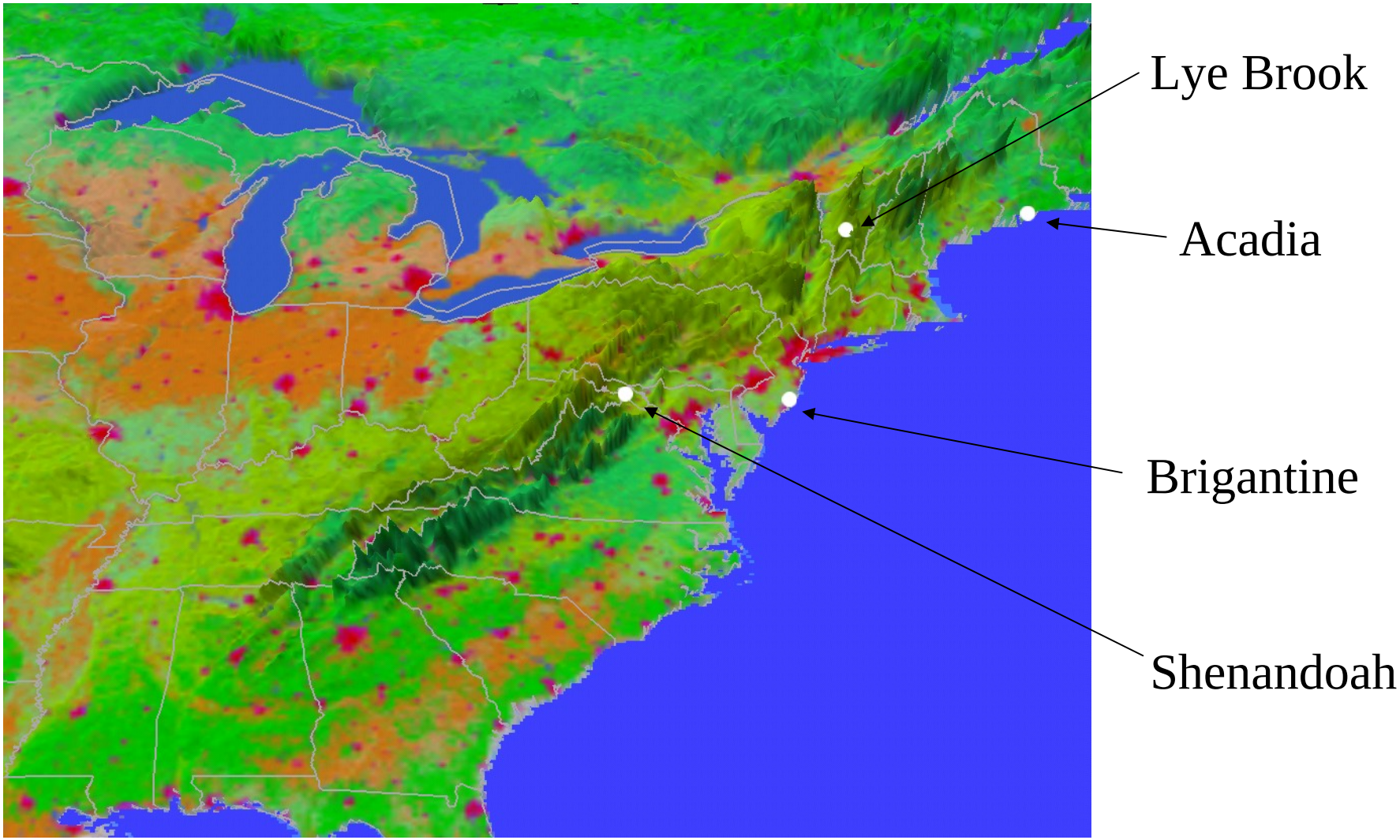
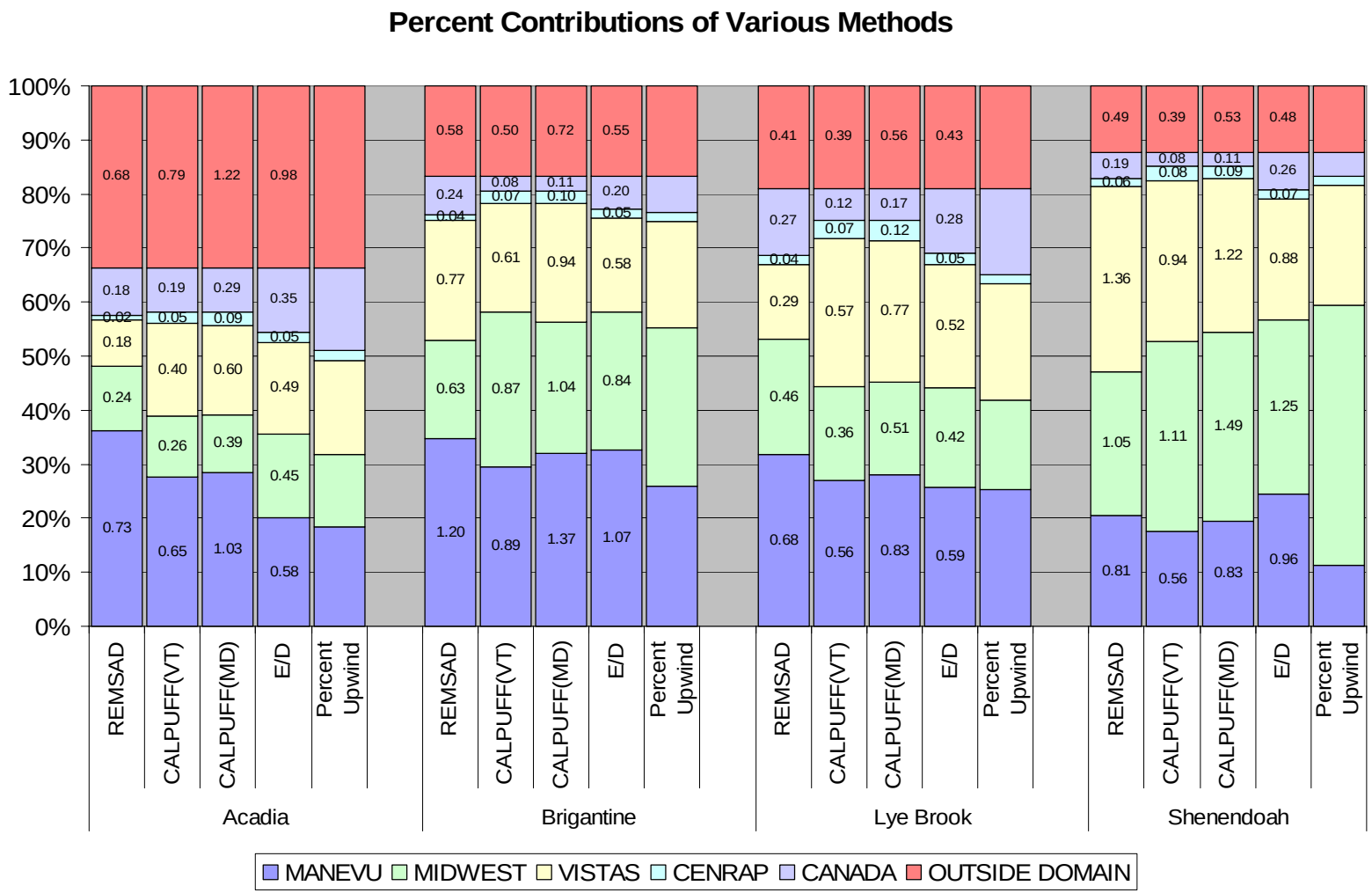
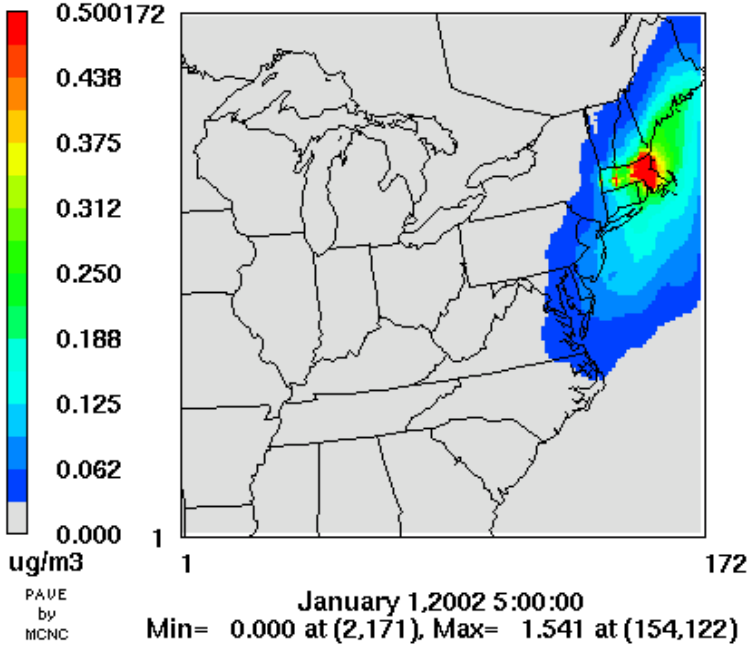
Location of four class-I areas (receptor site)

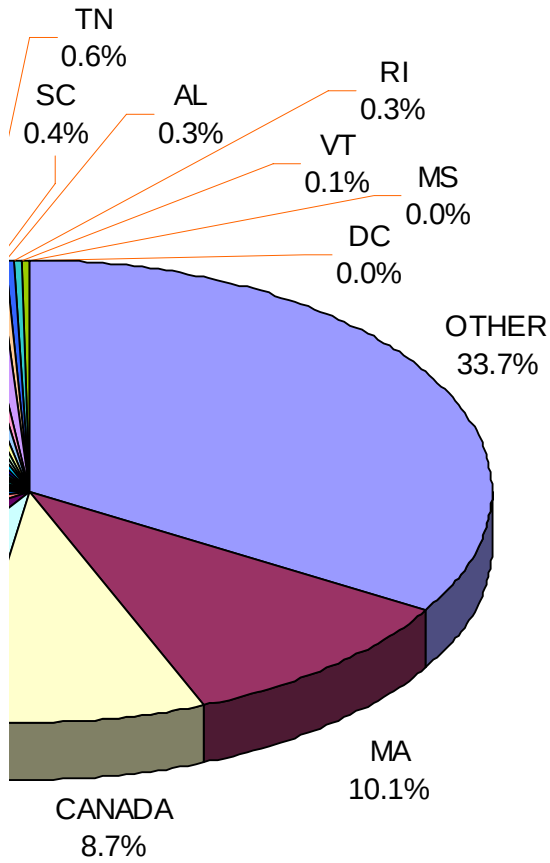


Contribution analysis
(Annual average sulfate concentration)



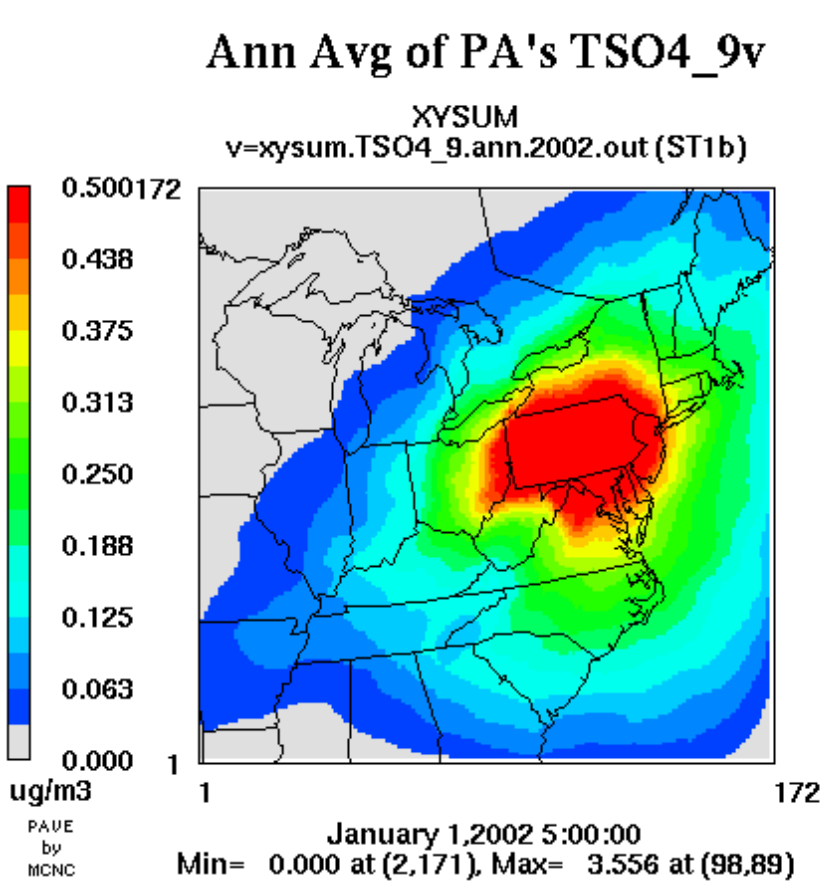
Contribution to PM sulfate in a receptor site

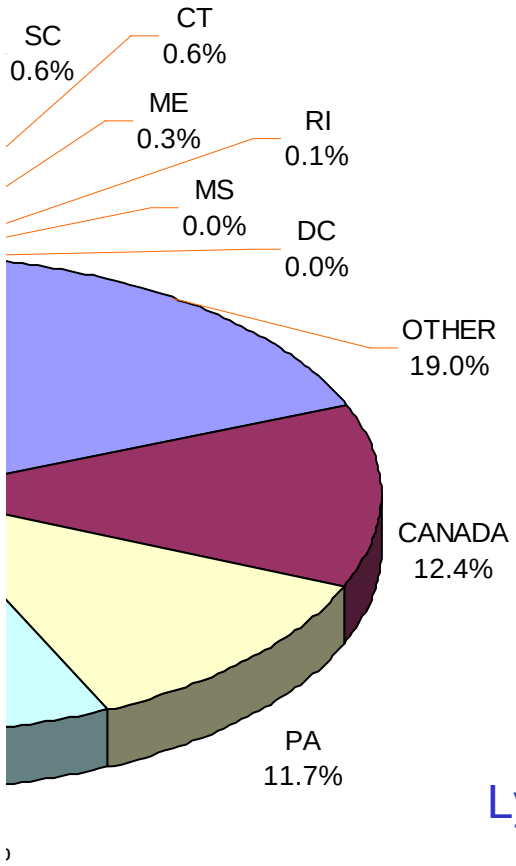




Acadia NP

Contribution to PM sulfate in a receptor site





Lye Brook, VT

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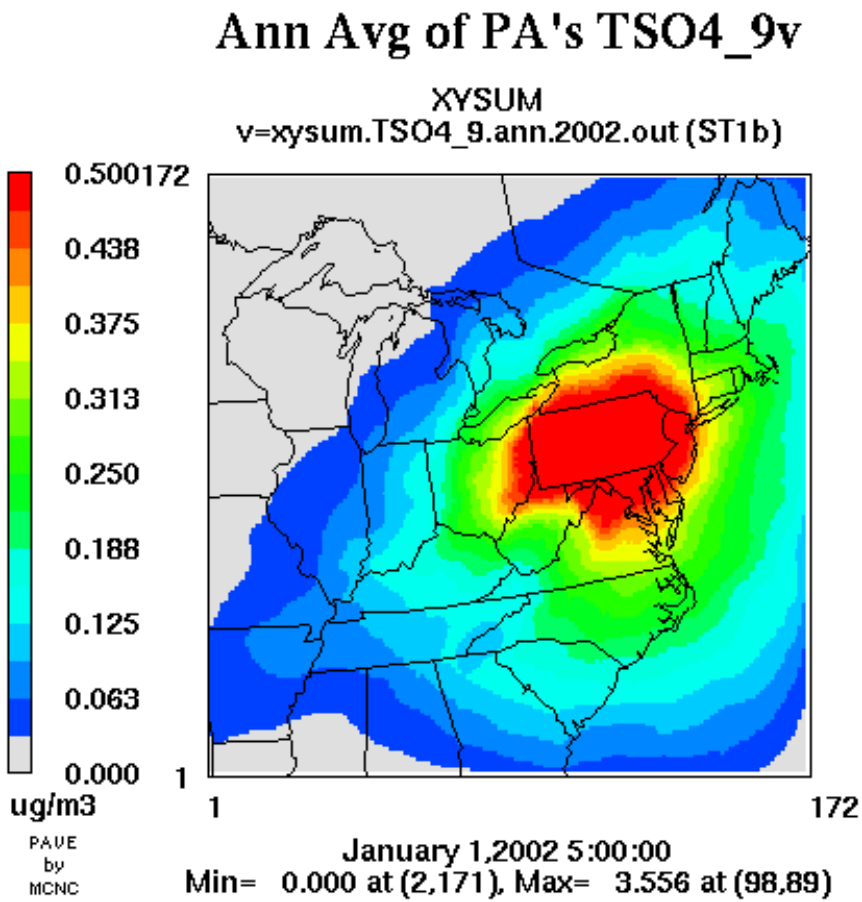
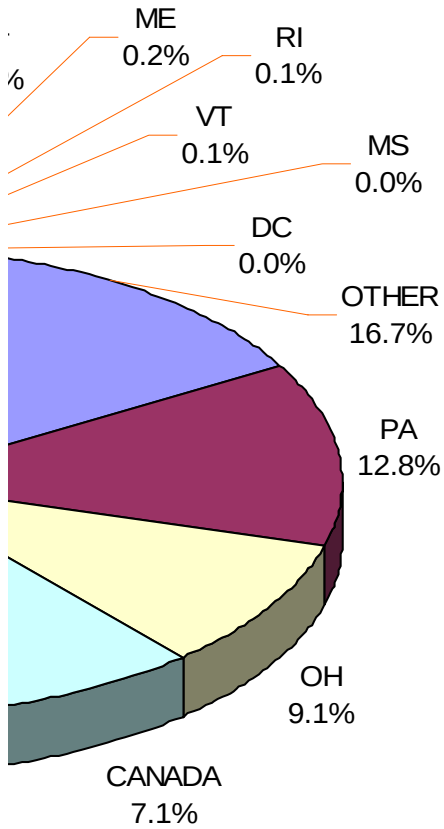
Contribution to PM sulfate in a receptor site





Brigantine, NJ

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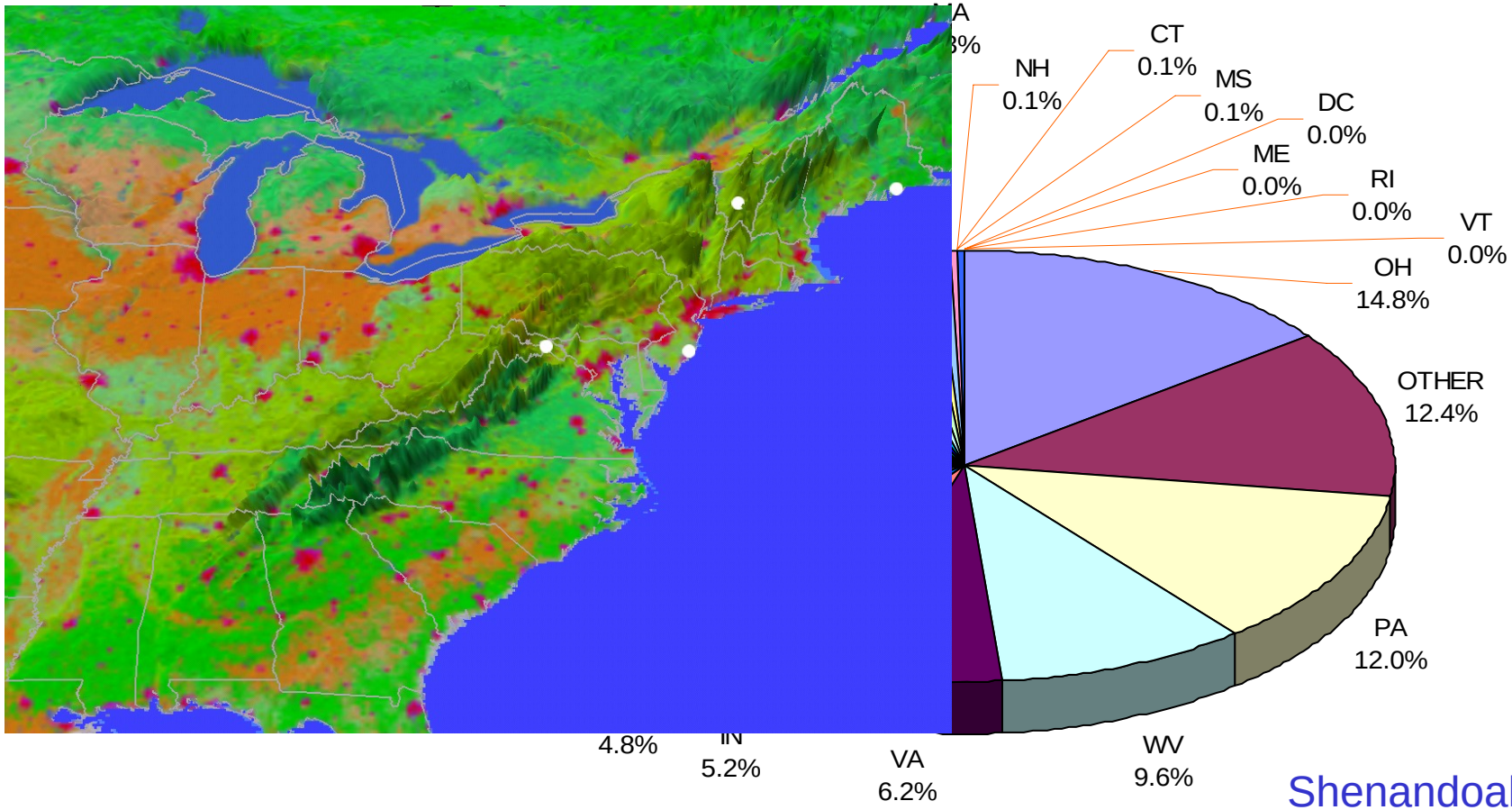
Contribution to PM sulfate in a receptor site



Shenandoah, VA

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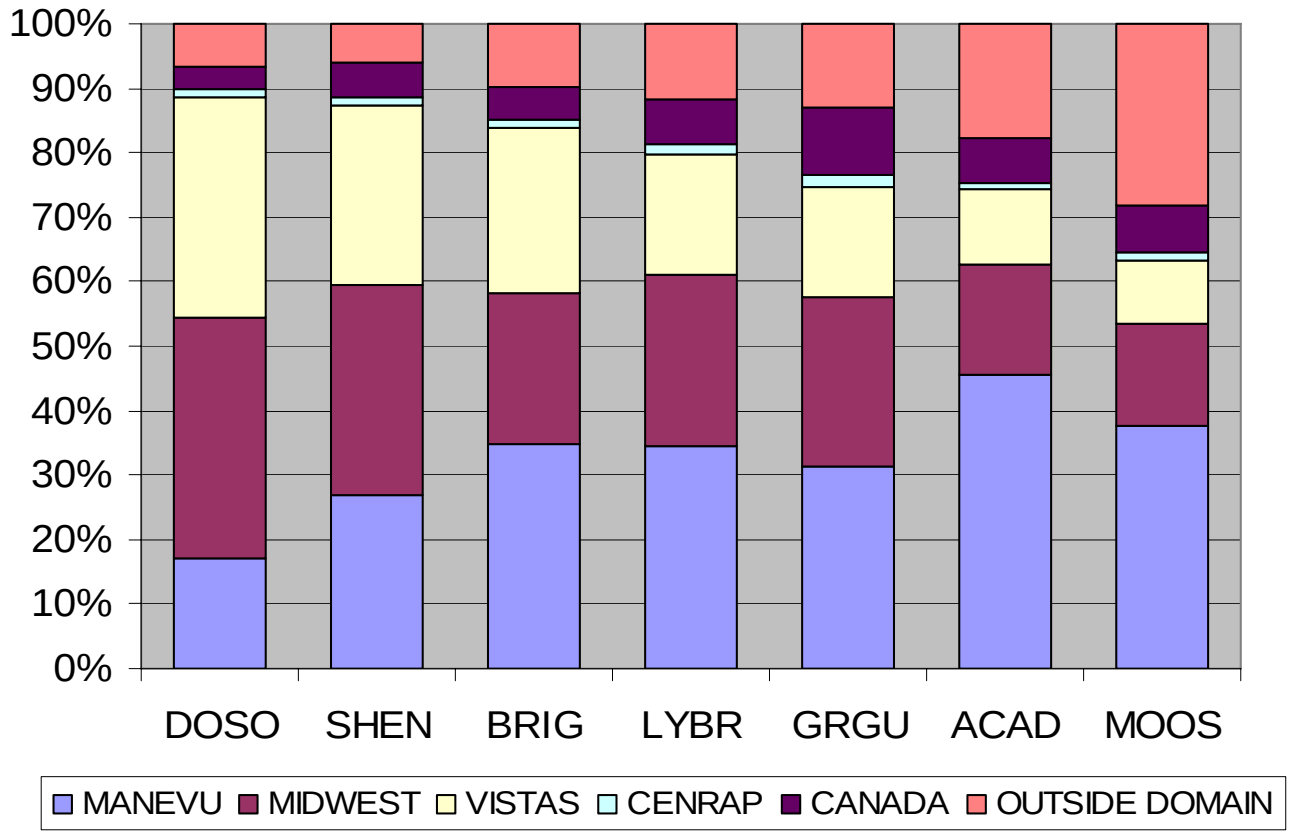
Comparison of Sulfate Extinctions on 20% Worst days



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Conclusion and On-going Work

- **Emissions tagging can reveal forward source contributions without having many zero-out runs**
- **Will do the same emissions processing and air quality modeling for the year 2018 control case (BOTW)**
- **NESCAUM has been using REMSAD model for mercury tagging as well but will move on to tagging version of CMAQ as it will be available in the near future**
- **More detailed information can be found in our contribution assessment report**

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Thank You!

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Emissions by Sources