

CALPUFF Ambient SO₄ Modeling
VT-MD-NESCAUM / MANE-VU RPO Study

VT Modeling PHASE II
June 2005 - November 2005

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MANE-VU/MARAMA Science Meeting
Baltimore, MD November 9, 2005

Purposes of this Modeling Study

(a joint effort involving VT APCD, MD DEP, and NESCAUM)

- 1. Develop a modeling platform for use in preliminary evaluation of individual “BART Eligible” sources in the northeastern U.S. : re contributions to regional haze for the MANE-VU RPO.**
- 2. Create a modeling platform that could be used to prioritize strategy modeling runs to be done later using CMAQ / REMSAD.**

The primary focus of the modeling is on sulfur emissions resulting in secondary ambient impacts of sulfate particles.

CALPUFF MODEL SETUP

CALPUFF_v5.711_030625 BETA version

DOMAIN compatible with standard RPO Projection.

(This BETA version dated June 25, 2003 was found to be necessary if input of hourly variable CEMS emission rates , contained in a PTEMARB.dat file, are being used.)

Params.dat file was edited to accommodate a large number of sources, a large number of ozone and surface met stations and a large number of precipitation stations.

parameter(mxpuff=2000000)	MAX PUFFS on Grid
parameter(mxnx=250,mxny=250,mxnz=12)	METEOROLOGY XYZ Grid max#
parameter(mxnxg=250,mxnyg=250)	COMPUTATIONAL XY Grid max#
parameter(mxrec=10000)	MAX Discrete Receptors
parameter(mxss=980,mxus=99,mxps=1500)	MAX Surf/Rawind/Precip Stations
parameter(mxpt1=3500,mxpt2=3500)	MAX Pt(const) Pt(variable) Srcs
parameter(mxarea=10000)	MAX Area Srcs
parameter(mxoz=600)	MAX Ozone Monitors

Vermont CALPUFF Modeling Study

REGIONAL DOMAIN

70 x 64 grid at 36 km allows inclusion of source regions affecting all Class I areas in the northeast portion of DOMAIN

SW corner of grid: 33.5 North Latitude & 98.2 West Longitude

Grid projection is Lambert Conformal.

Domain is consistent with RPO projection specifications.

MEASURED METEOROLOGY UTILIZED FOR REGIONAL DOMAIN

2002 has been processed utilizing NWS data sets
meteorological inputs consist of

700 surface stations : 30 radiosonde stations : 1100 precipitation sites

Upper Air Radiosonde Data – When possible, existing soundings with missing data were filled to allow their use

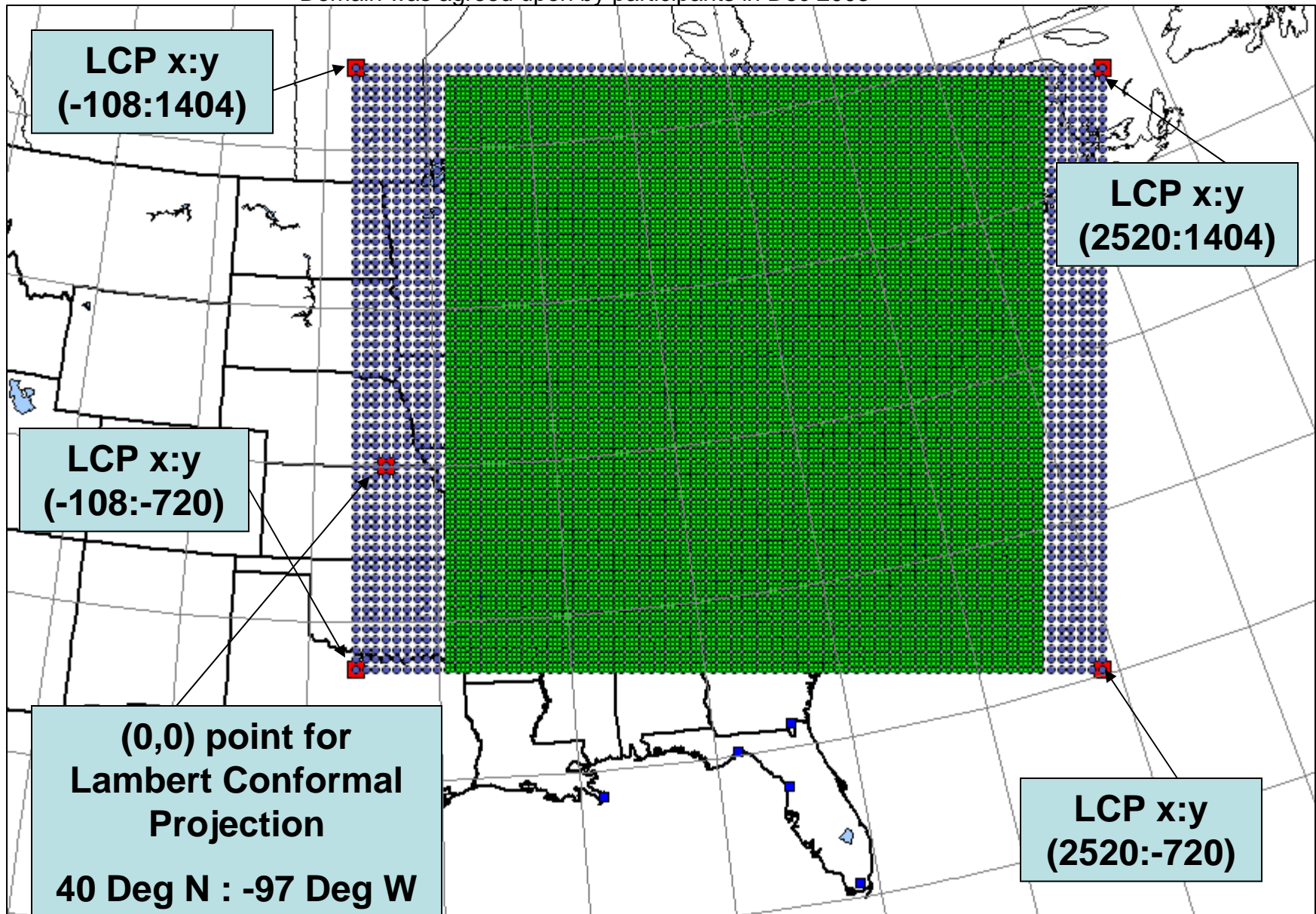
Surface Weather Data - The Integrated Surface Hourly Observations (ISHO) Dataset from NCDC was utilized. No Canadian Data Available.

Precipitation Data - Data from the NCDC CD: US Hourly Precipitation Data (TD3240 format), was utilized.

(A laborious process because of the number of stations involved.)

CALMET MET DOMAIN (Blue) / CALPUFF COMPUTATIONAL DOMAIN (Green)

Domain was agreed upon by participants in Dec 2003



Emission Inputs for First Phase CALPUFF runs completed in September 2004


<u>DOMAIN-WIDE SOURCES</u>		<u>Annual 2002 Emissions in TONS</u>		
<u>Source Type</u>		<u>SOx</u>	<u>NOx</u>	<u>PM2.5</u>
* U.S. EGUs (778 with CEMS Data)		7,460,961	2,833,981	n/a
Canadian NPRI Inventory 52 Stacks		859,688	147,945	15,513
U.S. NEI-1999 2109 Stacks		2,423,689	467,824	18,753
U.S. NEI-1999 3453 20km GridAreas		1,288,298	1,143,541	318,548
TOTALS included in Current Runs		12,032,636	4,593,291	352,814

* Hourly variable emissions were used in evaluations to date. CEMS data does not include Stack Temperature. Default was set at 422 K. Some combined points in database do not have Stack Velocity. Default set at 14.67 m/sec based on average of points with data.

1999 NEI point source Information used for Phase I testing only: will be replaced with 2002 NEI data when available

NEI Point Source Data file was read source by source: If Annual SO₂ for a source was greater than 100.0 Tons for any source in DOMAIN, source was modeled as a PT. If Annual SO₂ for a source was greater than 10.0 Tons for any source within 100 Km of any of 51 Northeastern IMPROVE or FRM PM_{2.5} monitoring sites, source was modeled as a PT.

SO2 Emission Inputs for 2nd Phase CALPUFF runs completed in November 2005

<u>DOMAIN-WIDE SOURCES</u>		<u>Annual 2002 Emissions in TONS</u>		
<u>Source Type</u>		<u>SOx</u>	<u>NOx</u>	<u>PM2.5</u>
	U.S. EGUs (869 with CEMS Data)	7,770,423	not yet summed	
	Canadian NPRI Inventory 52 Stacks	859,688	147,945	15,513
*	U.S. NEI-2002 5981 Stacks	1,835,735	not yet summed	
	U.S. NEI-2002 3381 20km GridAreas	1,617,890	not yet summed	
	U.S. NEI-2002 245 Cnty On-Road	71,287	not yet summed	
	U.S. NEI-2001 1117 Cnty Non-RdMob	1,224,159	not yet summed	
	U.S. NEI-2001 1067 Cnty Area Srcs	930,979	not yet summed	
TOTALS included in Current Runs		14,310,161	NO TOTAL	



Hourly variable emissions were used in evaluations to date. CEMS data does not include Stack Temperature. Default was set at 422 K. Some combined points in database do not have Stack Velocity. Default set at 14.67 m/sec based on average of points with data.

- * NEI Point Source Data file was read source by source: If Annual SO2 for a source was greater than 100.0 Tons for any source in DOMAIN, source was modeled as a PT. If Annual SO2 for a source was greater than 10.0 Tons for any source within 100 Km of any of 51 Northeastern IMPROVE or FRM PM2.5 monitoring sites, source was modeled as a PT.

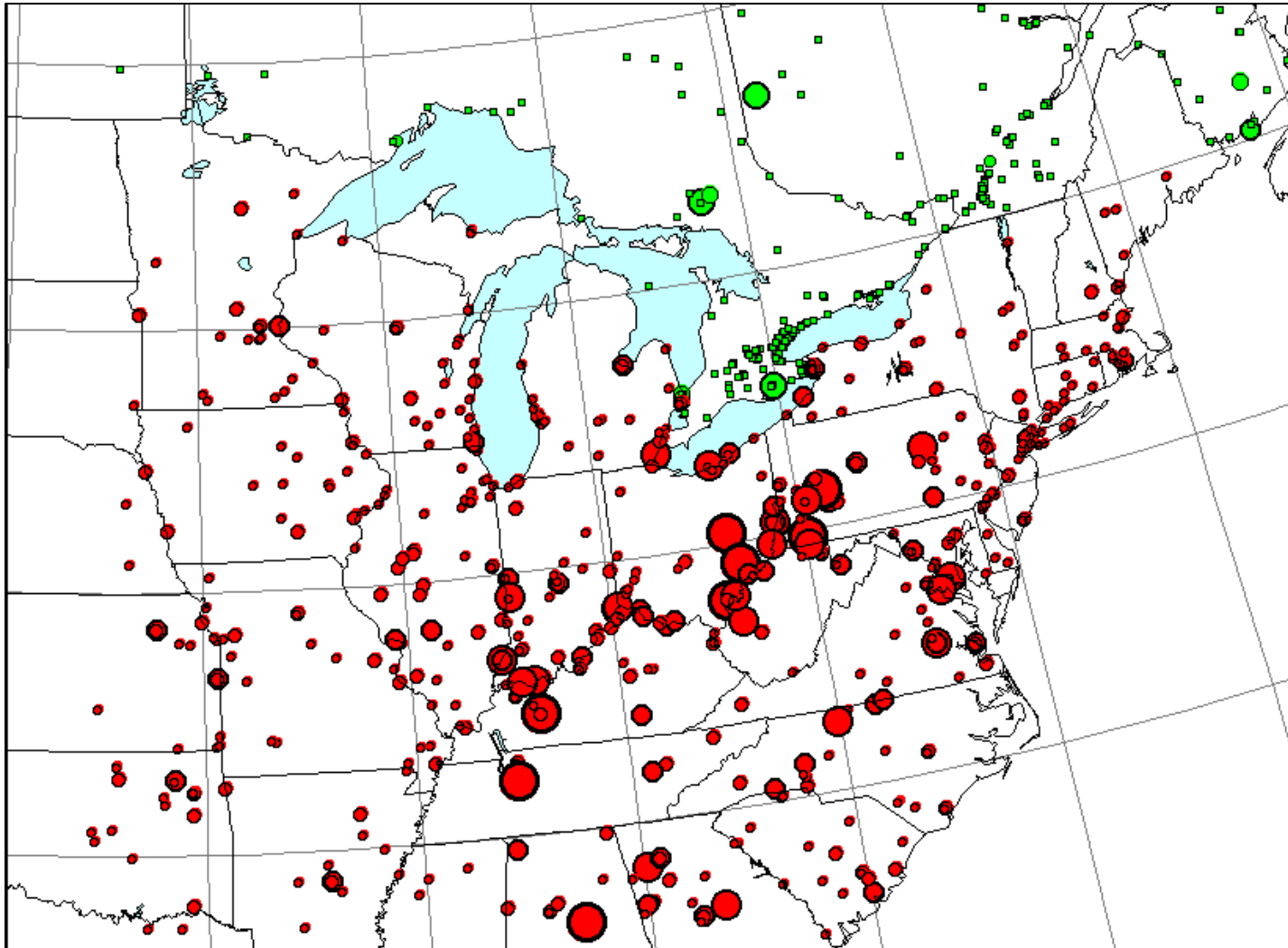
Detailed Emission Inputs for 2nd Phase VT CALPUFF runs completed in **NOVEMBER 2005**

2002 SO₂ Emissions Modeled (13,450,473 Tons) (14,310,161 with Canadian)

STATE	EGUs using CEMS	NEI Large PT as PT	NEI Small PT 20kmx20km AREA	MOBILE ON-ROAD as CNTY km ²	MOBILE NON-ROAD as CNTY km ²	NEI AREA as CNTY km ²
AL	301,262	28,979	31,376	not modeled	4,153	14,725
CT	10,131	1,907	289	1,534	8,149	11,489
DC	1,073	969	23	1,599	1,677	7,940
DE	31,144	5,002	4,045	2,942	18,180	5,744
GA	497,490	18,468	21,110	not modeled	9,074	29,014
IA	125,460	49,940	51,056	not modeled	4,429	not modeled
IL	342,762	142,503	148,152	not modeled	360,917	77,362
IN	720,890	285,213	294,066	not modeled	11,976	98,268
KY	462,012	30,689	34,363	not modeled	80,477	67,317
MA	90,194	11,220	3,418	3,338	9,776	40,421
MD	248,407	34,690	2,636	22,835	121,496	103,098
ME	1,923	20,612	720	2,682	6,620	10,689
MI	319,673	405,182	625,992	not modeled	6,736	23,069
MN	93,895	124,346	130,641	not modeled	5,701	3,990
MS	8	7,915	9,043	not modeled	10,071	176
NC	442,505	54,051	60,888	not modeled	51,775	8,625
NH	41,425	1,925	680	479	3,591	4,416
NJ	46,791	7,823	1,021	5,815	44,682	16,800
NY	216,112	30,187	6,974	9,781	38,960	117,584
OH	1,073,526	56,936	684	not modeled	83,946	22,961
PA	788,130	90,459	22,341	19,417	58,309	112,610
SC	189,252	55,119	60,483	not modeled	21,802	10,134
TN	302,876	84,655	5,609	not modeled	79,963	28,677
VA	224,375	20,364	56,180	not modeled	38,166	35,895
VT	5	876	39	515	25,580	2,322
WI	187,937	249,929	4,917	not modeled	5,616	2,065
WV	489,823	15,776	41,123	not modeled	106,622	71,793
RI	5	0	1	350	5,715	3,795
MO	179,396	not modeled	not modeled	not modeled	not modeled	not modeled
OK	103,734	not modeled	not modeled	not modeled	not modeled	not modeled
KS	125,918	not modeled	not modeled	not modeled	not modeled	not modeled
AR	70,009	not modeled	not modeled	not modeled	not modeled	not modeled
NE	30,536	not modeled	not modeled	not modeled	not modeled	not modeled
TX	39	not modeled	not modeled	not modeled	not modeled	not modeled
SD	11705	not modeled	not modeled	not modeled	not modeled	not modeled
CN		859,688	Canadian NPRI Inventory 52 Stacks			
U.S	7,770,423	1,835,735	1,617,890	71287	1,224,159	930,979

Red Circles represent **EGUs with year 2002 CEMS hourly SO₂ & NO_x data** that was used to create individual point source inputs for CALPUFF runs.

Green Circles represent **Canadian Point Sources for which 2002 SO₂, NO_x & PM_{2.5} emissions data** was modeled as individual point sources.



Monitoring Sites at which CALPUFF EVALUATION is being performed

22 IMPROVE sites with every 3rd day 24-hr SO₄ / NO₃

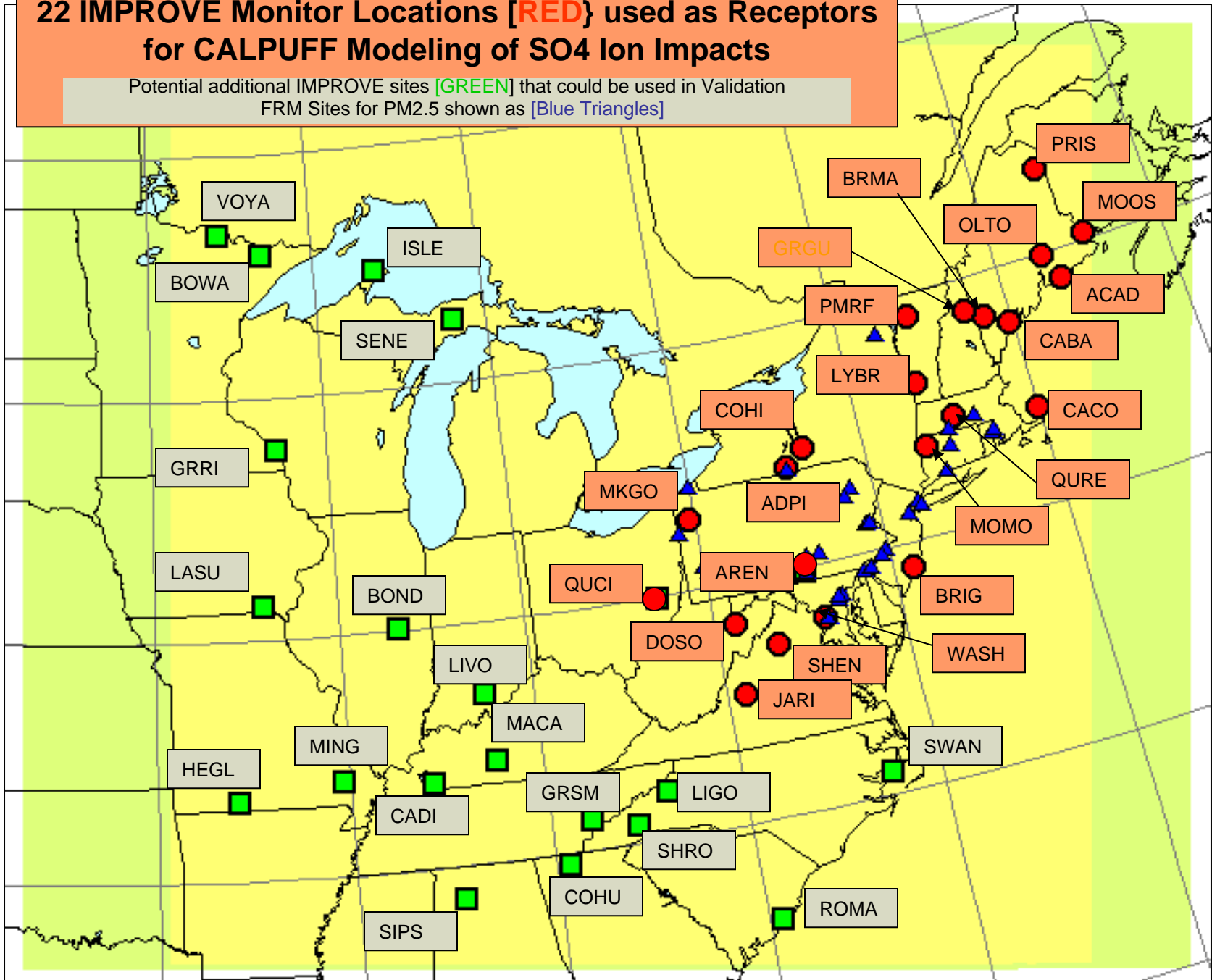
SITE	LAT	LON	X Domain(km)	Y Domain(km)	HT (m)
ACAD1	44.3771	-68.2612	2351.337	1562.515	HT meters (model terrain) = 24.000
ADPI1	42.0911	-77.2098	1721.239	1127.713	HT meters (model terrain) = 495.400
BRIG1	39.4650	-74.4492	2013.281	898.458	HT meters (model terrain) = 10.100
BRMA1	44.1074	-70.7293	2172.876	1475.422	HT meters (model terrain) = 166.000
CABA1	43.8325	-70.0643	2232.536	1461.539	HT meters (model terrain) = 8.500
CACO1	41.9758	-70.0247	2295.753	1265.698	HT meters (model terrain) = 1.100
COHI1	42.4009	-76.6535	1758.220	1171.176	HT meters (model terrain) = 387.700
DOSO1	39.1069	-79.4262	1606.407	766.581	HT meters (model terrain) = 849.800
GRGU1	44.3082	-71.2177	2129.293	1485.828	HT meters (model terrain) = 570.800
JARI1	37.6266	-79.5124	1630.454	604.494	HT meters (model terrain) = 406.200
LYBR1	43.1481	-73.1267	2016.655	1320.611	HT meters (model terrain) = 562.200
MKGO1	41.4269	-80.1445	1498.563	1007.167	HT meters (model terrain) = 362.800
MOMO1	41.8214	-73.2973	2041.224	1175.053	HT meters (model terrain) = 276.300
MOOS1	45.1259	-67.2661	2399.529	1666.287	HT meters (model terrain) = 74.900
OLTO1	44.9335	-68.6457	2303.333	1611.920	HT meters (model terrain) = 70.800
PMRF1	44.5286	-72.8687	1996.599	1473.871	HT meters (model terrain) = 315.500
PRIS1	46.6963	-68.0335	2287.614	1813.292	HT meters (model terrain) = 194.500
QURE1	42.2988	-72.3350	2103.643	1246.853	HT meters (model terrain) = 157.800
SHEN1	38.5228	-78.4347	1702.901	720.144	HT meters (model terrain) = 411.200
WASH1	38.8761	-77.0343	1812.820	783.760	HT meters (model terrain) = 48.600
QUCI1	39.9429	-81.3378	1429.282	827.828	HT meters (model terrain) = 291.300
AREN1	39.9231	-77.3078	1764.946	891.725	HT meters (model terrain) = 185.500

Note: the IMPROVE sites are Rural, except for the WASH1 site.

This Modeling will not model local urban sources well enough to be able to expect good results at urban PM_{2.5} sites.

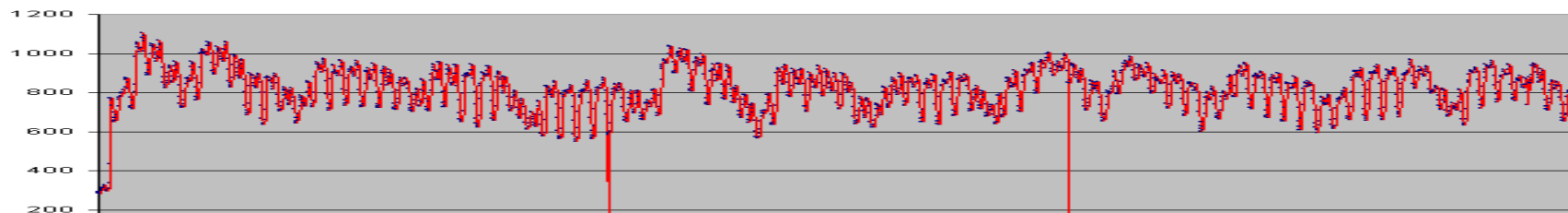
22 IMPROVE Monitor Locations [RED] used as Receptors for CALPUFF Modeling of SO₄ Ion Impacts

Potential additional IMPROVE sites [GREEN] that could be used in Validation
FRM Sites for PM_{2.5} shown as [Blue Triangles]

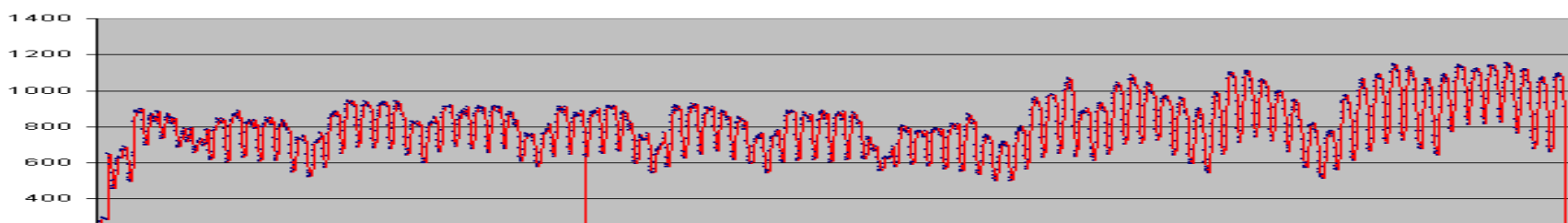


Hourly Variation during 2002 778 CEMS EGUs

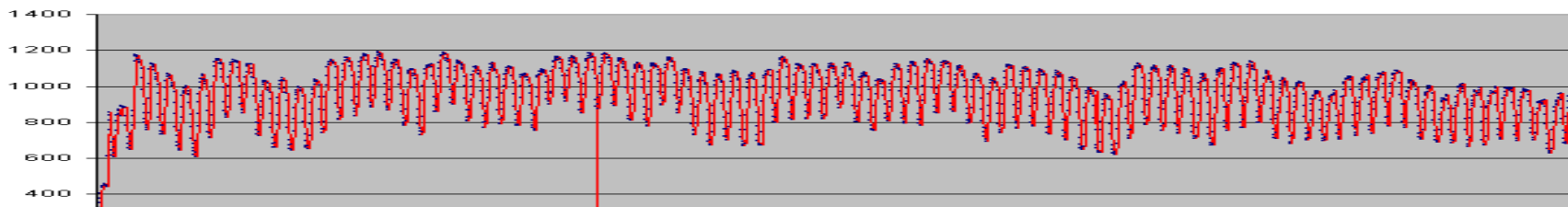
SO2 Emissions (Tons/Hr) from 778 CEMS Srcs
Quarter 1 2002



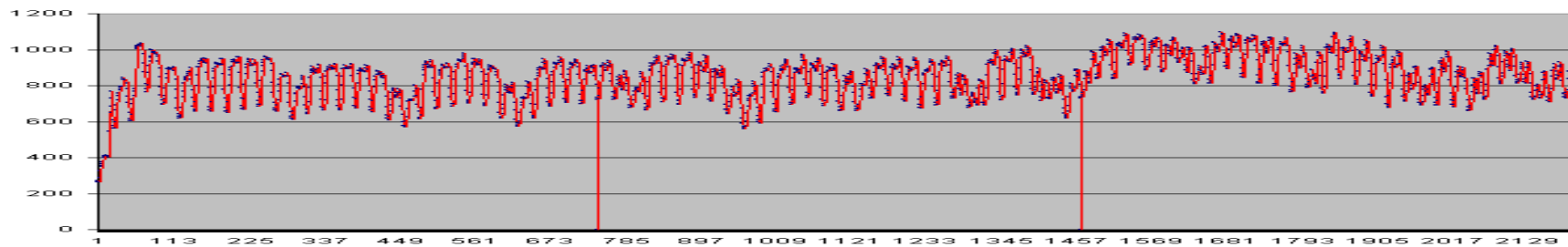
SO2 Emissions (Tons/Hr) from 778 CEMS Srcs
Quarter 2 2002



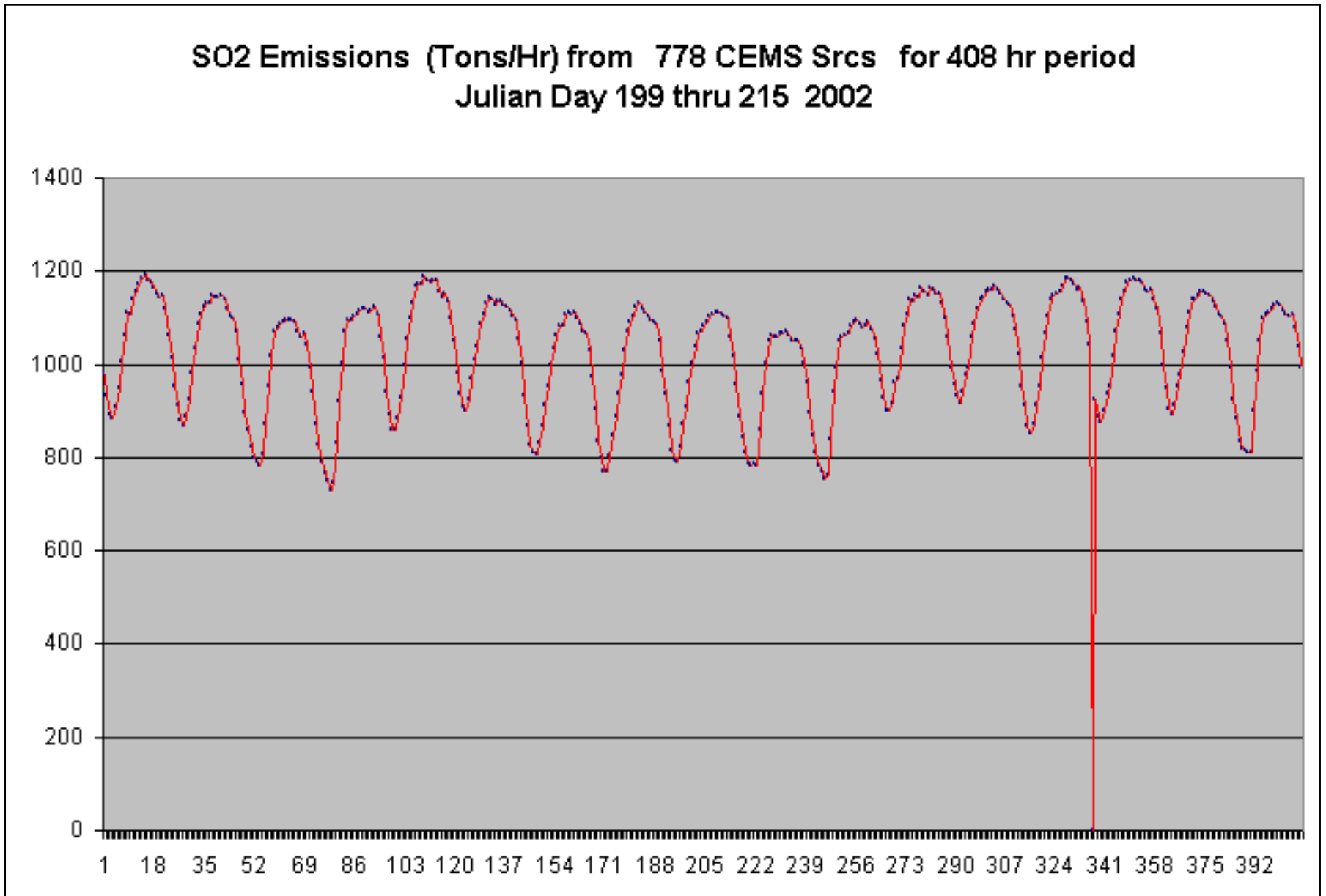
SO2 Emissions (Tons/Hr) from 778 CEMS Srcs
Quarter 3 2002



SO2 Emissions (Tons/Hr) from 778 CEMS Srcs
Quarter 4 2002

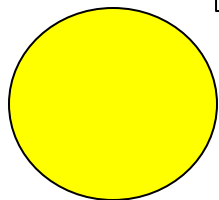
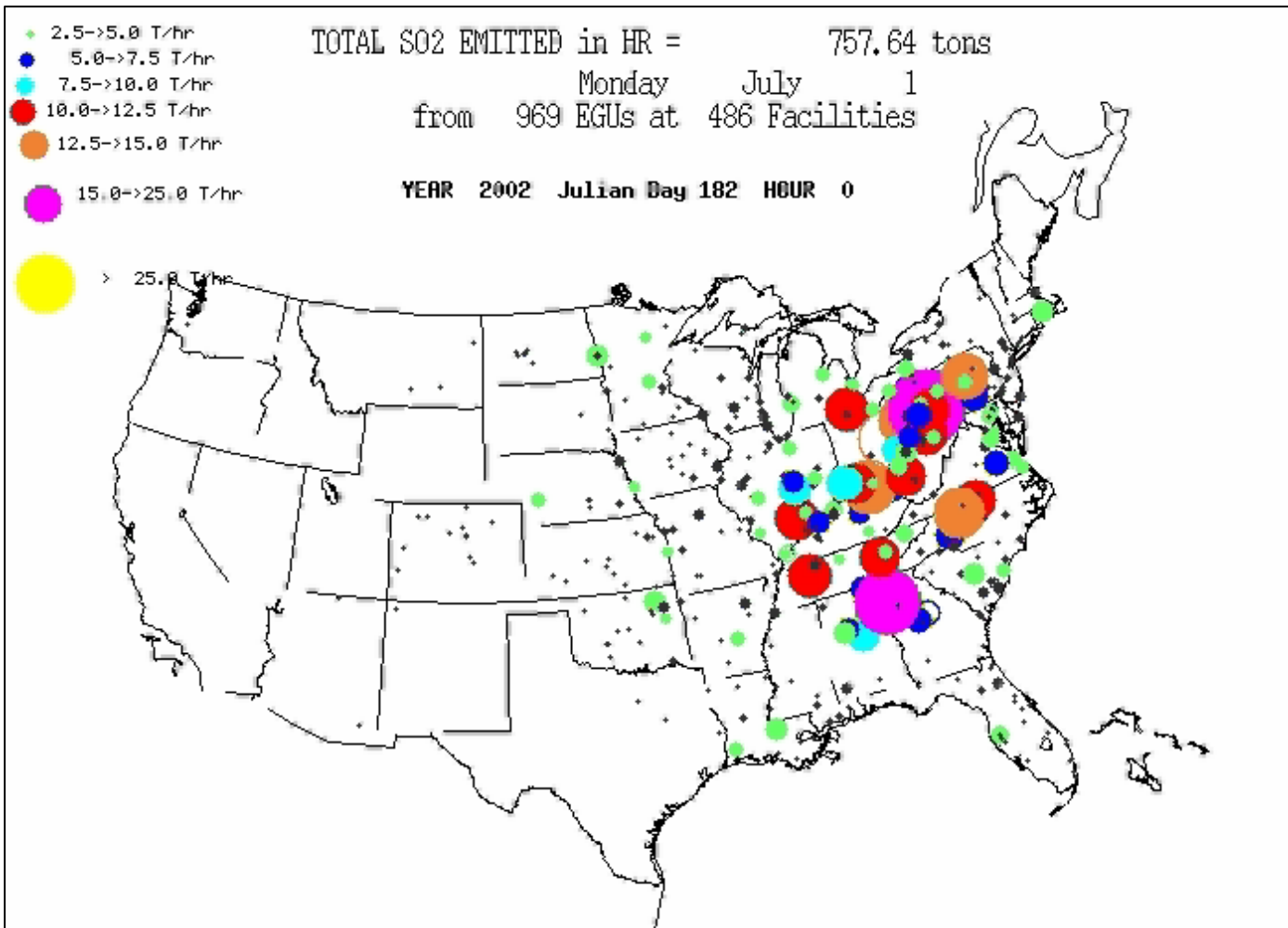


Detail of Hourly Variation Jul 18 -> Aug 3 778 CEMS EGUs

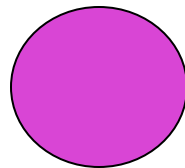


Individual CEMS Facility SO2 Emissions

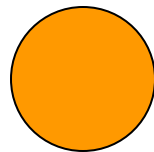
Hourly Variation



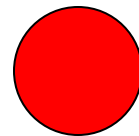
> 25.0
Tons/Hr



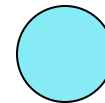
15.0 -> 25.0
Tons/Hr



12.5 -> 15.0
Tons/Hr



10.0 -> 12.5
Tons/Hr



7.5 -> 10.0
Tons/Hr



5.0 -> 7.5
Tons/Hr



2.5 -> 5.0
Tons/Hr



< 2.5
Tons/Hr

Single Source CALPUFF MODELING RUNS

869 of the EGUs with CEMS data for 2002 have been **modeled individually** in order to allow them to be ranked relative to their Sulfate Ion impacts at the Class I areas in the domain.

Because “Phase II” modeling was conducted using meteorology that may still be adjusted after more detailed evaluation has been completed and using preliminary assumptions for monthly background ammonia and H₂O₂, these rankings are not yet considered final and may change.

In particular, we are now revising some of the settings in CALMET to redo the first quarter (winter) period for the NWS Meteorology. Some of our evaluation to date indicates wind speeds biased high at about 750 meters for this quarter. Other quarters validate well with actual measurements at sites not included in the preparation of the wind fields.

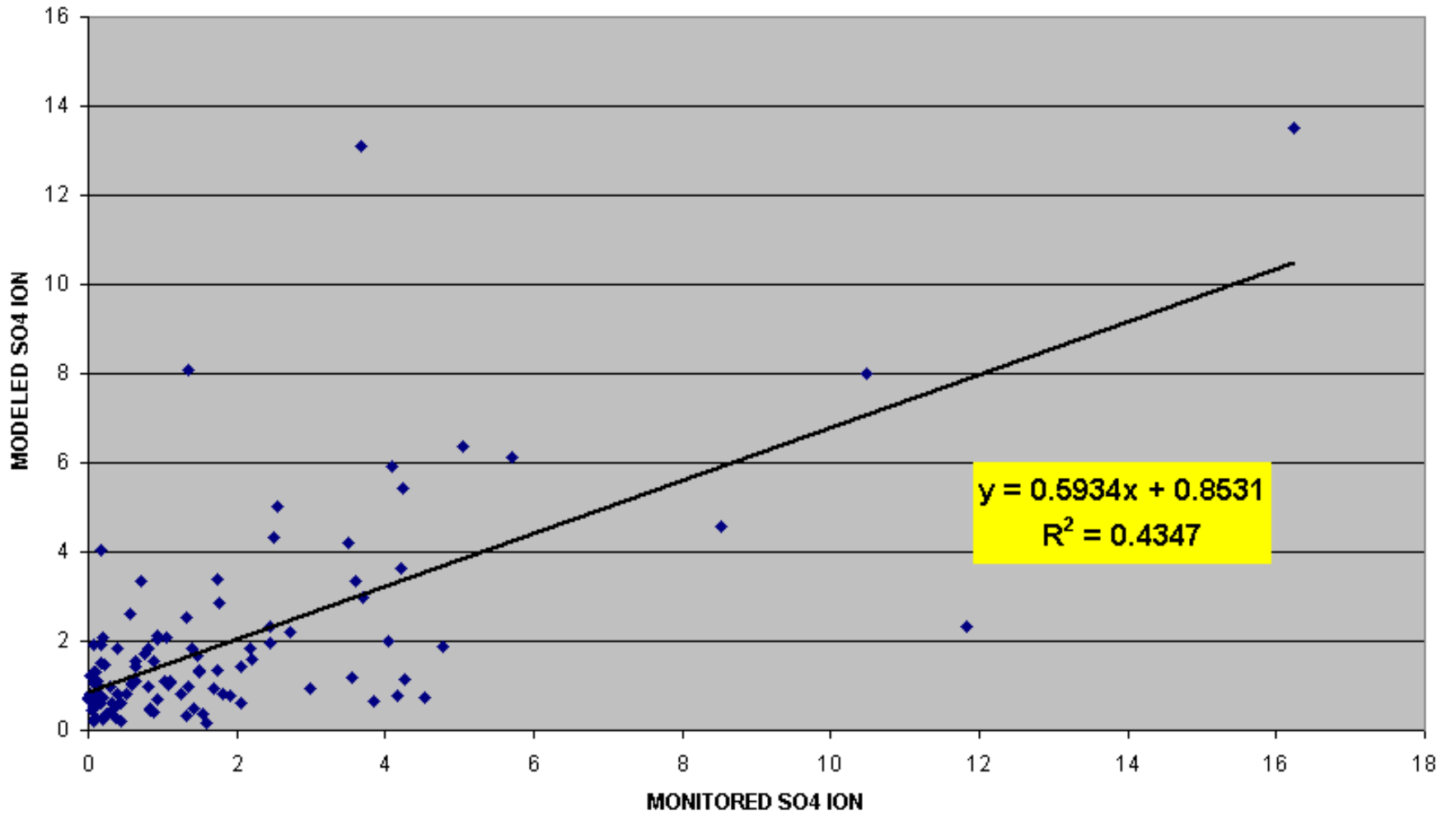
	PHASE II ASSUMPTIONS	FUTURE CONSIDERATIONS
Monthly Ammonia	Constant 1.0 ppb	Variable 1.0 – 10.0 ppb
Monthly H ₂ O ₂	Constant 1.0 ppb	Variable by season 0.7 -> 2.0
Nite-time SO ₂ loss rate	Constant 0.2 %/hr	Variable by season 0.1 -> 0.3

Full Domain-Wide 2002 SO₂ Emissions Modeled

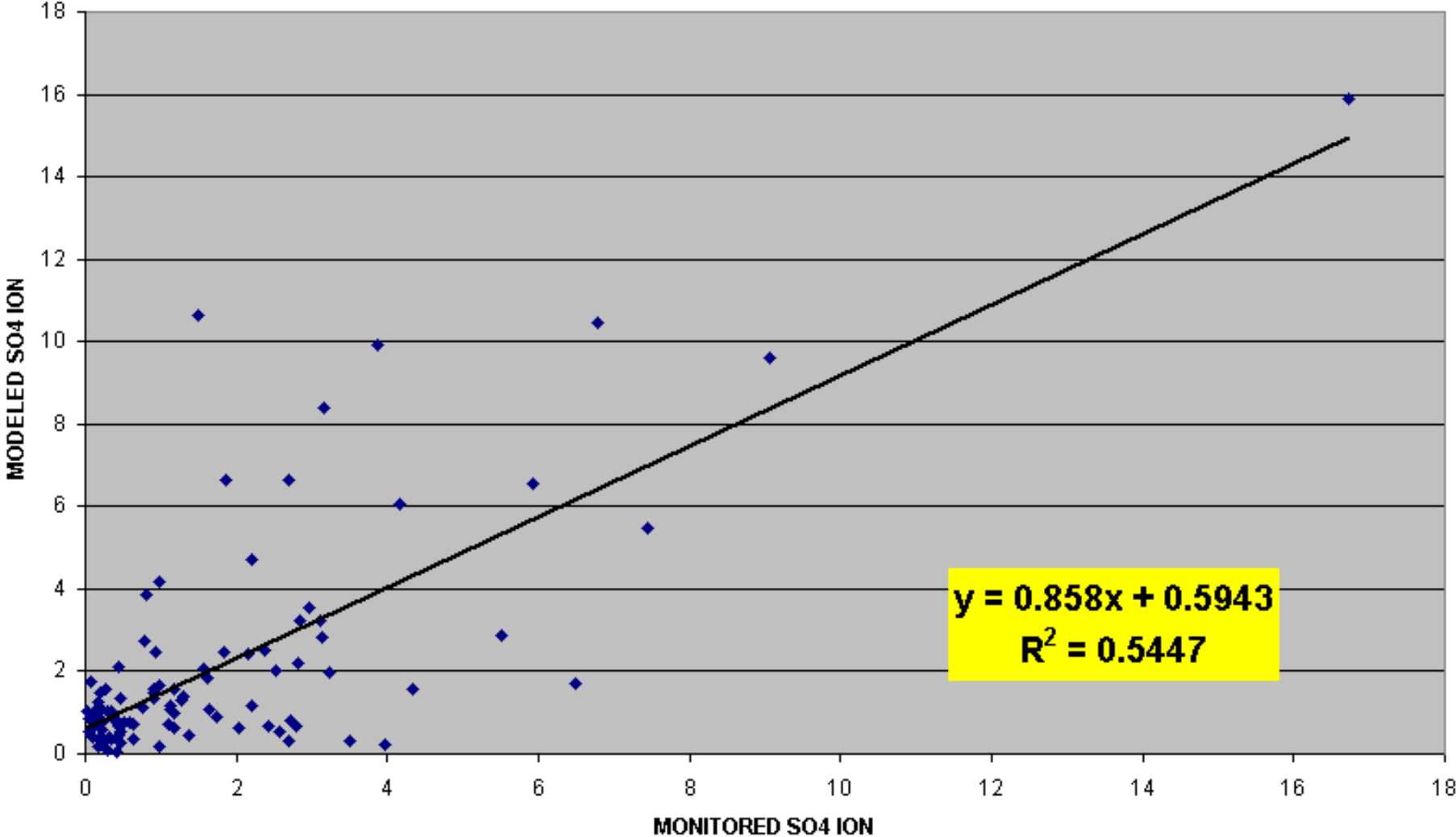
To validate the model at 22 sites based on:

- 24-hr average measurements of sulfate ion,
 - quarterly averages of sulfate ion, and
 - annual averages of sulfate ion.

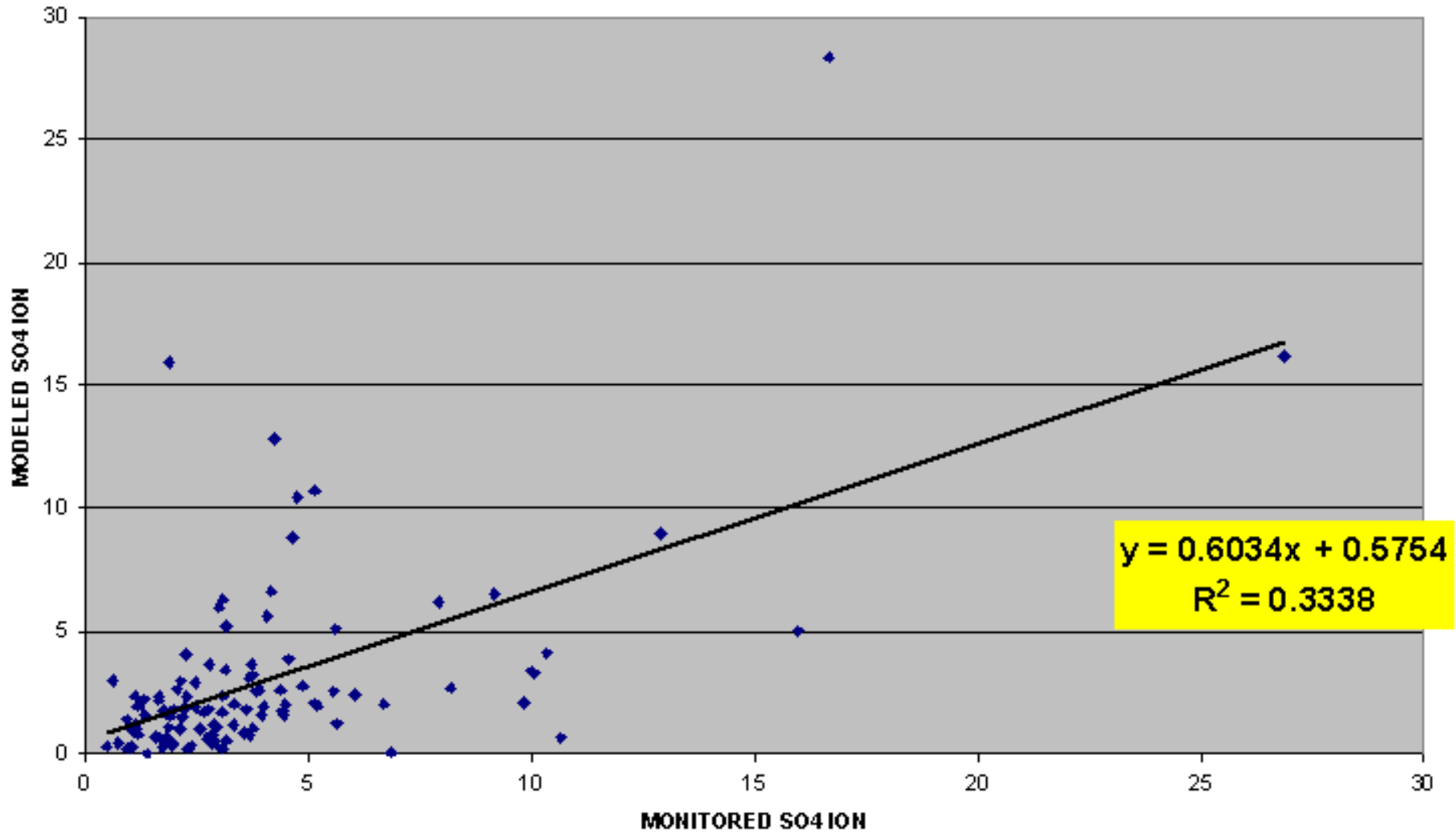
Modeled SO4 Ion vs Monitored SO4 Ion 24Hr Ave Values at ACAD



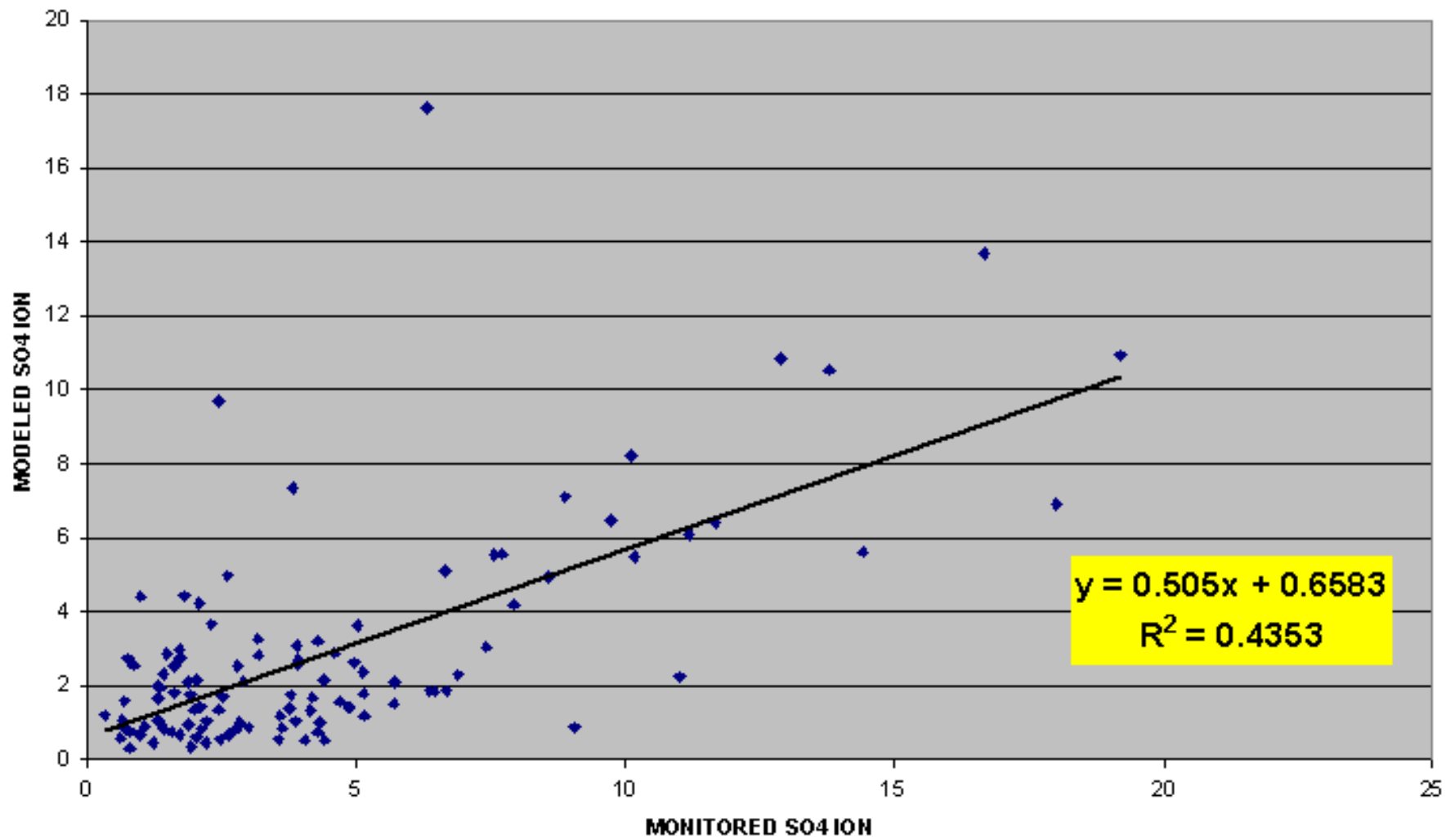
**Modeled vs Monitored
24Hr Ave SO4 ION at LYBR**



Modeled SO4 Ion vs Monitored SO4 Ion
24Hr Ave Values at BRIG

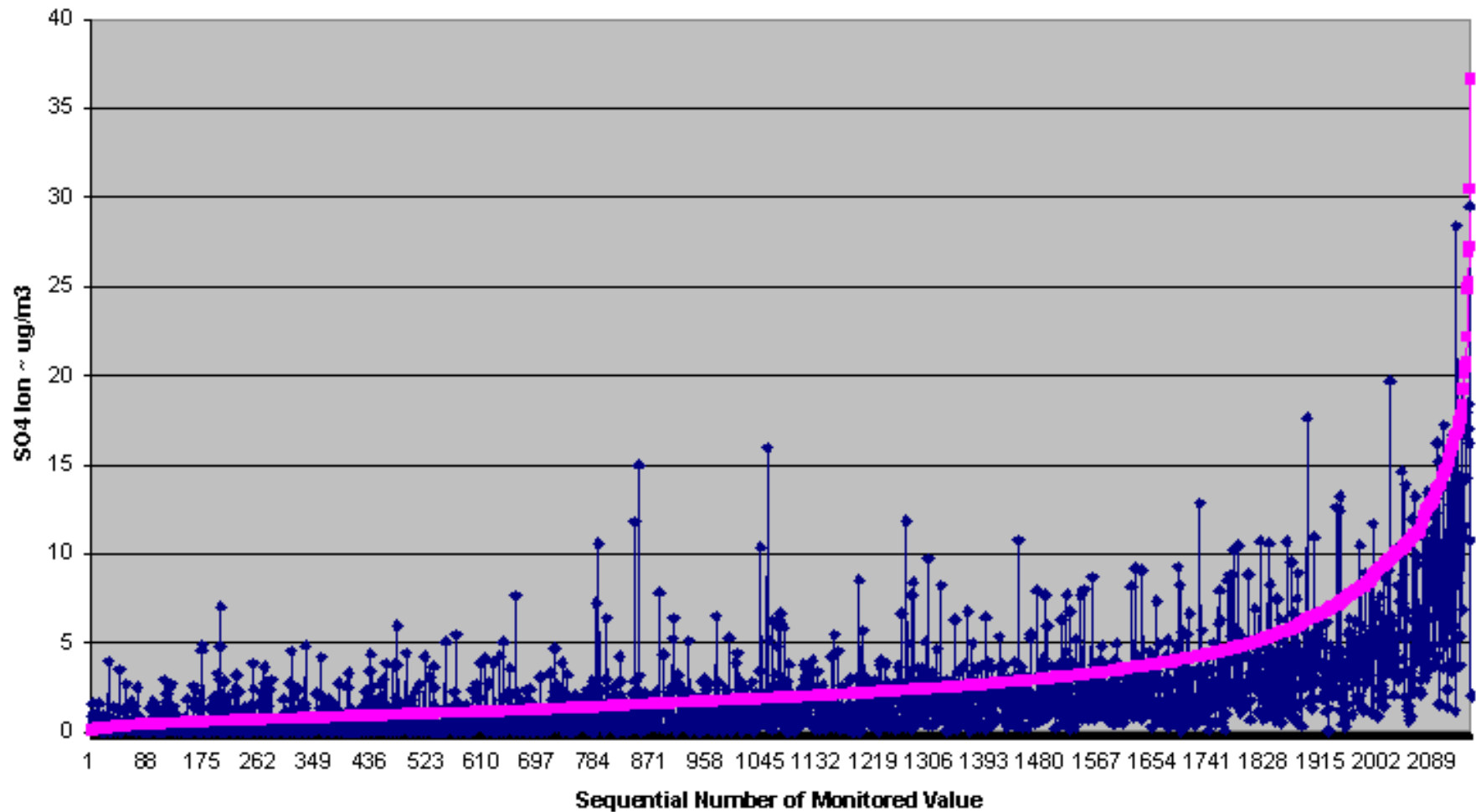


Modeled SO4 Ion vs Monitored SO4 Ion
24Hr Ave Values at SHEN

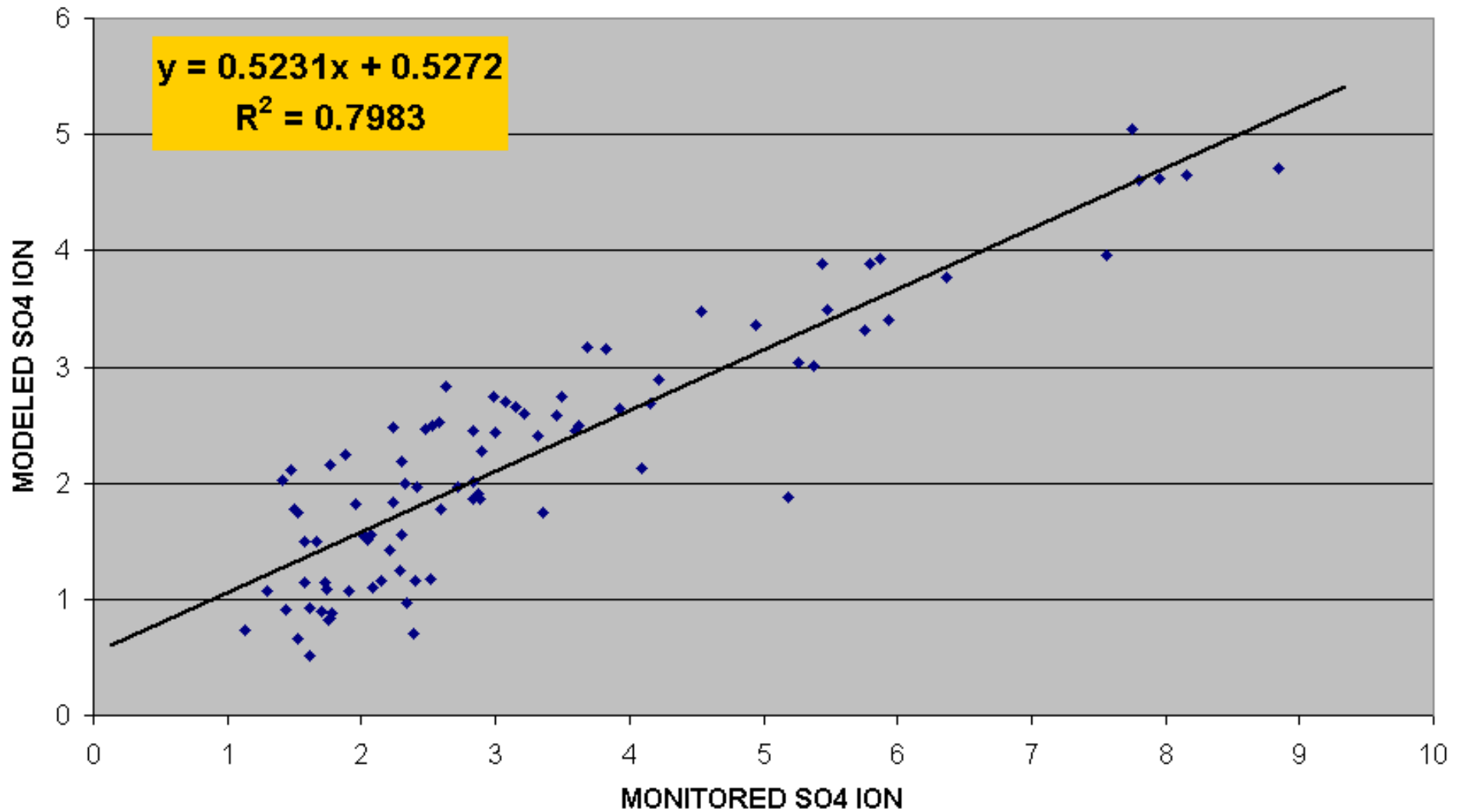


20 IMPROVE SITE COMPARISON

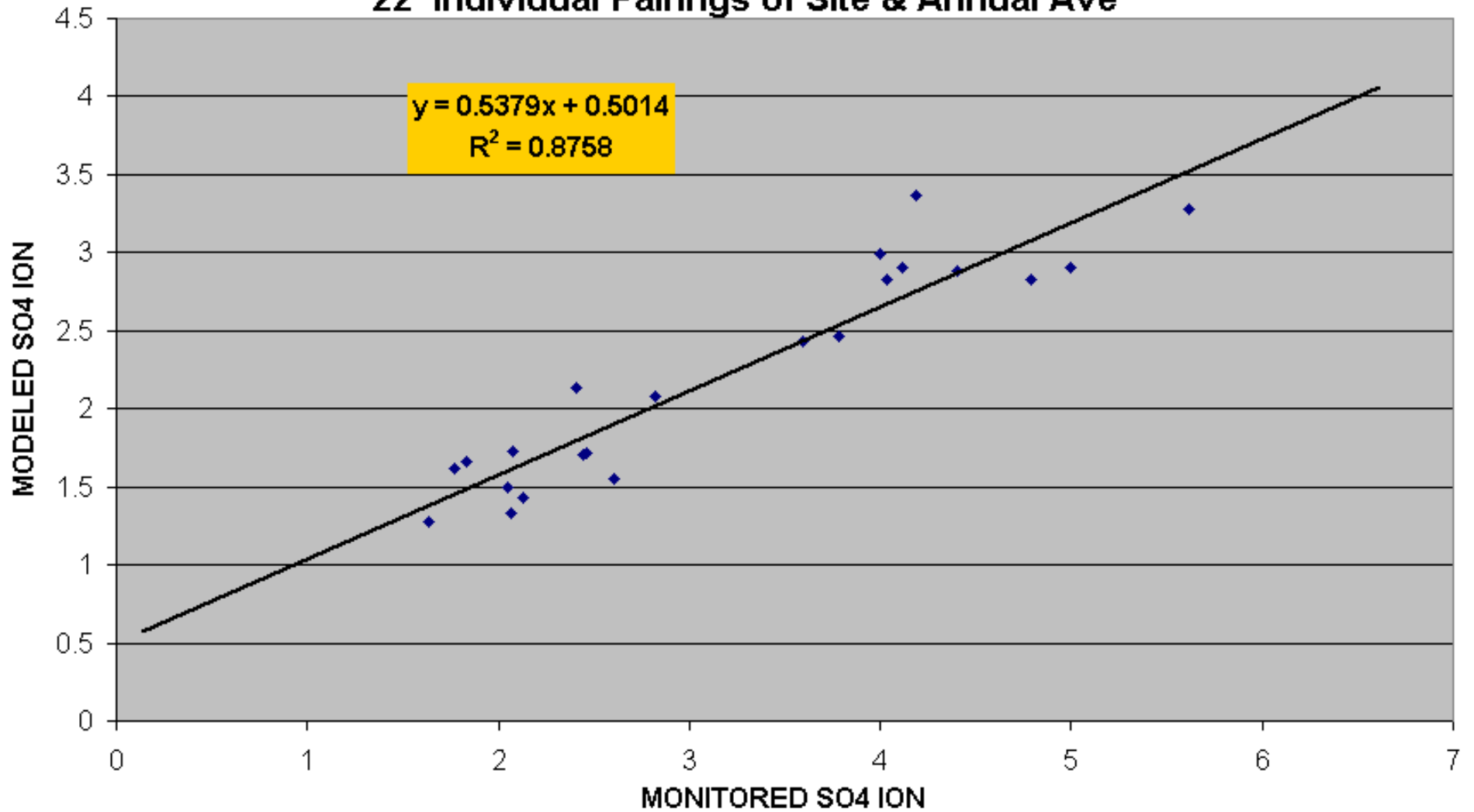
24Hr Monitored Values ordered from lowest to highest irrespective of site
Modeled Values corresponding are plotted in BLUE



ALL FOUR QUARTERS 22 Northeast SITES
88 Individual Pairings of Site & Qtrly Ave



ANNUAL SO4 AVERAGES 22 SITES
22 Individual Pairings of Site & Annual Ave



Preliminary Phase II Modeling Results for SULFATE ION

At four of the IMPROVE monitoring locations

Acadia National Park	ME	ACAD
Lye Brook Wilderness Area	VT	LYBR
Brigantine National Wildlife Area	NJ	BRIG
Shenandoah National Park	VA	SHEN

ACAD SO4 ion impacts from U.S. SO2 Sources Modeled Ranked by State

ALL SRCS SO4 Ion Impact	EGUs Only SO4 Ion Impact	% of ACAD Annual from STATE	% of ACAD Annual from EGUs in STATE	% of ACAD Annual from Non-EGUs in STATE	STATE
0.20511	0.06117	12.555	29.823	70.177	MI
0.18026	0.14802	11.034	82.115	17.885	PA
0.16065	0.15126	9.834	94.154	5.846	OH
0.15302	0.08927	9.367	58.337	41.663	IN
0.13476	0.06408	8.249	47.550	52.450	MA
0.12507	0.06275	7.656	50.173	49.827	NY
0.07073	0.04090	4.330	57.824	42.176	IL
0.06633	0.06048	4.060	91.183	8.817	WV
0.05698	0.00321	3.488	5.634	94.366	ME
0.05270	0.04504	3.226	85.457	14.543	KY
0.04612	0.03686	2.823	79.928	20.072	NH
0.04539	0.03591	2.779	79.109	20.891	NC
0.04381	0.03852	2.682	87.921	12.079	MD
0.03958	0.03071	2.423	77.587	22.413	VA
0.03767	0.01753	2.306	46.538	53.462	WI
0.02778	0.02088	1.701	75.150	24.850	TN
0.02416	0.00836	1.479	34.604	65.396	MN
0.02370	0.01358	1.451	57.297	42.703	NJ
0.01731	0.00000	1.060	0.000	100.000	VT
0.01628	0.00958	0.996	58.854	41.146	IA
0.01572	0.01575	0.962	100.171	-0.171	MO
0.01387	0.00423	0.849	30.487	69.513	CT
0.01329	0.00929	0.813	69.925	30.075	SC
0.01250	0.01117	0.765	89.355	10.645	GA
0.01137	0.00859	0.696	75.524	24.476	DE
0.00946	0.00791	0.579	83.598	16.402	AL
0.00887	0.00888	0.543	100.094	-0.094	KS
0.00744	0.00000	0.455	0.000	100.000	RI
0.00598	0.00596	0.366	99.679	0.321	OK
0.00420	0.00421	0.257	100.169	-0.169	AR
0.00193	0.00194	0.118	100.428	-0.428	NE
0.00082	0.00082	0.050	99.821	0.179	SD
0.00042	0.00014	0.026	32.968	67.032	DC
0.00034	0.00000	0.021	0.000	100.000	MS
0.00000	0.00000	0.000	0.000	100.000	TX
1.63365	1.01700				

LYBR SO4 ion impacts from U.S. SO2 Sources Modeled Ranked by State

ALL SRCS SO4 Ion Impact	EGUs Only SO4 Ion Impact	% of LYBR Annual from STATE	% of LYBR Annual from EGUs in STATE	% of LYBR Annual from Non-EGUs in STATE	STATE
0.27072	0.07963	14.485	29.414	70.586	MI
0.24887	0.20647	13.316	82.963	17.037	PA
0.22733	0.21467	12.164	94.431	5.569	OH
0.18845	0.10739	10.083	56.986	43.014	IN
0.15071	0.06330	8.064	42.001	57.999	NY
0.09714	0.08844	5.198	91.043	8.957	WV
0.07731	0.06669	4.137	86.261	13.739	KY
0.07625	0.04340	4.080	56.919	43.081	IL
0.05690	0.02670	3.045	46.924	53.076	WI
0.05677	0.05018	3.038	88.387	11.613	MD
0.05343	0.04306	2.859	80.593	19.407	NC
0.05050	0.00000	2.702	0.000	100.000	VT
0.03998	0.03037	2.139	75.967	24.033	VA
0.03785	0.02811	2.025	74.268	25.732	TN
0.03570	0.01249	1.910	34.990	65.010	MN
0.02789	0.01143	1.492	40.988	59.012	MA
0.02611	0.02352	1.397	90.084	9.916	GA
0.02352	0.01324	1.259	56.288	43.712	IA
0.01812	0.01811	0.969	99.965	0.035	MO
0.01771	0.01483	0.948	83.737	16.263	AL
0.01524	0.00837	0.815	54.925	45.075	NJ
0.01481	0.00977	0.793	65.956	34.044	SC
0.01162	0.01162	0.622	100.011	-0.011	KS
0.01018	0.00751	0.545	73.772	26.228	NH
0.00747	0.00747	0.400	99.971	0.029	OK
0.00712	0.00481	0.381	67.566	32.434	DE
0.00598	0.00180	0.320	30.097	69.903	CT
0.00523	0.00523	0.280	99.953	0.047	AR
0.00385	0.00016	0.206	4.152	95.848	ME
0.00263	0.00262	0.141	99.504	0.496	NE
0.00129	0.00000	0.069	0.000	100.000	RI
0.00110	0.00110	0.059	99.651	0.349	SD
0.00063	0.00000	0.034	0.000	100.000	MS
0.00052	0.00011	0.028	21.286	78.714	DC
0.00000	0.00000	0.000	0.000	100.000	TX
1.86893	1.20260				

BRIG SO4 ion impacts from U.S. SO2 Sources Modeled Ranked by State

ALL SRCS SO4 Ion Impact	EGUs Only SO4 Ion Impact	% of BRIG Annual from STATE	% of BRIG Annual from EGUs in STATE	% of BRIG Annual from Non-EGUs in STATE	STATE
0.34766	0.26779	12.942	77.026	22.974	PA
0.27127	0.25709	10.098	94.772	5.228	OH
0.19602	0.14775	7.297	75.374	24.626	VA
0.19403	0.05828	7.223	30.037	69.963	MI
0.18805	0.14604	7.000	77.661	22.339	NC
0.18712	0.10734	6.966	57.365	42.635	IN
0.16177	0.14844	6.022	91.762	8.238	WV
0.16111	0.13734	5.997	85.247	14.753	MD
0.15333	0.06940	5.708	45.261	54.739	NY
0.10332	0.04344	3.846	42.044	57.956	NJ
0.09442	0.08081	3.515	85.583	14.417	KY
0.08335	0.04676	3.103	56.103	43.897	IL
0.07242	0.06506	2.696	89.842	10.158	GA
0.06759	0.04884	2.516	72.258	27.742	TN
0.06010	0.02799	2.237	46.570	53.430	WI
0.05952	0.04114	2.216	69.117	30.883	DE
0.05773	0.03964	2.149	68.669	31.331	SC
0.05063	0.02665	1.885	52.636	47.364	MA
0.03991	0.03331	1.486	83.468	16.532	AL
0.03477	0.01218	1.294	35.030	64.970	MN
0.02343	0.01313	0.872	56.030	43.970	IA
0.01578	0.01578	0.588	100.000	0.000	MO
0.01552	0.00430	0.578	27.706	72.294	CT
0.01032	0.01032	0.384	99.990	0.010	KS
0.00879	0.00727	0.327	82.661	17.339	NH
0.00575	0.00575	0.214	100.000	0.000	OK
0.00447	0.00446	0.166	99.884	0.116	AR
0.00418	0.00000	0.156	0.000	100.000	RI
0.00370	0.00038	0.138	10.282	89.718	ME
0.00348	0.00000	0.130	0.000	100.000	VT
0.00271	0.00271	0.101	100.167	-0.167	NE
0.00213	0.00097	0.079	45.452	54.548	DC
0.00100	0.00100	0.037	99.847	0.153	SD
0.00091	0.00000	0.034	0.000	100.000	MS
0.00000	0.00000	0.000	0.000	100.000	TX

2.68630

1.87136

SHEN SO4 ion impacts from U.S. SO2 Sources Modeled Ranked by State

ALL SRCS SO4 Ion Impact	EGUs Only SO4 Ion Impact	% of SHEN Annual from STATE	% of SHEN Annual from EGUs in STATE	% of SHEN Annual from Non-EGUs in STATE	STATE
0.45441	0.42944	15.636	94.505	5.495	OH
0.34797	0.29115	11.974	83.671	16.329	PA
0.30515	0.27478	10.500	90.048	9.952	WV
0.26047	0.15032	8.963	57.712	42.288	IN
0.25459	0.07863	8.760	30.886	69.114	MI
0.20159	0.17153	6.937	85.088	14.912	NC
0.15321	0.10871	5.272	70.956	29.044	VA
0.13537	0.11193	4.658	82.686	17.314	MD
0.13300	0.11380	4.576	85.566	14.434	KY
0.09986	0.07186	3.436	71.961	28.039	TN
0.09552	0.05286	3.287	55.337	44.663	IL
0.09446	0.08485	3.250	89.826	10.174	GA
0.06144	0.02951	2.114	48.028	51.972	WI
0.06026	0.04999	2.073	82.962	17.038	AL
0.05439	0.03758	1.871	69.097	30.903	NY
0.04461	0.02878	1.535	64.509	35.491	SC
0.03418	0.01197	1.176	35.025	64.975	MN
0.02399	0.01332	0.825	55.524	44.476	IA
0.01918	0.01918	0.660	100.000	0.000	MO
0.01685	0.01043	0.580	61.886	38.114	NJ
0.01475	0.01071	0.507	72.627	27.373	DE
0.01163	0.01161	0.400	99.863	0.137	KS
0.00621	0.00375	0.214	60.417	39.583	MA
0.00615	0.00615	0.212	99.987	0.013	OK
0.00586	0.00586	0.202	100.000	0.000	AR
0.00251	0.00251	0.086	100.000	0.000	NE
0.00181	0.00055	0.062	30.382	69.618	CT
0.00162	0.00036	0.056	22.269	77.731	DC
0.00131	0.00000	0.045	0.000	100.000	MS
0.00126	0.00105	0.043	83.264	16.736	NH
0.00081	0.00081	0.028	100.000	0.000	SD
0.00068	0.00003	0.023	4.412	95.588	ME
0.00065	0.00000	0.022	0.000	100.000	VT
0.00035	0.00000	0.012	0.000	100.000	RI
0.00000	0.00000	0.000	100.000	0.000	TX
2.90608	2.18401				

NEXT STEPS

- 1. Attempt to improve the components of the source emissions inputs for sources other than the CEMS EGU sources.**
- 2. Continue to evaluate the CALMET produced meteorological fields based on closer examination of the patterns of the CALPUFF results in conjunction with the default settings and assumptions used in producing the fields.**
- 3. Evaluate the CALPUFF model using CASTNET data (weekly analyses) as well as the FRM fine particulate matter measurement data (full year of daily 24-Hr measurements).**
- 4. Compare these NWS Meteorological field CALPUFF results to those obtained with 2002 meteorology created by converting MM5 fields produced by the University of Maryland for 2002 to CALPUFF compatible fields (ERM work).**