

Proposed IMPROVE Steering Committee Response to Comments on the Downsizing Plan

Presented to the IMPROVE
Steering Committee
September 26, 2006

Introduction/Overview

- Reason for the plan
 - EPA's FY2007 budget that supports air quality monitoring (including IMPROVE) may be cut by as much as 15%
 - 15% budget shortfall for the 110 site IMPROVE Network ~ \$535,800 $\approx$ 30% IMPROVE site reduction
- Development of the plan in 3 steps by 3 committees of states, FLM, and EPA representatives
 - 1. Site-specific information committee – RPO monitoring representatives – work completed in June
 - 2. Plan development/implementation committee – State & FLM representatives – work completed in July
 - 3. Plan review committee – IMPROVE Steering Committee – public review completed in August, response to review drafted for IMPROVE S.C. consideration in September

Overview of Step 2 Plan Approach

-Principles-

- Only the 118 IMPROVE and EPA Protocol sites are eligible for decommissioning
- All visibility-protected class I areas need to have representative monitoring
- Data redundancy is the primary characteristic for selecting sites for decommissioning
- The priority-ordered list should be generated by a data/information-driven process (i.e. a set of rules) uniformly applied to all eligible sites

118 Candidate sites are marked



Plan Approach

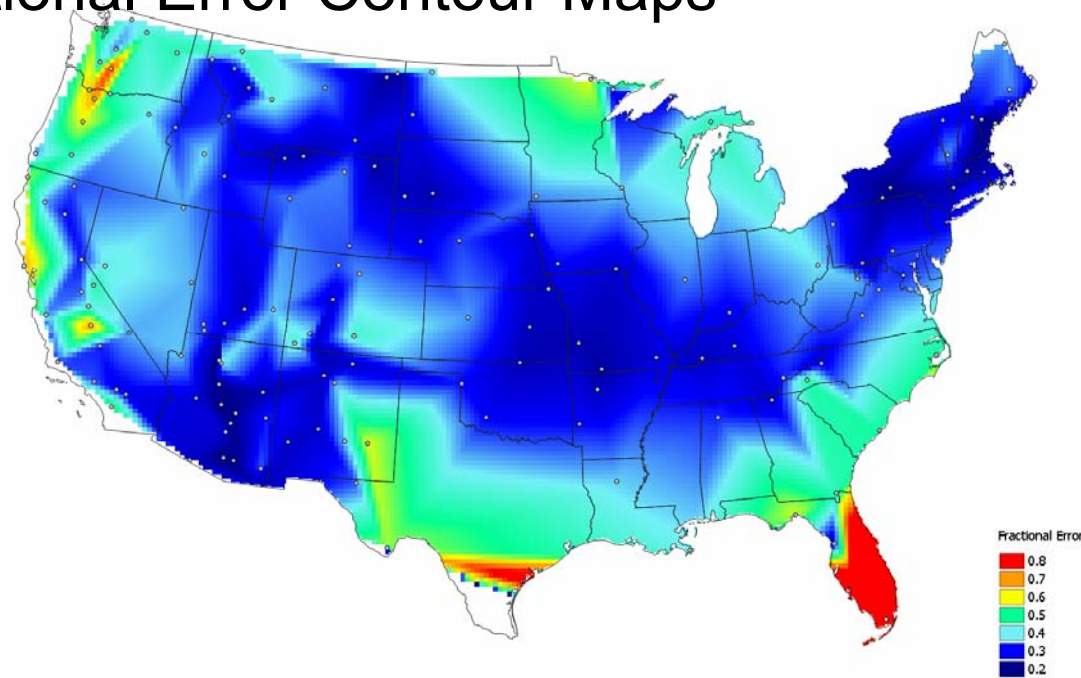
-Process-

- Step 1 – Identification of data redundant site-groups or regions (candidates)
 - Data from all IMPROVE & Protocol sites' are included in the assessment, but only 118 site are possible candidates
 - Nitrate concentration selected as the parameter to test for data redundancy though many were considered
 - Correlation between site-measured and neighboring-sites predicted nitrate values selected as the redundancy metric
 - Candidate sites with high redundancy metric values were identified and became the nuclei for groups of redundant sites
 - Groupings were refined by comparisons to sulfate and nitrate EOF analysis site groupings

Component Fractional Error Contour Maps

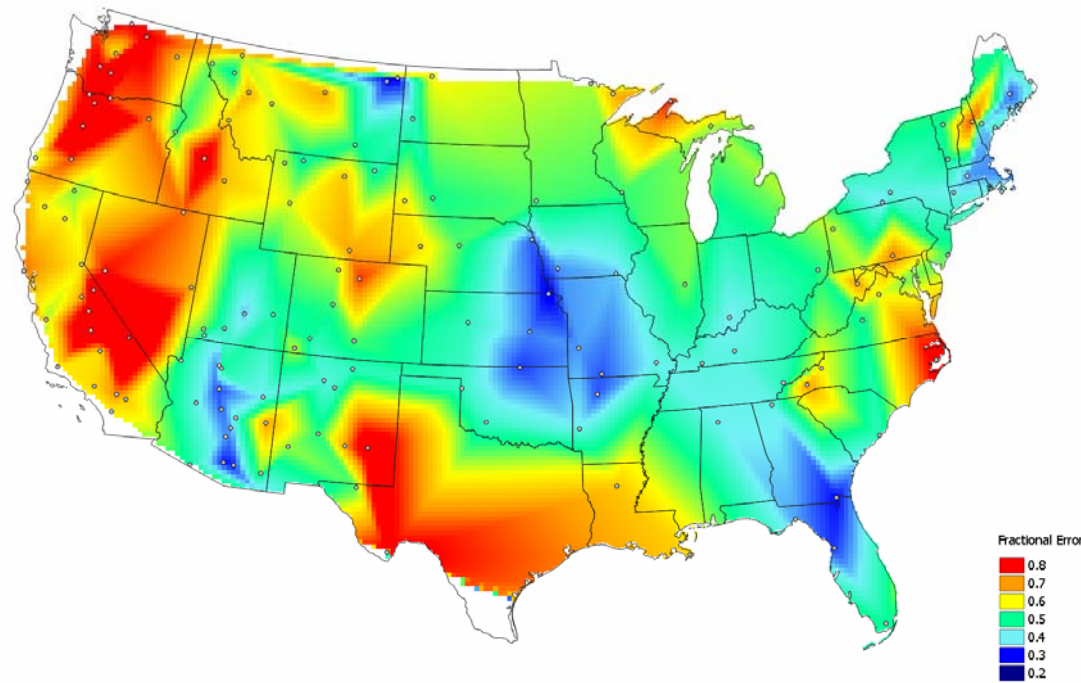
Sulfate fractional error map

- Low fractional errors ($FE < 0.4$) over most of the country
- Many sites are redundant if sulfate is the only concern



Nitrate fractional error map

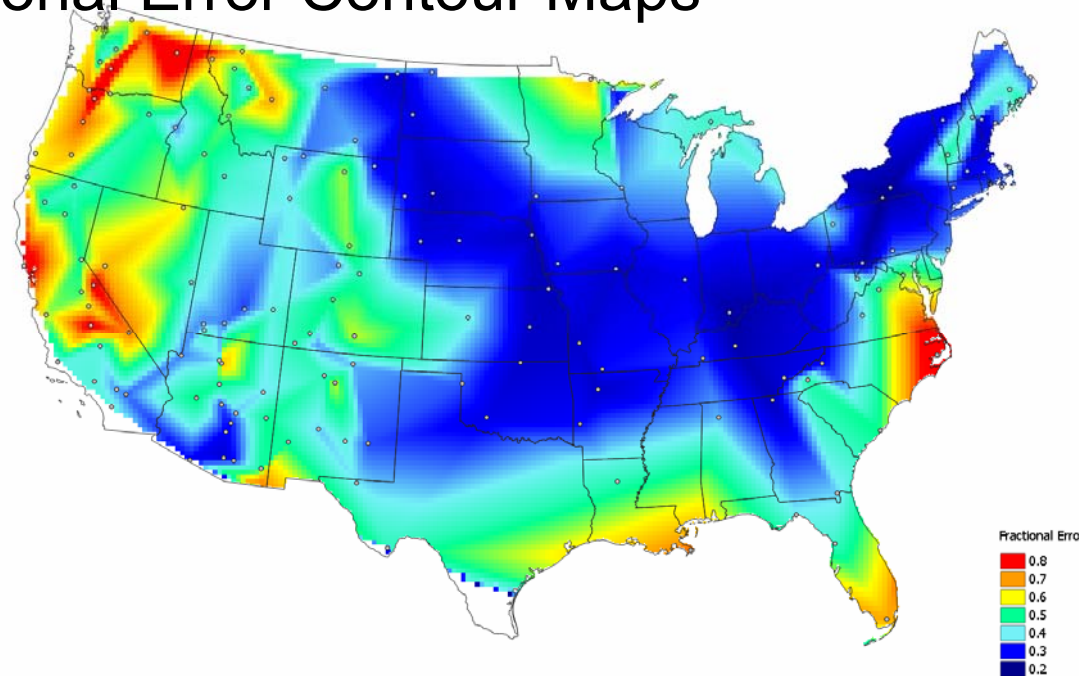
- Low fractional errors ($FE < 0.4$) in several small regions and in the center of the country
- Most regions have sites that are more unique with respect to nitrates



Component Fractional Error Contour Maps

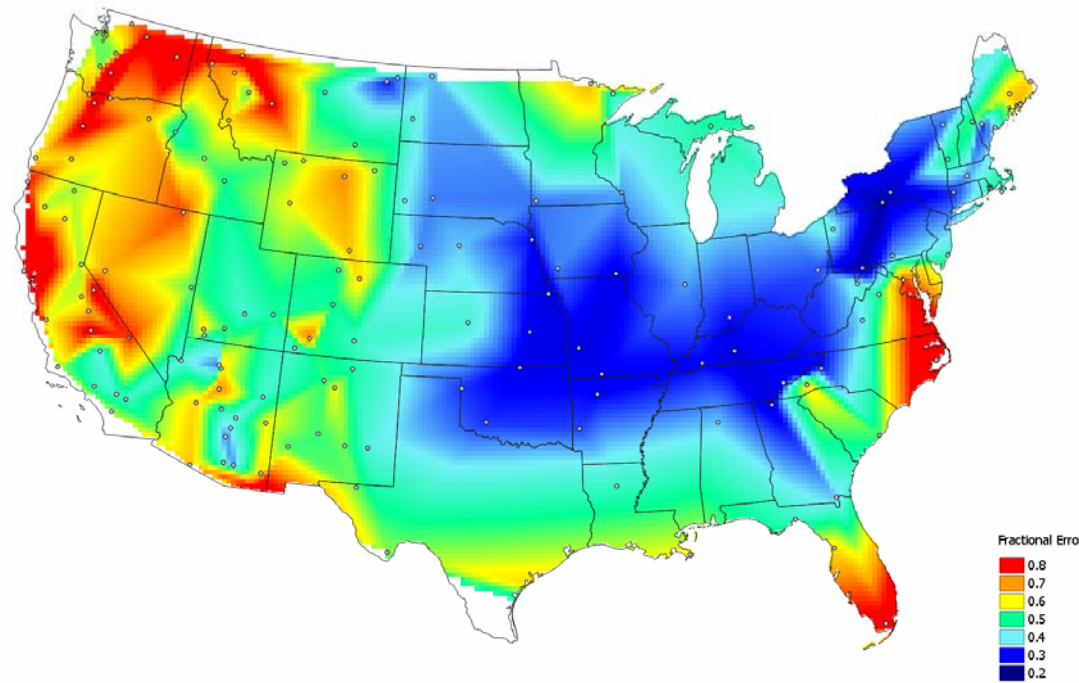
Organic fractional error map

- Low fractional errors ($FE < 0.4$) over much of the center and eastern U.S. and in southern AZ
- Some regions in the west are highly unique (smoke impact areas?), while other regions are less unique (secondary biogenic impacts?)



Elemental Carbon fractional error map

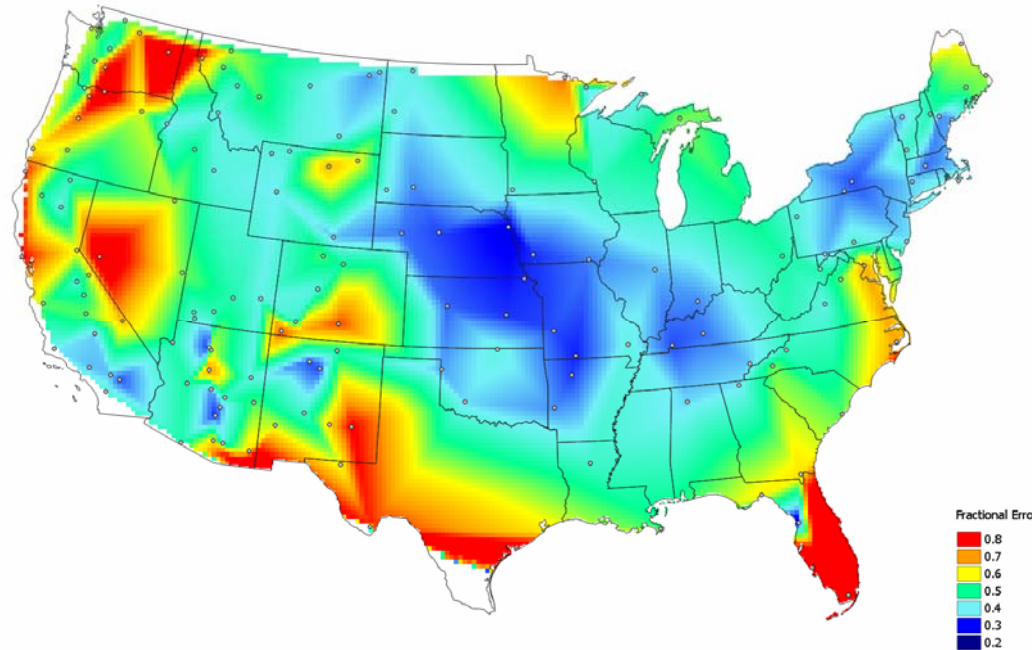
- Low fractional errors ($FE < 0.4$) over much of the center and eastern U.S.
- Compared to the organic map, the west has larger regions of uniqueness (maybe because there is no secondary elemental carbon)



Component Fractional Error Contour Maps

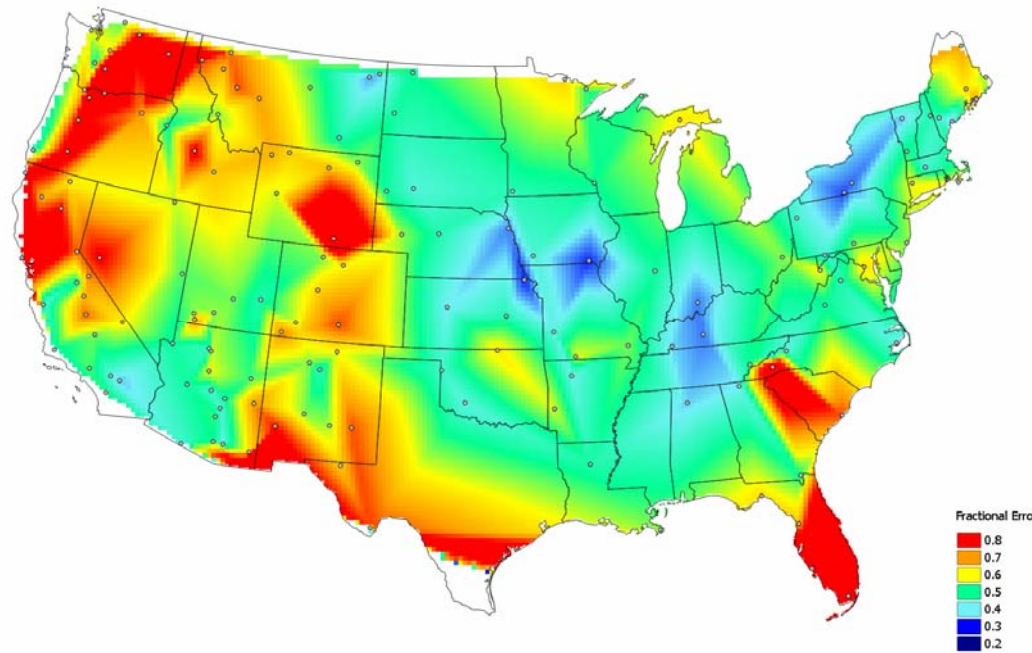
Fine Soil fractional error map

- Low fractional errors ($FE < 0.4$) over the center of the country and a few small regions



Coarse Mass fractional error map

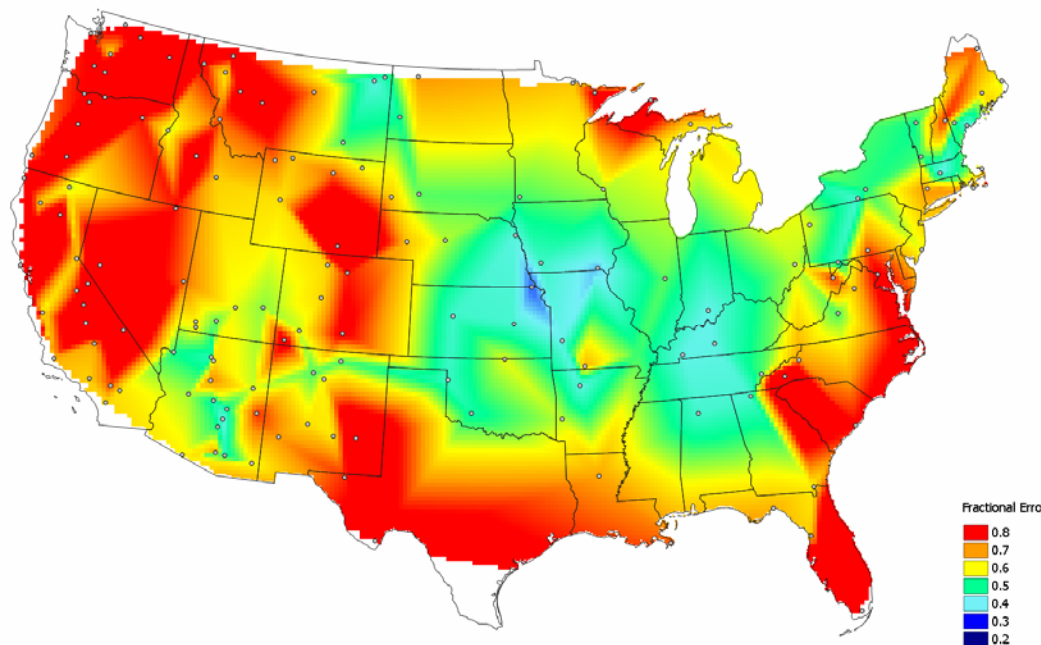
- Low fractional errors ($FE < 0.4$) in a few small regions in the center of the country and northeast
- As would be expected with coarse mass, many of the site's data are unique



Composite Parameter Fractional Error Contour Maps

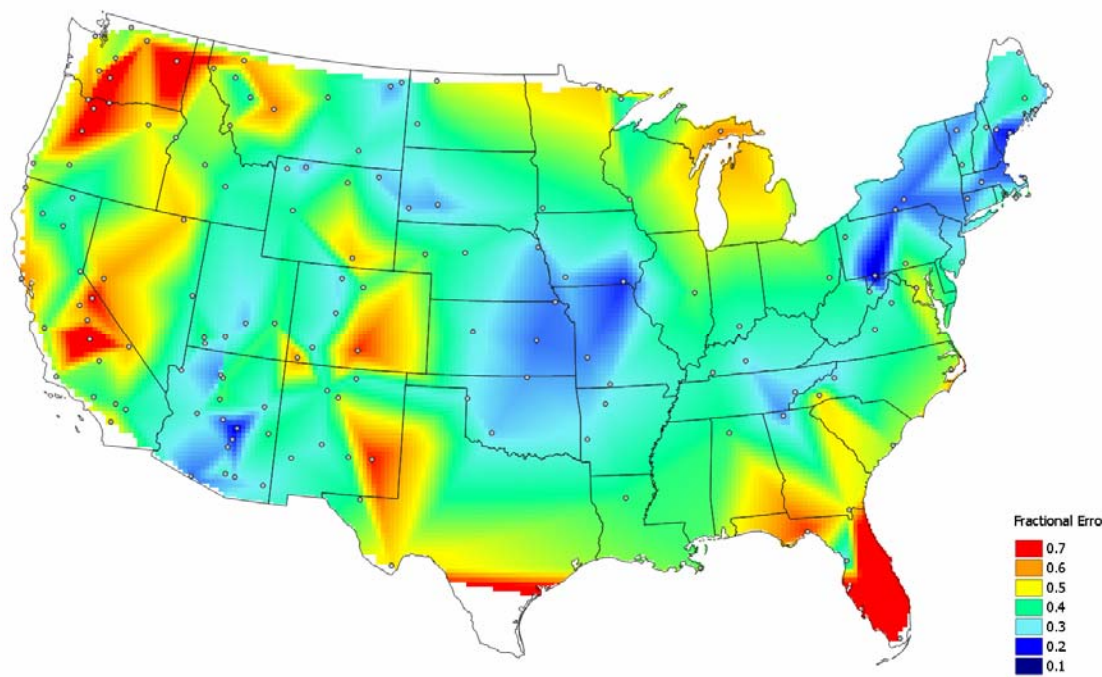
Site-maximum component fractional error map

- This map treats each component equally by displaying the components largest fractional error
- Shows the center of the country, regions in the northeast, AZ and MT as having redundant sites

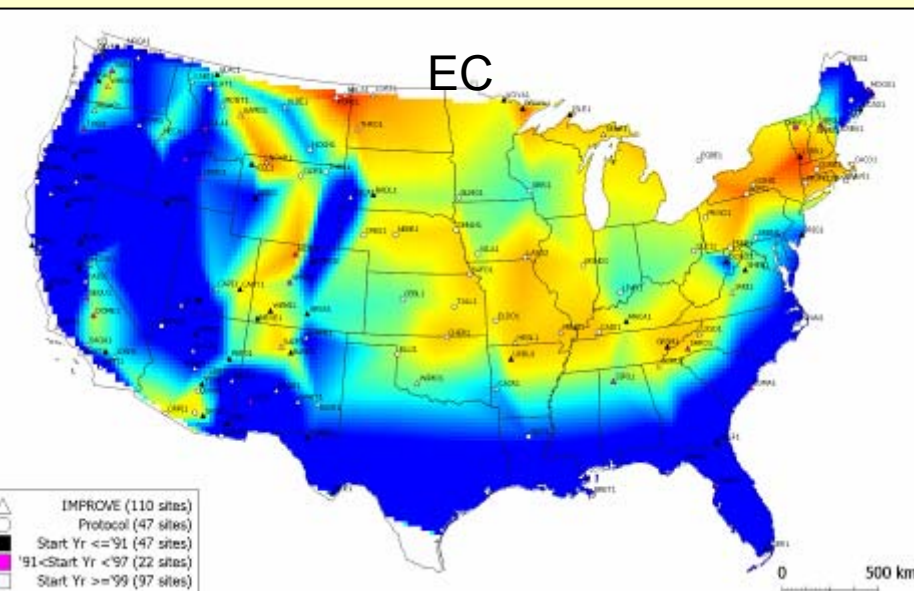
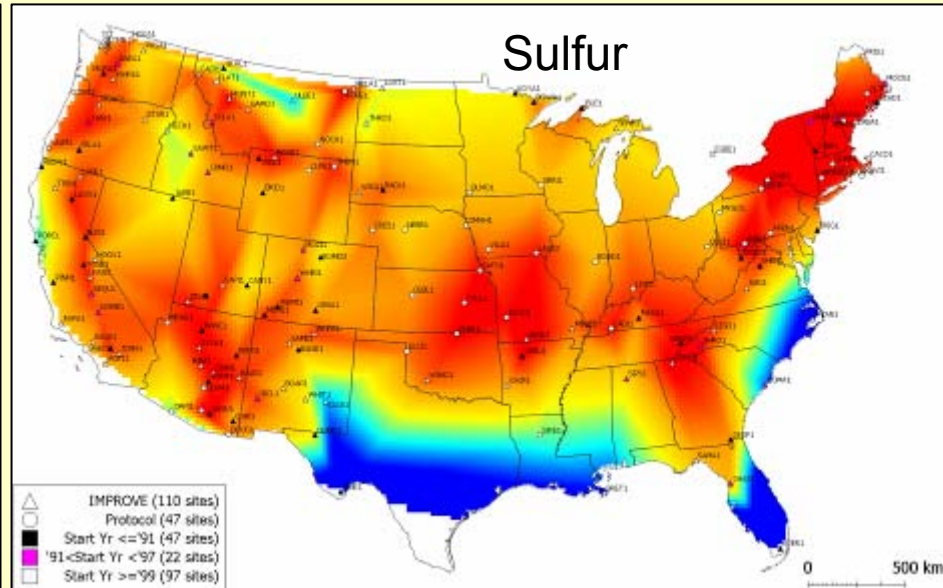
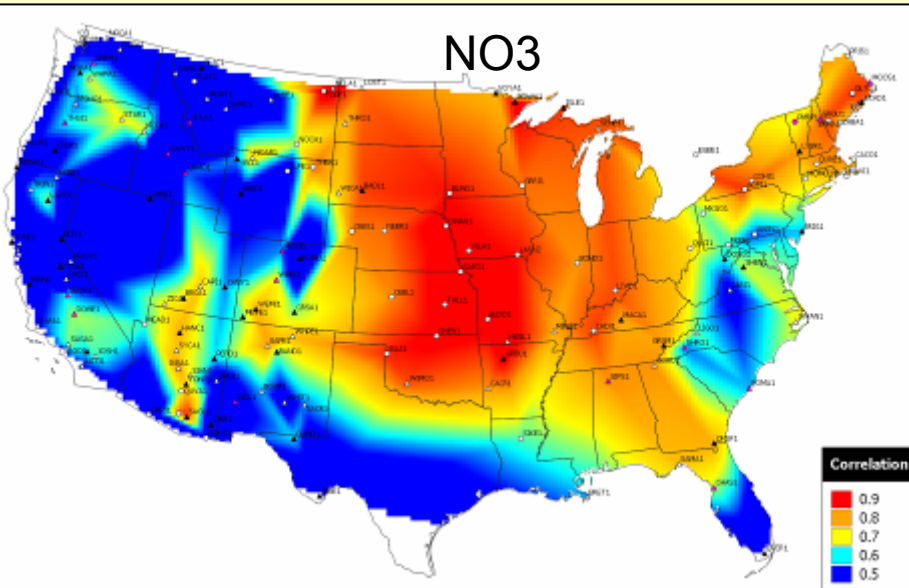


Aerosol extinction fractional error map (note the different scale)

- This map weights the components by their contribution to light extinction
- Because haze is dominated in the east by sulfate, which is the most spatially uniform component, more of the eastern sites are redundant
- Also show parts of AZ & MT as having redundant sites

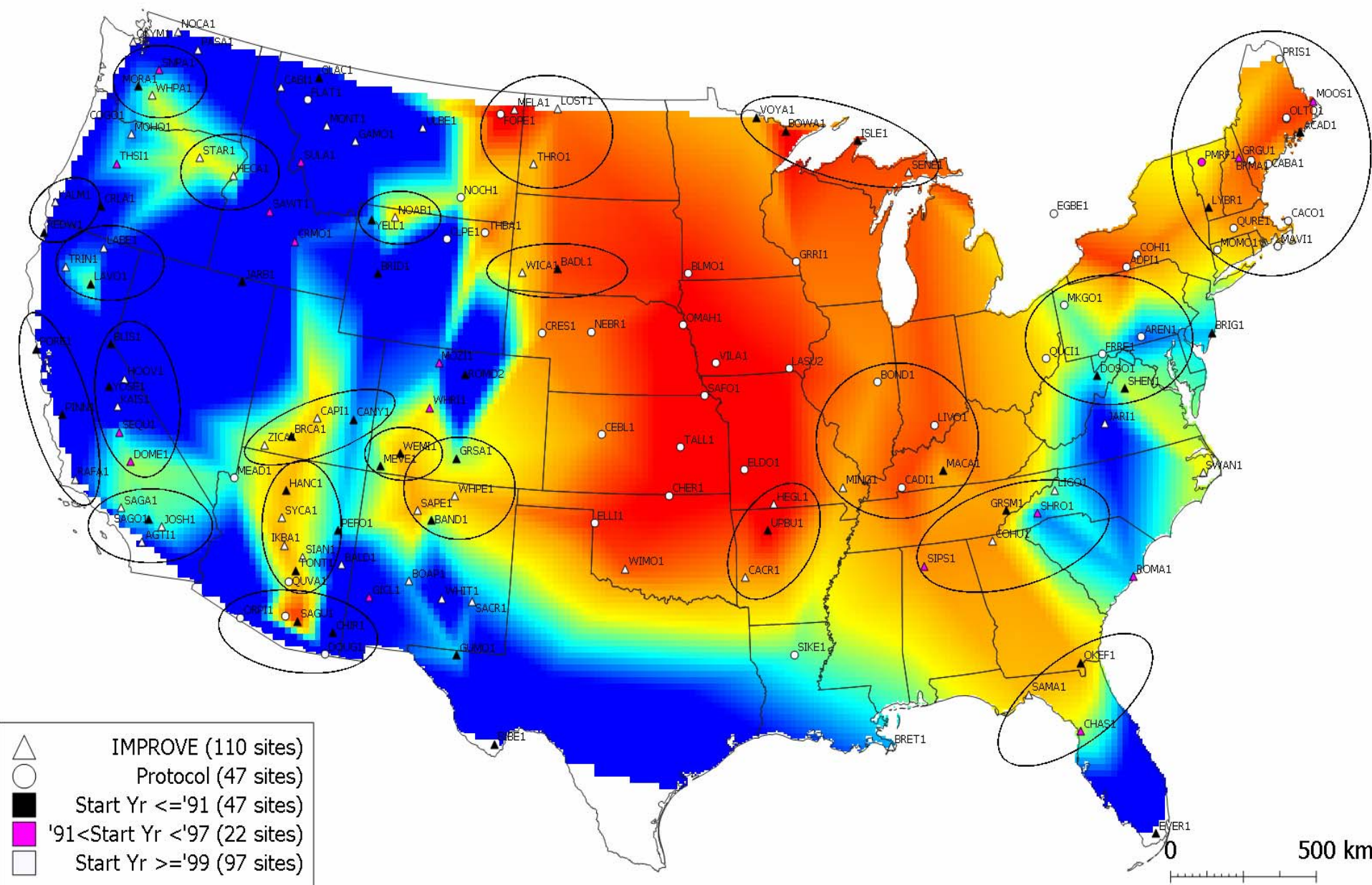


Correlation of Estimated and Measured Concentrations



Note that the color shades are opposite to those for relative error maps in the earlier slides, because a high degree of data redundancy corresponds to high correlation coefficient values and to low relative error values.

Site Selection Decommissioning Regions



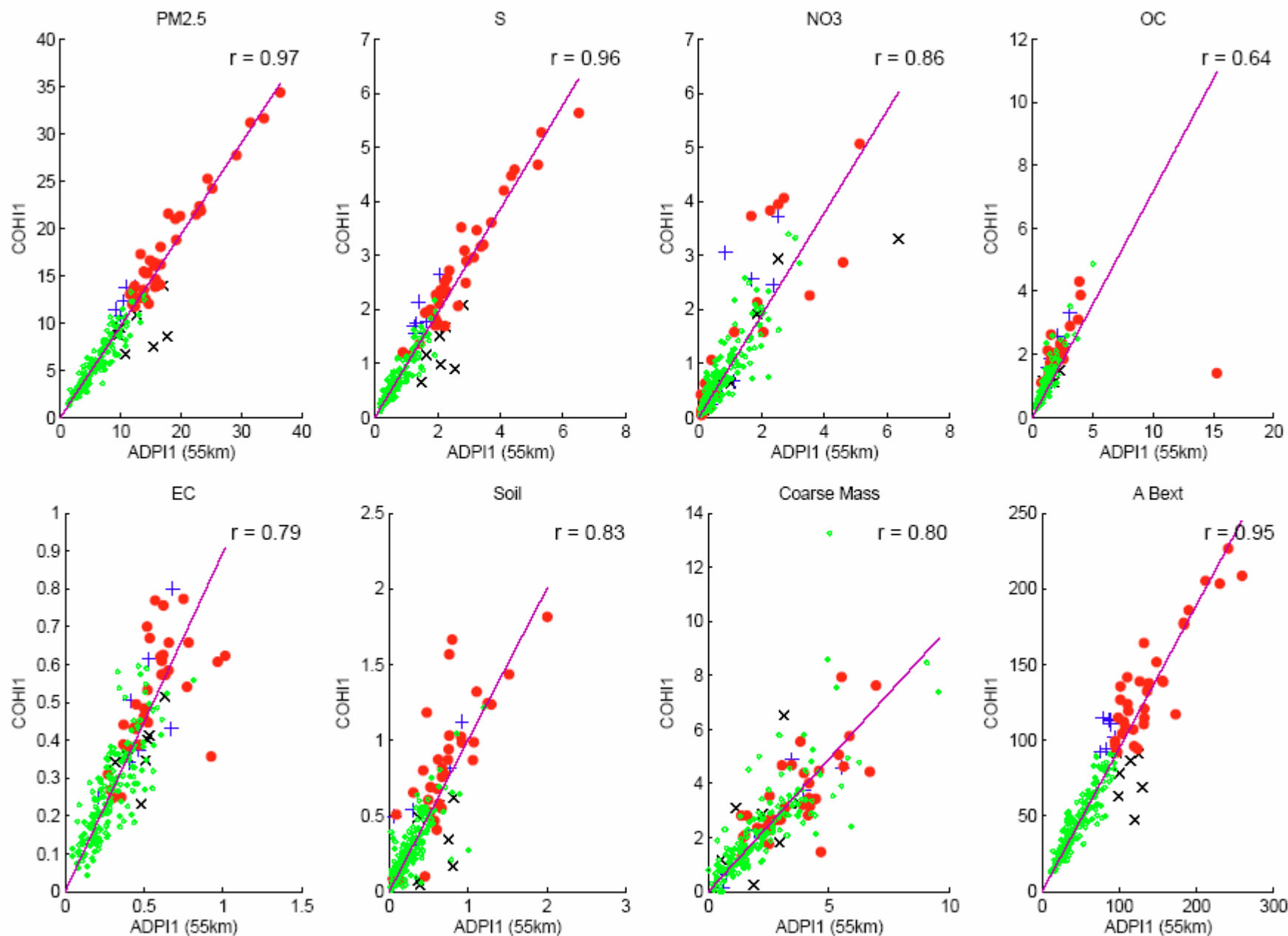
First Two Sites Selected Not Using the Process

- Two sites were pre-selected outside of the process, but are included on the priority list
 - Hawaii Volcano National Park IMPROVE site will be mothballed until sulfate from the erupting volcano no-longer dominates its worst haze days
 - Connecticut Hill EPA Protocol site in NY will be shut down this year as redundant with Addison Pinnacles state-Protocol site located about 30 miles away

Step 2 Plan Approach

-Process-

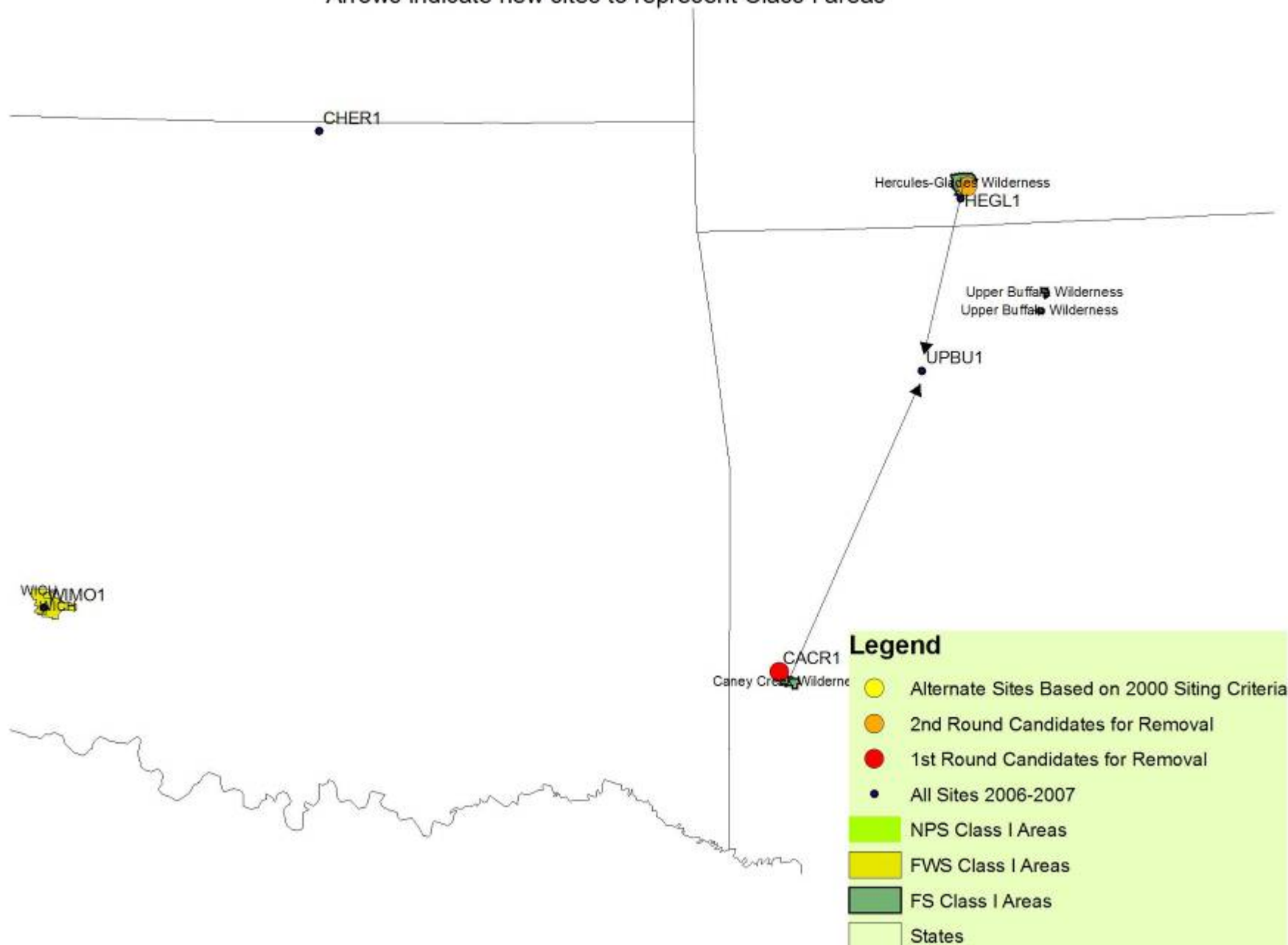
- Step 2 – Priority site selection among the candidate sites in each group
 - **Site-Specific Redundancy Metric**
 - Highest of the correlation coefficient (r value) between the nitrate data from a site and that of other sites in each region
 - Was used to prioritize the regions
 - **Redundancy Metric Adjustments**
 - Reduce the metric by 0.2 for sites with 15 years or more of data and 0.1 for site with 10 years or more of data (to give sites with long data records some protection against being shut down)
 - Reduce the metric for the non-selected sites in a region by 0.1 for each time a site is selected from the region (prevents the same region from having two or more sites sequentially listed)
 - **Process Steps**
 - Selection is based on the adjusted metric among all candidate sites
 - In case of identical metrics for two eligible sites in a region (rare), other factors (e.g. collocated measurements) are used to pick the less important of the two site for listing
 - With each selection, the potentially orphaned class I areas are typically assigned to the monitoring site in the region with the highest nitrate correlation to the selected site, after which the caretaker site is ineligible for future selection



× ADPI1-20% Worst (7) + COHI1-20% Worst (7) • Both-20% Worst (35)

Analysis Region 4

Arrows indicate new sites to represent Class I areas



Summary Description of Step 2 Results

Table 1. Numbers of class I areas (CIA) and sites and ratios of IMPROVE sites to CIAs currently, listed for removal, and remaining by Regional Planning Organization (RPO). Also shown is the number of EPA Protocol sites listed by RPO.

RPO	CIA	Current Network		Sites Listed		Remaining Sites	
		IMPROVE Sites	Sites/CIA	Protocol	IMPROVE Sites	IMPROVE Sites	Sites/CIA
WRAP	117	77	66%	0	21	56	48%
CENRAP	10	10	100%	0	3	7	70%
MRPO	2	2	100%	2	1	1	50%
VISTAS	18	15	83%	1	4	11	61%
MANE-VU	8	6	75%	1	2	4	50%
Total	155	110	71%	4	31	79	51%

Table 2. Number of sites currently, listed for removal, and the fraction of sites listed for removal by federal agency.

	Current	Listed	Fraction
FS	48	19	40%
FWS	18	4	22%
NPS	44	8	18%
EPA	8	4	50%
Total	118	35	30%

Step 2 Priority Order List of IMPROVE and EPA Protocol Site for Decommissioning

Rank	Site ID	Site Name	State	Site Type	Affiliation
1	COHI1	Connecticut Hill	NY	PROTOCOL	EPA
2	HAVO1	Hawaii Volcanoes	HI	IMPROVE	NPS
3	MELA1	Medicine Lake	MT	IMPROVE	FWS
4	HEGL1	Hercules-Glades	MO	IMPROVE	FS
5	SAGU1	Saguaro	AZ	IMPROVE	NPS
6	ISLE1	Isle Royale	MI	IMPROVE	NPS
7	GRGU1	Great Gulf	NH	IMPROVE	FS
8	LIVO1	Livonia	IN	PROTOCOL	EPA
9	COHU1	Cohutta	GA	IMPROVE	FS
10	SYCA1	Sycamore Canyon	AZ	IMPROVE	FS
11	SAMA1	St. Marks	FL	IMPROVE	FWS
12	CACR1	Caney Creek	AR	IMPROVE	FS
13	ZICA1	Zion Canyon	UT	IMPROVE	NPS
14	VOYA2	Voyageurs	MN	IMPROVE	NPS
15	LOST1	Lostwood	ND	IMPROVE	FWS
16	KAIS1	Kaiser	CA	IMPROVE	FS
17	WICA1	Wind Cave	SD	IMPROVE	NPS
18	HECA1	Hells Canyon	OR	IMPROVE	FS

Rank	Site ID	Site Name	State	Site Type	Affiliation
19	SAPE1	San Pedro Parks	NM	IMPROVE	FS
20	QUCI1	Quaker City	OH	PROTOCOL	EPA
21	WHPA1	White Pass	WA	IMPROVE	FS
22	WHRI1	White River	CO	IMPROVE	FS
23	TRIN1	Trinity	CA	IMPROVE	FS
24	MOOS1	Moosehorn	ME	IMPROVE	FWS
25	SIAN1	Sierra Ancha	AZ	IMPROVE	FS
26	CADI1	Cadiz	KY	PROTOCOL	EPA
27	BLIS1	Bliss	CA	IMPROVE	FS
28	NOAB1	North Absaroka	WY	IMPROVE	FS
29	SAGA1	San Gabriel	CA	IMPROVE	FS
30	CAPI1	Capitol Reef	UT	IMPROVE	NPS
31	KALM1	Kalmiopsis	OR	IMPROVE	FS
32	MOHO1	Mount Hood	OR	IMPROVE	FS
33	LIGO1	Linville Gorge	NC	IMPROVE	FS
34	DOSO1	Dolly Sods	WV	IMPROVE	FS
35	LABE1	Lava Beds	CA	IMPROVE	NPS

Current Lower 48 IMPROVE and IMPROVE Protocol Network 2006

Candidate Sites are Marked and Numbered in Order of Proposed Removal



Step 2 Reassignment of class I areas to “Caretaker” monitoring sites

Rank	SiteID	Class I Area #1	Alternate Site to Represent Class I Area #1 - Site Code	Class I Area #2	Alternate Site to Represent Class I Area #2 - Site Code	Class I Area #3	Alternate Site to Represent Class I Area #3 - Site Code
1	COHI1		ADPI1				
2	HAVO1	Hawaii Volcanoes	HALE1				
3	MELA1	Medicine Lake	FOPE1				
4	HEGL1	Hercules-Glades	UPBU1				
5	SAGU1	Saguaro	SAWE1				
6	ISLE1	Isle Royale	SENE1				
7	GRGU1	Great Gulf	BRMA1	Presidential Range - Dry River	BRMA1		
8	LIVO1		MACA1				
9	COHU1	Cohutta	GRSM1				
10	SYCA1	Sycamore Canyon	GRCA2				
11	SAMA1	St. Marks	OKEF1				
12	CACR1	Caney Creek	UPBU1				
13	ZICA1	Zion	BRCA1				
14	VOYA2	Voyageurs	BOWA1				
15	LOST1	Lostwood	FOPE1				
16	KAIS1	Kaiser	YOSE1	Ansel Adams	HOOV1	John Muir	SEQU1
17	WICA1	Wind Cave	BADL1				
18	HECA1	Hells Canyon	STAR1				
19	SAPE1	San Pedro Parks	BAND1				
20	QUCI1		DOSO1				
21	WHPA1	Goat Rocks	MORA1	Mount Adams	MORA1		
22	WHRI	Maroon Bells Snowmass	MOZI1	Eagle's Nest	MOZI1	West Elk	WEMI1
23	TRIN1	Marble Mountain	REDW1	Yolla Bolly - Middle Eel	LAVO1		
24	MOOS1	Moosehorn	ACAD1	Roosevelt Campobello	ACAD1		
25	SIAN1	Sierra Ancha	TONT1				
26	CADI1		MACA1				
27	BLIS1	Desolation	HOOV1				
28	NOAB1	North Absaroka	YELL2	Washakie	YELL2		
29	SAGA1	San Gabriel	SAGO1	Cucamonga	SAGO1		
30	CAPI1	Capitol Reef	CANY				
31	KALM1	Kalmiopsis	REDW1				
32	MOHO1	Mount Hood	THSI1				
33	LIGO1	Linville Gorge	SHRO1				
34	DOSO1	Dolly Sods	FRRE1	Otter Creek			
35	LABE1	Lava Beds	LAVO1	South Warner	LAVO1		

State/Tribal
Protocol Sites are
Highlighted Yellow

Public Review of the Step 2 Plan

- Plan methodology and results were widely distributed to states, RPOs, FLMs, EPA, and others in mid-July
- Comments were received during a nominal one month comment period (July 15th to August 15th)
- Comments were organized by region, compiled, summarized and became the basis of the proposed IMPROVE Steering Committee response and step 3 plan for IMPROVE downsizing in response to reduced budget

Step 3

Overview of Comments

- General comments received from 18 states, 5 RPOs, 4 EPA Regions, numerous FLMs
 - its premature (with regard to the RHR process) to shut down any of the 110 sites – SIPs not yet complete; need to ensure progress by trends tracking; some sites with only a few complete years of data; don't know the fate of other protocol sites that would be caretakers
 - reducing the number of sites effectively diminishes the number of visibility-protected areas since the RHR uses monitoring data to define the pace of progress and document its performance
 - IMPROVE Steering Committee is not the appropriate body to make decisions since they can't balance it against other air program needs
 - other approaches to reduce cost should be considered, instead of shutting down sites
 - the methodology of using current data to make decisions about redundancy is flawed for a 60-year trends program where emissions will undoubtedly change significantly
 - concerns that depending on a state or tribal protocol site for RHR tracking is vulnerable to changing priorities of the sponsor
 - No written comments were received supporting the reduction of IMPROVE monitoring network

Site-Specific Comment

- Principally indicated why we shouldn't shut down specific sites
 - helpful in fine-tuning the list of sites
 - provide information for identifying class I areas that would lack representative monitoring if certain sites are shut down
 - Summarized by site in a spreadsheet (CommentsCompiledBySite.xls)

IMPROVE Response to Comments

- Issues being considered (brief responses in red)
 - Should we proceed with the priority listing of sites for decommissioning?
Yes, by categorizing sites instead of a single priority ordered list.
 - Are we the appropriate organization to do this? Yes.
 - Is this the best time to do it? If not, then when? Categorization now, final selection after the budget is available.
 - Should we pursue other ways to reduce cost (e.g. 1 day in 6 instead of 1 day in 3 sampling) instead of reducing sites? Not at this time.
 - Should we modify the current list of sites and if so how? Yes.
 - Do we want to redo a data-based assessment to identify redundancy using other parameters or a different approach? No, except for minor changes.
 - Should we work from the current list making changes based on comments received? Yes, except for minor changes.
 - Should we change the reassignment of class I areas to remaining monitoring sites based on comments received? Yes, in some cases.
 - Should we explicitly indicate our judgment about the degree of representation a site has for the class I areas assigned to it? Yes, this is the thrust of our response.
 - Should we consider other ways to reduce cost in addition to reducing the number of sites? Rejected at this time to preserve the utility of data at remaining sites for RHR tracking, source attribution, model testing, etc.
 - most sites only operating 4 years out of each 5
 - most sites only weighing the samples until years end when we choose the extreme mass events to analyze
 - one day in six instead of one day in 3

IMPROVE Response to Comments

- Steering Committee has been meeting via conference calls to discuss and resolved issues
 - Steering Committee will base their response on the principle goal of IMPROVE– ***to generated data representative of visibility-protected federal class I areas***
 - Minor changes will be made to the list of sites based on comments received
 - Additional assessment inspired by the comments will be applied uniformly to all sites on the modified list as the basis for categorizing sites with respect to the principle goal

Minor Modification to the List

- Bliss site will be replaced by the Hoover site at the suggestion of California and others
- Protocol sites will not be counted upon for long-term operations so won't be used as caretaker sites as suggested by many in comments – there were 4 such sites and this does remove a few sites from the list
- All 8 EPA Protocol sites are included (only 4 were on the original list) since none of them are representative of class I areas

Site Categories

- **Non-Class I Area Sites** – Sites that don't represent class I areas (i.e. the 8 EPA CASTNET sites);
- **Replaceable Sites** – Sites that if removed would have all of its class I areas monitored by the remaining IMPROVE sites;
- **Non-Replaceable Sites** – Sites that if removed leave one or more class I areas without representative monitoring; and
- **Conditional Sites** – Sites where the data sets are too short (1 year or less) to draw reliable conclusions.

Additional Assessments

- Used to categorize sites (failure of any test places a site in the non-replaceable category)
 - 1. Mean best & worst day total light extinction and extinction budgets
 - 2. Seasonality of best & worst day light extinction budgets
 - 3. Annual trends of best & worst day light extinction
- Used to help select sites within categories (only after the funding is known)
 - Number & magnitude of assessment failures (above)
 - Number of non-represented class I areas
 - Back-trajectory source areas for worst day light extinction
 - Sensitivity to additional particulate concentration
 - Other factors and consultations

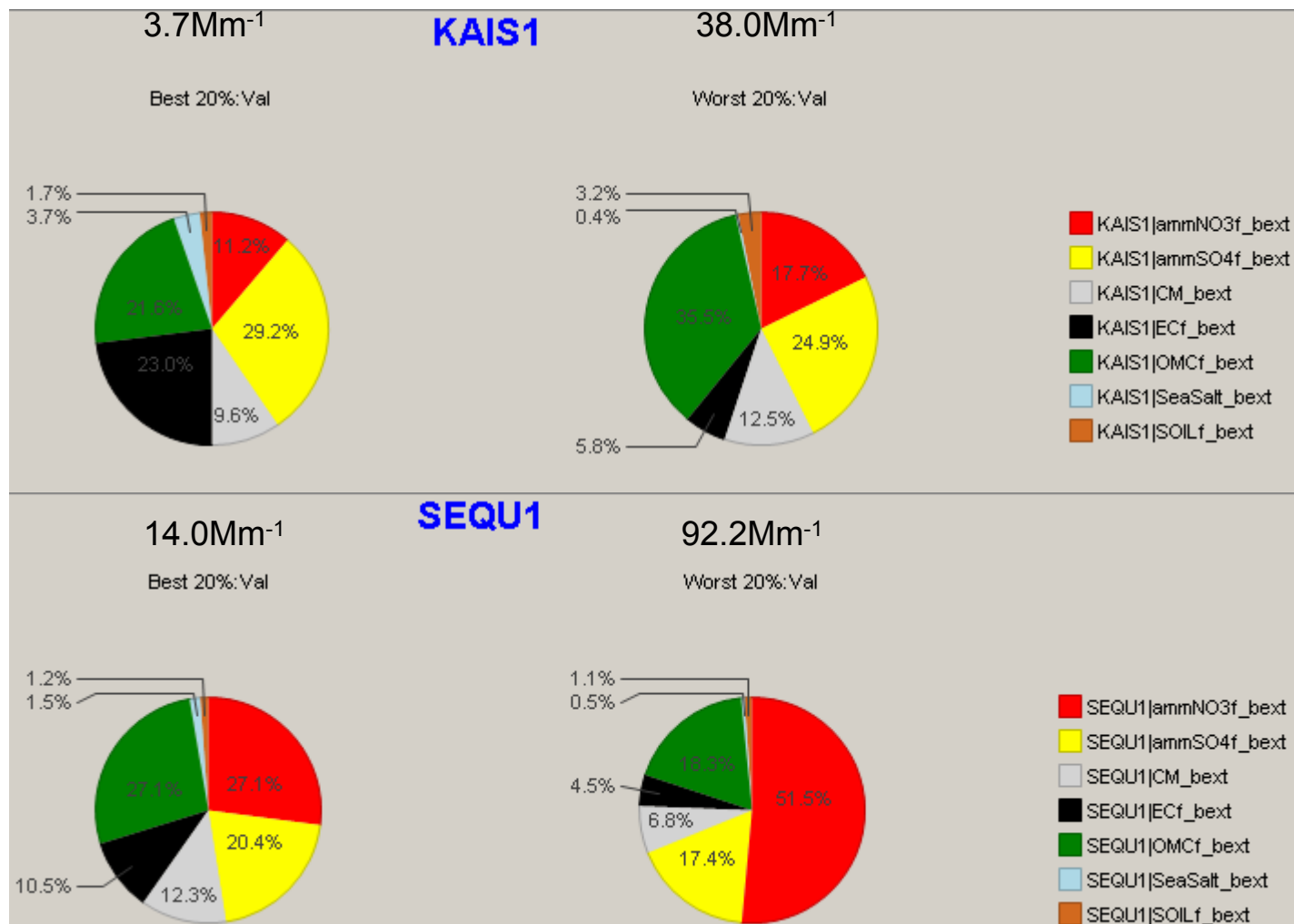
Extinction/Extinction Budget Tests

- Test 1a – largest change in annual mean aerosol light extinction due to the between sites' difference in one species should not exceed 25% of the aerosol extinction on either hazy or clear days
- Test 1b – change in total annual mean aerosol light extinction between the two sites should not exceed 50% on hazy days

Example of the Aerosol Extinction Budget Test

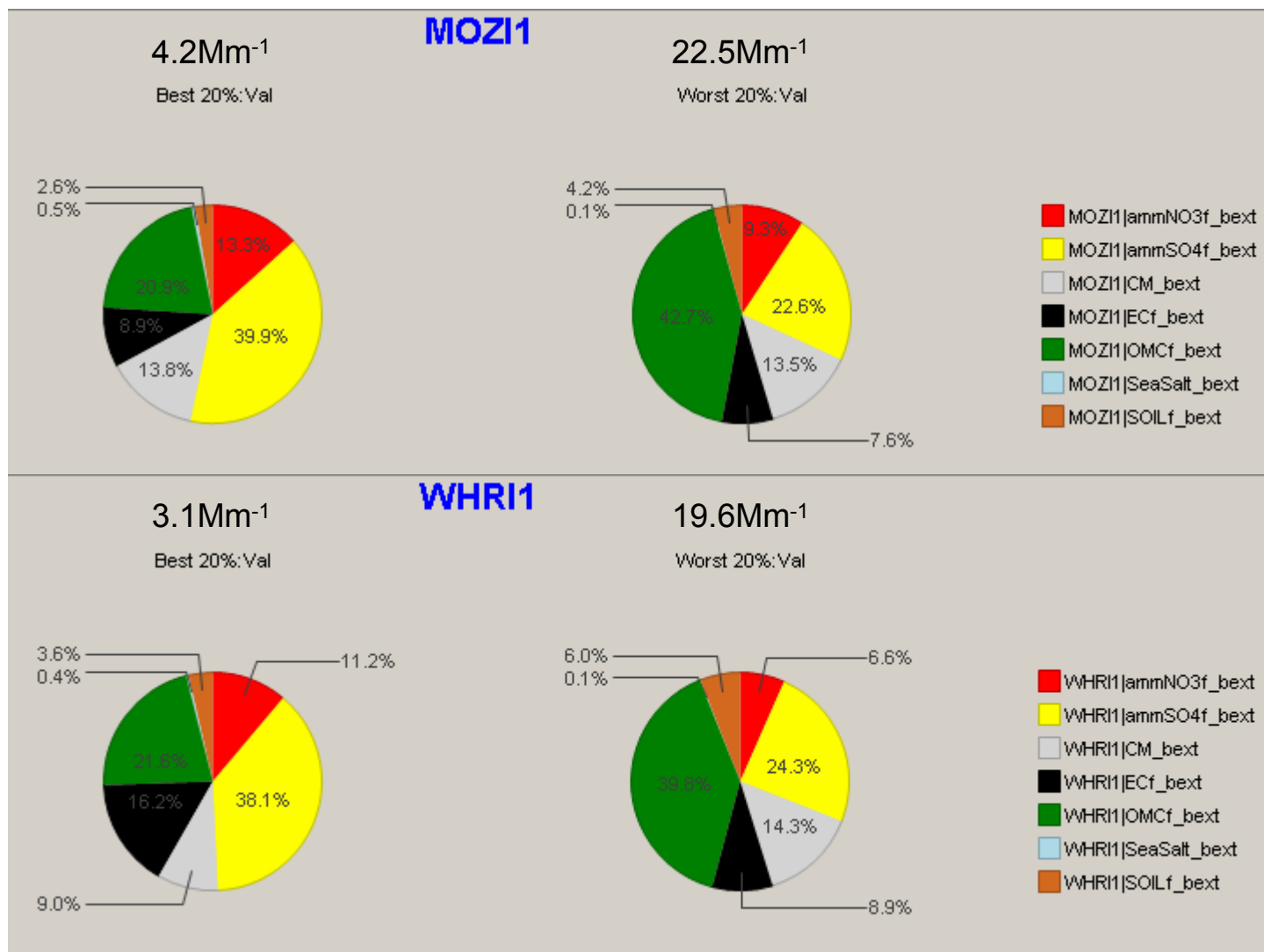
This site pair fails both test 1a and 1b with values of 98% and -143% respectively. However because there is only one common year of data it will be classified as conditional.

Worst day nitrate caused the failure of test 1a



Example of the Aerosol Extinction Budget Test

This site pair passes both test 1a and 1b with values of 7% and -38% respectively based on 4 years of common complete data.



Seasonality Test

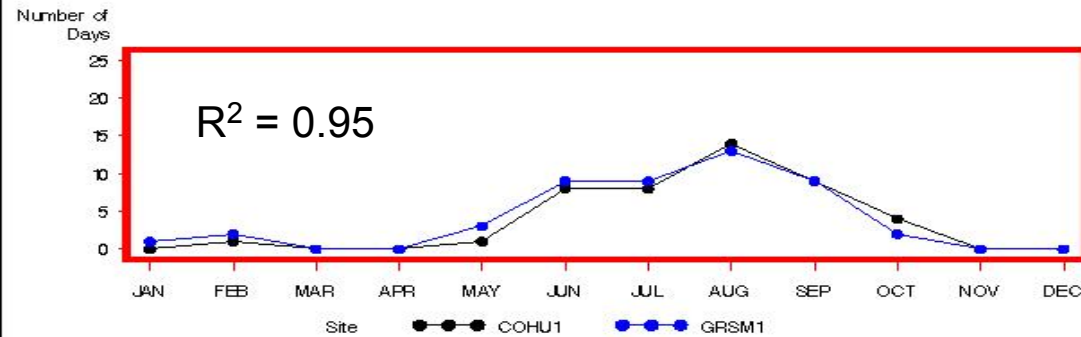
- Test 2a – Monthly frequencies of the haziest days should have an R^2 value greater than 0.5 (i.e. variance explained > 50%)
- Test 2b – Monthly frequencies of the clearest days should have an R^2 value greater than 0.5 (i.e. variance explained > 50%)

Example of the Seasonal Test

- The cumulative number of worst days in each month (for paired complete years of data) are shown for the paired sites in the plots
- Correlation analysis is done and the test requires $R^2 > 0.5$ for replaceable sites
- Of these examples only SIAN and TONT fail with $R^2 = 0.40$; the frequency of hazy days increases through the fall months at TONT, but decreases for SIAN

Monthly Number of Hazy Days

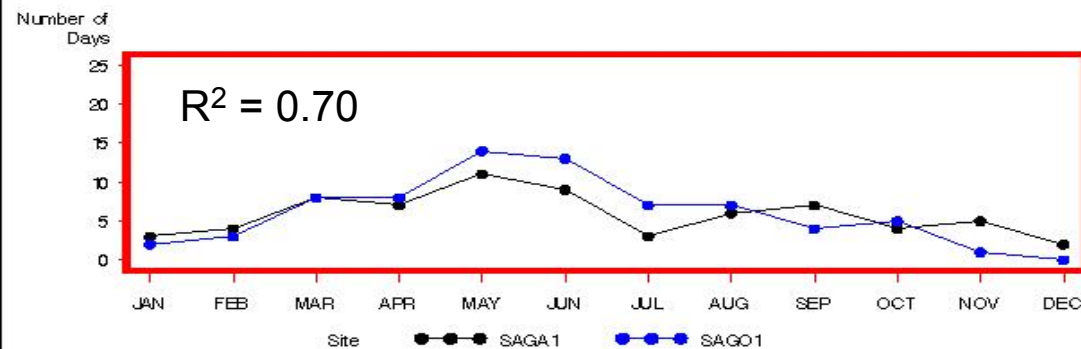
region = 9



September 8, 2006

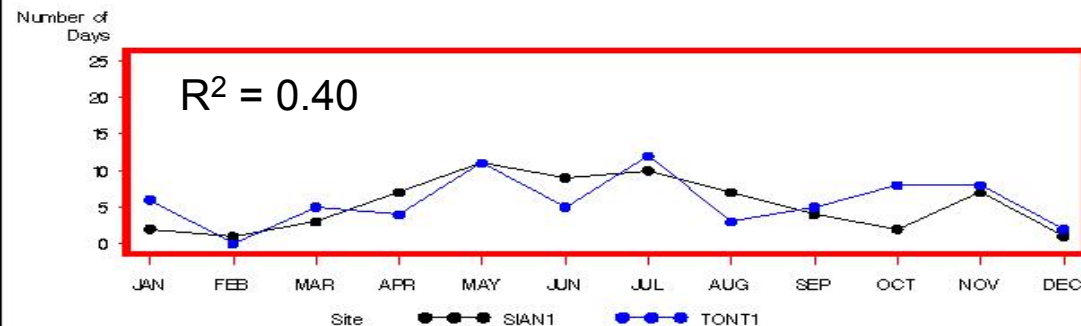
Monthly Number of Hazy Days

region = 25



Monthly Number of Hazy Days

region = 22



September 8, 2006

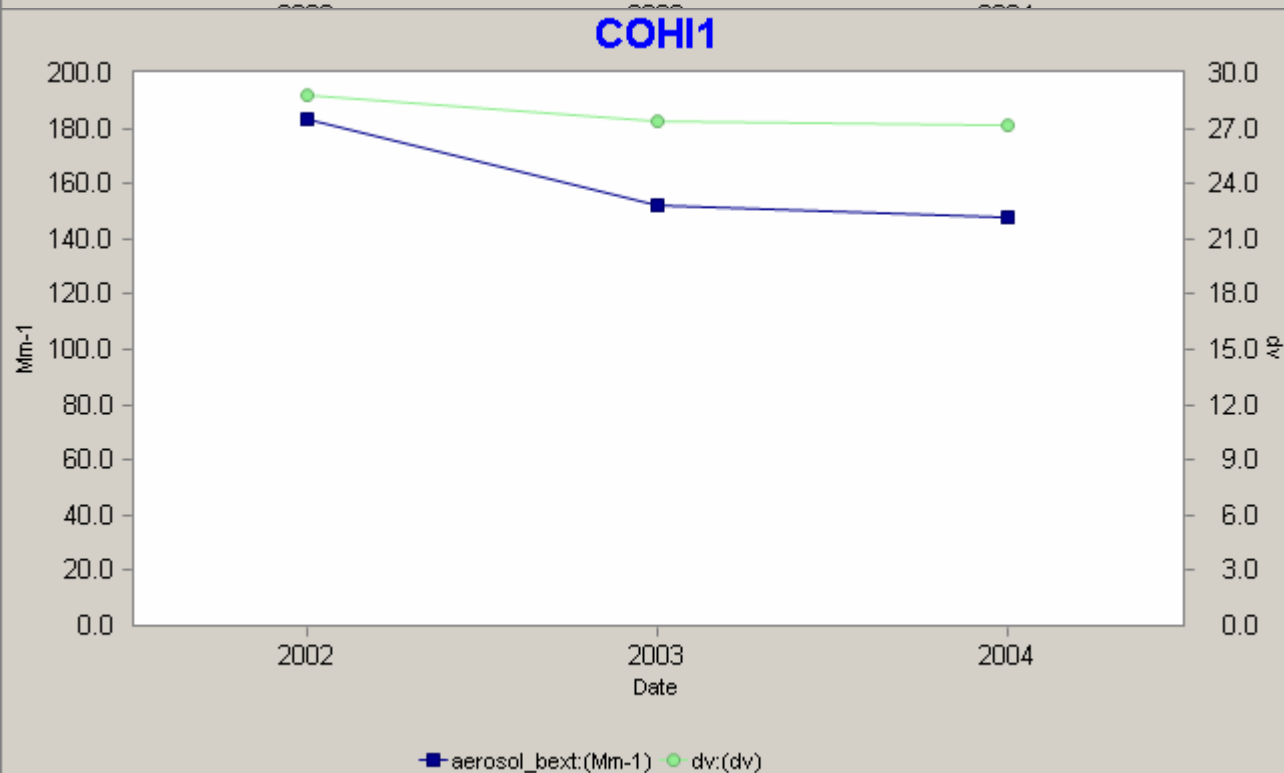
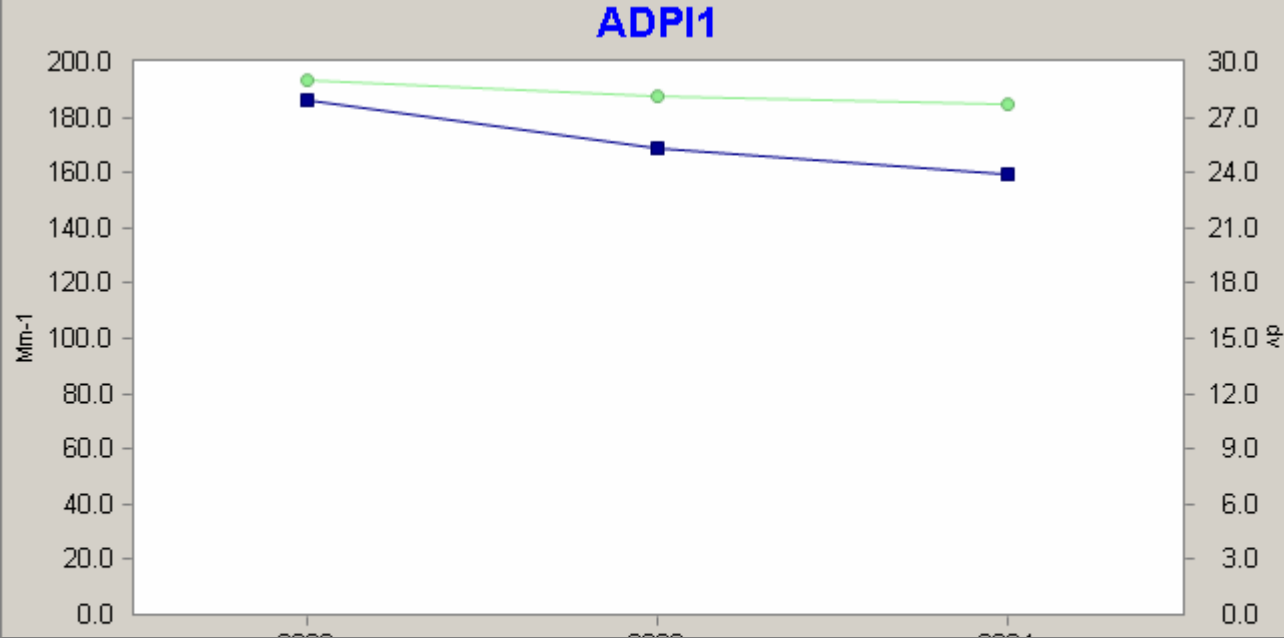
Annual Trends Test

- Test 3a – Differences between the two sites' annual trends should be less than 1 deciview for clear days
- Test 3b – Differences between the two sites' annual trends should be less than 1 deciview for hazy days

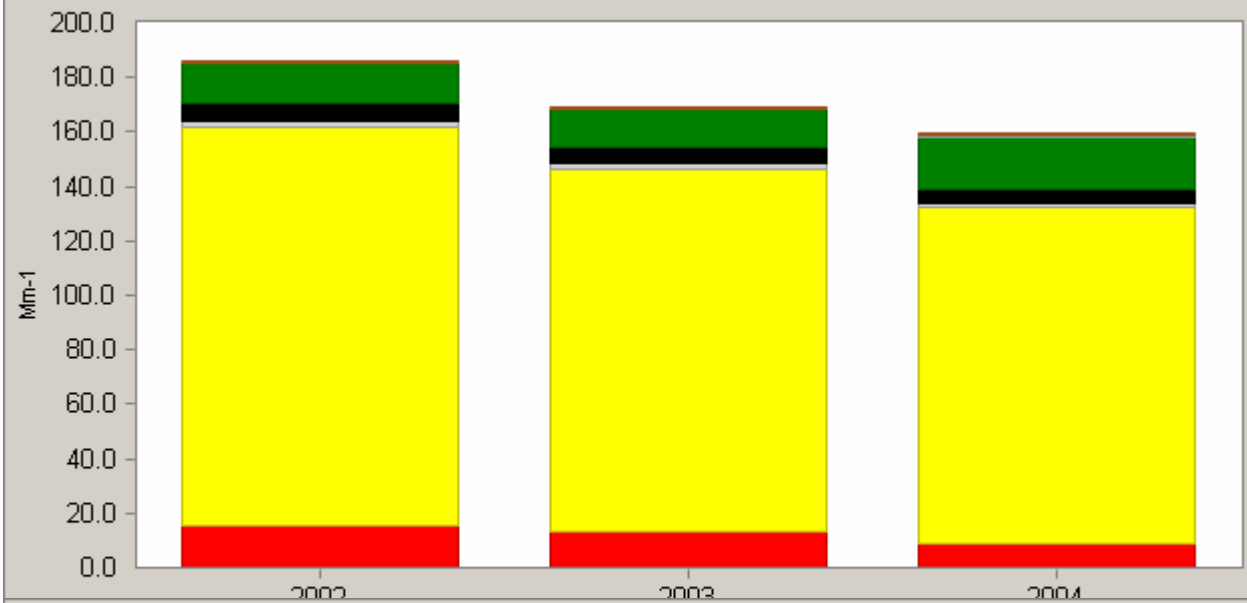
Worst Day Trends for Addison Pinnacles & Connecticut Hills

site	Year	aerosol_bext	dv
ADPI1	2002	185.92	29.04
ADPI1	2003	168.76	28.18
ADPI1	2004	159.49	27.67
COHI1	2002	183.16	28.79
COHI1	2003	152.2	27.43
COHI1	2004	148.14	27.17

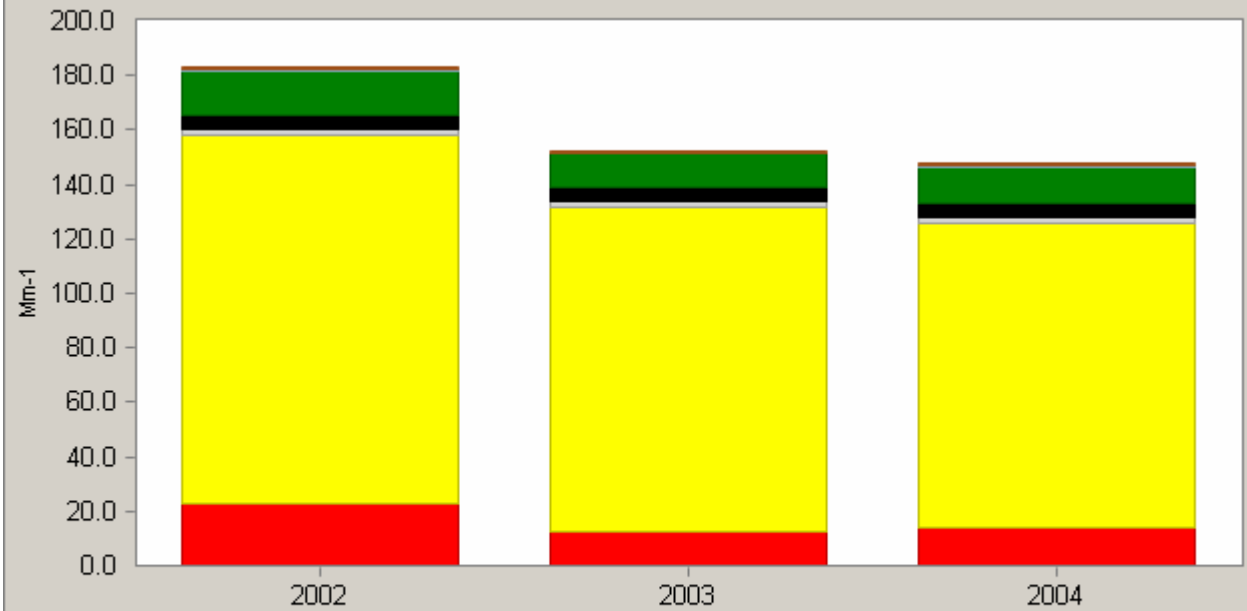
dv trend ADPI	dv trend COHI	delta trend
-0.86	-1.36	0.50
-0.51	-0.26	-0.25



ADPI1



COH1



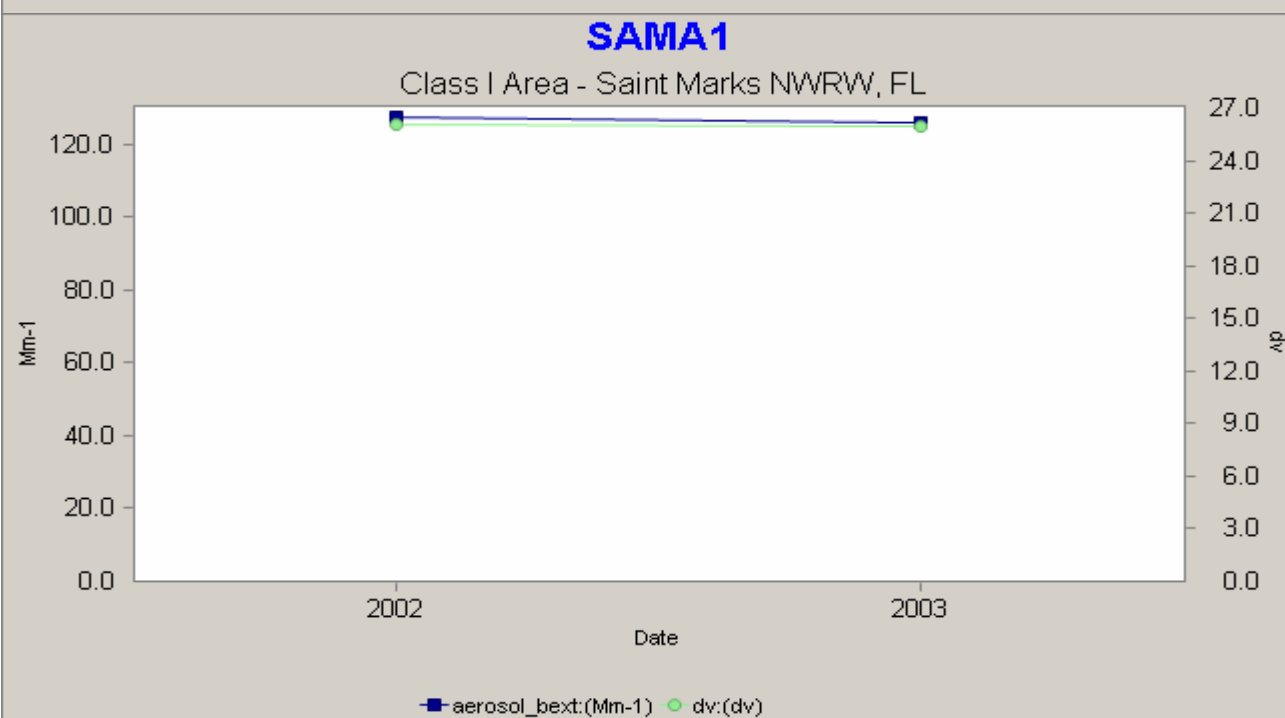
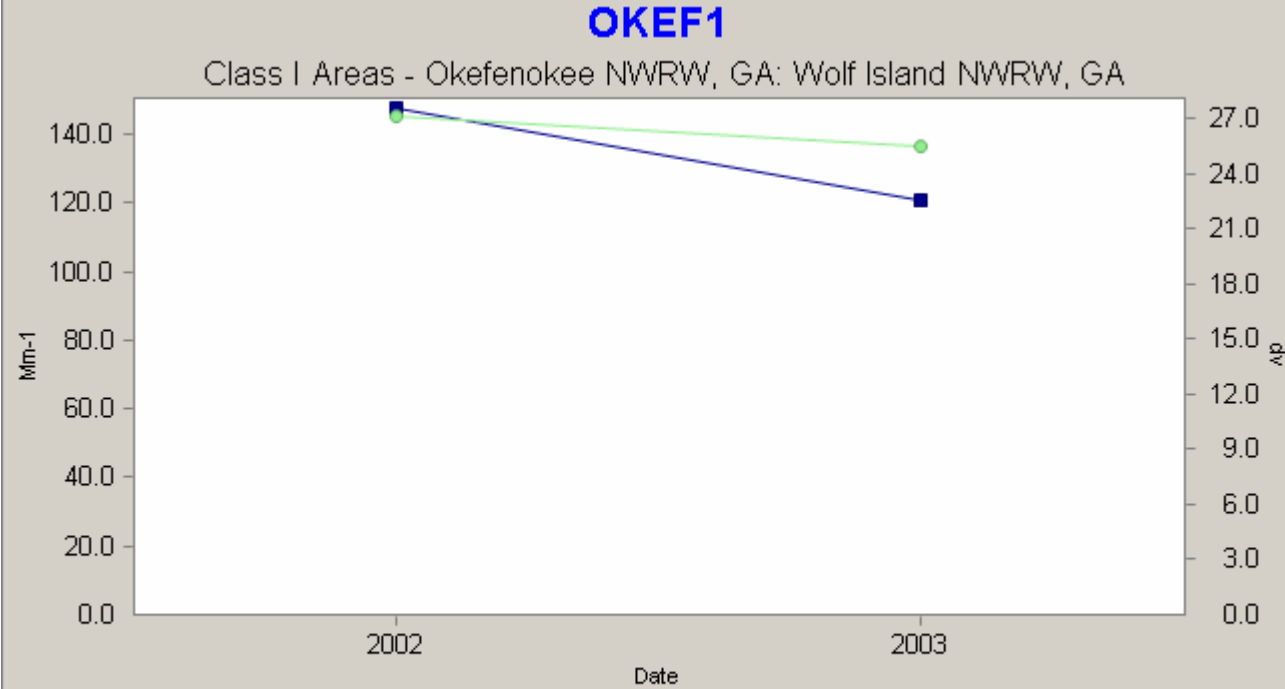
ammNO3f_bext: ammSO4f_bext: CM_bext: ECf_bext:
OMCf_bext: SeaSalt_bext: SOILf_bext:

Worst Day Trends for Okefenokee and Saint Marks

site	Year	aerosol_bext	dv
OKEF1	2002	147.76	27.1
OKEF1	2003	120.58	25.52
SAMA1	2002	127.5	26.06
SAMA1	2003	126.14	26

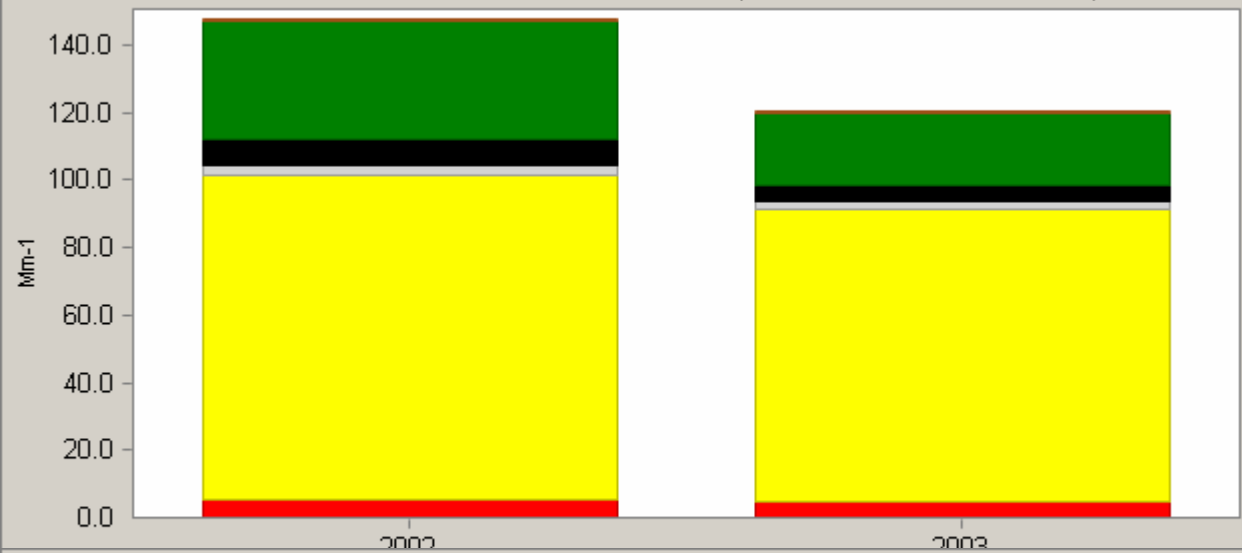
dv trend	dv trend	delta trend
OKEF	SAMA	
-1.58	-0.06	-1.52

Highlighted if absolute value of delta trend ≥ 1



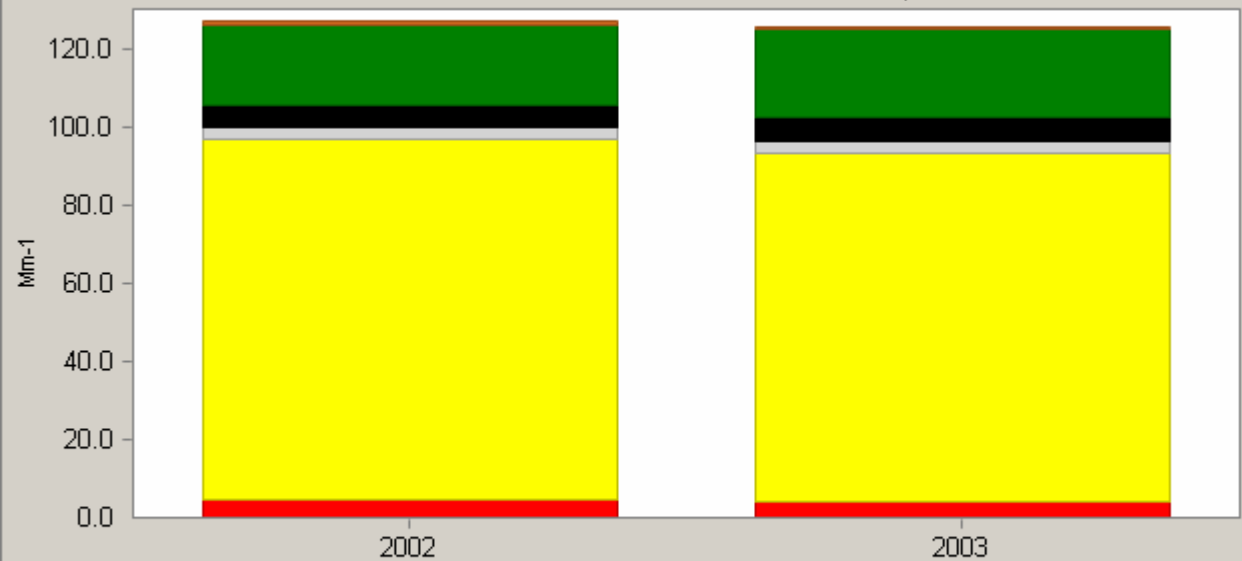
OKEF1

Class I Areas - Okefenokee NWRW, GA: Wolf Island NWRW, GA



SAMA1

Class I Area - Saint Marks NWRW, FL



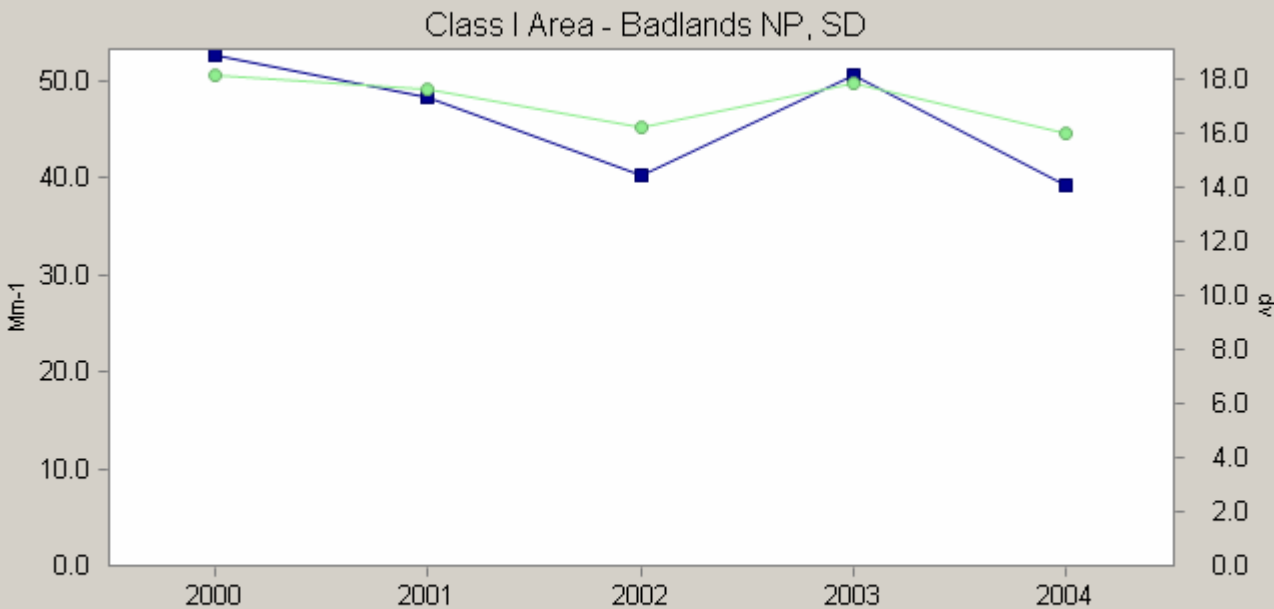
ammNO3f_bext: ammSO4f_bext: CM_bext: ECf_bext:
OMCf_bext: SeaSalt_bext: SOILf_bext:

Worst Day Tends for Badlands and Wind Caves

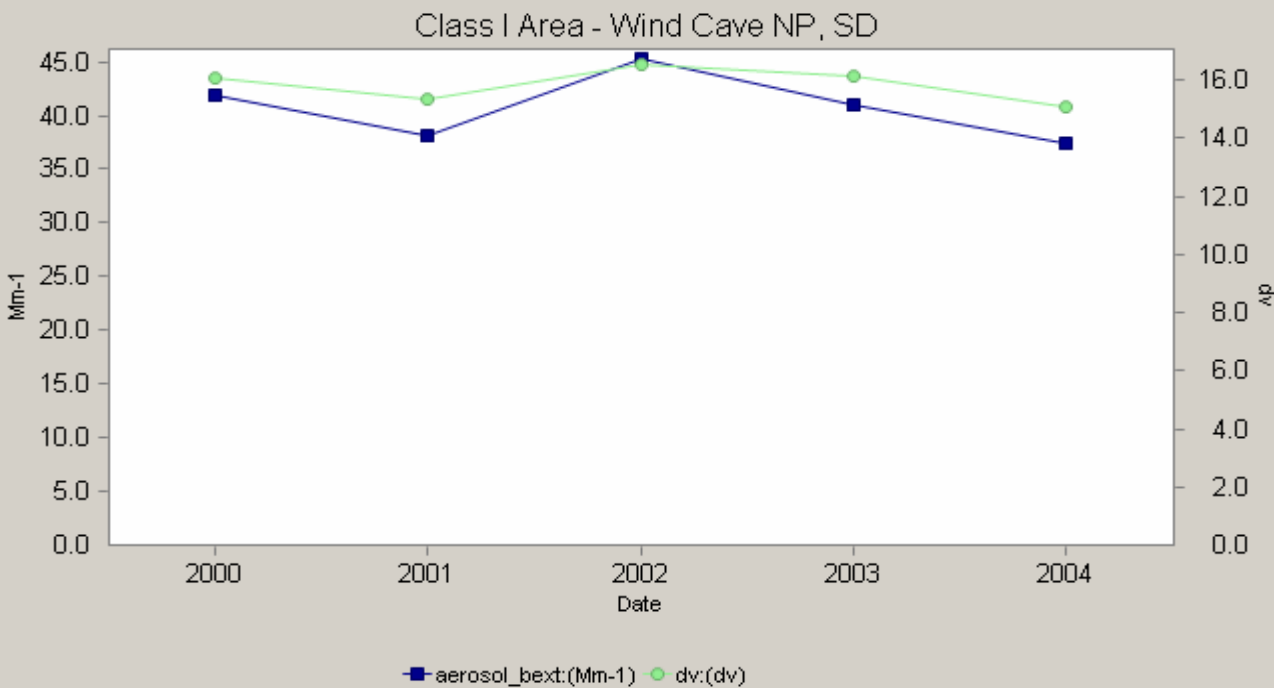
site	Year	aerosol_bext	dv
BADL1	2000	52.49	18.14
BADL1	2001	48.32	17.63
BADL1	2002	40.28	16.18
BADL1	2003	50.53	17.81
BADL1	2004	39.25	15.94
WICA1	2000	41.94	16.07
WICA1	2001	38.09	15.33
WICA1	2002	45.29	16.57
WICA1	2003	41.05	16.12
WICA1	2004	37.32	15.11

dv trend BADL	dv trend WICA	delta trend
-0.51	-0.74	0.23
-1.45	1.24	-2.69
1.63	-0.45	2.08
-1.87	-1.01	-0.86

BADL1

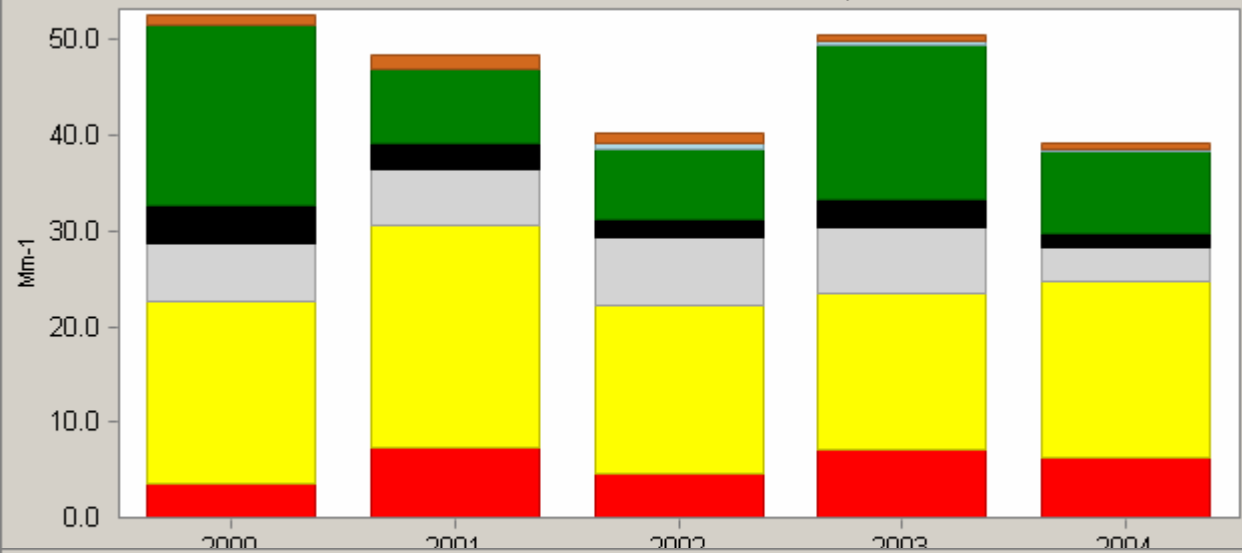


WICA1



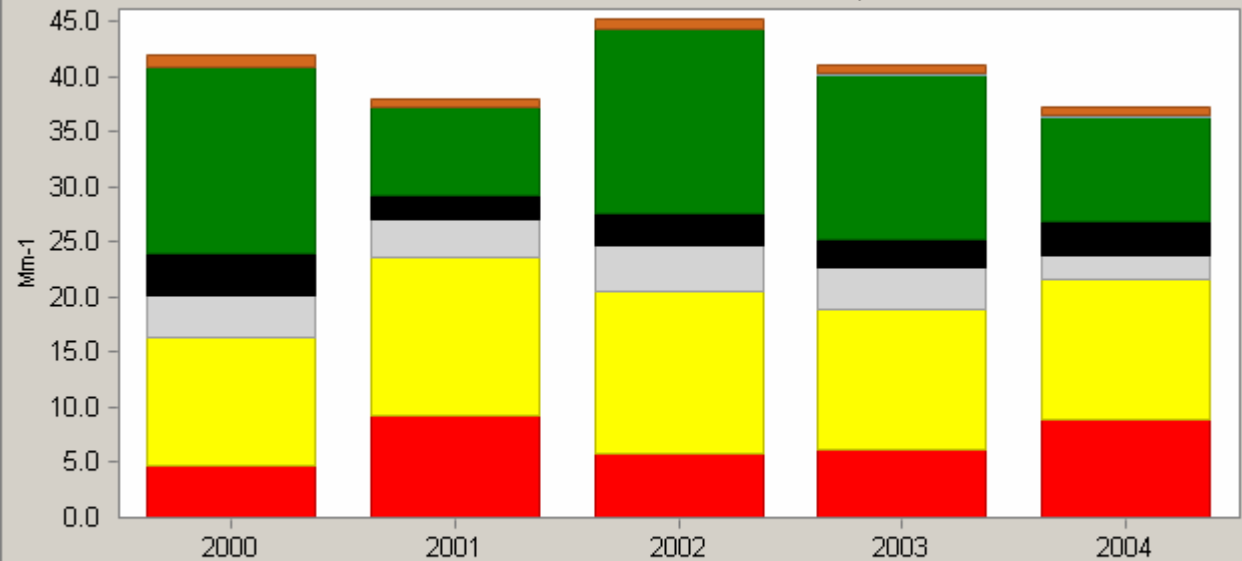
BADL1

Class I Area - Badlands NP, SD



WICA1

Class I Area - Wind Cave NP, SD



ammNO3f_bext: ammSO4f_bext: CM_bext: ECf_bext:
OMCf_bext: SeaSalt_bext: SOILf_bext:

Example Section of the Results Worksheet Summarizing the Replaceability Test Results

Candidate Site for Removal	Replacement Site	Number of Valid Years	Clear & Hazy Budget Difference Test 1a	Percent Difference in Hazy Aerosol Extinction Test 1b	Seasonal Hazy R-Squared Test 2a	Seasonal Clear R-Squared Test 2b	Annual Clear Day Trend Difference Test 3a	Annual Hazy Day Trend Difference Test 3b	Status
		< 2 is automatic "Conditional"	> 25% is Not Representative	> 50% is Not Representative	< .50 is Not Representative	< .50 is Not Representative	>1 is Not Representative	>1 is Not Representative	
COHI1	ADPI1	3	6%	-5%	0.91	0.75	-0.5	0.7	Pass
SYCA1	GRCA2	3	14%	33%	0.71	0.77	1.1	0.7	Fail Test 3a
SAMA1	OKEF1	2	4%	0%	0.35	0.17	-1.0	-1.2	Fail Test 2a
ZICA1	BRCA1	1	9%	3%	0.06	0.67			Conditional
KAIS1	YOSE1	2	30%	-29%	0.66	0.82	0.1	1.7	Fail Test 1a
KAIS1	HOOV1	2	15%	25%	0.94	0.96	0.2	0.0	Pass
KAIS1	SEQU1	1	98%	-143%	0.03	0.82			Conditional
HOOV1	BLIS1	2	11%	6%	0.63	0.73	0.6	1.3	Fail Test 3b
WICA1	BADL1	5	14%	-15%	0.77	0.92	-0.9	-2.3	Fail Test 3b
HECA1	STAR1	3	16%	2%	0.92	0.21	1.1	2.0	Fail Test 2b
SAPE1	BAND1	4	6%	-15%	0.48	0.56	0.9	-0.8	Fail Test 1b
QUCI1	DOSO1	3	4%	9%	0.85	0.62	0.4	1.4	Fail Test 3b
WHPA1	MORA1	3	55%	-100%	0.73	0.80	-0.9	-0.7	Fail Test 1a
WHRI1	MOZI1	4	7%	-14%	0.71	0.90	-0.8	0.6	Pass
WHRI1	WEMI1	4	2%	-5%	0.89	0.70	0.4	2.7	Fail Test 3b
HAVO1	HALE1	4	60%	52%	0.22	0.01	0.7	-1.6	Fail Test 1a
TRIN1	REDW1	3	29%	11%	0.39	0.59	0.4	1.8	Fail Test 1a

DRAFT Categorization of the Sites for Submission/Approval of IMPROVE Steering Committee

Non-Replaceable Sites (25)

Not Representative of class I areas (8)

AREN1	Arendtsville	PA	EPA
BOND1	Bondville	IL	EPA
CADI1	Cadiz	KY	EPA
COHI1	Connecticut Hill	NY	EPA
LIVO1	Livonia	IN	EPA
MKGO1	MK Goddard	PA	EPA
QUCI1	Quaker City	OH	EPA
SIKE1	Sikes	LA	EPA

Replaceable Sites (3)

CACR1	Caney Creek	AR	FS	UPBU1
COHU1	Cohutta	GA	FS	GRSM1
VOYA2	Voyageurs	MN	NPS	BOWA1

Conditional Sites (2)

KAIS1	Kaiser	CA	FS	YOSE1/SEQU1/HOOV1
ZICA1	Zion Canyon	UT	NPS	BRCA1

CAPI1	Capitol Reef	UT	NPS	CANY1
DOSO1	Dolly Sods	WV	FS	SHEN1
GRGU1	Great Gulf	NH	FS	LYBR1
HAVO1	Hawaii Volcanoes	HI	NPS	HALE1
HECA1	Hells Canyon	OR	FS	STAR1
HEGL1	Hercules-Glades	MO	FS	UPBU1
HOOV1	Hoover	CA	FS	BLIS1
ISLE1	Isle Royale	MI	NPS	SENE1
KALM1	Kalmiopsis	OR	FS	REDW1
LABE1	Lava Beds	CA	NPS	LAVO1
LIGO1	Linville Gorge	NC	FS	SHRO1
MELA1	Medicine Lake	MT	FWS	LOST1
MOHO1	Mount Hood	OR	FS	THSI1
MOOS1	Moosehorn	ME	FWS	ACAD1
NOAB1	North Absaroka	WY	FS	YELL2
SAGA1	San Gabriel	CA	FS	SAGO1
SAMA1	St. Marks	FL	FWS	OKEF1
SAPE1	San Pedro Parks	NM	FS	BAND1
SIAN1	Sierra Ancha	AZ	FS	TONT1
SYCA1	Sycamore Canyon	AZ	FS	GRCA1
THRO1	Theodore Roosevelt	ND	NPS	LOST1
TRIN1	Trinity	CA	FS	REDW1/LAVO1
WHPA1	White Pass	NM	FS	MORA1
WHRI1	White River	CO	FS	MOZI1/WEMI1
WICA1	Wind Cave	SD	NPS	BADL1

Other Considerations

- Sites within each categories will be listed alphabetically, not by priority
- IMPROVE's interest is in maintaining as much representative monitoring of class I areas as possible so Non-Class I Area and Replaceable Site Categories are lower priority than Conditional and Non-Replaceable Site Categories
- Specific site recommendations will be made in consultation with state, FLMs, RPOs, & EPA only after the budget is determined
- Our goal is to submit the four site category lists and documentation of the process prior to the IMPROVE Steering Committee meeting (Sept 26 – 28, 2006)

Additional Analysis

Will be helpful in selecting sites
from the non-replaceable category
if required

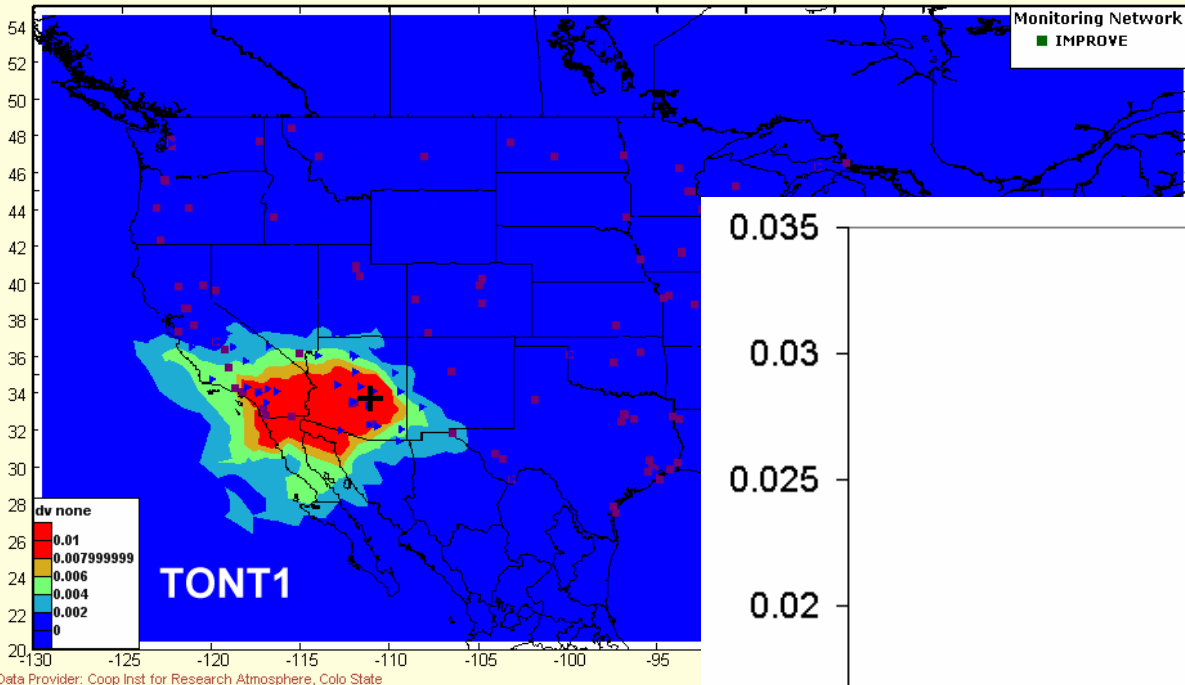
Back Trajectory Test:

Are similar locations upwind of target and replacement sites on haziest 20% Days?

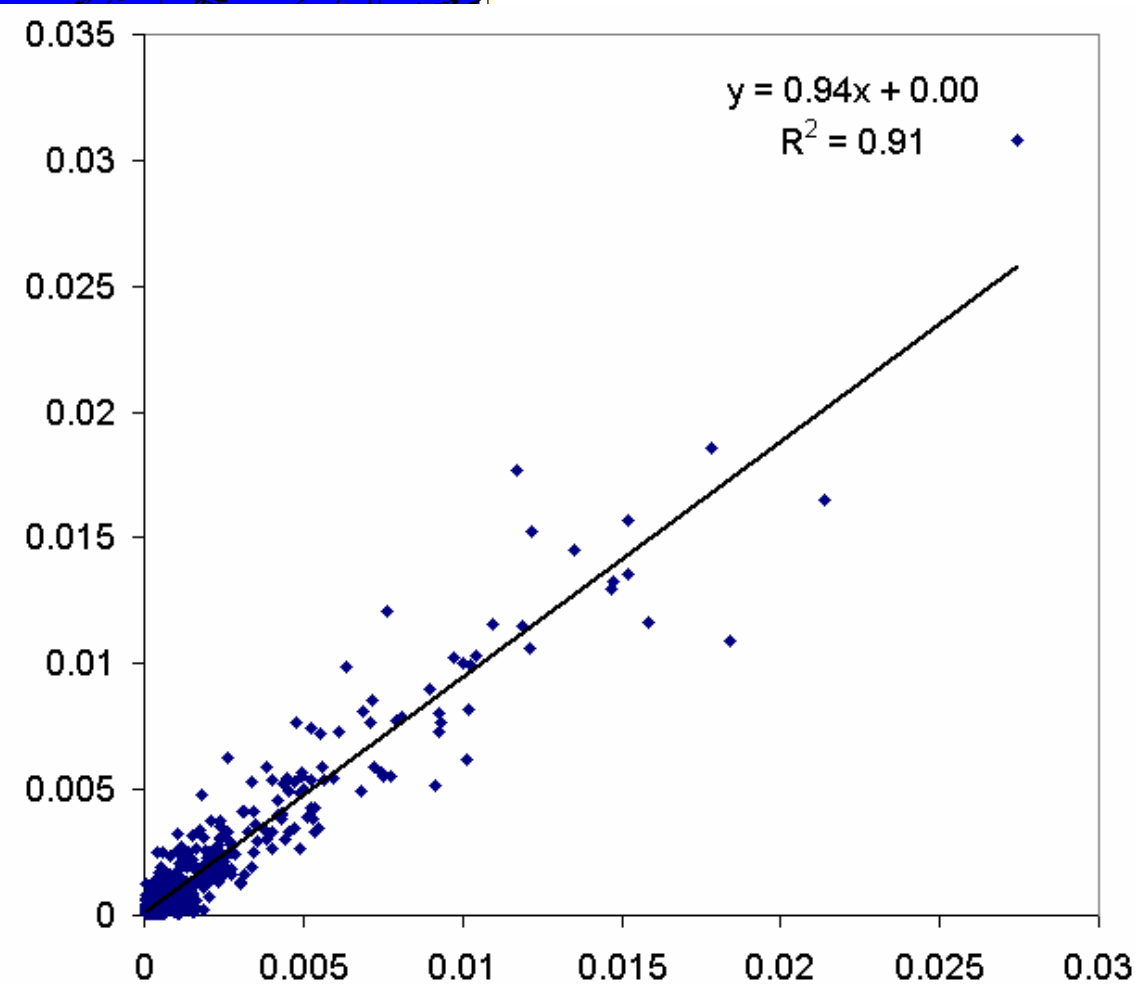
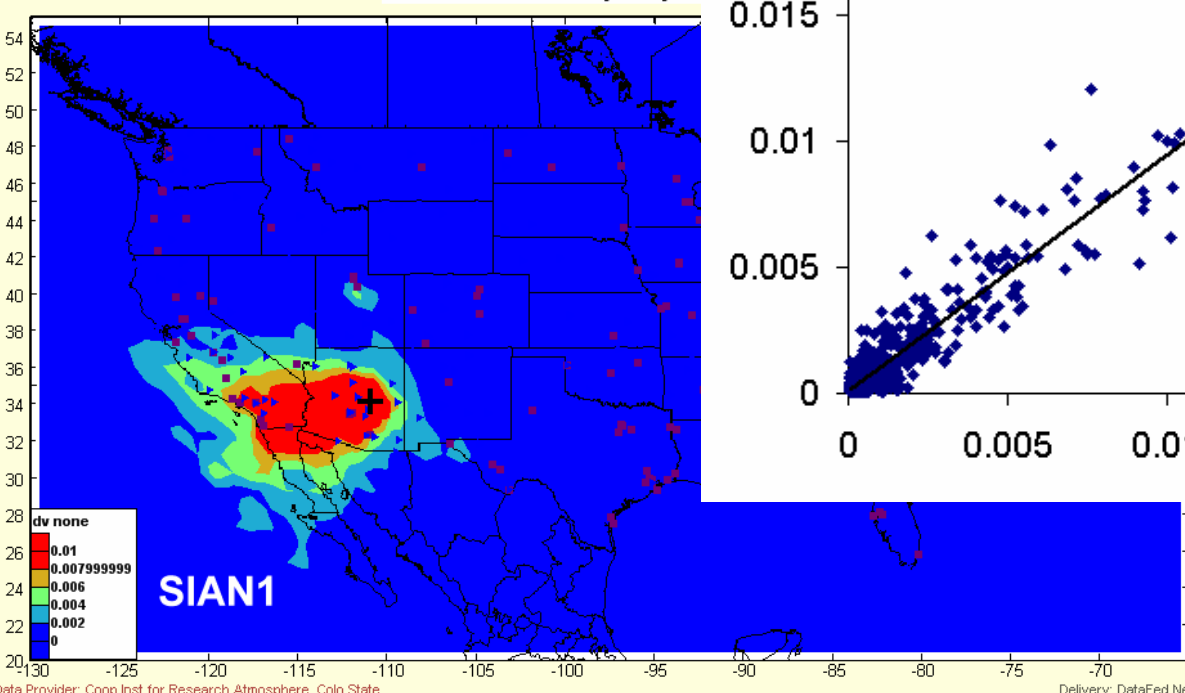
Use CATT tool (<http://datafedwiki.wustl.edu/index.php/CATT>) to Calculate “Weighted Hazy Day Upwind Probability Fields” for worst 20% DV days For years 2000-2004 (or longest period of common sampling at paired sites).

4/day ATAD back trajectory endpoints aggregated in 1x1 degree grid cells, endpoint counts weighted by haziness in DV and converted to probability by dividing by total in all grid cells.

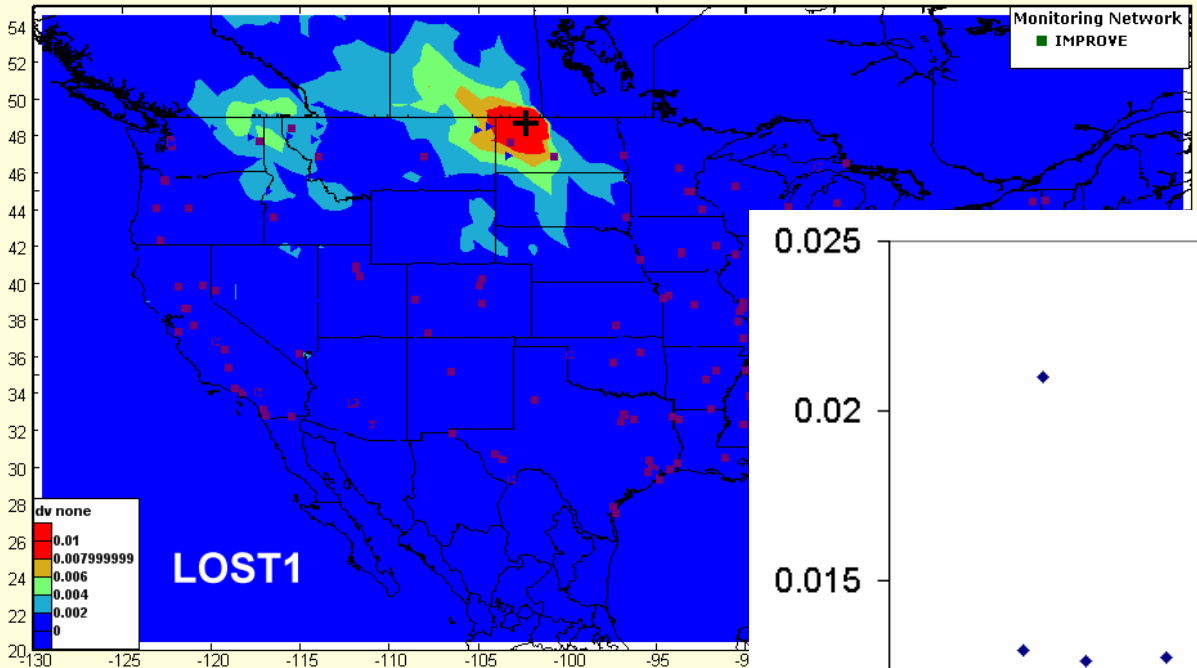
Test Metric is correlation (R^2) of gridded probability values at paired sites, Excluding (very high) values in receptor grid squares and excluding (large numbers of) zeros (typically about half of the 2400 grid cells have no trajectories).



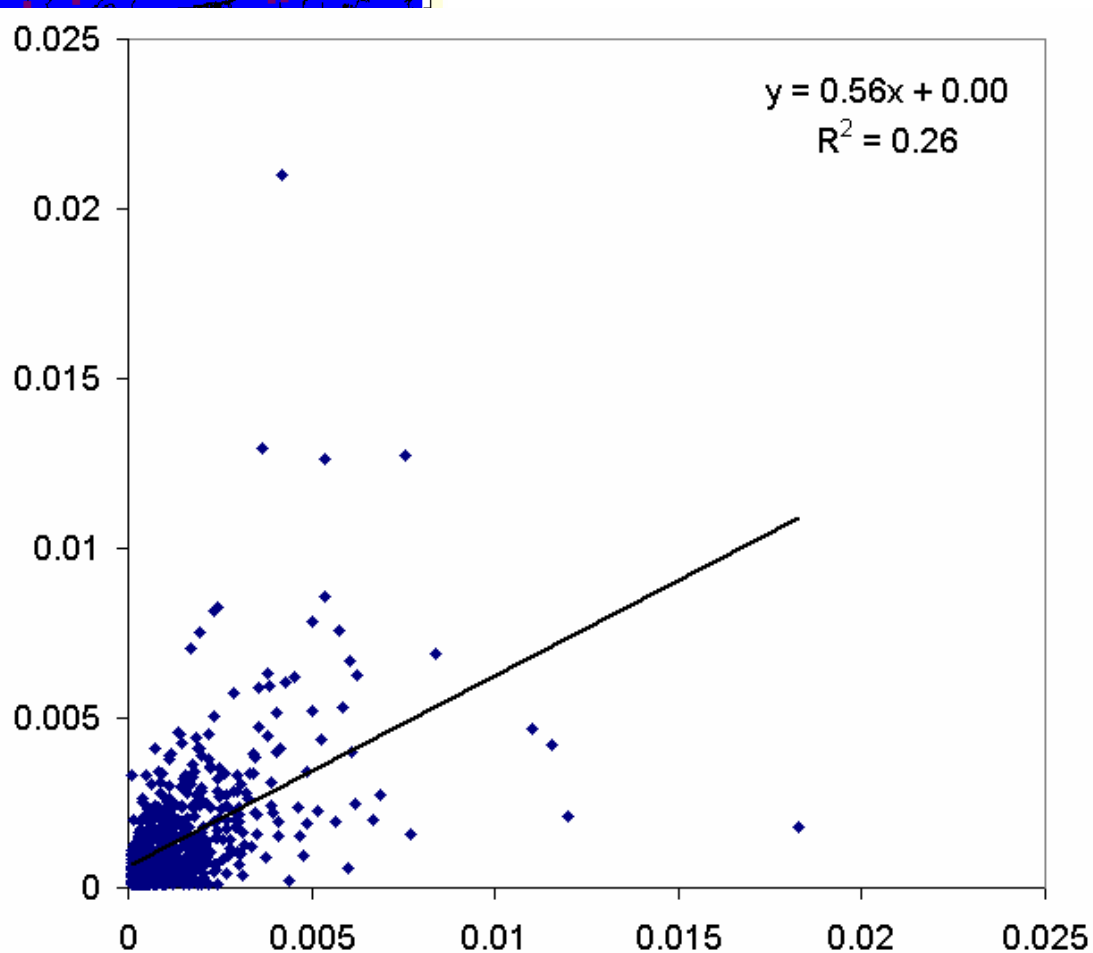
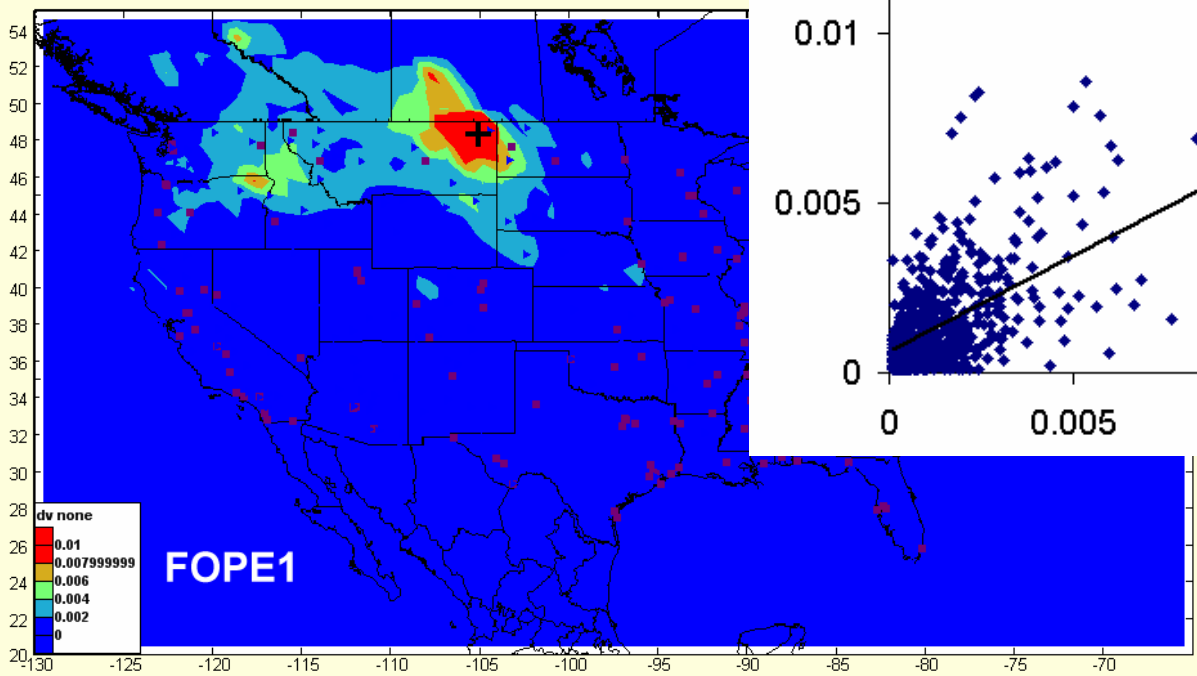
Combined Aerosol Trajectory To



Combined Aerosol Trajectory Tool (CATT)



Combined Aerosol Trajectory Tool (CATT)



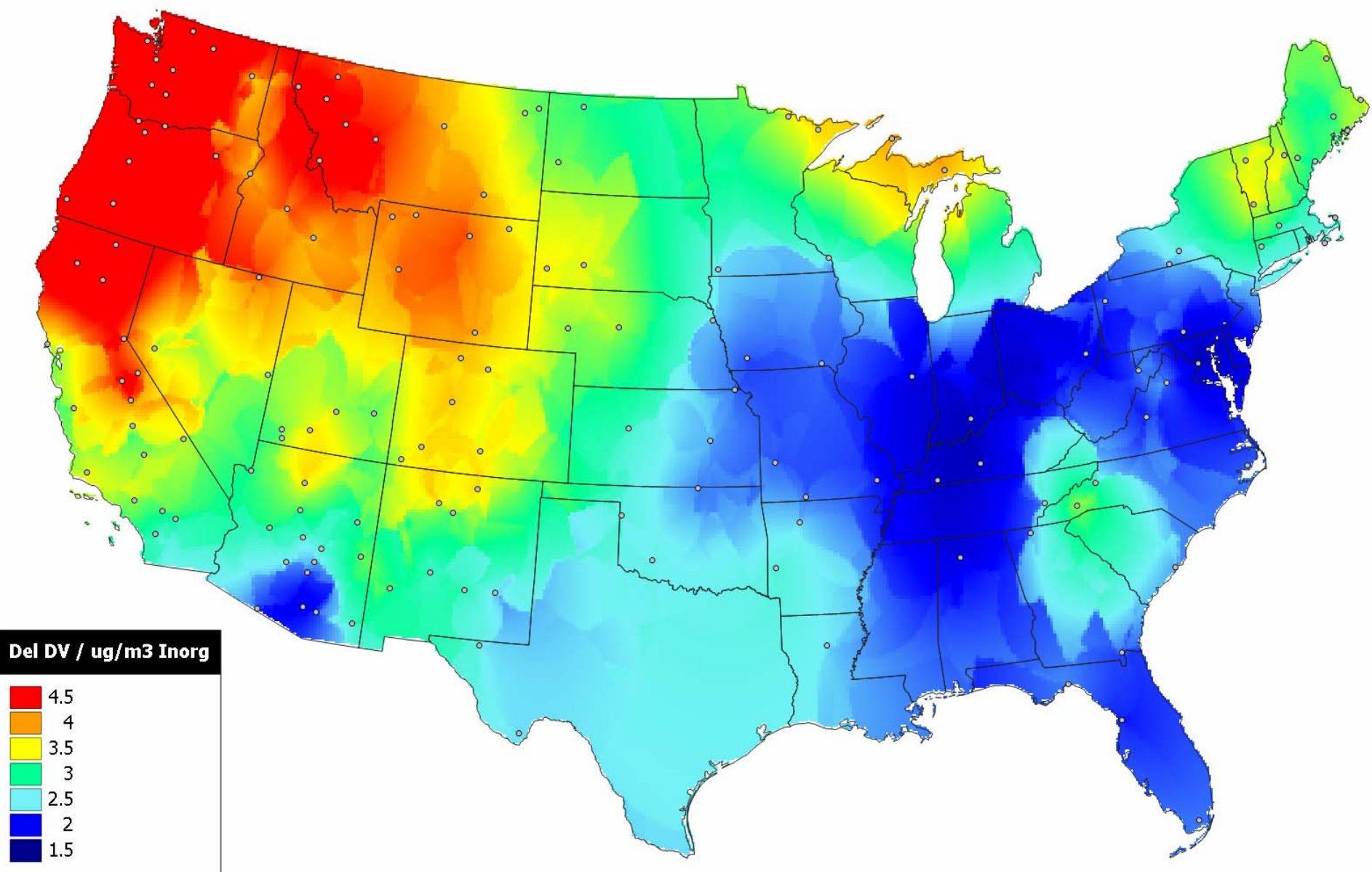
Correlation of Paired Sites Hazy Day Upwind Probability Values, 2000-2004 (or less)

Remove?	Represent?	R ²		Remove?	Represent?	R ²		Remove?	Represent?	R ²
SIAN1	TONT1	0.91		LABE1	LAVO1	0.69		WICA1	BADL1	0.49
TRIN1	LAVO1	0.88		MELA1	FOPE1	0.69		SAMA1	OKEF1	0.48
HEGL1	UPBU1	0.85		HECA1	STAR1	0.64		QUCI1	DOSO1	0.47
COHI1	ADPI1	0.84		KALM1	REDW1	0.64		GRGU1	LYBR1	0.45
MOOS1	ACAD1	0.84		CACR1	UPBU1	0.63		VOYA2	BOWA1	0.44
GRGU1	BRMA1	0.84		TRIN1	REDW1	0.62		WHRI1	WEMI1	0.42
COHU1	GRSM1	0.81		KAIS1	HOOV1	0.61		ISLE1	SENE1	0.42
SYCA1	GRCA2	0.80		MELA1	LOST1	0.61		HOOV1	BLIS1	0.30
SAPE1	BAND1	0.80		KAIS1	YOSE1	0.60		LOST1	FOPE1	0.26
SAGA1	SAGO1	0.80		LIVO1	MACA1	0.60		ZICA1	BRCA1	?
MOHO1	THSI1	0.80		WHRI1	MOZI1	0.59		HAVO1	HALE1	?
WHPA1	MORA1	0.78		KAIS1	SEQU1	0.58		DOSO1	FRRE1	?
SAGU1	SAWE1	0.78		NOAB1	YELL2	0.55				
LIGO1	SHRO1	0.77		CAP11	CANY1	0.55				
CADI1	MACA1	0.71								

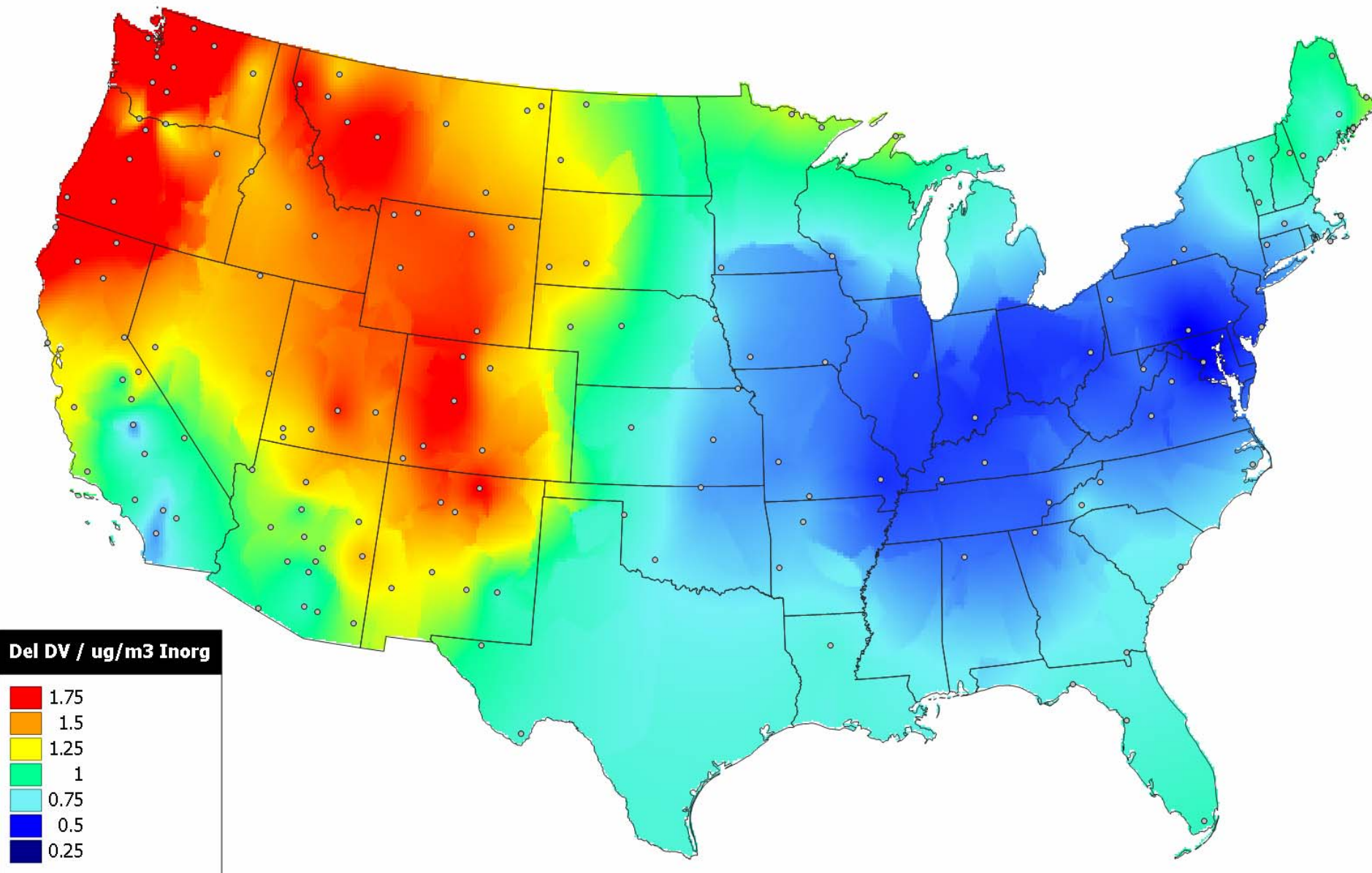
Start at: <http://datafed.net/> . Select “ViewEdit” on left; pull-down “File”, “Open Page”; Select “CATT”, “RichP”, “IMPhiDVprob.page” (or for incremental probability by Mark Green Method, select “IMP_IP_MGM.page”). Change sites using pull-down “Location” menu.

To export gridded results, select “Service Program”, “Evaluate”, “Service Output” and “Session Export”.

Deciview sensitivity to an increase of 1 $\mu\text{g}/\text{m}^3$ of inorganic material on the best 20% haze days.



Deciview sensitivity to an increase of 1 $\mu\text{g}/\text{m}^3$ of inorganic material on the worst 20% haze days.



Budget Summary Information

IMPROVE and Protocol Monitoring Network 2006 Funding Estimates

Type	#	Sect 103	Sect 105	FLM ¹	Total
IMPROVE	110	\$2,340k	\$1,232k	~\$800k	\$4,371k
State	28	\$966k	\$0	\$0	\$966k
CASTNET ²	7	\$241k	\$0	\$0	\$241k
Urban Collocated ²	5	\$172	\$0	\$0	\$172k
Tribal ²	9	?	?	\$0	\$315k
FLM	9	\$0	\$0	~\$382k	\$382k
Total	168	\$3,719k	\$1,232k	\$1,182k	\$6,447k

1. FLMs pay site operators at all IMPROVE sites, and both the operators and their sites' contractor costs for all FLM Protocol sites.
2. CASTNET, Urban Collocated, and Tribal costs don't include site operators' costs.

Budget Assessment

- IMPROVE network budget consists of
 - Site-specific cost ~\$2,200/site/year
 - Sample-specific cost ~\$13,300/site/year (~\$9,800 is for sample composition analysis)
 - Network-wide cost ~\$18,500/site/year for the current network (175 sites). For the purpose of this assessment these cost will be held constant. [Network-wide cost cover quality assurance, data processing, methods and procedures evaluation and refinement, communications, etc.]

Summary/comparison of cost savings and cost per site are shown using three IMPROVE Network budget reduction approaches.

# Sites Affected	Site Reductions		Gravimetric Screening ¹	Mothball	
	Savings	Cost/Site	Savings	Savings	Cost/site ²
0	\$0	\$34,000	\$0	\$0	\$34,000
5	\$77,600	\$34,544	\$24,500	\$15,500	\$34,106
10	\$155,200	\$35,120	\$49,000	\$31,000	\$34,214
15	\$232,800	\$35,733	\$73,500	\$46,500	\$34,323
20	\$310,400	\$36,385	\$98,000	\$62,000	\$34,433
25	\$388,000	\$37,080	\$122,500	\$77,500	\$34,544
30	\$465,600	\$37,823	\$147,000	\$93,000	\$34,657
35	\$543,200	\$38,620	\$171,500	\$108,500	\$34,771
40	\$620,800	\$39,476	\$196,000	\$124,000	\$34,886
100			\$490,000	\$310,000	\$36,387
150			\$735,000	\$465,000	\$37,828

¹ Cost/site for sites employing Gravimetric Screening is ~\$29,100, other sites are ~\$34,000

² Cost/site shown for sites employing the Mothball approach is for the four years that they operate, every fifth year their cost are \$0/site