

National Park Service Special Images

The following images have been extracted from the IMPROVE Slide Spectrum CDs. They represent the cleanest and the haziest clear sky, non-weather, images found in the IMPROVE 35mm slide data base. For each image, the extinction coefficient was estimated from slide contrast measurements. Then using the average species concentrations of the 20% lowest and highest fine mass days, the yearly average $f(\text{rh})$ from EPA's HazeCalc program, and the following procedure, the estimated Reconstructed $\text{PM}_{2.5}$ and PM_{10} aerosol concentrations were calculated:

$$b_{\text{ext}} = 3.0 f(\text{rh})[\text{Sulfate}] + 3.0 f(\text{rh})[\text{Nitrate}] + 4.0[\text{OMC}] + 10.0[\text{LAC}] + 1.0[\text{Soil}] + 0.6[\text{CM}] + b_{\text{RAY}} \quad (1)$$

$$\text{Reconstructed Fine Mass} = \text{RCFM} = [\text{Sulfate}] + [\text{Nitrate}] + [\text{OMC}] + [\text{LAC}] + [\text{Soil}] \quad (2)$$

$$\text{Species Mass Fraction} = \text{FracSpecies} = [\text{Species}] / \text{RCFM} \quad (3)$$

Then rearranging and dividing both sides of equation 1 by RCFM

$$\frac{\{b_{\text{ext}} - b_{\text{RAY}}\}}{\text{RCFM}} = \frac{3.0 f(\text{rh})[\text{Sulfate}]}{\text{RCFM}} + \frac{3.0 f(\text{rh})[\text{Nitrate}]}{\text{RCFM}} + \frac{4.0[\text{OMC}]}{\text{RCFM}} + \frac{10.0[\text{LAC}]}{\text{RCFM}} + \frac{1.0[\text{Soil}]}{\text{RCFM}} + \frac{0.6[\text{CM}]}{\text{RCFM}} \quad (4)$$

Then for any estimated b_{ext} and specific Species Mass Fractions, the corresponding RCFM can be calculated as:

$$\text{PM}_{2.5} = \text{RCFM} = \{b_{\text{ext}} - b_{\text{RAY}}\} / \{ 3.0 f(\text{rh}) \text{FracSulfate} + 3.0 f(\text{rh}) \text{FracNitrate} + 4.0 \text{FracOMC} + 10.0 \text{FracLAC} + 1.0 \text{FracSoil} + 0.6 \text{FracCM} \} \quad (5)$$

$$\text{PM}_{10} = \text{RCFM} + \text{RCFM} * \text{FracCM} \quad (6)$$

Canyonlands National Park
 IMPROVE Aerosol Data 3/2/1988 - 5/29/1999 964 Sampling Days
 Annual f(rh) = 2

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	4.98	-	-	9.05	-	-	14.39	-	-
PM2.5	1.47	-	-	3.45	-	-	5.96	-	-
SO4	0.52	36.9%	10.6%	1.08	36.4%	12.6%	1.54	31.8%	11.6%
NO3	0.13	9.5%	2.7%	0.23	7.7%	2.7%	0.37	7.7%	2.8%
OMC	0.40	28.6%	8.2%	0.82	27.4%	9.5%	1.36	28.1%	10.2%
LAC	0.11	8.0%	2.3%	0.16	5.4%	1.9%	0.22	4.5%	1.6%
Soil	0.24	16.9%	4.8%	0.69	23.1%	8.0%	1.36	28.0%	10.2%
CM	3.51	250.1%	71.4%	5.60	187.8%	65.3%	8.43	173.9%	63.5%
RCFM2.5		1.41			2.98			4.85	
RCFM2.5 / PM2.5		0.96			0.86			0.81	
RCFM10		4.92			8.57			13.28	
RCFM10 / PM10		0.99			0.95			0.92	
RCFM2.5 bext (Mm-1)		6.9			13.4			20.5	
RCFM10 bext (Mm-1)		9.0			16.8			25.5	
RCFM2.5 b/mass (m2/g)		4.9			4.5			4.2	
RCFM10 b/mass (m2/g)		1.8			2.0			1.9	
Total bext (Mm-1)		19.0			26.8			35.5	
Visual Range (km)		205.9			146.0			110.1	
dV		6.4			9.9			12.7	
15.0 mg/m3 Fine Mass									
CM		37.5			28.2			26.1	
bext (Mm-1)		106.1			94.6			88.9	
Visual Range km		36.9			41.4			44.0	
dV		23.6			22.5			21.9	
65.0 mg/m3 Fine Mass									
CM		162.6			122.1			113.0	
bext (Mm-1)		426.4			376.4			352.1	
Visual Range km		9.2			10.4			11.1	
dV		37.5			36.3			35.6	

Crater Lake National Park
 IMPROVE Aerosol Data 3/2/1988 - 5/29/1999 792 Sampling Days
 Annual f(rh) = 3.5

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	2.77	-	-	6.38	-	-	12.63	-	-
PM2.5	0.72	-	-	2.92	-	-	6.57	-	-
SO4	0.16	20.5%	5.6%	0.51	20.7%	8.6%	0.95	18.2%	8.4%
NO3	0.04	4.7%	1.3%	0.13	5.2%	2.2%	0.27	5.1%	2.4%
OMC	0.34	43.6%	11.9%	1.17	47.4%	19.8%	2.66	50.7%	23.5%
LAC	0.15	19.7%	5.4%	0.24	9.8%	4.1%	0.38	7.2%	3.3%
Soil	0.09	11.5%	3.2%	0.42	16.9%	7.0%	0.99	18.8%	8.7%
CM	2.05	265.2%	72.6%	3.46	139.9%	58.3%	6.06	115.6%	53.6%
RCFM2.5		0.77			2.47			5.24	
RCFM2.5 / PM2.5		1.06			0.85			0.80	
RCFM10		2.82			5.93			11.30	
RCFM10 / PM10		1.02			0.93			0.89	
RCFM2.5 bext (Mm-1)		5.0			14.2			28.2	
RCFM10 bext (Mm-1)		6.2			16.3			31.8	
RCFM2.5 b/mass (m2/g)		6.5			5.8			5.4	
RCFM10 b/mass (m2/g)		2.2			2.8			2.8	
Total bext (Mm-1)		16.2			26.3			41.8	
Visual Range (km)		241.2			148.6			93.5	
dV		4.8			9.7			14.3	
15.0 mg/m3 Fine Mass									
CM		39.8			21.0			17.3	
bext (Mm-1)		131.0			109.1			101.1	
Visual Range km		29.9			35.9			38.7	
dV		25.7			23.9			23.1	
65.0 mg/m3 Fine Mass									
CM		172.4			90.9			75.1	
bext (Mm-1)		534.1			439.3			404.8	
Visual Range km		7.3			8.9			9.7	
dV		39.8			37.8			37.0	

Glacier National Park IMPROVE Aerosol Data 3/9/1988 - 5/29/1998 1037 Sampling Days Annual f(rh) = 2.95									
	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	5.01	-	-	11.76	-	-	21.31	-	-
PM2.5	2.05	-	-	5.64	-	-	11.11	-	-
SO4	0.52	25.3%	10.3%	0.98	19.7%	8.8%	1.30	13.9%	6.6%
NO3	0.13	6.2%	2.5%	0.30	6.0%	2.7%	0.61	6.5%	3.1%
OMC	1.01	49.6%	20.2%	2.67	54.0%	24.1%	5.48	58.6%	28.0%
LAC	0.21	10.3%	4.2%	0.43	8.6%	3.9%	0.78	8.3%	4.0%
Soil	0.18	8.7%	3.5%	0.58	11.8%	5.3%	1.19	12.7%	6.1%
CM	2.96	145.0%	59.2%	6.12	123.5%	55.2%	10.20	109.1%	52.2%
RCFM2.5		2.04			4.95			9.35	
RCFM2.5 / PM2.5		1.00			0.88			0.84	
RCFM10		5.00			11.07			19.56	
RCFM10 / PM10		1.00			0.94			0.92	
RCFM2.5 bext (Mm-1)		12.0			26.8			47.8	
RCFM10 bext (Mm-1)		13.8			30.5			53.9	
RCFM2.5 b/mass (m2/g)		5.9			5.4			5.1	
RCFM10 b/mass (m2/g)		2.8			2.8			2.8	
Total bext (Mm-1)		23.8			40.5			63.9	
Visual Range (km)		164.4			96.7			61.2	
dV		8.7			14.0			18.5	
15.0 mg/m3 Fine Mass									
CM		21.8			18.5			16.4	
bext (Mm-1)		111.3			102.2			96.4	
Visual Range km		35.1			38.3			40.6	
dV		24.1			23.2			22.7	
65.0 mg/m3 Fine Mass									
CM		94.3			80.2			70.9	
bext (Mm-1)		449.0			409.7			384.4	
Visual Range km		8.7			9.5			10.2	
dV		38.0			37.1			36.5	

Great Basin National Park IMPROVE Aerosol Data 5/27/91 - 5/29/1999 681 Sampling Days Annual f(rh) = 1.97									
	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.52	-	-	6.73	-	-	11.35	-	-
PM2.5	1.03	-	-	3.00	-	-	5.85	-	-
SO4	0.25	22.1%	6.9%	0.68	26.1%	10.7%	1.13	24.2%	11.1%
NO3	0.06	5.0%	1.6%	0.16	6.2%	2.6%	0.31	6.7%	3.1%
OMC	0.52	46.6%	14.5%	0.98	37.3%	15.4%	1.58	34.0%	15.6%
LAC	0.15	12.9%	4.0%	0.19	7.3%	3.0%	0.24	5.1%	2.3%
Soil	0.15	13.3%	4.1%	0.60	23.1%	9.5%	1.39	29.9%	13.7%
CM	2.49	221.9%	68.9%	3.73	142.6%	58.8%	5.50	118.3%	54.2%
RCFM2.5		1.12			2.62			4.64	
RCFM2.5 / PM2.5		1.09			0.87			0.79	
RCFM10		3.61			6.35			10.14	
RCFM10 / PM10		1.03			0.94			0.89	
RCFM2.5 bext (Mm-1)		5.5			11.4			18.6	
RCFM10 bext (Mm-1)		7.0			13.7			21.9	
RCFM2.5 b/mass (m2/g)		4.9			4.4			4.0	
RCFM10 b/mass (m2/g)		1.9			2.2			2.2	
Total bext (Mm-1)		17.0			23.7			31.9	
Visual Range (km)		230.5			165.4			122.8	
dV		5.3			8.6			11.6	
15.0 mg/m3 Fine Mass									
CM		33.3			21.4			17.8	
bext (Mm-1)		103.4			88.3			80.6	
Visual Range km		37.8			44.3			48.5	
dV		23.4			21.8			20.9	
65.0 mg/m3 Fine Mass									
CM		144.2			92.7			76.9	
bext (Mm-1)		414.8			349.3			316.0	
Visual Range km		9.4			11.2			12.4	
dV		37.3			35.5			34.5	

Grand Canyon National Park
 IMPROVE Aerosol Data 7/9/1988 - 8/29/1998 857 Sampling Days
 Annual f(rh) = 1.77

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	4.64	-	-	8.28	-	-	13.09	-	-
PM2.5	1.28	-	-	3.29	-	-	5.93	-	-
SO4	0.41	34.1%	9.0%	1.01	36.1%	13.0%	1.59	33.3%	13.3%
NO3	0.10	8.3%	2.2%	0.20	7.2%	2.6%	0.31	6.5%	2.6%
OMC	0.39	32.6%	8.6%	0.80	28.7%	10.3%	1.39	29.2%	11.7%
LAC	0.11	9.2%	2.4%	0.18	6.3%	2.3%	0.25	5.3%	2.1%
Soil	0.19	15.8%	4.1%	0.61	21.7%	7.8%	1.23	25.8%	10.3%
CM	3.36	280.2%	73.7%	4.99	179.0%	64.2%	7.16	149.7%	60.0%
RCFM2.5		1.20			2.79			4.78	
RCFM2.5 / PM2.5		0.93			0.85			0.81	
RCFM10		4.56			7.78			11.94	
RCFM10 / PM10		0.98			0.94			0.91	
RCFM2.5 bext (Mm-1)		5.6			12.0			19.4	
RCFM10 bext (Mm-1)		7.6			15.0			23.7	
RCFM2.5 b/mass (m2/g)		4.6			4.3			4.1	
RCFM10 b/mass (m2/g)		1.7			1.9			2.0	
Total bext (Mm-1)		17.6			25.0			33.7	
Visual Range (km)		222.7			156.7			116.0	
dV		5.6			9.1			12.2	
15.0 mg/m3 Fine Mass									
CM		42.0			26.9			22.5	
bext (Mm-1)		104.7			90.5			84.5	
Visual Range km		37.4			43.2			46.3	
dV		23.5			22.0			21.3	
65.0 mg/m3 Fine Mass									
CM		182.1			116.4			97.3	
bext (Mm-1)		420.4			358.8			332.7	
Visual Range km		9.3			10.9			11.8	
dV		37.4			35.8			35.0	

Mesa Verde National Park
 IMPROVE Aerosol Data 3/16/1988 - 5/29/1999 954 Sampling Days
 Annual f(rh) = 1.99

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.94	-	-	7.16	-	-	12.57	-	-
PM2.5	1.43	-	-	3.32	-	-	6.10	-	-
SO4	0.48	34.0%	12.2%	1.03	36.3%	15.5%	1.54	31.3%	13.5%
NO3	0.09	6.3%	2.3%	0.14	5.1%	2.2%	0.21	4.3%	1.9%
OMC	0.49	34.6%	12.5%	0.83	29.1%	12.4%	1.36	27.6%	11.9%
LAC	0.13	8.9%	3.2%	0.16	5.6%	2.4%	0.22	4.4%	1.9%
Soil	0.23	16.2%	5.8%	0.68	24.0%	10.2%	1.60	32.4%	14.0%
CM	2.51	177.4%	63.9%	3.84	134.7%	57.4%	6.47	131.3%	56.8%
RCFM2.5		1.41			2.85			4.93	
RCFM2.5 / PM2.5		0.99			0.86			0.81	
RCFM10		3.92			6.69			11.40	
RCFM10 / PM10		1.00			0.93			0.91	
RCFM2.5 bext (Mm-1)		6.8			12.6			19.7	
RCFM10 bext (Mm-1)		8.3			14.9			23.6	
RCFM2.5 b/mass (m2/g)		4.8			4.4			4.0	
RCFM10 b/mass (m2/g)		2.1			2.2			2.1	
Total bext (Mm-1)		18.3			24.9			33.6	
Visual Range (km)		213.2			156.9			116.6	
dV		6.1			9.1			12.1	
15.0 mg/m3 Fine Mass									
CM		26.6			20.2			19.7	
bext (Mm-1)		98.6			88.6			81.7	
Visual Range km		39.7			44.2			47.9	
dV		22.9			21.8			21.0	
65.0 mg/m3 Fine Mass									
CM		115.3			87.6			85.3	
bext (Mm-1)		393.9			350.5			320.7	
Visual Range km		9.9			11.2			12.2	
dV		36.7			35.6			34.7	

Mount Rainier National Park
 IMPROVE Aerosol Data 3/12/1988 - 5/29/1999 950 Sampling Days
 Annual f(rh) = 3.67

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.93	-	-	8.70	-	-	16.04	-	-
PM2.5	1.34	-	-	5.26	-	-	11.17	-	-
SO4	0.28	23.2%	7.3%	1.34	29.8%	16.9%	2.71	28.9%	19.0%
NO3	0.05	3.9%	1.2%	0.22	4.9%	2.8%	0.44	4.7%	3.1%
OMC	0.68	57.4%	18.1%	2.29	51.1%	28.9%	4.88	52.2%	34.3%
LAC	0.13	10.7%	3.4%	0.42	9.3%	5.3%	0.84	9.0%	5.9%
Soil	0.06	4.9%	1.5%	0.22	4.9%	2.8%	0.49	5.2%	3.4%
CM	2.59	217.4%	68.5%	3.44	76.8%	43.4%	4.87	52.1%	34.3%
RCFM2.5		1.19			4.49			9.35	
RCFM2.5 / PM2.5		0.89			0.85			0.84	
RCFM10		3.78			7.93			14.22	
RCFM10 / PM10		0.96			0.91			0.89	
RCFM2.5 bext (Mm-1)		7.6			30.7			63.0	
RCFM10 bext (Mm-1)		9.2			32.8			65.9	
RCFM2.5 b/mass (m2/g)		6.4			6.8			6.7	
RCFM10 b/mass (m2/g)		2.4			4.1			4.6	
Total bext (Mm-1)		19.2			42.8			75.9	
Visual Range (km)		204.0			91.5			51.5	
dV		6.5			14.5			20.3	
15.0 mg/m3 Fine Mass									
CM		32.6			11.5			7.8	
bext (Mm-1)		125.5			119.6			115.8	
Visual Range km		31.2			32.7			33.8	
dV		25.3			24.8			24.5	
65.0 mg/m3 Fine Mass									
CM		141.3			49.9			33.9	
bext (Mm-1)		510.3			484.7			468.4	
Visual Range km		7.7			8.1			8.4	
dV		39.3			38.8			38.5	

Point Reyes National Park IMPROVE Aerosol Data 3/5/1988 - 5/29/1998 907 Sampling Days Annual f(rh) = 2.84									
	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	9.10	-	-	16.92	-	-	27.20	-	-
PM2.5	2.69	-	-	6.96	-	-	13.35	-	-
SO4	0.81	44.1%	9.8%	1.63	38.4%	11.5%	2.39	28.8%	10.8%
NO3	0.28	15.1%	3.4%	1.03	24.3%	7.3%	2.77	33.3%	12.5%
OMC	0.55	30.4%	6.7%	1.20	28.3%	8.5%	2.46	29.6%	11.1%
LAC	0.11	6.1%	1.4%	0.19	4.4%	1.3%	0.38	4.6%	1.7%
Soil	0.08	4.3%	0.9%	0.19	4.5%	1.4%	0.31	3.7%	1.4%
CM	6.41	351.1%	77.8%	9.96	234.6%	70.1%	13.85	166.7%	62.5%
RCFM2.5		1.83			4.25			8.31	
RCFM2.5 / PM2.5		0.68			0.61			0.62	
RCFM10		8.23			14.21			22.16	
RCFM10 / PM10		0.90			0.84			0.81	
RCFM2.5 bext (Mm-1)		12.6			29.6			57.9	
RCFM10 bext (Mm-1)		16.5			35.5			66.2	
RCFM2.5 b/mass (m2/g)		6.9			7.0			7.0	
RCFM10 b/mass (m2/g)		2.0			2.5			3.0	
Total bext (Mm-1)		26.5			45.5			76.2	
Visual Range (km)		147.8			85.9			51.3	
dV		9.7			15.2			20.3	
15.0 mg/m3 Fine Mass									
CM		52.7			35.2			25.0	
bext (Mm-1)		145.4			135.6			129.5	
Visual Range km		26.9			28.9			30.2	
dV		26.8			26.1			25.6	
65.0 mg/m3 Fine Mass									
CM		228.2			152.5			108.3	
bext (Mm-1)		596.6			554.2			527.9	
Visual Range km		6.6			7.1			7.4	
dV		40.9			40.1			39.7	

Rocky Mountain National Park
 IMPROVE Aerosol Data 9/19/1990 - 5/29/1999 794 Sampling Days
 Annual f(rh) = 2.1

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
	PM10	3.82	-	-	7.12	-	-	12.13	-
PM2.5	0.89	-	-	3.16	-	-	6.25	-	-
SO4	0.33	30.2%	8.2%	0.93	30.8%	13.3%	1.49	27.7%	13.2%
NO3	0.05	4.5%	1.2%	0.29	9.5%	4.1%	0.50	9.3%	4.4%
OMC	0.42	38.9%	10.5%	1.00	33.1%	14.3%	1.86	34.5%	16.5%
LAC	0.11	9.8%	2.6%	0.17	5.8%	2.5%	0.26	4.8%	2.3%
Soil	0.18	16.6%	4.5%	0.63	20.8%	9.0%	1.28	23.8%	11.4%
CM	2.94	270.5%	73.0%	3.96	131.8%	56.9%	5.88	109.0%	52.2%
RCFM2.5		1.09			3.01			5.39	
RCFM2.5 / PM2.5		1.22			0.95			0.86	
RCFM10		4.02			6.97			11.27	
RCFM10 / PM10		1.05			0.98			0.93	
RCFM2.5 bext (Mm-1)		5.3			14.0			23.9	
RCFM10 bext (Mm-1)		7.1			16.3			27.4	
RCFM2.5 b/mass (m2/g)		4.9			4.6			4.4	
RCFM10 b/mass (m2/g)		1.8			2.3			2.4	
Total bext (Mm-1)		17.1			26.3			37.4	
Visual Range (km)		229.3			148.5			104.6	
dV		5.3			9.7			13.2	
15.0 mg/m3 Fine Mass									
CM		40.6			19.8			16.4	
bext (Mm-1)		107.7			91.6			86.2	
Visual Range km		36.3			42.7			45.4	
dV		23.8			22.1			21.5	
65.0 mg/m3 Fine Mass									
CM		175.8			85.7			70.9	
bext (Mm-1)		433.2			363.5			340.1	
Visual Range km		9.0			10.8			11.5	
dV		37.7			35.9			35.3	

Shenandoah National Park
 IMPROVE Aerosol Data 3/12/1988 - 5/29/1998 931 Sampling Days
 Annual f(rh) = 3.03

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	6.95	-	-	16.03	-	-	31.32	-	-
PM2.5	3.64	-	-	11.40	-	-	24.85	-	-
SO4	1.87	48.7%	26.1%	6.29	62.3%	42.7%	14.21	70.7%	53.5%
NO3	0.61	16.0%	8.6%	0.74	7.3%	5.0%	0.45	2.2%	1.7%
OMC	0.93	24.3%	13.1%	2.23	22.1%	15.2%	4.17	20.8%	15.7%
LAC	0.24	6.3%	3.4%	0.41	4.0%	2.7%	0.53	2.6%	2.0%
Soil	0.18	4.8%	2.6%	0.44	4.4%	3.0%	0.74	3.7%	2.8%
CM	3.31	86.2%	46.3%	4.63	45.8%	31.4%	6.47	32.2%	24.3%
RCFM2.5		3.83			10.11			20.10	
RCFM2.5 / PM2.5		1.05			0.89			0.81	
RCFM10		7.14			14.73			26.57	
RCFM10 / PM10		1.03			0.92			0.85	
RCFM2.5 bext (Mm-1)		28.8			77.3			156.0	
RCFM10 bext (Mm-1)		30.8			80.1			159.9	
RCFM2.5 b/mass (m2/g)		7.5			7.6			7.8	
RCFM10 b/mass (m2/g)		4.3			5.4			6.0	
Total bext (Mm-1)		40.8			90.1			169.9	
Visual Range (km)		95.8			43.4			23.0	
dV		14.1			22.0			28.3	
15.0 mg/m3 Fine Mass									
CM		12.9			6.9			4.8	
bext (Mm-1)		130.6			128.8			129.3	
Visual Range km		30.0			30.4			30.3	
dV		25.7			25.6			25.6	
65.0 mg/m3 Fine Mass									
CM		56.0			29.8			20.9	
bext (Mm-1)		532.7			525.0			526.8	
Visual Range km		7.3			7.5			7.4	
dV		39.8			39.6			39.6	

Weimunucho Wilderness IMPROVE Aerosol Data 3/2/1988 - 5/29/1999 955 Sampling Days Annual f(rh) = 1.98									
	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.88	-	-	6.72	-	-	10.74	-	-
PM2.5	1.07	-	-	2.88	-	-	5.29	-	-
SO4	0.32	29.5%	8.2%	0.85	34.0%	13.4%	1.39	32.1%	14.2%
NO3	0.05	4.3%	1.2%	0.11	4.4%	1.7%	0.19	4.3%	1.9%
OMC	0.38	34.9%	9.7%	0.79	31.6%	12.5%	1.42	32.8%	14.5%
LAC	0.13	12.4%	3.4%	0.20	7.9%	3.1%	0.27	6.2%	2.7%
Soil	0.21	19.0%	5.3%	0.55	22.0%	8.7%	1.07	24.6%	10.9%
CM	2.81	260.1%	72.2%	3.85	153.7%	60.6%	5.44	126.0%	55.7%
RCFM2.5		1.08			2.50			4.32	
RCFM2.5 / PM2.5		1.01			0.87			0.82	
RCFM10		3.89			6.35			9.77	
RCFM10 / PM10		1.00			0.94			0.91	
RCFM2.5 bext (Mm-1)		5.2			11.4			18.8	
RCFM10 bext (Mm-1)		6.9			13.7			22.0	
RCFM2.5 b/mass (m2/g)		4.8			4.6			4.3	
RCFM10 b/mass (m2/g)		1.8			2.2			2.3	
Total bext (Mm-1)		16.9			23.7			32.0	
Visual Range (km)		231.4			164.9			122.2	
dV		5.3			8.6			11.6	
15.0 mg/m3 Fine Mass									
CM		39.0			23.1			18.9	
bext (Mm-1)		105.9			92.2			86.4	
Visual Range km		37.0			42.4			45.3	
dV		23.6			22.2			21.6	
65.0 mg/m3 Fine Mass									
CM		169.1			99.9			81.9	
bext (Mm-1)		425.4			366.2			341.1	
Visual Range km		9.2			10.7			11.5	
dV		37.5			36.0			35.3	

Yellowstone National Park
 IMPROVE Aerosol Data 3/16/1988 - 5/26/1999 872 Sampling Days
 Annual f(rh) = 2.13

	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.18	-	-	8.07	-	-	16.90	-	-
PM2.5	1.02	-	-	3.29	-	-	6.77	-	-
SO4	0.35	29.6%	10.5%	0.65	21.9%	8.4%	0.87	15.8%	5.6%
NO3	0.11	9.4%	3.3%	0.18	5.9%	2.3%	0.21	3.7%	1.3%
OMC	0.51	42.6%	15.2%	1.28	43.0%	16.5%	2.57	46.2%	16.4%
LAC	0.09	7.4%	2.6%	0.18	6.0%	2.3%	0.32	5.8%	2.1%
Soil	0.13	11.0%	3.9%	0.69	23.2%	8.9%	1.58	28.4%	10.1%
CM	2.16	180.9%	64.4%	4.78	160.7%	61.6%	10.13	182.6%	64.6%
RCFM2.5		1.20			2.97			5.55	
RCFM2.5 / PM2.5		1.17			0.90			0.82	
RCFM10		3.36			7.75			15.68	
RCFM10 / PM10		1.06			0.96			0.93	
RCFM2.5 bext (Mm-1)		6.0			12.9			22.0	
RCFM10 bext (Mm-1)		7.3			15.7			28.1	
RCFM2.5 b/mass (m2/g)		5.0			4.3			4.0	
RCFM10 b/mass (m2/g)		2.2			2.0			1.8	
Total bext (Mm-1)		17.3			25.7			38.1	
Visual Range (km)		225.6			152.0			102.8	
dV		5.5			9.5			13.4	
15.0 mg/m3 Fine Mass									
CM		27.1			24.1			27.4	
bext (Mm-1)		102.0			89.4			85.9	
Visual Range km		38.3			43.8			45.6	
dV		23.2			21.9			21.5	
65.0 mg/m3 Fine Mass									
CM		117.6			104.4			118.7	
bext (Mm-1)		408.8			353.9			338.7	
Visual Range km		9.6			11.1			11.6	
dV		37.1			35.7			35.2	

Yosemite National Park IMPROVE Aerosol Data 3/9/1988 - 5/29/1999 951 Sampling Days Annual f(rh) = 2.16									
	Average of 20% Lowest PM2.5 days			Mean of All Sampling Days			Average of 20% Highest PM2.5 days		
	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10	ug/m3	% of RCFM2.5	% of RCFM10
PM10	3.59	-	-	9.56	-	-	17.56	-	-
PM2.5	1.04	-	-	4.77	-	-	9.92	-	-
SO4	0.23	22.3%	6.4%	0.99	23.5%	11.0%	1.90	22.3%	11.7%
NO3	0.10	9.3%	2.7%	0.47	11.1%	5.2%	0.94	11.0%	5.8%
OMC	0.49	48.0%	13.8%	1.94	45.8%	21.5%	4.13	48.6%	25.6%
LAC	0.10	9.6%	2.8%	0.27	6.3%	3.0%	0.50	5.9%	3.1%
Soil	0.11	10.8%	3.1%	0.56	13.3%	6.2%	1.04	12.3%	6.5%
CM	2.54	249.1%	71.4%	4.80	113.5%	53.2%	7.64	89.8%	47.3%
RCFM2.5		1.02			4.23			8.51	
RCFM2.5 / PM2.5		0.98			0.89			0.86	
RCFM10		3.56			9.03			16.15	
RCFM10 / PM10		0.99			0.94			0.92	
RCFM2.5 bext (Mm-1)		5.1			20.5			40.9	
RCFM10 bext (Mm-1)		6.7			23.3			45.5	
RCFM2.5 b/mass (m2/g)		5.0			4.8			4.8	
RCFM10 b/mass (m2/g)		1.9			2.6			2.8	
Total bext (Mm-1)		16.7			33.3			55.5	
Visual Range (km)		234.8			117.4			70.4	
dV		5.1			12.0			17.1	
15.0 mg/m3 Fine Mass									
CM		37.4			17.0			13.5	
bext (Mm-1)		108.0			92.8			90.2	
Visual Range km		36.2			42.2			43.4	
dV		23.8			22.3			22.0	
65.0 mg/m3 Fine Mass									
CM		161.9			73.7			58.4	
bext (Mm-1)		434.5			368.7			357.7	
Visual Range km		9.0			10.6			10.9	
dV		37.7			36.1			35.8	

Bryce Canyon National Park: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.4 \text{ }\mu\text{g}/\text{m}^3$



Bryce Canyon National Park: Estimated $b_{\text{ext}} = 78 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 14.2 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 30.2 \text{ }\mu\text{g}/\text{m}^3$



Canyonlands National Park: Estimated $b_{\text{ext}} = 12 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.3 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 1.1 \text{ }\mu\text{g}/\text{m}^3$



Canyonlands National Park: Estimated $b_{\text{ext}} = 98 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 16.7 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 45.8 \text{ }\mu\text{g}/\text{m}^3$



Crater Lake National Park: Estimated $b_{\text{ext}} = 12 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.3 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.7 \text{ } \mu\text{g}/\text{m}^3$



Crater Lake National Park: Estimated $b_{\text{ext}} = 391 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 62.7 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 135.2 \text{ } \mu\text{g}/\text{m}^3$



Glacier National Park: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.4 \mu\text{g}/\text{m}^3$



Glacier National Park: Estimated $b_{\text{ext}} = 206 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 34.0 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 71.1 \mu\text{g}/\text{m}^3$



Grand Canyon National Park: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.6 \text{ } \mu\text{g}/\text{m}^3$



Grand Canyon National Park: Estimated $b_{\text{ext}} = 195 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 37.3 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 93.1 \text{ } \mu\text{g}/\text{m}^3$



Great Basin National Park: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.5 \mu\text{g}/\text{m}^3$



Great Basin National Park: Estimated $b_{\text{ext}} = 98 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 18.7 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 40.8 \mu\text{g}/\text{m}^3$



Mesa Verde National Park: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.5 \text{ }\mu\text{g}/\text{m}^3$



Mesa Verde National Park: Estimated $b_{\text{ext}} = 98 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 18.4 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 42.6 \text{ }\mu\text{g}/\text{m}^3$



Mount Rainier National Park: Estimated $b_{\text{ext}} = 15 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.7 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 2.1 \mu\text{g}/\text{m}^3$



Mount Rainier National Park: Estimated $b_{\text{ext}} = 391 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 54.0 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 82.2 \mu\text{g}/\text{m}^3$



Point Reyes National Park: Estimated $b_{\text{ext}} = 12 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.1 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.5 \text{ } \mu\text{g}/\text{m}^3$



Point Reyes National Park: Estimated $b_{\text{ext}} = 196 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 23.3 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 62.3 \text{ } \mu\text{g}/\text{m}^3$



Rocky Mt. National Park: Estimated $b_{\text{ext}} = 13 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.5 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 1.7 \text{ }\mu\text{g}/\text{m}^3$



Rocky Mt. National Park: Estimated $b_{\text{ext}} = 196 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 36.6 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 76.6 \text{ }\mu\text{g}/\text{m}^3$



Shenandoah National Park: Estimated $b_{\text{ext}} = 13 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.3 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.5 \text{ }\mu\text{g}/\text{m}^3$



Shenandoah National Park: Estimated $b_{\text{ext}} = 531 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 65.4 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 86.4 \text{ }\mu\text{g}/\text{m}^3$



Weminuche Wilderness: Estimated $b_{\text{ext}} = 11 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.2 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 0.6 \text{ } \mu\text{g}/\text{m}^3$



Weminuche Wilderness: Estimated $b_{\text{ext}} = 130 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 23.6 \text{ } \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 53.2 \text{ } \mu\text{g}/\text{m}^3$



Yellowstone National Park: Estimated $b_{\text{ext}} = 15 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.8 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 2.3 \mu\text{g}/\text{m}^3$



Yellowstone National Park: Estimated $b_{\text{ext}} = 196 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 36.8 \mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 104.0 \mu\text{g}/\text{m}^3$



Yosemite National Park: Estimated $b_{\text{ext}} = 12 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 0.3 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 1.1 \text{ }\mu\text{g}/\text{m}^3$



Yosemite National Park: Estimated $b_{\text{ext}} = 245 \text{ Mm}^{-1}$, $\text{PM}_{2.5} = 43.9 \text{ }\mu\text{g}/\text{m}^3$, $\text{PM}_{10} = 83.4 \text{ }\mu\text{g}/\text{m}^3$

