

Supplementary Material For Manuscript “Particulate sulfate ion concentration and SO<sub>2</sub> emission trends in the United States through 2010” by J.L. Hand et al.

Table 1. IMPROVE 1989–2010 annual median particulate sulfate ion concentration, standard deviation, annual mean trend, and statistical significance (p). Sites are organized by regions defined in the text. OCONUS refers to sites outside the contiguous United States.

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Northeast									
Washington D.C.	DC	WASH1	38.876	-77.034	15	4.97	1.12	-2.8	0.00
Mammoth Cave NP	KY	MACA1	37.132	-86.148	235	4.71	0.87	-3.0	0.00
Acadia NP	ME	ACAD1	44.377	-68.261	157	1.95	0.58	-4.4	0.00
Moosehorn NWR	ME	MOOS1	45.126	-67.266	78	1.64	0.34	-3.9	0.00
Boundary Waters Canoe Area	MN	BOWA1	47.947	-91.495	527	1.21	0.28	-3.1	0.00
Brigantine NWR	NJ	BRIG1	39.465	-74.449	5	3.93	0.81	-3.0	0.00
Shenandoah NP	VA	SHEN1	38.523	-78.435	1079	4.47	1.02	-2.9	0.00
Lye Brook WA	VT	LYBR1	43.148	-73.127	1015	2.23	0.48	-3.1	0.00
Dolly Sods WA	WV	DOSO1	39.105	-79.426	1182	4.60	1.10	-3.9	0.00
Southeast									
Sipsy Wilderness	AL	SIPS1	34.343	-87.339	286	4.72	1.19	-4.1	0.00
Chassahowitzka NWR	FL	CHAS1	28.748	-82.555	4	3.24	0.63	-3.1	0.00
Okefenokee NWR	GA	OKEF1	30.740	-82.128	48	3.44	0.63	-2.8	0.00
Shining Rock WA	NC	SHRO1	35.394	-82.774	1617	3.36	0.77	-3.6	0.00
Cape Romain NWR	SC	ROMA1	32.941	-79.657	5	3.83	0.61	-2.5	0.01
Great Smoky Mountains NP	TN	GRSM1	35.633	-83.942	811	4.64	0.89	-2.0	0.00
MidSouth									
Upper Buffalo WA	AR	UPBU1	35.826	-93.203	723	2.98	0.60	-3.3	0.00
Big Bend NP	TX	BIBE1	29.303	-103.178	1067	1.82	0.23	0.0	0.98
GuadalupeMountains NP	TX	GUMO1	31.833	-104.809	1672	1.27	0.20	-1.3	0.03
West									

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend (% yr <sup>-1</sup> )	Significance (p)
Bliss SP (TRPA)	CA	BLIS1	38.976	-120.103	2131	0.48	0.08	-1.7	0.01
Lassen Volcanic NP	CA	LAVO1	40.540	-121.577	1733	0.41	0.05	-0.1	0.93
Pinnacles NM	CA	PINN1	36.483	-121.157	302	0.94	0.13	-1.8	0.00
Point Reyes National Seashore	CA	PORE1	38.122	-122.909	97	1.12	0.11	-1.2	0.00
Redwood NP	CA	REDW1	41.561	-124.084	244	0.63	0.10	-2.0	0.00
San Geronio WA	CA	SAGO1	34.194	-116.913	1726	0.97	0.15	-1.6	0.00
Sequoia NP	CA	SEQU1	36.489	-118.829	519	1.24	0.20	-1.8	0.00
Yosemite NP	CA	YOSE1	37.713	-119.706	1603	0.67	0.09	-1.2	0.00
Great Basin NP	NV	GRBA1	39.005	-114.216	2066	0.46	0.07	-1.3	0.04
Jarvis WA	NV	JARB1	41.893	-115.426	1869	0.38	0.04	-1.0	0.01
Crater Lake NP	OR	CRLA1	42.896	-122.136	1996	0.31	0.05	-1.3	0.02
Three Sisters WA	OR	THSI1	44.291	-122.043	885	0.42	0.06	-2.3	0.00
Columbia River Gorge	WA	CORI1	45.664	-121.001	179	0.86	0.22	-3.7	0.00
Mount Rainier NP	WA	MORA1	46.758	-122.124	439	0.77	0.23	-4.2	0.00
Snoqualmie Pass	WA	SNPA1	47.422	-121.426	1049	0.63	0.21	-4.8	0.00
Southwest									
Chiricahua NM	AZ	CHIR1	32.009	-109.389	1555	0.95	0.18	-2.3	0.00
Grand Canyon NP	AZ	GRCA2	35.973	-111.984	2267	0.68	0.11	-2.0	0.00
Indian Gardens	AZ	INGA1	36.078	-112.129	1166	0.72	0.15	-2.8	0.00
Petrified Forest NP	AZ	PEFO1	35.078	-109.769	1766	0.77	0.11	-1.9	0.00
Tonto NM	AZ	TONT1	33.655	-111.107	775	1.02	0.14	-1.8	0.00
Great Sand Dunes NM	CO	GRSA1	37.725	-105.519	2498	0.57	0.08	-1.8	0.00
Mesa Verde NP	CO	MEVE1	37.198	-108.491	2172	0.64	0.12	-2.5	0.00
Mount Zirkel WA	CO	MOZI1	40.538	-106.677	3243	0.48	0.09	-3.0	0.00
Rocky Mountain NP	CO	ROMO1	40.278	-105.546	2760	0.61	0.09	-2.0	0.00
Weminuche WA	CO	WEMI1	37.659	-107.800	2750	0.52	0.10	-2.6	0.00
Bandelier NM	NM	BAND1	35.780	-106.266	1988	0.72	0.12	-2.0	0.00
Gila WA	NM	GICL1	33.220	-108.235	1776	0.76	0.15	-3.6	0.00
Bryce Canyon NP	UT	BRCA1	37.618	-112.174	2481	0.58	0.10	-2.2	0.00
Canyonlands NP	UT	CANY1	38.459	-109.821	1798	0.66	0.15	-3.0	0.00
Great Plains									
Glacier NP	MT	GLAC1	48.511	-113.997	975	0.61	0.12	-2.5	0.00
Badlands NP	SD	BADL1	43.743	-101.941	736	1.04	0.15	-1.7	0.00

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Bridger WA	WY	BRID1	42.975	-109.758	2627	0.46	0.07	-1.8	0.00
Yellowstone NP	WY	YELL2	44.565	-110.400	2425	0.42	0.06	-1.4	0.00
OCONUS									
Denali NP	AK	DENA1	63.723	-148.967	675	0.33	0.09	-0.8	0.20

NM=National Monument

NP=National Park

NWR=National Wildlife Refuge

WA=Wilderness Area

Table 2. IMPROVE 2000–2010 annual median particulate sulfate ion concentration, standard deviation, annual mean trend, and statistical significance (p). Sites are organized by regions defined in the text. OCONUS refers to sites outside the contiguous United States.

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Northeast									
Mohawk Mt.	CT	MOMO1	41.821	-73.297	522	2.62	0.63	-7.5	0.01
Washington D.C.	DC	WASH1	38.876	-77.034	15	4.80	0.95	-5.2	0.00
Viking Lake	IA	VILA1	40.969	-95.045	371	2.26	0.54	-8.1	0.01
Bondville	IL	BOND1	40.052	-88.373	263	3.22	0.61	-4.7	0.01
Livonia	IN	LIVO1	38.535	-86.260	282	4.37	0.88	-5.5	0.01
Cadiz	KY	CADI1	36.784	-87.850	192	4.14	0.73	-4.2	0.02
Mammoth Cave NP	KY	MACA1	37.132	-86.148	235	4.46	0.73	-3.9	0.00
Cape Cod	MA	CACO1	41.976	-70.024	49	2.41	0.56	-7.4	0.00
Martha's Vineyard	MA	MAVI1	41.331	-70.785	3	2.25	0.64	-11.4	0.00
Quabbin Summit	MA	QURE1	42.299	-72.335	318	2.43	0.53	-6.4	0.01
Acadia NP	ME	ACAD1	44.377	-68.261	157	1.62	0.33	-6.2	0.00
Bridgton	ME	BRMA1	44.107	-70.729	234	1.71	0.45	-8.7	0.00
Casco Bay	ME	CABA1	43.833	-70.064	27	1.82	0.43	-7.0	0.00
Moosehorn NWR	ME	MOOS1	45.126	-67.266	78	1.41	0.30	-6.2	0.00
Presque Isle	ME	PRIS1	46.696	-68.033	166	1.33	0.31	-7.2	0.00
Isle Royale NP	MI	ISLE1	47.460	-88.149	182	1.25	0.23	-4.8	0.00
Seney	MI	SENE1	46.289	-85.950	215	1.61	0.35	-5.1	0.02
Blue Mounds	MN	BLMO1	43.716	-96.191	473	1.54	0.21	-3.5	0.05
Boundary Waters Canoe Area	MN	BOWA1	47.947	-91.495	527	1.04	0.17	-3.5	0.01
Great River Bluffs	MN	GRR11	43.937	-91.405	370	1.81	0.39	-6.2	0.08
Voyageurs NP #1	MN	VOYA1	48.413	-92.829	426	1.09	0.14	-2.8	0.04
Great Gulf WA	NH	GRGU1	44.308	-71.218	454	1.53	0.40	-8.2	0.00
Brigantine NWR	NJ	BRIG1	39.465	-74.449	5	3.72	0.82	-6.3	0.00
Addison Pinnacle	NY	ADPI1	42.091	-77.210	512	3.31	0.79	-7.2	0.01

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Quaker City	OH	QUCI1	39.943	-81.338	366	4.66	0.98	-5.9	0.01
Arendtsville	PA	AREN1	39.923	-77.308	267	4.25	0.91	-6.1	0.00
M.K. Goddard	PA	MKGO1	41.427	-80.145	380	3.63	0.84	-6.8	0.00
James River Face Wilderness	VA	JARI1	37.627	-79.512	290	4.08	1.10	-7.5	0.00
Shenandoah NP	VA	SHEN1	38.523	-78.435	1079	4.10	0.88	-5.7	0.00
Lye Brook WA	VT	LYBR1	43.148	-73.127	1015	1.88	0.48	-6.0	0.02
Proctor Maple Research Facility	VT	PMRF1	44.528	-72.869	401	1.93	0.48	-7.2	0.00
Dolly Sods WA	WV	DOSO1	39.105	-79.426	1182	3.96	0.87	-6.0	0.00
Southeast									
Sipsy Wilderness	AL	SIPS1	34.343	-87.339	286	4.01	0.90	-5.5	0.01
Chassahowitzka NWR	FL	CHAS1	28.748	-82.555	4	2.96	0.61	-5.0	0.00
Everglades NP	FL	EVER1	25.391	-80.681	1	2.09	0.35	-3.0	0.02
St. Marks	FL	SAMA1	30.093	-84.161	8	3.23	0.58	-4.0	0.04
Cohutta	GA	COHU1	34.785	-84.627	735	4.13	0.85	-5.0	0.00
Okefenokee NWR	GA	OKEF1	30.740	-82.128	48	3.22	0.53	-4.4	0.00
Sikes	LA	SIKE1	32.057	-92.435	45	3.05	0.59	-5.2	0.02
Linville Gorge	NC	LIGO1	35.972	-81.933	969	3.81	1.01	-6.3	0.02
Shining Rock WA	NC	SHRO1	35.394	-82.774	1617	3.12	0.76	-6.2	0.00
Swanquarter	NC	SWAN1	35.451	-76.207	-4	3.24	0.55	-4.2	0.00
Cape Romain NWR	SC	ROMA1	32.941	-79.657	5	3.44	0.63	-3.9	0.02
Great Smoky Mountains NP	TN	GRSM1	35.633	-83.942	811	4.26	0.88	-4.7	0.01
Midsouth									
Caney Creek	AR	CACR1	34.454	-94.143	683	2.88	0.55	-5.1	0.00
Upper Buffalo WA	AR	UPBU1	35.826	-93.203	723	2.72	0.53	-3.9	0.01
Cedar Bluff	KS	CEBL1	38.770	-99.763	666	1.37	0.25	-5.9	0.01
Sac and Fox	KS	SAFO1	39.979	-95.568	293	2.04	0.46	-5.7	0.01
Tallgrass	KS	TALL1	38.434	-96.560	390	1.99	0.36	-4.9	0.03
El Dorado Springs	MO	ELDO1	37.701	-94.035	298	2.43	0.62	-8.3	0.00
Hercules-Glades	MO	HEGL1	36.614	-92.922	404	2.82	0.57	-5.3	0.00
Mingo	MO	MING1	36.972	-90.143	111	3.64	0.71	-5.2	0.01
Cherokee Nation	OK	CHER1	36.956	-97.031	342	2.09	0.35	-4.1	0.08

Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Ellis	OK	ELLI1	36.085	-99.935	697	1.55	0.35	-6.5	0.00
Wichita Mountains	OK	WIMO1	34.732	-98.713	509	2.11	0.45	-4.9	0.01
Big Bend NP	TX	BIBE1	29.303	-103.178	1067	1.92	0.26	-3.5	0.02
Guadalupe Mountains NP	TX	GUMO1	31.833	-104.809	1672	1.11	0.20	-4.2	0.02
West									
Agua Tibia	CA	AGTI1	33.464	-116.971	508	1.78	0.31	-5.2	0.00
Bliss SP (TRPA)	CA	BLIS1	38.976	-120.103	2131	0.47	0.05	-1.1	0.31
Death Valley NP	CA	DEVA1	36.509	-116.848	130	0.73	0.09	-2.7	0.02
Dome Lands WA	CA	DOME1	35.728	-118.138	927	0.96	0.11	-2.6	0.04
Hoover	CA	HOOV1	38.088	-119.177	2561	0.39	0.05	-1.1	0.53
Joshua Tree NP	CA	JOSH1	34.069	-116.389	1235	0.95	0.15	-3.3	0.02
Kaiser	CA	KAIS1	37.221	-119.155	2598	0.56	0.06	-0.9	0.24
Lava Beds NM	CA	LABE1	41.712	-121.507	1460	0.38	0.05	-2.6	0.04
Lassen Volcanic NP	CA	LAVO1	40.540	-121.577	1733	0.42	0.04	-0.9	0.19
Pinnacles NM	CA	PINN1	36.483	-121.157	302	0.89	0.10	-2.2	0.00
Point Reyes National Seashore	CA	PORE1	38.122	-122.909	97	1.09	0.11	-2.3	0.00
San Rafael	CA	RAFA1	34.734	-120.007	957	1.03	0.18	-4.5	0.00
Redwood NP	CA	REDW1	41.561	-124.084	244	0.58	0.06	-1.8	0.02
San Gabriel	CA	SAGA1	34.297	-118.028	1791	0.87	0.12	-1.3	0.46
San Geronio WA	CA	SAGO1	34.194	-116.913	1726	0.92	0.14	-3.4	0.04
Sequoia NP	CA	SEQU1	36.489	-118.829	519	1.23	0.16	-3.5	0.00
Trinity	CA	TRIN1	40.786	-122.805	1014	0.42	0.06	0.2	0.93
Yosemite NP	CA	YOSE1	37.713	-119.706	1603	0.63	0.10	-3.6	0.01
Craters of the Moon NM	ID	CRMO1	43.460	-113.555	1818	0.40	0.05	-3.5	0.04
Sawtooth NF	ID	SAWT1	44.171	-114.927	1990	0.33	0.04	-0.5	0.65
Great Basin NP	NV	GRBA1	39.005	-114.216	2066	0.44	0.05	-1.1	0.19
Jarbridge WA	NV	JARB1	41.893	-115.426	1869	0.35	0.04	-0.7	0.48
Crater Lake NP	OR	CRLA1	42.896	-122.136	1996	0.30	0.04	-1.1	0.19
Hells Canyon	OR	HECA1	44.970	-116.844	655	0.42	0.06	-1.8	0.13
Kalmiopsis	OR	KALM1	42.552	-124.059	80	0.46	0.05	-2.1	0.02
Mount Hood	OR	MOHO1	45.289	-121.784	1531	0.36	0.07	-4.3	0.00
Starkey	OR	STAR1	45.225	-118.513	1259	0.41	0.06	-3.0	0.07

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Three Sisters WA	OR	THSI1	44.291	-122.043	885	0.38	0.06	-2.9	0.10
Columbia Gorge #1	WA	COGO1	45.569	-122.210	230	0.80	0.17	-5.5	0.01
Columbia River Gorge	WA	CORI1	45.664	-121.001	179	0.73	0.15	-5.1	0.00
Mount Rainier NP	WA	MORA1	46.758	-122.124	439	0.55	0.15	-5.3	0.00
North Cascades	WA	NOCA1	48.732	-121.065	569	0.51	0.10	-4.5	0.01
Olympic	WA	OLYM1	48.007	-122.973	600	0.62	0.07	-2.9	0.04
Pasayten	WA	PASA1	48.388	-119.927	1627	0.34	0.04	-1.8	0.18
Puget Sound	WA	PUSO1	47.570	-122.312	98	1.21	0.24	-5.9	0.00
Snoqualmie Pass	WA	SNPA1	47.422	-121.426	1049	0.51	0.17	-6.4	0.00
White Pass	WA	WHPA1	46.624	-121.388	1827	0.33	0.07	-5.7	0.01
Southwest									
Mount Baldy	AZ	BALD1	34.058	-109.441	2509	0.61	0.10	-4.1	0.02
Chiricahua NM	AZ	CHIR1	32.009	-109.389	1555	0.86	0.09	-2.7	0.00
Hance Camp at Grand Canyon NP	AZ	GRCA2	35.973	-111.984	2267	0.59	0.07	-2.0	0.14
Ike's Backbone	AZ	IKBA1	34.340	-111.683	1298	0.76	0.10	-3.1	0.00
Indian Gardens	AZ	INGA1	36.078	-112.129	1166	0.67	0.09	-1.6	0.19
Meadview	AZ	MEAD1	36.019	-114.068	902	0.73	0.10	-5.3	0.01
Organ Pipe	AZ	ORPI1	31.951	-112.802	504	1.00	0.15	-4.7	0.01
Petrified Forest NP	AZ	PEFO1	35.078	-109.769	1766	0.71	0.07	-2.0	0.05
Phoenix	AZ	PHOE1	33.504	-112.096	342	1.06	0.16	-3.7	0.02
Queen Valley	AZ	QUVA1	33.294	-111.286	661	0.97	0.13	-3.2	0.04
Saguaro NM	AZ	SAGU1	32.175	-110.737	941	0.91	0.14	-4.1	0.02
Saguaro West	AZ	SAWE1	32.249	-111.218	714	0.90	0.12	-3.6	0.02
Sierra Ancha	AZ	SIAN1	34.091	-110.942	1600	0.77	0.11	-3.0	0.01
Sycamore Canyon	AZ	SYCA1	35.141	-111.969	2046	0.63	0.10	-3.5	0.02
Tonto NM	AZ	TONT1	33.655	-111.107	775	0.89	0.13	-3.5	0.01
Great Sand Dunes NM	CO	GRSA1	37.725	-105.519	2498	0.51	0.06	-2.9	0.00
Mesa Verde NP	CO	MEVE1	37.198	-108.491	2172	0.57	0.08	-3.5	0.00
Mount Zirkel WA	CO	MOZI1	40.538	-106.677	3243	0.46	0.07	-3.3	0.01
Rocky Mountain NP	CO	ROMO1	40.278	-105.546	2760	0.55	0.09	-4.1	0.00
Weminuche WA	CO	WEMI1	37.659	-107.800	2750	0.45	0.07	-4.0	0.02
White River NF	CO	WHRI1	39.154	-106.821	3414	0.39	0.06	-3.3	0.02
Bandelier NM	NM	BAND1	35.780	-106.266	1988	0.66	0.08	-2.9	0.00
Bosque del Apache	NM	BOAP1	33.869	-106.852	1390	0.79	0.13	-4.2	0.00

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Gila WA	NM	GICL1	33.220	-108.235	1776	0.70	0.11	-3.9	0.00
Salt Creek	NM	SACR1	33.460	-104.404	1072	1.40	0.21	-4.3	0.00
San Pedro Parks	NM	SAPE1	36.014	-106.845	2935	0.54	0.08	-3.0	0.04
White Mountain	NM	WHIT1	33.469	-105.535	2064	0.92	0.10	-1.6	0.40
Wheeler Peak	NM	WHPE1	36.585	-105.452	3366	0.48	0.05	-0.8	0.42
Bryce Canyon NP	UT	BRCA1	37.618	-112.174	2481	0.51	0.07	-3.1	0.04
Canyonlands NP	UT	CANY1	38.459	-109.821	1798	0.55	0.08	-3.2	0.02
Capitol Reef NP	UT	CAPI1	38.302	-111.293	1897	0.52	0.10	-4.2	0.01
Zion Canyon	UT	ZICA1	37.198	-113.151	1215	0.62	0.10	-5.5	0.01
Great Plains									
Cabinet Mountains	MT	CABI1	47.955	-115.671	1441	0.40	0.05	-3.8	0.00
Flathead	MT	FLAT1	47.773	-114.269	1580	0.39	0.04	-0.9	0.40
Fort Peck	MT	FOPE1	48.308	-105.102	638	0.86	0.10	2.3	0.06
Gates of the Mountains	MT	GAMO1	46.826	-111.711	2387	0.35	0.04	-2.7	0.03
Glacier NP	MT	GLAC1	48.511	-113.997	975	0.55	0.08	-3.1	0.01
Medicine Lake	MT	MELA1	48.487	-104.476	606	0.95	0.07	-0.1	0.94
Monture	MT	MONT1	47.122	-113.154	1282	0.37	0.05	-3.0	0.02
Northern Cheyenne	MT	NOCH1	45.650	-106.557	1283	0.59	0.07	-2.2	0.06
Sula Peak	MT	SULA1	45.860	-114.000	1896	0.34	0.03	-1.6	0.33
UL Bend	MT	ULBE1	47.582	-108.720	891	0.62	0.06	-2.1	0.00
Lostwood	ND	LOST1	48.642	-102.402	696	1.17	0.08	0.0	0.94
Theodore Roosevelt	ND	THRO1	46.895	-103.378	853	0.92	0.08	-0.5	0.70
Crescent Lake	NE	CRES1	41.763	-102.434	1207	0.87	0.06	-1.5	0.22
Nebraska NF	NE	NEBR1	41.889	-100.339	883	1.13	0.10	-2.8	0.05
Badlands NP	SD	BADL1	43.743	-101.941	736	0.89	0.10	-1.2	0.07
Wind Cave	SD	WICA1	43.558	-103.484	1296	0.72	0.07	-2.2	0.02
Bridger WA	WY	BRID1	42.975	-109.758	2627	0.44	0.05	-2.5	0.07
Cloud Peak	WY	CLPE1	44.333	-106.956	2471	0.43	0.05	-0.3	0.83
North Absaroka	WY	NOAB1	44.745	-109.382	2483	0.41	0.06	-3.4	0.01
Thunder Basin	WY	THBA1	44.663	-105.287	1195	0.66	0.05	-0.7	0.53
Yellowstone NP 2	WY	YELL2	44.565	-110.400	2425	0.41	0.05	-2.8	0.07
OCONUS									
Denali NP	AK	DENA1	63.723	-148.967	675	0.32	0.09	6.0	0.04



Site Name	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000-2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000-2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend ( $\% \text{ yr}^{-1}$ )	Significance (p)
Simeonof	AK	SIME1	55.326	-160.506	57	0.56	0.09	1.2	0.40
Trapper Creek	AK	TRCR1	62.315	-150.316	155	0.32	0.08	2.7	0.53
Tuxedni	AK	TUXE1	59.993	-152.666	15	0.37	0.09	4.0	0.30
Haleakala NP	HI	HALE1	20.809	-156.282	1153	0.87	0.19	1.5	0.18
Hawaii Volcanoes NP	HI	HAVO1	19.431	-155.258	1259	2.16	0.78	9.4	0.00
Virgin Islands NP	VI	VIIS1	18.336	-64.796	51	1.08	0.13	0.7	0.62

NM=National Monument

NP=National Park

NWR=National Wildlife Refuge

WA=Wilderness Area

Table 3. CSN 2000–2010 annual median particulate sulfate ion concentration, standard deviation, annual mean trend, and statistical significance (p). Sites are organized by regions defined in the text.

City	State	Site Code	Latitude (deg)	Longitude (deg)	Elevation (m)	2000- 2010 Median Sulfate Ion ( $\mu\text{g}/\text{m}^3$ )	2000- 2010 Standard Deviation ( $\mu\text{g}/\text{m}^3$ )	Trend (% $\text{yr}^{-1}$ )	Significance (p)
Northeast									
Washington D.C.	DC	110010043	38.922	-77.013	31	4.73	1.00	-5.9	0.01
Dover	DE	100010003	39.155	-75.518	6	4.04	0.84	-6.2	0.00
Wilmington	DE	100032004	39.739	-75.558	31	4.47	0.98	-5.7	0.00
Cedar Rapids	IA	191130037	42.008	-91.679	254	2.35	0.43	-4.3	0.02
Des Moines	IA	191530030	41.603	-93.643	282	2.17	0.37	-5.3	0.08
Davenport	IA	191630015	41.530	-90.588	212	2.74	0.65	-5.8	0.00
Chicago	IL	170310057	41.913	-87.723	185	3.07	0.60	-5.3	0.02
Chicago	IL	170310076	41.751	-87.714	188	3.13	0.66	-6.6	0.01
Northbrook	IL	170314201	42.140	-87.799	194	2.55	0.82	-7.4	0.08
Middleton	IN	180650003	40.009	-85.523	309	3.88	0.87	-5.1	0.04
Gary	IN	180890022	41.607	-87.305	179	3.33	0.80	-5.8	0.08
Indianapolis	IN	180970078	39.811	-86.115	240	4.29	0.92	-5.2	0.01
Ashland	KY	210190017	38.459	-82.641	189	4.67	1.10	-6.9	0.01
Lexington	KY	210670012	38.065	-84.500	296	4.69	0.91	-4.6	0.04
Covington	KY	211170007	39.072	-84.525	220	4.69	0.94	-4.9	0.08
Westover AFB	MA	250130008	42.194	-72.555	60	2.84	0.64	-6.8	0.03
Boston	MA	250250042	42.329	-71.082	5	3.00	0.59	-5.5	0.00
Essex	MD	240053001	39.311	-76.474	10	4.49	0.97	-6.1	0.00
Grand Rapids	MI	260810020	42.984	-85.671	190	2.74	0.70	-6.2	0.01
Houghton Lake	MI	261130001	44.311	-84.892	347	1.97	0.46	-5.1	0.02
Erie	MI	261150005	41.764	-83.472	175	3.14	0.93	-8.5	0.02
Allen Park	MI	261630001	42.229	-83.208	182	3.41	0.87	-6.4	0.01
Detroit	MI	261630033	42.307	-83.149	179	3.69	1.11	-9.6	0.01
Minneapolis	MN	270530963	44.954	-93.258	265	1.95	0.37	-5.2	0.01
Rochester	MN	271095008	43.997	-92.450	318	1.94	0.29	-2.8	0.10
Camden	NJ	340070003	39.923	-75.098	2	4.29	0.70	-4.5	0.01
New Brunswick	NJ	340230006	40.473	-74.423	24	3.70	0.88	-7.5	0.00
Chester	NJ	340273001	40.788	-74.676	256	3.53	0.86	-7.7	0.00
Elizabeth	NJ	340390004	40.641	-74.208	3	3.99	0.88	-6.3	0.00

Bronx	NY	360050110	40.816	-73.902	14	3.73	0.71	-5.0	0.04
Buffalo	NY	360290005	42.877	-78.810	186	3.40	0.84	-7.7	0.00
Wilmingon	NY	360310003	44.393	-73.859	584	1.84	0.55	-8.1	0.01
Queens	NY	360810124	40.736	-73.822	13	3.88	0.83	-6.9	0.00
Addison	NY	361010003	42.091	-77.210	490	3.49	0.74	-6.3	0.00
Middletown	OH	390171004	39.530	-84.393	227	4.32	0.78	-4.1	0.22
Cleveland	OH	390350038	41.477	-81.682	186	4.30	0.96	-5.9	0.10
Cleveland	OH	390350060	41.494	-81.678	197	4.36	0.82	-4.6	0.01
Columbus	OH	390490081	40.088	-82.960	263	3.68	0.91	-5.6	0.10
Sheffield	OH	390933002	41.463	-82.114	182	3.49	0.71	-5.4	0.08
Toledo	OH	390950026	41.621	-83.641	191	3.31	0.84	-4.8	0.14
Youngstown	OH	390990014	41.096	-80.658	281	3.93	0.92	-6.8	0.01
Akron	OH	391530023	41.088	-81.542	313	4.01	1.31	-6.7	0.04
Arendtsville	PA	420010001	39.920	-77.310	241	4.67	1.06	-8.1	0.00
Pittsburgh	PA	420030008	40.466	-79.961	312	5.15	0.89	-5.5	0.00
State College	PA	420270100	40.811	-77.877	354	4.31	0.83	-5.7	0.00
Toughkenamon	PA	420290100	39.834	-75.768	91	4.30	0.79	-5.7	0.01
Harrisburg	PA	420430401	40.245	-76.845	125	4.58	1.01	-7.7	0.00
Erie	PA	420490003	42.142	-80.039	202	3.57	0.83	-6.4	0.02
Scranton	PA	420692006	41.443	-75.623	265	3.49	1.16	-10.5	0.00
Lancaster	PA	420710007	40.047	-76.283	99	4.70	1.11	-8.3	0.00
Freemansburg	PA	420950025	40.628	-75.341	93	4.10	0.89	-6.6	0.01
Philadelphia	PA	421010004	40.009	-75.098	25	3.81	0.76	-5.5	0.06
Burgettstown	PA	421255001	40.445	-80.421	344	4.51	0.93	-5.9	0.02
Greensburg	PA	421290008	40.305	-79.506	378	4.83	0.95	-6.2	0.01
York	PA	421330008	39.965	-76.699	125	4.58	1.06	-8.0	0.00
Providence	RI	440070022	41.808	-71.415	17	3.22	0.58	-5.3	0.00
Burlington	VT	500070012	44.480	-73.214	42	2.15	0.51	-7.2	0.00
Seattle	WA	530330080	47.568	-122.308	58	1.13	0.16	-4.0	0.00
Mayville	WI	550270007	43.435	-88.528	348	2.34	0.41	-4.3	0.08
Milwaukee	WI	550790026	43.061	-87.912	216	2.69	0.62	-4.4	0.03
Perkinstown	WI	551198001	45.204	-90.600	449	1.61	0.32	-5.0	0.02
Waukesha	WI	551330027	43.020	-88.215	263	2.41	0.57	-5.9	0.04
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Southeast									
Birmingham	AL	10730023	33.553	-86.815	177	4.55	0.91	-5.1	0.01
Birmingham	AL	10732003	33.500	-86.924	180	4.28	1.04	-7.8	0.00
Hunstville	AL	10890014	34.688	-86.586	180	4.38	1.08	-8.4	0.01
Montgomery	AL	11011002	32.407	-86.256	64	4.10	0.83	-6.2	0.00
Tallahassee	FL	120730012	30.440	-84.348	16	3.23	0.63	-5.8	0.02
Macon	GA	130210007	32.778	-83.641	103	4.25	1.13	-9.3	0.01

Athens	GA	130590001	33.946	-83.372	214	4.05	1.15	-10.1	0.00
Douglas	GA	130690002	31.513	-82.750	64	3.21	0.73	-7.6	0.01
Panthersville	GA	130890002	33.688	-84.290	244	4.51	0.94	-4.7	0.01
Columbus	GA	132150011	32.431	-84.932	78	4.17	1.03	-7.5	0.01
Augusta	GA	132450091	33.434	-82.022	57	4.36	0.92	-6.8	0.00
Shreveport	LA	220150008	32.536	-93.749	47	2.93	0.60	-4.6	0.01
Baton Rouge	LA	220330009	30.462	-91.179	16	3.69	0.71	-5.2	0.01
Gulfport	MS	280470008	30.390	-89.050	6	3.64	0.53	-4.5	0.04
Asheville	NC	370210034	35.607	-82.583	706	3.88	0.96	-7.4	0.04
Hickory	NC	370350004	35.729	-81.366	341	4.47	0.91	-5.7	0.01
Winston-Salem	NC	370670022	36.111	-80.227	279	4.71	1.05	-7.9	0.01
Charlotte	NC	371190041	35.240	-80.786	223	4.40	0.86	-5.0	0.01
Raleigh	NC	371830014	35.856	-78.574	92	4.06	0.71	-5.6	0.00
Charleston	SC	450190049	32.791	-79.959	0	3.64	0.63	-4.3	0.04
Chesterfield	SC	450250001	34.615	-80.199	122	4.19	0.72	-4.9	0.00
Nashville	TN	470370023	36.176	-86.739	153	4.05	0.89	-5.8	0.06
Chattanooga	TN	470654002	35.051	-85.293	258	4.79	0.97	-5.8	0.02
Knoxville	TN	470931020	36.019	-83.874	309	4.41	1.06	-7.2	0.01
Loretto	TN	470990002	35.116	-87.470	230	3.78	0.89	-6.5	0.02
Midsouth									
Little Rock	AR	511900007	34.756	-92.281	77	3.03	0.66	-5.9	0.00
Kansas City	KS	202090021	39.118	-94.636	269	2.54	0.40	-3.0	0.03
Liberty	MO	290470005	39.303	-94.377	273	2.63	0.50	-6.3	0.02
Bonne Terre	MO	291860005	37.901	-90.424	250	3.24	0.80	-7.9	0.03
St. Louis	MO	295100085	38.657	-90.199	144	3.57	0.68	-4.2	0.00
Edmond	OK	401091037	35.614	-97.475	344	2.66	0.47	-4.9	0.06
Tulsa	OK	401431127	36.205	-95.977	193	2.91	0.44	-4.6	0.00
Big Bend National Park	TX	480430101	29.302	-103.168	1052	1.87	0.22	-0.9	0.62
Dallas	TX	481130069	32.820	-96.860	132	3.07	0.55	-4.9	0.02
El Paso	TX	481410044	31.766	-106.455	1128	1.11	0.19	-4.2	0.01
Deer Park	TX	482011039	29.670	-95.129	9	3.39	0.49	-3.7	0.02
Corpus Christi	TX	483550034	27.812	-97.466	2	2.88	0.31	-0.7	0.33
West									
Chico	CA	60070002	39.757	-121.842	62	0.84	0.09	-0.3	0.83
Fresno	CA	60190008	36.781	-119.772	91	1.49	0.17	-2.5	0.00
Calexico	CA	60250005	32.676	-115.483	2	1.50	0.27	-3.4	0.10
Bakersfield	CA	60290014	35.356	-119.040	118	1.80	0.21	-3.3	0.01
Los Angeles	CA	60371103	34.067	-118.227	126	3.22	0.92	-8.8	0.00
Portola	CA	60631009	39.808	-120.472	1625	0.55	0.06	-1.3	0.01

Rubidoux	CA	60658001	34.000	-117.416	250	2.69	0.70	-8.0	0.00
Sacramento	CA	60670006	38.614	-121.367	19	1.12	0.13	-3.4	0.00
Sacramento	CA	60670010	38.558	-121.492	19	1.04	0.15	-3.0	0.21
El Cajon	CA	60730003	32.791	-116.942	169	2.40	0.67	-7.6	0.00
Escondido	CA	60731002	33.128	-117.075	204	2.32	0.39	-5.1	0.02
San Jose	CA	60850005	37.348	-121.895	21	1.31	0.17	-4.1	0.01
Modesto	CA	60990005	37.642	-120.994	27	1.36	0.13	-2.7	0.02
Visalia	CA	61072002	36.332	-119.290	97	1.61	0.18	-3.5	0.02
Simi Valley	CA	61112002	34.278	-118.685	308	2.23	0.50	-6.7	0.02
Reno	NV	320310016	39.525	-119.808	1403	0.61	0.10	-4.6	0.01
Medford	OR	410290133	42.314	-122.879	433	0.59	0.04	-2.0	0.01
Eugene	OR	410390060	44.026	-123.084	183	0.75	0.07	-3.2	0.01
Southwest									
Phoenix	AZ	40139997	33.504	-112.096	355	1.16	0.15	-3.1	0.02
Tucson	AZ	40191028	32.295	-110.982	710	1.01	0.15	-1.0	0.53
Commerce City	CO	80010006	39.826	-104.937	1558	1.17	0.26	-7.1	0.00
Platteville	CO	81230008	40.209	-104.824	1464	0.96	0.14	-3.7	0.02
Bountiful	UT	490110004	40.903	-111.884	1307	0.94	0.19	-4.7	0.01
Salt Lake City	UT	490353006	40.736	-111.872	1309	0.98	0.25	-5.0	0.00
Lindon	UT	490494001	40.341	-111.714	1456	0.85	0.22	-7.1	0.01
Great Plains									
Missoula	MT	300630031	46.875	-113.995	1020	0.82	0.16	-7.2	0.01
Omaha	NE	310550019	41.246	-95.973	347	2.27	0.32	-3.5	0.01
Fargo	ND	380171004	46.934	-96.855	273	1.33	0.12	-1.8	0.06