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Supplement of

Development of PM_{2.5} source impact spatial fields using a hybrid source apportionment air quality model

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Note A

During the chosen period of study, the CSN network performed thermal optical transmittance analyses to determine carbon species concentrations. As a result, organic and elemental carbon concentrations were converted to IMPROVE or total optical reflectance equivalents using previously derived methods (Malm et al. 2011). Additionally, measurements below detection limit are handled by setting the concentration to $\frac{1}{2}$ of the measurement detection limit (MDL) and setting the measurement uncertainty to $\frac{2}{3}$ of the MDL (Marmor et al. 2006).

Table S1. Median and mean CTM-RM and SH adjustment factors for withheld CSN observation locations

Source Categories	\widetilde{R}_{CTM-RM}	\widetilde{R}_{SH}	\overline{R}_{CTM-RM}	\overline{R}_{SH}	RMSE
Agricultural Burning	0.881	0.778	0.669	0.683	0.316
Aircraft Emissions	1.000	1.000	0.996	0.997	0.022
Biogenic Emissions	1.001	1.002	0.986	0.988	0.126
Coal CM [†]	0.954	0.966	0.937	0.941	0.074
Diesel CM [†]	1.000	1.000	1.000	1.000	0.004
Dust	0.100	0.105	0.131	0.133	0.185
Fuel Oil CM [†]	0.985	0.969	0.956	0.956	0.100
Livestock Emissions	1.001	0.999	0.990	0.994	0.094
Liquid Petroleum Gas CM [†]	1.000	1.000	0.999	0.999	0.009
Lawn Waste Burning	0.100	0.107	0.285	0.156	1.738
Metal Processing	0.778	0.742	0.677	0.687	0.322
Meat Cooking	0.985	0.973	0.931	0.937	0.168
Mexican CM [†]	1.000	1.000	0.999	1.001	0.017
Mineral Processing	0.875	0.874	0.857	0.845	0.165
Natural Gas CM [†]	0.604	0.620	0.599	0.591	0.269
NR [§] Diesel CM [†]	1.001	0.995	0.964	0.979	0.132
NR [§] Fuel Oil CM [†]	0.999	0.996	0.985	0.990	0.055
NR [§] Gasoline CM [†]	1.000	0.998	0.963	0.975	0.139
NR [§] Liquid Petroleum Gas CM [†]	1.000	1.000	0.997	0.998	0.017
NR [§] Natural Gas CM [†]	1.000	1.000	0.999	1.000	0.007
Other NR Sources	1.000	1.000	1.000	0.999	0.005
Open Fires	0.704	0.652	0.584	0.590	0.270
Onroad Diesel CM [†]	0.983	0.976	0.944	0.960	0.115
Onroad Gasoline CM [†]	0.873	0.884	0.826	0.857	0.285
Other CM [†] Sources	0.954	0.911	0.874	0.867	0.254
Other PM Sources	0.667	0.654	0.632	0.641	0.279
Prescribed Burning	0.959	0.942	1.047	0.894	1.930
Railroad Emissions	1.001	0.998	0.992	0.993	0.046
Seasalt	0.995	0.993	0.988	0.986	0.034
Solvent Emissions	0.943	0.920	0.843	0.852	0.262
Wildfires	0.866	0.866	0.791	0.787	0.250
Woodfuel Burning	0.953	0.939	0.854	0.881	0.264
Woodstoves	0.100	0.128	0.322	0.184	1.768

[§]NR = Nonroad, [†]CM = Combustion

Table S2. January 2004 domain-wide PM_{2.5} emissions and uncertainties.

Source Categories	Emissions (metric tons/day)	Uncertainty (factor)	Rank
Agricultural Burning	323.5	± 5	12
Aircraft Emissions	25.1	± 1.5	25
Biogenic Emissions	0.0	± 1.5	33
Coal CM [†]	1274.3	± 1.1	4
Diesel CM [†]	2.0	± 1.3	30
Dust	5300.9	± 10	1
Fuel Oil CM [†]	228.6	± 1.3	17
Livestock Emissions	1.3	± 1.3	31
Liquid Petroleum Gas CM [†]	13.7	± 1.3	26
Lawn Waste Burning	759.9	± 5	6
Metal Processing	171.2	± 1.3	18
Meat Cooking	309.5	± 1.5	14
Mexican CM [†]	13.2	± 1.5	27
Mineral Processing	315.9	± 1.3	13
Natural Gas CM [†]	619.7	± 1.3	8
NR [§] Diesel CM [†]	353.7	± 1.5	11
NR [§] Fuel Oil CM [†]	33.8	± 1.5	24
NR [§] Gasoline CM [†]	238.3	± 1.5	16
NR [§] Liquid Petroleum Gas CM [†]	2.9	± 1.5	29
NR [§] Natural Gas CM [†]	0.3	± 1.5	32
Other NR Sources	5.8	± 1.5	28
Open Fires	398.5	± 5	9
Onroad Diesel CM [†]	358.3	± 1.5	10
Onroad Gasoline CM [†]	159.7	± 1.5	20
Other CM [†] Sources	169.6	± 1.5	19
Other PM Sources	785.0	± 1.5	5
Prescribed Burning	725.3	± 10	7
Railroad Emissions	64.4	± 1.5	21
Seasalt	1893.4	± 1.5	3
Solvent Emissions	61.3	± 1.5	22
Wildfires	45.7	± 10	23
Woodfuel Burning	245.8	± 1.5	15
Woodstoves	3407.4	± 5	2

[§]NR = Nonroad, [†]CM = Combustion

Table S3. Mean observations and model simulations for January 2004 for withheld CSN observations (N = 75 observations).

	OBS		CMAQ-DDM			HYB			SH		
	Avg.	Std.	Avg.	Std.	RMSE	Avg.	Std.	RMSE	Avg.	Std.	RMSE
PM_{2.5}	11.7	8.3	16.3	11	12.5	8.59	4.7	7.9	9.20	5.7	8.6
OC	2.05	2.1	3.28	3.3	3.6	1.23	0.84	1.9	1.39	1.1	2.1
EC	0.727	0.64	0.944	1.3	1.3	0.55	0.59	0.74	0.627	0.90	0.99
NO₃	2.96	3.8	2.05	2.3	3.6	1.87	2.0	3.5	1.87	2.1	3.6
NH₄	1.38	1.3	1.45	0.99	1.2	1.20	0.79	1.1	1.24	0.83	1.2
SO₄	2.07	1.4	2.78	1.9	1.5	2.32	1.6	1.1	2.38	1.7	1.2
Na	0.0602	0.069	0.0960	0.079	0.12	0.0339	0.019	0.074	0.0394	0.028	0.078
Mg	0.0127	0.0017	0.0255	0.020	0.028	0.0960	0.061	0.018	0.0111	0.091	0.019
Al	0.0149	0.015	0.187	0.16	0.23	0.0397	0.022	0.034	0.0451	0.029	0.043
Si	0.0814	0.066	0.568	0.50	0.69	0.113	0.070	0.081	0.149	0.017	0.18
P	0.0046	0.0019	0.0064	0.0054	0.0061	0.0021	0.0011	0.0034	0.0026	0.0018	0.0035
Cl	0.0436	0.10	0.369	0.33	0.46	0.0798	0.056	0.090	0.0931	0.077	0.12
K	0.0725	0.068	0.429	0.46	0.59	0.0738	0.062	0.065	0.0946	0.13	0.15
Ca	0.0407	0.060	0.182	0.14	0.19	0.0445	0.023	0.054	0.0501	0.030	0.058
V	0.022	0.0030	0.0015	0.0014	0.025	4.64 E-4	3.1E-4	0.0068	5.68E-4	5.0E-4	0.011
Fe	0.0707	0.16	0.160	0.14	0.0034	0.0368	0.022	0.0034	0.0447	0.036	0.0034
Cu	0.0027	0.0034	0.0035	0.053	0.0060	0.0015	0.0011	0.0032	0.0020	0.0022	0.0035
Zn	0.0209	0.070	0.0099	0.013	0.010	0.0029	0.0021	0.0075	0.0035	0.0032	0.0077
Se	0.0018	0.0016	0.0017	0.011	0.21	0.0012	7.1E-4	0.15	0.0012	7.7E-4	0.15
Pb	0.0054	0.011	0.0019	0.0022	0.0064	5.60E-4	3.8E-4	0.0035	7.42E-4	7.8E-4	0.0038

Note: All averages and standard deviations are expressed in $\mu\text{g m}^{-3}$.

Table S4. Linear regression and correlation coefficients for model simulations vs. observations for January 2004 for withheld CSN observations (N = 75 observations). Regression equation: $Conc_{model} = \alpha + \beta \cdot Conc_{obs}$

	CMAQ-DDM vs. OBS					HYB vs. OBS					SH vs. OBS				
	α	SE_{α}	β	SE_{β}	r	α	SE_{α}	β	SE_{β}	r	α	SE_{α}	β	SE_{β}	r
PM_{2.5}	11.2	4.3	0.43	0.30	0.321	5.5	1.7	0.27	0.12	0.470	6.4	2.1	0.24	0.15	0.350
OC	2.49	1.0	0.39	0.36	0.242	0.73	0.22	0.25	0.076	0.605	1.01	0.33	0.18	0.11	0.351
EC	0.61	0.43	0.46	0.45	0.234	0.34	0.20	0.29	0.20	0.314	0.41	0.31	0.30	0.32	0.217
NO₃	1.3	0.63	0.25	0.13	0.409	1.1	0.54	0.25	0.11	0.454	1.2	0.55	0.25	0.12	0.440
NH₄	0.98	0.30	0.34	0.16	0.454	0.78	0.23	0.31	0.12	0.516	0.81	0.24	0.31	0.13	0.492
SO₄	0.77	0.56	0.97	0.23	0.706	0.48	0.46	0.89	0.19	0.744	0.55	0.48	0.89	0.19	0.730
Na	0.11	0.024	-0.17	0.27	-0.145	0.032	0.0059	0.030	0.065	0.110	0.040	0.0087	-0.016	0.096	-0.039
Mg	0.025	0.0057	0.038	0.27	0.033	0.0091	0.0018	0.039	0.084	0.109	0.011	0.0027	0.025	0.13	0.046
Al	0.16	0.050	1.86	2.4	0.182	0.033	0.0070	0.44	0.33	0.301	0.041	0.0093	0.27	0.44	0.145
Si	0.37	0.18	2.46	1.7	0.320	0.079	0.024	0.42	0.23	0.392	0.13	0.061	0.20	0.59	0.078
P	0.0081	0.0033	-0.36	0.67	-0.124	0.0024	6.90E-4	-0.058	0.14	-0.098	0.0035	0.011	-0.21	0.22	-0.216
Cl	0.35	0.081	0.46	0.72	0.147	0.065	0.011	0.33	0.098	0.620	0.086	0.019	0.16	0.17	0.221
K	0.42	0.16	0.11	1.6	0.016	0.041	0.019	0.45	0.19	0.496	0.098	0.043	-0.041	0.43	-0.022
Ca	0.13	0.0035	1.22	0.48	0.513	0.038	0.0060	0.16	0.083	0.420	0.044	0.008	0.16	0.11	0.316
V	0.0015	4.0E-4	-3.77E-4	0.11	-8.0E-4	4.25E-4	8.8E-5	0.018	0.024	0.173	5.45E-4	1.44E-4	0.011	0.039	0.063
Fe	0.15	0.035	0.16	0.20	0.180	0.034	0.0053	0.046	0.031	0.326	0.042	0.0090	0.038	0.053	0.166
Cu	0.0036	0.0016	-0.022	0.37	-0.014	0.0013	3.2E-4	0.078	0.074	0.238	0.0018	6.4E-4	0.071	0.15	0.110
Zn	0.0099	0.0033	4.8E-4	0.045	0.003	0.0029	5.2E-4	0.0011	0.0072	0.037	0.0034	7.4E-4	0.0032	0.011	0.070
Se	0.0015	3.9E-4	0.082	0.16	0.116	9.8E-4	2.5E-4	0.11	0.10	0.235	0.0010	2.7E-4	0.11	0.11	0.225
Pb	0.0017	5.7E-4	0.027	0.046	0.135	5.3E-4	9.7E-5	0.0052	0.0078	0.153	6.13E-4	7.9E-4	0.024	0.015	0.345

Table S5. Mean observations and model simulations for January 2004 for SEARCH monitors (N = 8 monitors).

	OBS		CMAQ-DDM			SH		
	Avg	Std.	Avg	Std.	RMSE	Avg	Std.	RMSE
PM_{2.5}	11.2	5.3	14.7	9.8	9.3	9.04	5.3	5.6
OC	2.81	2.4	3.05	2.8	1.8	1.66	1.5	1.3
EC	0.831	0.81	0.711	0.76	1.4	0.457	0.48	1.4
NO₃	1.08	0.78	1.01	1.5	0.93	0.927	1.4	0.75
NH₄	1.12	0.51	1.22	0.92	0.80	1.01	0.70	0.74
SO₄	2.73	1.6	3.78	2.3	2.8	3.30	2.0	2.3
Al	0.0062	0.0058	0.143	0.12	0.0015	0.0342	0.027	0.0016
Si	0.0292	0.026	0.388	0.28	0.010	0.0936	0.064	0.011
K	0.0600	0.027	0.279	0.24	0.0032	0.0504	0.035	0.0031
Ca	0.0281	0.031	0.141	0.11	0.0070	0.0396	0.032	0.0019
Fe	0.0368	0.044	0.132	0.14	0.0073	0.0328	0.031	0.0024
Cu	0.0013	0.0018	0.0043	0.0077	0.0041	0.0016	0.0017	0.0042
Zn	0.0157	0.030	0.0108	0.013	0.0020	0.0036	0.0028	0.0021
Se	8.00E-04	8.00E-04	0.0013	0.0013	0.0015	9.00E-04	9.00E-04	0.0012
Pb	0.0027	0.0041	0.0020	0.0033	0.0027	5.00E-04	7.00E-04	0.0029

Note: All averages and standard deviations are expressed in $\mu\text{g m}^{-3}$.

Table S6. Mean observations and model simulations for January 2004 for IMPROVE monitors (N = 38 monitors).

	OBS		CMAQ-DDM			SH		
	Avg	Std.	Avg	Std.	RMSE	Avg	Std.	RMSE
PM_{2.5}	6.25	3.8	11.51	8.2	8.5	6.63	4.4	3.6
OC	1.39	1.2	2.33	2.3	2.3	0.959	1.2	1.3
EC	0.298	0.22	0.532	0.52	0.51	0.283	0.30	0.28
NO₃	1.25	1.4	1.41	1.6	1.2	1.23	1.4	1.1
NH₄	0.894	0.40	0.984	0.66	0.61	0.870	0.57	0.55
SO₄	1.64	1.1	2.43	1.7	1.5	2.09	1.4	1.08
Al	0.0128	0.017	0.103	0.099	0.13	0.0268	0.022	0.028
Si	0.0629	0.039	0.297	0.27	0.35	0.0781	0.067	0.071
K	0.0416	0.027	0.291	0.30	0.39	0.0615	0.060	0.059
Ca	0.0218	0.015	0.101	0.094	0.13	0.0297	0.024	0.024
Fe	0.0198	0.021	0.0860	0.094	0.11	0.0234	0.021	0.022
Cu	7.00E-04	6.0E-04	0.0020	0.0043	0.0044	0.0011	0.0019	0.0019
Zn	0.00840	0.0078	0.0085	0.010	0.010	0.0035	0.0066	0.0103
Se	9.00E-04	0.001	0.0011	0.0013	0.0014	8.00E-04	8.0E-04	0.001
Pb	0.00190	0.0024	0.0011	0.0016	0.0027	4.00E-04	5.0E-04	0.0028

Note: All averages and standard deviations are expressed in $\mu\text{g m}^{-3}$.

Table S7. Linear regression and correlation coefficients for model predictions vs. observations for January 2004 for SEARCH monitors (N = 8 monitors). Regression equation: $Conc_{model} = \alpha + \beta \cdot Conc_{obs}$

	CMAQ-DDM vs. OBS					SH vs. OBS				
	α	SE_{α}	β	SE_{β}	r	α	SE_{α}	β	SE_{β}	r
PM_{2.5}	6.40	5.2	0.746	0.42	0.404	6.67	2.7	0.332	0.22	0.357
OC	1.72	0.93	0.473	0.25	0.413	1.18	0.47	0.264	0.13	0.445
EC	0.353	0.23	0.431	0.20	0.462	0.263	0.14	0.307	0.12	0.519
NO₃	0.222	0.59	0.730	0.44	0.371	0.497	0.59	0.604	0.44	0.315
NH₄	0.760	0.53	0.411	0.43	0.227	0.827	0.40	0.294	0.32	0.216
SO₄	0.794	0.74	1.10	0.23	0.752	0.840	0.55	0.978	0.17	0.807
Al	0.0882	0.037	8.86	4.4	0.446	0.028	0.0097	1.89	1.1	0.379
Si	0.214	0.087	5.95	2.2	0.556	0.0755	0.022	1.12	0.58	0.437
K	0.135	0.14	2.40	2.1	0.271	0.0412	0.020	0.253	0.31	0.200
Ca	0.0820	0.031	2.10	0.74	0.581	0.0281	0.0095	0.613	0.23	0.559
Fe	0.0395	0.028	2.52	0.49	0.788	0.0206	0.0086	0.473	0.15	0.615
Cu	7.00E-04	0.0018	2.85	0.81	0.657	0.0012	5.00E-04	0.507	0.24	0.470
Zn	0.0088	0.0033	0.130	0.098	0.313	0.0035	7.00E-04	0.0296	0.022	0.323
Se	0.0012	4.00E-04	0.0946	0.39	0.060	0.001	3.00E-04	0.0657	0.28	0.060
Pb	0.0013	9.00E-04	0.265	0.19	0.335	5.00E-04	2.00E-04	0.0593	0.042	0.330

Table S8. Linear regression and correlation coefficients for model predictions vs. observations for January 2004 for IMPROVE monitors (N = 38 monitors). Regression equation: $Conc_{model} = \alpha + \beta \cdot Conc_{obs}$

	CMAQ-DDM vs. OBS					SH vs. OBS				
	α	SE_{α}	β	SE_{β}	r	α	SE_{α}	β	SE_{β}	r
PM_{2.5}	3.53	1.4	1.28	0.19	0.590	1.96	0.72	0.747	0.098	0.637
OC	1.11	0.35	0.877	0.19	0.456	0.359	0.18	0.432	0.097	0.439
EC	0.189	0.084	1.15	0.23	0.479	0.0862	0.049	0.661	0.13	0.472
NO₃	0.431	0.17	0.782	0.092	0.684	0.346	0.15	0.712	0.081	0.696
NH₄	0.369	0.31	0.689	0.32	0.422	0.355	0.27	0.576	0.28	0.406
SO₄	0.617	0.25	1.11	0.13	0.692	0.451	0.20	0.997	0.10	0.728
Al	0.0894	0.013	1.05	0.62	0.182	0.023	0.0029	0.295	0.13	0.232
Si	0.180	0.054	1.86	0.73	0.268	0.0554	0.014	0.361	0.18	0.208
K	0.194	0.059	2.33	1.2	0.209	0.0274	0.011	0.820	0.22	0.370
Ca	0.0387	0.016	2.83	0.62	0.448	0.0155	0.0043	0.648	0.16	0.400
Fe	0.0455	0.012	2.05	0.42	0.466	0.0143	0.0028	0.461	0.095	0.469
Cu	3.00E-04	7.0E-04	2.42	0.78	0.319	5.00E-04	3.00E-04	0.842	0.35	0.256
Zn	0.0049	0.002	0.434	0.13	0.339	0.002	0.001	0.182	0.090	0.214
Se	7.00E-04	2.0E-04	0.403	0.13	0.321	5.00E-04	1.00E-04	0.330	0.083	0.399
Pb	8.00E-04	2.0E-04	0.143	0.075	0.204	3.00E-04	1.00E-04	0.0305	0.022	0.151

Table S9. January 2004 domain-wide precursor emissions estimates (metric tons/day).

Source Categories	NO_x	VOC	PM_{2.5}	SO₂	NH₃	CO	EC	POA
Agricultural	21.5	157.0	323.5	0.6	3.4	1826.6	12.9	216.7
Aircraft Emissions	282.7	74.1	25.1	26.0	0.1	801.9	16.5	7.3
Biogenic Emissions	2381.1	24552.5	0.0	0.0	0.0	6140.7	0.0	0.0
Coal CM [†]	14250.1	192.0	1274.3	35080.3	4.2	2000.6	12.7	254.9
Diesel CM [†]	32.9	2.6	2.0	3.2	0.0	10.4	1.5	0.4
Dust	3.5	1.1	5300.9	0.1	0.4	1.8	22.7	311.3
Fuel Oil CM [†]	7960.5	61.2	228.6	20482.6	23.5	485.1	23.8	18.5
Livestock	0.0	86.0	1.3	0.0	3244.8	0.0	0.0	0.1
LPG CM [†]	265.7	8.7	13.7	113.2	0.2	50.2	0.0	8.3
Lawn Waste Burn	173.7	657.1	759.9	15.4	0.4	4973.4	28.5	255.9
Metal Processing	0.3	34.1	171.2	0.3	0.0	42.2	2.1	166.2
Meat Cooking	370.9	224.4	309.5	3451.7	5.3	5279.1	2.1	40.0
Mexican CM [†]	133.9	5.1	13.2	595.3	9.1	21.4	0.0	0.0
Mineral Processing	917.4	88.1	315.9	812.3	6.1	539.0	4.7	24.0
Natural Gas CM [†]	10119.7	569.2	619.7	5760.1	72.5	2984.6	0.0	371.1
NR [§] Diesel CM [†]	5262.8	150.4	353.7	412.2	3.4	1841.1	262.1	79.4
NR [§] Fuel Oil CM [†]	727.8	20.5	33.8	428.0	0.1	86.3	2.9	3.6
NR [§] Gasoline CM [†]	614.1	7472.8	238.3	34.1	2.4	47448.5	19.1	187.3
NR [§] LPG CM [†]	639.6	159.6	2.9	0.6	0.2	2508.9	0.0	2.5
NR [§] Nat. Gas CM [†]	81.1	1.2	0.3	0.1	0.0	324.3	0.0	0.3
Other NR Sources	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0
Open Fires	96.4	235.7	398.5	0.0	0.0	3258.3	15.9	267.0
Onroad Diesel CM [†]	9613.6	249.0	358.3	309.4	17.9	3732.2	229.0	98.8
Onroad Gas CM [†]	14749.9	15719.4	159.7	337.2	788.1	249971.1	21.4	57.0
Other CM [†] Sources	814.0	67.1	169.6	1155.5	16.6	871.8	12.0	56.2
Other PM Sources	1152.9	3057.4	785.0	3053.7	1427.3	4665.5	12.4	151.2
Prescribed Burning	170.6	229.0	725.3	42.6	30.6	7300.9	116.0	558.4
Railroad Emissions	2765.7	38.4	64.4	158.8	0.0	330.8	47.7	14.4
Seasalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solvent Emissions	334.9	22842.9	61.3	403.9	4.8	86.2	2.2	32.7
Wildfires	12.1	20.1	45.7	3.0	5.1	547.7	7.3	35.2
Woodfuel Burning	343.9	48.3	245.8	194.4	2.0	1001.0	34.4	95.9
Woodstoves	326.6	9282.2	3407.4	50.0	32.9	25707.7	367.0	1927.2
All Sources	74619.7	86307.1	16414.5	72924.7	5701.6	374839.3	1277.1	5242.0

[§]NR = Nonroad, [†]CM = Combustion, LPG = Liquid Petroleum Gasoline

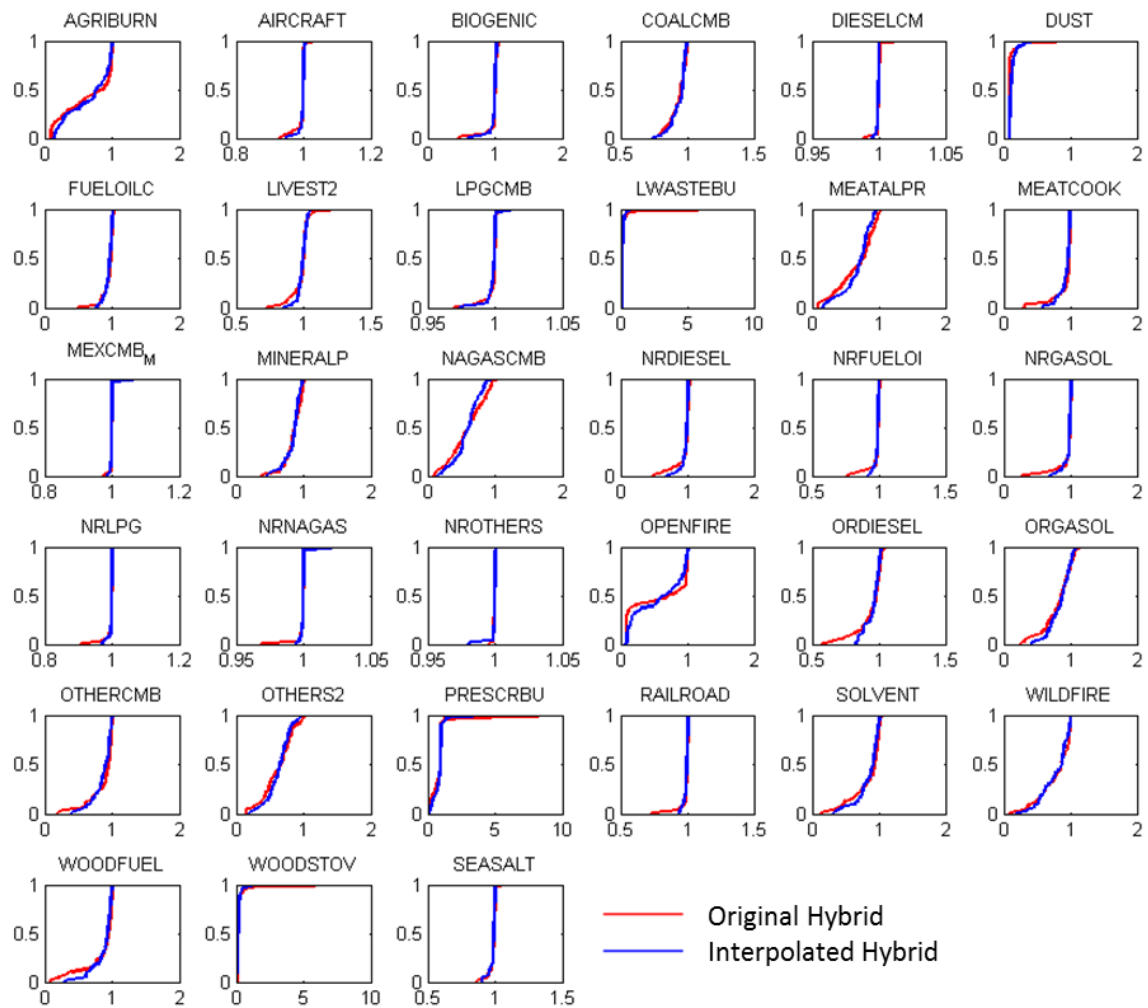


Figure S1. Cumulative distributions of original and interpolated hybrid adjustment factors for withheld CSN observation locations.

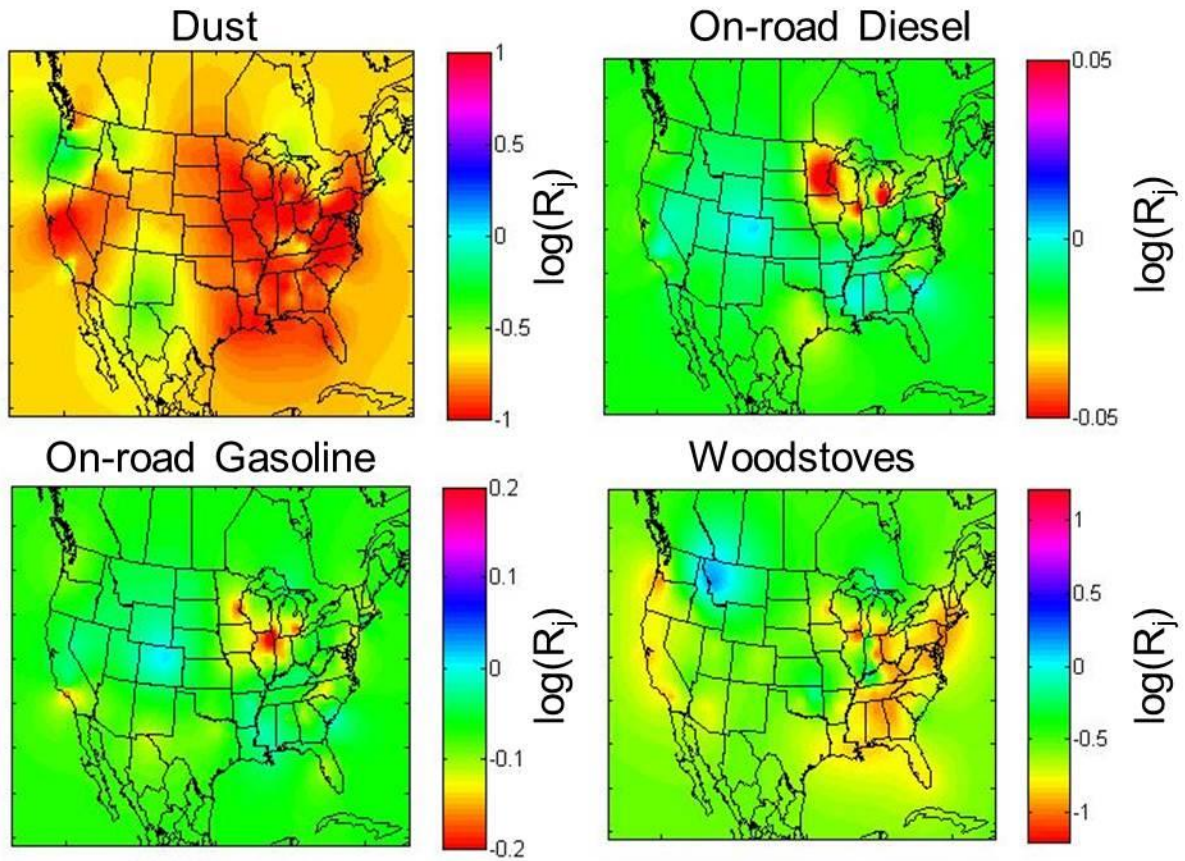


Figure S2. Spatial fields of temporally-averaged, kriged adjustment factors (R_j^{SH}) for dust, on-road diesel combustion, on-road gasoline combustion, and woodstove sources for January 2004. Values were averaged over 9 observations days in the month. Note that each figure has a different scale.

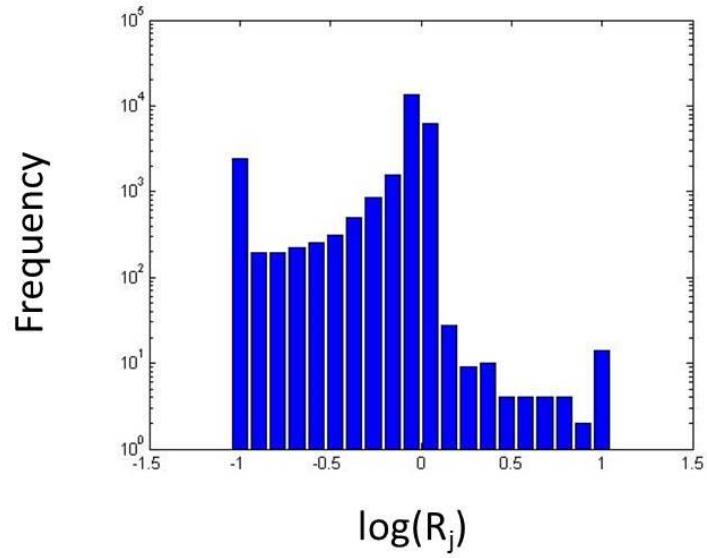


Figure S3. Distribution of R_j values generated by hybrid analysis of CSN data for January 2004 ($n = 26,400$; $0.1 < R_j < 10$). Note that the y-axis is on a log scale and R_j values are log transformed.

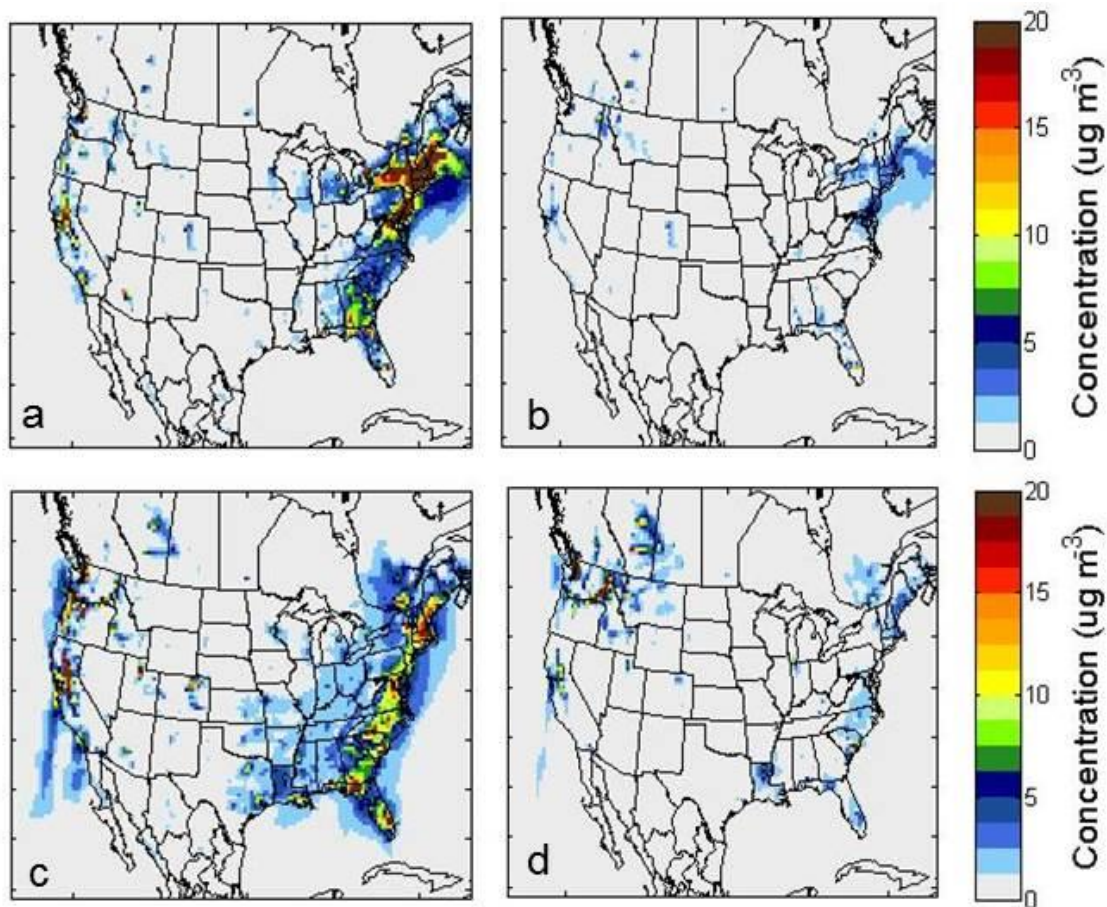


Figure S5. Hybrid adjustment of biomass burning impacts on PM_{2.5} on January 4th and 22nd in 2004. Biomass burning fields are produced by aggregating source impacts from agricultural burning, lawn waste burning, open fires, prescribed burning, wildfires, woodfuel and woodstove burning. (a) CMAQ-DDM spatial field for January 4th. (b) SH spatial field for January 4th. (c) CMAQ-DDM spatial field for January 22nd. (d) SH spatial field for January 22nd.

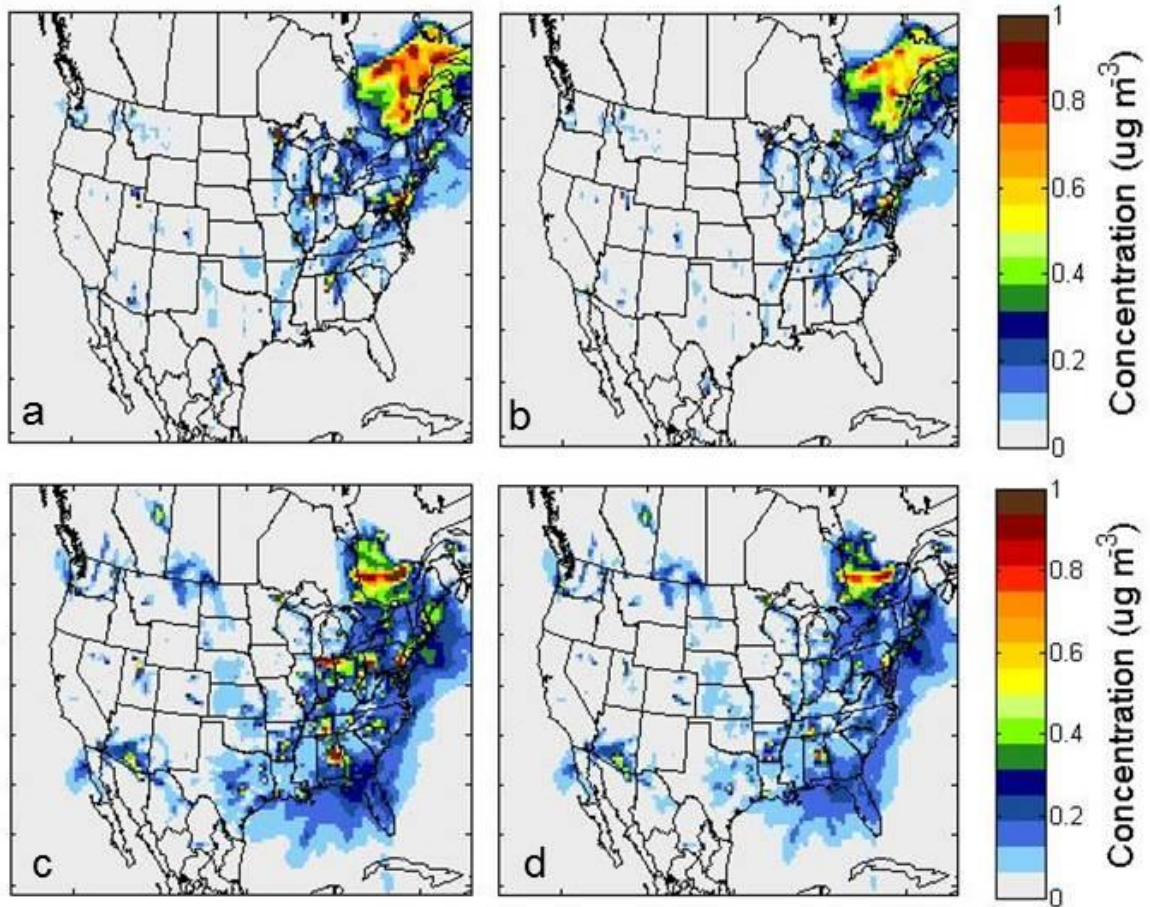


Figure S6. Hybrid adjustment of metals processing impacts on PM_{2.5} on January 4th and 22nd in 2004. (a) CMAQ-DDM spatial field for January 4th. (b) SH spatial field for January 4th. (c) CMAQ-DDM spatial field for January 22nd. (d) SH spatial field for January 22nd.

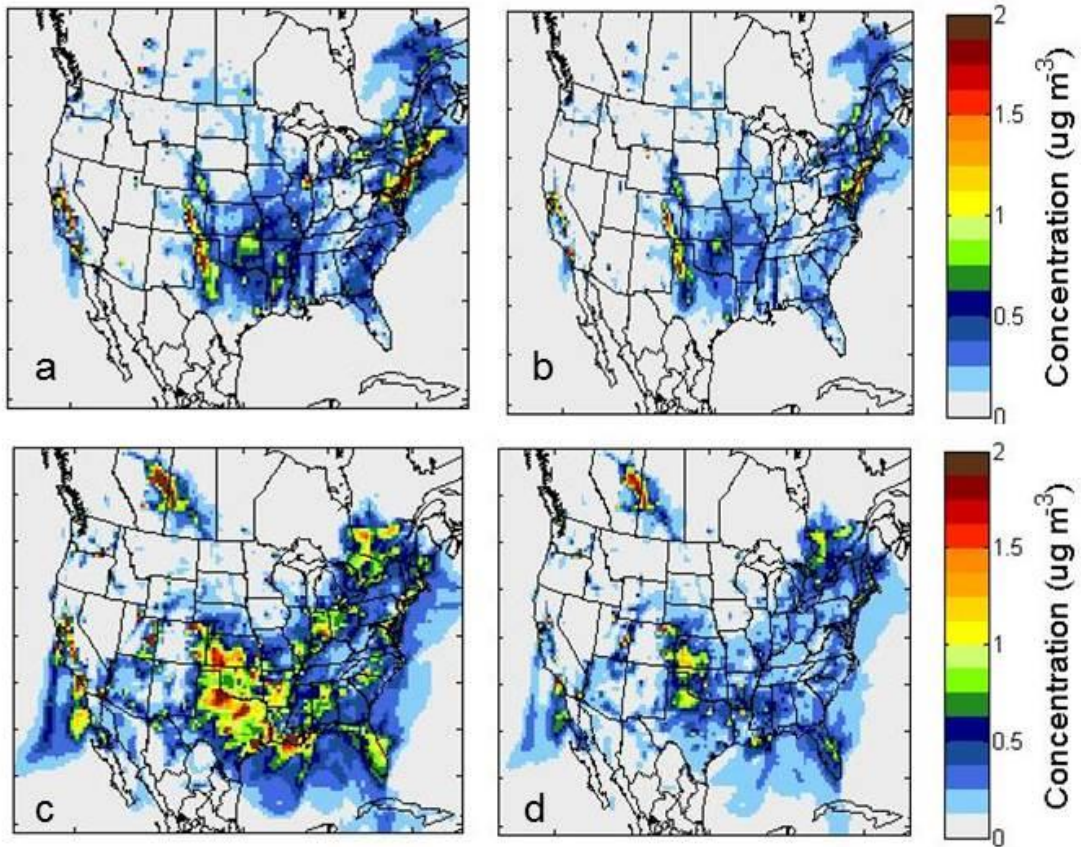


Figure S7. Hybrid adjustment of natural gas combustion (point and area sources) source impact fields on January 4th and 22nd in 2004. (a) CMAQ-DDM spatial field for January 4th. (b) SH spatial field for January 4th. (c) CMAQ-DDM spatial field for January 22nd. (d) SH spatial field for January 22nd.