

Supplemental Information

Figure S1. Weather station locations. The number of stations from which temperature (temp), wind speed (ws), and water vapor pressure (wvp) data were obtained is denoted by $n_{temp,ws,wvp}$. The number of stations from which precipitation frequency data were obtained is denoted by n_{rain} . (NW: Northwest, UM: Upper Midwest, IM: Industrial Midwest, NE: Northeast, SC: Southern California, SW: Southwest, SE: Southeast).

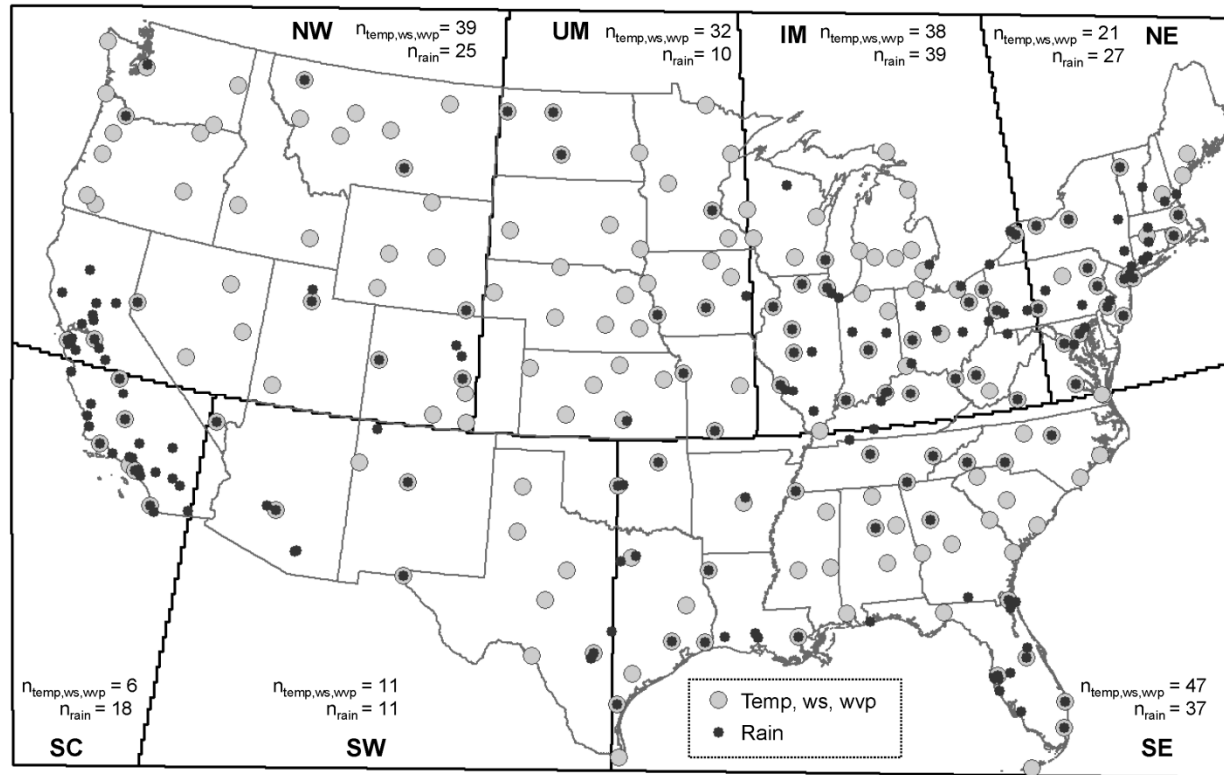


Figure S2. Illustration of weather penalty calculation method for O₃.

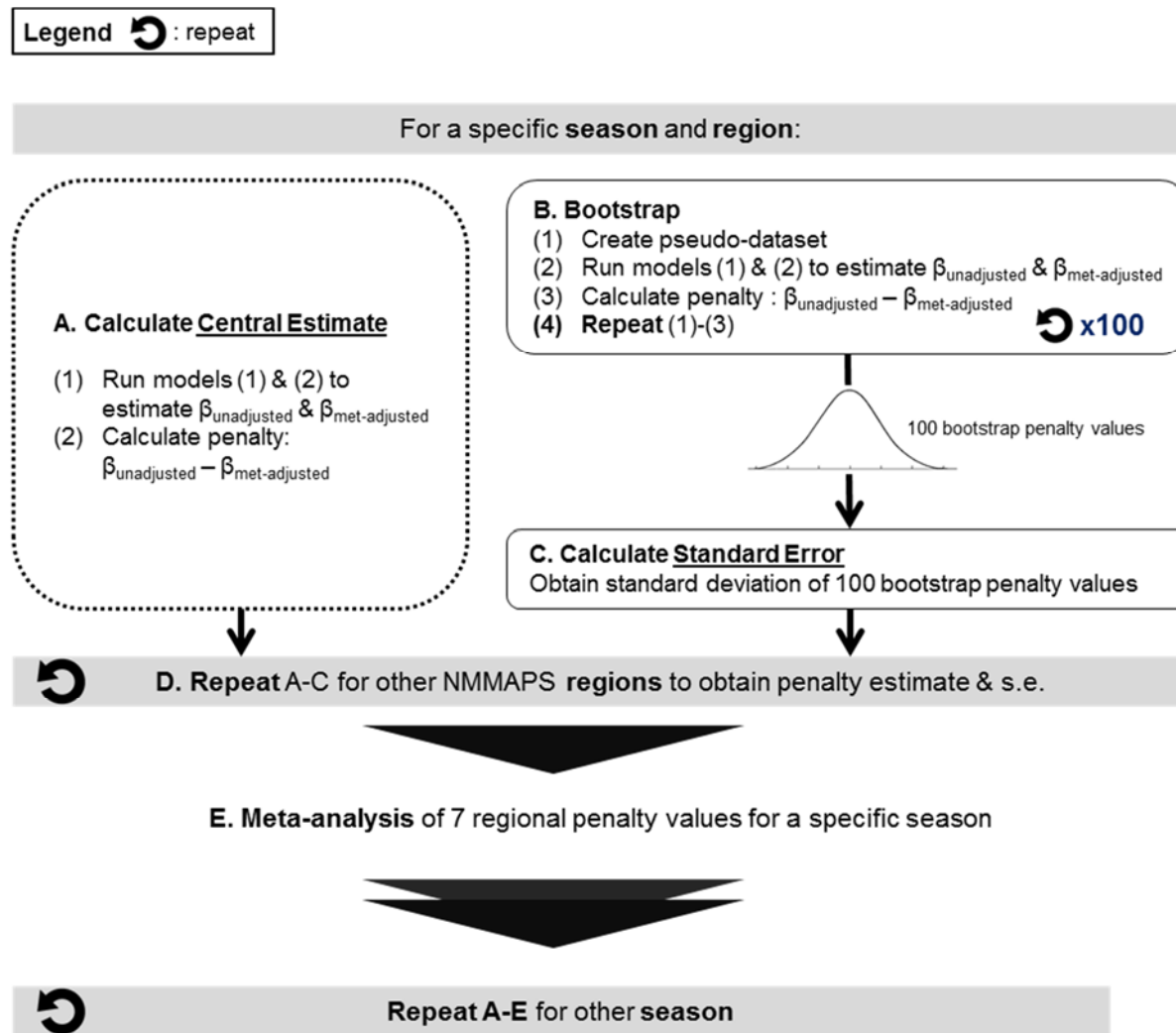


Figure S3. Changes in O₃ and PM_{2.5} by month between 1994-2012.

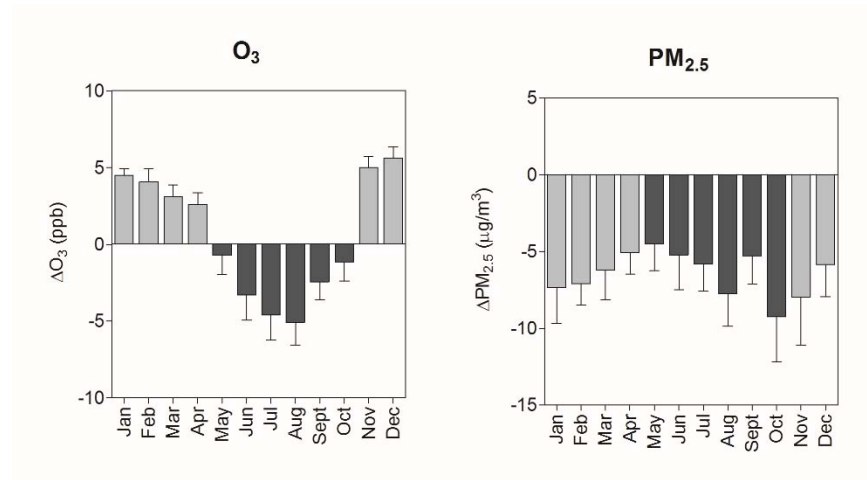


Figure S4. Unadjusted trends, weather-adjusted trends (using relative humidity instead of water vapor pressure), and weather penalties of 8-h max O₃ and PM_{2.5} in 1994-2012 by region and season. The 95% confidence intervals are shown.

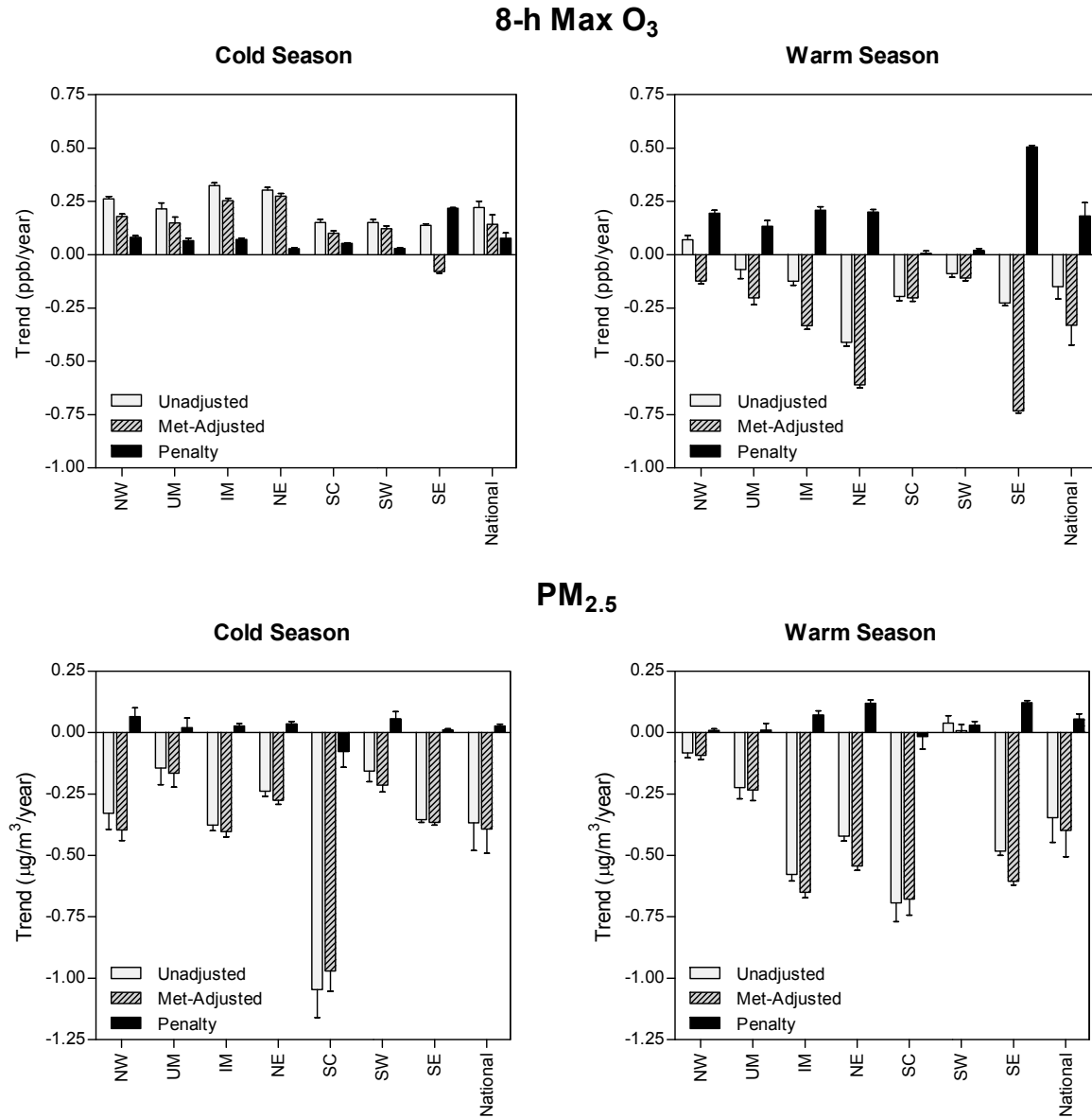


Figure S5. Unadjusted trends, weather-adjusted trends, and penalties of 1-h max O₃ (Apr-Sept) and PM_{2.5} (Jan-Dec) that were applied to estimate mortality averted. The 95% confidence intervals are shown.

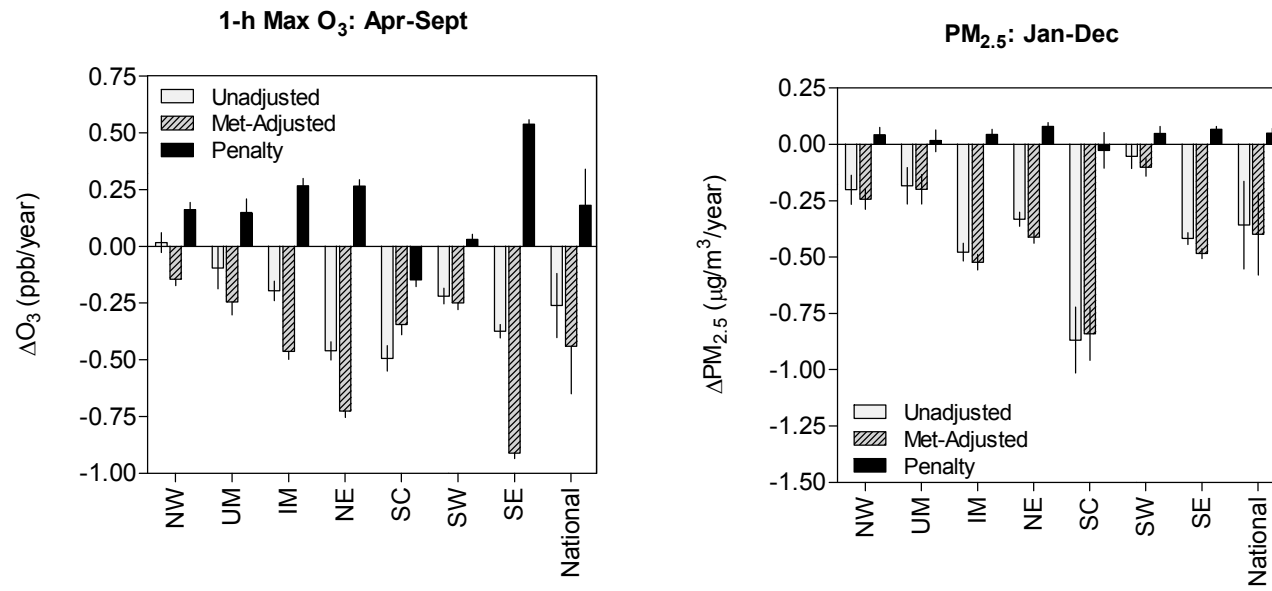


Table S1. Distance between Air Quality Monitoring Stations and nearest Weather Stations (in km)

Ozone				
Region	N	Mean	Median	(Min, Max)
Industrial Midwest	30	57.5	38.1	(8.8, 183.9)
Northeast	45	70.0	48.8	(5.1, 194.0)
Northwest	73	117.2	109.5	(2.2, 294.0)
Southeast	144	62.8	43.0	(6.1, 202.5)
Southern California	95	81.5	64.8	(2.9, 225.2)
Southwest	68	71.3	27.8	(5.7, 331.1)
Upper Midwest	13	85.8	68.0	(5.1, 212.3)
All	468	77.3	53.3	(2.2, 331.1)

Region	N	PM_{2.5} (ws, temp, wvp)			PM_{2.5} (prcp frequency)		
		Mean	Median	(Min, Max)	Mean	Median	(Min, Max)
Industrial Midwest	11	16.5	16.3	(3.7, 34.3)	14.5	15.5	(3.7, 25.9)
Northeast	14	47.5	37.1	(9.4, 111.7)	36.8	12.5	(4.9, 120.8)
Northwest	5	58.5	53.4	(9.3, 108.5)	30.3	21.6	(5.7, 61.6)
Southeast	24	25.5	17.6	(5.0, 108.3)	58.1	20.3	(6.1, 286.8)
Southern California	4	25.0	12.7	(4.2, 70.2)	11.6	11.7	(4.2, 18.9)
Southwest	3	8.9	10.7	(4.1, 12.0)	8.9	10.7	(4.1, 12.0)
Upper Midwest	1	9.3	9.3	(9.3, 9.3)	9.3	9.3	(9.3, 9.3)
All	62	30.4	17.4	(3.7, 111.7)	37.2	15.8	(3.7, 286.8)

Table S2. Trends of weather parameters in cold and warm seasons in 1994-2003 and 2004-2012. (*italics*: p-value > 0.05)

	(per year)	Cold		Warm	
		1994-2003	2004-2012	1994-2003	2004-2012
National	temp (°C)	0.06	0.06	0.03	0.08
	ws (m/s)	-0.03	-0.02	-0.02	-0.03
	wvp (hPa)	0.02	0.01	<i>0.00</i>	-0.05
	prcp (%)	1.29	-0.35	2.61	0.44
IM	temp (°C)	0.15	0.13	<i>0.00</i>	0.10
	ws (m/s)	-0.02	-0.05	-0.02	-0.02
	wvp (hPa)	0.06	0.03	0.02	-0.02
	prcp (%)	1.08	-1.38	3.23	0.18
NE	temp (°C)	0.07	0.20	-0.02	0.11
	ws (m/s)	-0.04	-0.04	-0.04	-0.03
	wvp (hPa)	0.04	0.04	0.03	0.03
	prcp (%)	1.46	0.03	3.21	1.47
NW	temp (°C)	-0.02	-0.04	0.08	0.02
	ws (m/s)	-0.02	<i>0.00</i>	-0.01	-0.03
	wvp (hPa)	-0.01	-0.04	-0.04	-0.06
	prcp (%)	3.91	0.72	1.88	-0.45
SE	temp (°C)	<i>0.00</i>	0.06	0.02	0.07
	ws (m/s)	-0.04	-0.03	-0.02	-0.02
	wvp (hPa)	<i>0.01</i>	0.05	0.03	-0.05
	prcp (%)	0.19	-0.31	2.23	0.53
SC	temp (°C)	-0.09	-0.02	-0.06	-0.02
	ws (m/s)	-0.05	-0.03	-0.04	-0.03
	wvp (hPa)	-0.08	-0.09	<i>0.00</i>	-0.03
	prcp (%)	2.49	-0.83	-1.08	-2.93
SW	temp (°C)	<i>0.00</i>	0.08	0.05	0.19
	ws (m/s)	<i>0.01</i>	<i>0.01</i>	0.02	0.01
	wvp (hPa)	0.03	-0.09	0.02	-0.21
	prcp (%)	0.38	-0.83	2.42	0.98
UM	temp (°C)	0.19	<i>0.01</i>	0.04	0.09
	ws (m/s)	-0.02	-0.03	-0.01	-0.04
	wvp (hPa)	0.05	<i>0.01</i>	-0.03	-0.05
	prcp (%)	0.30	-0.44	1.64	-1.04

Table S3. Comparison of national weather-adjusted trends and weather penalties of O₃ and PM_{2.5} using water vapor pressure versus relative humidity.

	<i>Adjusted trends</i>		<i>Penalty</i>	
	<i>wvp</i>	<i>rhum</i>	<i>wvp</i>	<i>rhum</i>
<i>O₃ cold</i>	0.149	0.142	0.071	0.078
<i>O₃ warm</i>	-0.334	-0.331	0.185	0.181
<i>PM_{2.5} cold</i>	-0.392	-0.392	0.027	0.027
<i>PM_{2.5} warm</i>	-0.397	-0.397	0.056	0.056