

Potential for electric vehicle adoption to mitigate extreme air quality events in China

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Introduction

This supplementary information includes figures and tables that provide model evaluation, parameter values, and other summary statistics.

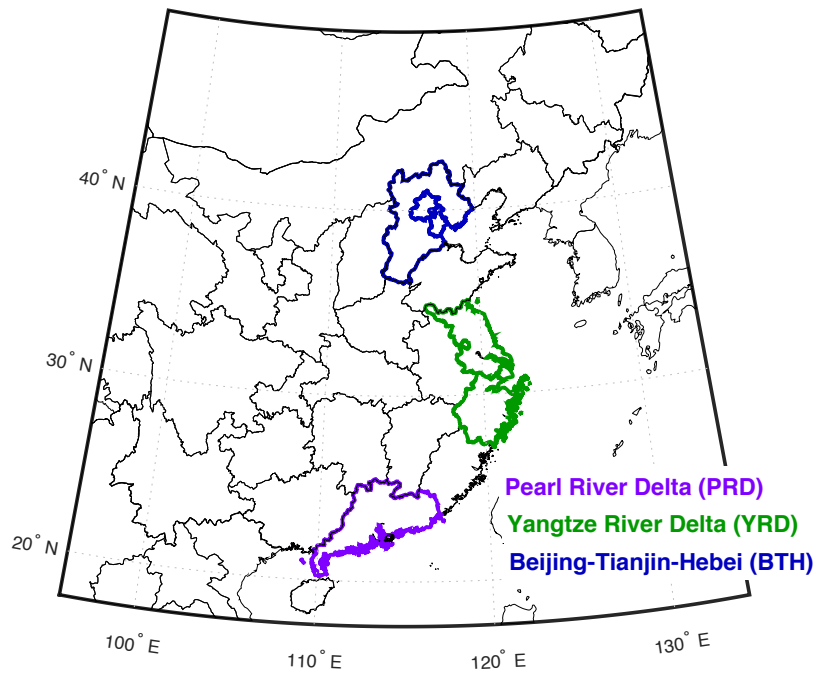


Figure S1. Major industrialized regions.

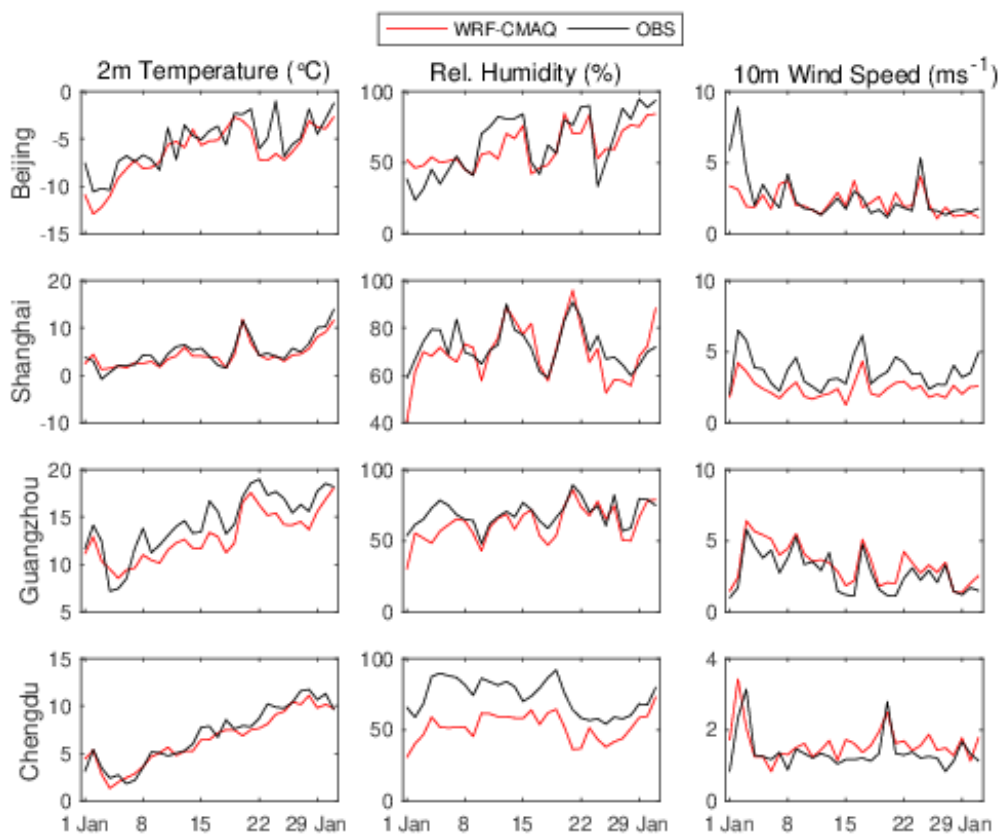


Figure S2. Meteorological comparison of WRF-CMAQ (red) against surface observations sites (NOAA NCEP Integrated Surface Database (<https://www.ncdc.noaa.gov/isd/data-access>)) nearest the sites where PM_{2.5} is measured.

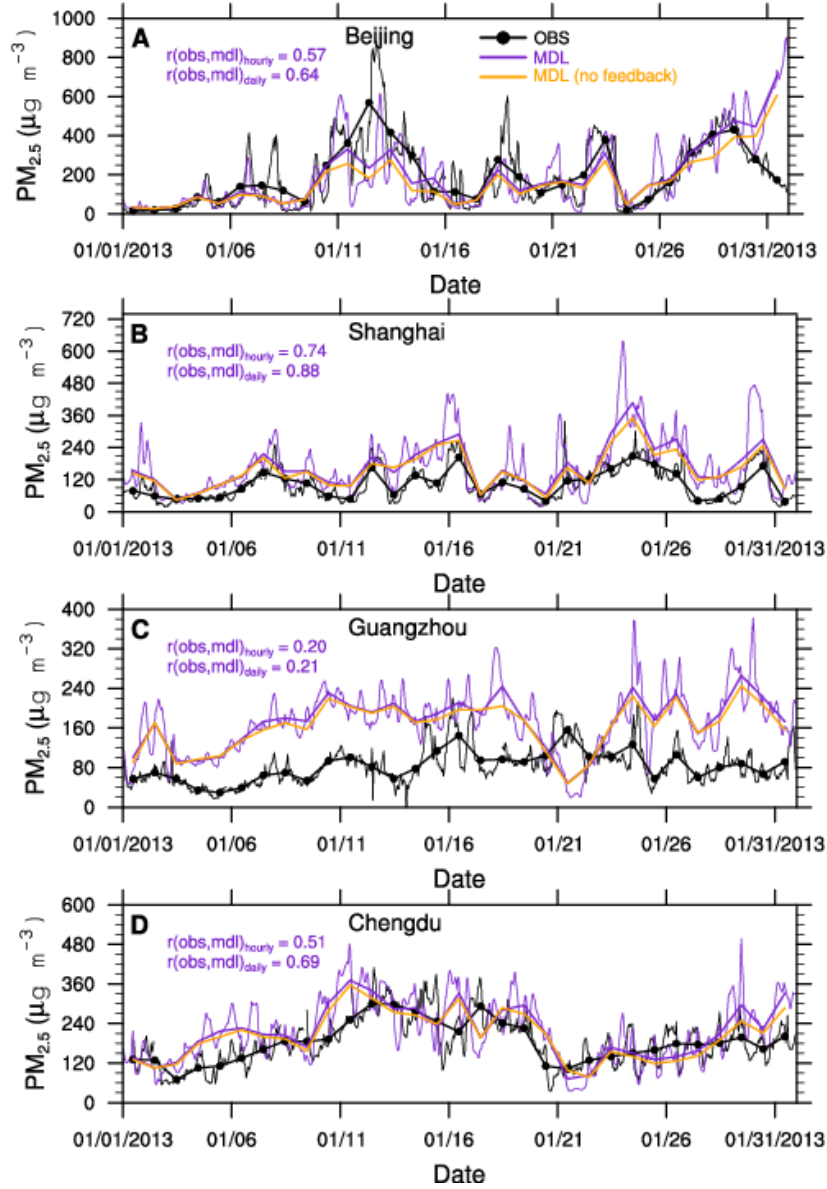


Figure S3. Comparison of WRF-CMAQ to U.S. Embassy observations. Purple lines are the single grid cells over the observation sites for *BASE*, orange is the simulation without shortwave aerosol-radiation feedback.

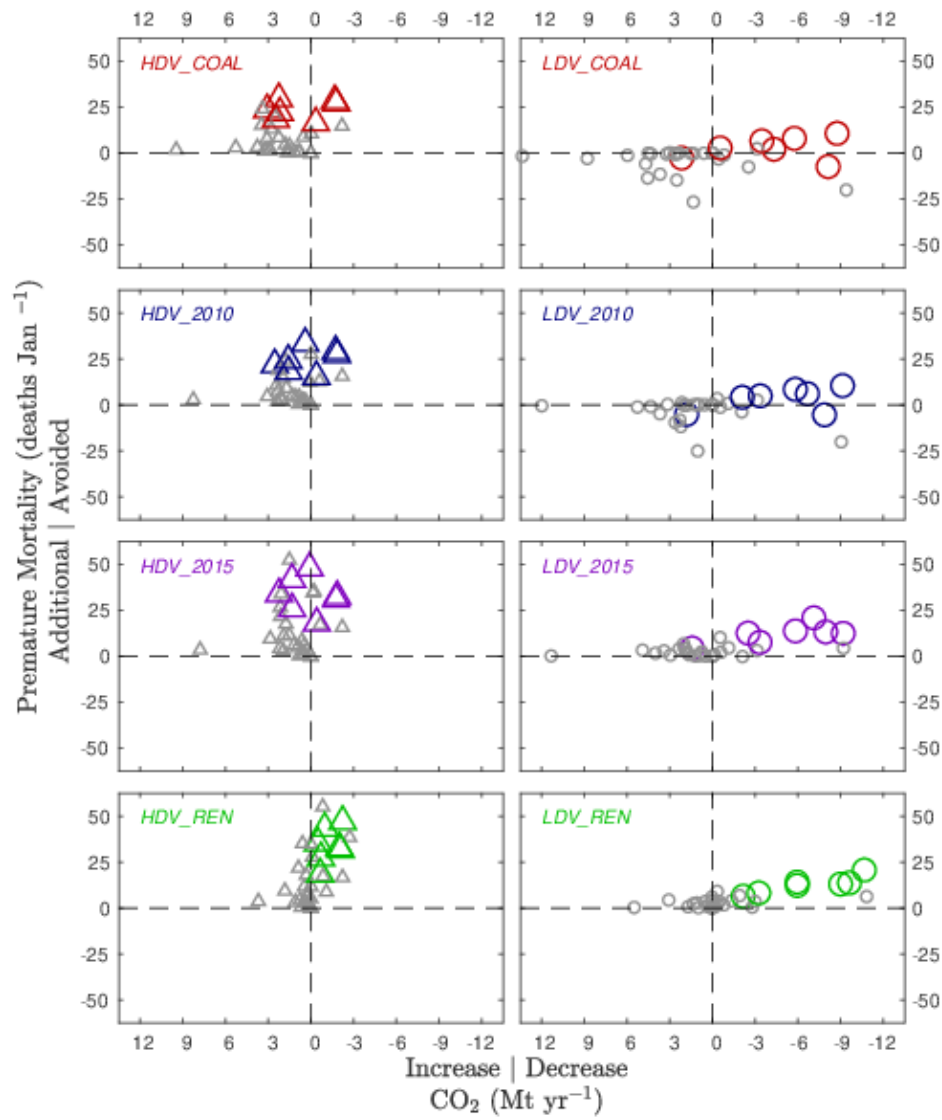


Figure S4. Province co-benefits for each experiment. Colored, large markers are provinces in major industrialized regions (Fig. S1).

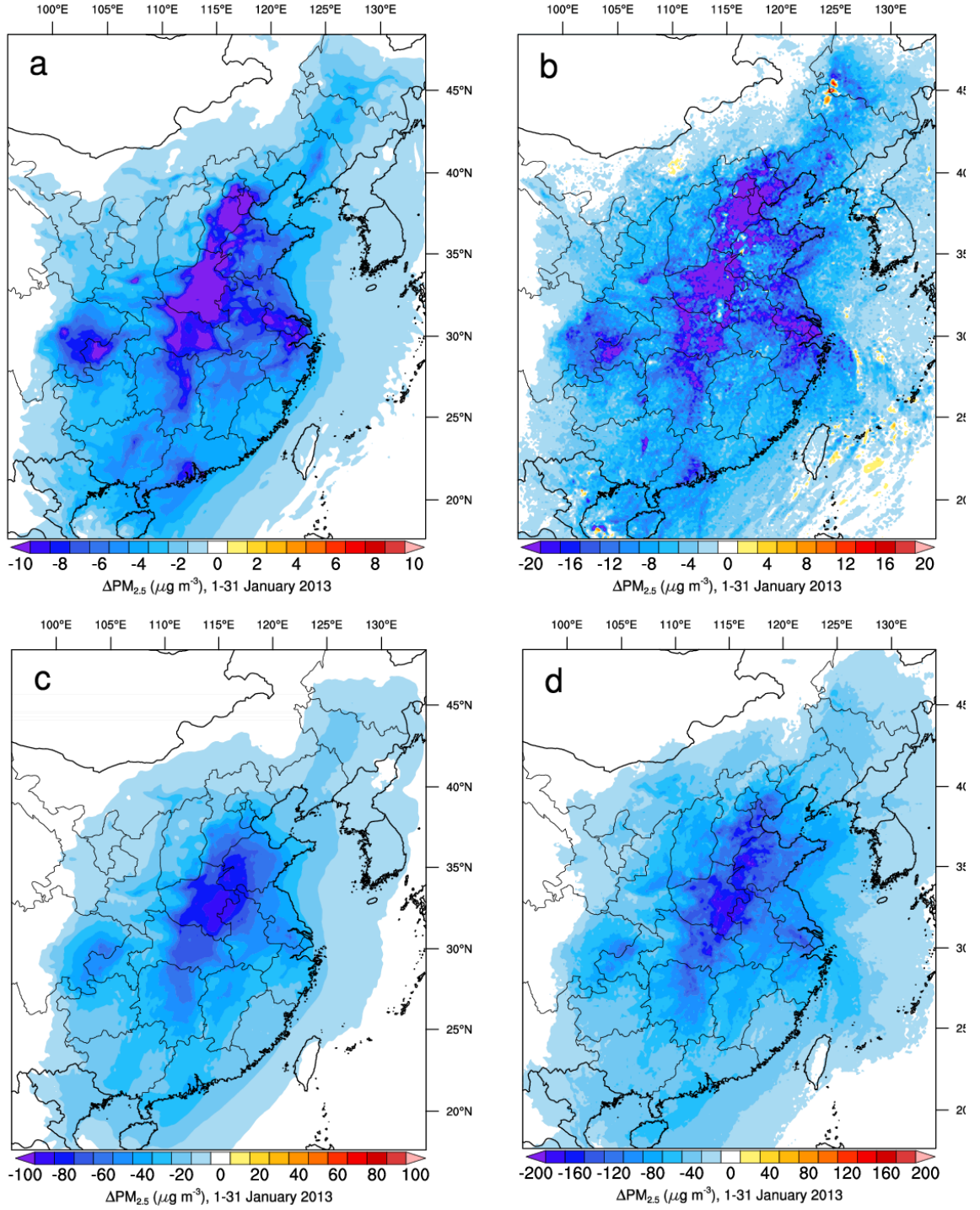


Figure S5. Mean (a, c) and (b, d) 95th percentile changes for (a, b) NO-TRA and (c, d) NO-ENE.

Health endpoints	β (per 10 $\mu\text{g m}^{-3}$, 95% CI) (%)	References	IRs (%)	References	Unit Loss (US\$/case)	# BASE
Mortality	0.22 (0.15, 0.28)	Chen et al. (2017)	0.022377	BMBPH (2012)	273,513.36	67914
Respiratory hospital admission	2.0 (1.33, 2.67)	Aunan and Pan (2004), Zhang et al. (2007)	0.051925	BMBPH (2012)	2761.04	503402
Cardiovascular hospital	1.17 (0.5, 1.83)	Aunan and Pan (2004), Zhang et al. (2007)	0.093509	BMBPH (2012)	2761.04	581086
Outpatient visits—internal medicine (15 +)	0.57 (0.32, 0.82)	Xu et al. (1995), Zhang et al. (2007)	2.92083	Zhang et al. (2007)	83.86	8671799
Outpatient visits—pediatrics (0–14)	0.65 (0.23, 1.07)	Xu et al. (1995), Zhang et al. (2007)	0.811925	Zhang et al. (2007)	83.86	256173
Acute bronchitis	9.17 (3.15, 15.18)	Jing et al. (2000), Zhang et al. (2007)	0.140377	Zhang et al. (2007)	407.03	3467216
Asthma	2.1 (1.45, 2.74)	Xie et al. (2009)	0.215982	Zhang et al. (2007)	299.61	2175469

Table S1. Parameters, references, and number of cases for *BASE* for seven health endpoints. Parameters and references are a reproduction of Tables 1 and 2 from Gao et al. (2015).

Experiment	$\Delta\text{PM}_{2.5}$			ΔNO_2			ΔCO_2	Avoided Mortality	10 ⁶ US\$ Saved
	China	EV grid cells	e-forward cities	China	EV grid cells	e-forward cities			
HDV_COAL	-0.14	-0.20	-0.88	-0.11	-0.18	-1.24	62	314	-141
HDV_2010	-0.29	-0.37	-1.05	-0.11	-0.19	-1.25	36	355	-21
HDV_CUR	-0.85	-1.04	-2.18	-0.12	-0.20	-1.29	31	562	87
HDV_REN	-0.87	-1.07	-2.25	-0.12	-0.20	-1.29	-5	575	235
LDV_COAL	0.51	0.60	0.66	-0.02	-0.04	-0.38	3	-90	-60
LDV_2010	0.38	0.46	0.51	-0.02	-0.04	-0.39	-22	-59	48
LDV_CUR	-0.16	-0.20	-0.62	-0.03	-0.05	-0.43	-27	145	155
LDV_REN	-0.17	-0.21	-0.61	-0.03	-0.06	-0.43	-64	152	306
HDV_CUR (2014)	-0.56	-0.70	-1.70	-0.13	-0.21	-1.33	31	485	54
LDV_CUR (2014)	-0.01	-0.04	-0.46	-0.04	-0.06	-0.46	-27	108	137
NO_TRA	-3.21	-3.95	-7.42	-0.46	-0.75	-2.97	n/a	1878	715
NO_ENE	-21.15	-25.13	-40.85	-0.30	-0.39	-1.15	n/a	7687	3394
^a Health impact only									

Table S2. Summary of EV co-benefits: mean changes in $\text{PM}_{2.5}$ ($\mu\text{g m}^{-3}$) and NO_2 (ppb), CO_2 emission changes (Mt yr^{-1}), avoided mortality (deaths/January, and economic valuation (CO_2 + seven health endpoints) for each experiment.

	NO _x	SO ₂	BC	PM ₁₀ THR	CO	HCHO
On-road	13.3	0.2	3.5	0.2	9.7	25.0
Energy	35.3	27.0	1.4	11.4	0.8	0.0

Table S3. Fraction of total emissions in the on-road and energy generation sectors.

Experiment	CO ₂	SO ₂	NO _x	PM _{2.5}
COAL/2010	905.6	2.48	2.67	0.27
2015/FUT	861.0	0.42	0.35	0.10

Table S4. Average coal-fired EGU emission rates.

Experiment	ΔPM _{2.5}			ΔNO ₂		
	China	EV grid cells	e-forward cities	China	EV grid cells	e-forward cities
HDV_COAL	-0.25	-1.53	-1.52	-0.37	-4.21	-4.26
HDV_2010	-0.62	-2.19	-2.20	-0.38	-4.23	-4.28
HDV_CUR	-1.86	-4.58	-4.53	-0.40	-4.29	-4.35
HDV_REN	-1.94	-4.79	-4.73	-0.41	-4.28	-4.34
LDV_COAL	1.25	1.72	1.57	-0.08	-1.32	-1.46
LDV_2010	0.96	1.47	1.26	-0.10	-1.33	-1.47
LDV_CUR	-0.26	-1.07	-1.07	-0.12	-1.40	-1.54
LDV_REN	-0.32	-1.26	-1.42	-0.12	-1.41	-1.56
HDV_CUR ('14)	-1.49	-4.37	-4.33	-0.42	-4.28	-4.37
LDV_CUR ('14)	-0.08	-0.94	-1.11	-0.13	-1.41	-1.59
NO_TRA	-6.87	-15.20	-15.38	-1.41	-8.62	-9.62
NO_ENE	-48.63	-91.84	-88.70	-0.81	-1.86	-3.62

Table S5. 95th percentile PM_{2.5} changes (μg m⁻³) for each experiment.