Supporting information for "Reduced-complexity air quality intervention modelling over China: development of the InMAPv1.6.1-China and comparison with the CMAQv5.2 model"

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27   **Table S1 Model configurations in WRFv3.8.**

Parameter	Configuration
Simulation Period	Dec. 20, 2016-Dec. 31, 2017
Domain	East Asia (West-to-East:178 × North-to-South:133)
Horizontal resolution	36 km×36 km
Vertical resolution	23 sigma layers from surface to tropopause (100 mb)
Meteorological IC and BC	Reanalysis data from the National Centers for Environmental Prediction Final Analysis (NCEP-FNL)
Shortwave radiation	New Goddard (Chou et al., 1998)
Longwave radiation	RRTM (Mlawer et al., 1997)
Land surface data	USGS
Surface layer	Pleim-Xiu (Xiu and Pleim et al., 2001)
Planetary boundary layer model	ACM2 (Pleim et al., 2007)
Cumulus Parameterization	Kain-Fritsch (Kain et al., 2004)
Cloud microphysics	WSM6
Analysis nudging	Temperature and water vapor mixing (above PBL); Wind (in and above PBL)
Observational nudging	Temperature, water vapor mixing and wind (in and above PBL)
Soil nudging	Include soil moisture and temperature

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34 **Table S2 Model configurations in CMAQv5.2.**

Parameter	Configuration
Simulation Period	Dec. 20, 2016-Dec. 31, 2017
Domain and spatial resolution	East Asia (West-to-East:172 × North-to-South:127) 36 km× 36 km
Vertical resolution	14 sigma levels from surface to tropopause. The values of sigma levels are 1.000, 0.995, 0.988,0.980, 0.970, 0.956, 0.938, 0.893, 0.839, 0.777, 0.702, 0.582, 0.400, 0.200 and 0.000.
IC and BC	GEOS-Chem simulation
Gas-phase mechanism	CB05 gas-phase mechanism with active chlorine chemistry and updated toluene mechanism of (Whitten et al., 2010)
Aqueous-phase mechanism	The updated mechanism of the RADM model (Walcek and Taylor et al., 1986; Chang et al., 1987)
Aerosol module	AERO6
Aerosol thermodynamics	ISORROPIA-II (Fountoukis and Nenes et al., 2007)
Wind blown dust	Not included
The lightening NO_x emissions	Not included
Biogenic emissions	MEGANv2.10 model
Anthropogenic emissions	MEIC inventory for mainland of China emissions in 2017 MIX2010 inventory for the emissions at the region outside the China in East Asia

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39 **Table S3 WRF evaluation**

Variable	Mean_obs	Mean_sim	Sample	Cor r	MB	ME	RMSE	NMB (%)	NME (%)
TEMP (°C)	15.03	14.36	5027288	0.94	-0.67	2.18	3.07	-6.07	19.95
WSPD (m/s)	2.70	3.04	4850753	0.59	0.34	1.48	2.03	12.43	55.39
RH (%)	69.26	73.40	5018557	0.79	4.14	9.96	13.28	6.12	14.53

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59 **Table S4 CMAQ evaluation**

Statistical metrics	PM$_{2.5}$	SO$_2$	NO$_2$
Data Pairs	124476	124572	124659
R	0.59	0.39	0.57
Observed Mean ($\mu g/m^3$)	45.86	18.52	32.96
Simulated Mean ($\mu g/m^3$)	42.12	17.69	28.39
MB ($\mu g/m^3$)	-3.74	-0.83	-4.57
RMSE (%)	36.07	25.29	21.91
NMB (%)	-8.16	-4.47	-13.87
NME (%)	50.03	77.15	51.02

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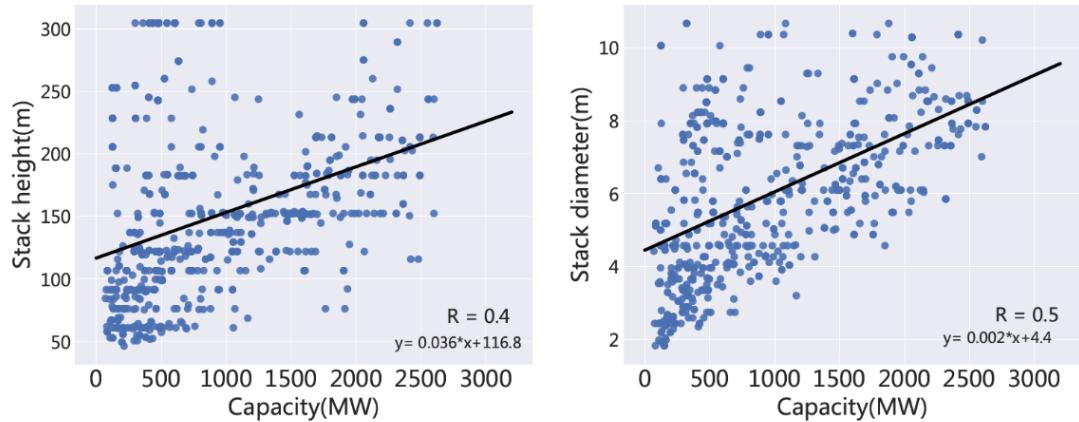
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79 **Figure S1 Scatter plot and linear relationship of stack attribution and unit capacity of power plants based on**

80 **the coal-fired power plant data in 2011 from the national emission inventory in the United States.** The stack

81 height and stack diameter are displayed in subplots (a) and (b), respectively.

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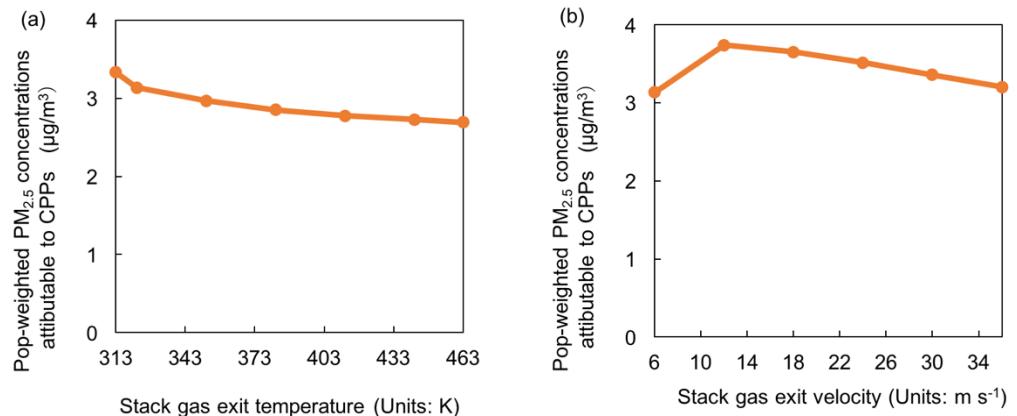
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95 **Figure S2 Sensitivity results for two stack attributions of coal-fired power plants.** Panel (a) and (b) show the

96 impacts on concentrations of stack gas exit velocity (units: K) and stack gas exit temperature

97 (units: m s^{-1}), respectively.

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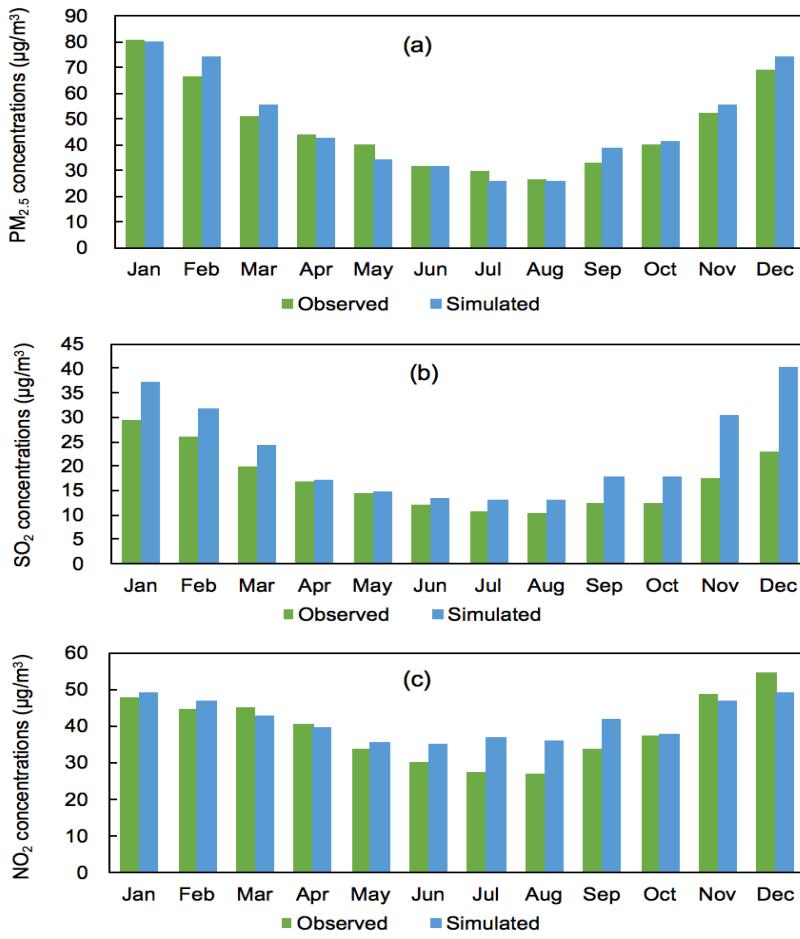
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105 **Figure S3 Monthly variations in PM$_{2.5}$, SO$_2$ and NO$_2$ concentrations simulated by the CMAQ model and**

106 **comparison with observations.**

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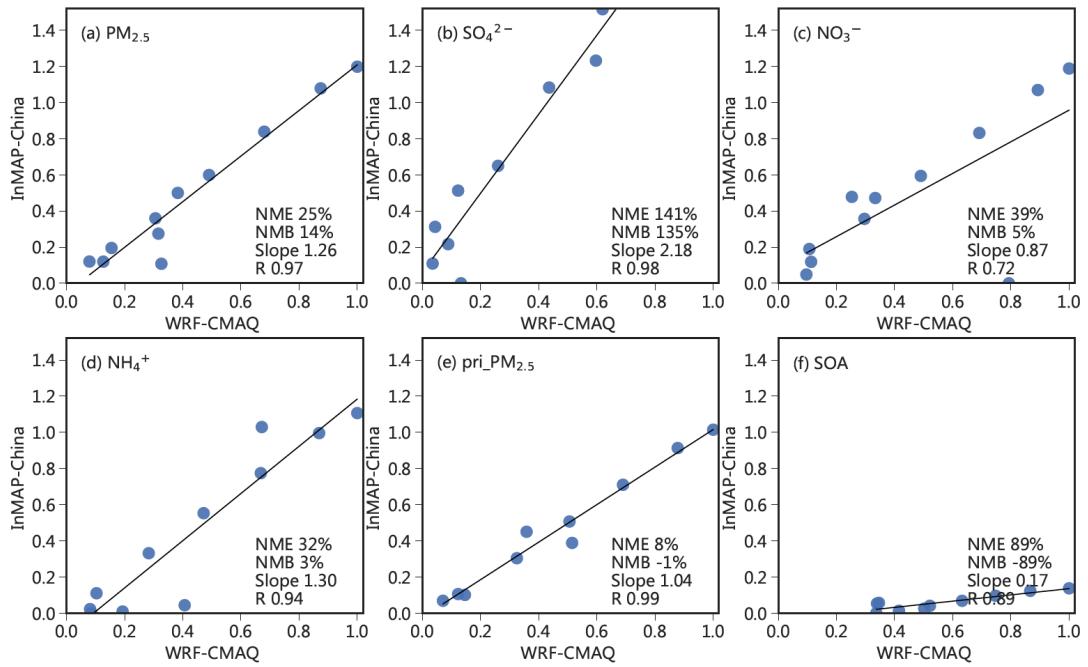
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112 **Figure S4 Marginal change in population-weighted PM$_{2.5}$ concentrations and their composition over the BTH**

113 **region modelled by the InMAP-China and WRF-CMAQ models.** The population-weighted pollutant

114 concentration for each scenario is normalized using the largest value among all scenarios modelled by CMAQ.

115 Eleven dots represent the eleven scenarios, and the statistical metrics are labelled in the lower right corner for each

116 panel.

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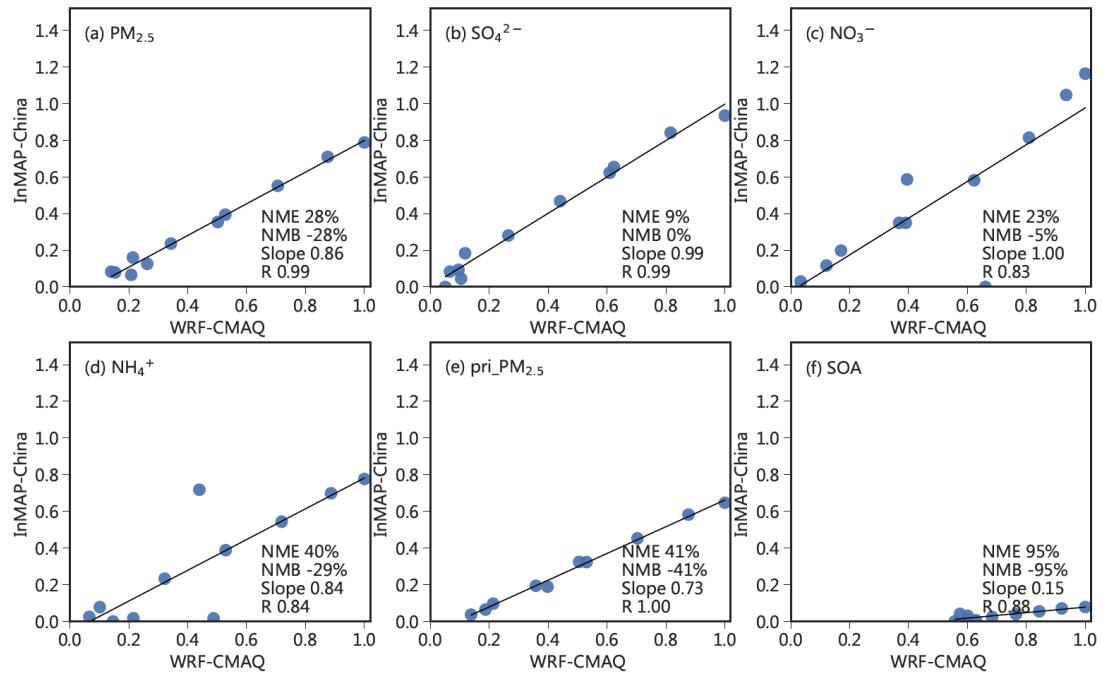
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121 **Figure S5 Marginal change in population-weighted PM$_{2.5}$ concentrations and their composition over the PRD**

122 **region modelled by the InMAP-China and WRF-CMAQ models.** The population-weighted pollutant

123 concentration for each scenario is normalized using the largest value among all scenarios modelled by the CMAQ.

124 The eleven dots represent the eleven scenarios, and the statistical metrics are labelled in the lower right corner for

125 each panel.

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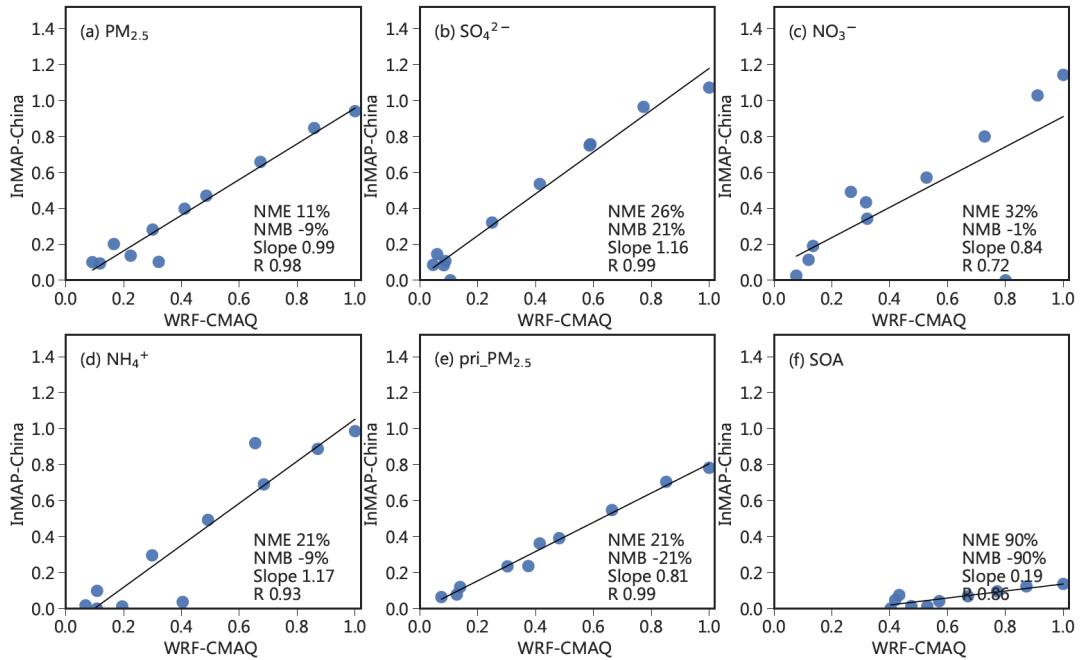
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130 **Figure S6 Marginal change in population-weighted PM$_{2.5}$ concentrations and their composition over the YRD**

131 **region modelled by the InMAP-China and WRF-CMAQ models.** The population-weighted air pollutant

132 concentration for each scenario is normalized using the largest value among all scenarios modelled by

133 CMAQ. Eleven dots represent the eleven scenarios, and the statistical metrics are labelled in the lower

134 right corner for each panel.

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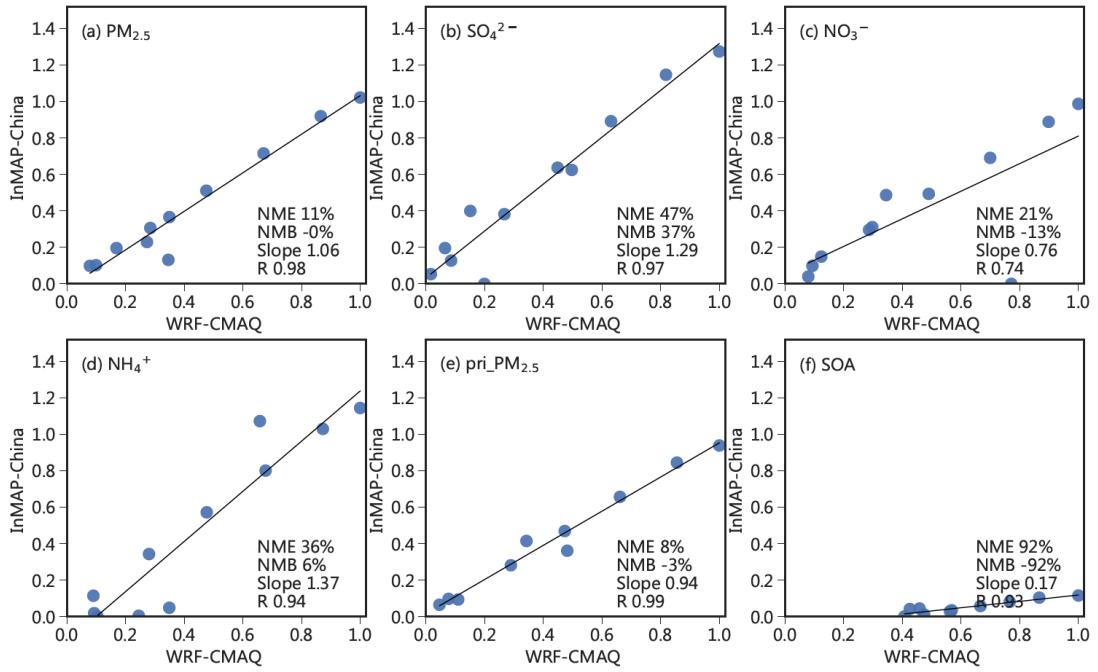
Figure S7 Marginal change in population-weighted PM$_{2.5}$ concentrations and their composition over the Fen Wei Plain region modelled by the InMAP-China and WRF-CMAQ models. The population-weighted air pollutant concentration for each scenario is normalized using the largest value among all scenarios modelled by CMAQ. The eleven dots represent the eleven scenarios, and the statistical metrics are labelled in the lower right corner for each panel.