

Supplementary data

Long-Range Transport Influence on Key Chemical Components of PM_{2.5} in the Seoul Metropolitan Area, South Korea, during the Years 2012–2016

Changhan Bae ¹, Byeong-Uk Kim ², Hyun Cheol Kim ^{3,4}, Chul Yoo ⁵ and Soontae Kim ^{1,*}

Table S1. Statistics of CMAQ model performance evaluation for daily mean PM_{2.5} concentration and chemical composition at the SMA super site for the period of 2012–2016.

		PM _{2.5}	Sulfate	Nitrate	Ammonium	EC	OC
Number of data		1721	1269	1267	1270	1305	1305
Observed mean concentration (µg/m³)		31.7	6.4	6.3	4.1	1.5	3.6
Simulated mean concentration (µg/m³)		28.1	4.6	8.4	4.3	1.8	3.3
Correlation Coefficient (R)		0.72	0.61	0.59	0.66	0.60	0.61
Normalized mean bias (NMB)		-11%	-28%	33%	5%	21%	-8%
Normalized mean error (NME)		30%	48%	68%	44%	41%	33%
Root mean square error (µg/m³)		14.1	5.83	7.0	2.6	0.8	1.2
Index of agreement		0.82	0.67	0.74	0.79	0.74	0.77
Goals and Criteria (Emery et al., 2017)							
R	Goal	>0.70	>0.70	-	>0.70	-	-
	Criteria	>0.40	>0.40	-	>0.40	-	-
NMB	Goal	<±10%	<±10%	<±15%	<±10%	<±20%	<±15%
	Criteria	<±30%	<±30%	<±65%	<±30%	<±40%	<±50%
NME	Goal	<35%	<35%	<65%	<35%	<60%	<45%
	Criteria	<50%	<50%	<115%	<50%	<75%	<65%

Table S2. Statistics of WRF model performance evaluation for 1-hr average temperature and wind speed over Northeast Asia in modeling domain for the period of 2012–2016.

	2-m Temperature	10-m Wind Speed
Number of Data	43817	43817
Observed Mean	14.8 °C	3.2 m/s
Simulated Mean	14.4 °C	4.0 m/s
Correlation Coefficient (R)	0.99	0.8
Root Mean Square Error (RMSE)	1.3 °C	1.0 m/s
Bias	-0.4 °C	0.8 m/s
Index of Agreement (IOA)	0.99	0.79
Statistical Benchmarks (Emery et al., 2001)		
RMSE	-	< 2.0 m/s
Bias	< ±0.5 °C	< ±0.5 m/s
IOA	> 0.8	> 0.6

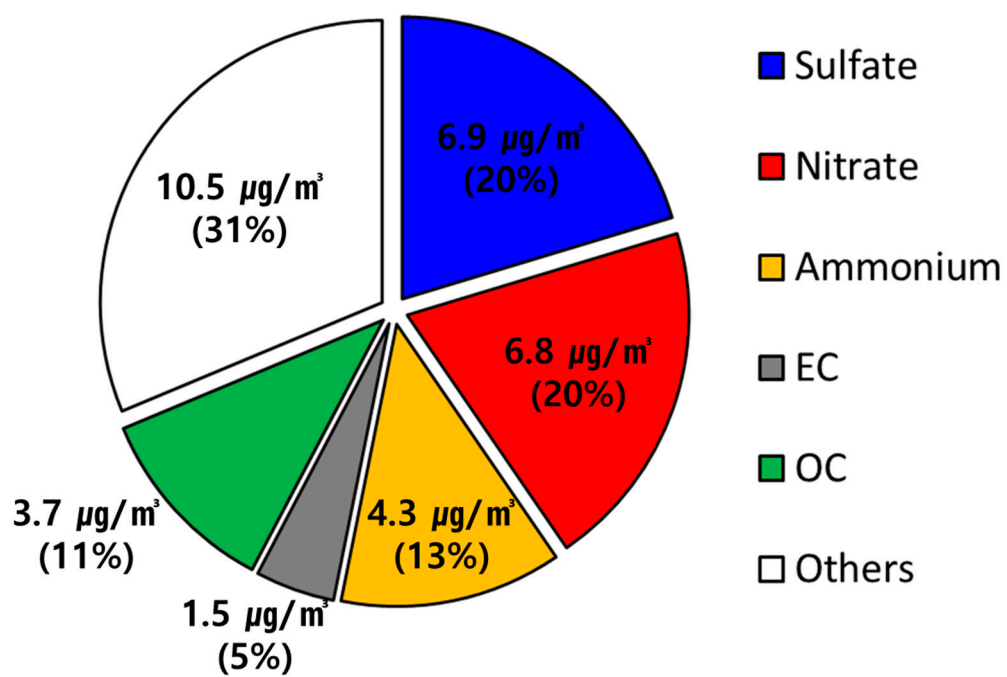


Figure S1. PM_{2.5} chemical composition observed at the SMA super site for the period of 2012–2016.

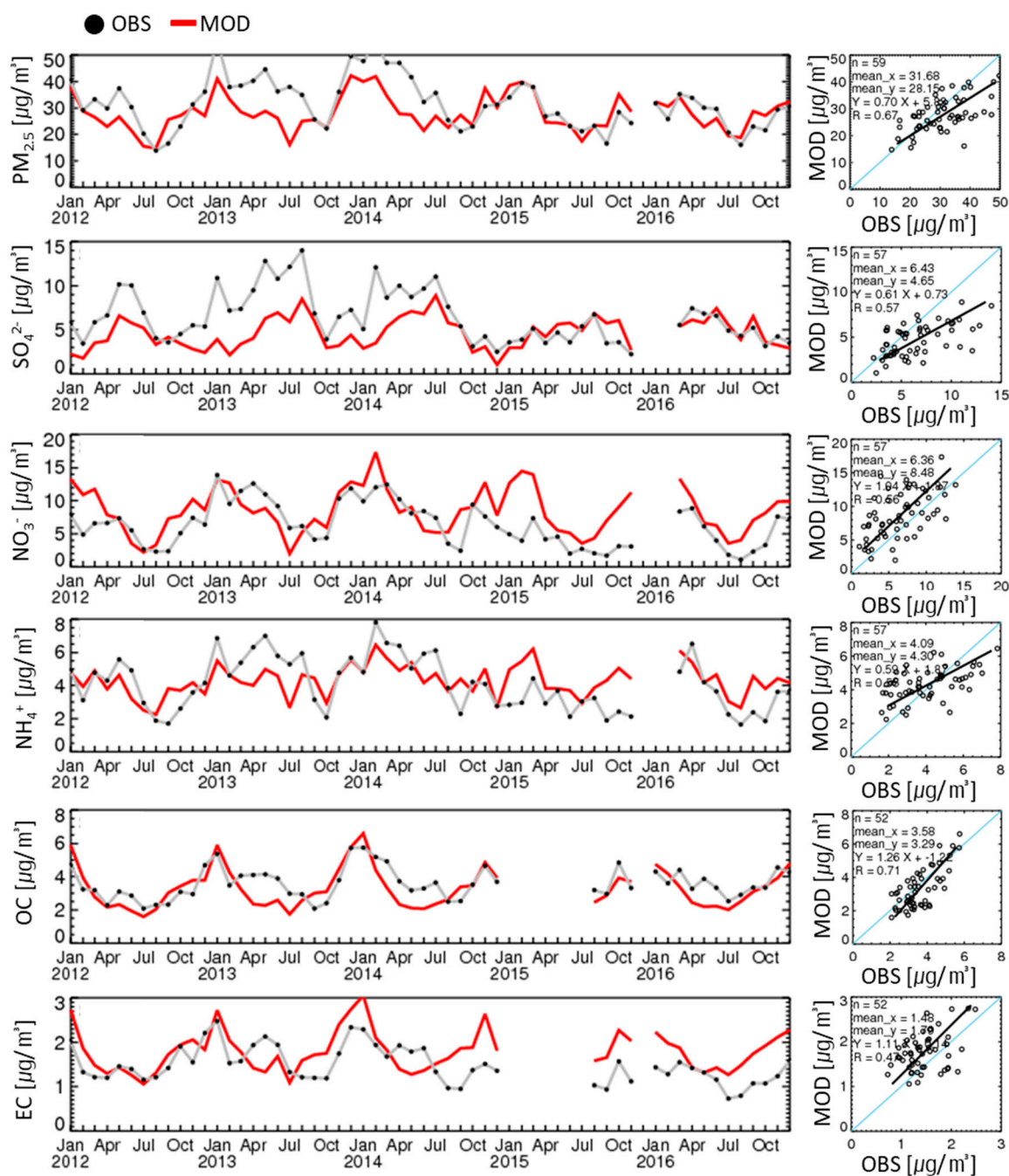


Figure S2. Time series (left) and scatter (right) of monthly mean $PM_{2.5}$ and its components at the SMA super site from 2012 to 2016. Black circle and red line presents the observed and modeled concentrations, respectively.

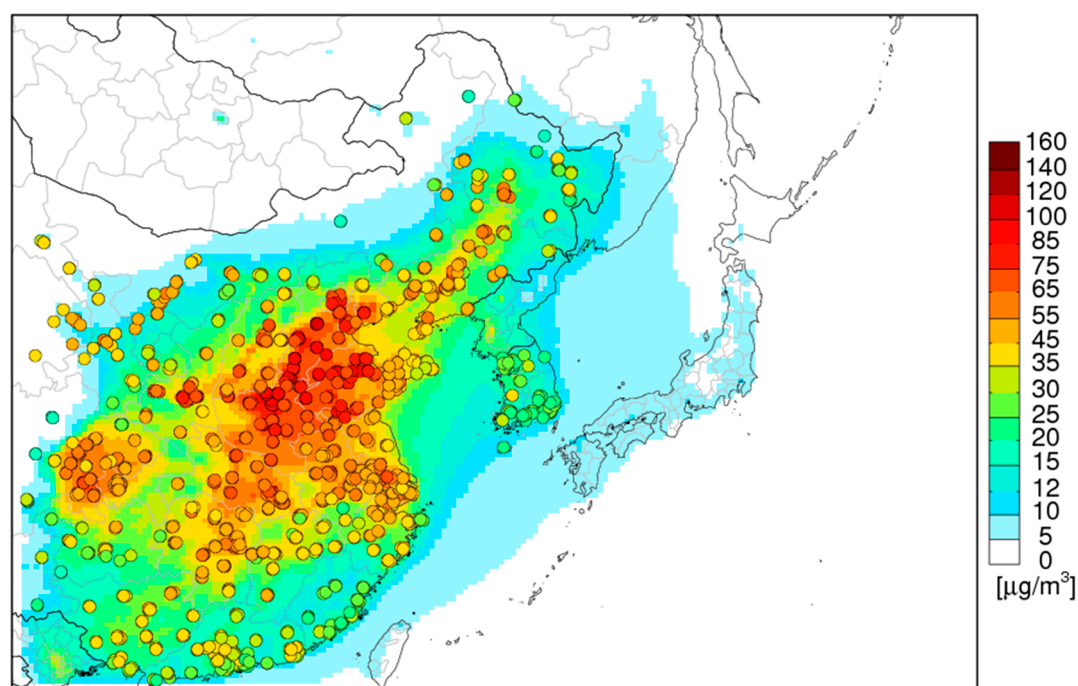


Figure S3. Spatial tile plot of simulated period mean $PM_{2.5}$ concentrations overlaid by the observations at surface air quality monitoring sites in China during the period of 2015–2016. Circles represent the locations of air quality monitoring sites.

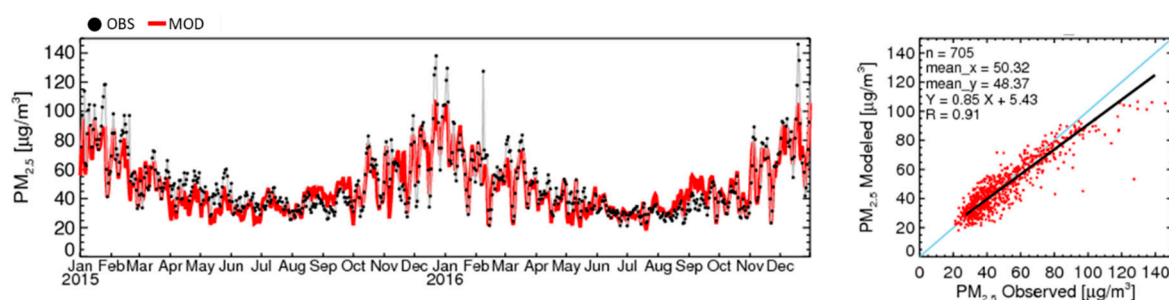


Figure S4. Time series (left) and scatter (right) of daily mean $PM_{2.5}$ averaged over air quality monitoring sites in China for the period of 2015 to 2016. Black and red line presents the observed and modeled concentrations, respectively.

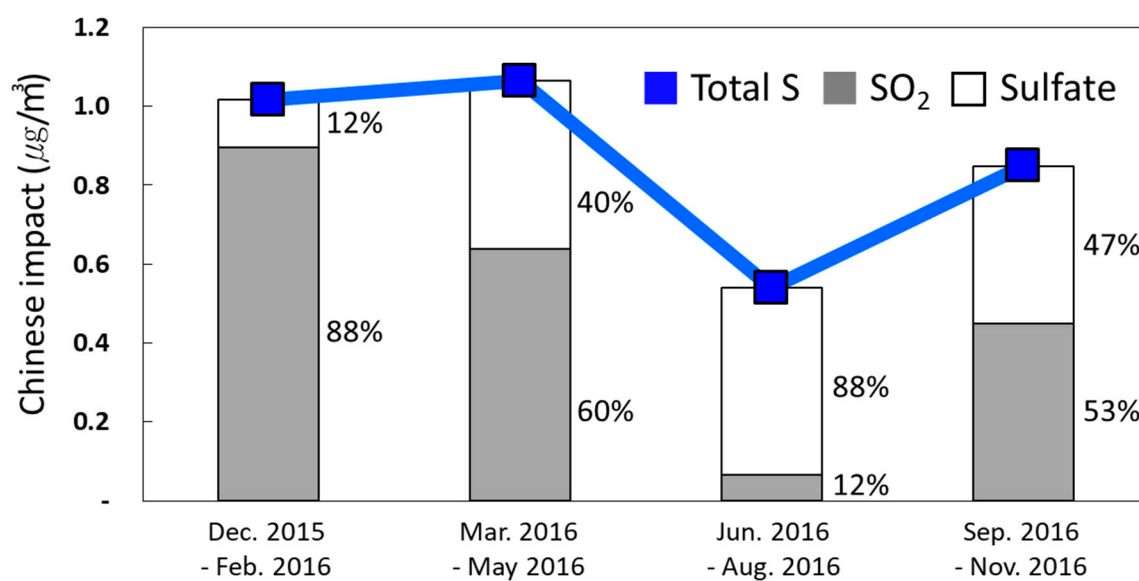


Figure S5. Seasonal Chinese impacts to Total S, SO₂, and sulfate concentration estimated over the SMA for the period of 2015–2016. The percentages represent SO₂/Total S ratio and sulfate/Total S ratio.