Supplementary Information for:

Daily Emission Patterns of Coal-Fired Power Plants in China Based on Multisource Data Fusion

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Supplementary Text: Preprocessing of CEMS data

In this section, we provide details on the removal of outliers of emission rates. The emission rates of SO_2, NO_x and PM depend on activity data, emission factors and removal efficiencies. Here, we assume a pessimistic case that the plant does not install pollution control equipment or it does not operate as required, which represents the removal efficiency is zero. And the theoretical maximum emission rates (i.e., reference upper bounds) are mainly driven by uncontrolled emission factors and coal consumption per hour:

$$E_s = EF_s \times U \times A \quad (1)$$

where E_s is the theoretical maximum emissions per hour for pollutants *s* including SO_2, NO_x and PM; *EF* is the emission factor without taking into account any control measures, which represents direct emissions per unit of coal consumption; $U \times A$ is used to calculate a reference coal consumption, of which *U* is the unit capacity and *A* is coal consumption per unit of electricity generation.

Table S1. Correlation Coefficients between Monthly Profiles Based on Flue Gas Volume (For CO_2) and Emission Rates (For SO_2, NO_x and $PM_{2.5}$) from CEMS and Power Generation for 30 Provinces in China.

Province	R_{CO_2}	R_{SO_2}	R_{NO_x}	$R_{PM_{2.5}}$	Province	R_{CO_2}	R_{SO_2}	R_{NO_x}	$R_{PM_{2.5}}$
Anhui	0.95	0.80	0.88	0.71	Jiangsu	0.94	0.91	0.93	0.82
Beijing	0.68	0.71	0.74	0.75	Jiangxi	0.93	0.62	0.76	0.65
Chongqing	0.90	0.58	0.88	0.71	Jilin	0.84	0.80	0.85	0.63
Fujian	0.93	0.64	0.85	0.67	Liaoning	0.75	0.56	0.57	0.53
Gansu	0.93	0.80	0.92	0.80	Ningxia	0.87	0.52	0.78	0.69
Guangdong	0.93	0.86	0.93	0.90	Qinghai	0.86	0.80	0.83	0.71
Guangxi	0.34	0.38	0.38	0.30	Shandong	0.85	0.84	0.83	0.60
Guizhou	0.83	0.78	0.83	0.82	Shanghai	0.81	0.62	0.90	0.74
Hainan	0.91	0.66	0.84	0.72	Shannxi	0.74	0.56	0.74	0.55
Hebei	0.87	0.67	0.78	0.82	Shanxi	0.92	0.48	0.81	0.70
Heilongjiang	0.77	0.80	0.78	0.73	Sichuan	0.84	0.83	0.88	0.86
Henan	0.98	0.95	0.95	0.92	Tianjin	0.69	0.37	0.46	0.58
Hubei	0.87	0.53	0.80	0.65	Xinjiang	0.75	0.62	0.61	0.51
Hunan	0.90	0.85	0.88	0.77	Yunnan	0.90	0.94	0.92	0.89
Inner Mongolia	0.90	0.10	0.69	0.27	Zhejiang	0.94	0.92	0.95	0.76

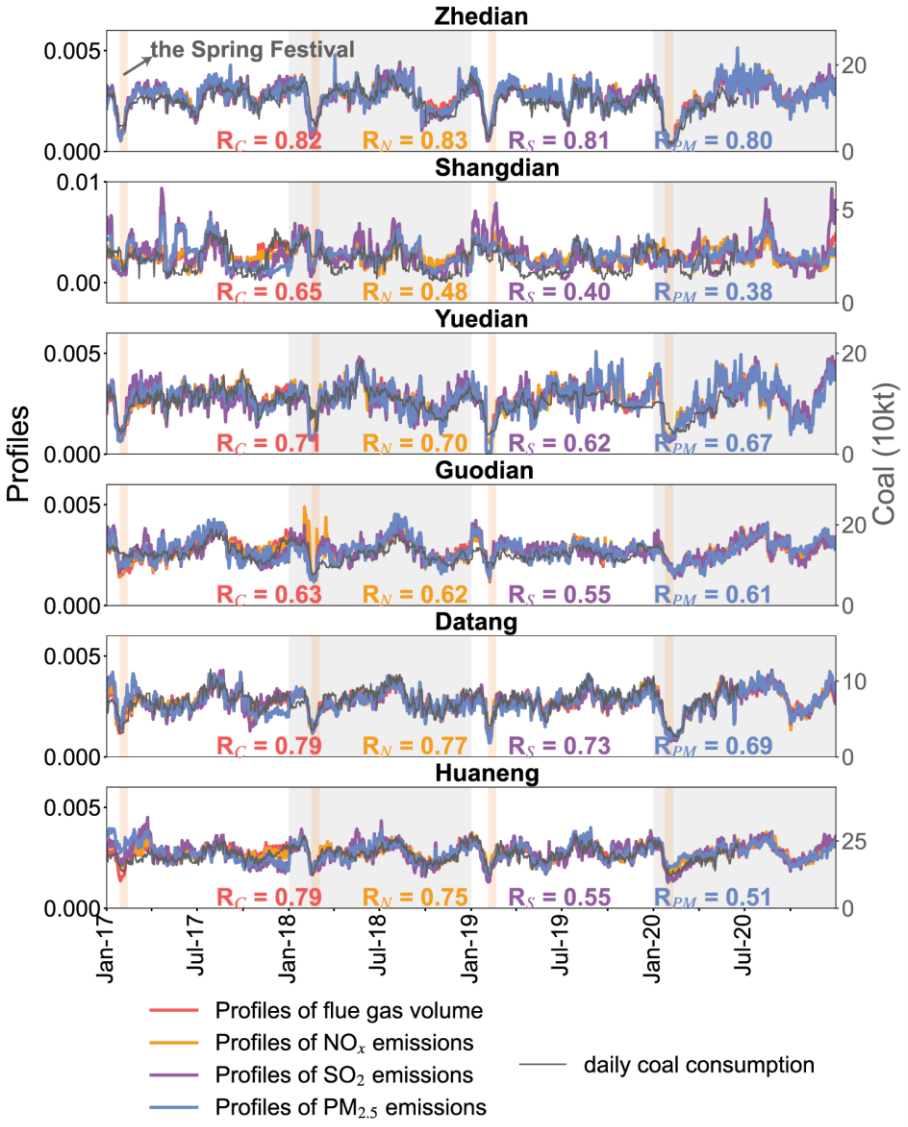

Figure S1. Comparison of daily coal consumption (gray lines) from the six major power generation groups with daily profiles based on flue gas volume (red lines), NO_x emissions (yellow lines), SO_2 emissions (purple lines) and $PM_{2.5}$ emissions (blue lines) in CEMS from the corresponding power plants. The *r* values in red (or yellow, purple, and blue) represent the Pearson correlation coefficient between daily coal consumption and daily flue gas volume (or NO_x emissions, SO_2 emissions, and $PM_{2.5}$ emissions). The light orange shades indicate the Spring Festival (i.e., from the New Year's Eve to the 15th day of the first lunar month).

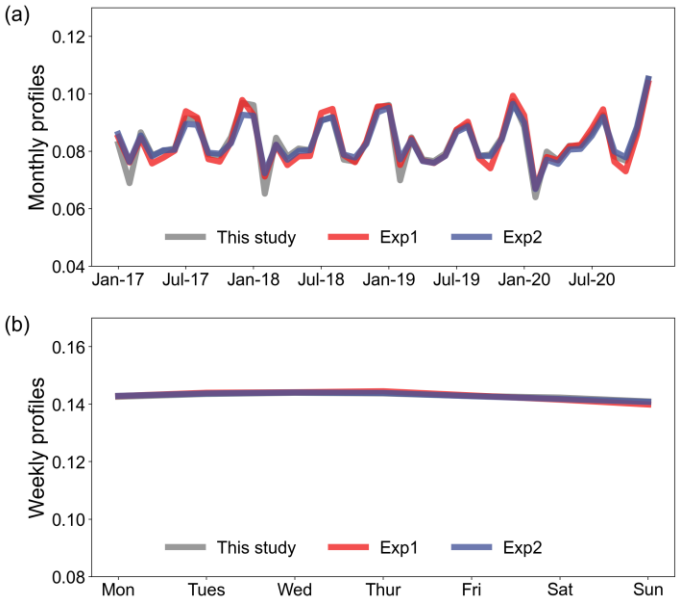

Figure S2. Comparisons of monthly and weekly profiles based on different imputation methods for the missing flue gas volume data from CEMS as an example. The gray, red and blue lines represent the stepwise interpolation method used in this study, the scheme without any imputation in Exp1 and linear interpolation method in Exp2, respectively.

Table S2. Sensitivity Tests for Different Imputation Methods. Comparisons of Monthly and Weekly Profiles and Changes of Total Flue Gas Volume and Emission Rates along with Different Imputation Methods at the National and Provincial Level are Listed.

		Exp1 (Without Imputation)				Exp2 (Linear interpolation)			
		CO_2	SO_2	NO_x	$PM_{2.5}$	CO_2	SO_2	NO_x	$PM_{2.5}$
National	$R_{monthly}$[a]	0.96	0.93	0.96	0.93	0.97	0.93	0.96	0.96
	R_{weekly}[a]	0.98	0.97	0.97	0.90	0.98	0.97	0.97	0.93
	$(\Delta F_{CEMS}$[c]$)/F_{CEMS}$[b]	-12.3%	/	/	/	7.6%	/	/	/
	$(\Delta E_{CEMS}$[e]$)/E_{CEMS}$[d]	/	-17.6%	-8.9%	-13.3%	/	-0.5%	1.0%	-0.1%
Provincial	mean$[(R_{monthly}$[a]$)]$	0.86	0.84	0.90	0.84	0.90	0.86	0.92	0.88
	mean$[(R_{weekly}$[a]$)]$	0.73	0.74	0.79	0.61	0.77	0.74	0.77	0.71
	mean$[(\Delta F_{CEMS}$[c]$)/F_{CEMS}$[b]$]$	-11.5%	/	/	/	11.9%	/	/	/
	mean$[(\Delta E_{CEMS}$[e]$)/E_{CEMS}$[d]$]$	/	-16.4%	-7.7%	-13.8%	/	-0.04%	-1.5%	-1.0%

[a]Pearson correlation coefficients between monthly (or weekly) profiles based on the stepwise interpolation method used in this study and Exp1 (or Exp2) at the national (or provincial) scale.

[b]the total flue gas volume from CEMS based on Exp1 (or Exp2).

[c]the difference between the total flue gas volume based on Exp1 (or Exp2) and the stepwise method used in this study.

[d]the total emission rates from CEMS based on Exp1 (or Exp2).

[e]the difference between the total emission rates based on Exp1 (or Exp2) and the stepwise method used in this study.

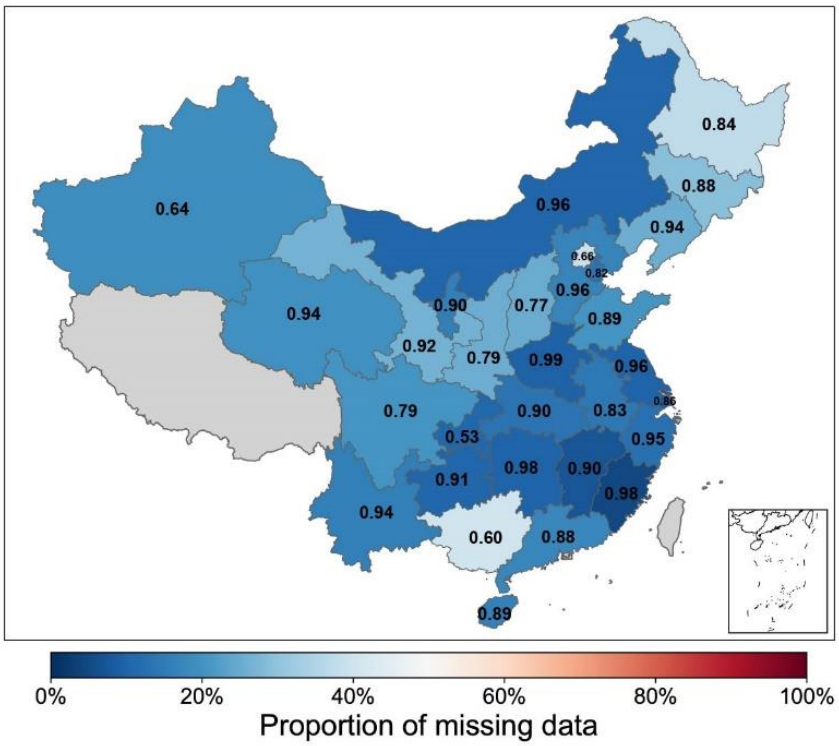

Figure S3. The proportion of missing flue gas volume data in different provinces as an example. Numbers in the map represent R between monthly profiles based on the stepwise imputation method used in this study and Exp1. Gray shading indicates no valid data.