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Technical note: Rapid assessment of drivers and air quality effects of regional daily changes in air pollutant emissions based on near-real-time techniques

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Table S1 Comparisons between observed and simulated meteorological parameters in D3. OBS and SIM represent observation and simulation, respectively. (T2: temperature at 2 m; WS10: wind speed at 10 m; RH2: relative humidity at 2 m). Criteria are taken from Emery et al. (Emery, C., Liu, Z., Russell, A. G., Odman, M. T., Yarwood, G., and Kumar, N.: Recommendations on statistics and benchmarks to assess photochemical model performance, J. Air Waste Manag. Assoc., 67, 582-598, 10.1080/10962247.2016.1265027, 2017).

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Meteorological parameters	Evaluation metrics	Jan	Apr	Jul	Oct	Criterion
WS10	OBS (m/s)	2.84	3.10	2.85	2.55	
	SIM (m/s)	3.53	3.48	3.33	3.13	
	Bias (m/s)	0.51	0.27	0.33	0.45	≤±0.5
	RMSE (m/s)	2.25	2.11	1.82	2.2	≤2.0
	IOA	0.71	0.71	0.73	0.68	≥0.6
T2	OBS (℃)	3.18	17.89	28.84	17.60	
	SIM (℃)	3.92	17.35	28.57	17.73	
	Bias (℃)	0.53	-0.22	-0.35	-0.17	≤±0.5
	RMSE (℃)	1.96	0.99	0.87	1.03	≤2.0
	IOA	0.95	0.98	0.99	0.94	≥0.8
RH2	OBS (%)	73.09	68.08	78.00	64.65	
	SIM (%)	67.42	62.01	71.31	56.47	
	Bias (%)	-4.01	-6.06	-6.88	-7.43	
	RMSE (%)	12.27	16.85	15.22	16.28	
	IOA	0.97	0.99	0.97	0.92	≥0.7

Table S2 City-level variations in air pollutant emissions across representative cities in Jiangsu Province during the lockdown (April-May 2022) versus the baseline period (April-May 2023).

City	Pollutant	Baseline (tons) (April-May 2023)	Lockdown (tons) (April-May 2022)	Emission reduction (tons)	Relative change (%)
Suzhou (Southern Jiangsu)	SO_2	9358	8516	-842	-9.0%
	NO_X	19193	16276	-2917	-15.2%
	$PM_{2.5}$	8066	7018	-1048	-13.0%
	NMVOCs	38059	31247	-6812	-17.9%
Nantong (Central Jiangsu)	SO_2	2643	2513	-130	-4.9%
	NO_X	7106	6453	-653	-9.2%
	$PM_{2.5}$	2971	2770	-201	-6.8%
	NMVOCs	23109	21121	-1988	-8.6%
Xuzhou (Northern Jiangsu)	SO_2	5764	5593	-171	-3.0%
	NO_X	15204	14850	-354	-2.3%
	$PM_{2.5}$	4542	4413	-129	-2.8%
	NMVOCs	14534	14102	-432	-3.0%

Table S3 Comparison of the observed and simulated concentrations of specific air pollutants for selected months in Jiangsu. In total, 110 state-operated observation sites were included in the comparison.

Species	Period	Observation (μg/m^3)	Simulation (μg/m^3)	R^2		NMB (%)		NME (%)	
			This work	This work	MEIC	This work	MEIC	This work	MEIC
SO_2	2022/1	11.9	14.6	0.49	0.41	23.0	24.1	53.5	49.0
	2022/4	16.1	14.4	0.44	0.32	-26.7	-30.4	33.7	45.6
	2022/7	10.7	11.1	0.44	0.36	24.1	25.5	38.6	40.9
	2022/10	16.7	14.1	0.57	0.43	-37.1	-33.4	51.2	51.8
NO_2	2022/1	78.0	71.1	0.59	0.55	-2.5	-16.1	15.9	24.3
	2022/4	59.0	61.5	0.37	0.30	21.3	30.0	36.2	55.1
	2022/7	45.7	54.5	0.45	0.38	27.0	35.6	25.8	22.3
	2022/10	72.1	60.1	0.47	0.44	-20.2	-19.9	26.2	31.7
$PM_{2.5}$	2022/1	108.1	108.9	0.58	0.47	10.8	14	33.2	37.5
	2022/4	61.8	56.7	0.38	0.29	-18.6	21.7	39.2	55.3
	2022/7	40.8	39.7	0.39	0.25	-3.2	25.2	48.1	62.5
	2022/10	41.5	31.7	0.49	0.38	-1.91	-8.58	42.6	51.3
O_3	2022/1	79.2	66.9	0.66	0.30	-23.1	-39.1	49.3	51.4
	2022/4	203.2	159.3	0.46	0.26	-41.2	-30.6	41.1	54.0
	2022/7	158.8	130.4	0.62	0.56	-24.2	-28.1	32.7	44.3
	2022/10	128.8	102.3	0.52	0.32	-30.5	-39.9	44.6	54.5

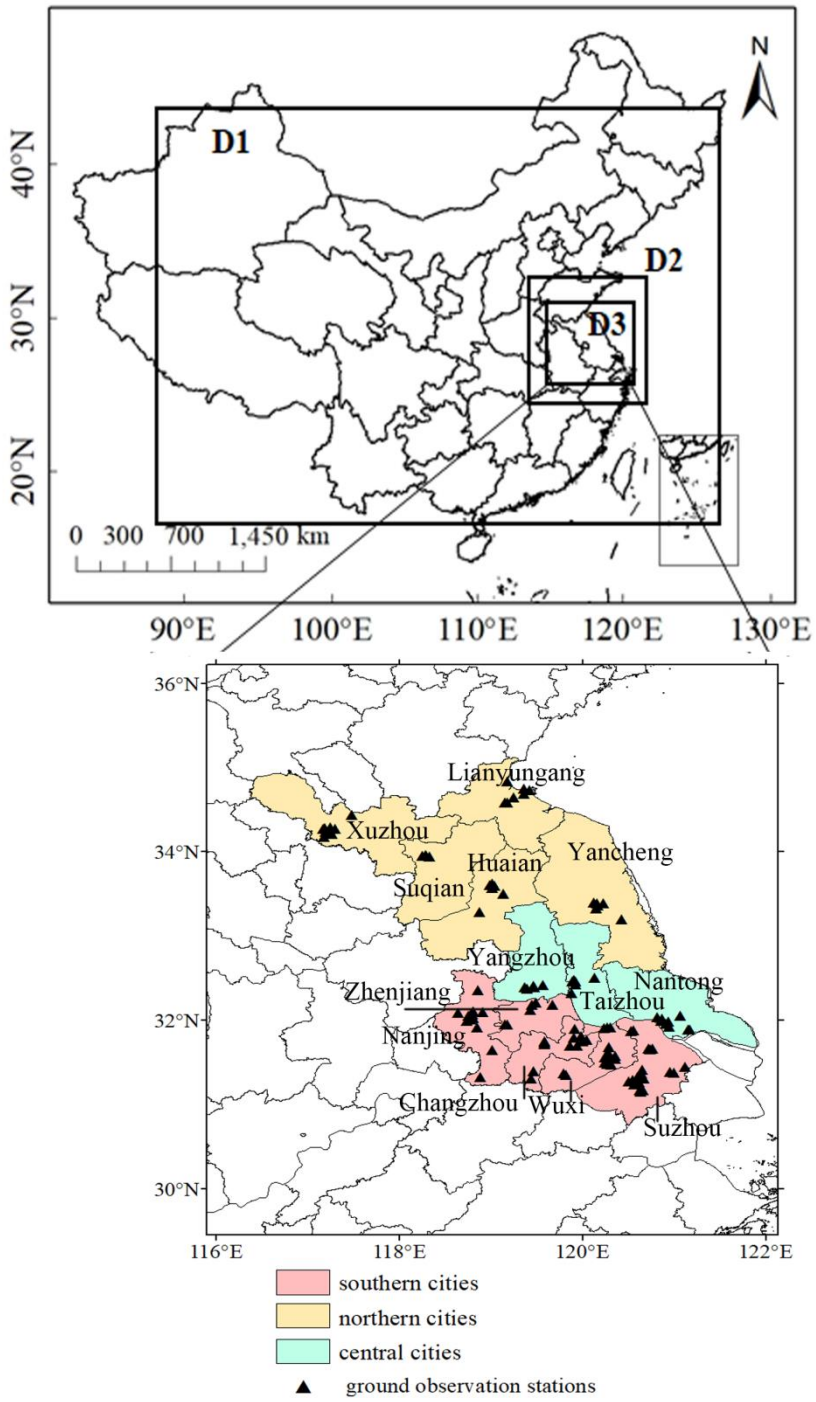


Figure S1 The locations of Jiangsu Province and the spatial distribution of ground observation stations. The map data provided by Resource and Environment Data Cloud Platform are freely available for academic use (http://www.resdc.cn/data.aspx?DATAID=201), © Institute of Geographic Sciences &

Natural Resources Research, Chinese Academy of Sciences.

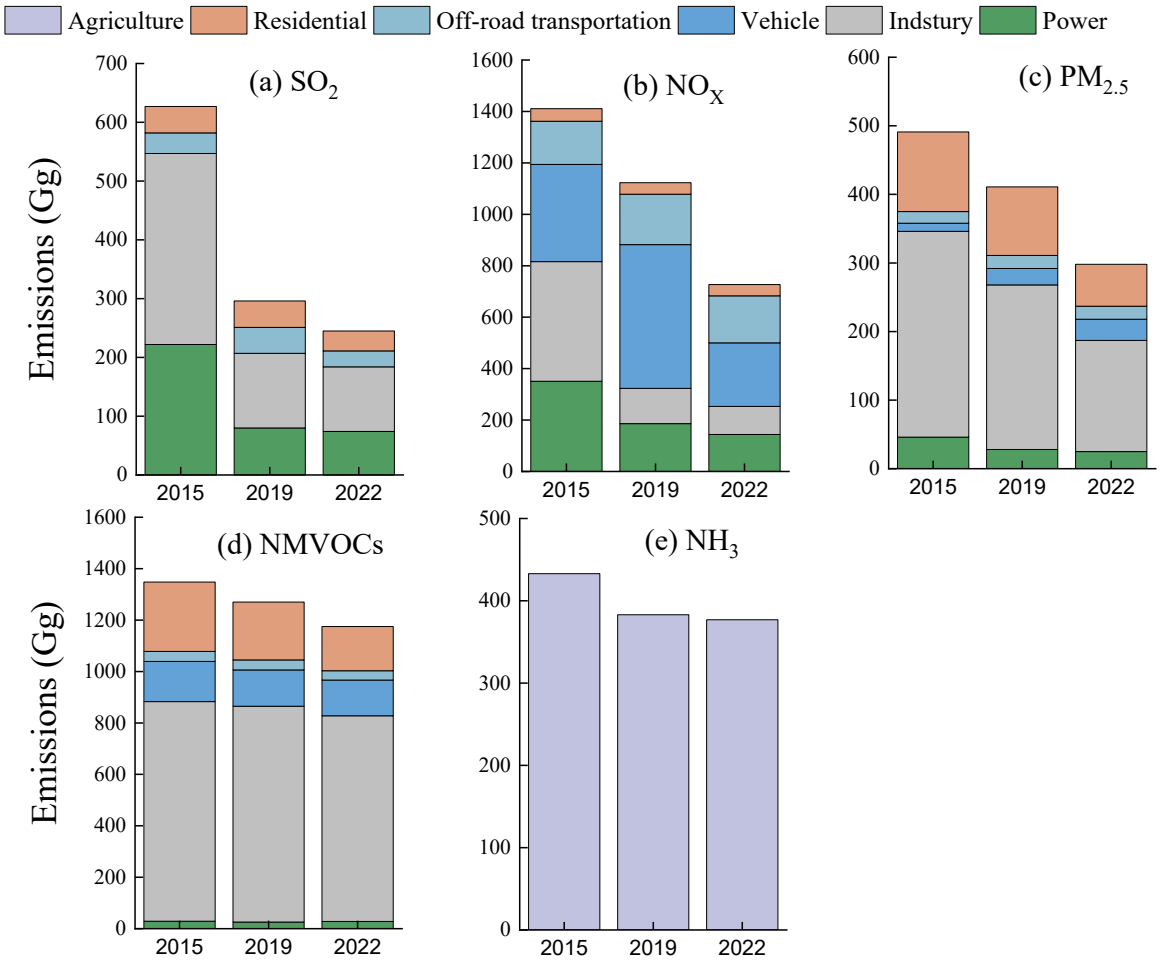


Figure S2 Air pollutant emissions by sector for Jiangsu in 2015, 2019, and 2022. (a) SO_2; (b) NO_X; (c) $PM_{2.5}$; (d) NMVOCs; (e) NH_3.

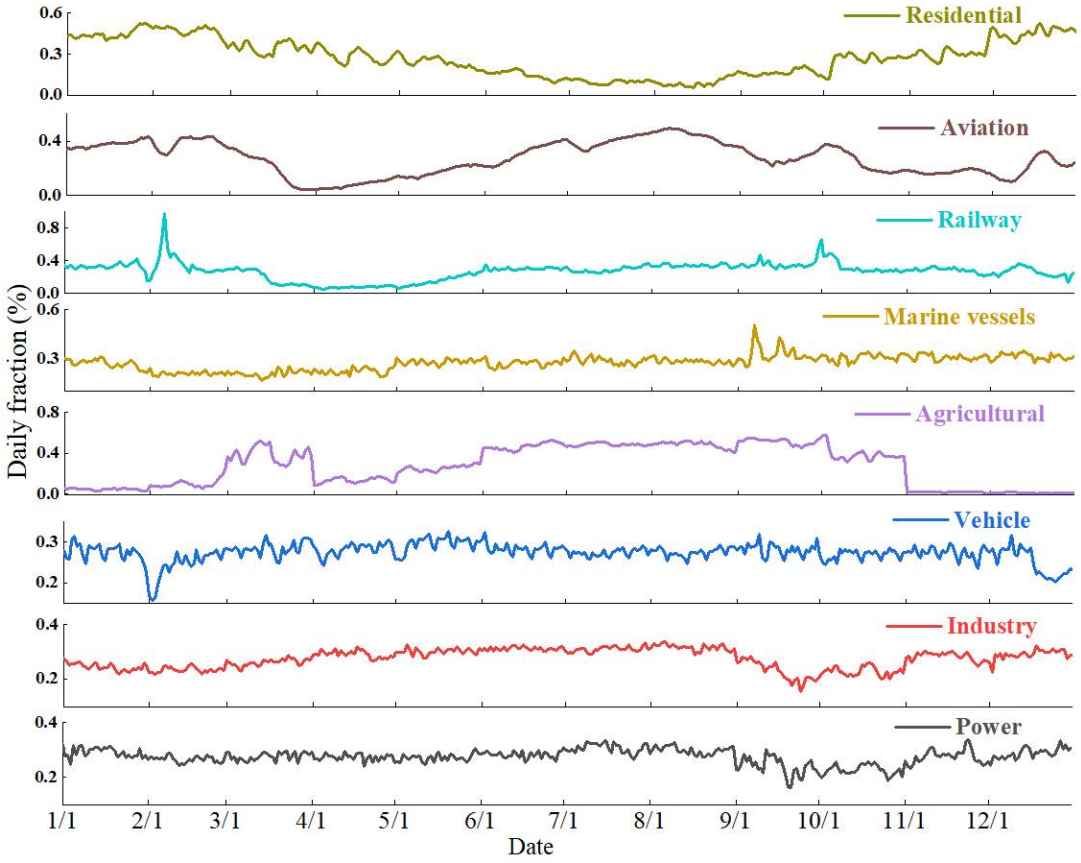


Figure S3 The temporal profiles of NO_X emissions for key sectors for Jiangsu in 2022. From top to bottom are residential, aviation, diesel locomotive, marine, agricultural machinery, on-road vehicles, industry, and power sectors.

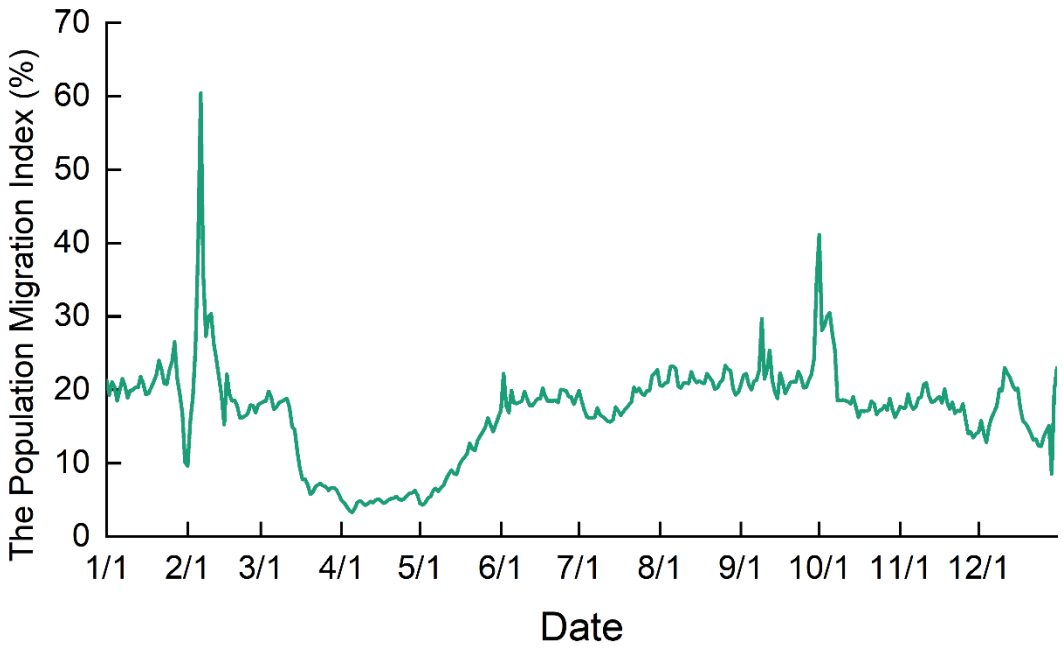


Figure S4 The daily population migration index for Jiangsu in 2022.

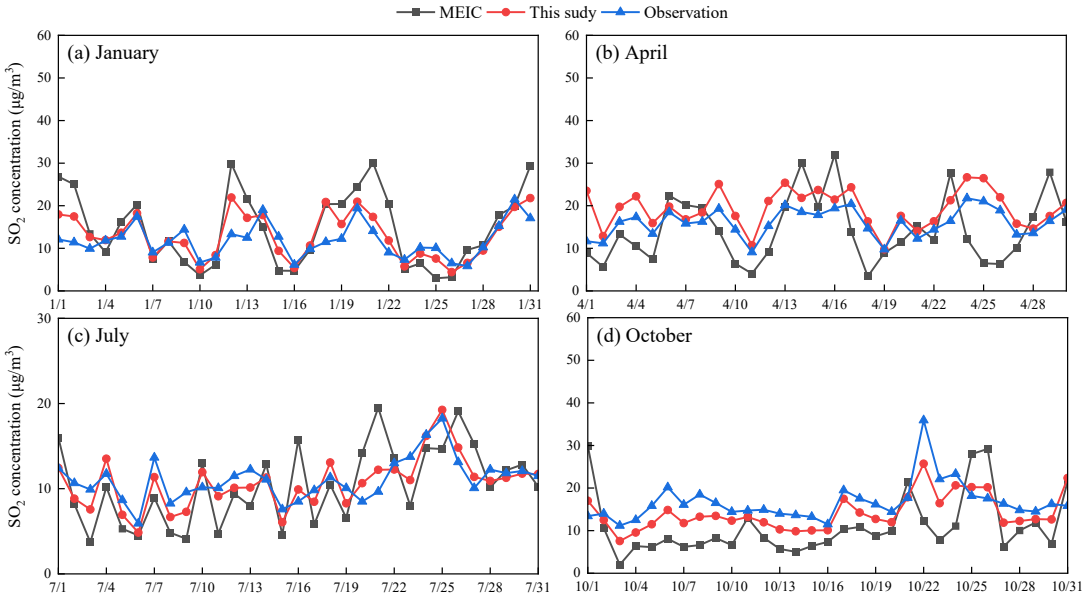


Figure S5 The comparison between the observed daily SO_2 concentrations and those simulated with different emission inventories (this work and MEIC) for January, April, July and October 2022 for Jiangsu Province.

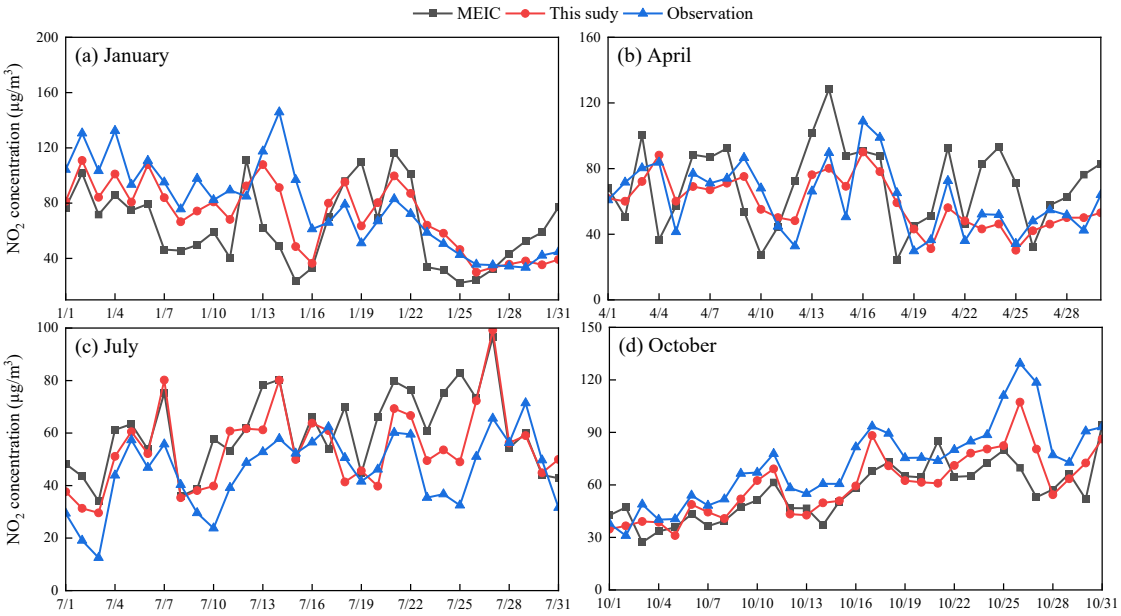


Figure S6 The comparison between the observed daily NO_2 concentrations and those simulated with different emission inventories (this work and MEIC) for January, April, July and October 2022 for Jiangsu Province.

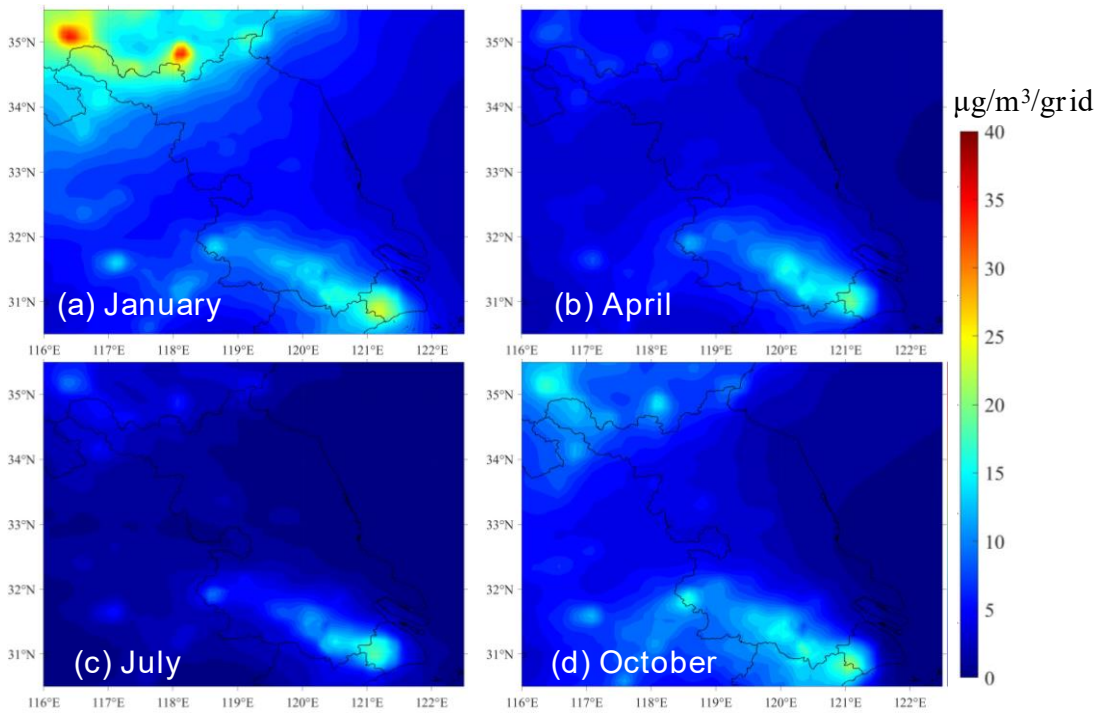


Figure S7 Spatial distribution of SO_2 concentrations for Jiangsu in 2022 simulated with CMAQ. (a) January; (b) April; (c) July; and (d) October.

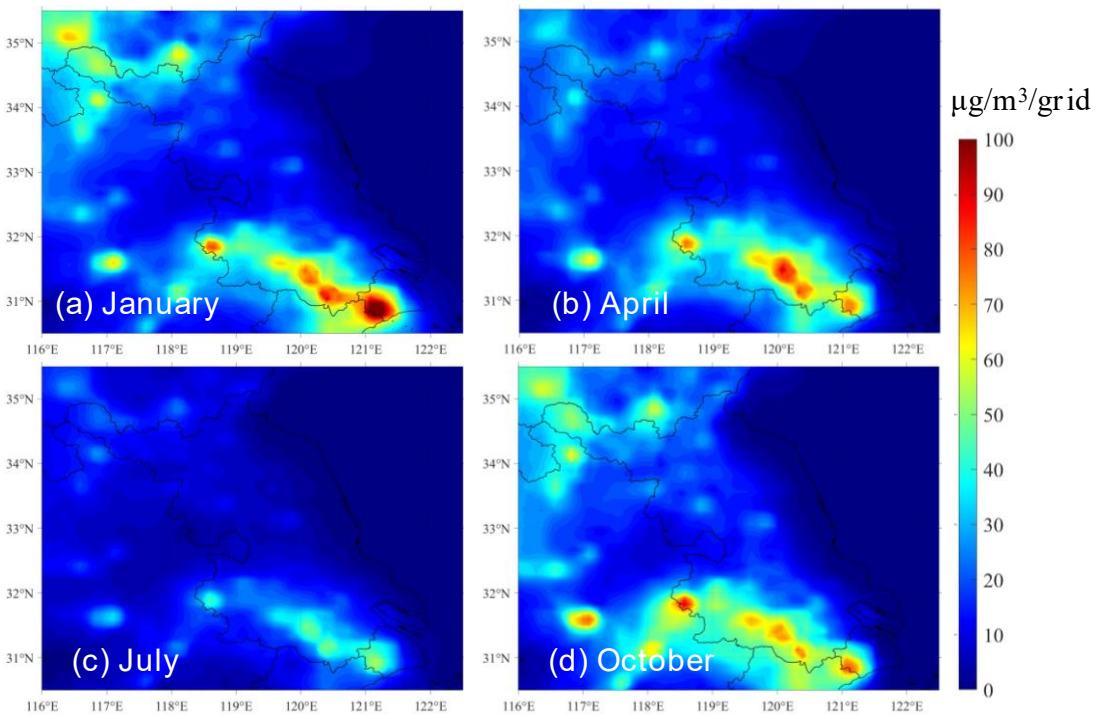


Figure S8 Spatial distribution of NO_2 concentrations for Jiangsu in 2022 simulated with CMAQ. (a) January; (b) April; (c) July; and (d) October.

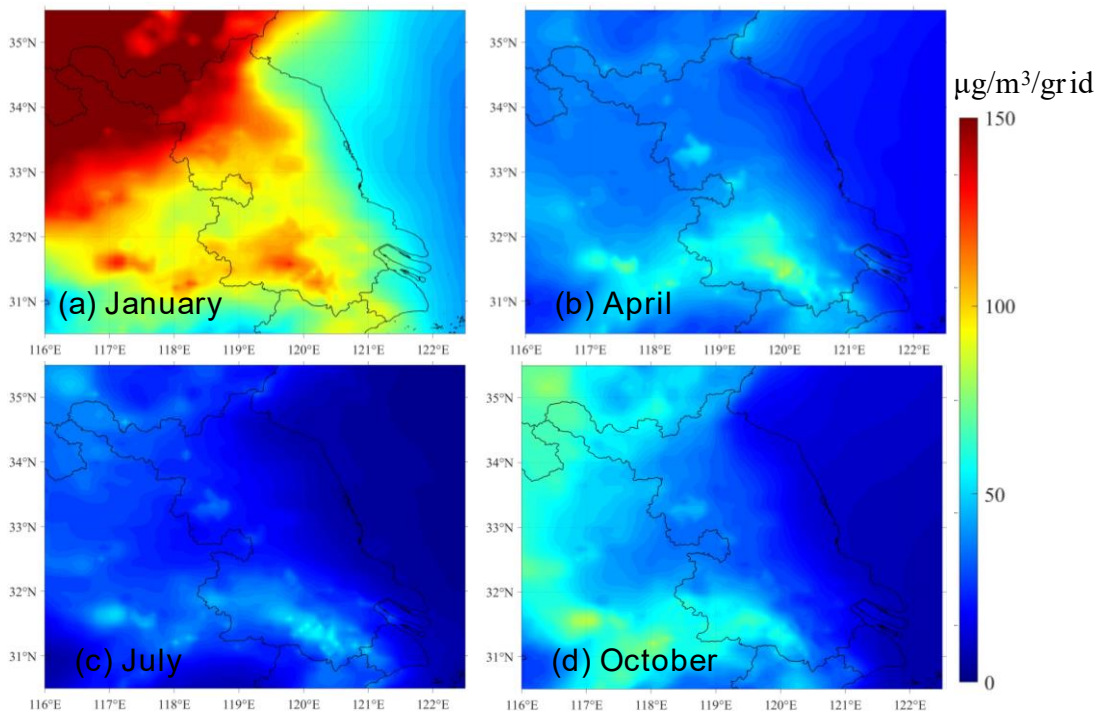


Figure S9 Spatial distribution of $PM_{2.5}$ concentrations for Jiangsu in 2022 simulated with CMAQ. (a) January; (b) April; (c) July; and (d) October.

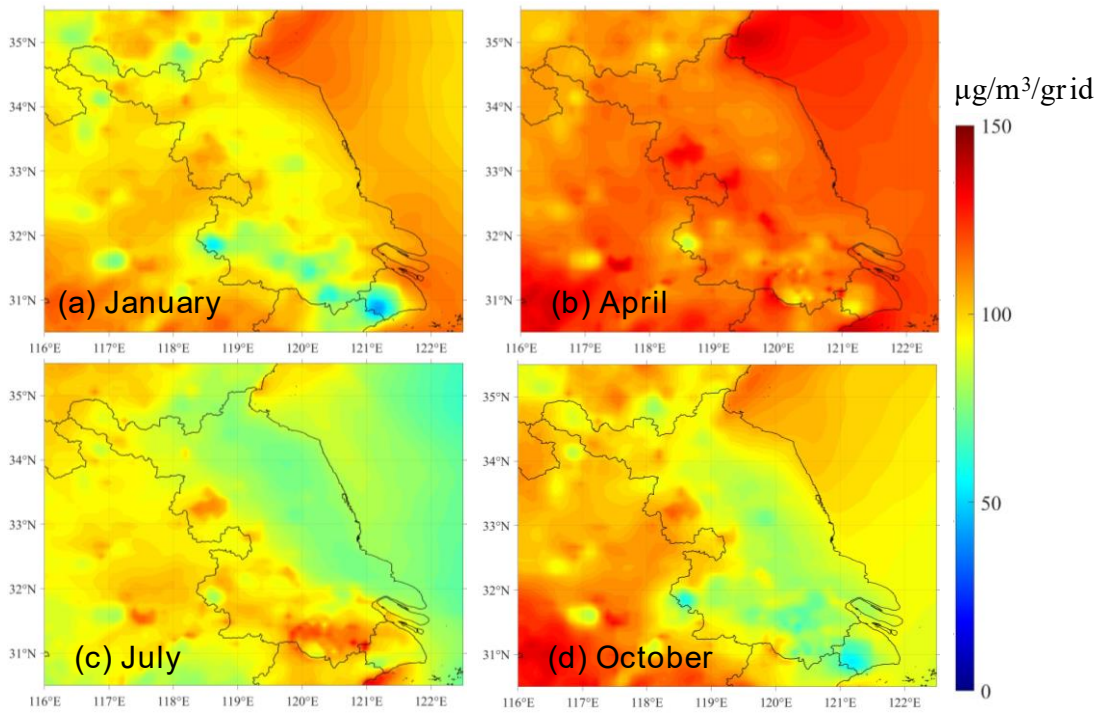
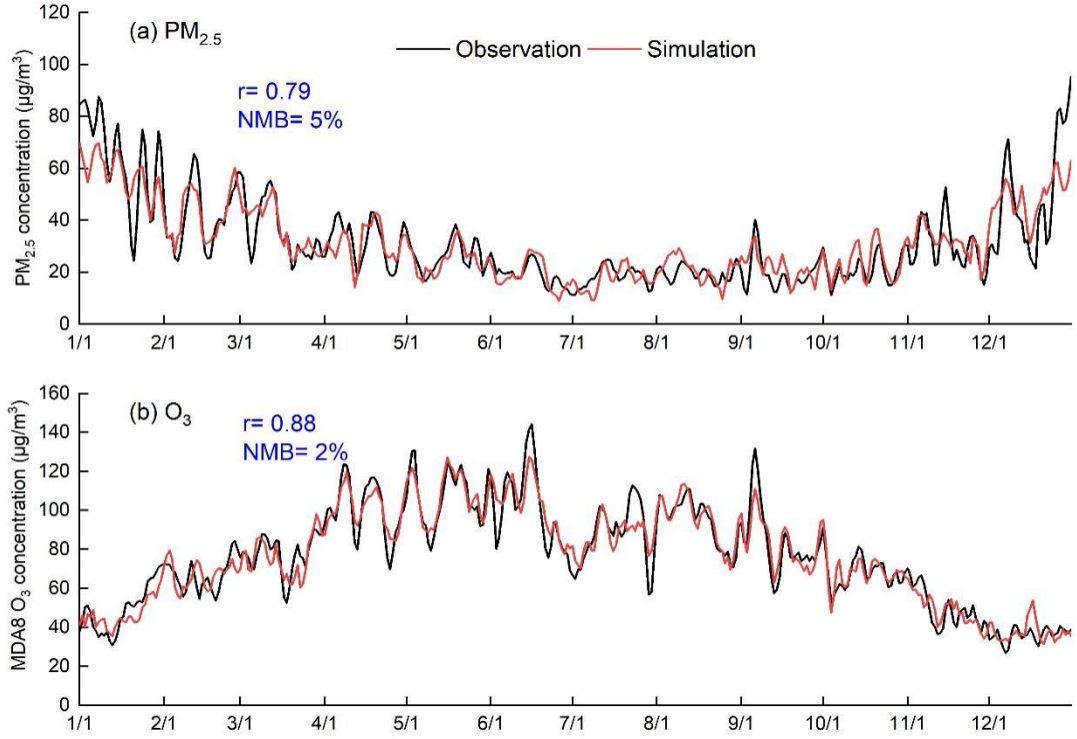


Figure S10 Spatial distribution of O_3 concentrations for Jiangsu in 2022 simulated with CMAQ. (a) January; (b) April; (c) July; and (d) October.



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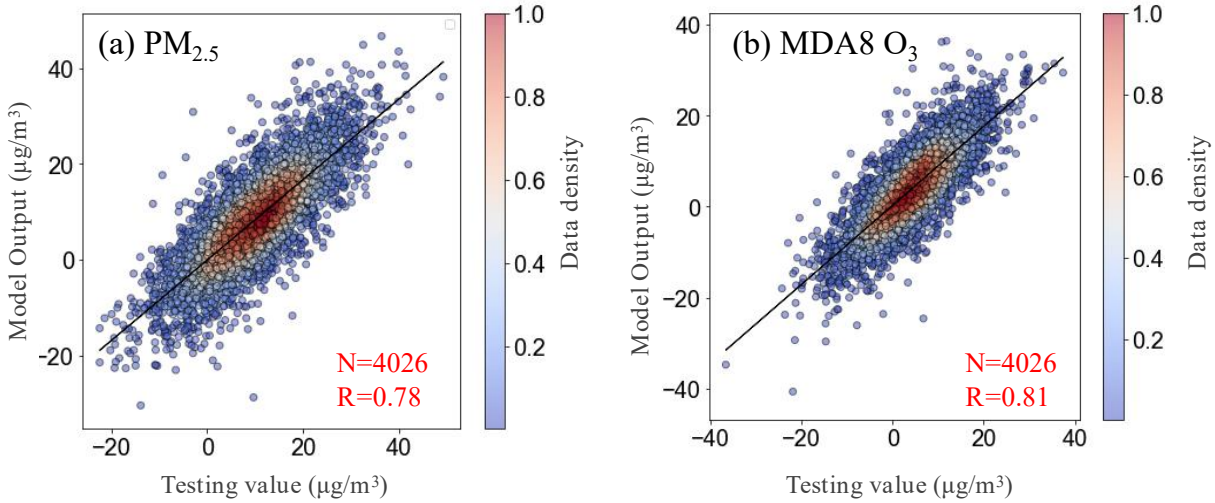

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