



Supplement of

**O₃–NO_x–VOCs sensitivity in major Chinese regions:
detailed insights from GEMS satellite
hourly observations**

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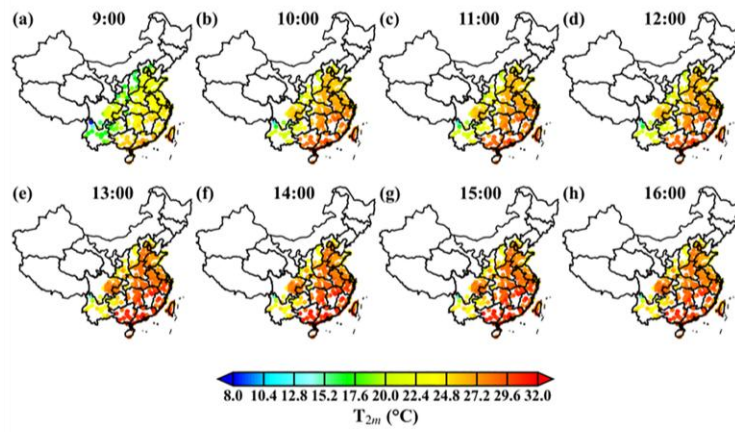


Figure S1. Hourly spatial distribution of 2-meter temperature (T_{2m}) during the warm season (April–September) from 2021 to 2023.

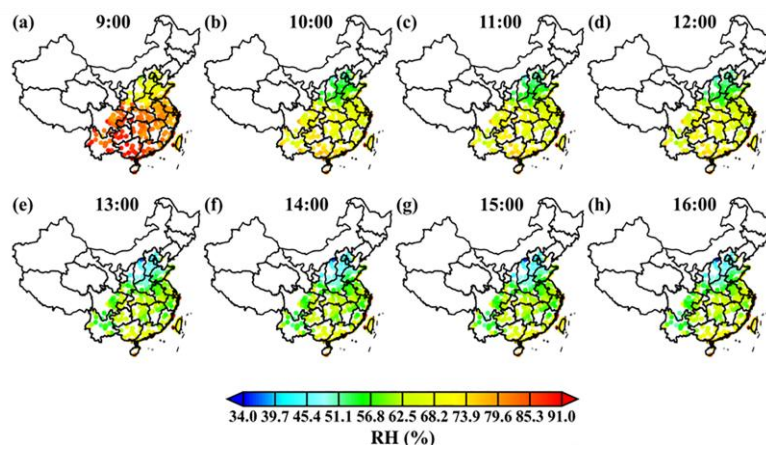


Figure S2. Hourly spatial distribution of relative humidity (RH) during the warm season (April–September) from 2021 to 2023.

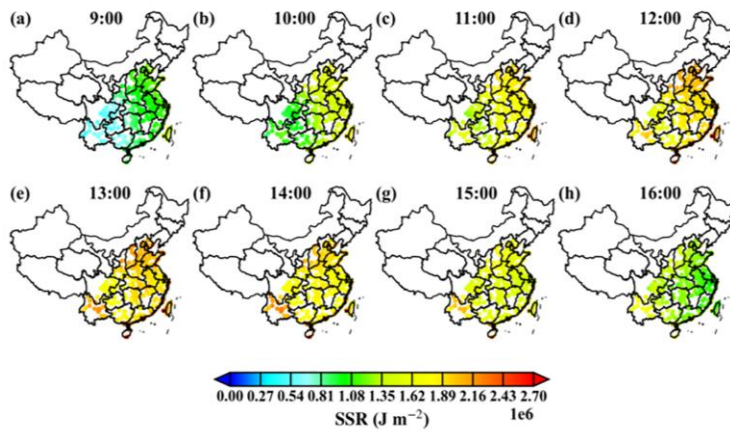


Figure S3. Hourly spatial distribution of surface solar radiation (SSR) during the warm season (April–September) from 2021 to 2023.

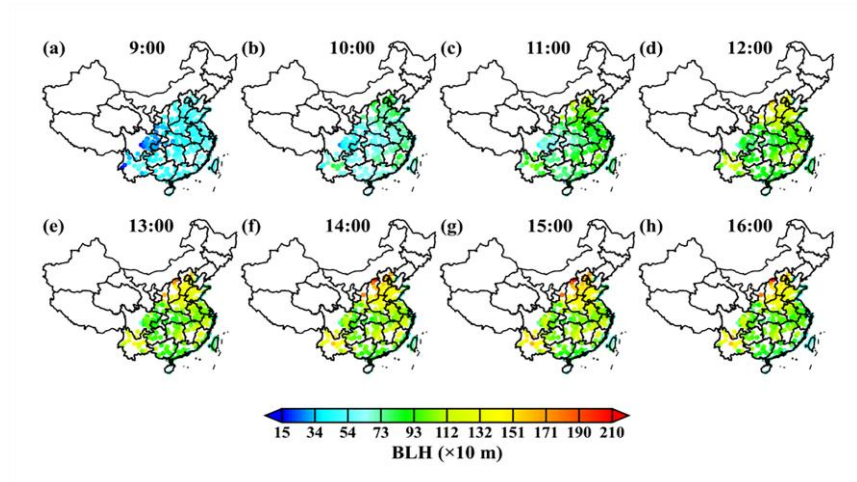


Figure S4. Hourly spatial distribution of boundary layer height (BLH) during the warm season (April–September) from 2021 to 2023. (Units: m; values in the figure are one-tenth of the original data.)

Table S1. Spearman correlation coefficients between pollutants and meteorological variables over time.

Pollutant	MetVar	N	Spearman ρ	p (corrected)
O ₃	RH	4376	-0.166	0.014
O ₃	T _{2m}	4376	0.329	<0.001
O ₃	SSR	4376	0.219	<0.001
O ₃	BLH	4376	0.058	0.049
NO ₂	RH	4376	-0.203	<0.001
NO ₂	T _{2m}	4376	-0.556	<0.001
NO ₂	SSR	4376	0.164	0.007
NO ₂	BLH	4376	-0.201	<0.001
HCHO	RH	4376	0.265	<0.001
HCHO	T _{2m}	4376	0.531	<0.001
HCHO	SSR	4376	0.415	<0.001
HCHO	BLH	4376	0.400	<0.001

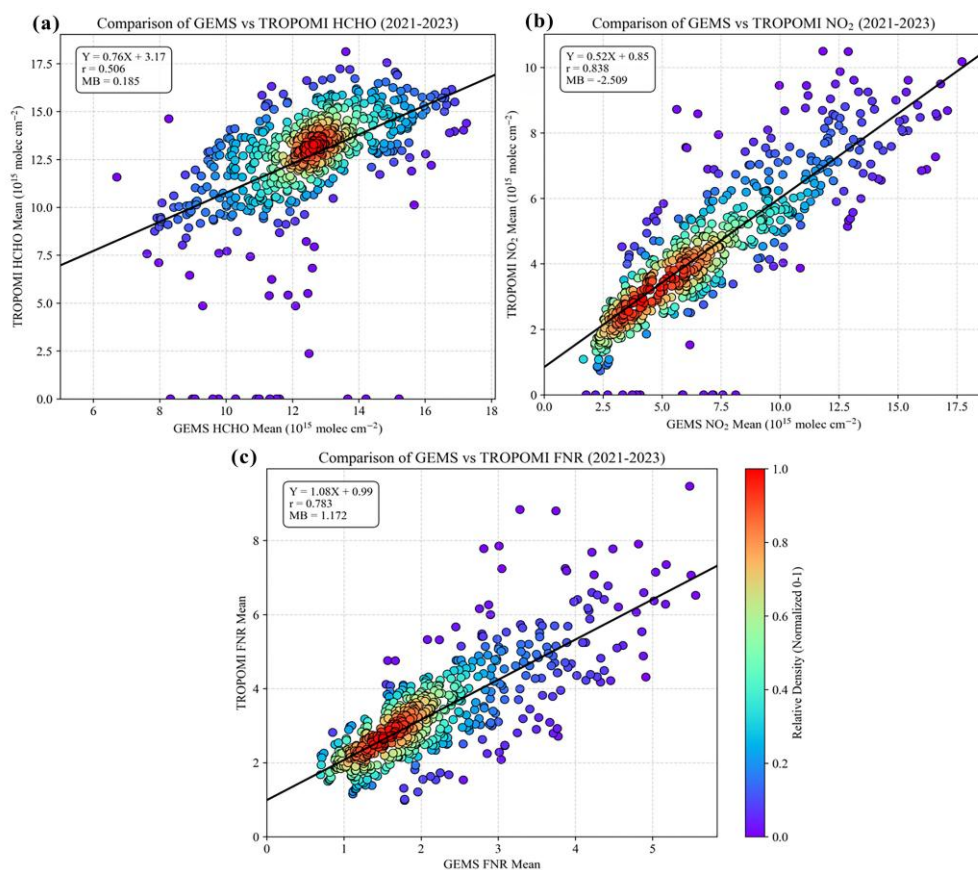


Figure S5. Comparison of GEMS and TROPOMI satellite data for HCHO (a), NO₂ (b), and FNR (c) at 13:00 local time during the warm season (2021–2023). Scatter colors indicate local point density, with darker colors representing higher density. The black line shows the linear fit, with the Pearson correlation coefficient (r) and mean bias (MB) indicated. The color bar represents relative density (0–1).

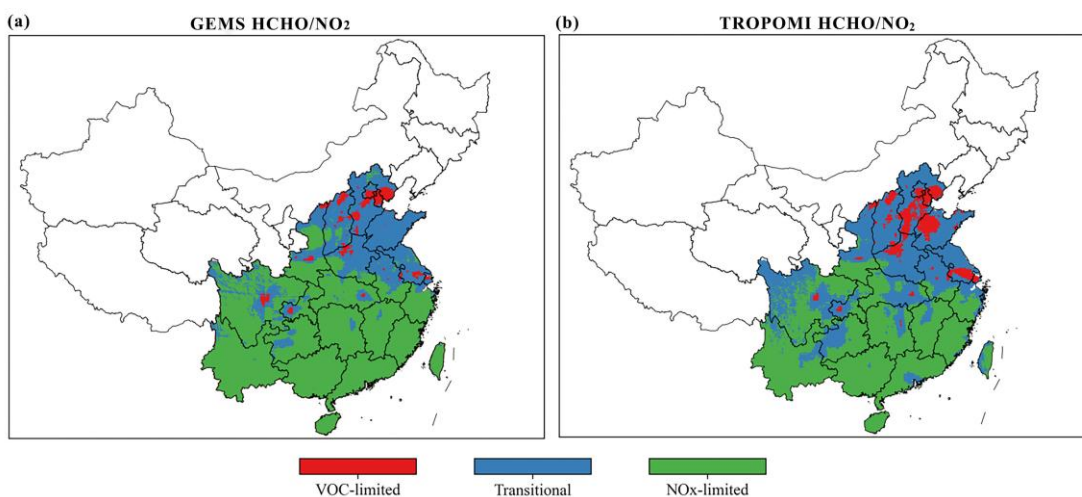


Figure S6. Spatial distribution of FNR from GEMS and TROPOMI satellites. (a) GEMS_FNR with a range of 1.3–2.2, derived from the LOESS fitting results in Section 3 of this study. (b) TROPOMI_FNR with a range of 1.7–3.5, based on the study by Li et al. (2024).

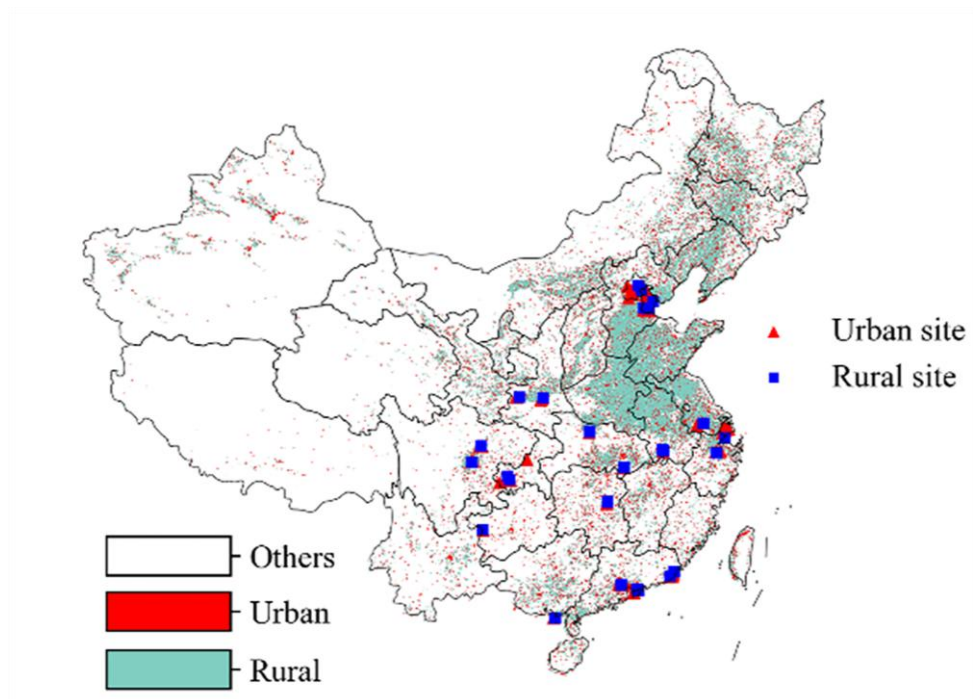


Figure S7. Spatial distribution of rural stations and their nearest corresponding urban stations.

Table S2. Spearman correlation coefficients between pollutants and meteorological variables in Beijing.

Pollutant	MetVar	N	Spearman ρ	p (corrected)
O ₃	RH	4376	-0.081	0.008
O ₃	T _{2m}	4376	0.189	<0.001
O ₃	SSR	4376	0.226	<0.001
O ₃	BLH	4376	0.367	<0.001
NO ₂	RH	4376	0.111	<0.001
NO ₂	T _{2m}	4376	-0.187	<0.001
NO ₂	SSR	4376	-0.384	<0.001
NO ₂	BLH	4376	-0.219	<0.001
HCHO	RH	4376	-0.107	<0.001
HCHO	T _{2m}	4376	0.119	<0.001
HCHO	SSR	4376	0.415	<0.001
HCHO	BLH	4376	0.117	0.010

Table S3. Spearman correlation coefficients between pollutants and meteorological variables in Nanjing.

Pollutant	MetVar	N	Spearman ρ	p (corrected)
O ₃	RH	4376	-0.262	<0.001
O ₃	T _{2m}	4376	0.280	<0.001
O ₃	SSR	4376	0.507	<0.001
O ₃	BLH	4376	0.387	<0.001
NO ₂	RH	4376	0.245	<0.001
NO ₂	T _{2m}	4376	-0.300	<0.001
NO ₂	SSR	4376	-0.056	0.003
NO ₂	BLH	4376	-0.017	0.016
HCHO	RH	4376	-0.120	<0.001
HCHO	T _{2m}	4376	0.270	<0.001
HCHO	SSR	4376	0.190	<0.001
HCHO	BLH	4376	0.077	<0.001

Table S4. Spearman correlation coefficients between pollutants and meteorological variables in Chengdu.

Pollutant	MetVar	N	Spearman ρ	p (corrected)
O ₃	RH	4376	-0.343	<0.001
O ₃	T _{2m}	4376	0.387	<0.001
O ₃	SSR	4376	0.343	<0.001
O ₃	BLH	4376	0.307	<0.001
NO ₂	RH	4376	-0.014	0.031
NO ₂	T _{2m}	4376	-0.245	<0.001
NO ₂	SSR	4376	-0.065	<0.001
NO ₂	BLH	4376	-0.117	<0.001
HCHO	RH	4376	-0.185	<0.001
HCHO	T _{2m}	4376	0.320	<0.001
HCHO	SSR	4376	0.140	0.009
HCHO	BLH	4376	0.133	<0.001

Table S5. Spearman correlation coefficients between pollutants and meteorological variables in Guangzhou.

Pollutant	MetVar	N	Spearman ρ	p (corrected)
O ₃	RH	4376	-0.244	<0.001
O ₃	T _{2m}	4376	0.475	<0.001
O ₃	SSR	4376	0.578	<0.001
O ₃	BLH	4376	0.445	<0.001
NO ₂	RH	4376	0.078	<0.001
NO ₂	T _{2m}	4376	-0.139	0.027
NO ₂	SSR	4376	-0.180	<0.001
NO ₂	BLH	4376	-0.058	0.016
HCHO	RH	4376	-0.024	<0.001
HCHO	T _{2m}	4376	0.220	<0.001
HCHO	SSR	4376	0.055	0.024
HCHO	BLH	4376	0.095	<0.001