Supporting Information

Table S1. The average and monthly average value of T, RH, WS.

Meteorological Parameters		T (℃)	RH (%)	WS (m/sec)
average		23.36	55.84	1.18
monthly average	June	28.38	34.48	1.67
	July	26.69	70.85	1.17
	August	25.98	58.82	1.16
	September	22.33	65.40	0.97
	October	13.42	49.64	0.94

Table S2. Overview on HONO field observations performed in Beijing since 2000.

Date	Site Property	HONO (ppbV)	$HONO/NO_2$	Emission Factor	Reference
May 16th-25th, 2000 Jun. 24th- Jul. 4th, 2000 Sep.7th-11th, 2000 Dec. 18th-28th, 2000	Urban site (Peking University) 39.54°N,116.23°E	3.51 3.05 2.66 2.97	-	---	(Hu et al., 2002)
Jul.-Aug., 2002 Jul.-Aug., 2003	Urban site (Peking University) 39.54°N,116.23°E	3.6	-	-	(Wu et al., 2009)
Jan.23nd-Feb.14th., 2007 Aug.2nd-Aug.31st., 2007	Urban site (Peking University) 39.99°N,116.28°E	1.04 1.45	0.03 0.05	0.0065	(Spataro et al., 2013)
Jul.2008-Apr.2009	Urban site (Institute of Atmospheric	0.19 (Spring) 0.18 (Summer)	0.015 (Spring) 0.008 (Summer)	-	(Hendrick et al., 2014)

	Physics of the Chinese Academy of Sciences, IAPCAS) 39.98°N,116.38°E	0.46 (Fall) 0.48 (Winter)	0.020 (Fall) 0.015 (Winter)		
Oct.28th-Nov.3rd, 2014	Urban site (Institute of Chemistry, Chinese Academy of Sciences, ICCAS) 39.99°N,116.32°E	1.45	0.039	0.0065	(Tong et al., 2015)
	Suburban Site (Lake yanqi campus of University of Chinese Academy of Sciences, UCAS) 40.4°N, 116.6°E	0.74	0.088		
Feb.22nd-Mar.2nd, 2014	Urban site (ICCAS) 39.99°N,116.32°E	0.28-3.24	-	0.0065	(Hou et al., 2016)
Dec.12th-Dec.22nd, 2015	Urban site (ICCAS) 39.99°N,116.32°E	0.86	0.052		(Tong et al., 2016)
	Suburban Site (Lake yanqi campus of UCAS) 40.4°N, 116.6°E	0.52	0.08		
Sep.22nd-Oct.21th,2015 Jan.3rd-Jan.27th,2016 Apr.1st-May14th,2016 Jun.20th-Jul.25th,2016	Urban site (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences) 40.0078°N, 116.33°E	2.27 (Fall) 1.05 (Winter) 1.05 (Spring) 1.38 (Summer)	0.070±0.033 0.046±0.024 0.041±0.023 0.079±0.014	-	(Wang et al., 2017)
Dec. 16th-23nd, 2016	Urban site (ICCAS) 39.99°N,116.32°E	3.5±2.7	-	0.013	(Zhang et al., 2019)
Apr. 14th-28th, 2017	Urban site (ICCAS) 39.99°N,116.32°E	1.21	-	0.008	(Lin et al., 2022)
Dec. 15th,2017-Jan. 4th, 2018	Urban site (ICCAS) 39.99°N,116.32°E	1.17±1.20	-	0.0051-0.0081	(Zhang et al., 2022a)
May 7th-30th, 2017 Jan. 15th-30th, 2018	Urban site (Chinese Research Academy of Environmental Sciences) (CRAES) 40°04′N, 116°42′E	1.25±0.94 (Summer) 1.04±1.27 (Winter)	0.072±0.052 (Summer) 0.041±0.026 (Winter)	0.008	(Gu et al., 2022)
Apr.-May, 2016 Jul.-Aug., 2017 Oct.-Nov., 2017 Dec. 2017- Feb., 2018	Urban site the Institute of Urban Meteorological 39°56′N,116°17′E	3.17 (Spring) 3.53 (Summer) 4.30 (Autumn) 1.70 (Winter)	-	-	(Su et al., 2021)
Aug. 18th-Sep. 16th, 2018	Suburban Site Qingyuan campus of Beijing Institute of Petrochemical Technology (BIPT)	0.38 ± 0.35	-	0.0085	(Xuan et al., 2023)

Oct. 25th-Dec. 7th, 2018	Urban site (ICCAS) 39.99°N,116.32°E IAPCAS 39.98°N,116.38°E	2.52±1.61		0.00973	(Zhang et al., 2023b)
May 25th-Jul.15th, 2018 Nov. 26th, 2018-Jan. 15th, 2019	IAPCAS 39.98°N,116.38°E	1.27±0.44 (Summer) 1.13±0.68 (Winter)	6.75±1.43% (Summer) 5.09±2.69% (Winter)	0.0078	(Liu et al., 2021)
Dec. 22nd, 2018-Jan. 23rd, 2019	Urban site (ICCAS) 39.99°N,116.32°E	0.98±0.85	-	0.0051-0.0081	(Zhang et al., 2022b)
Jun. 13th-Jul.4th, 2019	Urban site (CRAES) 40°04′N, 116°42′E	0.44±0.24	-	0.003,0.0065,0.008	(Li et al., 2021)
Jan. 22th-Feb. 28th, 2018; Dec. 1st, 2018-Feb. 28th, 2019; Dec. 1st, 2019-Feb. 28th, 2020; Dec. 1st, 2020-Feb. 28th, 2021;	Urban site, (West Campus of Beijing University of Chemical Technology) 39.95°N,116.31°E	0.66 (2018) 1.38 (2019) 0.95 (2020) 1.30 (2021)	0.038(2018) 0.052 (2019) 0.042 (2020) 0.067 (2021)	0.0079	(Lian et al., 2022)
Oct. 1st-Oct. 31st,2019	Urban site (ICCAS) 39.99°N,116.32°E	0.99	-	-	(Jia et al., 2023)
Mar. 1st-30th, 2021	Urban site (ICCAS) 39.99°N,116.32°E	1.48±1.09	0.07	0.008	(Zhang et al., 2023a)
Jun.18th-Oct.25th, 2021	Urban site (CRAES) 40°04′N, 116°42′E	1.06	0.052	0.0172	This work

Table S3. Correlations of Punknown against various parameters during the observation period.

Parameters	June	July	August	summer	September	October	autumn	sum

	R, N = 42	R, N = 82	R, N = 103	R, N= 227	R, N = 102	R, N = 64	R, N= 166	R, N= 393
NO_2	0.42	0.42	-0.3	0.19	-0.05	0.08	-0.21	-0.09
JNO_2	-0.18	0.038	-0.076	-0.044	0.21	-0.13	0.23	0.12
$PM_{2.5}$	0.66	0.49	0.06	0.30	-0.20	0.16	-0.088	0.05
RH	0.63	0.04	-0.38	0.05	-0.23	0.11	-0.067	-0.003
NO_3^-	0.39	0.48	-0.17	0.21	-0.16	0.16	-0.083	0.007
JNO_2*RH	0.71	0.15	-0.36	0.039	-0.024	-0.025	0.20	0.13
NO_2*$PM_{2.5}$	0.57	0.50	-0.1	0.28	-0.19	0.034	-0.17	-0.077
NO_2*OC	0.57	0.45	-0.058	0.26	-0.15	0.062	-0.17	-10^{-4}
NO_2*EC	0.22	0.32	-0.12	0.15	-0.14	0.11	-0.16	-0.078
NO_2*JNO_2*$PM_{2.5}$	0.62	0.32	-0.12	0.24	-0.11	-0.06	-0.11	-0.02
NO_2*JNO_2*RH*$PM_{2.5}$	0.60	0.33	-0.18	0.22	-0.12	-0.049	-0.092	0.019
NO_2*JNO_2*OC	0.58	0.21	-0.12	0.19	-0.031	-0.1	-0.013	0.09
NO_2*JNO_2*RH*OC	0.62	0.26	-0.18	0.20	-0.07	-0.04	0.008	0.12
NO_2*JNO_2*EC	0.36	0.22	-0.15	0.095	-0.11	-0.1	-0.12	-0.05
NO_2*JNO_2*RH*EC	0.41	0.22	-0.19	0.088	-0.13	-0.07	-0.10	-0.021
JNO_2*NO_3^-	0.48	0.29	-0.20	0.18	-0.09	0.032	0.005	0.065
JNO_2*RH*NO_3^-	0.50	0.30	-0.24	0.16	-0.10	0.006	0.047	0.11
JNO_2*NO_3*SO_4^{2-}	0.26	0.32	-0.14	0.10	-0.16	0.13	-0.023	0.021
JNO_2*RH*NO_3*SO_4^{2-}	0.23	0.33	-0.17	0.092	-0.15	0.16	0.0069	0.049
JNO_2*NO_3*Cl^-	0.16	0.46	-0.26	0.17	-0.12	0.093	-0.074	-0.0085
JNO_2*RH*NO_3*Cl^-	0.14	0.44	-0.27	-0.029	-0.11	0.075	-0.058	0.052
JNO_2*NO_3^-*OC	0.55	0.26	-0.05	0.19	-0.14	0.045	-0.05	0.038
JNO_2*RH*NO_3*OC	0.52	0.29	-0.23	0.18	-0.11	0.027	-0.020	-0.079

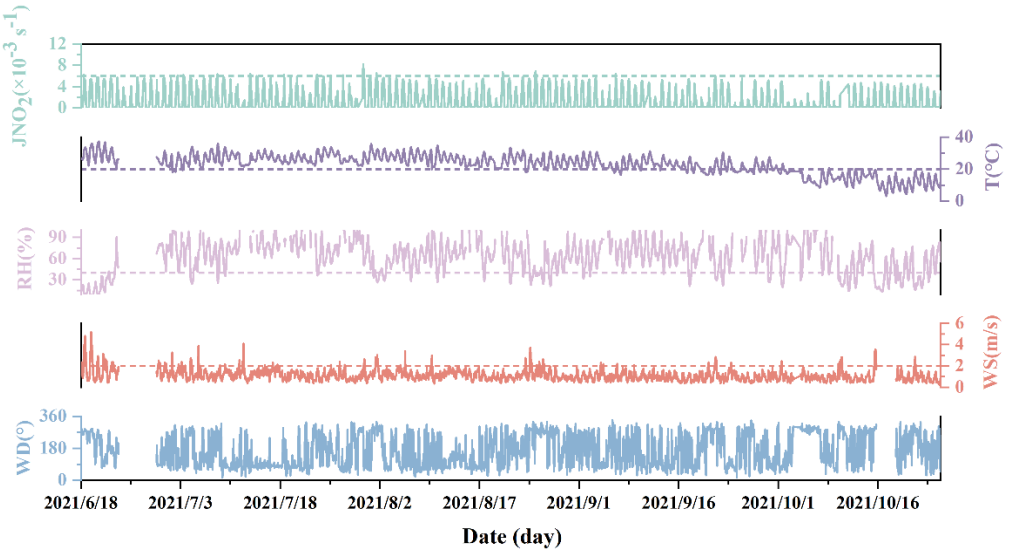
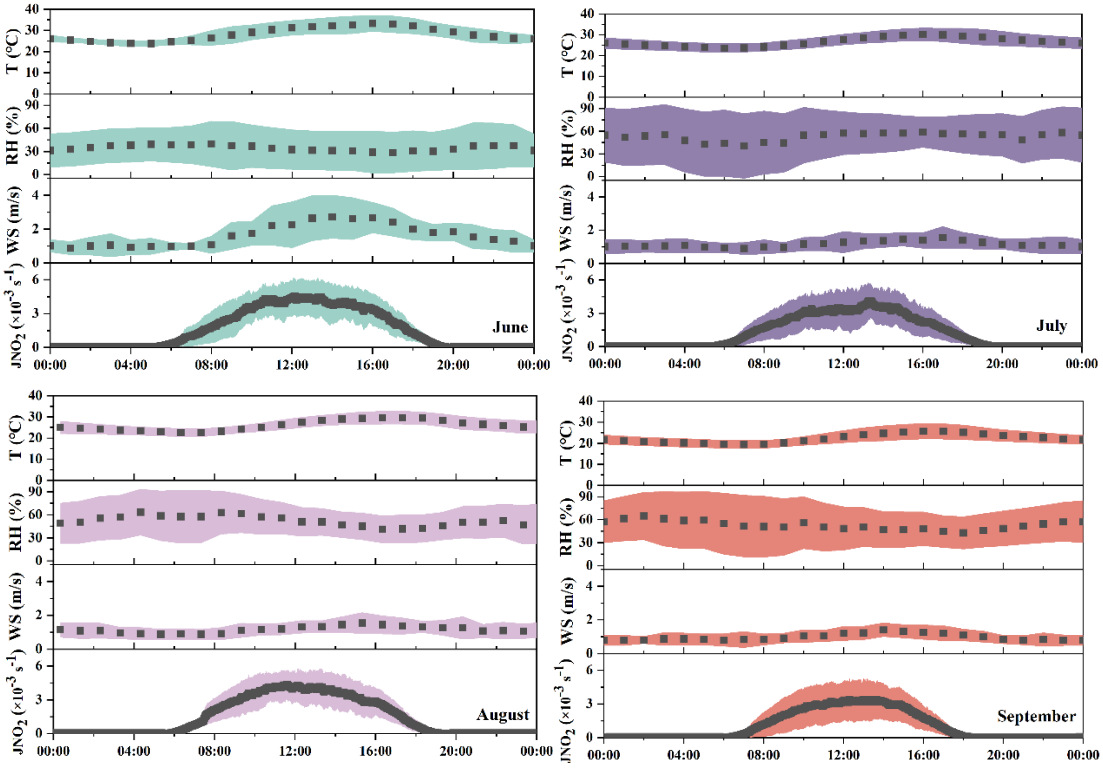


Figure S1. Temporal trends of hourly average RH, T, WD, WS, and JNO2 during the measurement.



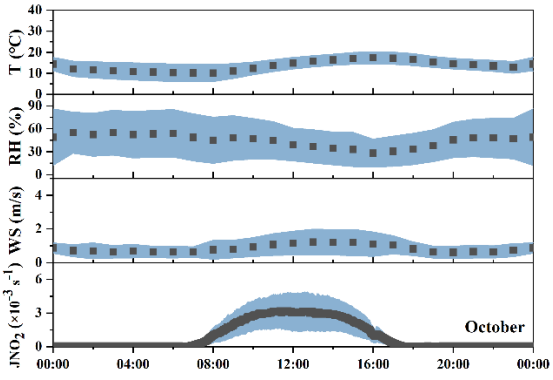
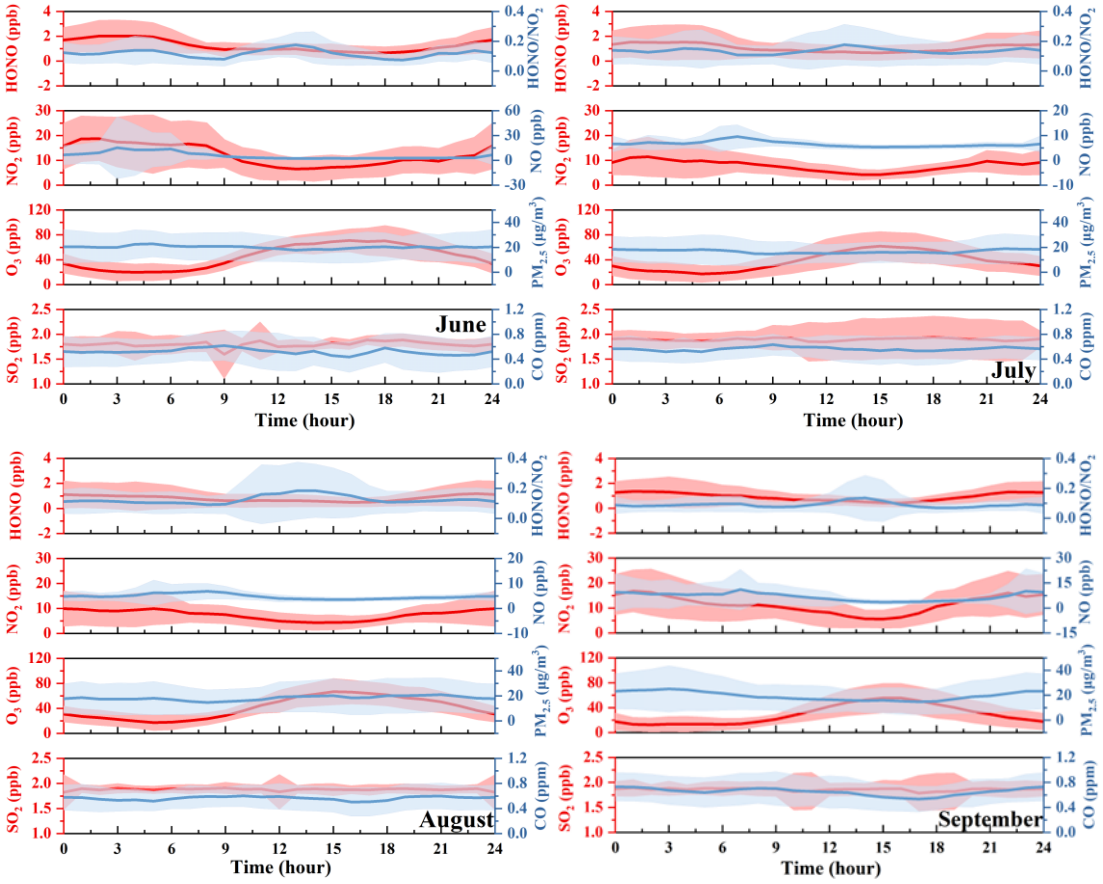


Figure S2. Daily averaged variation of several meteorology data during the observation.



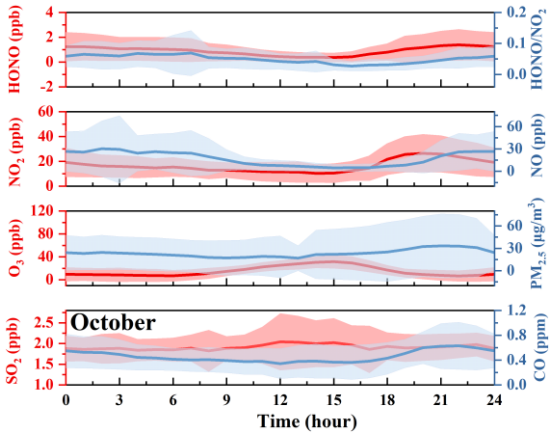


Figure S3. Daily averaged values of several parameters during the observation. The shaded areas represent the standard deviation of the corresponding pollutant concentration.

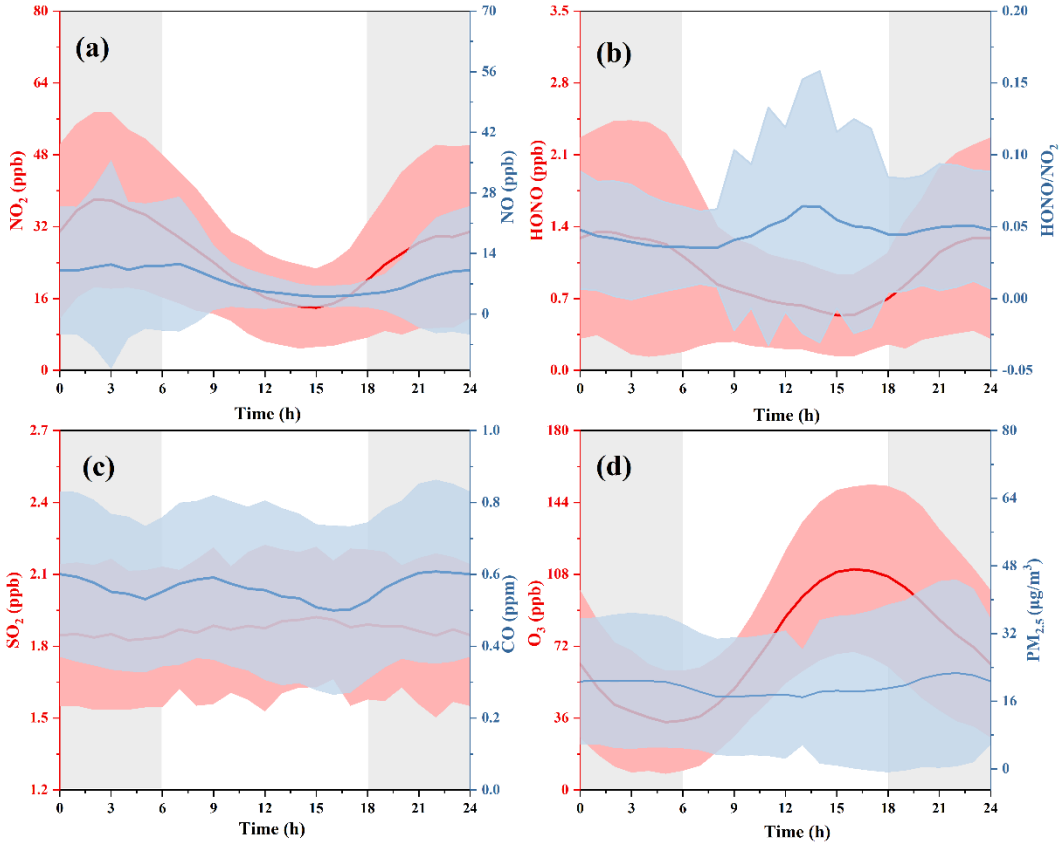


Figure S4. Daily averaged values of several parameters during the observation. The shaded areas represent the standard deviation of the corresponding pollutant concentration. The gray shading areas indicate nighttime, 18:00-06:00 LT.

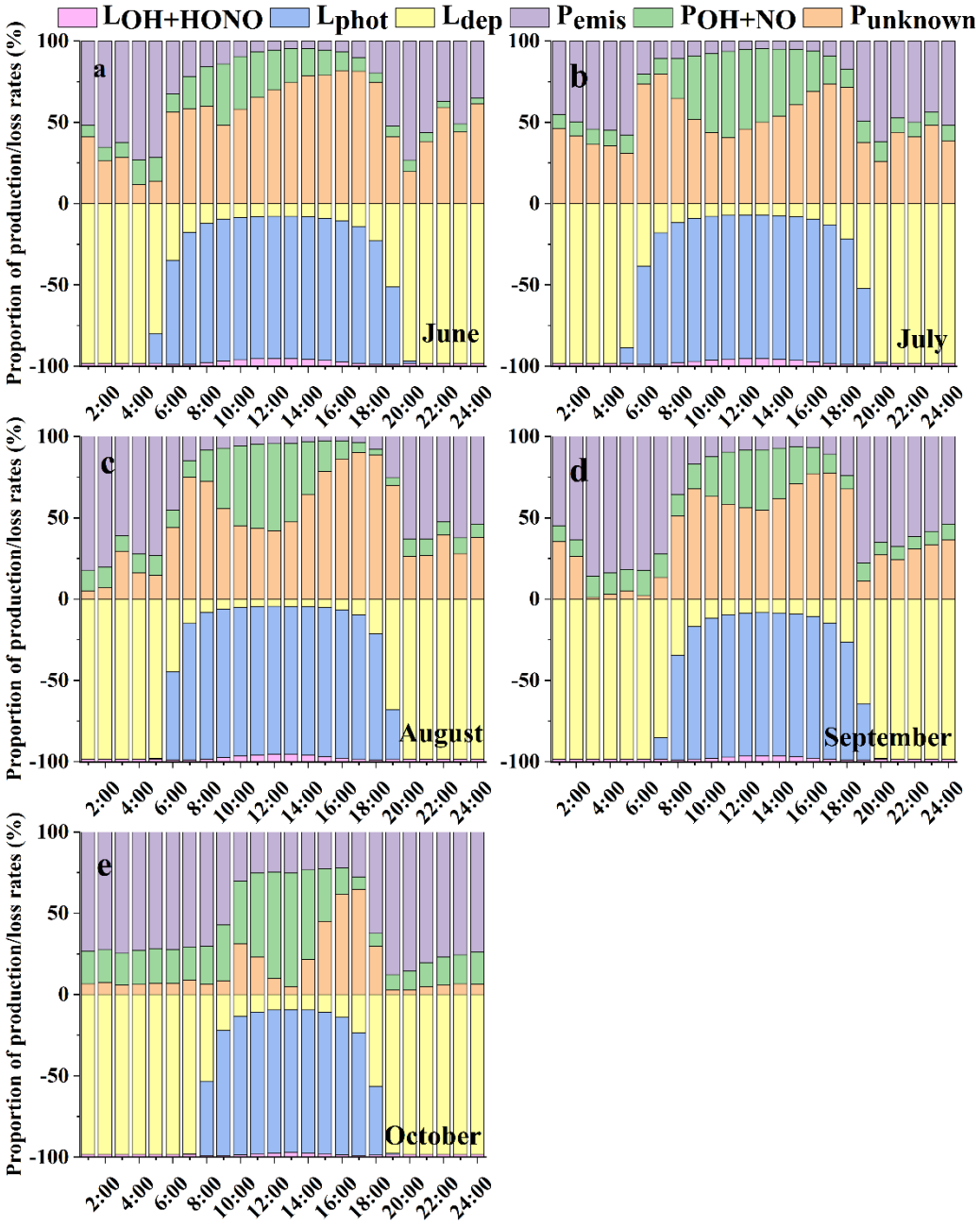


Figure S5. Daytime HONO budget proportion in average production (Pemis, PNO+OH, Punknown) and loss rates (LOH+HONO, Lphot, Ldep) during the five months: (a) June, (b) July, (c) August, (d) September, (e) October.

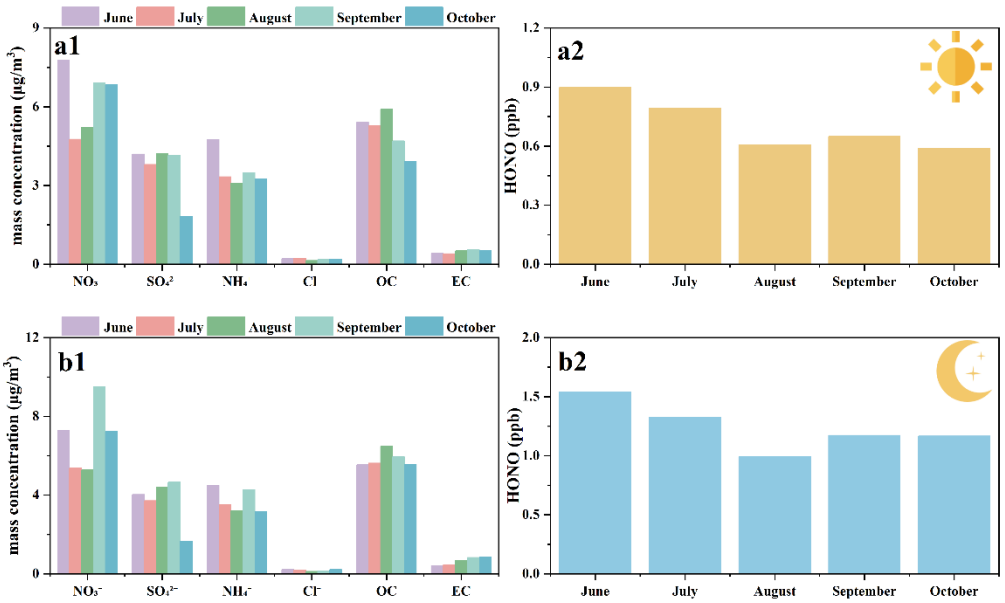


Figure S6. Distributions of NO_3^-, SO_4^{2-}, NH_4^+, Cl^-, OC, EC, and HONO mean concentrations under different months. The upper panel was the daytime average value (7:00-18:00), and the bottom panel was the nighttime average value (19:00-6:00)

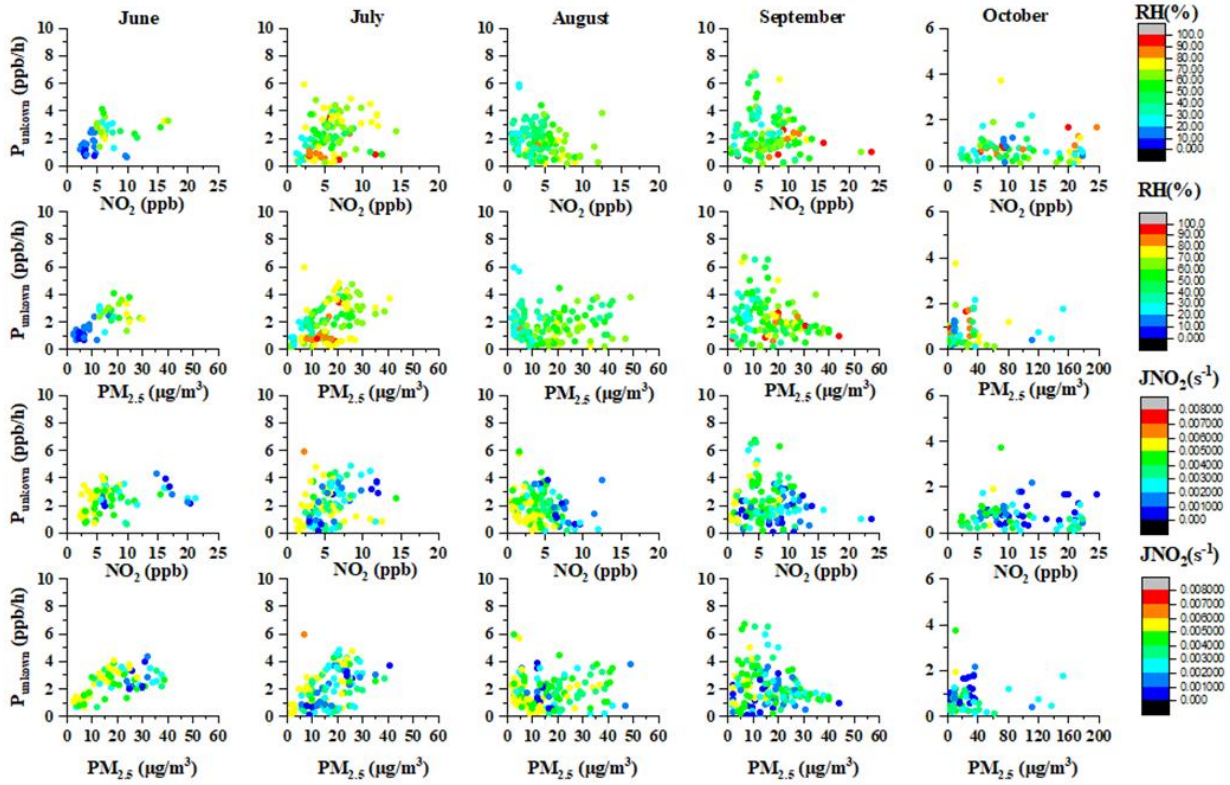


Figure S7. Scatter plots of Punkown versus NO_2 and $PM_{2.5}$ concentrations by month with colormaps to distinguish the changes in relative humidity (RH) and JNO_2

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