

Measurement of the vertical distributions of atmospheric pollutants using an
uncrewed aerial vehicle platform in Xi'an, China

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Supplementary material

Tables:

Table S1

Summary of uncrewed aerial vehicle (UAV) flights.

Flight NO.	Date	Flight time (duration/min)	Flight NO.	Date	Flight time (duration/min)
1	July 4	15:05-15:13(9)	14	July 7	18:07-18:11(5)
2	July 4	18:27-18:35(9)	15	July 7	23:47-23:55(9)
3	July 4	00:14-00:22(9)	16	November 26	07:53-08:01(9)
4	July 5	08:14-08:22(9)	17	November 26	13:38-13:46(9)
5	July 5	13:15-13:23(9)	18	November 26	18:59-19:07(9)
6	July 5	18:13-18:21(9)	19	November 26	22:51-22:59(9)
7	July 5	23:43-23:51(9)	20	November 27	08:44-08:52(9)
8	July 6	07:14-07:22(9)	21	November 27	13:01-13:09(9)
9	July 6	13:47-13:55(9)	22	November 27	18:03-18:11(9)
10	July 6	18:13-18:21(9)	23	November 27	22:56-23:04(9)
11	July 6	23:13-23:21(9)	24	November 28	08:08-08:16(9)
12	July 7	08:46-08:50(5)	25	November 28	23:13-23:21(9)
13	July 7	13:21-13:29(9)	26	November 30	22:52-23:00(9)

Table S2

Sensor package components and their parameters.

Item	Manufacturer	Dimensions (cm)	Weight (g)	Limit of detection	Range
O ₃	Alphasense, UK	2*3.2(H*ID)	6	1 ppb	0–20 ppm
CO	Alphasense, UK	2*3.2(H*ID)	12	1 ppb	0–20 ppm
PM	Alphasense, UK	7.5*6*6(LWH)	105	10 µg/m ³	0–2000 µg/m ³

Table S3

The pollutant concentrations and wind direction from the nearest ground monitoring station (24.5 km away from the observation site, between observation site and urban area of Xi'an), obtained through the Moji Weather software.

Date	Time	Wind direction	AQI	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)	O ₃ ($\mu\text{g}/\text{m}^3$)	CO (mg/m^3)
2021/7/4	13:00	northwest	128	62	80	256	0.7
	18:00	southeast	65	25	75	172	0.6
	23:30	northwest	24	13	24	48	0.4
2021/7/5	08:00	north	63	28	75	30	0.6
	13:00	northeast	73	31	96	78	0.8
	18:00	southeast	61	18	72	166	0.6
	23:30	west	24	14	24	49	0.6
2021/7/6	08:00	southeast	53	17	56	7	0.7
	13:00	southwest	53	23	56	145	0.7
	18:00	southeast	47	16	24	149	0.7
	23:30	east	61	15	71	90	0.7
2021/7/7	08:00	breeze	29	13	29	32	0.7
	13:00	east	46	15	39	147	0.3
	18:00	northeast	132	24	53	264	0.4
	23:30	southeast	54	27	57	99	0.5
2021/11/26	08:00	southwest	73	38	95	4	0.6
	13:00	southwest	137	104	153	18	1
	18:00	southwest	132	100	178	35	1.1
	23:30	northwest	185	139	227	5	1.6
2021/11/27	08:00	west	156	119	186	5	1.1
	13:00	northwest	223	173	283	8	1.7
	18:00	southeast	247	197	288	5	1.7
2021/11/28	23:30	southwest	264	214	300	5	1.8
	08:00	southwest	216	166	224	5	1.5
	23:30	southwest	240	190	283	17	1.3
2021/11/30	23:30	southeast	57	34	64	5	0.7

Figs:



Fig. S1 A hexacopter uncrewed aerial vehicle carrying the miniature atmospheric detector.

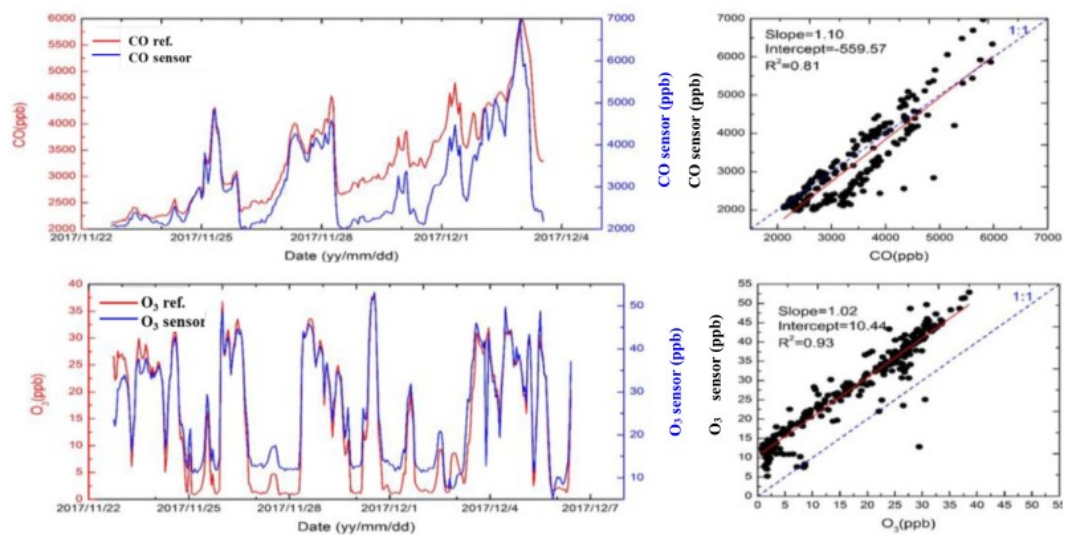


Fig. S2 Comparison between air pollutant sensors (CO and O₃) (Alphasense B Series) and reference apparatus (Thermo Fisher, USA) (Pang et al., 2021).

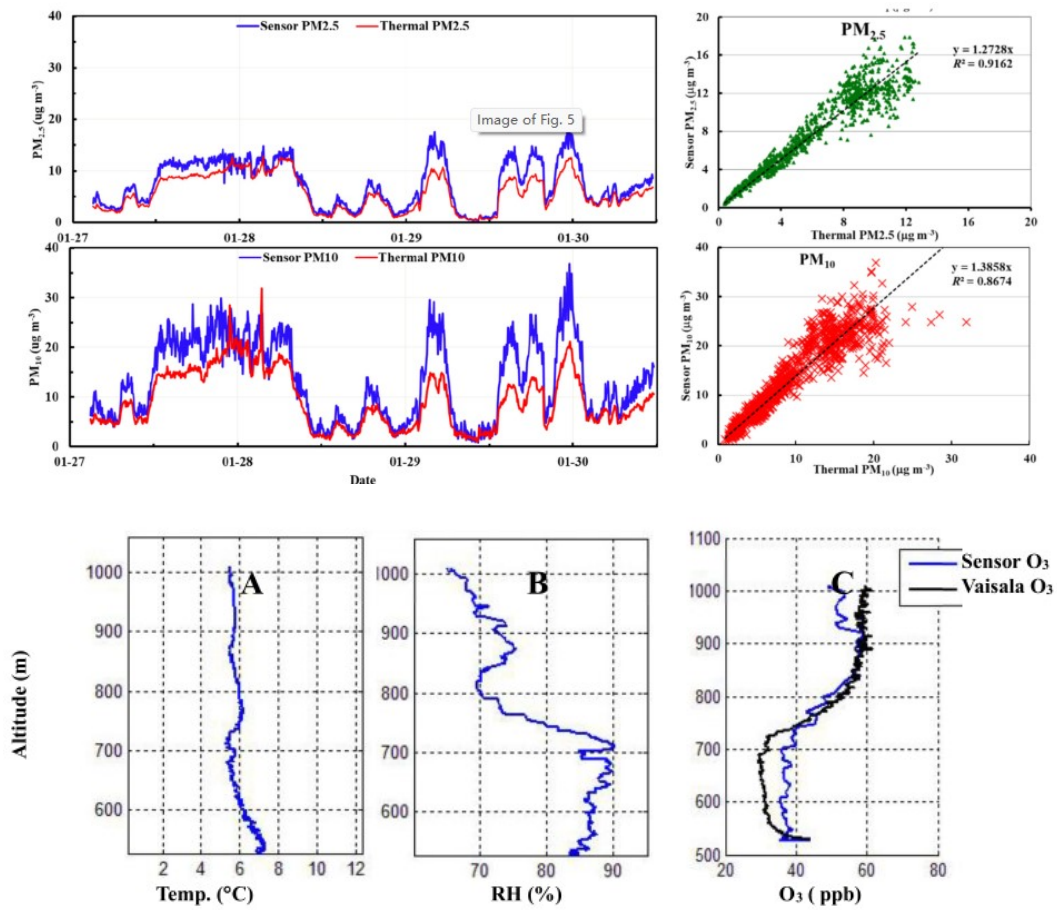


Fig. S3 Comparison between PM sensor (Alphasense OPC-N2), O₃ sensor (Alphasense) and reference PM apparatus (Thermo Fisher, 5030i PM SHARP Monitor), reference O₃ apparatus (Vaisala, O₃ Sounding Monitor) (Pang et al., 2021).

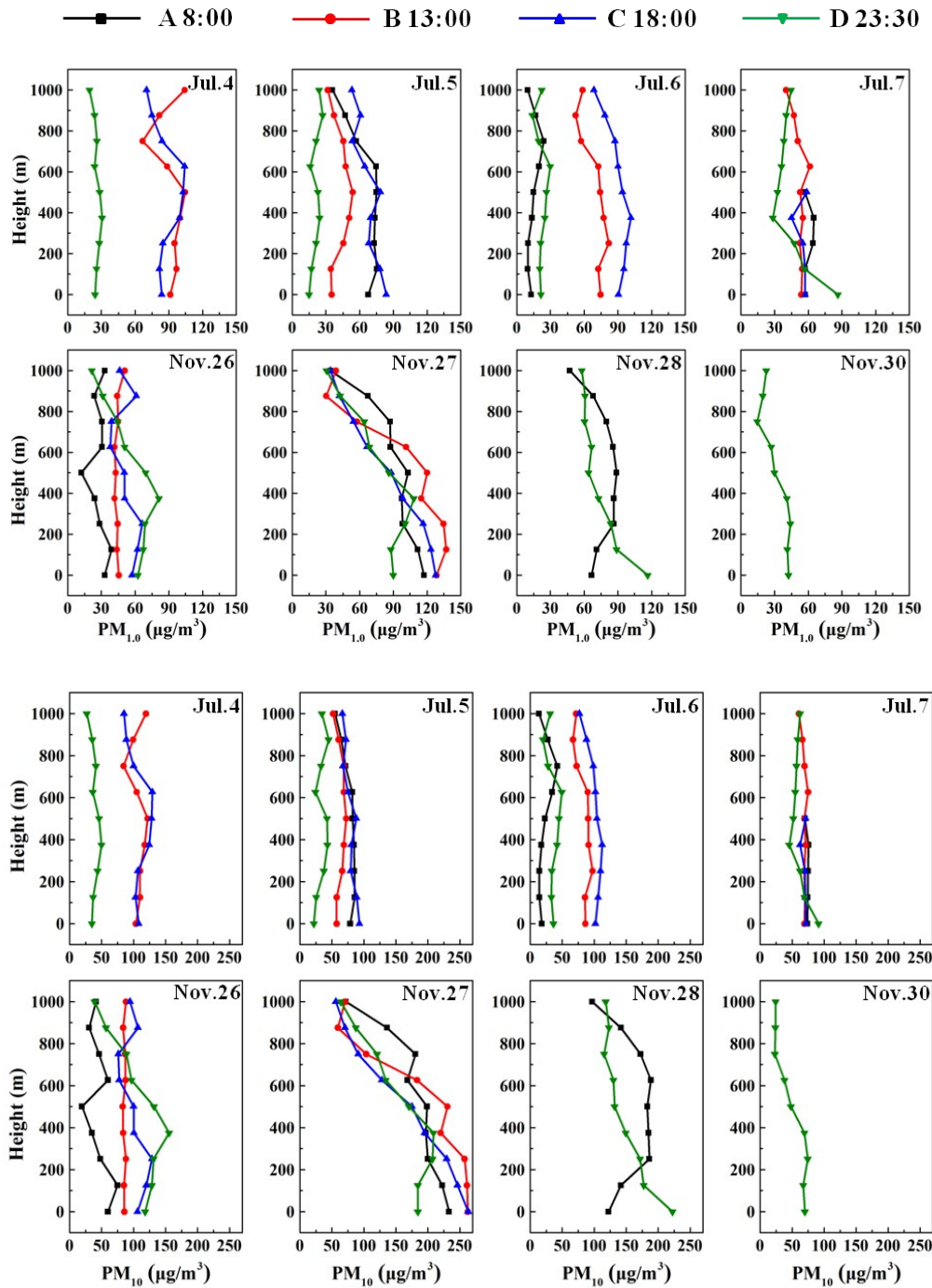


Fig. S4 Vertical variations of $PM_{1.0}$ and PM_{10} concentrations during July (4, 5, 6 and 7) and November (26, 27, 28 and 30), 2021.

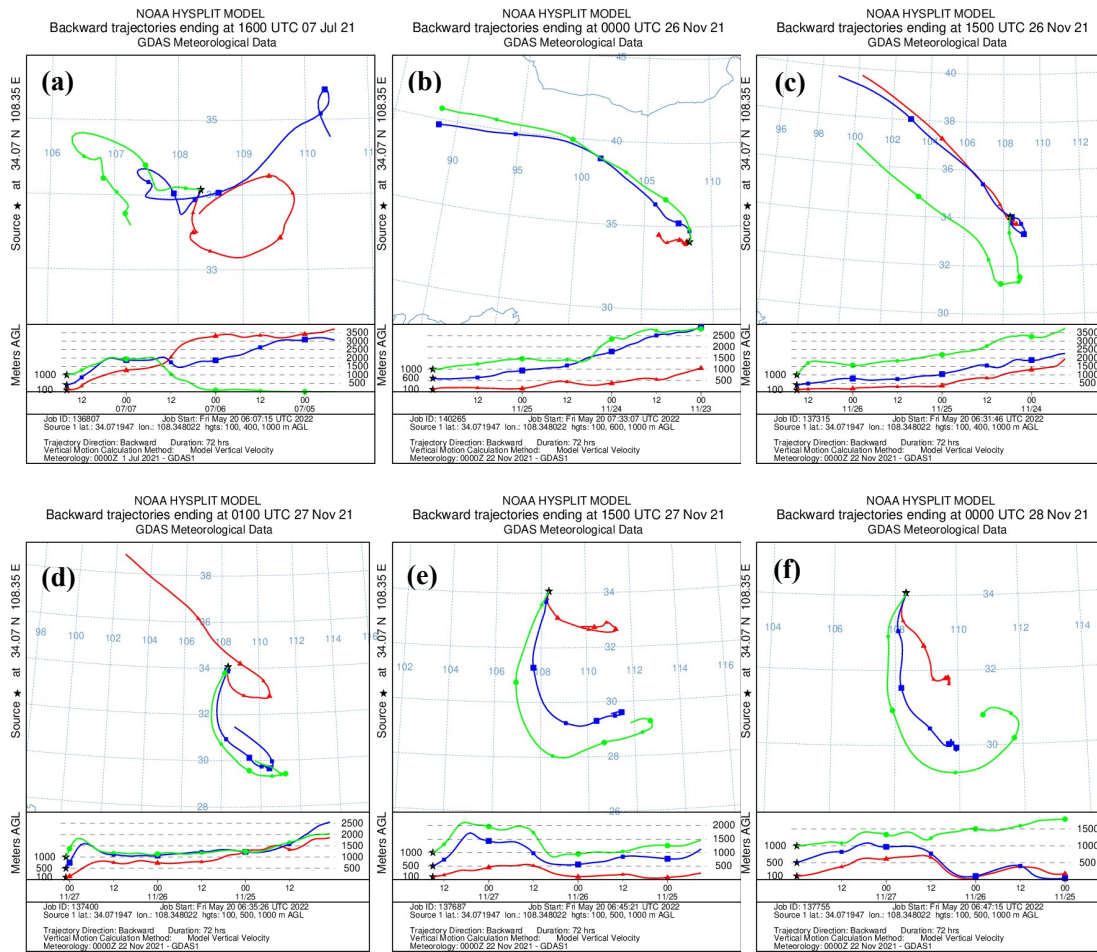


Fig. S5 The 72-h backward trajectories arriving at the observational site on July 7 and November (26, 27, and 28) at an arrival time (Beijing time) of (a) 23:30 on July 7, (b) 08:00 on November 26, (c) 23:00 on November 26, (d) 9:00 on November 27, (e) 23:00 on November 27, and (f) 08:00 on November 28. The time in the figure is given in UTC, which is 8 hours later than Beijing time.