Supporting Materials

Text S1

Ansys Fluent is a comprehensive CFD software widely used in both engineering and research to simulate fluid flow and heat transfer. It offers a wide range of physical models and numerical schemes applicable to various flow scenarios, including incompressible/compressible flows, laminar/turbulent flows, multiphase flows, heat transfer, and chemical reactions [1-3]. Ansys Fluent utilizes numerical simulation and iterative solving methods based on the finite volume method to discretize flow equations. The Fluent module enables users to define physical models, set boundary conditions, and perform meshing, solving fluid flow equations via partial differential equations. The post-processing tool, CFD-Post, is then used to analyze and visualize simulation results. In this study, we employed the finite volume method for Reynolds-Averaged Navier-Stokes (RANS) simulations. The Navier-Stokes equations, based on the conservation laws of mass, momentum, and energy, are used to calculate the flow field while accounting for fluid viscosity to yield more realistic results.

This study employed the Shear Stress Transfer (SST) k-ω turbulence model to calculate the viscous effects of the fluid. The SST k-ω model combines the advantages of both the k-ω model and the k-ε model, using the k-ω model within the boundary layer and the k-ε model in the free flow region. This allows for more accurate prediction of flow separation phenomena and improves the accuracy of simulation results. By solving the transport equations for k and ω, the turbulent shear stress and turbulent viscosity were calculated, thereby simulating parameters such as flow velocity and turbulence intensity in turbulent flow [4-6]:

k-equation (Turbulent Kinetic Energy Equation):

$$\frac{\partial(\varrho u_i k)}{\partial x_i} = \tau_{ij}\frac{\partial u_i}{\partial x_j} - \beta^* \varrho k\omega + \frac{\partial}{\partial x_j}[(\mu+\sigma_k\mu_t)\frac{\partial k}{\partial x_j} \quad (1)$$

ω-equation (Turbulent Dissipation Rate Equation):

$$\frac{\partial(\varrho u_i \omega)}{\partial x_i} = \frac{\gamma}{v_t}\tau_{ij}\frac{\partial u_i}{\partial x_j} - \beta\varrho\omega^2 + \frac{\partial}{\partial x_j}\left[(\mu+\sigma_\omega\mu_t)\frac{\partial \omega}{\partial x_j}\right] + 2(1-F_1)\varrho\sigma_{\omega 2}\frac{1}{\omega}\frac{\partial k}{\partial x_j}\frac{\partial \omega}{\partial x_j} \quad (2)$$

$$\mu_t = \frac{a_1 \varrho k}{\max(a_1\omega, SF_2)} \quad (3)$$

in the equations, μ represents dynamic viscosity; μ_t denotes turbulent viscosity; S stands for the strain rate; F_1 and F_2 are blending functions. Boundary conditions and flow field simulation were set up using the Fluent module. The simulation medium was set as air, with atmospheric pressure at 1 atm, temperature at 288.16 K, and gravity acceleration in the -z direction with a magnitude of 9.8 m/s^2. The solid material selected was aluminum with a density of 2.719 g/cm^3. Pressure-inlet and pressure-outlet boundary conditions were applied to the wall surfaces. For the M300 RTK, the maximum rotor speed could set at 5489 rpm, and the average rotor speed during hovering was 2685 rpm. For the UAV's ascending, hovering, and descending processes, simulations were conducted for three different rotor speeds: 5489 rpm, 2685 rpm, and 1500 rpm. Additionally, the presence of significant crosswinds in the environment could impact the stability and sampling accuracy of the UAV. Therefore, for the hovering state (with a rotor speed of 2685 rpm), three different wind speeds (2 m/s, 6 m/s, and 10 m/s) were set in the x-direction for flow field simulations.

Table S1. Specifications of DJI Matrice 300 RTK.

Name	Parameters
Dimensions (excluding propellers) (mm)	810 × 670 × 430（L × W × H）
Maximum payload (g)	2700
Average hovering speed (rpm)	2685
Longest flight time (min)	55
Maximum rotation speed (rpm)	5489
Maximum ascent speed (m/s)	6
Maximum descent speed (m/s)	5
Maximum withstand able wind speed (m/s)	12

Table S2. Sensor module technical specifications.

Parameters	Measuring range	Accuracy	Resolution
Atmospheric pressure	30~125 kPa	± 0.08 hPa	0.01 hPa
Temperature	-10℃~+60℃	± 0.5℃	0.1℃
Relative humidity	0%~100%	± 3% RH	0.1% RH
$PM_{2.5}$	0~500 μg/m³	± 15% FS（Full Scale）	1 μg/m³
PM_{10}	0~500 μg/m³	± 15% FS	1 μg/m³

Table S3. 123 standard gases and method detection limits.

VOCs	RFRSD(%)	MDL	VOCs	RFRSD（%）	MDL
Ethane	20.0	0.2	Bromomethane	7.9	0.1
Propane	2.6	0.4	Chloroethane	3.3	0.1
Isobutane	2.6	0.3	Trichloromonofluoromethane	16.1	0.9
n-Butane	10.3	0.5	Vinylidene chloride	8.1	0.4
2-Methylbutane	16.2	0.6	Dichloromethane	23.1	0.1
Pentane	19.2	0.7	1,1,2-Trichlorotrifluoroethane	11.8	0.1
2,2-Dimethylbutane	19.9	0.5	trans-1,2-Dichloroethylene	14.6	0.3
Cyclopentane	10.2	0.3	1,1-Dichloroethane	3.6	0.1
2,3-Dimethylbutane	16.9	0.3	cis-1,2-Dichloroethene	11.4	0.3
2-Methylpentane	18.3	0.4	Chloroform	22.6	0.3
3-Methylpentane	16.4	0.5	1,2-Dichloroethane-d4	10.3	0.1
n-Hexane	8.2	0.2	1,1,1-Trichlorethane	16.2	0.3
Methylcyclopentane	16.8	0.2	Carbon tetrachloride	14.7	0.4
2,4-Dimethylpentane	12.5	0.1	1,2-Dichloropropane	18.3	0.2
Cyclohexane	15.2	0.1	Bromodichloromethane	14.2	0.3
2-Methylhexane	12.3	0.1	Trichloroethylene	16.1	1.1
2,3-Dimethylpentane	6.1	0.1	trans-1,3-Dichloropropene	12.6	0.1
3-Methylhexane	9.9	0.2	cis-1,3-Dichloropropene	15.1	0.2
2,2,4-Trimethylpentane	13.8	0.1	1,1,2-Trichloroethane	10.4	0.1
Heptane	21.5	0.2	Chlorodibromomethane	8.9	0.2
Methylcyclohexane	20.6	0.3	1,2-Dibromoethane	13.7	0.1
2,3,4-Trimethylpentane	20.3	0.2	Perchlorethylene	12.3	0.1

Table S3. 123 standard gases and method detection limits (continued Table S3).

2-Methylheptane	11.6	0.1	Bromoform	16.7	0.2
3-Methylheptane	24.8	0.2	Tetrachloroethane	24.9	0.2
Octane	19.1	0.1	1,4-Dichlorobenzene	10.6	0.2
Nonane	23.6	0.4	1,2-Dichlorobenzene	4.4	0.1
n-Decane	19.4	0.2	1,3-Dichlorobenzene	4.6	0.1
Undecane	14.7	0.2	1,2,4-Trichlorobenzene	13.5	0.1
Dodecane	10.7	0.2	Hexachlorobutadiene	22.9	0.2
Dichlorodifluoromethane	9.4	0.1	Acetonitrile	3.2	0.2
Chloromethane	9.2	0.1	Benzene	2.8	0.1
1,2-Dichlorotetrafluoroethane	9.7	0.1	Toluene	13.5	0.2
Vinyl Chloride	5.9	0.4	Chlorobenzene	11.7	0.1
Ethylbenzene	19.2	0.1	Propylene	2.8	0.3
p-Xylene	19.0	0.1	1-Butene	15.1	0.6
Styrene	18.9	0.2	1,3-Butadiene	14.4	0.5
o-Xylene	19.4	0.1	trans-2-Butene	14.3	0.5
Cumene	15.3	0.1	cis-2-Butene	17.5	0.4
n-Propylbenzene	17.0	0.1	1-Pentene	22.1	0.6
3-Ethyltoluene	23.0	0.1	Isoprene	19.7	0.4
p-Ethyltoluene	17.6	0.1	trans-2-Pentene	21.7	0.7
Mesitylene	19.0	0.1	cis-2-Pentene	21.8	0.6
o-Ethyltoluene	21.3	0.2	1-Hexene	15.4	0.3
1,2,4-Trimethylbenzene	23.2	0.1	Carbon disulfide	6.3	0.1
Benzyl Chloride	4.2	0.1	α-Pinene	23.6	0.2
1,2,3-Trimethylbenzene	23.5	0.1	β-Pinene	22.8	0.3
m-Diethylbenzene	20.1	0.1	D-Limonene	12.8	0.7
p-Diethylbenzene	14.0	0.2	Eucalyptol	11.8	0.6
Naphthalene	23.5	0.2	γ-Terpinene	15.9	0.1
Acetaldehyde	6.5	0.4	Acetylene	12.6	0.1
Acrolein	21.6	0.8			
Acetone	15.4	0.4			
Propanal	15.6	0.5			
i-propylalcohol	10.9	0.1			
Methacrolein	18.4	0.6			
tert-Butylmethyl ether	19.6	0.5			
Vinylacetate	12.9	0.3			
Butanal	15.7	0.7			
2-Butanone	22.1	0.4			
Ethyl acetate	11.8	0.2			
Tetrahydrofuran	16.9	0.3			
Crotonaldehyde	23.5	0.7			
2-Pentanone	11.4	0.5			
Pentanal	16.6	0.1			
3-Pentanone	12.9	0.1			

Table S3. 123 standard gases and method detection limits (continued Table S3).

1,4-Dioxane	9.7	0.1
Methyl methacrylate	17.9	0.1
Methyl Isobutyl Ketone	19.5	0.7
2-Hexanone	23.8	0.8
Hexanal	24.6	0.6
Benzaldehyde	20.1	0.8
3-Methylbenzaldehyde	20.9	0.6
Ethylene	18.6	0.1

Table S4. Measurement results and sample stability rates of samples in quartz and SUMMA canisters on day 0 and day 3.

VOCs	quartz Day 0 ppbv	SUMMA Day 0 ppbv	quartz Day 3 ppbv	SUMMA Day 3 ppbv	quartz stability	SUMMA stability
3-Methylhexane	7.5	7.7	7.3	8.6	97.66%	111.82%
2,2,4-Trimethylpentane	9.5	9.5	9.1	10.2	95.57%	106.63%
2-Methylhexane	9.4	9.5	9.2	10.2	97.25%	106.66%
Cyclohexane	9.9	9.7	9.1	10.3	92.72%	106.78%
Propane	9.9	9.7	8.5	9.9	85.41%	101.66%
n-Decane	11.1	9.7	8.4	12.2	76.02%	125.62%
2,3-Dimethylpentane	9.6	9.7	9.3	10.2	96.73%	105.24%
Methylcyclopentane	9.8	10	9.4	10.4	96.14%	104.85%
2,4-Dimethylpentane	9.9	10	9.4	10.3	94.49%	102.86%
3-Methylheptane	10.5	10.1	9.5	11.8	89.86%	116.77%
2,2-Dimethylbutane	10	10.1	9.4	10.5	94.16%	103.59%
2,3,4-Trimethylpentane	10.6	10.1	9.7	11.8	90.98%	115.88%
Ethane	9.8	9.2	8.8	10.2	89.88%	110.98%
Cyclopentane	9.3	9.3	8.7	9.7	93.39%	104.39%
Octane	10.2	9.4	8.9	11	87.29%	116.77%
Nonane	10.9	9.4	9	12	82.13%	127.12%
Isobutane	9.6	9.5	8.9	9.6	92.36%	101.39%
Methylcyclohexane	10.5	10.2	9.7	11.8	91.98%	115.80%
Dodecane	7.6	7.4	5.3	10.2	69.40%	137.87%
n-Hexane	8.1	7.6	7	8.5	87.38%	112.24%
n-Butane	10.1	10.2	9.3	10.5	91.75%	102.73%
2-Methylpentane	9.6	10.2	9.5	10.7	98.54%	104.62%
2-Methylheptane	10.8	10.3	9.8	11.8	90.42%	114.57%
2-Methylbutane	9.7	10.3	9.3	10.3	95.66%	99.77%
3-Methylpentane	10.2	10.4	9.7	10.8	95.79%	103.99%
Heptane	10.8	10.4	9.8	12	90.26%	115.23%
Undecane	11	9.8	7.8	12.9	70.38%	131.23%
2,3-Dimethylbutane	10.2	10.5	9.6	10.9	93.88%	103.52%
Pentane	10.2	10.5	9.3	10.6	91.46%	101.10%

Table S4. Measurement results and sample stability rates of samples in quartz and SUMMA canisters on day 0 and day 3 (continued Table S4).

1-Butene	9	9	8.1	9.5	90.64%	105.35%
Isoprene	9.8	9	8.6	9.9	87.09%	109.71%
Ethylene	9.9	9.3	9.1	10.2	92.03%	109.84%
cis-2-Butene	9.6	9.4	9	7.6	93.39%	80.99%
Propylene	9.7	9.8	8.3	9.8	85.20%	100.01%
1,3-Butadiene	9.9	10	9	10.5	90.52%	105.31%
trans-2-Butene	9.8	10.1	9.6	10.5	97.90%	104.33%
cis-2-Pentene	10.1	10.2	9.3	10.7	92.59%	104.63%
1-Pentene	9.9	10.2	9.5	10.5	95.73%	102.65%
trans-2-Pentene	10	10.3	9.4	10.7	93.84%	103.91%
1-Hexene	10.3	10.6	9.5	10.9	92.54%	103.26%
Benzaldehyde	6.4	3.4	4.1	5.2	63.99%	154.95%
3-Methylbenzaldehyde	3.5	3.8	3.2	3.6	91.46%	95.79%
2-Hexanone	4.7	4.6	5.3	6.1	112.27%	132.10%
Hexanal	6.7	5	5.5	5.8	82.88%	116.28%
Methyl Isobutyl Ketone	6.6	6.1	6	7.6	91.23%	123.98%
Acetaldehyde	7.8	6.6	6.4	7.9	82.50%	119.89%
Pentanal	8.2	7.2	6.8	7.7	82.65%	107.17%
2-Butanone	8.2	7.6	7.3	8.4	89.02%	111.53%
Methyl methacrylate	7.7	7.7	7.3	8.6	94.42%	112.10%
Acetone	8.2	7.7	7.8	8.4	95.59%	109.99%
Tetrahydrofuran	9.1	8.1	7.4	8.6	82.14%	105.72%
Butanal	8.6	8.3	7.3	8.8	84.29%	105.82%
Methacrolein	9.7	9.1	8.4	9.4	86.06%	104.21%
Propanal	9	9.2	8.6	9.7	94.72%	105.21%
1,4-Dioxane	9.2	9.2	8.5	10.5	92.78%	113.63%
Vinyl acetate	9.2	9.3	8.4	9.7	90.74%	104.90%
3-Pentanone	9.5	9.6	8.9	10.2	93.83%	106.44%
tert-Butyl methyl ether	9.3	9.8	8.6	9.9	93.15%	101.71%
2-Pentanone	9.8	10	8.9	10.4	90.43%	104.13%
i-Propylalcohol	9.9	10	9.2	10.2	92.48%	101.35%
Acrolein	11.2	10.3	9.9	11.6	88.40%	113.09%
Ethyl acetate	10.5	10.4	9.4	10.7	89.36%	102.89%
Crotonaldehyde	9.4	10.7	6.7	6.7	71.40%	62.77%
Naphthalene	4.7	2	2.8	3.9	60.85%	194.96%
p-Diethylbenzene	7.1	6.1	5.5	6.1	76.98%	100.50%
Styrene	10.6	8.5	9.4	10.9	89.03%	128.41%
1,3,5-Trimethylbenzene	10.6	9	8.3	10.3	78.19%	115.01%
m-Diethylbenzene	10.5	9.1	8.4	10.9	80.27%	119.62%
m-Ethyltoluene	10.6	9.2	8	11.8	75.11%	128.46%
p-Ethyltoluene	10.8	9.2	8.2	10.8	75.69%	117.55%
n-Propylbenzene	10.6	9.2	8.7	10.8	82.28%	117.77%

Table S4. Measurement results and sample stability rates of samples in quartz and SUMMA canisters on day 0 and day 3 (continued Table S4).

1,2,4-Trimethylbenzene	10.2	9.3	8.1	9.8	79.22%	106.23%
Benzene	9.5	9.5	9.1	10	95.69%	105.41%
o-Ethylmethylbenzene	10.9	9.6	8.7	12.2	79.59%	127.38%
Toluene	10.3	9.6	9	11.3	87.48%	117.56%
Ethylbenzene	10.4	9.8	8.9	11.5	85.42%	118.10%
p-Xylene	10	9.8	8.7	11.6	87.20%	117.45%
o-Xylene	11	9.9	9.2	10.3	83.33%	104.24%
Cumene	11.1	10	9	12.5	80.74%	125.13%
1,2,3-Trimethylbenzene	10.6	9.3	8.1	10.8	75.77%	116.85%
Acetonitrile	7.2	4.7	5.6	5.7	78.19%	122.64%
Trichloromonofluoromethane	6.6	4.7	4.6	5.4	68.91%	114.19%
1,2,4-Trichlorobenzene	6.8	5.9	5	8.3	73.52%	140.59%
Benzyl Chloride	10.9	7.2	6.9	8.5	62.77%	118.89%
o-dichlorobenzene	10	7.7	6.4	10.4	63.57%	134.47%
1,3-Dichlorobenzene	10.1	7.9	7.1	10.5	70.80%	132.48%
1,4-Dichlorobenzene	10	8.1	7.1	10.6	71.05%	131.98%
Hexachlorobutadiene	10.2	8.4	7.7	10.9	75.60%	130.65%
Dichloromethane	10.1	8.8	8.6	9.3	84.39%	105.53%
Tetrachloroethane	11.1	8.8	8.3	11.1	74.82%	125.57%
1,2-Dibromoethane	9.9	8.9	8.4	10.8	84.60%	120.84%
Bromoform	10.2	9.1	8.7	11.2	85.56%	123.00%
Chlorobenzene	9.8	9.3	8.5	11.1	86.47%	119.89%
1,2-Dichloropropane	9.4	9.3	8.8	10.1	93.84%	108.54%
cis-1,3-Dichloropropene	10.9	9.4	8.6	11.2	78.66%	118.78%
Perchlorethylene	9.9	9.5	8.9	11.4	89.38%	119.12%
1,2-Dichlorotetrafluoroethane	9.7	9.6	8.6	10.1	88.33%	105.75%
cis-1,2-Dichloroethylene	9.5	9.6	8.9	10.3	92.93%	107.38%
1,1,2-Trichloroethane	10.3	9.6	8.8	11.3	86.19%	118.40%
1,2-Dichloroethane-d4	10	9.6	8.9	9.9	88.29%	103.13%
Bromomethane	9.4	9.6	9.4	10.2	100.11%	106.88%
trans-1,2-Dichloroethylene	9.5	9.6	8.8	10.3	92.04%	107.28%
Bromodichloromethane	9.7	9.6	8.5	10.1	88.15%	105.18%
Chloroform	9.6	9.6	8.9	10.1	92.63%	105.41%
Chlorodibromomethane	10.4	9.6	9.1	11.5	87.78%	119.24%
Trichloroethylene	9.5	9.7	6.2	7.6	64.62%	78.61%
1,1,2-Trichlorotrifluoroethane	9.7	9.8	9.2	10.3	94.54%	104.63%
Chloroethane	9.8	9.8	9.1	10.3	93.11%	104.99%
Carbon tetrachloride	10.1	9.9	9.2	10.3	90.60%	104.65%

Table S5. Execution time and boundary layer height for each mission.

longitude and latitude	sampling site	Time	BLH
30º33.82'N，103º24.45'E	Xinchang (XC)	4:42	91.1 m
30º25.84'N，103º21.41'E	Datong (DT)	5:31	97.6 m
30º15.83'N，103º33.27'E	Shou'anxi (SAX)	7:24	173.4 m
30º09.54'N，103º43.00'E	Duouyue (DY)	8:35	171.7 m
30º09.25'N，103º52.04'E	Meishanbei (MSB)	9:16	171.7 m
30º09.81'N，104º03.91'E	Heilongtan (HLT)	10:28	256.6 m

Table S6. VOCs volume mixing ratio concentration data at 2 m, 150 m and 250 m sampling points (ppbv).

VOCs	2	150	250	2	150	250	2	150	250	2	150	250	2	150	250	2	150	250
		XC			DT			SAX			DY			MSB			HLT		
Ethane	0.7	1.4	2.4	6.0	6.9	2.1	6.3	2.9	3.5	3.8	3.4	3.7	5.9	5.2	9.8	4.9	4.3	4.2
Propane	0.5	0.8	1.6	3.6	5.4	1.0	3.3	1.8	2.5	2.7	2.7	3.5	4.0	5.0	6.8	3.6	3.5	4.6
n-Butane	0.0	0.1	0.5	1.4	1.8	0.3	1.5	0.7	0.8	0.9	0.8	1.1	1.4	1.8	2.5	0.9	0.9	1.3
Pentane	0.0	0.0	0.1	0.4	0.7	0.1	0.5	0.2	0.3	0.2	0.2	0.2	0.4	0.6	1.3	0.2	0.2	0.2
2,2-Dimethylbutane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2,3-Dimethylbutane	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
2-Methylpentane	0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.6	0.1	0.1	0.1
3-Methylpentane	0.0	0.0	0.0	0.8	0.5	0.1	0.3	0.1	0.0	0.0	0.0	0.1	0.2	0.6	1.3	0.1	0.0	0.0
n-Hexane	0.2	0.2	0.6	4.2	2.5	5.7	3.0	6.0	2.1	2.9	1.5	2.3	5.7	9.7	9.6	0.4	0.6	2.3
Methylcyclopentane	0.0	0.0	0.1	1.3	0.7	0.1	0.3	0.1	0.0	0.0	0.0	0.1	0.2	0.8	1.9	0.0	0.0	0.0
2,4-Dimethylpentane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyclohexane	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.0	0.1	0.0	0.0	0.1	0.4	1.0	0.0	0.0	0.1
2-Methylhexane	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.3	0.0	0.1	0.1	0.0	0.1	0.3	0.3	0.0	0.0	0.1
2,3-Dimethylpentane	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
3-Methylhexane	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.1
Heptane	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.0	0.1	0.1	0.0	0.1	0.2	0.3	0.0	0.0	0.1
Methylcyclohexane	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.0
2,3,4-Trimethylpentane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-Methylheptane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-Methylheptane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Octane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nonane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S6. VOCs volume mixing ratio concentration data at 2 m, 150 m and 250 m sampling points (ppbv) (continued Table S6).

Undecane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Dodecane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylene	0.0	0.0	0.8	0.4	1.4	0.2	1.9	1.1	1.4	1.3	1.0	1.5	1.9	2.9	3.5	1.5	2.3	1.9
Propylene	0.0	0.3	1.0	0.8	1.4	0.4	1.0	0.6	0.8	0.9	0.7	0.9	1.3	1.5	1.9	1.0	1.0	1.1
1-Butene	0.0	0.0	0.2	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.5	0.3	0.0	0.1	0.5
1,3-Butadiene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
trans-2-Butene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
cis-2-Butene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-Pentene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoprene	0.0	0.0	0.0	0.3	0.0	0.1	0.3	0.1	0.0	0.1	0.0	0.0	0.2	0.4	0.3	0.1	0.4	0.2
trans-2-Pentene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cis-2-Pentene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-Hexene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzene	0.0	0.4	0.5	0.6	0.4	4.9	0.7	0.5	0.5	0.6	0.5	0.6	1.6	0.8	1.0	0.7	0.7	0.8
Toluene	0.0	0.0	0.0	0.0	0.0	20.5	0.0	20.0	0.0	7.1	1.1	0.0	0.1	5.6	2.7	0.0	0.1	4.7
Chlorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene	0.4	0.3	0.1	0.0	0.0	7.8	0.0	15.2	0.4	1.1	1.5	0.6	0.4	0.7	0.2	0.0	0.3	0.8
p-Xylene	0.7	0.6	0.2	0.0	0.0	19.9	0.0	43.6	0.7	1.4	3.6	1.5	0.6	0.8	0.3	0.0	0.6	0.6
o-Xylene	0.6	0.4	0.2	0.0	0.0	8.4	0.0	15.4	0.4	1.2	2.1	0.8	0.6	0.8	0.3	0.0	0.6	0.9
Cumene	0.1	0.0	0.0	0.0	0.0	0.9	0.0	1.1	0.0	0.4	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.4
n-Propylbenzene	0.1	0.0	0.0	0.0	0.0	0.7	0.0	1.1	0.0	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.3
m-Ethyltoluene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p-Ethyltoluene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,3,5-Trimethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o-Ethylmethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S6. VOCs volume mixing ratio concentration data at 2 m, 150 m and 250 m sampling points (ppbv) (continued Table S6).

1,2,4-Trimethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzyl Chloride	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,2,3-Trimethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
m-Diethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p-Diethylbenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Naphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acrolein	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.3	0.4	0.1	0.3	0.2
Methacrolein	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2
tert-Butyl methyl ether	0.0	0.0	0.0	0.2	0.1	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0
Vinyl acetate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Butanal	0.1	0.0	0.2	0.3	0.1	0.2	0.4	0.0	0.1	0.0	0.2	0.1	0.1	0.0	0.1	0.5	0.1	0.0
2-Butanone	0.1	0.0	0.4	1.0	0.7	1.8	1.1	1.1	0.5	0.7	0.7	0.7	0.7	1.1	1.4	0.3	0.6	1.0
Tetrahydrofuran	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crotonaldehyde	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.3	0.2	0.1	0.1	0.1
2-Pentanone	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pentanal	0.1	0.5	0.5	0.3	0.2	0.5	0.1	0.5	0.3	0.4	0.4	0.4	0.2	0.6	0.3	0.4	0.7	0.5
Methyl methacrylate	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0
Methyl Isobutyl Ketone	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hexanal	0.2	0.8	0.8	0.2	0.4	2.2	0.1	1.0	0.4	1.3	0.8	0.8	0.5	0.6	0.3	0.0	0.6	1.6
Dichlorodifluoromethane	0.4	0.6	0.6	0.6	0.9	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Chloromethane	0.3	0.4	0.5	1.1	0.9	0.5	1.1	0.5	0.6	0.6	0.6	0.7	0.8	0.7	1.1	0.7	0.6	0.6
1,2-Dichlorotetrafluoroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vinyl Chloride	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Bromomethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S6. VOCs volume mixing ratio concentration data at 2 m, 150 m and 250 m sampling points (ppbv) (continued Table S6).

Trichloromonofluoromethane	0.0	0.0	0.0	0.2	0.5	0.3	0.4	0.3	0.2	0.3	0.2	0.4	0.4	0.8	1.6	0.1	0.2	0.2
Vinylidene chloride	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichloromethane	1.0	0.5	0.8	15.0	11.8	8.8	8.3	9.4	1.1	2.0	2.5	2.8	7.3	16.0	31.8	1.9	1.9	2.4
1,1,2-Trichlorotrifluoroethane	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
trans-1,2-Dichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,1-Dichloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
cis-1,2-Dichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloroform	0.0	0.0	0.1	0.5	1.7	0.1	0.4	0.1	0.1	0.1	0.0	0.1	0.3	0.7	2.4	0.0	0.0	0.1
1,2-Dichloroethane-d4	0.0	0.2	0.2	1.0	2.3	0.3	1.6	0.4	0.4	0.4	0.3	0.5	1.2	1.5	3.6	0.8	0.7	0.6
1,1,1-Trichlorethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbon tetrachloride	0.0	0.1	0.1	0.4	0.2	0.1	0.6	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1
1,2-Dichloropropane	0.0	0.1	0.1	0.3	0.4	0.1	0.5	0.1	0.1	0.2	0.1	0.2	0.5	0.6	1.1	0.2	0.1	0.2
Bromodichloromethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E-1,3-Dichloropropene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cis-1,3-Dichloropropene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,1,2-Trichloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorodibromomethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,2-Dibromoethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perchlorethylene	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.8	0.1	0.4	0.2	0.0	0.1	0.2	0.2	0.0	0.0	0.3
Bromoform	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tetrachloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
para-Dichlorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o-dichlorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,3-Dichlorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S6. VOCs volume mixing ratio concentration data at 2 m, 150 m and 250 m sampling points (ppbv) (continued Table S6).

1,2,4-Trichlorobenzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexachlorobutadiene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
α-Pinene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
β-Pinene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D-Limonene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eucalyptol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
γ-Terpinene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acetylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Carbon disulfide	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Acetonitrile	0.0	0.1	0.4	2.5	7.6	0.2	1.6	0.3	0.5	0.3	0.6	0.6	1.0	2.2	7.6	0.5	0.6	0.5

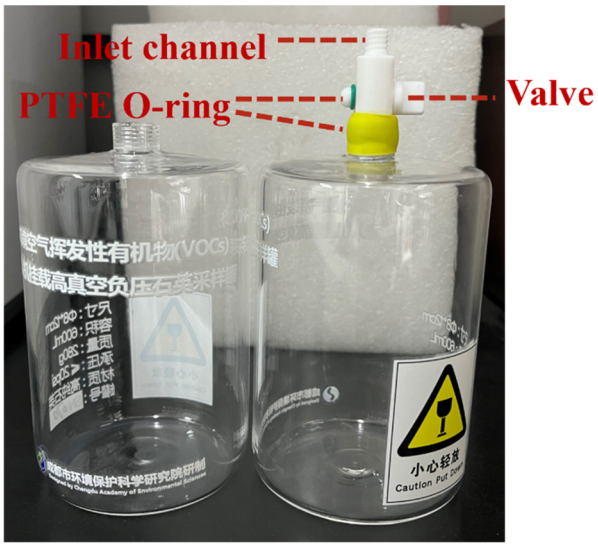


Figure S1. Schematic diagram of quartz sampling canisters.

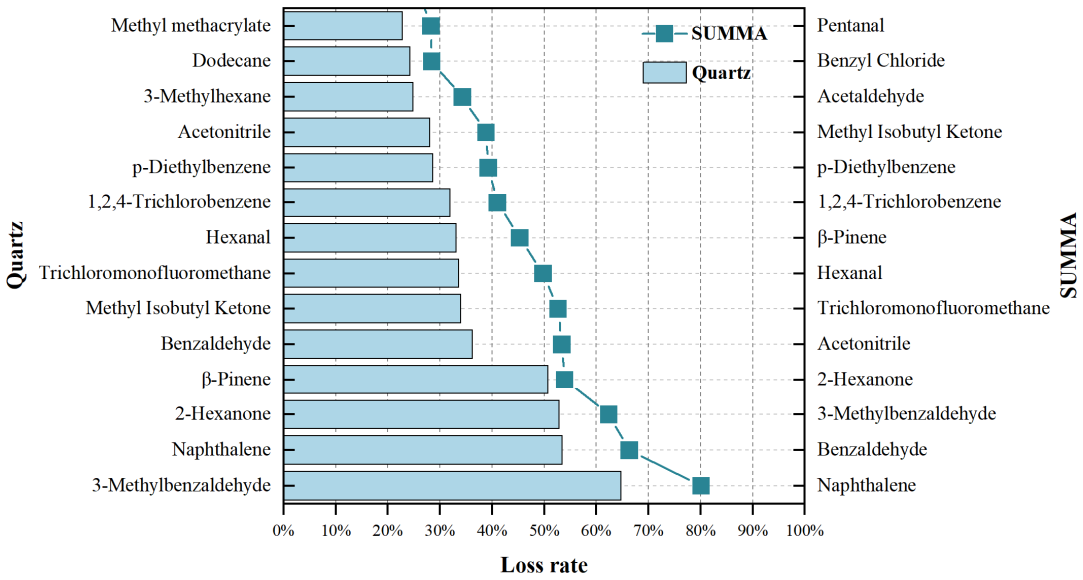


Figure S2. Top 14 compounds with significant adsorption losses in quartz and SUMMA canisters.

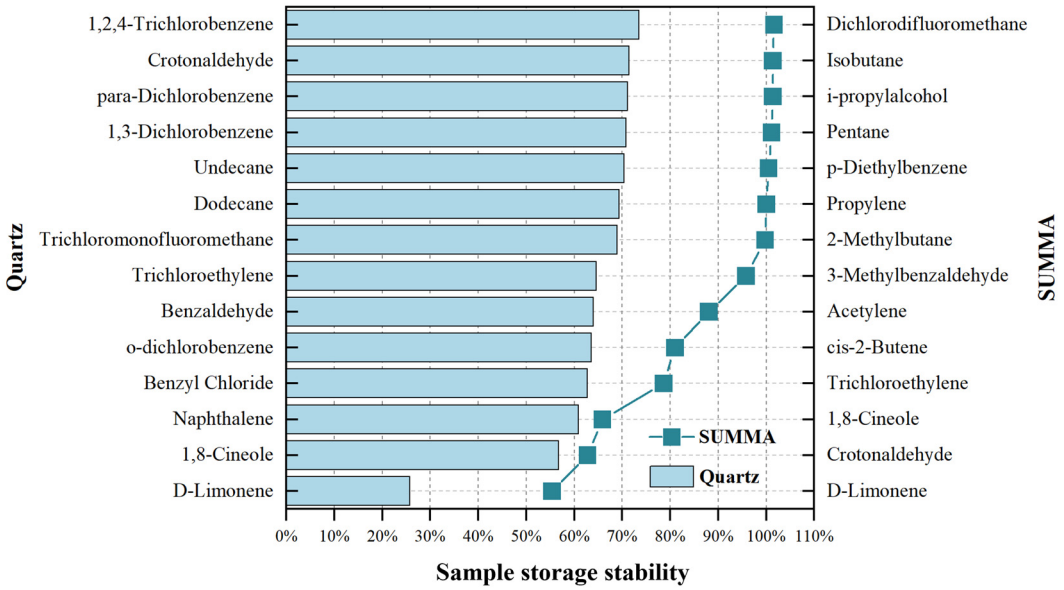
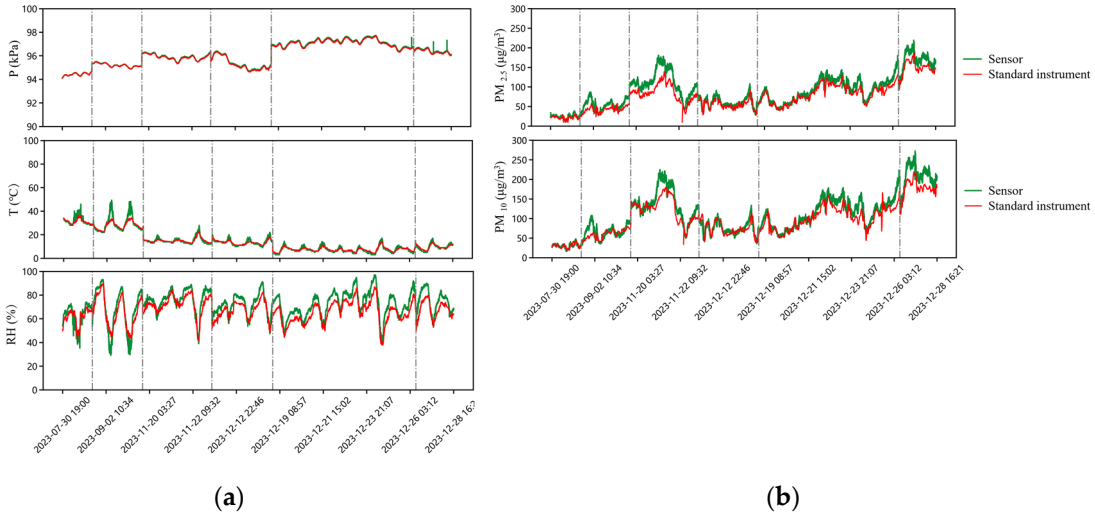


Figure S3. Top 14 species with low sample storage stability in quartz and SUMMA canisters.



(**a**) (**b**)

Figure S4. Time Series Plots of Sensor Output Signals Compared to Standard Instrument Data Across Five Monitoring Periods (**a**) P, T and RH; (**b**) $PM_{2.5}$ and PM_{10}.

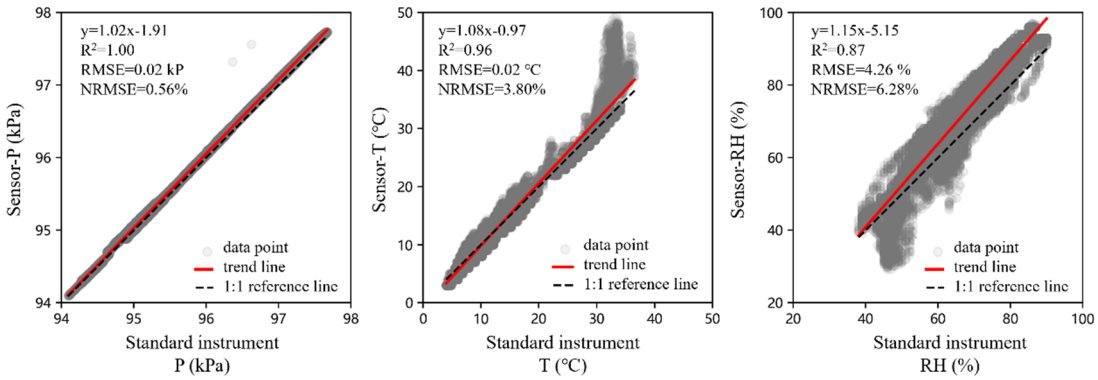


Figure S5. Comparison of linear correlation between P, T and RH sensor signals and standard instrument monitoring values.

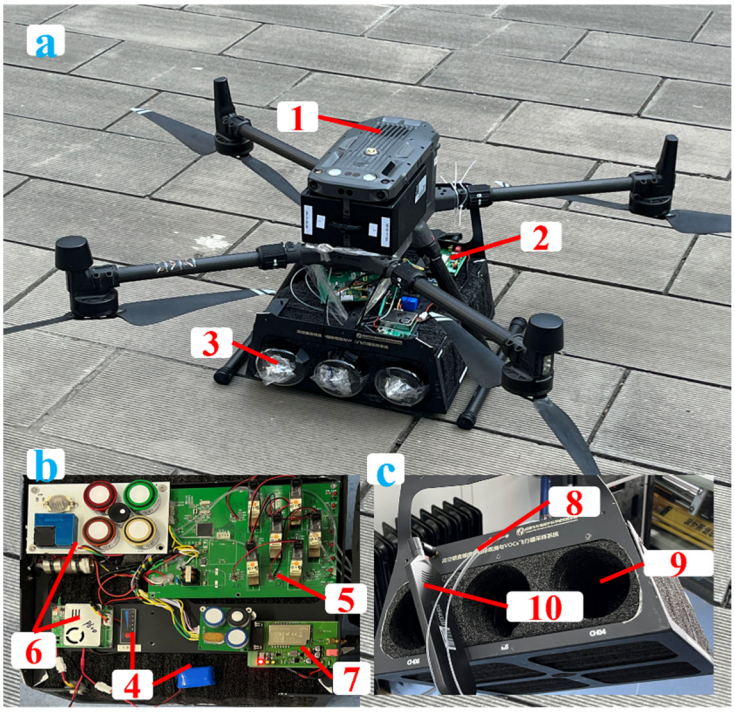


Figure S6. (a) Overall structure of the platform, including: (1) DJI Matrice300 RTK quadcopter, (2) Sensors and control circuits, and (3) VOCs sampling equipment; (b) Details of the sensors and control circuits, including: (4) Battery and battery level indicator, (5) Six solenoid valves, (6) M702 sensor module and BMP388, and (7) Wireless signal receiving module; (c) Details of the VOCs sampling equipment, including: (8) Teflon intake duct, (9) Installation channel for the VOC sampling canister, and (10) Antenna

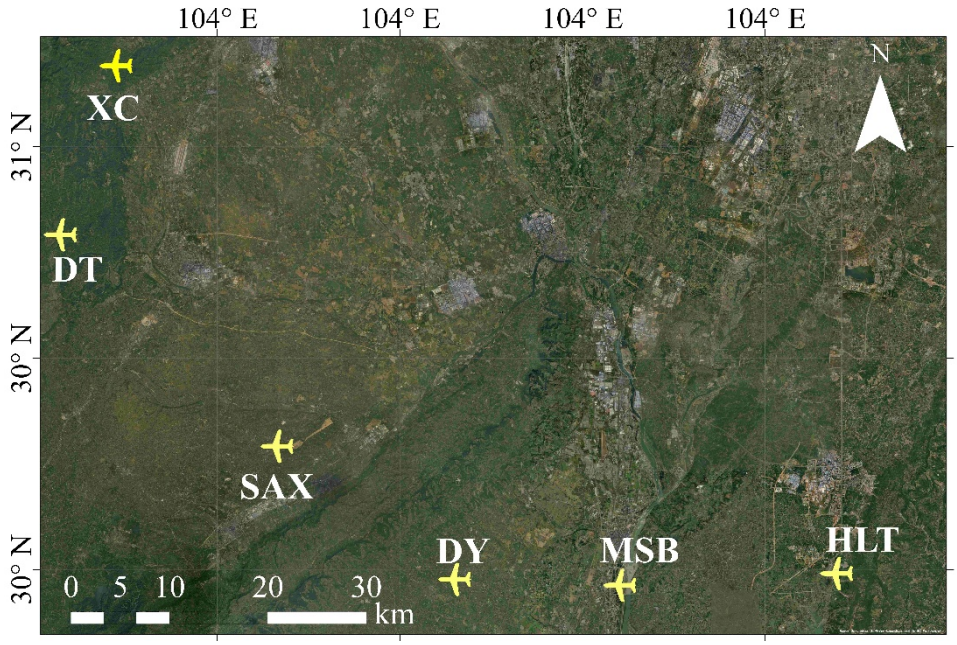


Figure S7. The specific position of the six sampling sites.

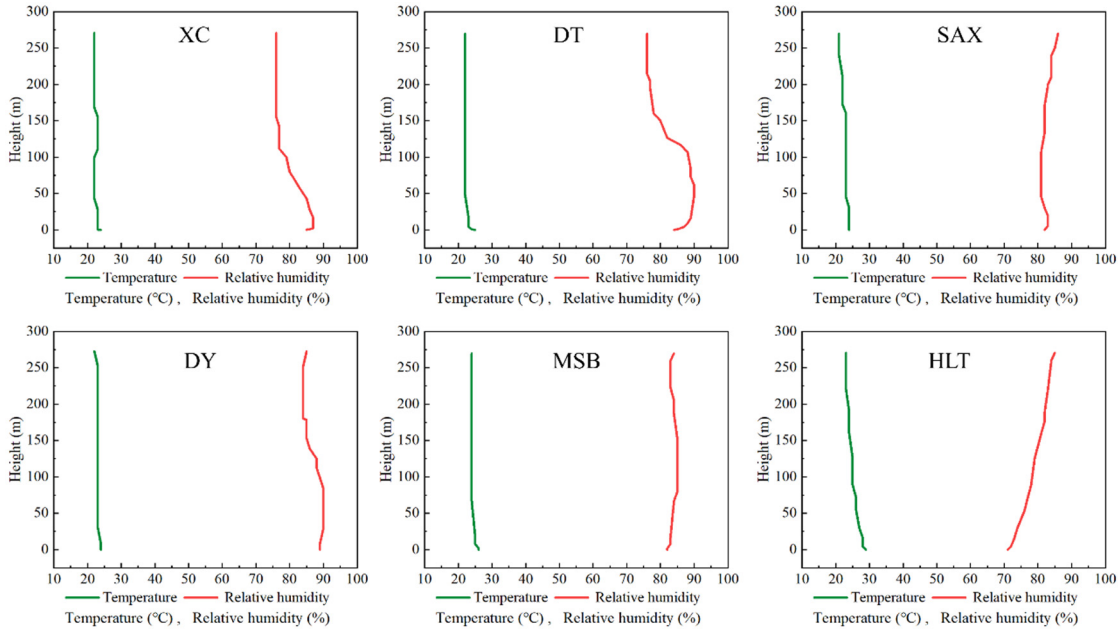


Figure S8. Vertical distribution of T and RH at six sampling sites.

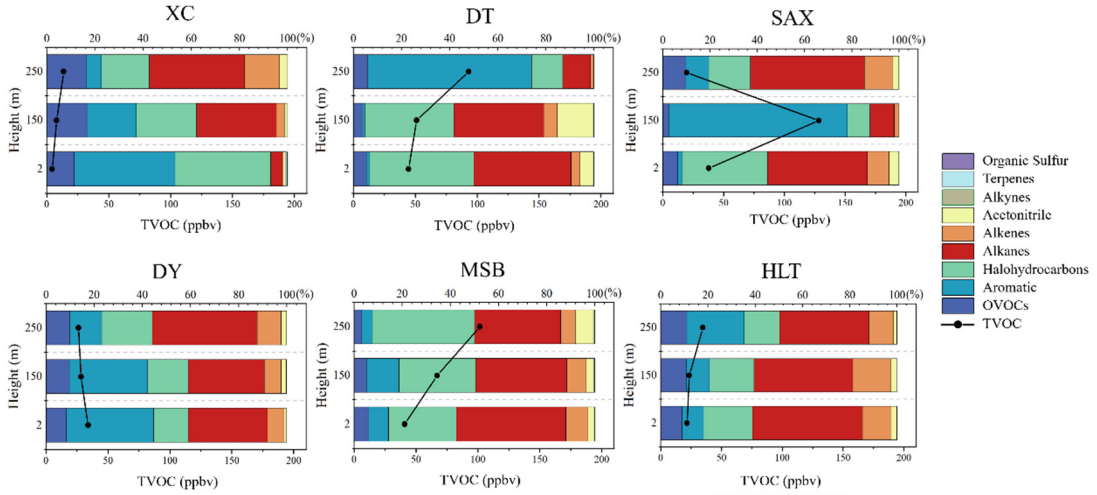


Figure S9. Proportion of various VOCs and vertical distribution characteristics of TVOC at six sampling sites at 2 m, 150 m, and 250 m.

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