Supplementary data

Characterization of ambient volatile organic compounds, source apportionment, and the ozone-NOx-VOC sensitivities in a heavily polluted megacity of central China: Effect of sporting events and the emission reductions

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Number of Tables: 5

Table list:

Table S1 Air quality control measures for NMG China 2019

Table S2. results of monitored 106 VOCs species monitored: MDLs, concentrations with statistical analysis (Mean±SD) during the three periods (unit: ppbv).

Table S3 Non-carcinogenic and carcinogenic risk assessment results of VOCs in this paper and of other cities in China.

Table S4 Noncarcinogenic and carcinogenic risk assessment results of VOCs during the three periods.

Table S5 Meteorological conditions for the three sampling periods in Zhengzhou.

Number of Figures: 11

Figure List:

Fig. S1 Locations of the sampling stations in Zhengzhou.

Fig. S2 Four-level nested domains used in the WRF/CMAQ simulations. d01, d02, d03 and d04 have horizontal resolutions of 36, 12, 4 and 1 km, respectively. ZZ: Zhengzhou main city; ZM: Zhongmu; XZ: Xinzheng; XM: Xinmi; DF: Dengfeng; GY: Gongyi; XY: Xingyang.

Fig. S3 The ratios of Qtrue/Qrobust and Qtrue/Qexp at factor size ranged from 3–10.

Fig. S4 The 48-h backward trajectories from Zhengzhou during the three periods.

Fig. S5 Average concentrations and percentage of each group of VOCs.

Fig. S6 Diurnal variations in concentrations of TVOC and its compounds in Zhengzhou.

Fig. S7 Diurnal variations in concentrations of NO and NO_2 in Zhengzhou during the three periods.

Fig. S8 Ratios of T/B and i/n-Pentane in Zhengzhou.

Fg. S9 Hotspots diagram (https://firms.modaps.eosdis.nasa.gov/firemap/), (a) August and (b) September.

Fig. S10 The contributions and percentage of VOCs groups to the total OFP before, during, and after the control period during the NMG 2019.

Fig. S11 The evolution of HQ and carcinogenic risks of hazardous VOC species during the three period. 1, 2, and 3 of x-axis represent pre-NMG, NMG and post-NMG periods, respectively.

Table S1 Air quality control measures for NMG China 2019

Emission sources	Description of control measures
Industrial source controls	(1) Industries failed to meet related standards must halt or reduce production; (2) High VOCs emissions factories and power plants: halted from production or cut their productions
Vehicles controls	(1) Cargo trucks (~136 thousand vehicles) were banned whole day (2) 20% of vehicles (excluding taxies and buses) (~800 thousand vehicles) were not allowed to drive inside the third ring during 07:00–21:00
Oil evaporation controls	(1) Fuel tank trucks, oil storages and gas stations failed to meet related standards must stop offering service during 8:00 to 18:00
Solvent source controls	(1) Required to operate under sealed conditions, or totally halted from operating in Zhengzhou

Table S2. results of monitored 106 VOCs species monitored: MDLs, concentrations with statistical analysis (Mean±SD) during the three periods (unit: ppbv).

Groups	VOC species	MDL	pre-NMG	NMG	post-NMG
Alkanes					
	Ethane	0.028	3.1±2.1	4.2±1.7	3.2±2.9
	Propane	0.035	1.9±1.1	2.1±0.9	2.6±5.1
	Isobutane	0.038	0.8±0.5	0.7±0.4	1±1
	n-Butane	0.041	1±0.6	0.8±0.4	1.1±1.3
	Cyclopentane	0.029	BDL	BDL	BDL
	Isopentane	0.024	1.4±1	1.1±0.7	1.6±0.9
	n-Pentane	0.025	0.6±0.5	0.6±0.4	0.8±1.1
	2,2-Dimethyl butane	0.004	BDL	BDL	BDL
	2,3-Dimethylbutane	0.005	0.3±0.2	0.2±0.1	0.3±0.2
	2-Methylpentane	0.01	0.3±0.2	0.2±0.1	0.2±0.1
	3-Methylpentane	0.005	0.2±0.1	0.2±0.1	0.2±0.1
	n-Hexane	0.005	4.3±6	2.5±2.1	2.1±1.4
	2,4-Dimethylpentane	0.004	BDL	BDL	BDL
	Methyl cyclopentane	0.006	0.2±0.1	0.1±0.1	0.2±0.1
	2-Methylhexane	0.004	0.1±0	0.1±0	0.1±0
	Cyclohexane	0.004	0.1±0.1	0.1±0.1	0.1±0.2
	2,3-Dimethylpentane	0.005	0.1±0.1	BDL	BDL
	3-Methylhexane	0.003	0.1±0.1	0.1±0	0.1±0.1
	2,2,4-Trimethylpentane	0.003	0.1±0	0.1±0	0.1±0.1
	n-Heptane	0.007	0.1±0.1	0.1±0.1	0.1±0.2
	Methyl cyclohexane	0.005	0.1±0.1	BDL	0.1±0.1
	2,3,4-Trimethylpentane	0.005	BDL	BDL	BDL
	2-Methylheptane	0.004	BDL	BDL	BDL

	3-Methylheptane	0.006	BDL	BDL	BDL
	n-Octane	0.004	0.1±0.1	0.1±0	0.1±0
	n-Nonane	0.004	0.1±0	0.1±0	0.1±0
	n-Decane	0.005	0.1±0.1	0.1±0.1	0.1±0.1
	n-Undecane	0.006	BDL	BDL	BDL
	n-Dodecane	0.047	BDL	BDL	BDL
Alkenes					
	Ethene	0.04	1.2±0.7	1.4±0.9	2±1.6
	Propene	0.034	0.2±0.1	0.2±0.1	0.3±1.2
	Trans-2-butene	0.025	BDL	BDL	BDL
	1-Butene	0.029	0.1±0.1	BDL.1	0.1±0.1
	Cis-2-butene	0.025	0.1±0.1	0.1±0.1	0.1±0.1
	1-Pentene	0.01	0.1±0.1	0.1±0.1	0.1±0.1
	1,3-Butadiene	0.006	BDL	BDL	BDL
	Trans-2-pentene	0.008	0.3±0.4	0.2±0.1	0.2±0.2
	Isoprene	0.006	0.4±0.5	0.2±0.3	0.2±0.2
	Cis-2-pentene	0.008	BDL	BDL	BDL
	1-Hexene	0.005	BDL	BDL	BDL
Alkynes					
	Acetylene	0.038	2.6±1.5	1.2±0.8	2.5±5.8
Aromatics					
	Benzene	0.004	1±0.7	1±0.6	1.2±0.7
	Toluene	0.006	1.1±1	1.1±0.9	1.5±1.1
	Ethylbenzene	0.008	0.3±0.2	0.3±0.2	0.4±0.3
	m/p-xylene	0.009	1±0.8	0.9±0.9	1.2±0.9
	O-xylene	0.005	0.3±0.2	0.3±0.3	0.3±0.3
	Styrene	0.005	0.1±0.1	0.1±0.1	0.1±0.1

	Isopropyl benzene	0.005	BDL	BDL	BDL
	n-Propyl benzene	0.005	BDL	BDL	BDL
	3-Ethyltoluene	0.005	0.1±0.1	0.1±0.1	0.1±0.1
	4-Ethyltoluene	0.005	0.1±0	0.1±0	0.1±0.1
	1,3,5-Trimethylbenzene	0.006	0.1±0	0.1±0	0.1±0.1
	2-Ethyltoluene	0.004	BDL	BDL	0.1±0
	1,2,4-Trimethylbenzene	0.004	0.1±0.1	0.1±0.1	0.2±0.1
	1,2,3-Trimethylbenzene	0.005	BDL	BDL	0.1±0
	1,3-Diethylbenzene	0.005	BDL	BDL	BDL
	1,4-Diethylbenzene	0.005	BDL	BDL	BDL
	Naphthalene	0.005	BDL	0.1±0	0.2±0.3
Halohydrocarbons					
	Freon 12	0.007	BDL	BDL	BDL
	Freon 114	0.007	BDL	BDL	BDL
	Freon 11	0.006	0.3±0.1	0.3±0.1	0.3±0.1
	Freon 113	0.005	0.1±0	0.1±0	0.1±0
	Chloromethane	0.019	0.1±0.1	0.6±0.4	0.8±0.4
	Bromomethane	0.006	BDL	BDL	BDL
	Chloroethane	0.005	BDL.1	BDL	BDL
	Dichloromethane	0.004	3.3±7.6	1.8±1.1	2.1±1.3
	1,1-Dichloroethane	0.004	BDL	0.1±0	0.1±0.1
	Trichloromethane	0.005	0.9±0.6	0.6±0.3	0.6±0.3
	1,1,2-Trichloroethane	0.005	BDL	BDL	0.1±0
	Carbon tetrachloride	0.005	0.6±0.4	0.6±0.5	0.5±0.4
	1,2-Dichloroethane	0.004	1.1±0.7	1±0.7	1.4±1.3
	1,2-Dichloropropane	0.005	0.2±0.1	0.2±0.2	0.3±0.2
	Dibromochloromethane	0.005	BDL	BDL	BDL

	Bromodichloromethane	0.005	BDL	BDL	BDL
	1,1,2-Trichloroethane	0.005	BDL	BDL	0.1±0
	1,1-Dichloroethylene	0.005	BDL	BDL	BDL
	Hexachloro-1,3-butadiene	0.005	BDL	BDL	BDL.1
	1,2,4-Trichlorobenzene	0.005	BDL	BDL	BDL.1
	1,2-Dibromoethane	0.005	BDL	BDL	BDL
	Bromoform	0.005	BDL	BDL	BDL
	1,1,2,2-Tetrachloroethane	0.005	BDL	BDL	BDL
	Vinyl chloride	0.007	BDL	BDL.1	0.1±0.1
	Cis-1,2-dichloroethylene	0.003	0.2±0.2	0.2±0.2	0.4±0.5
	trans-1,2-Dichloroethylene	0.003	BDL	BDL	BDL
	Trichlorethylene	0.004	BDL	BDL	BDL
	Trans-1,3-dichloropropene	0.005	BDL	BDL	BDL
	Cis-1,3-dichloropropene	0.004	BDL	BDL	BDL
	Tetrachloroethylene	0.005	0.9±0.6	0.7±0.5	0.6±0.3
	Chlorobenzene	0.005	BDL	BDL	BDL
	1,3-Dichlorobenzene	0.004	BDL	BDL	BDL
	1,4-Dichlorobenzene	0.006	0.1±0	0.1±0	0.1±0.1
	Benzyl chloride	0.005	BDL	BDL	BDL
	1,2-Dichlorobenzene	0.006	BDL	BDL	BDL
OVOC					
	Acrolein	0.007	0.1±0	0.1±0	0.1±0.1
	4-Methyl-2-pentanone	0.006	BDL	BDL	0.1±0
	2-Hexanone	0.007	0.2±0.1	0.1±0.1	0.2±0.1
	Isopropanol	0.004	0.2±0.2	0.2±0.2	0.3±0.3
	Vinyl acetate	0.012	2.2±3	1.3±1.1	1±0.7
	Acetone	0.007	2.9±4.5	2.5±1.2	2.7±0.5

	Ethyl acetate	0.005	0.2±0.1	0.2±0.1	0.2±0.1
	2-Butanone	0.005	0.4±0.2	0.4±0.2	0.5±0.1
	Methyl methacrylate	0.01	0.2±1.4	BDL	BDL
	Tetrahydrofuran	0.009	0.3±0.2	0.4±0.3	0.3±0.2
	Methyl tert-butyl ether	0.006	0.2±0.1	0.1±0.1	0.1±0.1
	1,4-Dioxane	0.01	BDL	BDL	BDL
Sulfide					
	Carbon disulfide	0.005	0.1±0.1	0.2±0.7	0.3±0.4

Table S3 Non-carcinogenic and carcinogenic risk assessment results of VOCs in this paper and of other cities in China.

Species	RFC ($mg\ m^{-3}$)	IUR ($\mu g\ m^{-3}$)	This study		Zhengzhou (2018)		Langfang		Beijing	
			HQ	Risk	HQ	Risk	HQ	Risk	HQ	Risk
1,1,1-Trichloroethane	5.00E+00	-	1.30E-06	-	6.30E-09	-	4.60E-07	-	2.40E-07	-
1,1,2-Trichloroethane	4.00E-01	1.60E-05	1.00E-04	6.60E-07	5.20E-05	3.30E-07	-	2.30E-07	-	-
1,1-Dichloroethane	5.00E-01	1.60E-06	6.90E-05	5.50E-08	3.70E-05	2.90E-08	-	-	-	-
1,1-Dichloroethylene	2.00E-01	-	1.60E-05	-	2.20E-04	-	-	-	-	-
1,2,3-Trimethylbenzene	6.00E-02	-	5.80E-04	-	4.30E-04	-	5.70E-04	-	-	-
1,2,4-Trichlorobenzene	2.00E-01	-	2.10E-05	-	1.40E-04	-	-	-	-	-
1,2,4-Trimethylbenzene	6.00E-02	-	1.70E-03	-	5.70E-04	-	1.70E-03	-	-	-
1,2-Dibromoethane	9.00E-03	6.00E-04	1.40E-03	7.40E-06	1.70E-04	8.90E-07	2.60E-04	7.10E-07	4.90E-05	2.70E-07
1,2-Dichloroethane	2.40E+00	2.60E-05	3.10E-04	1.90E-05	2.30E-04	1.40E-05	-	-	-	-
1,2-Dichloropropane	4.00E-03	-	4.30E-02	-	5.90E-02	-	1.20E-01	-	8.00E-02	-
1,3,5-Trimethylbenzene	6.00E-02	-	8.40E-04	-	2.00E-04	-	7.90E-04	-	-	-
1,3-Butadiene	2.00E-03	3.00E-05	1.60E-03	9.40E-08	3.30E-03	2.00E-07	4.40E-02	2.60E-06	8.10E-03	4.90E-07
1,4-Dichlorobenzene	8.00E-01	1.10E-05	1.10E-04	9.30E-07	1.40E-05	1.20E-07	1.40E-05	-	5.90E-05	-
1,4-Dioxane	3.00E-02	5.00E-06	5.50E-05	8.20E-09	1.40E-03	2.20E-07	-	-	-	-
2-Butanone	5.00E+00	-	3.90E-05	-	4.90E-05	-	-	-	-	-
2-Hexanone	5.00E+00	-	2.00E-05	-	4.40E-05	-	-	-	-	-
4-Methyl-2-pentanone	3.00E+00	-	1.00E-05	-	9.80E-06	-	-	-	-	-
Acrolein	2.00E-05	-	1.60E+00	-	7.80E-01	-	4.90E+00	-	-	-
Benzene	3.00E-02	7.80E-06	1.80E-02	4.10E-06	4.30E-03	1.00E-06	3.50E-02	8.30E-06	3.60E-02	8.40E-06
Bromoform	-	1.10E-06	-	2.70E-08	-	7.90E-09	-	3.20E-09	-	-
Bromomethane	5.00E-03	-	1.80E-03	-	2.00E-03	-	1.30E-03	-	5.40E-03	-
Carbon disulfide	7.00E-01	-	1.40E-04	-	2.40E-04	-	-	-	-	-

Chlorobenzene	1.00E+00	-	2.90E-05	-	2.70E-04	-	-	-	-	-
Chloroethane	1.00E+01	-	1.40E-06	-	9.25E-07	-	-	-	-	-
Chloroform	9.80E-02	2.30E-05	5.80E-03	1.30E-05	2.60E-03	5.90E-06	-	1.30E-05	-	-
Chloromethane	9.00E-02	-	1.70E-03	-	3.70E-03	-	-	-	-	-
Cyclohexane	6.00E+00	-	9.10E-06	-	8.30E-06	-	1.20E-04	-	5.20E-05	-
Dichloromethane	6.00E-01	1.00E-08	1.90E-03	1.20E-08	1.40E-03	8.20E-09	-	-	-	-
Ethylbenzene	1.00E+00	2.50E-06	2.10E-04	5.30E-07	9.80E-05	2.50E-07	5.40E-04	-	4.20E-04	-
Hexachloro-1,3-butadiene	9.00E-02	2.20E-05	2.90E-04	5.70E-07	6.50E-04	1.30E-06	-	-	-	-
Isopropyl benzene	4.00E-01	-	4.40E-05	-	4.30E-05	-	9.10E-05	-	1.50E-05	-
m/p-Xylene	1.00E-01	-	2.00E-03	-	1.30E-03	-	1.50E-02	-	1.30E-03	-
Methyl methacrylate	7.00E-01	-	8.40E-05	-	1.80E-05	-	2.60E-03	1.60E-08	5.40E-03	3.20E-10
MTBE	3.00E+00	2.60E-07	2.80E-05	2.20E-08	1.40E-04	1.10E-07	2.90E-05	-	-	-
Naphthalene	3.00E-03	3.40E-05	2.40E-02	2.40E-06	3.10E-02	3.20E-06	-	-	-	-
n-Hexane	7.00E-01	-	2.40E-03	-	9.00E-04	-	4.20E-04	-	3.40E-04	-
o-Xylene	1.00E-01	-	7.00E-03	-	1.10E-03	-	4.90E-03	-	1.00E-02	-
Propylene	3.00E+00	-	1.90E-05	-	-	-	-	-	-	-
Styrene	1.00E+00	-	4.20E-05	-	3.20E-05	-	2.90E-04	-	6.50E-05	-
Tetrachloroethylene	4.00E-02	2.60E-07	2.10E-02	2.20E-07	6.30E-04	6.60E-09	2.50E-02	2.60E-08	2.00E-02	1.90E-07
Tetrachloromethane	1.00E-01	6.00E-06	5.90E-03	3.50E-06	1.20E-03	7.30E-07	-	-	-	-
Toluene	5.00E+00	-	1.50E-04	-	6.50E-05	-	2.40E-04	-	1.50E-04	-
trans-1,3-Dichloropropene	2.00E-02	4.00E-06	6.90E-04	5.60E-08	1.10E-03	8.70E-08	-	-	-	-
Trichloroethylene	2.00E-03	4.10E-06	1.00E-02	8.40E-08	3.30E-03	2.70E-08	2.00E-02	1.70E-07	2.10E-01	1.70E-06
Vinyl acetate	2.00E-01	-	4.30E-03	-	5.80E-04	-	-	-	-	-
Vinyl chloride	1.00E-01	8.80E-06	1.30E-04	1.20E-07	1.80E-04	1.60E-07	3.70E-04	3.30E-07	-	4.70E-06

Table S4 Noncarcinogenic and carcinogenic risk assessment results of VOCs during the three periods.

Species	HQ			
	pre-NMG	**NMG**	**post-NMG**	**Average**
Propylene	1.5E-05	1.8E-05	3.0E-05	2.0E-05
1,3-Butadiene	2.0E-03	1.1E-03	1.6E-03	1.6E-03
Cyclohexane	1.1E-05	8.1E-06	1.1E-05	9.5E-06
n-Hexane	3.6E-03	2.1E-03	1.8E-03	2.6E-03
Benzene	1.9E-02	1.8E-02	2.2E-02	1.9E-02
Toluene	1.5E-04	1.4E-04	1.9E-04	1.5E-04
Ethylbenzene	2.3E-04	1.9E-04	2.6E-04	2.2E-04
m/p-Xylene	2.2E-03	1.8E-03	2.5E-03	2.1E-03
o-Xylene	7.2E-03	6.7E-03	9.0E-03	7.3E-03
Styrene	4.9E-05	3.7E-05	4.8E-05	4.4E-05
Isopropyl benzene	5.1E-05	4.5E-05	4.2E-05	4.6E-05
1,3,5-Trimethylbenzene	8.3E-04	8.9E-04	1.0E-03	8.9E-04
1,2,4-Trimethylbenzene	1.8E-03	1.7E-03	2.3E-03	1.8E-03
1,2,3-Trimethylbenzene	6.0E-04	5.8E-04	6.9E-04	6.1E-04
Naphthalene	1.4E-02	1.8E-02	6.3E-02	2.6E-02
Carbon disulfide	9.1E-05	1.8E-04	1.9E-04	1.5E-04
Acrolein	1.5E+00	1.9E+00	1.9E+00	1.8E+00
2-Butanone	3.8E-05	4.1E-05	4.8E-05	4.1E-05
4-Methyl-2-pentanone	1.1E-05	1.0E-05	1.2E-05	1.1E-05
2-Hexanone	2.3E-05	2.0E-05	2.4E-05	2.2E-05
Vinyl acetate	6.5E-03	3.8E-03	3.1E-03	4.5E-03
Methyl methacrylate	2.4E-04	1.6E-05	1.9E-05	9.4E-05
MTBE	3.3E-05	2.7E-05	3.0E-05	2.9E-05

1,4-Dioxane	6.5E-05	4.1E-05	8.9E-05	5.8E-05
Tetrachloromethane	6.0E-03	6.4E-03	5.5E-03	6.0E-03
Dichloromethane	3.2E-03	1.7E-03	2.1E-03	2.3E-03
Bromomethane	1.7E-03	2.0E-03	2.0E-03	1.9E-03
Chloromethane	5.2E-04	2.3E-03	3.3E-03	1.9E-03
Chloroform	7.5E-03	5.4E-03	4.8E-03	5.9E-03
1,1,2-Trichloroethane	1.1E-04	1.0E-04	1.3E-04	1.1E-04
1,1,1-Trichloroethane	1.4E-06	1.3E-06	1.3E-06	1.3E-06
1,2-Dibromoethane	1.6E-03	1.3E-03	1.5E-03	1.4E-03
1,2-Dichloroethane	3.2E-04	3.0E-04	3.9E-04	3.2E-04
1,1-Dichloroethane	4.2E-05	8.1E-05	1.2E-04	7.5E-05
Chloroethane	1.5E-06	1.5E-06	1.5E-06	1.5E-06
1,2-Dichloropropane	4.3E-02	4.2E-02	5.5E-02	4.5E-02
Tetrachloroethylene	2.5E-02	2.0E-02	1.6E-02	2.1E-02
1,1-Dichloroethylene	1.7E-05	1.7E-05	1.7E-05	1.7E-05
Vinyl chloride	3.9E-05	2.0E-04	2.2E-04	1.5E-04
Trichloroethylene	1.2E-02	8.9E-03	1.3E-02	1.1E-02
trans-1,3-Dichloropropene	7.8E-04	6.2E-04	8.6E-04	7.3E-04
Hexachloro-1,3-butadiene	2.5E-04	2.7E-04	5.1E-04	3.1E-04
1,2,4-Trichlorobenzene	2.3E-05	1.2E-05	4.2E-05	2.2E-05
1,4-Dichlorobenzene	1.1E-04	1.1E-04	9.8E-05	1.1E-04
Chlorobenzene	3.1E-05	2.9E-05	3.5E-05	3.0E-05
	Carcinogenic risk			
	pre-NMG	**Dduging-NMG**	**post-NMG**	**Average**
1,3-Butadiene	1.2E-07	6.5E-08	9.5E-08	9.4E-08
Benzene	4.3E-06	4.3E-06	5.2E-06	4.4E-06

Ethylbenzene	5.8E-07	4.8E-07	6.6E-07	5.5E-07
Naphthalene	1.4E-06	1.8E-06	6.4E-06	2.6E-06
MTBE	2.5E-08	2.1E-08	2.3E-08	2.3E-08
1,4-Dioxane	9.8E-09	6.1E-09	1.3E-08	8.8E-09
Tetrachloromethane	3.6E-06	3.8E-06	3.3E-06	3.6E-06
Dichloromethane	1.9E-08	1.0E-08	1.3E-08	1.4E-08
Bromoform	3.1E-08	2.6E-08	3.0E-08	2.8E-08
Chloroform	1.7E-05	1.2E-05	1.1E-05	1.3E-05
1,1,2-Trichloroethane	6.9E-07	6.4E-07	8.2E-07	6.9E-07
1,2-Dibromoethane	8.6E-06	6.9E-06	8.1E-06	7.7E-06
1,2-Dichloroethane	2.0E-05	1.8E-05	2.5E-05	2.0E-05
1,1-Dichloroethane	3.4E-08	6.5E-08	9.7E-08	6.0E-08
Tetrachloroethylene	2.6E-07	2.1E-07	1.6E-07	2.2E-07
Vinyl chloride	3.4E-08	1.8E-07	2.0E-07	1.3E-07
Trichloroethylene	9.6E-08	7.3E-08	1.1E-07	8.7E-08
trans-1,3-Dichloropropene	6.2E-08	5.0E-08	6.9E-08	5.8E-08
Hexachloro-1,3-butadiene	4.9E-07	5.4E-07	1.0E-06	6.1E-07
1,4-Dichlorobenzene	9.5E-07	1.0E-06	8.6E-07	9.5E-07

Table S5 Meteorological conditions for the three sampling periods in Zhengzhou.

Periods	**ppt**	**T**	**RH**	**Pressure**	**Visibility**	**WS**
Unit.	mm	℃	%	hPa	km	m/s
pre-NMG period	236.9	27.4±1.2	71±11	993±4	16.7±5.5	1.7±0.3
during-NMG period	39.8	24.2±3.3	65±14	1000±4	14.1±7.0	1.7±0.4
post-NMG period	1.6	22.3±1.5	60±7	1007±2	13.0±2.7	1.5±0.3

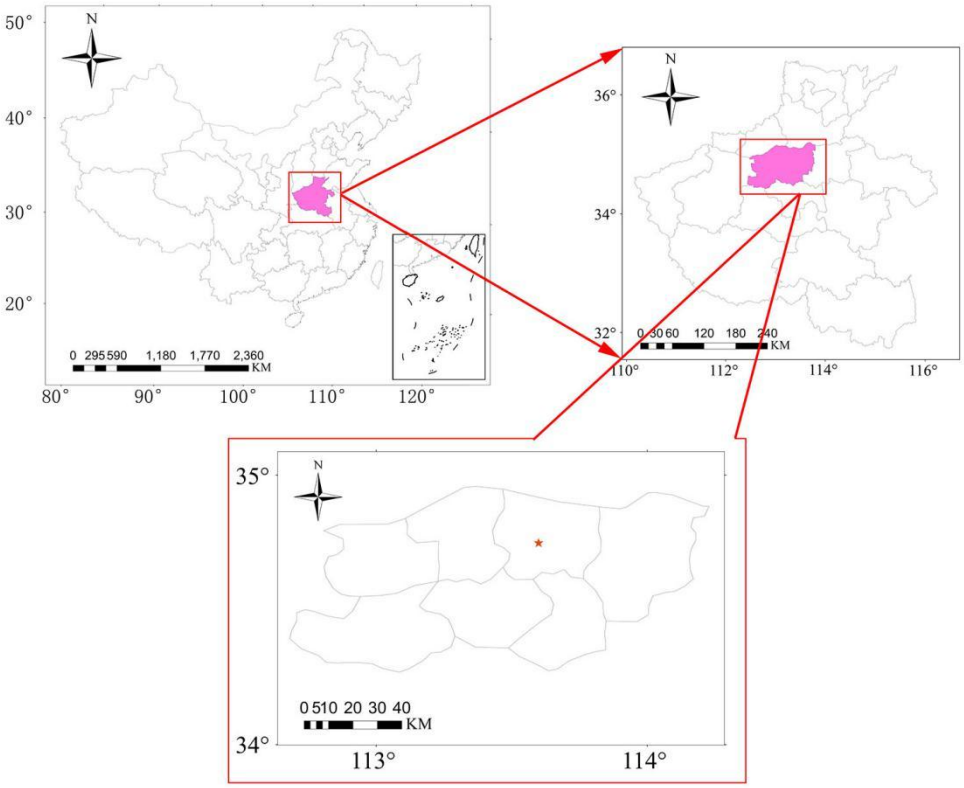


Fig. S1 Locations of the sampling stations in Zhengzhou.

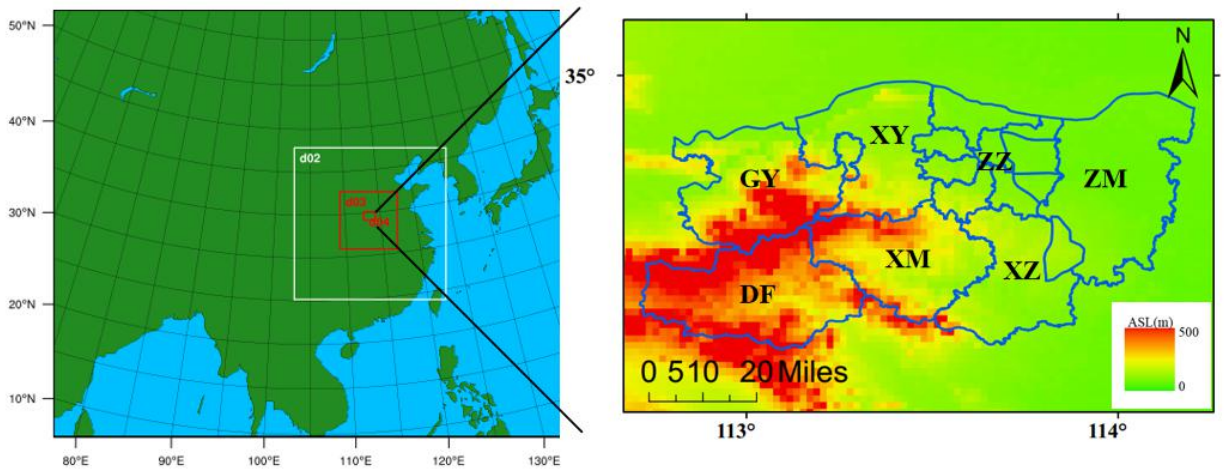


Fig. S2 Four-level nested domains used in the WRF/CMAQ simulations. d01, d02, d03 and d04 have horizontal resolutions of 36, 12, 4 and 1 km, respectively. ZZ: Zhengzhou main city; ZM: Zhongmu; XZ: Xinzheng; XM: Xinmi; DF: Dengfeng; GY: Gongyi; XY: Xingyang.

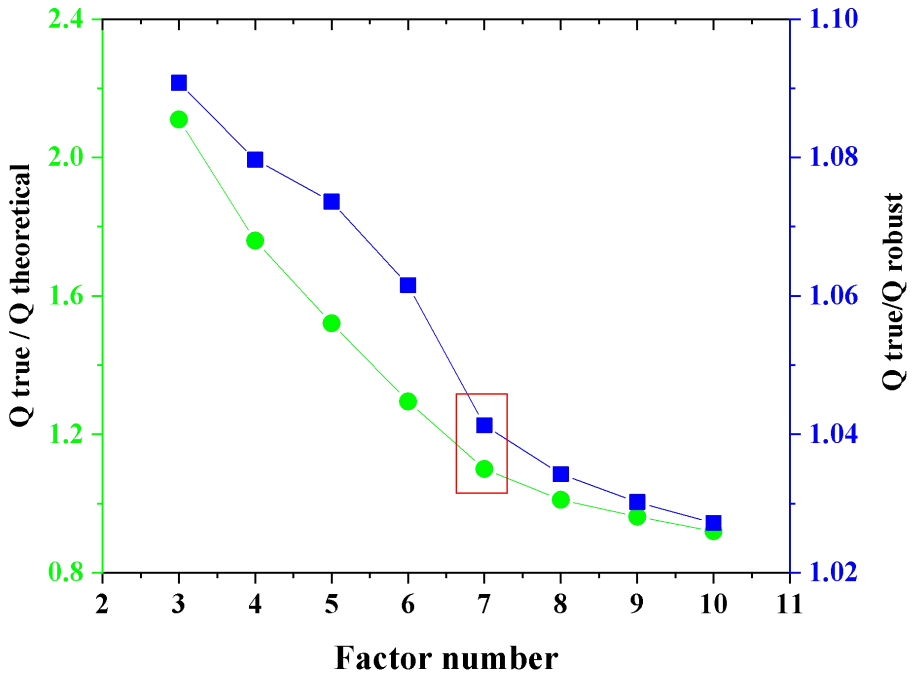


Fig. S3 The ratios of Qtrue/Qrobust and Qtrue/Qexp at factor size ranged from 3–10.

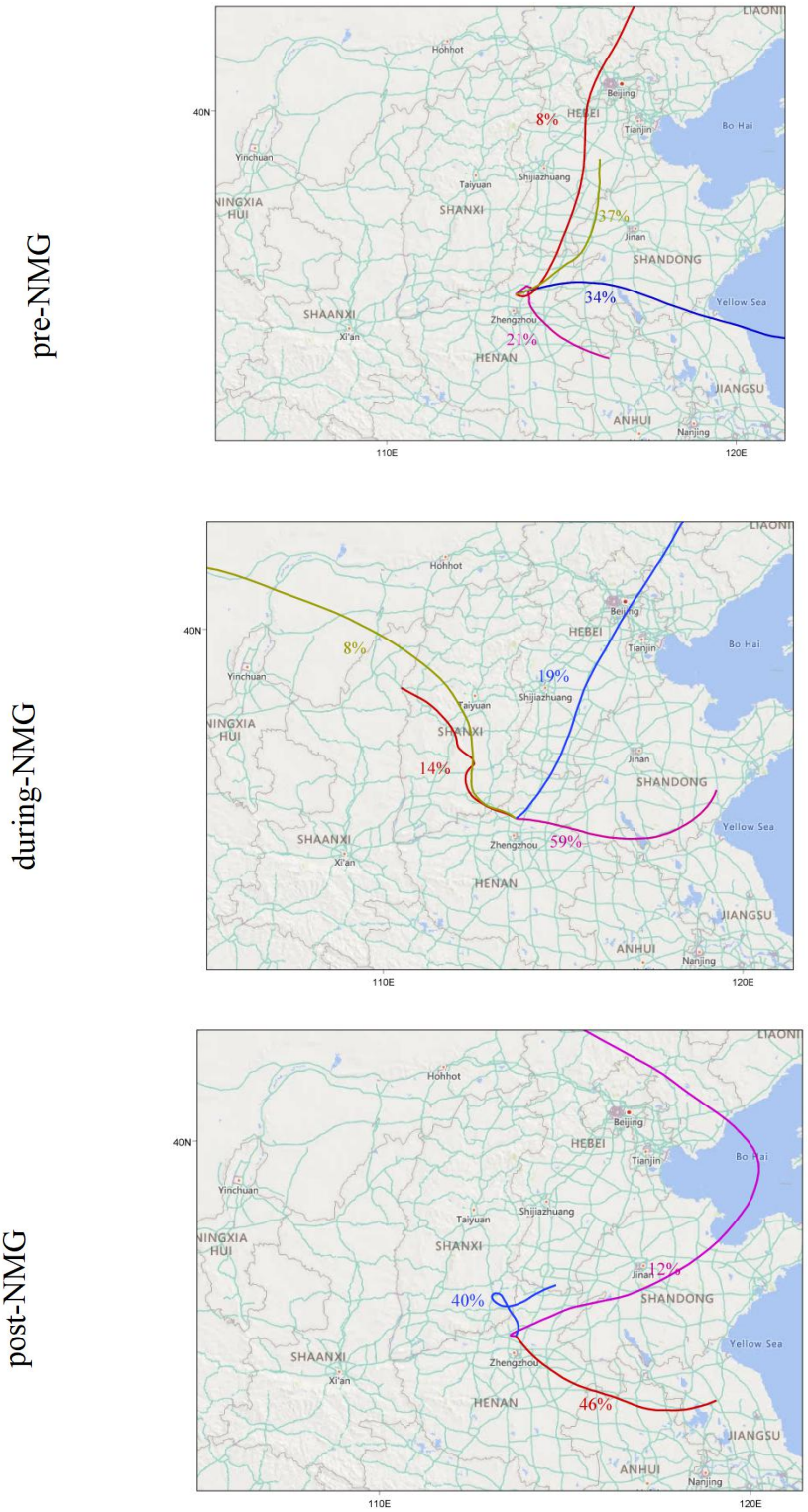


Fig. S4 The 48-h backward trajectories from Zhengzhou during the three periods.

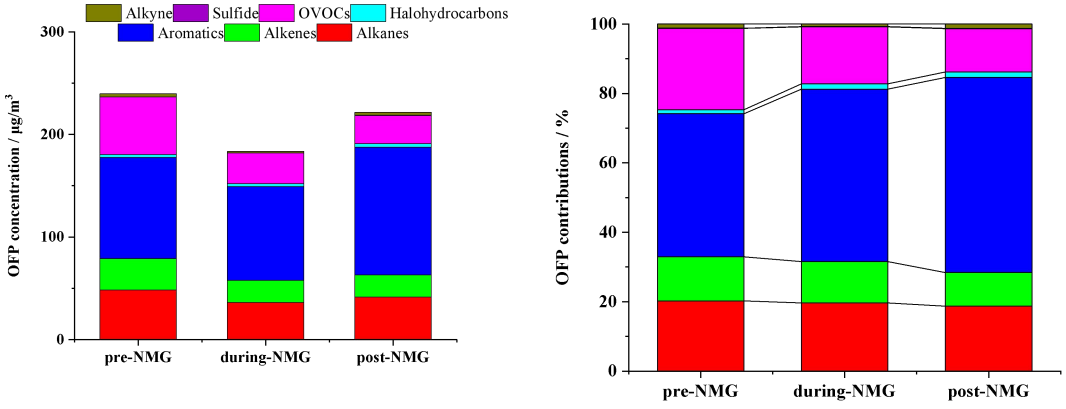


Fig. S5 Average concentrations and percentage of each group of VOCs.

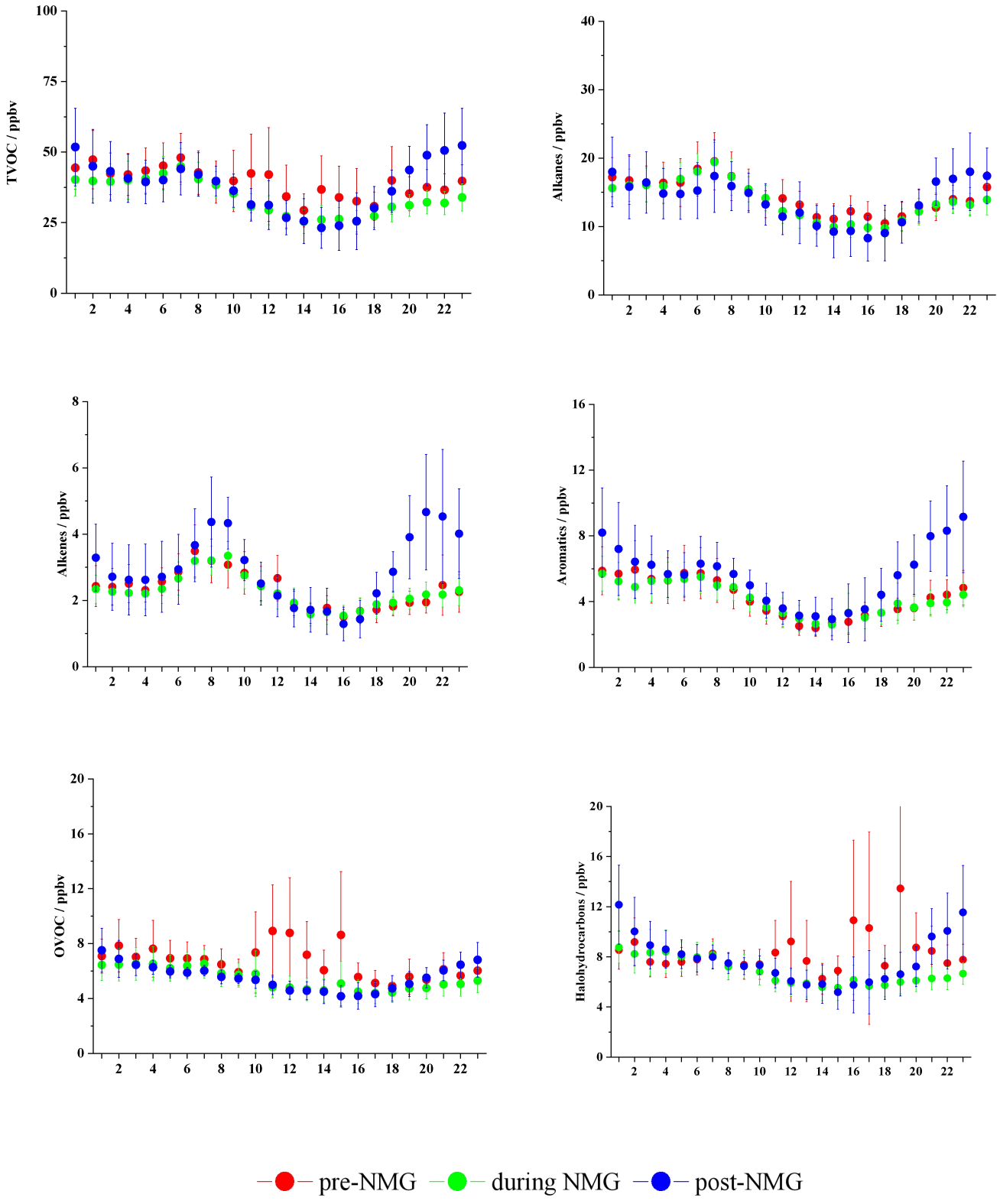


Fig. S6 Diurnal variations in concentrations of TVOC and its compounds in Zhengzhou.

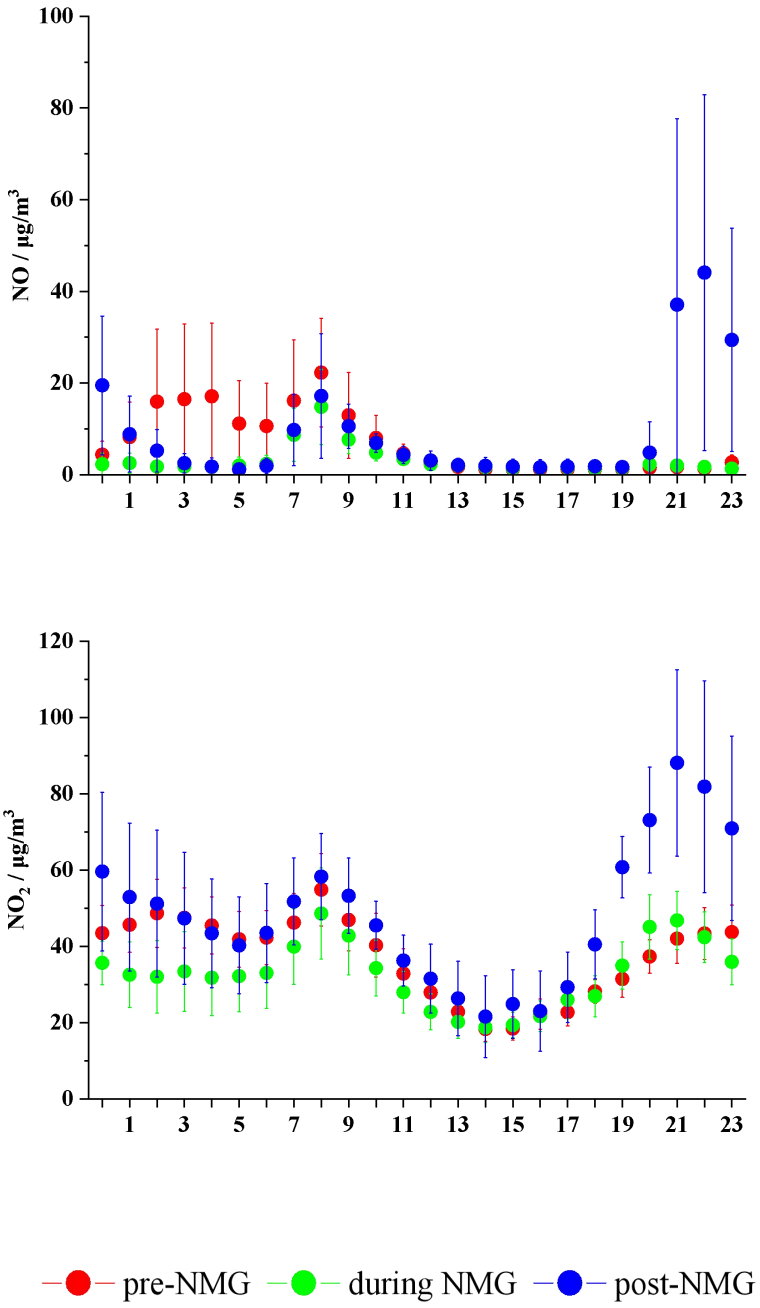


Fig. S7 Diurnal variations in concentrations of NO and NO_2 in Zhengzhou during the three periods.

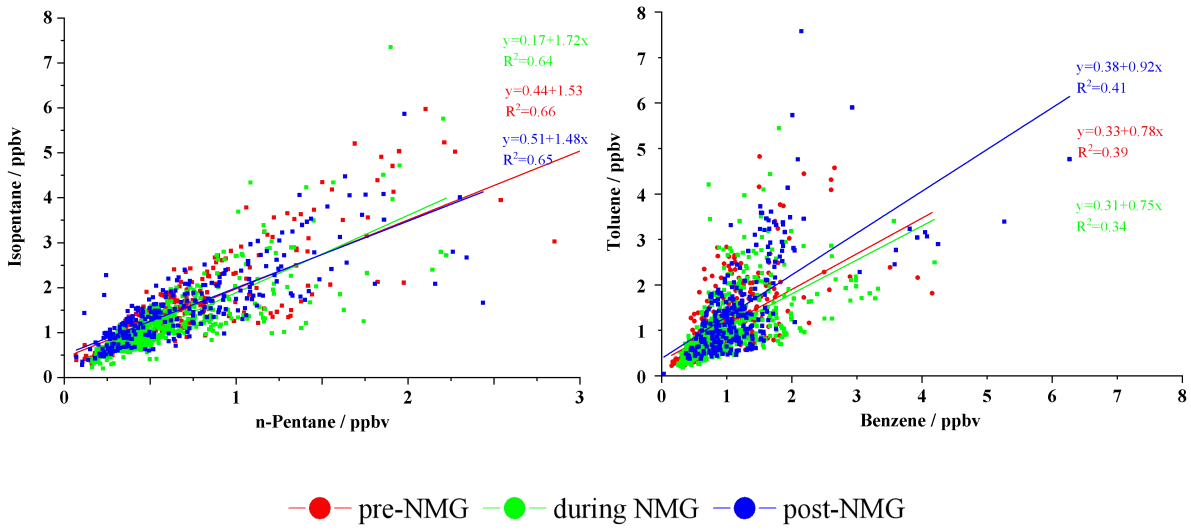
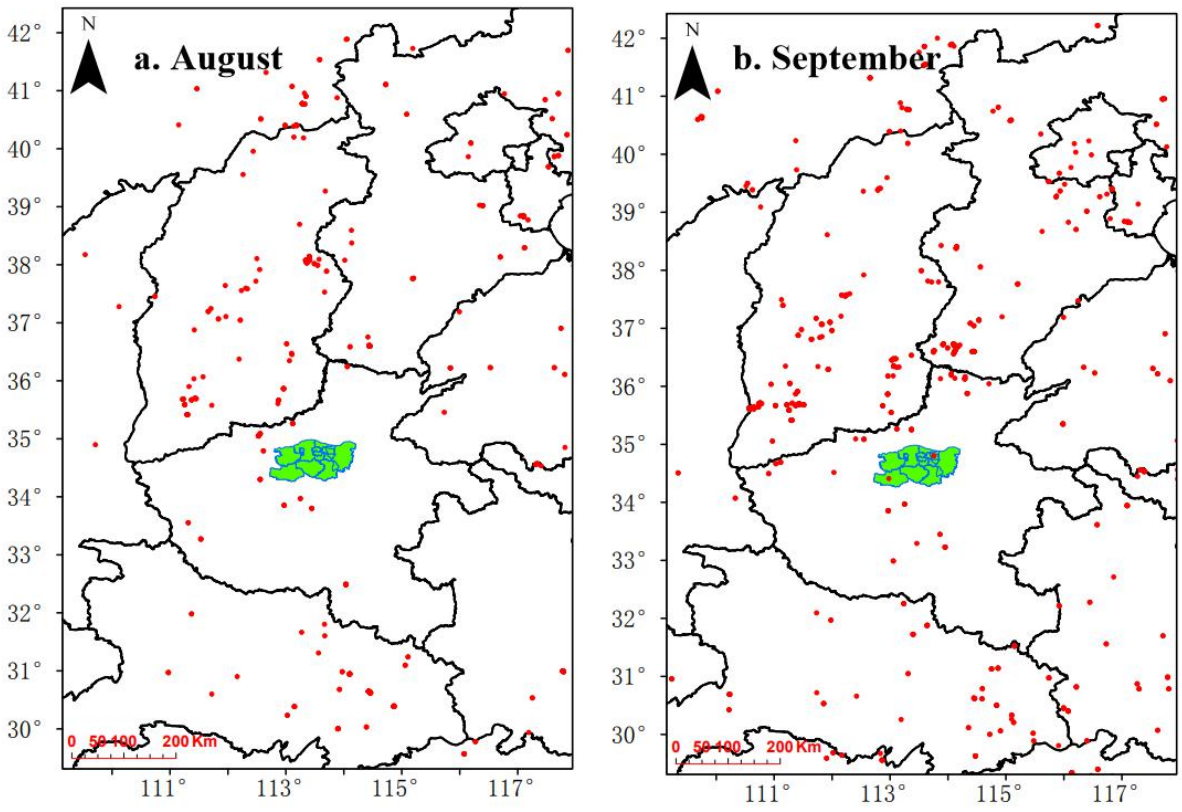


Fig. S8 Ratios of T/B and *i*/*n*-Pentane in Zhengzhou.



Fg. S9 Hotspots diagram (https://firms.modaps.eosdis.nasa.gov/firemap/), (a) August and (b) September.

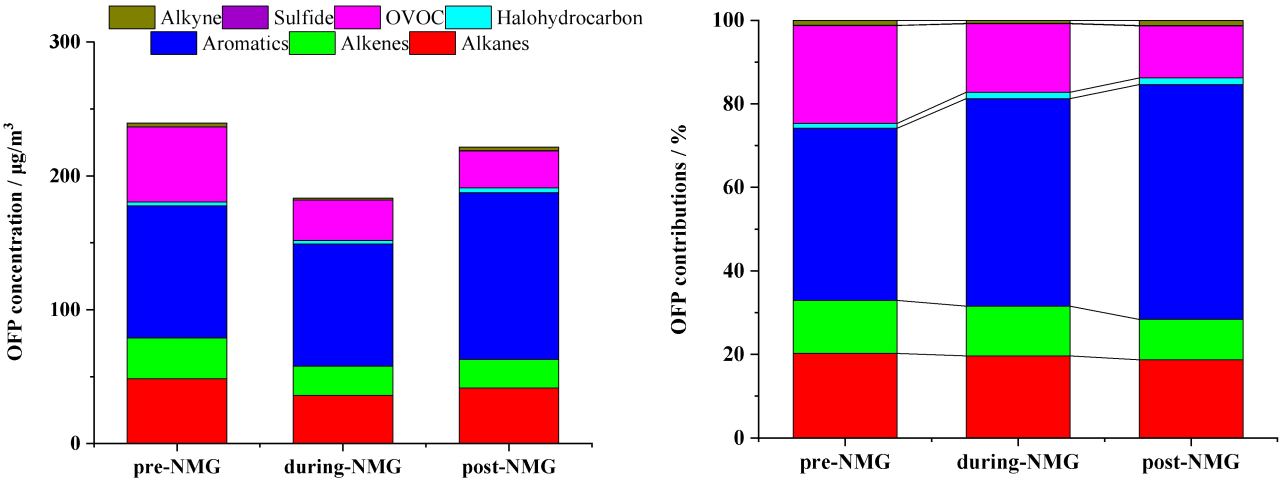


Fig. S10 The contributions and percentage of VOCs groups to the total OFP before, during, and after the control period during the NMG 2019.

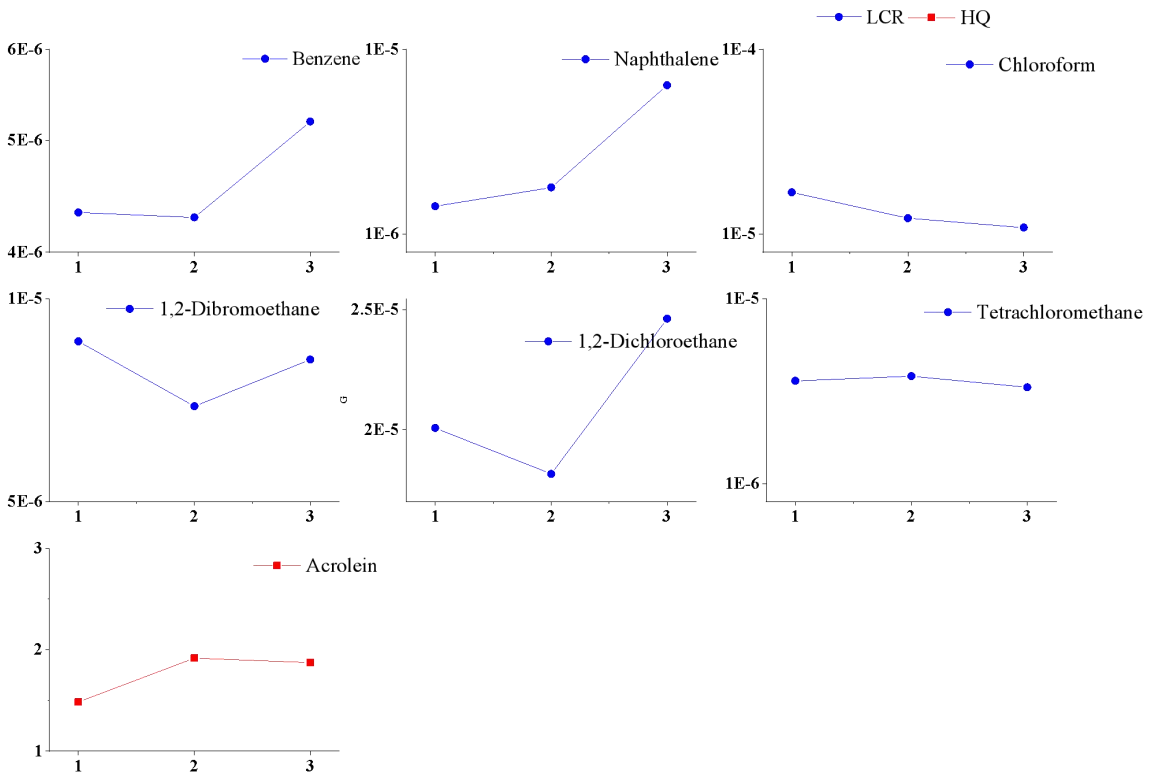


Fig. S11 The evolution of HQ and carcinogenic risks of hazardous VOC species during the three period. 1, 2, and 3 of x-axis represent pre-NMG, NMG and post-NMG periods, respectively.