Supplement-Vehicular volatile organic compounds (VOCs)-NO_x-CO emissions in a tunnel study in northern China: emission factors, profiles, and source apportionment

Congbo Song[1], Yan Liu[1], Shida Sun[1], Luna Sun[1], Yanjie Zhang[1], Chao Ma[1], Jianfei Peng[2], Qian Li[1], Jinsheng Zhang[1], Qili Dai[1], Baoshuang Liu[1], Peng Wang[2], Yi Zhang[1], Ting Wang[1], Lin Wu[1], Min Hu[3], and Hongjun Mao[1]

[1]Center for Urban Transport Emission Research & State Environmental Protection Key Laboratory of Urban Ambient Air Particulate Matter Pollution Prevention and Control, College of Environmental Science and Engineering, Nankai University, Tianjin, 300071, China

[2]Zachry Department of Civil Engineering, Texas A and M University, College Station, TX, 77845, USA

[3]Laboratory of Environmental Simulation and Pollution Control, College of Environmental Sciences and Engineering, Peking University, Beijing, 100871, China

Correspondence: Hongjun Mao (hongjunm@nankai.edu.cn)

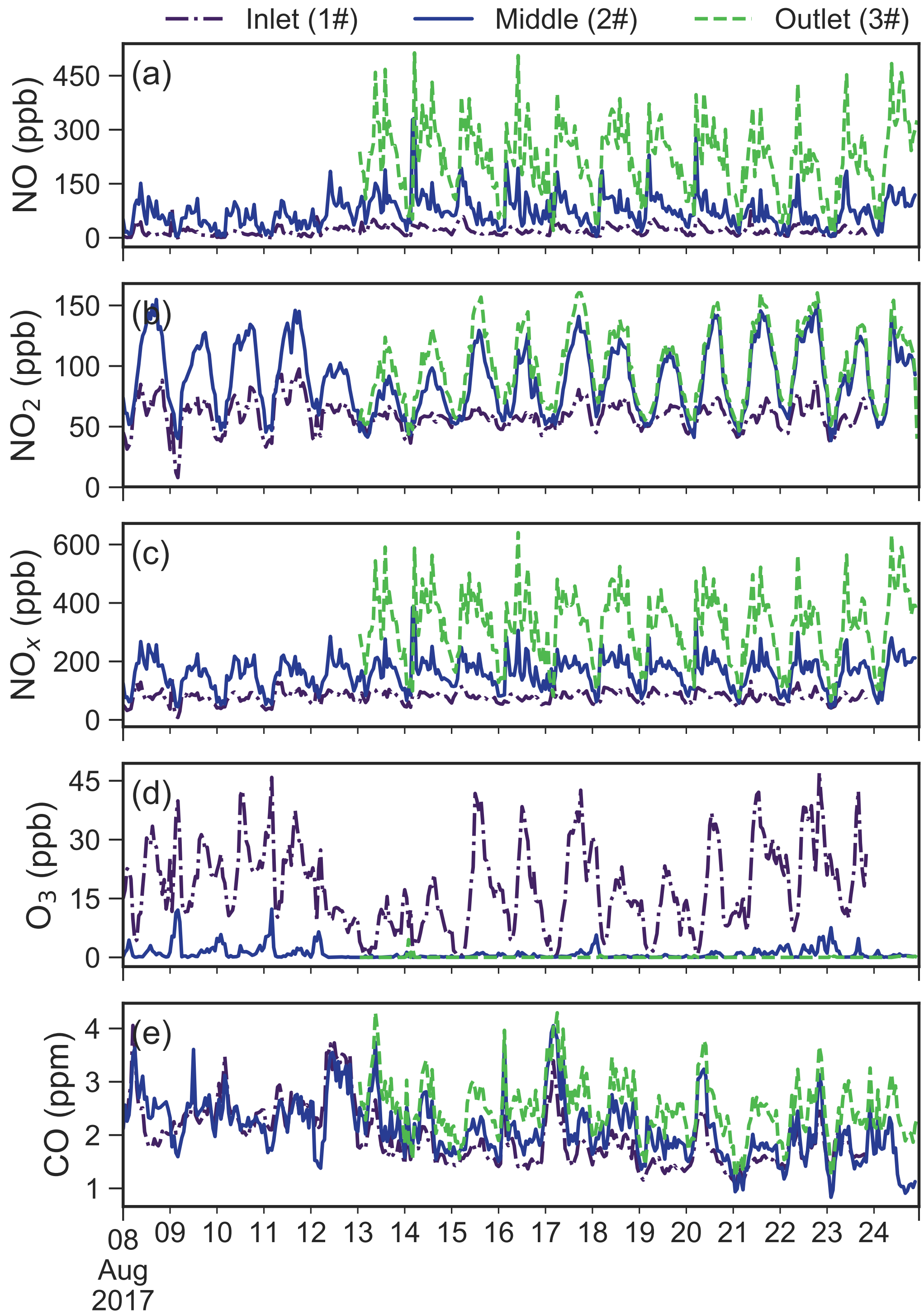

Figure A1. The time series of (a) NO, (b) NO_2, (c) NO_x, (d) CO and (e) wind speed (WS, measured by Flowsick).

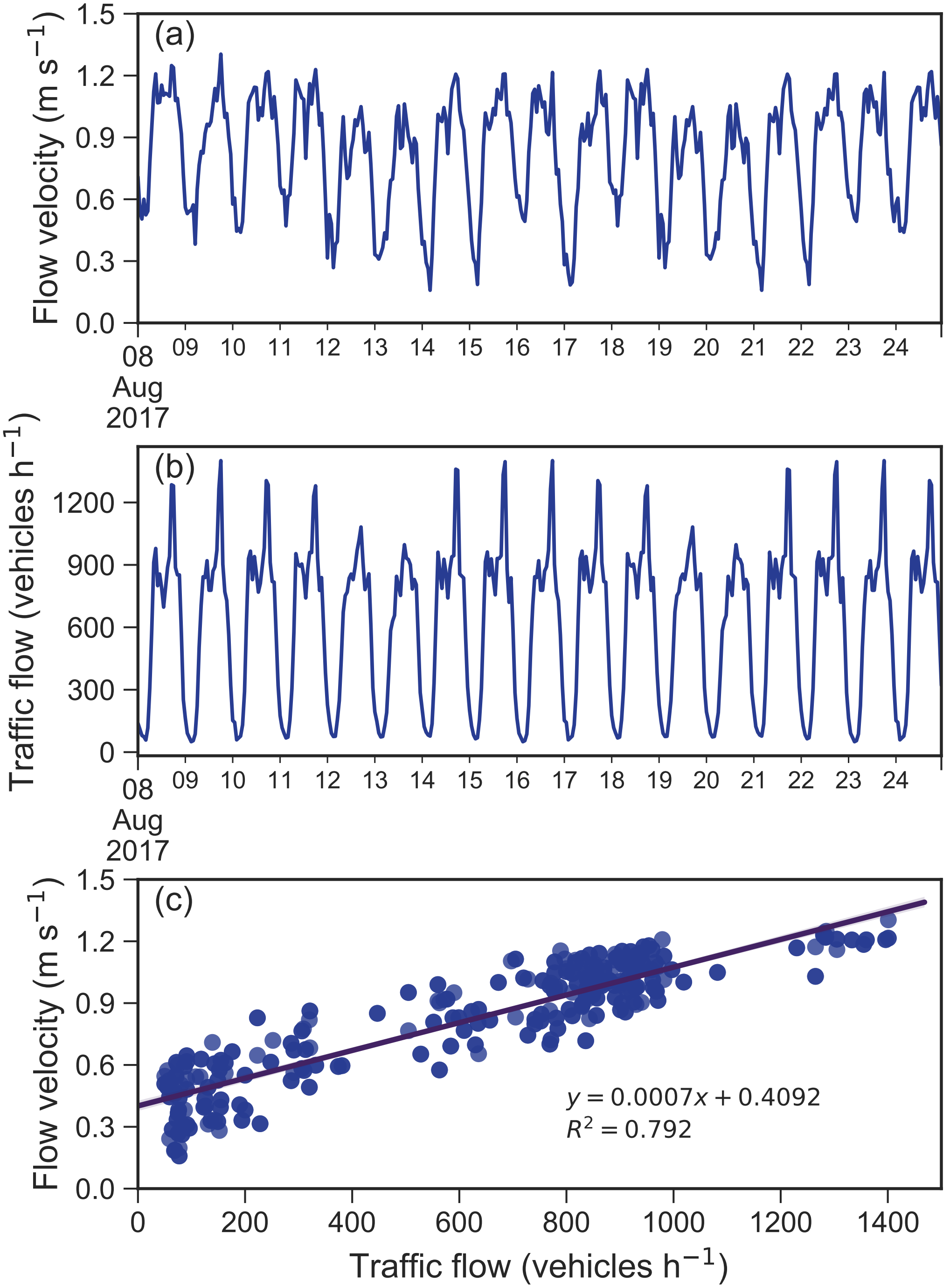

Figure A2. The time series of (a) traffic flow and (b) velocity flow, and (c) their relationships.

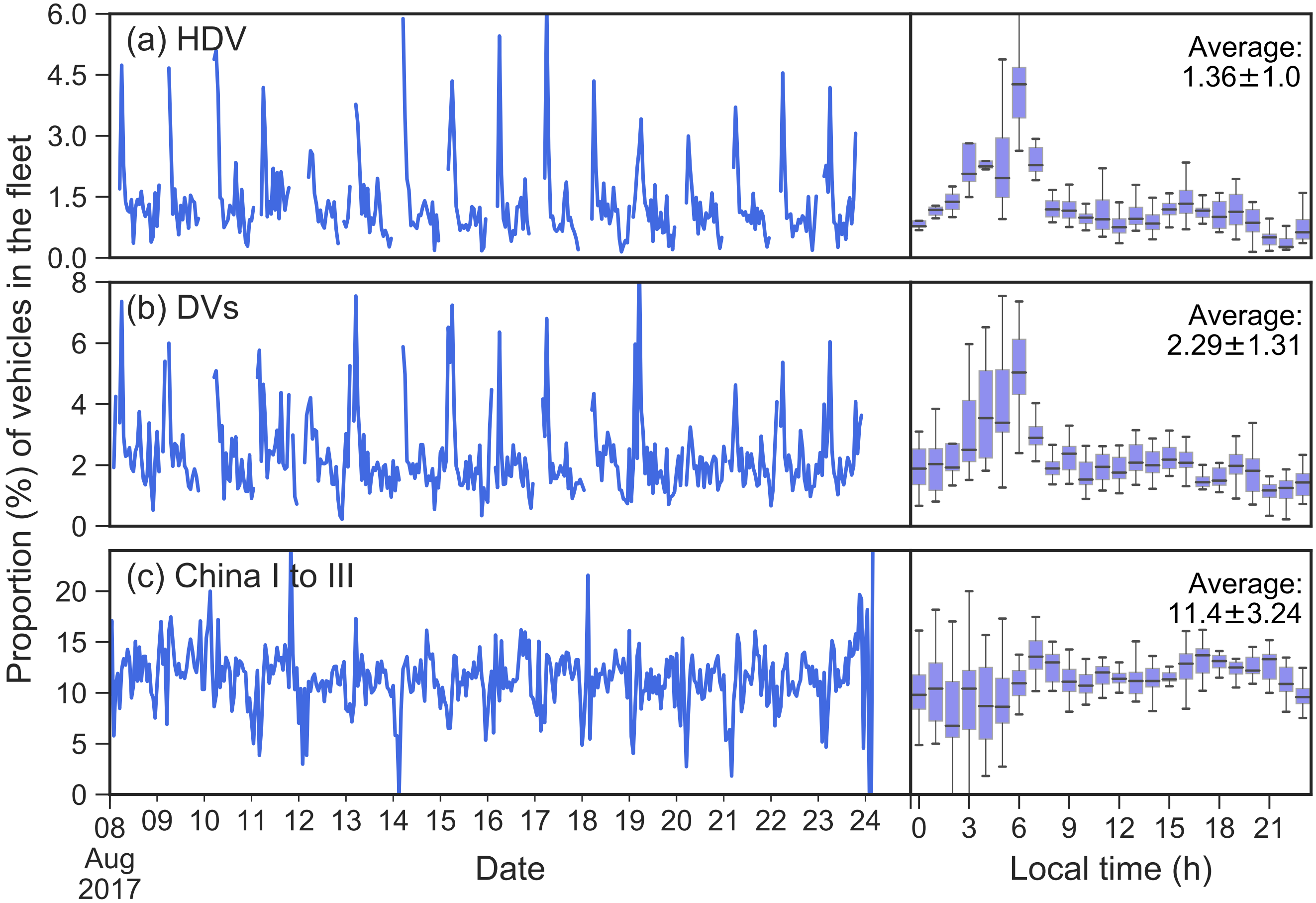

Figure A3. The proportions of (a) heavy-duty vehicles (HDV), (b) diesel vehicles (DVs), and (c) emission standards from China I to China III in the fleet.

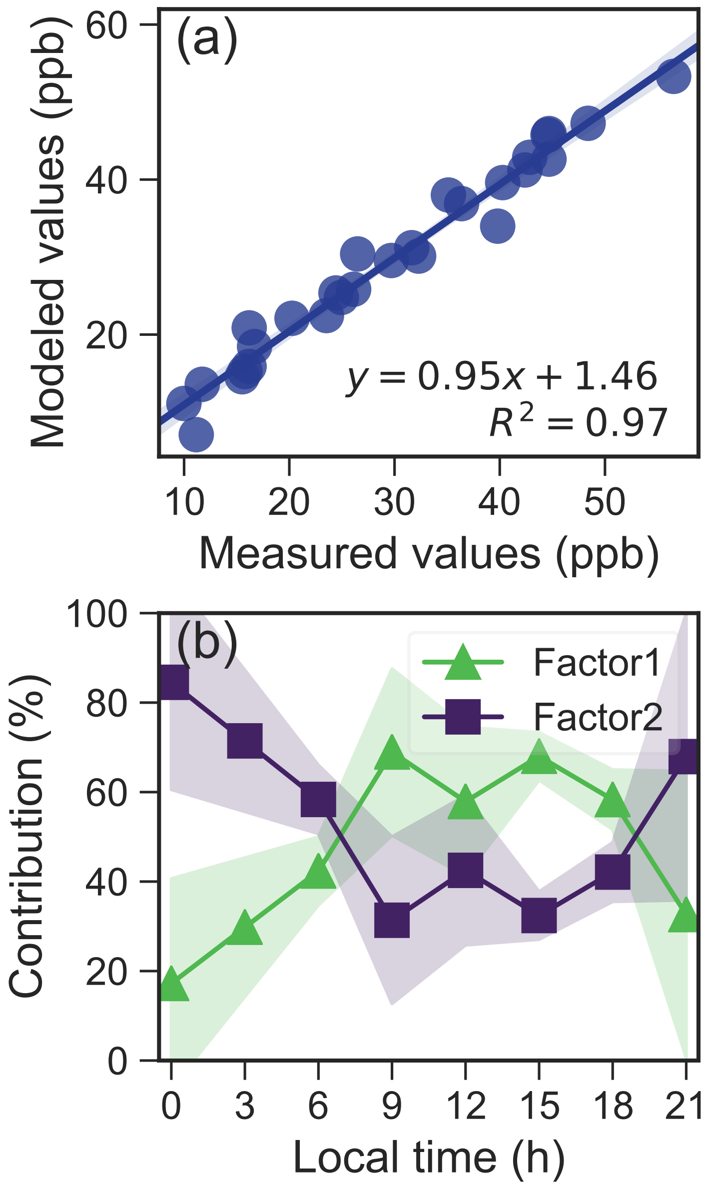

Figure A4. (a) The relationships between the measured and modeled concentrations of NMVOCs for PMF; (b) the diurnal variations (filled with one standard deviation) of the factor contributions to total variance.

Table A1. The meteorological factors and concentrations of air pollutants in the ambient air, and the inlet and outlet of the tunnel.

	Ambient	Inlet (1#)	Middle (2#)	Outlet (3#)
Meteorological factors				
Wind speed ($m\ s^{-1}$)	1.51±0.65	1.56±0.48	0.88±0.26	N.A.
Pressure (hPa)	1004.57±3.54	1001.12±9.31	1003.86±30.55	N.A.
Temperature (°C)	27.13±2.32	28.52±2.68	29.28±1.50	N.A.
Relative humidity (%)	71.44±10.44	64.92±11.06	62.68±7.68	N.A.
Air pollutants				
NO (ppb)	2.76±3.09	19.42±13.59	72.65±44.84	220.43±99.73
NO_2 (ppb)	14.73±6.90	59.12±12.33	89.06±28.57	99.48±30.48
NO_x (ppb)	17.49±8.85	78.54±20.38	161.71±54.80	319.91±118.35
O_3	45.44±25.86	18.05±10.65	0.96±1.63	0.05±0.32
CO (ppm)	0.97±0.40	1.96±0.55	2.13±0.57	2.50±0.55
O_x (ppb)	60.17±22.38	77.17±17.21	90.03±28.42	99.53±30.42
NO_2/NO_x	0.85±0.08	0.77±0.11	0.58±0.15	0.34±0.11
NMVOCs (ppb)	N.A.	73.46±26.70	104.31±23.06	N.A.
NMVOCs/NO_x (ppbC/ppb)	N.A.	3.43±1.50	2.74±0.90	N.A.

N.A. – not available.

Table A2: The statistical description of the linear regression between fleet-average emission factors (and f_{NO_2}) and the proportions of vehicle types (HDV: heavy-duty vehicles, LDV: light-duty vehicles, DVs: diesel vehicles, GVs: gasoline vehicles).

Vehicle type	Road condition	Target	Intercept	Slope	Pearson's r	Adj. R-Square	Prob>F
DVs	Downslope	NO	29.15±6.57	1298.33±2.59	0.93	0.83	0.01
		NO_2	15.41±3.01	29.37±1.19	0.12	-0.23	0.82*
		NO_x	51.88±6.15	1081.15±2.43	0.91	0.79	0.01
		CO	144.38±26.55	4598.72±10.47	0.91	0.79	0.01
		f_{NO_2} Ratio1	0.48±0.02	-3.85±0.01	-0.93	0.83	0.01
		f_{NO_2} Ratio2	0.21±0.02	-1.42±0.01	-0.67	0.32	0.14*
	Upslope	NO	96.42±4.95	2724.6±1.95	0.99	0.97	0
		NO_2	15.08±2.47	363.77±0.97	0.88	0.72	0.02
		NO_x	114.02±7.08	2933.45±2.8	0.98	0.96	0
		CO	466.9±35.73	3279.35±14.1	0.76	0.47	0.08*
		f_{NO_2} Ratio1	0.10±0.01	-0.33±0.53	-0.30	0.14	0.56*
		f_{NO_2} Ratio2	0.09±0.01	-0.23±0.59	-0.19	0.20	0.71*
	Overall	NO	52.13±6.94	2102.17±2.74	0.97	0.92	0
		NO_2	16.34±1.65	-20.76±0.65	-0.16	-0.22	0.77*
		NO_x	71.42±7.31	2084.32±2.88	0.96	0.91	0
		CO	297.65±22.42	1389.61±8.85	0.62	0.23	0.19*
		f_{NO_2} Ratio1	0.06±0.03	2.46±0.01	0.76	0.47	0.08*
		f_{NO_2} Ratio2	0.04±0.02	2.57±0.01	0.8	0.55	0.06*
HDV	Downslope	NO	32.55±5.06	1586.99±3.14	0.93	0.83	0.01
		NO_2	17.73±2.42	-149.63±1.5	-0.45	0	0.37*
		NO_x	57.71±6.13	1146.53±3.8	0.83	0.62	0.04
		CO	134.52±27.44	7245.15±17	0.91	0.77	0.01
		f_{NO_2} Ratio1	0.48±0.01	-6.32±0.01	-0.98	0.94	0
		f_{NO_2} Ratio2	0.23±0.02	-3.02±0.01	-0.79	0.52	0.06*
	Upslope	NO	115.34±8.34	3101.09±5.17	0.95	0.88	0
		NO_2	15.3±1.62	501.46±1.01	0.93	0.83	0.01
		NO_x	135.81±9.77	3090.29±6.05	0.93	0.83	0.01

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Table A2 : *(Continued)*

Vehicle type	Road condition	Target	Intercept	Slope	Pearson's r	Adj. R-Square	Prob>F
		CO	474.6±22.28	1240.84±13.81	0.41	-0.04	0.42*
		f_{NO_2} Ratio1	0.08±0.01	0.27±0.61	0.22	-0.19	0.68*
		f_{NO_2} Ratio2	0.07±0.01	0.42±0.59	0.34	-0.11	0.51*
	Overall	NO	66.33±6.43	2196.89±3.98	0.94	0.85	0.01
		NO_2	17.09±1.66	-65.88±1.03	-0.3	-0.13	0.56*
		NO_x	87.87±7.61	2038.12±4.72	0.91	0.78	0.01
		CO	286.53±17.51	1590.86±10.85	0.59	0.19	0.22*
		f_{NO_2} Ratio1	-0.24±0.52	0.33±0.53	0.3	-0.14	0.56*
		f_{NO_2} Ratio2	-0.14±0.57	0.23±0.59	0.19	0.20	0.71*
GVs	Downslope	NO	1327.48±253.37	-1298.33±2.59	-0.93	0.83	0.01
		NO_2	44.77±115.98	-29.37±1.19	-0.12	-0.23	0.82*
		NO_x	1133.02±237.18	-1081.15±2.43	-0.91	0.79	0.01
		CO	4743.1±1023.68	-4598.72±10.47	-0.91	0.79	0.01
		f_{NO_2} Ratio1	-3.37±0.76	3.85±0.01	0.93	0.83	0.01
		f_{NO_2} Ratio2	-1.21±0.76	1.42±0.01	0.67	0.32	0.14*
	Upslope	NO	282.02±190.93	-2724.6±1.95	-0.99	0.97	0
		NO_2	378.85±95.2	-363.77±0.97	-0.88	0.72	0.02
		NO_x	3047.47±273.2	-2933.45±2.8	-0.98	0.96	0
		CO	3746.25±1377.98	-3279.35±14.1	-0.76	0.47	0.08*
		f_{NO_2} Ratio1	-0.24±0.52	0.33±0.53	0.30	0.14	0.56*
		f_{NO_2} Ratio2	-0.14±0.57	0.23±0.59	0.19	-0.20	0.71*
	Overall	NO	2154.3±267.47	-2102.17±2.74	-0.97	0.92	0
		NO_2	-4.42±63.81	20.76±0.65	0.16	-0.22	0.77*
		NO_x	2155.74±281.88	-2084.32±2.88	-0.96	0.91	0
		CO	1687.25±864.58	-1389.61±8.85	-0.62	0.23	0.19*
		f_{NO_2} Ratio1	2.51±1.02	-2.46±0.01	-0.76	0.47	0.08*
		f_{NO_2} Ratio2	2.61±0.94	-2.57±0.01	-0.8	0.55	0.06*
LDV	Downslope	NO	1619.53±309.53	-1586.99±3.14	-0.93	0.83	0.01
		NO_2	-131.9±147.96	149.63±1.5	0.45	0	0.37*

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Table A2 : *(Continued)*

Vehicle type	Road condition	Target	Intercept	Slope	Pearson's r	Adj. R-Square	Prob>F
		NO_x	1204.24±374.63	-1146.53±3.8	-0.83	0.62	0.04
		CO	7379.67±1677.3	-7245.15±17	-0.91	0.77	0.01
		f_{NO_2} Ratio1	-5.84±0.7	6.32±0.01	0.98	0.94	0
		f_{NO_2} Ratio2	-2.8±1.18	3.02±0.01	0.79	0.52	0.06*
	Upslope	NO	3216.43±509.5	-3101.09±5.17	-0.95	0.88	0
		NO_2	516.76±99.21	-501.46±1.01	-0.93	0.83	0.01
		NO_x	3226.1±597.22	-3090.29±6.05	-0.93	0.83	0.01
		CO	1715.45±1361.86	-1240.84±13.81	-0.41	-0.04	0.42*
		f_{NO_2} Ratio1	-0.35±0.61	-0.27±0.61	-0.22	0.19	0.68*
		f_{NO_2} Ratio2	-0.49±0.58	-0.42±0.59	-0.34	-0.11	0.51*
	Overall	NO	2263.22±392.93	-2196.89±3.98	-0.94	0.85	0.01
		NO_2	-48.79±101.52	65.88±1.03	0.3	-0.13	0.56*
		NO_x	2126±465.35	-2038.12±4.72	-0.91	0.78	0.01
		CO	1877.39±1070.2	-1590.86±10.85	-0.59	0.19	0.22*
		f_{NO_2} Ratio1	4.4±1.07	-4.35±0.01	-0.9	0.75	0.02
		f_{NO_2} Ratio2	4.22±1.02	-4.18±0.01	-0.9	0.76	0.02

* – The linear regression is not significant at the 0.05 level (p>0.05).

Table A3. The average (±standard deviation) emission factors (mg km^{-1} veh^{-1}) measured in the WJL tunnel in Tianjin in 2017.

Vehicle type		Road condition	NO	NO_2	NO_x	CO
Fleet		Downslope	61.92±72.46	16.52±11.49	79.45±78.43	269.96±342.38
		Upslope	158.58±73.48	23.98±20.14	181.22±88.29	577.76±382.22
		Overall	97.52±69.84	15.86±9.38	116.56±77.61	344.67±250.01
GVs/DVs	GVs	Downslope	29.15±6.57	N.A.	51.88±6.15	144.38±26.55
		Upslope	96.42±4.95	15.08±2.47	114.02±7.08	N.A.
		Overall	52.13±6.94	N.A.	71.42±7.31	N.A.
	DVs	Downslope	1133.02±237.18	N.A.	1327.48±253.37	4743.1±1023.68
		Upslope	2802.02±190.93	378.85±95.2	3047.47±273.2	N.A.
		Overall	2154.3±267.47	N.A.	2155.74±281.88	N.A.
LDV/HDV	LDV	Downslope	32.55±5.06	N.A.	57.71±6.13	134.52±27.44
		Upslope	115.34±8.34	15.3±1.62	135.81±9.77	N.A.
		Overall	66.33±6.43	N.A.	87.87±7.61	N.A.
	HDV	Downslope	1204.24±374.63	N.A.	1619.53±309.53	7379.67±1677.3
		Upslope	3216.43±509.5	516.76±99.21	3726.1±597.22	N.A.
		Overall	2126±465.35	N.A.	2263.22±392.93	N.A.

N.A. – The linear regression is not significant at the 0.05 level (p>0.05).

Table A4: Average emission factors (mg km^{-1} veh^{-1}) for individual VOC from different tunnel studies.

Compound	CAS No.	Taiwan[a]	Hong Kong[b]	Guangzhou[c]	Taiwan[d]	Guangzhou[e]	Nanjing[f]	Hong Kong[g]	Tianjin[h]
		2000	2003	2004	2005	2014	2015	2015	2017
Alkanes									
Ethane	74-84-0	4.27±0.96	1.7±0.6	4.9±0.72	N.A.	9± 0.51	52.47±6.72	1 ± 0.8	1.91±0.84
Propane	74-98-6	2.4±0.77	5.7±2.5	15.2±16.85	0.2	184±10.71	11.8±3.48	4.8 ± 2.4	0.36±0.21
Isobutane	75-28-5	4.57±0.94	5.5±2.2	5.1±2.37	N.A.	31± 1.53	4.09±1.64	7.3 ± 4.5	0.56±0.27
n-Butane	106-97-8	6.56±1.96	8.7±3.1	10.3±4.98	5.12	53± 3.06	4.34±0.13	10.2 ± 5.9	2.03±0.89
2,2-Dimethylbutane	75-83-2	1.32±0.25	0.2±0.2	1.1±0.32	2.26	0.8± 0.05	0.36±0.23	0.1 ± 0.1	0.17±0.06
2,3-Dimethylbutane	565-59-3	1.33±0.69	0.3±0.2	4±0.64	12.7	1.5± 0.1	5.63±2.71	0.3 ± 0.5	0.39±0.15
n-Pentane	109-66-0	9.52±3.05	1.7±0.6	14.1±2.15	19.28	7± 0.51	4.89±3.59	1.3 ± 1.8	2.14±0.99
Isopentane	78-78-4	12.5±4.09	5.6±2.1	41.5±6.94	40.07	17± 1.53	17.82±11.97	2.5 ± 1.7	6.80±2.35
2-Methylpentane	107-83-5	5.27±1.72	1.8±0.7	20.5±3.36	12.56	5.7± 0.41	4.60±2.69	0.6 ± 0.4	1.59±0.59
3-Methylpentane	96-14-0	6.39±1.53	1.2±0.5	13.2±2.37	5.62	3.6± 0.26	2.03±1.10	0.3 ± 0.2	1.38±0.54
2,3-Dimethylpentane	565-59-3	1.33±0.69	0.1±0.1	1.9±0.4	0.72	0.9±0.05	0.86±0.55	0.1 ± 0.1	0.20±0.04
2,4-Dimethylpentane	108-08-7	0.44±0.07	0.2±0.1	1.4±0.32	0.9	3±0.15	0.23±0.10	0.1 ± 0.1	0.14±0.03
2,2,4-Trimethylpentane	540-84-1	0.29±0.18	1±0.7	N.A.	0.77	1.6± 0.1	0.33±0.17	0.6 ± 0.4	0.66±0.10
2,3,4-Trimethylpentane	565-75-3	N.A.	0.2±0.2	N.A.	0.05	0.6± 0.05	0.16±0.08	0.2 ± 0.2	0.38±0.10
n-Hexane	110-54-3	4.18±1.56	1.3±0.5	8.1±1.52	5.7	2.3± 0.26	1.70±1.35	1.2 ± 1.5	0.85±0.27
2-Methylhexane	591-76-4	N.A.	0.7±0.3	7.3±1.15	2.53	0.6± 0.05	1.2±0.56	0.2 ± 0.1	0.37±0.13
3-Methylhexane	589-34-4	2.94±0.43	0.8±0.3	7.4±1.05	2.75	2.5± 0.15	0.33±0.17	0.3 ± 0.2	0.55±0.15
n-Heptane	142-82-5	1.46±0.24	0.9±0.4	4.7±0.72	1.63	1.9± 0.1	0.85±0.42	0.2 ± 0.2	0.39±0.09
2-Methylheptane	592-27-8	1.05±0.29	0.3±0.1	3.5±0.75	0.79	0.9± 0.05	0.79±0.32	0.1 ± 0.1	0.20±0.05
3-Methylheptane	589-81-1	1.02±0.33	0.2±0.1	4.3±0.83	2.01	0.9± 0.05	0.38±0.18	0.1 ± 0.1	0.17±0.05
Octane	111-65-9	1.31±0.29	0.5±0.2	3.2±0.86	0.78	0.8± 0.05	0.59±0.29	0.1 ± 0.2	0.18±0.05
n-Nonane	111-84-2	0.54±0.13	0.7±0.4	2.7±0.28	0.31	0.6± 0.05	0.10±0.07	0.6 ± 0.7	0.06±0.01
n-Decane	124-18-5	N.A.	0.8±0.6	2.1±0.69	0.07	0.8± 0.05	0.05±0.04	1 ± 1.4	0.07±0.02
Udecane	1120-21-4	N.A.	N.A.	2.2±0.59	1.39	1.8±0.15	N.A.	N.A.	0.04±0.02
Dodecane	112-40-3	N.A.	N.A.	3.1±0.96	N.A.	1.9± 6.06	N.A.	N.A.	0.13±0.09
Cyclopentane	287-92-3	0.89±0.21	1±0.4	4.2±1.42	2	0.8± 5.97	0.33±0.14	0.2 ± 0.9	0.26±0.10
Methylcyclopentane	96-37-7	2.64±0.93	0.7±0.2	N.A.	2.19	0.6± 0.05	1.18±0.60	0.2 ± 0.2	0.58±0.18
Methylcyclohexane	108-87-2	0.94±0.18	0.4±0.2	7±0.57	0.73	1.1± 0.05	0.45±0.25	0.2 ± 0.2	0.26±0.09
Cyclohexane	110-82-7	0.98±0.13	0.3±0.1	1.1±0.13	0.4	2.4± 5.88	0.07±0.05	0.2 ± 0.2	0.24±0.15
Alkenes									
Ethylene	74-85-1	26.23±4.89	13.0±4.0	52.9±7.44	N.A.	16± 9.15	10.17±1.05	4.2 ± 2	2.56±0.47
Acetylene	74-86-2	11.56±3.02	4.0±1.3	N.A.	N.A.	7± 0.51	5.06±1.51	1.5±1	0.69±0.19
Propylene	115-07-1	N.A.	5.3±1.5	22.6±3.21	10.36	9.7± 0.46	6.79±1.55	1.9 ± 0.9	1.02±0.22
cis-2-Butene	590-18-1	1.84±0.46	0.5±0.1	4.6±0.92	1.56	1.3± 0.1	0.49±0.14	0.1 ± 0.1	0.17±0.07
trans-2-Butene	624-64-6	1.61±0.38	0.6±0.2	4.9±1.01	0.81	1.9± 0.15	0.90±0.36	0.2 ± 0.1	0.23±0.11
1-Butene	106-98-9	8.27±1.55	1.6±0.6	17.7±6.26	10.67	2.8± 0.15	0.79±0.13	1.2 ± 1.1	0.19±0.07
1,3-Butadiene	590-19-2	2.56±0.38	0.3±0.6	7.8±1.72	3.83	0.7± 0.2	0.11±0.08	0.2 ± 0.3	0.17±0.06
cis-2-Pentene	627-20-3	1.59±0.43	N.A.	4.6±1.21	1.57	0.8± 0.05	0.39±0.20	0.1 ± 0.1	0.09±0.03
trans-2-Pentene	646-04-8	2.76±0.77	0.6±0.2	8.5±2	4.08	1.5± 0.15	0.9±0.36	0.2 ± 0.1	0.25±0.10

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Table A4 : *(Continued)*

Compound	CAS No.	Taiwan[a]	Hong Kong[b]	Guangzhou[c]	Taiwan[d]	Guangzhou[e]	Nanjing[f]	Hong Kong[g]	Tianjin[h]
		2000	2003	2004	2005	2014	2015	2015	2017
1-Pentene	109-67-1	1.61±0.38	1.9±2.1	4.6±0.73	0.97	0.8± 0.05	0.23±0.01	0.2 ± 0.1	0.09±0.03
1-Hexene	592-41-6	N.A.	0.4±0.3	4.5±1.02	12.04	0.5± 0.05	0.30±0.14	0.1 ± 0.1	0.08±0.02
Isoprene	78-79-5	N.A.	0±0	N.A.	15.25	N.A.	N.A.	0.2 ± 0.2	0.08±0.03
Aromatics									
Benzene	71-43-2	12.21±3.26	4.5±0.9	18.7±21.13	5.87	4.6± 0.26	3.68±1.40	1.4 ± 0.9	1.97±0.52
Ethylbenzene	100-41-4	5.88±1.55	1.3±0.4	8.6±11.37	5.3	2.9± 0.2	1.32±0.83	1.1 ± 1.9	0.66±0.26
1,4-Diethylbenzene	105-05-5	N.A.	0.6±0.4	N.A.	2.41	2.6±0.15	0.33±0.01	0.1±0.1	0.09±0.04
1,3-Diethylbenzene	141-93-5	N.A.	0.2±0.2	N.A.	0.63	0.9±0.05	0.05±0.01	0±0.1	0.03±0.01
1,2,3-Trimethylbenzene	526-73-8	N.A.	1.4±1.1	2.7±5.13	1.95	4.3± 0.26	0.55±0.18	0.2 ± 0.2	0.12±0.04
1,2,4-Trimethylbenzene	95-63-6	14.28±2.94	3±2.4	11.2±15.08	11.8	7.7± 0.46	2.42±0.93	0.9 ± 1	0.48±0.19
1,3,5-Trimethylbenzene	108-67-8	2.31±0.38	0.8±0.4	3.1±3.67	3.72	3.6± 0.20	0.35±0.10	0.2 ± 0.2	0.13±0.04
n-Propylbenzene	103-65-1	1.68±0.6	0.5±0.2	1.8±2.2	1.7	1.6± 0.1	0.33±0.11	0.2 ± 0.2	0.10±0.04
Isopropylbenzene	98-82-8	N.A.	0.1±0.1	0.5±0.64	1.21	0.4± 0.05	0.12±0.07	0.2 ± 0.4	0.04±0.01
Toluene	108-88-3	29.02±16.02	12±3.9	31.7±37.13	29	11± 1.02	9.36±5.27	5.8 ± 5.2	3.29±1.10
2-Ethyltoluene	611-14-3	1.09±0.44	1.0±0.7	N.A.	3.91	2.5±0.15	0.54±0.19	0.2±0.2	0.12±0.04
3-Ethyltoluene	620-14-4	N.A.	1.4±0.9	N.A.	5.3	3.9±0.46	1.41±0.55	0.5±0.7	0.30±0.11
4-Ethyltoluene	622-96-8	N.A.	0.7±0.8	N.A.	2.79	3.1±0.2	0.56±0.20	0.3±0.5	0.14±0.06
o-Xylene	95-47-6	7.88±2.14	1.6±0.6	8.9±10.5	6.35	3.8± 0.26	1.69±0.80	0.3 ± 0.5	0.48±0.19
m/p-Xylene	108-38-3/ 106-42-3	8.95±2.38	1.9±0.7	25.3±30.79	8.44	9± 0.51	4.47±1.66	1.7±4.2	1.42±0.42
Styrene	100-42-5	4.81±1.33	N.A.	1.8±2.4	2.75	1.1± 0.2	0.44±0.19	1 ± 2.3	0.08±0.04
Halocarbons									
Chloromethane	74-87-3	N.A.	0±0	N.A.	N.A.	N.A.	0.39±0.29	N.A.	0.02±0.01
Dichloromethane	75-09-2	N.A.	0.1±0.1	N.A.	N.A.	N.A.	3.76±2.96	N.A.	0.12±0.06
Bromomethane	74-83-9	N.A.	0.1±0.5	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Bromodichloromethane	75-27-4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Chloroethane	75-00-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,2-Dibromoethane	106-93-4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,1-Dichloroethane	75-34-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,2-Dichloroethane	107-06-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.02±0.01
1,1,1-Trichloroethane	71-55-6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,1,2-Trichloroethane	79-00-5	N.A.	N.A.	N.A.	N.A.	N.A.	0.19±0.11	N.A.	0±0
1,2-Dichloropropane	78-87-5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.12±0.11
Vinylchloride	75-35-4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Trichloroethylene	79-01-6	N.A.	0±0	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Tetrachloroethylene	127-18-4	N.A.	0±0	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,1-Dichloroethylene	75-35-4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
cis-1,2-Dichloroethylene	156-59-2	N.A.	0±0	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
cis-1,3-Dichloropropene	10061-01-5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
$trans$-1,3-Dichloropropene	10061-02-6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Chlorobenzene	108-90-7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0

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Table A4 : *(Continued)*

Compound	CAS No.	Taiwan[a]	Hong Kong[b]	Guangzhou[c]	Taiwan[d]	Guangzhou[e]	Nanjing[f]	Hong Kong[g]	Tianjin[h]
		2000	2003	2004	2005	2014	2015	2015	2017
1,2-Dichlorobenzene	95-50-1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,3-Dichlorobenzene	541-73-1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
1,4-Dichlorobenzene	106-46-7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.01±0
Benzylchloride	100-44-7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Carbontetrachloroide	56-23-5	N.A.	0±0	N.A.	N.A.	N.A.	0.24±0.19	N.A.	0±0
Chloroform	67-66-3	N.A.	N.A.	N.A.	N.A.	N.A.	0.39±0.29	N.A.	0.01±0.01
Freon11(CFCl3)	75-69-4	N.A.	N.A.	N.A.	N.A.	N.A.	1.22±0.90	N.A.	0±0
Freon113(C2F3Cl3)	76-13-1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
Freon114(C2F4Cl2)	76-14-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
OVOCs									
Acetone	67-64-1	N.A.	N.A.	N.A.	12.6	N.A.	N.A.	N.A.	1.20±0.62
Methylethyl ketone	78-94-4	N.A.	N.A.	N.A.	2.85	N.A.	N.A.	N.A.	0.31±0.24
Methylvinylketone	78-94-4	N.A.	N.A.	N.A.	N.A.	N.A.	0.14±0.14	N.A.	0.14±0.07
Acetaldehyde	75-07-0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.73±0.57
acrolein	107-02-8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.10±0.03
Propanal	123-38-6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.64±0.35
Methacrolein	78-85-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.08±0.15
n-Butanal	123-72-8	N.A.	N.A.	N.A.	N.A.	N.A.	0.05±0.04	N.A.	0.23±0.13
2-Pentanone	107-87-9	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.02±0.01
3-Pentanone	96-22-0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.01±0
n-Pentanal	110-62-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0±0
n-Hexanal	66-25-1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.44±0.40
MTBE	1634-04-4	N.A.	N.A.	N.A.	N.A.	N.A.	1.58±0.28	N.A.	2.48±1.21
Acetonitrile	75-05-8	N.A.	N.A.	N.A.	N.A.	N.A.	0.11±0.11	N.A.	0.04±0.03
Alkanes		74.14	23±66	194.1	123.53	338.6±16.84	117.63	34	19.59±6.84
Alkenes		58.03	35±9.4	132.7	61.14	42±3	26.13	10.1	5.52±1.31
Aromatics		88.11	33±11	114.3	93.13	63±7	27.62	14.1	9.02±2.25
Halocarbons		N.A.	0.5±0.5	N.A.	N.A.	N.A.	6.19	N.A.	0.20±0.14
OVOCs		N.A.	N.A.	N.A.	N.A.	N.A.	1.88	N.A.	5.29±2.22
NMVOCs		400±60	115±26	493±120	277.8	449±20	179.45 ±65.94	58.8±50.7	40.56±12.18

[a] Taiwan (?); [b] Hong Kong (?); [c] Guangzhou (?); [d] Taiwan (?); [e] Guangzhou (?); [f] Nanjing (?); [g] Hong Kong in 2015 (?); [h] This study. N.A. – not available.

Table A5: The R^2 from the linear regression between the measured and modeled VOCs concentrations for 2-factor solution, and the estimated EFs (mg km^{-1} veh^{-1}) of VOCs from evaportative and tailpipe emissions.

Compound	R^2	Evaporative	Tailpipe
Ethylene	0.99	1.2±0.22	1.36±0.25
Toluene	0.84	1.81±0.61	1.49±0.5
m/p-Xylene	0.86	0.91±0.28	0.51±0.15
Propylene	0.63	0.47±0.1	0.56±0.12
Isopentane	0.56	4.46±1.54	2.35±0.81
Propanal	0.39	0.56±0.31	0.08±0.05
1,2,4-Trimethylbenzene	0.86	0.32±0.13	0.16±0.07
o-Xylene	0.92	0.37±0.15	0.11±0.04
$trans$-2-Butene	0.75	0.16±0.08	0.07±0.03
Acetaldehyde	0.06	0.42±0.33	0.32±0.25
n-Pentane	0.78	1.51±0.7	0.64±0.3
$trans$-2-Pentene	0.51	0.16±0.06	0.1±0.04
cis-2-Butene	0.84	0.12±0.05	0.06±0.03
3-Methylpentane	0.87	0.91±0.36	0.48±0.19
3-Ethyltoluene	0.94	0.21±0.08	0.1±0.04
2-Methylpentane	0.88	1.03±0.39	0.57±0.21
Methylethyl ketone	0.11	0.19±0.15	0.13±0.1
n-Butane	0.65	1.49±0.65	0.55±0.24
1-Butene	0.80	0.13±0.05	0.07±0.03
Ethylbenzene	0.51	0.36±0.14	0.31±0.12
MTBE	0.77	1.66±0.82	0.83±0.4
1,3-Butadiene	0.73	0.07±0.03	0.11±0.04
1,3,5-Trimethylbenzene	0.83	0.08±0.03	0.05±0.02
1,2,3-Trimethylbenzene	0.86	0.07±0.02	0.05±0.02
Benzene	0.69	0.92±0.37	0.88±0.35
Methylcyclopentane	0.91	0.34±0.11	0.25±0.08
Methylvinylketone	0.35	0.11±0.06	0.03±0.02
cis-2-Pentene	0.68	0.06±0.02	0.04±0.01

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Table A5 : *(Continued)*

Compound	r^2	Evaporative	Tailpipe
n-Hexane	0.88	0.47±0.15	0.39±0.12
n-Butanal	0.01	0.11±0.06	0.12±0.07
NMVOCs	0.97	27.88±6.73	28.52±5.45