Supporting information

Molecular characteristics and diurnal variations of organic aerosols at a rural site in the North China Plain with implications for the influence of regional biomass burning

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Table S1 Concentrations of total measured organic compounds (ng m^{-3}) in the time-resolved (3-h) PM$_{2.5}$ samples in the rural site of NCP during the whole sampling period, Period 1 (P1) and Period 2 (P2).

Compounds	Whole period (N=117)				Period 1 (N=28)				Period 2 (N=13)			
	min	max	Mean	SD	min	max	Mean	SD	min	max	Mean	SD
I. n-alkanes												
C_{18}	0.76	7.82	3.05	1.35	1.70	6.42	3.55	1.22	1.16	4.58	2.26	0.96
C_{19}	0.73	6.83	2.66	1.28	0.81	5.83	3.03	1.19	1.02	3.72	2.04	0.86
C_{20}	0.69	5.44	2.08	0.96	0.80	5.44	2.69	1.02	0.69	2.69	1.46	0.57
C_{21}	1.12	9.47	4.35	1.93	2.50	9.47	5.93	1.83	1.46	4.06	2.49	0.75
C_{22}	0.72	8.85	3.25	1.68	1.53	8.85	4.62	1.89	0.75	2.72	1.58	0.55
C_{23}	0.78	18.9	6.56	3.74	3.37	18.93	9.77	3.95	1.31	4.58	2.80	1.10
C_{24}	0.62	17.1	4.75	3.07	2.46	12.6	6.47	2.31	1.03	2.60	1.87	0.54
C_{25}	0.77	25.2	8.10	5.41	3.62	20.4	12.0	4.27	1.48	3.84	2.50	0.80
C_{26}	0.84	22.4	6.35	4.63	3.21	15.7	9.11	3.66	1.21	3.52	2.17	0.82
C_{27}	0.92	52.2	16.2	11.7	7.79	44.7	28.3	9.70	1.65	6.03	3.50	1.27
C_{28}	0.55	26.9	7.85	5.55	3.88	18.8	11.9	4.13	0.55	5.25	2.35	1.25
C_{29}	0.76	249.3	44.6	39.3	16.9	135.1	80.2	31.5	2.66	25.9	7.39	5.94
C_{30}	0.24	49.1	8.67	6.91	4.95	26.1	13.6	4.70	0.57	6.16	2.61	1.34
C_{31}	0.18	317.5	42.7	46.7	11.8	317.5	79.1	61.3	2.47	27.7	8.11	7.20
C_{32}	0.40	61.5	9.65	8.07	6.12	31.3	14.9	5.08	0.40	6.69	2.65	1.72
C_{33}	0.95	63.4	15.4	11.6	7.32	42.5	24.5	8.54	0.95	7.30	3.53	2.08
C_{34}	0.28	51.1	7.77	6.70	5.53	24.4	12.2	4.36	0.28	4.62	1.93	1.20
C_{35}	0.24	44.5	7.19	6.09	5.04	23.1	11.9	4.38	0.24	3.60	1.53	1.05
C_{36}	0.49	37.9	6.4	5.19	3.92	18.3	9.94	3.80	0.49	2.65	1.49	0.77
subtotal	9.97	722.2	206.9	149.3	94.7	722.3	343.7	134.1	25.1	103.2	54.3	22.4
II. Fatty acids												
$C_{12:0}$	1.67	35.7	10.6	5.69	5.75	25.7	13.8	4.53	3.40	11.57	6.43	2.23
$C_{13:0}$	0.84	18.8	6.52	3.64	3.23	16.2	9.16	3.75	1.66	5.42	3.19	1.02
$C_{14:0}$	3.13	153.9	35.9	22.2	17.2	85.3	51.2	18.0	6.92	37.3	14.3	8.33
$C_{15:0}$	1.30	22.8	9.12	4.6	5.82	22.8	13.3	4.30	2.12	7.70	4.60	1.62
$C_{16:0}$	11.9	286.0	76.4	48.5	38.0	286.0	111.8	47.7	11.9	56.8	28.6	10.3
$C_{17:0}$	0.96	18.6	5.38	3.52	2.14	18.6	8.19	3.79	1.08	9.81	2.87	2.15
$C_{18:0}$	7.20	136.2	34.2	23.7	24.0	136.2	53.3	23.2	7.20	24.4	12.6	4.75
$C_{19:0}$	0.51	9.65	3.01	2.14	1.20	9.65	5.02	2.39	0.54	2.01	1.10	0.35
$C_{20:0}$	1.31	27.3	8.61	6.20	3.90	27.3	14.2	6.48	1.31	4.81	2.71	0.91
$C_{21:0}$	0.77	21.9	5.20	4.51	1.79	21.9	9.55	5.45	0.77	3.09	1.49	0.57
$C_{22:0}$	2.76	103.4	25.7	21.6	6.78	93.3	43.2	23.6	3.32	42.2	9.72	10.2
$C_{23:0}$	1.36	74.2	16.5	15.7	6.55	74.2	32.0	19.3	1.44	9.71	3.91	2.08
$C_{24:0}$	2.78	122.0	29.4	25.9	9.80	122.0	55.6	31.6	3.22	14.2	7.21	2.81
$C_{25:0}$	0.96	42.6	10.6	9.72	3.45	42.6	21.9	11.3	1.33	4.35	2.87	0.93
$C_{26:0}$	2.22	118.2	30.4	27.5	10.3	118.2	60.2	30.6	2.70	11.0	5.82	1.98
$C_{27:0}$	0.71	52.3	12.1	12.4	3.39	52.3	27.2	14.8	1.07	3.24	1.95	0.64
$C_{28:0}$	2.49	319.7	77.9	79.0	15.5	319.7	162.3	84.3	5.00	28.7	10.6	6.71
$C_{29:0}$	1.19	46.7	13.8	12.2	3.57	46.7	26.9	12.7	1.44	5.73	3.20	1.12
$C_{30:0}$	1.84	523.4	87.8	88.1	22.5	291.9	159.1	69.9	5.44	48.1	13.9	11.9
$C_{16:1}$	0.83	13.1	4.13	2.52	2.41	11.0	6.05	1.93	0.83	11.6	2.52	2.70
$C_{18:1}$	0.63	25.0	4.69	3.81	2.94	14.9	6.74	2.72	0.95	7.28	2.30	1.66

C$_{18:2}$	1.37	30.1	6.65	5.10	5.29	20.4	9.73	3.83	1.37	14.50	3.50	3.28
subtotal	64.6	1777	514.4	384.3	206.7	1528	900.3	358.3	81.4	234.4	145.3	47.7

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C$_{22}$	0.36	18.9	4.55	3.53	2.33	14.0	6.74	3.32	0.36	3.01	1.38	0.63
C$_{23}$	0.15	11.2	2.70	2.29	1.15	8.53	4.12	2.06	0.37	1.44	0.87	0.32
C$_{24}$	0.33	45.2	7.33	7.18	1.76	41.3	12.5	7.00	0.86	4.27	1.60	0.93
C$_{25}$	0.13	12.6	2.99	2.73	0.88	11.90	4.85	2.30	0.24	1.70	0.77	0.34
C$_{26}$	0.34	73.1	17.4	15.3	6.35	63.2	29.4	15.0	1.82	9.60	3.73	1.99
C$_{27}$	0.25	17.00	4.71	3.96	1.52	17.00	8.84	3.96	0.62	1.72	1.06	0.31
C$_{28}$	0.78	667.7	110.5	122.0	23.0	421.0	178.9	98.7	8.30	66.4	17.8	15.9
C$_{29}$	0.19	26.2	5.45	5.15	1.70	21.3	9.85	5.12	0.49	2.44	1.10	0.48
C$_{30}$	0.63	139.4	36.9	33.3	20.0	135.4	66.8	30.4	2.45	12.0	5.55	3.23
subtotal	3.18	975.9	192.6	187.4	62.4	638.2	322.0	150.7	16.6	100.2	33.9	22.6

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Anhydrosugars												
galactosan	1.03	97.78	18.5	20.6	2.16	97.8	29.5	27.9	1.45	13.3	4.61	3.13
mannosan	0.69	54.82	9.78	10.4	1.61	54.8	15.0	13.3	0.96	6.63	2.83	1.43
levoglucosan	5.56	1447	240.1	287.8	29.3	1428	404.0	344.0	11.2	123.0	47.8	26.2
Sugars												
fructose	0.48	98.6	8.96	10.4	4.15	23.6	13.9	5.12	0.90	4.28	1.90	0.94
glucose	1.29	315.9	48.9	50.2	17.4	245.9	90.7	49.0	3.49	37.4	11.0	9.51
sucrose	0.13	20.3	3.57	3.33	1.53	9.38	4.99	1.96	0.20	1.57	0.70	0.36
trehalose	0.06	25.3	4.23	4.91	1.59	25.3	9.46	5.91	0.18	3.75	0.88	0.98
Sugar alcohols												
arabitol	0.72	852.2	40.6	83.8	6.67	115.0	55.4	29.2	1.34	26.3	6.65	6.68
mannitol	0.43	669.6	56.6	81.6	12.9	211.9	92.7	53.4	1.09	107.3	16.4	29.1
inositol	0.08	7.08	1.67	1.40	0.74	5.93	2.94	1.48	0.19	1.24	0.48	0.25
subtotal	15.9	2228	432.8	428.9	151.9	1727	718.0	403.1	39.7	241.3	93.2	52.9

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phenanthrene	0.21	6.21	1.62	1.36	0.78	6.21	2.69	1.58	0.22	0.73	0.41	0.16
anthracene	0.04	0.38	0.14	0.08	0.09	0.36	0.20	0.07	0.05	0.09	0.07	0.01
fluoranthene	0.07	4.80	0.92	0.83	0.42	2.68	1.50	0.71	0.07	0.28	0.15	0.05
pyrene	0.09	3.87	0.90	0.79	0.43	2.89	1.52	0.80	0.09	0.36	0.18	0.06
benz(*a*)anthracene	0.03	2.30	0.49	0.48	0.15	1.80	0.82	0.54	0.05	0.21	0.09	0.04
chrysene / triphenylene	0.09	5.92	1.16	1.15	0.40	4.02	1.83	1.08	0.09	0.35	0.18	0.08
benzo(b)fluoranthene	0.07	9.14	1.82	1.91	0.45	6.23	2.75	1.81	0.13	0.77	0.31	0.19
benzo(k)fluoranthene	0.03	2.58	0.56	0.55	0.15	1.97	0.84	0.56	0.04	0.26	0.10	0.06
benzo(e)pyrene	0.07	6.26	1.23	1.28	0.36	4.28	1.82	1.15	0.09	0.51	0.22	0.12
benzo(a)pyrene	0.02	3.66	0.69	0.70	0.16	2.43	1.08	0.77	0.05	0.23	0.10	0.05
perylene	0.00	0.89	0.18	0.18	0.06	0.63	0.29	0.19	0.02	0.07	0.03	0.01
indeno[123-cd]pyrene	0.03	5.60	1.04	1.17	0.15	3.57	1.46	1.10	0.05	0.59	0.21	0.15
dibenz(a,h)anthracene	0.01	1.22	0.20	0.20	0.07	0.55	0.28	0.16	0.02	0.16	0.05	0.04
benzo(ghi)perylene	0.03	4.89	1.01	1.05	0.25	4.01	1.50	1.10	0.07	0.64	0.22	0.17
subtotal	1.11	48.5	12.0	11.0	4.21	37.7	18.6	11.0	1.25	5.01	2.33	0.98

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C$_{29}$αβ	0.30	2.77	1.05	0.61	0.42	2.77	1.47	0.59	0.30	0.68	0.52	0.10
C$_{29}$βα	ND[a]	1.20	0.37	0.26	ND	1.20	0.68	0.20	ND	0.23	0.15	0.04
C$_{30}$αβ	0.29	3.15	1.17	0.64	0.44	2.54	1.55	0.57	0.41	0.79	0.63	0.12
C$_{30}$βα	ND	1.91	0.46	0.33	ND	1.91	0.82	0.37	ND	0.22	0.17	0.04

$C_{31}\alpha\beta S$	ND	2.14	0.59	0.49	ND	2.14	0.91	0.58	ND	0.28	0.19	0.05
$C_{31}\alpha\beta R$	ND	0.90	0.40	0.24	ND	0.84	0.56	0.15	ND	0.26	0.17	0.05
subtotal	0.66	10.81	3.46	2.38	0.86	9.97	4.40	2.48	1.14	2.28	1.81	0.31
VII. Phthalate esters												
dimethyl	0.10	14.6	4.17	2.82	1.38	14.6	5.34	3.31	0.20	4.74	2.46	1.36
diethyl	0.36	9.72	3.03	1.94	1.19	9.72	3.89	2.38	0.80	2.40	1.42	0.44
diisobutyl	4.86	49.3	22.7	9.45	17.3	45.7	27.3	6.42	9.40	20.3	14.6	3.67
isobutylbutyl	0.32	3.97	1.71	0.79	0.85	3.71	2.03	0.64	0.74	2.06	1.15	0.38
dibutyl	4.02	46.0	18.4	8.78	10.8	37.9	21.3	6.19	6.92	18.9	11.2	3.51
bis (2-ethylhexyl)	6.46	137.4	34.9	24.7	26.5	137.4	51.7	25.8	6.46	74.8	20.3	18.2
Subtotal	17.7	219.9	84.9	41.3	68.8	183.1	111.5	32.7	31.5	100.8	51.1	18.1
VIII. Phthalic acids												
o-ph	12.3	400.2	100.6	56.8	52.5	208.6	115.6	40.9	12.6	71.1	35.8	15.7
m-ph	0.60	19.6	3.77	3.74	1.27	19.02	5.75	4.32	0.60	8.97	1.77	2.12
p-ph	2.77	248.00	50.1	52.0	16.7	248.0	89.6	67.5	2.77	23.6	8.73	5.50
Subtotal	17.1	487.2	154.5	93.9	91.3	388.6	211.0	87.1	17.1	81.0	46.3	17.1
IX. Biogenic SOA tracers												
Isoprene SOA tracers												
MeTHFdiols	0.73	31.8	7.04	5.93	2.61	31.8	12.6	8.38	2.26	5.54	3.64	1.04
C5-triols	4.29	218.8	40.7	41.3	16.7	218.8	85.4	58.4	9.39	25.5	15.7	4.42
MTs	3.98	134.7	45.0	32.7	17.9	134.7	74.6	35.4	12.5	74.5	28.7	19.3
2-MGA	2.00	60.0	19.2	13.4	9.89	60.0	35.9	13.2	4.08	24.2	8.93	5.51
Σisoprene SOA tracers	11.1	404.1	111.9	85.8	48.3	404.1	208.5	104.9	34.8	127.5	57.0	29.4
α-/β-Pinene SOA tracers												
cis-pinonic acid	1.13	29.9	10.6	6.6	4.06	29.9	14.4	6.25	2.34	10.8	4.86	2.36
pinic acid	1.94	37.4	10.5	6.74	4.92	35.8	15.3	8.07	2.61	37.4	7.09	8.83
3-hydroxyglutaric acid	1.21	51.1	14.0	11.4	8.6	51.1	26.4	13.4	1.51	6.87	3.20	1.41
MBTCA	6.86	81.1	31.3	13.8	15.7	50.1	29.3	9.58	18.4	49.8	29.8	9.28
Σmonoterpene SOA tracers	11.1	166.2	66.1	31.2	37.3	166.2	85.3	34.9	26.7	64.5	44.6	12.6
β-Caryophyllene SOA tracers												
β-caryophyllinic acid	0.49	77.7	17.4	17.1	4.60	77.8	34.7	20.8	2.44	6.28	4.08	1.21
subtotal	22.7	618.1	195.2	125.9	107.6	618.1	328.4	152.0	65.6	193.4	105.6	38.3
IX. Tolune SOA tracers												
DHOPA	1.59	35.3	9.36	7.15	4.06	35.3	15.6	9.80	2.70	6.99	4.16	1.42

[a] ND: not detected.
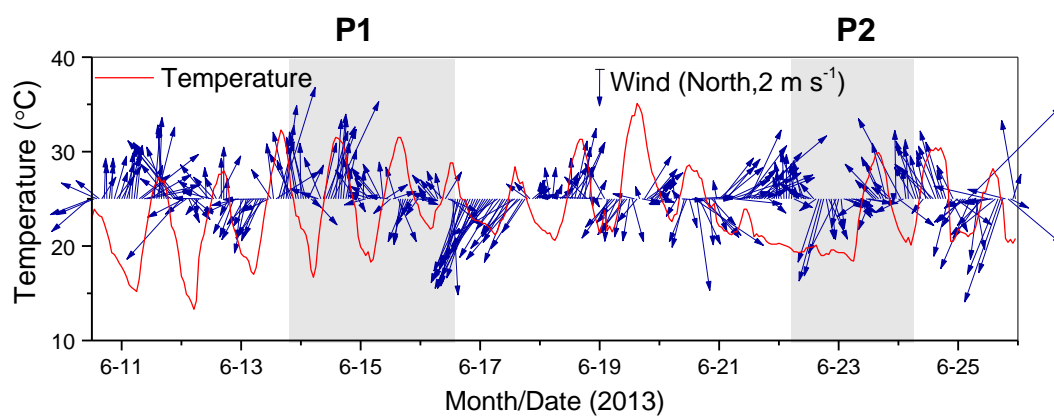
Figure S1 Temporal variations of temperature, wind speed, and wind direction at Gucheng during the study period.
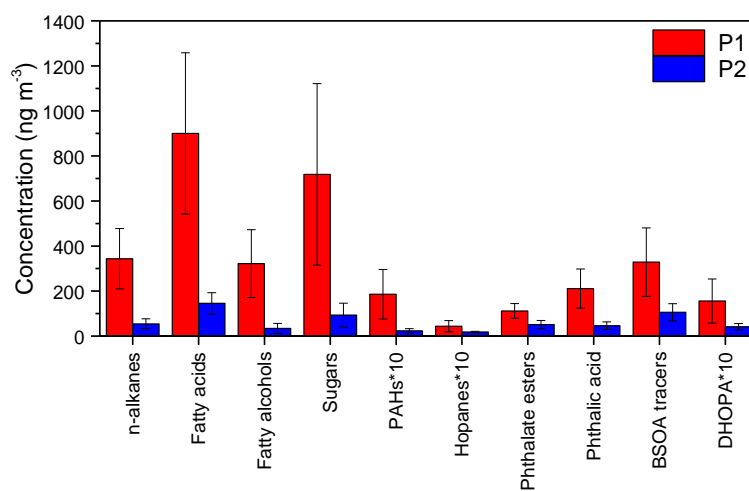
Figure S2. A comparison of the average concentrations of different organic compound classes in PM$_{2.5}$ during P1 and P2.
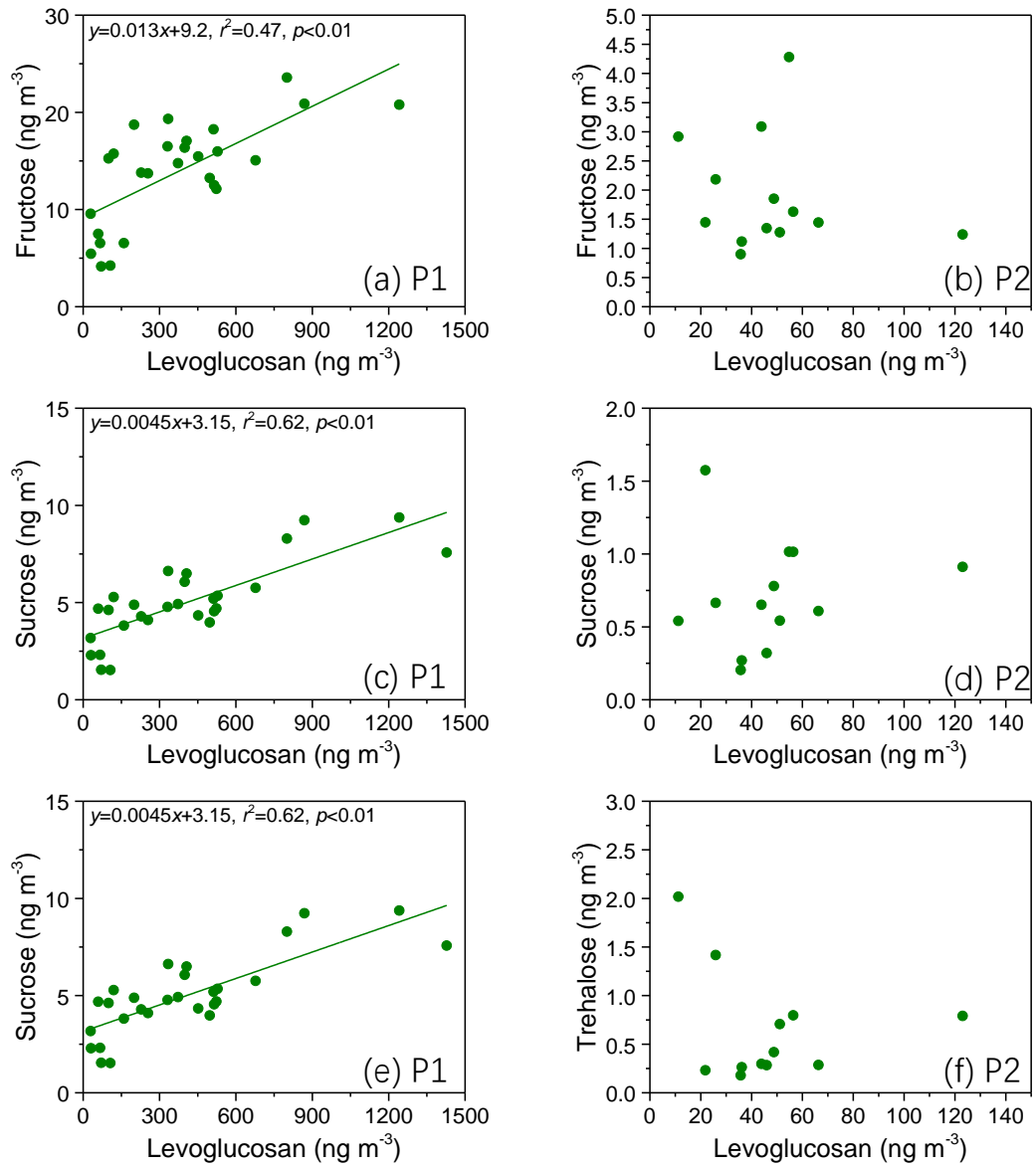
Figure S3 Relationships of fructose, sucrose, and trehalose with levoglucosan during P1 and P2.
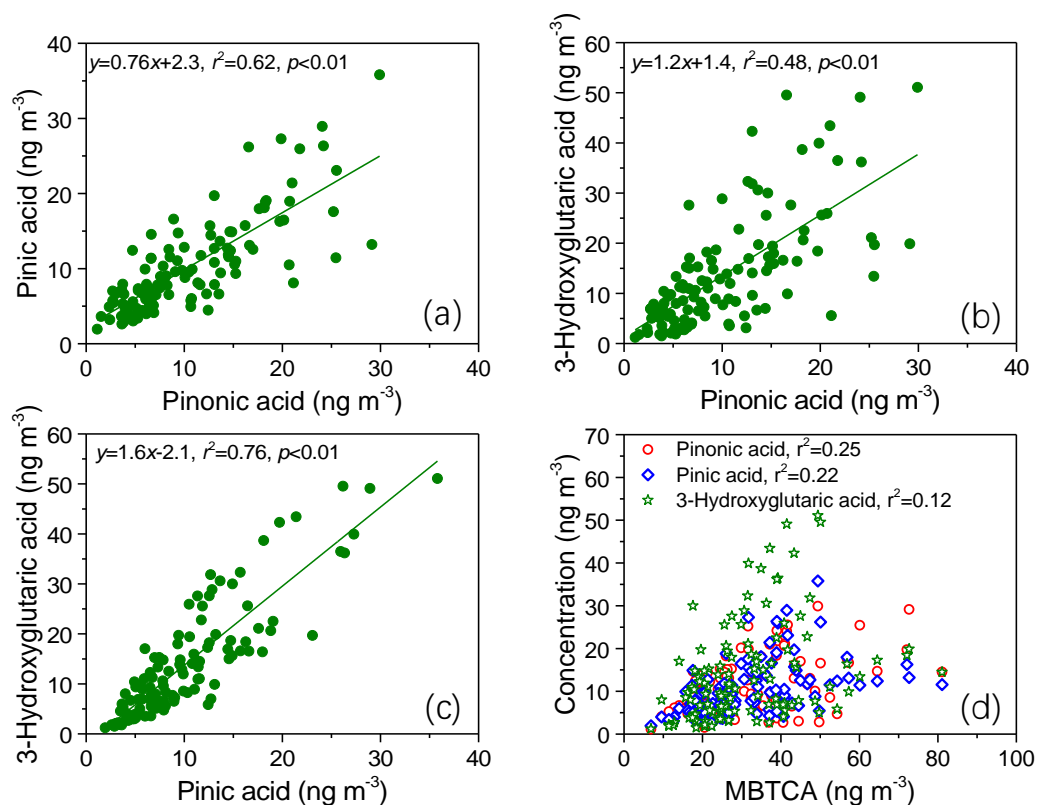
Figure S4 Relationships of the four α-/β-pinene-derived products, i.e., pinonic acid, pinic acid, 3-hydroxyglutaric acid, and MBTCA, during the study period.
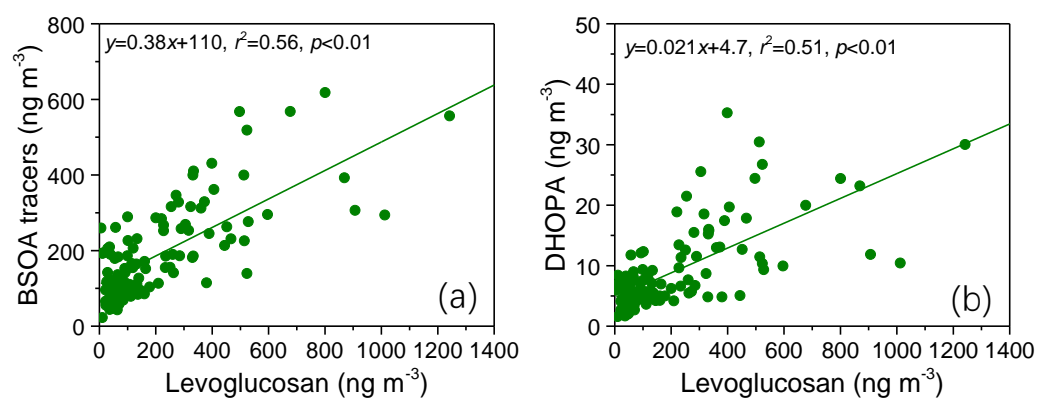
Figure S5 Relationships of the sum of BSOA tracers, and toluene-derived DHOPA with levoglucosan during the study period.