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Molecular markers of biomass burning and primary biological aerosols in urban Beijing: size distribution and seasonal variation

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Table S1. Information on the weather conditions during each of the sampling periods from April 2017 to January 2018.

Year	Season	Sampling period	Duration (min)	T (°C)[a]	RH (%)[b]	WS[c]	$PM_{2.5}$ ($\mu g\ m^{-3}$) [d]	PM_{10} ($\mu g\ m^{-3}$) [d]	Weather conditions
2017	spring	17–19 Apr.	2880	18.2	32.3	5	174	124	dust storm
		19–21 Apr.	2887	14.7	46.2	3	78.3	84.6	non-haze
		4–5 May	1364	20.1	33.4	6	501	656	dust storm
		5–6 May	1954	17.6	25.2	5	131	125	non-haze
	summer	30 Jun.–2 Jul.	2862	29.3	70.5	2	143	103	haze
		12–14 Jul.	2854	31.5	76.7	1	89.2	75.9	haze
		14–16 Jul.	2900	29.0	58.3	2	65.5	62.1	non-haze
		21–23 Jul.	2843	25.2	64.2	3	42.7	36.3	non-haze
	Autumn	11–13 Oct.	2877	12.3	64.2	2	38.1	32.4	non-haze
		16–18 Oct.	2900	13.1	69.1	2	78.0	68.7	non-haze
		25–27 Oct.	2865	11.8	81.3	1	183	120	haze
		6–8 Nov.	2887	9.36	72.4	2	146	91.7	haze
2017-2018	Winter	27–29 Dec.	2781	–2.34	75.2	1	137	140	haze
		2–4 Jan.	2757	–2.68	32.4	3	33.7	32.1	non-haze
		25–27 Jan.	2858	–8.13	41.6	1	82.2	59.6	haze
		29–31 Jan.	2835	–1.95	22.4	2	47.5	49.5	non-haze

[a] temperature (T)
[b] relative humidity (RH)
[c] wind scale (WS)
[d] averaged concentrations from the local monitoring station.

Table S2. Pearson correlation coefficients (r) among anhydrosugars and carbonaceous components in Beijing aerosols from April 2017 to January 2018.

	Levoglucosan	Mannosan	Galactosan	OC	EC
Levoglucosan	1				
Mannosan	0.99**	1			
Galactosan	0.98**	0.99**	1		
OC	0.16	0.21*	0.20	1	
EC	0.45**	0.43**	0.43**	0.45**	1

*p<0.01.
**p<0.001.

Table S3. Pearson correlation coefficients (r) among primary saccharides and sugar alcohols, and with levoglucosan in Beijing aerosols from April 2017 to January 2018.

	Levoglucosan	Glucose	Fructose	Sucrose	Trehalose	Xylose	Maltose	Arabitol	Mannitol	Inositol	Erythritol	OC	EC
Levoglucosan	1												
Glucose	-0.22	1											
Fructose	0.02	0.81**	1										
Sucrose	-0.03	0.81**	0.74**	1									
Trehalose	-0.30*	0.54**	0.48**	0.30*	1								
Xylose	0.86**	0.07	0.33**	0.26*	-0.18	1							
Maltose	0.86**	-0.04	0.27*	0.01	-0.05	0.80**	1						
Arabitol	-0.23	0.52**	0.59**	0.10	0.84**	-0.11	0.13	1					
Mannitol	-0.28*	0.59**	0.38**	0.02	0.66**	-0.19	0.02	0.83**	1				
Inositol	0.10	0.63**	0.71**	0.78**	0.65**	0.29*	0.22	0.36**	0.12	1			
Erythritol	0.50**	0.01	0.24	0.27*	0.03	0.40**	0.59**	0.42**	0.34**	-0.16	1		
OC	0.16	0.21	0.26*	0.24	0.82**	0.25	0.40**	0.77**	0.49**	0.75**	0.33**	1	
EC	0.45**	0.32**	0.59**	0.24	0.16	0.62**	0.69**	0.45**	0.35**	0.24	0.65**	0.45**	1

*p<0.01.
**p<0.001.

Table S4. Geometric mean diameter (GMD, μm) of anhydrosugars and other saccharides in the fine mode particles (<2.1 μm) in the Beijing, from April 2017 to January 2018. GMD: $\log GMD = (\sum C_i \log D_{pi})/\sum C_i$, where C_i is the concentration of compound in size i and D_{pi} is the geometric mean particle diameter collected on stage i.

Compounds	Fine Modes							
	Spring		Summer		Autumn		Winter	
	dust storm	non-haze	haze	non-haze	haze	non-haze	haze	non-haze
Anhydrosugars								
Galactosan	0.51	0.46	0.48	0.46	0.76	0.67	0.61	0.47
Mannosan	0.55	0.46	0.62	0.55	0.74	0.67	0.61	0.44
Levoglucosan	0.57	0.41	0.59	0.56	0.72	0.50	0.55	0.45
Sugar Alcohols								
Arabitol	0.38	0.43	0.69	0.84	0.58	0.75	0.61	0.37
Mannitol	0.46	0.42	0.76	0.49	0.69	0.55	0.53	0.54
Inositol	0.34	0.40	0.54	0.39	0.51	0.46	0.50	0.37
Erythritol	0.39	0.47	0.51	0.60	0.71	0.55	0.61	0.51
Sugars								
Glucose	0.38	0.46	0.72	0.68	0.60	0.48	0.51	0.43
Sucrose	0.33	0.51	0.68	0.48	0.65	0.56	0.48	0.49
Fructose	0.40	0.44	0.46	0.49	0.65	0.43	0.48	0.36
Maltose	0.31	0.36	0.47	0.31	0.57	0.39	0.61	0.34
Xylose	0.43	0.42	0.62	0.66	0.64	0.65	0.66	0.41
Trehalose	1.02	0.69	0.87	0.64	0.80	0.62	0.70	0.55

Table S5. Geometric mean diameter (GMD, μm) of anhydrosugars and other saccharides in the coarse mode particles (>2.1 μm) in the Beijing, from April 2017 to January 2018.

Compounds	Coarse Modes							
	Spring		Summer		Autumn		Winter	
	dust storm	non-haze	haze	non-haze	haze	non-haze	haze	non-haze
Anhydrosugars								
Galactosan	5.10	5.04	5.39	5.97	4.55	4.51	4.25	5.32
Mannosan	4.79	4.85	5.40	5.56	3.90	4.29	3.76	6.01
Levoglucosan	4.54	4.47	5.18	5.08	4.00	4.04	3.74	4.44
Sugar Alcohols								
Arabitol	11.4	9.14	5.33	4.34	5.35	5.21	6.10	6.80
Mannitol	10.7	8.71	5.38	4.68	4.87	5.91	5.81	7.04
Inositol	11.47	8.67	5.37	5.51	5.42	5.59	6.52	7.39
Erythritol	6.09	5.82	5.89	6.35	5.27	5.46	5.97	6.23
Sugars								
Glucose	10.6	8.69	5.00	4.43	5.79	5.28	6.88	7.43
Sucrose	7.03	9.01	6.21	6.31	5.65	5.38	7.16	7.55
Fructose	8.24	3.87	5.80	5.04	6.15	4.42	7.29	7.32
Maltose	7.13	6.18	5.92	5.55	5.33	5.83	6.31	6.43
Xylose	6.35	6.27	5.47	4.78	5.20	5.38	5.25	5.61
Trehalose	7.41	7.00	5.64	4.97	5.39	5.58	6.86	7.91

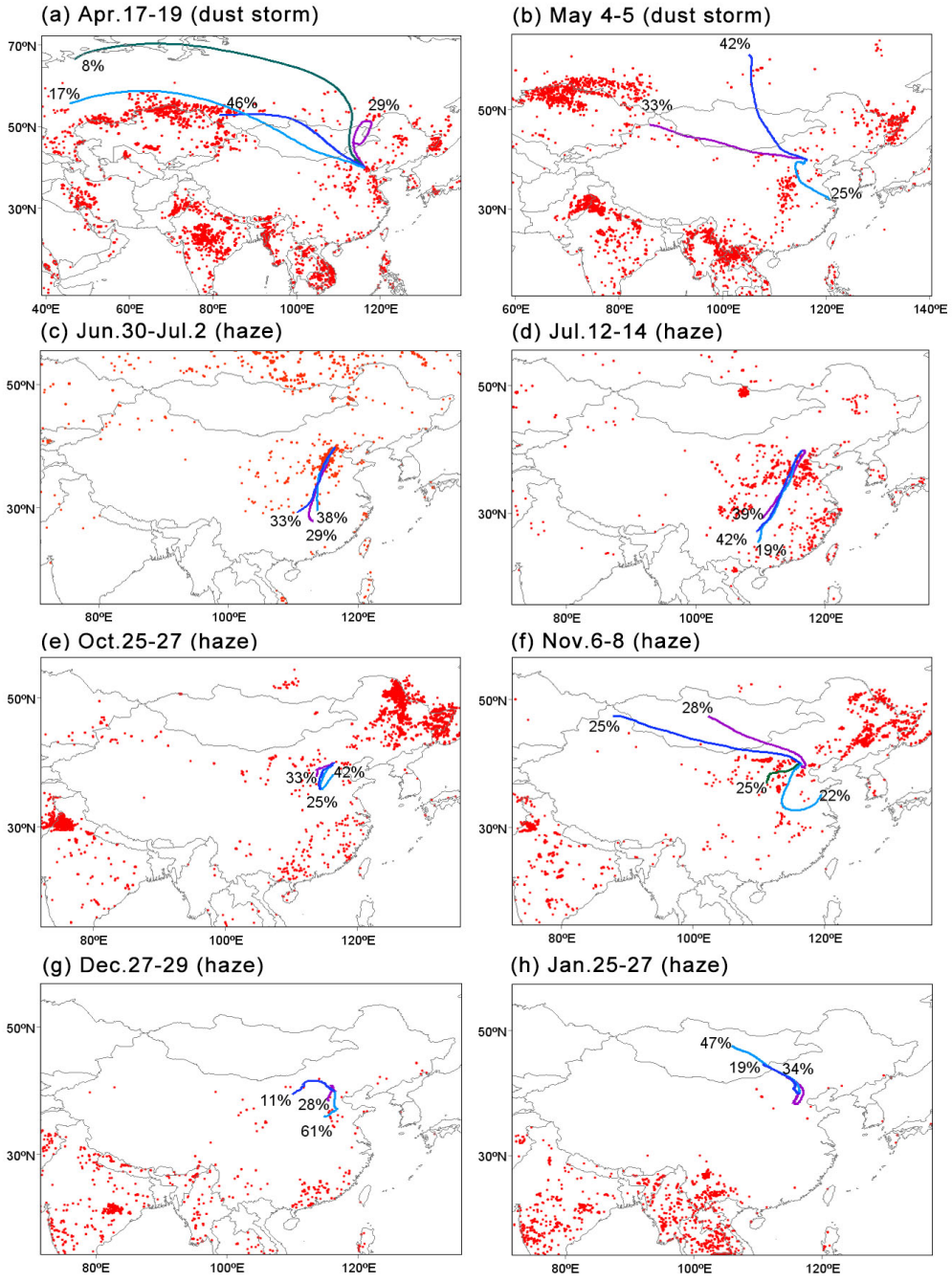

Figure S1. Clusters of 3-day backward trajectories of air masses arriving at Beijing (500 m a.g.l.) during dust storm events and haze periods from April 2017to January 2018. The numbers in each panel imply the percentages of trajectories in the sampling periods with air mass origins.