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Interactions between aerosol organic components and liquid water content during haze episodes in Beijing

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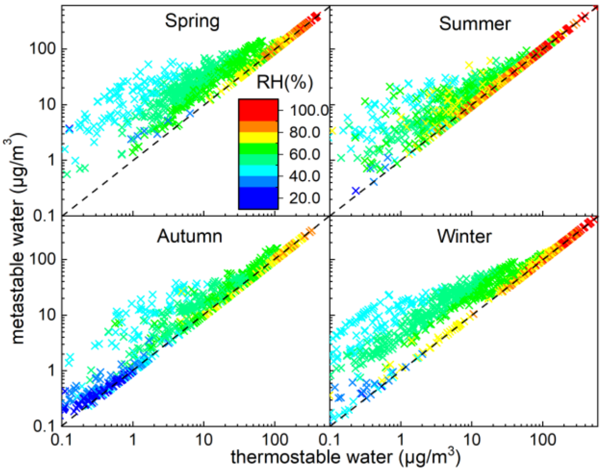

Figure S1. The comparison of "metastable" water and "stable" water predicted from ISORROPIA-II in different seasons in Beijing.

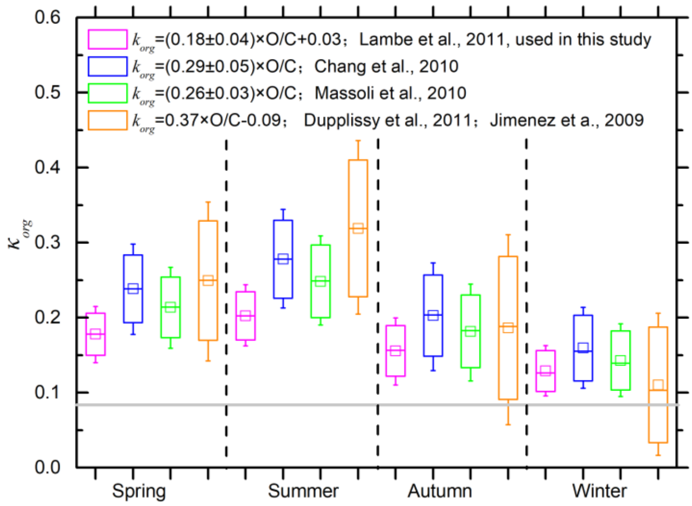

Figure S2. κ_{org} in four seasons in Beijing calculating from different methods. The box plots represent the 10th, 25th, 50th, 75th, and 90th percentiles of the corresponding data. The squares represent the mean value of the corresponding data. The methods used here were described in detail in Table S2.

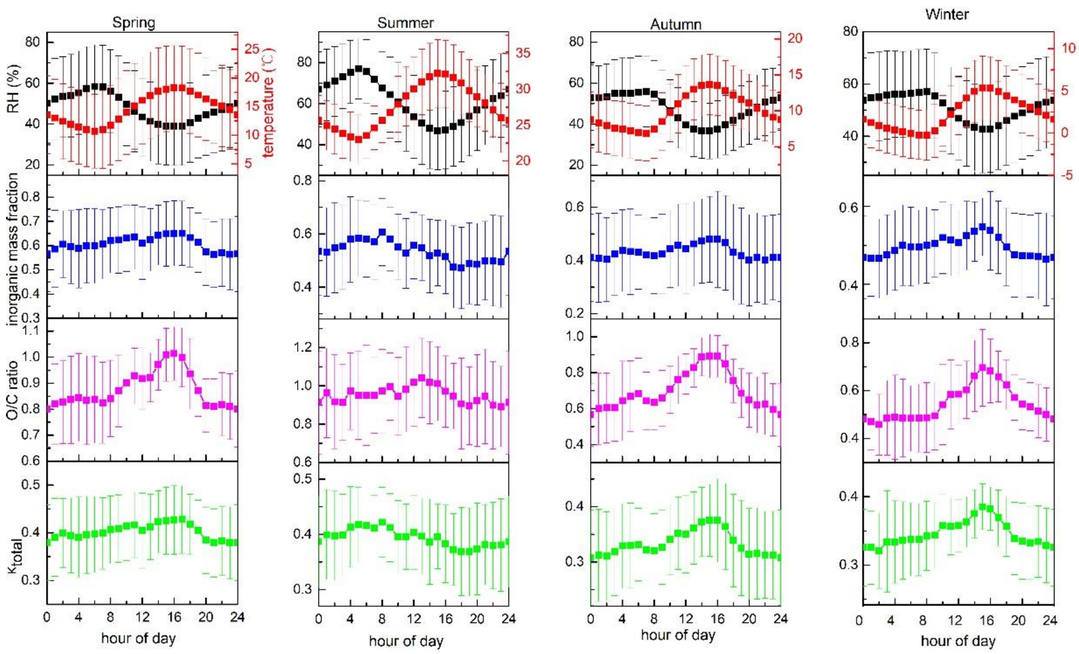

Figure S3. Diurnal variations of RH, temperature, inorganic aerosol fraction, organic O/C ratio, and κ_{total} in different seasons in Beijing.

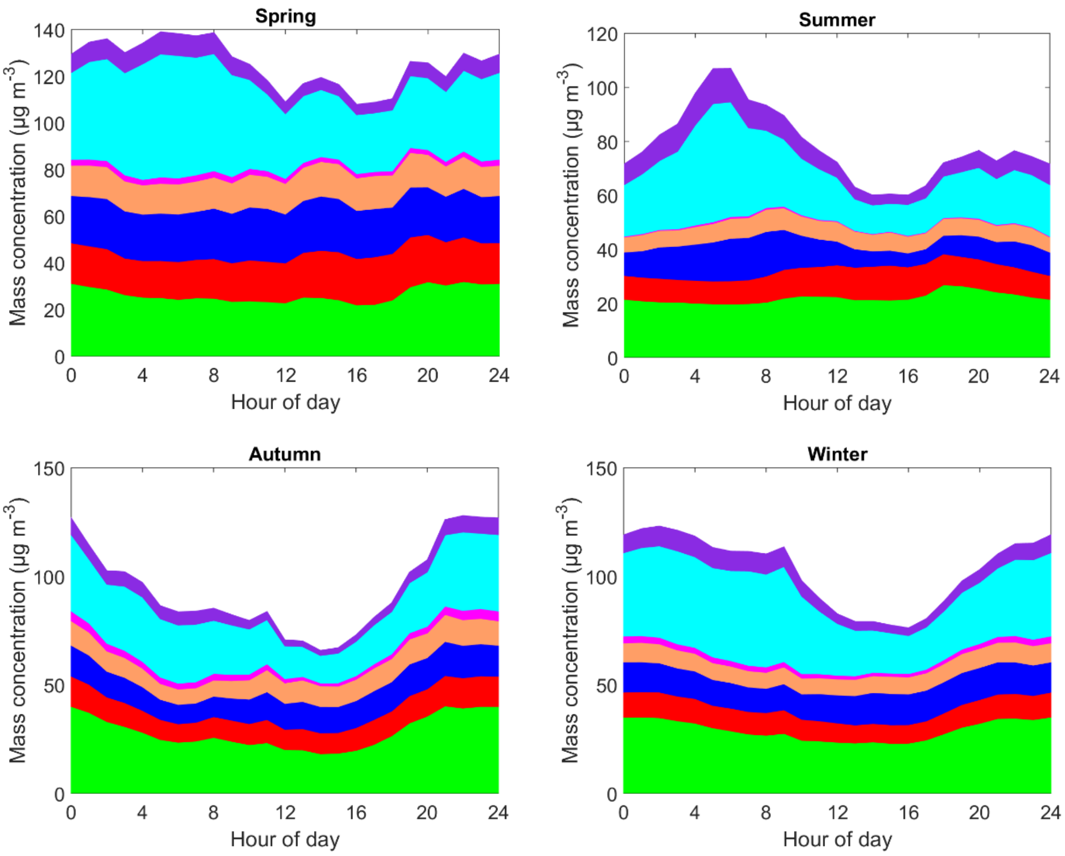

Figure S4. Diurnal variation of mass concentrations for different NR-PM$_1$ chemical compositions and ALW contents in different seasons in Beijing. ALW during night time is larger than those during day time.

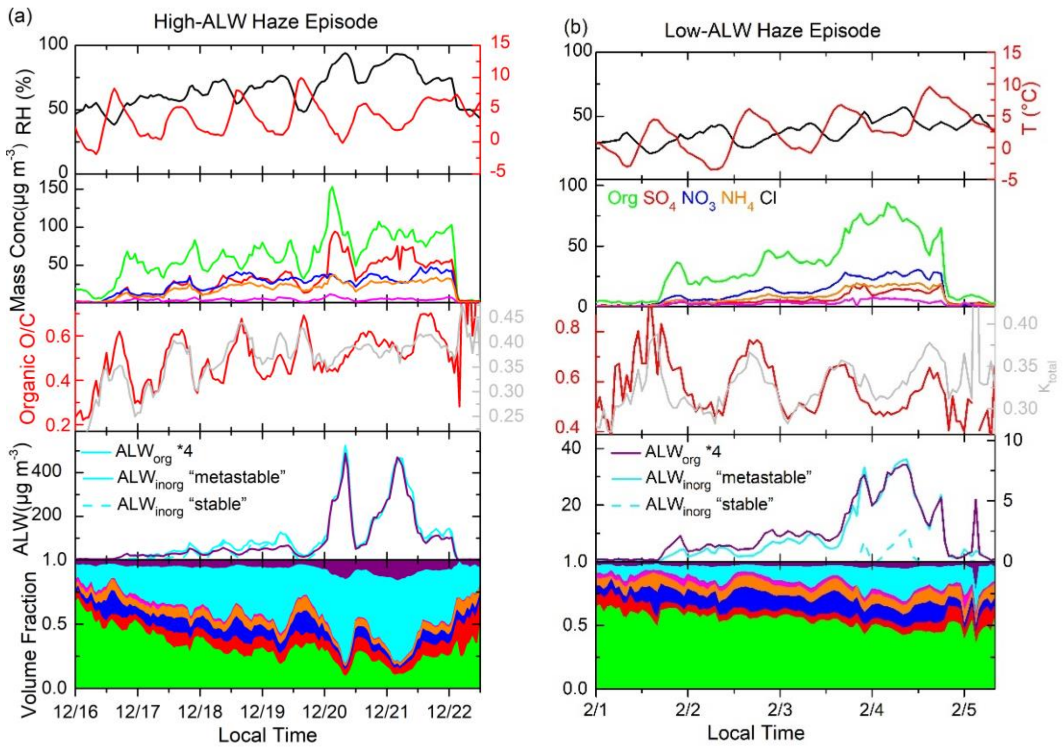

Figure S5. Variations of the relative humidity (RH) and particle chemical compositions (a) the typical high ALW episode in Figure 3a and (b) the typical low ALW episode in Figure 3b. For the high-ALW episode, ALW_{inorg} predicted from ISORROPIA "stable" mode was almost the same as from "metastable" mode. However, for low-ALW episode, "stable" mode resulted in much less ALW_{inorg} than from "metastable" mode.

Table S1. Summary of the data periods used in this research, the averaged $NR\text{-}PM_1$ concentration mass concentrations, component mass concentrations, f_{44}, T, and RH in the four seasons in Beijing.

Season	Time Period	Days	$NR\text{-}PM_1$($\mu g\ m^{-3}$)	Org	SO_4	NO_3	NH_4	Cl	f_{44}	T	RH
2013-spring	2013.3.9-5.28	81	81.1	26.2	18.0	21.0	13.6	2.3	0.172	15	48
2017-summer	2017.6.1-8.7	68	54.2	22.1	10.3	10.1	6.6	0.4	0.205	28	61
2013-Autumn	2013.10.11-12.2	53	63.9	28.1	11.0	12.3	9.7	2.9	0.144	10	47
2017-winter	2016.12.1-2017.2.28	90	63.2	29.0	10.2	13.3	8.2	2.3	0.109	2	51

Table S2. Calculation methods of κ_{org} from AMS/ACSM measured f_{44} or O/C.

Calculation Method	Application range	Tested Species	Calculated κ_{org} in this study	Reference
$\kappa_{org} = (0.18\pm0.04)\times O/C+0.03$	0.05 < O/C < 1.42	Alkanes, biogenic terpenoids, and aromatics-derived SOA; POA	0.16±0.04	Lambe et al., 2011[1]
$\kappa_{org} = (0.29\pm0.05)\times O/C$	0.3 < O/C < 0.6	Ambient aerosol, Egbert, a rural site in Ontario, Canada during the spring of 2007	0.22±0.07	Chang et al., 2010[2]
$\kappa_{org} = (0.26\pm0.03)\times O/C$	0.38 < O/C < 0.98	α-pinene and m-xylene derived SOA	0.19±0.06	Massoli et al., 2010[3]

$\kappa_{org} = 2.2\times f_{44}$-0.13 $\kappa_{org} = 0.37\times$O/C-0.09	$0.04 < f_{44} < 0.17$	Ambient aerosol, the high-alpine site Jungfraujoch, Switzerland and Mexico city	0.21±0.08	Dupplissy et al., 2011[4-5]

Table S3. Summary of the haze episodes in different seasons in Beijing.

	Haze episode	High ALW	Low ALW	Nontype
Spring	7	4	2	1
Summer	1	1	0	0
Autumn	6	3	3	0
winter	8	4	3	1
total	22	12	8	2
Average NR-PM_1	--	100.8	76.2	--
Average $frac_{org}$	--	0.51	0.63	--
Average O/C	--	0.75	0.68	--
κ_{total}	--	0.38	0.32	--

Reference

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