



Supplement of

Mixing state of refractory black carbon in fog and haze at rural sites in winter on the North China Plain

Yuting Zhang et al.

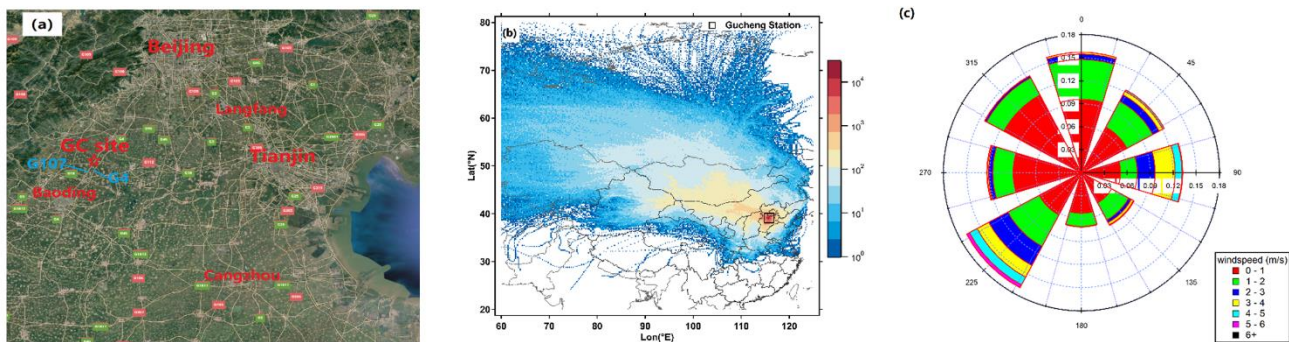
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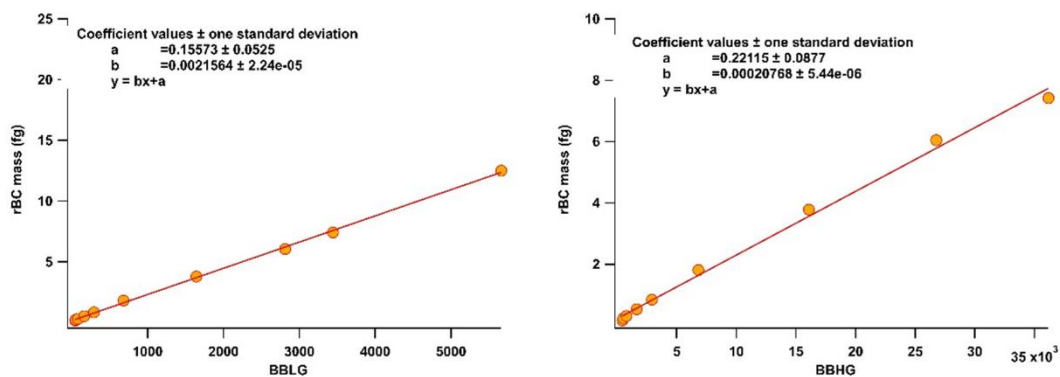
Abbreviation/symbols	Full name/explanation
SP2	Single particle soot photometer (DMT Inc.)
HR-AMS	Aerodyne high-resolution time-of-flight aerosol mass spectrometer (Aerodyne Research Inc.)
DMA	Differential mobility analyzer (TSI Inc.)
CPC	Condensation particle counter (TSI Inc.)
<i>r</i> BC	Refractory black carbon measured by SP2 through laser-induced incandescence method
NR-PM1	Non-refractory submicron
<i>D_c</i>	Mass equivalent diameter of <i>r</i> BC core
<i>D_p</i>	Diameter of <i>r</i> BC-containing particles including <i>r</i> BC core and coatings
MMD	Mass median diameter
CMD	Count median diameter
RCT	Relative coating thickness of <i>r</i> BC-containing particles (D_p/D_c)
ACT	Absolute coating thickness of <i>r</i> BC-containing particles ($(D_p - D_c)/2$)
LEO	Leading-edge-only fitting method
E_{abs}	Absorption enhancement of <i>r</i> BC-containing particles compared to bare <i>r</i> BC
MAC	mass absorption cross-section of <i>r</i> BC-containing particles
σ_{abs}	absorption coefficient of <i>r</i> BC-containing particles

Table S2: Representative cases of different episodes in Gucheng.

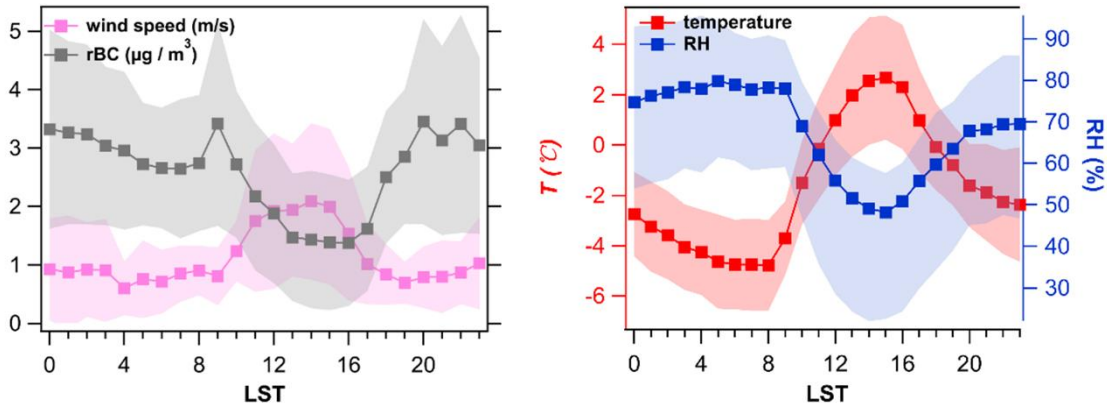
Selecte d cases	Month/Day/ time	rBC mass loading ($\mu\text{g m}^{-3}$)	MMD (nm)	CMD (nm)	RCT(ACT) (Dc@170- 190nm)	E_{dbs}	MAC (m^2/g)	RH (%)	T ($^{\circ}\text{C}$)	Wind speed (m s^{-1})
Fog	12/7/21:10-					$1.2 \pm$	5.4	100	-3.3 ± 1.1	0.63 ± 0.72
	12/9/13:30	3.1 ± 0.9	220	131	2.0 ± 0.3	0.1				
	12/9/17:30-				$(92.7 \pm$					
	12/10/14:20				$23.8)$					
Before- snow	12/15/00:00-	4.7 ± 0.7	213	120	1.4 ± 0.1	1.2 ± 0.1	5.4	61.0 ± 10.1	-0.2 ± 2.5	0.6 ± 0.3
	12/15/18:50				(39.9 ± 3.6)					
Snow	12/15/19:00-	2.8 ± 1.1	210	126	1.5 ± 0.1	1.3 ± 0.0	5.9	97.0 ± 4.9	0.1 ± 0.3	0.7 ± 0.3
	12/16/13:00				(46.9 ± 4.5)					
After- snow	12/16/13:10-	1.9 ± 0.2	206	129	1.7 ± 0.1	1.4 ± 0.0	6.3	96.0 ± 1.9	0.7 ± 0.6	0.9 ± 0.5
	12/17/00:00				(61.3 ± 4.7)					
EP2	12/12/19:00-	3.4 ± 1.4	203	118	1.5 ± 0.1	1.2 ± 0.1	5.4	50.4 ± 12.5	-0.4 ± 4.2	0.8 ± 0.5
	12/14/00:00				(42.3 ± 9.4)					
EP4	12/22/00:00-	1.2 ± 1.2	202	116	1.7 ± 0.1	1.3 ± 0.1	5.7	81.0 ± 13.1	-1.8 ± 2.5	1.0 ± 0.8
	12/26/08:00				(58.6 ± 12.7)					
EP5	12/27/00:00-	3.4 ± 1.3	211	122	1.6 ± 0.2	1.3 ± 0.1	5.6	62.4 ± 14.7	-1.4 ± 3.5	1.1 ± 0.7
	12/29/20:00				(48.9 ± 14.1)					
EP6	12/30/00:00-	0.5 ± 0.3	216	122	1.4 ± 0.1	1.1 ± 0.0	5.2	22.7 ± 7.7	-4.8 ± 2.3	2.3 ± 1.2
	12/31/00:00				(37.0 ± 9.5)					



25 Figure S1: (a) Map of the experimental site (GC) that is located about 120 kilometers southwest of Beijing, adjacent to National Highway 107 (G107) and Beijing-Hong Kong-Macau Expressway (G4); the map was taken from Google Maps (©Google Maps 2021, <https://www.google.com/maps>, last access: 15 March 2021). (b) The sampling site was influenced by the historical air mass during the observation period, back trajectory analysis calculated by NOAA Hybrid Single-Particle Lagrangian Integrated Trajectory Model (HYSPPLIT). (c) The wind rose shows the frequency distribution of every 10 minutes averaged wind direction and speed throughout the experimental period.



30 Figure S2: The calibration coefficient values for broadband high gain (BBHG) and broadband low gain (BBLG) of incandescence signals.



35 Figure S3: Diurnal variation in rBC mass loading, wind speed, temperature, and RH. The shaded areas denote the standard deviation.

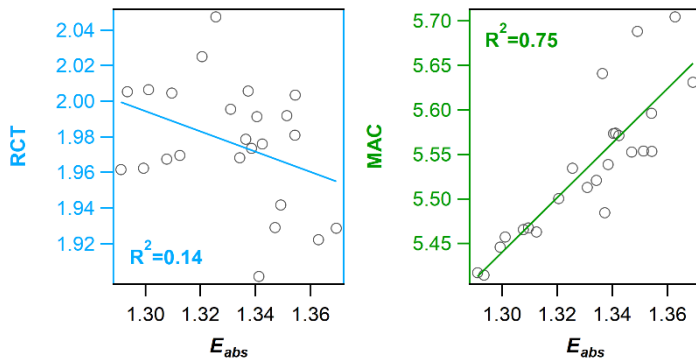


Figure S4: Correlation of E_{abs} with RCT and MAC in a diurnal cycle pattern.