Sources and trends of Black Carbon Aerosol in a Megacity of Nanjing, East China After the China Clean Action Plan and Three-Year Action Plan

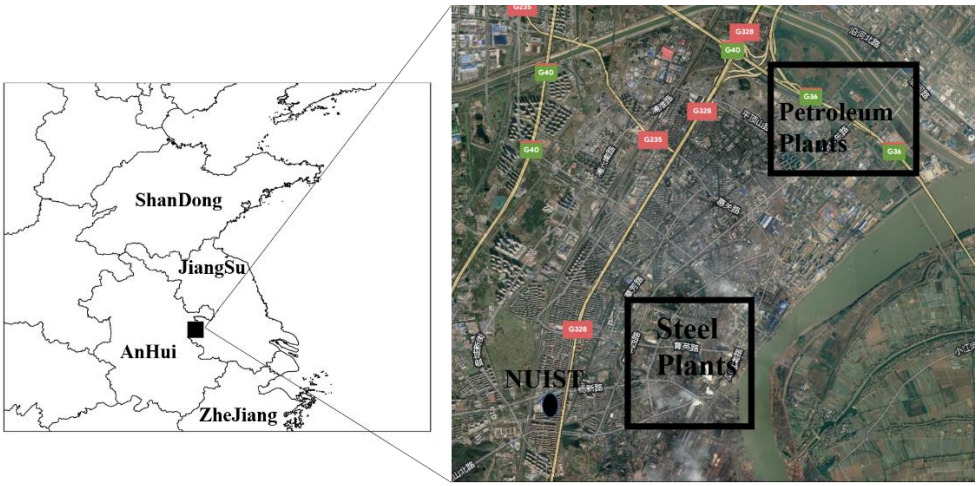

Figure S1 The location of sampling site, In the right panel, the sampling site in Nanjing is marked with a black elliptical dot (© Google Earth)

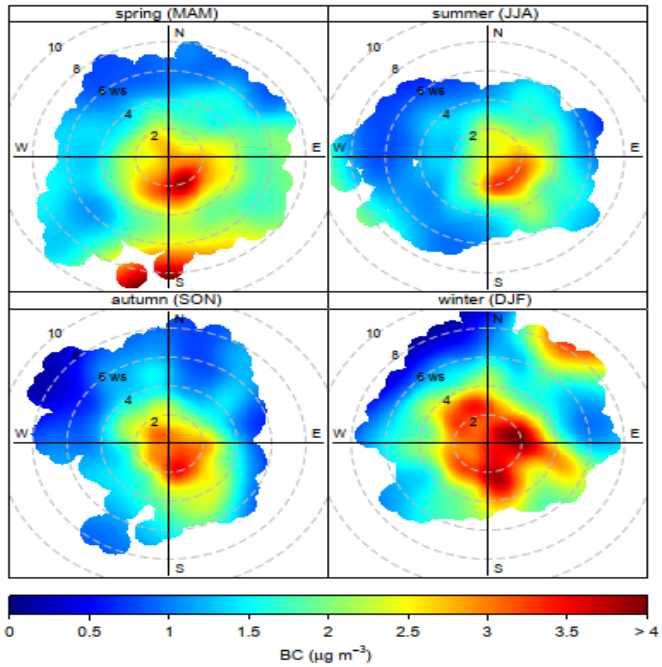

Figure S2 Bivariate polar plots of hourly BC concentration in four seasons

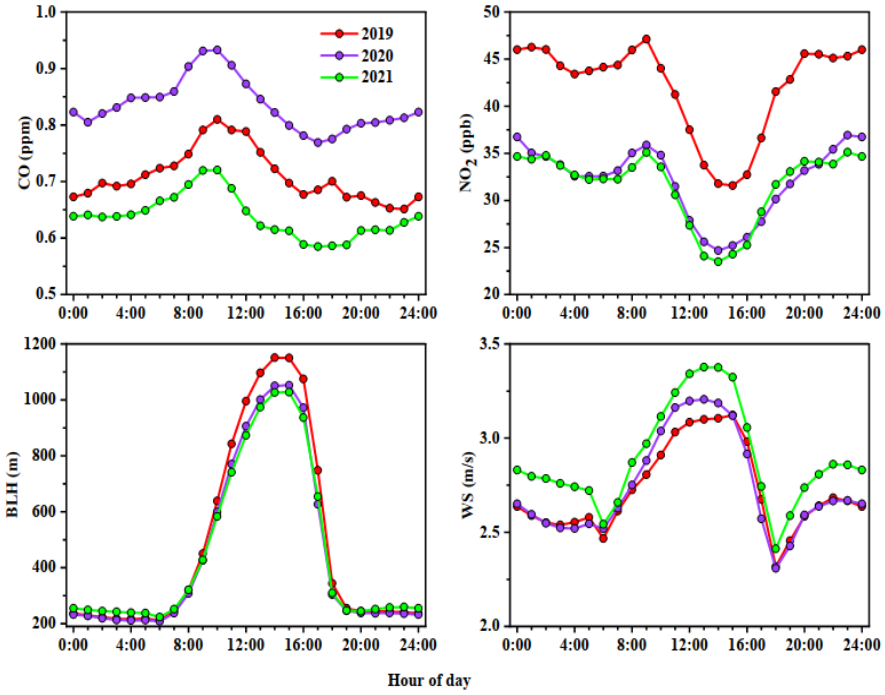

Figure S3 Diurnal variation of pollutant gases and meteorology factors

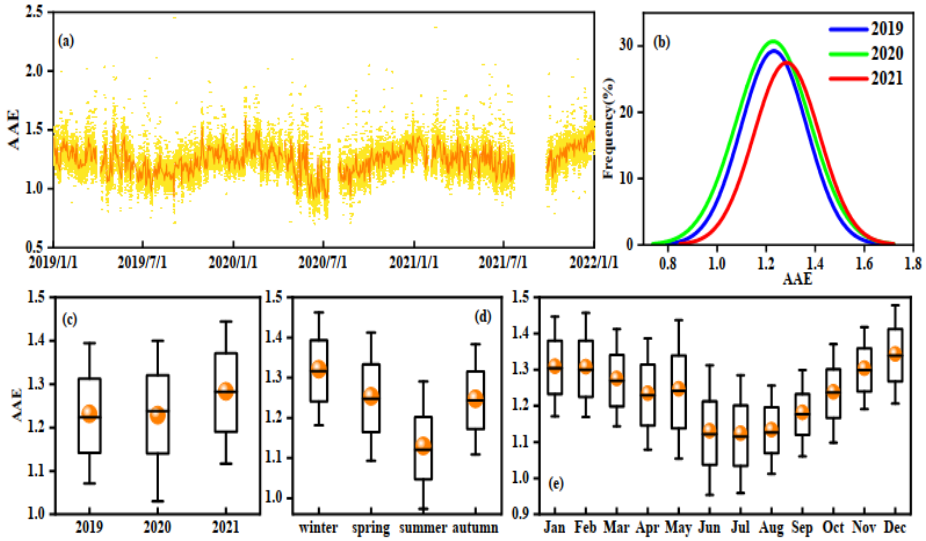

Figure S4 Hourly, annually, seasonal and monthly variation of AAE

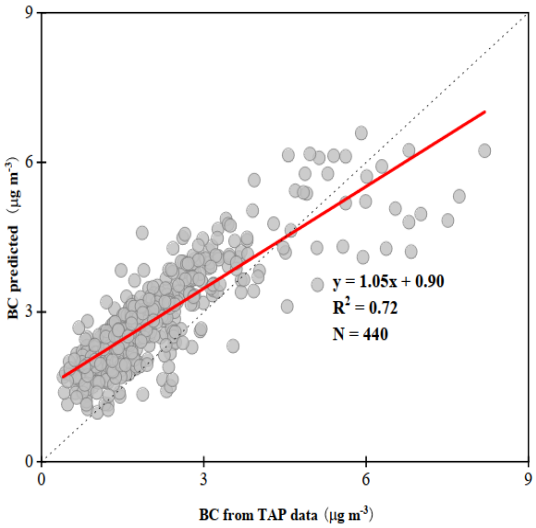

Figure S5 Comparison of BC from TAP data and predicted daily average BC by the machine learning models

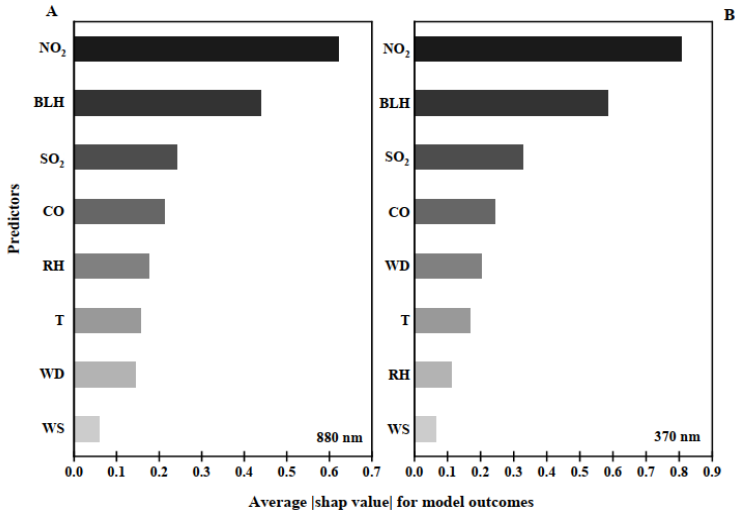

Figure S6 The predictor's importance for BC at (A) 880 nm and (B) 370 nm

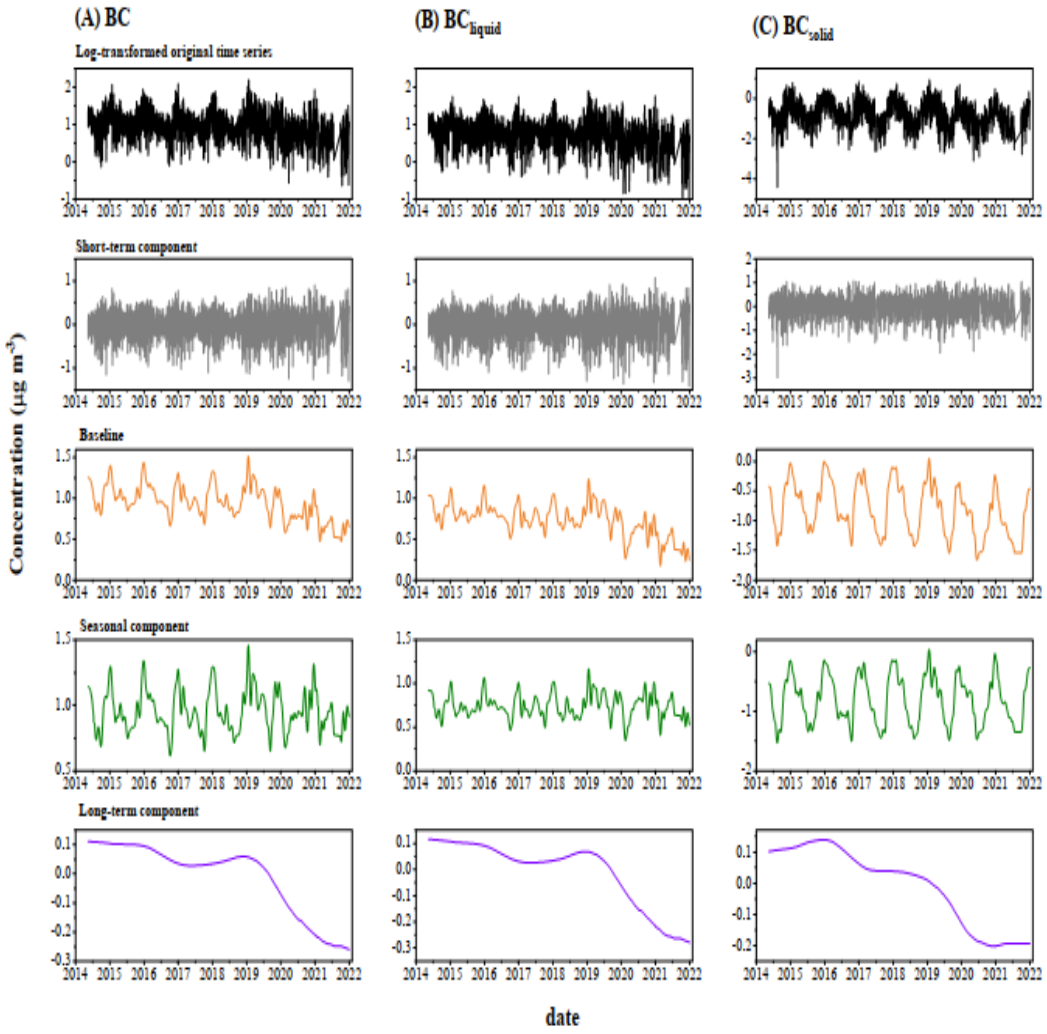

Figure S7 Different component distinguished by KZ filter for (A) BC (B) BC_{liquid} (C) BC_{solid}

Table S1 Source apportionment results used different AAE combinations

Parameters	AAE_{solid}=1.8		AAE_{solid}=1.9		AAE_{solid}=2.0		AAE_{solid}=2.1		AAE_{solid}=2.2	
	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid
AAE_{liquid}=0.8	62.40%	37.60%	67.14%	32.86%	71.06%	28.94%	74.34%	25.66%	77.12%	22.88%
AAE_{liquid}=0.9	67.27%	32.73%	71.67%	28.33%	75.24%	24.76%	78.20%	21.80%	80.66%	19.33%
AAE_{liquid}=1.0	73.40%	26.60%	77.25%	22.74%	80.31%	19.69%	82.80%	17.20%	84.85%	15.15%
AAE_{liquid}=1.1	81.33%	18.66%	84.28%	15.72%	86.56%	13.44%	88.37%	11.63%	89.83%	10.16%

Table S2 $BC/PM_{2.5}$ and BC/CO ratios from different sources

Sources	$BC/PM_{2.5}$
Biomass burning & coal	
Agricultural burning	0.058-0.131[a]
Forest fire	0.032[a]
Residential wood combustion	0.042-0.33[a]
Residential coal combustion	0.26[a]
Fossil fuel	
Light-duty gasline	0.059-0.37[a]
Heavy-duty diesel	0.33-0.74[a]
Light-duty diesel	0.62-0.64[a]

Sources	BC/CO
Industry	0.0072[b]
Power plant	0.0177[b]
Residential	0.0371[b]
Traffic	0.0052[b]

a:(Chow et al., 2011)

b:(Zhang et al., 2009)

Table S3 The change rates of BC and other air pollutants across different seasons

seasons	Air pollutants	absolute slope[a]	relative slope[b]	*p*
spring	BC	-0.17	-0.06	0.03
	Bc_{liquid}	-0.13	-0.06	0.05
	BC_{solid}	-0.02	-0.05	0.14
	so2	-3.22	-0.21	0.00
	no2	-1.99	-0.05	0.04
	co	-0.08	-0.10	0.02
	pm2.5	-4.60	-0.10	0.00
summer	BC	-0.11	-0.04	0.01
	Bc_{liquid}	-0.08	-0.04	0.02
	BC_{solid}	-0.02	-0.04	0.02
	so2	-1.96	-0.16	0.00
	no2	-0.50	-0.01	0.42
	co	-0.04	-0.05	0.23
	pm2.5	-5.48	-0.16	0.01
autumn	BC	-0.08	-0.03	0.07
	Bc_{liquid}	-0.05	-0.02	0.16
	BC_{solid}	-0.02	-0.07	0.00
	so2	-2.34	-0.19	0.09
	no2	-1.21	-0.04	0.02
	co	-0.03	-0.04	0.41
	pm2.5	-6.69	-0.23	0.01
winter	BC	-0.21	-0.07	0.01
	Bc_{liquid}	-0.16	-0.07	0.01
	BC_{solid}	-0.05	-0.06	0.01
	so2	-3.71	-0.26	0.00
	no2	-0.67	-0.01	0.43
	co	-0.07	-0.07	0.00
	pm2.5	-5.47	-0.10	0.00

[a]: $\mu g\ m^{-3}\ yr^{-1}$

[b]: % yr-1

Table S4 Total variance of log-transformed time series of BC, BC_{liquid} and BC_{solid} and relative contributions of variances of and covariances among each component to total variance

Component	BC	BC_{liquid}	BC_{solid}
Var(X)	0.16	0.16	0.40
$Var(X_{ST})$	68.87%	72.80%	51.71%
$Var(X_{SN})$	15.90%	11.37%	39.71%
$Var(X_{LT})$	8.00%	8.10%	0.35%
Cov (X_{SN}, X_{ST})	2.73%	2.76%	0.23%
Cov (X_{SN}, X_{LT})	0.90%	1.15%	0.00%
Cov (X_{ST}, X_{LT})	0.00%	0.00%	2.44%
$Var(X_{LT}^{emi})$	2.76%	2.31%	2.31%
$Var(X_{LT}^{met})$	2.16%	2.68%	0.35%
Cov (X_{ST}, X_{LT})	1.50%	1.54%	0.41%

Chow, J. C., Watson, J. G., Lowenthal, D. H., Antony Chen, L. W., and Motallebi, N.: PM2.5 source profiles for black and organic carbon emission inventories, Atmospheric Environment, 45, 5407-5414, https://doi.org/10.1016/j.atmosenv.2011.07.011, 2011.

Zhang, Q., Streets, D. G., Carmichael, G. R., He, K. B., Huo, H., Kannari, A., Klimont, Z., Park, I. S., Reddy, S., Fu, J. S., Chen, D., Duan, L., Lei, Y., Wang, L. T., and Yao, Z. L.: Asian emissions in 2006 for the NASA INTEX-B mission, Atmos. Chem. Phys., 9, 5131-5153, 10.5194/acp-9-5131-2009, 2009.