



*Supplement of*

**Measurement report: Characteristics of airborne black-carbon-containing particles during the 2021 summer COVID-19 lockdown in a typical Yangtze River Delta city, China**

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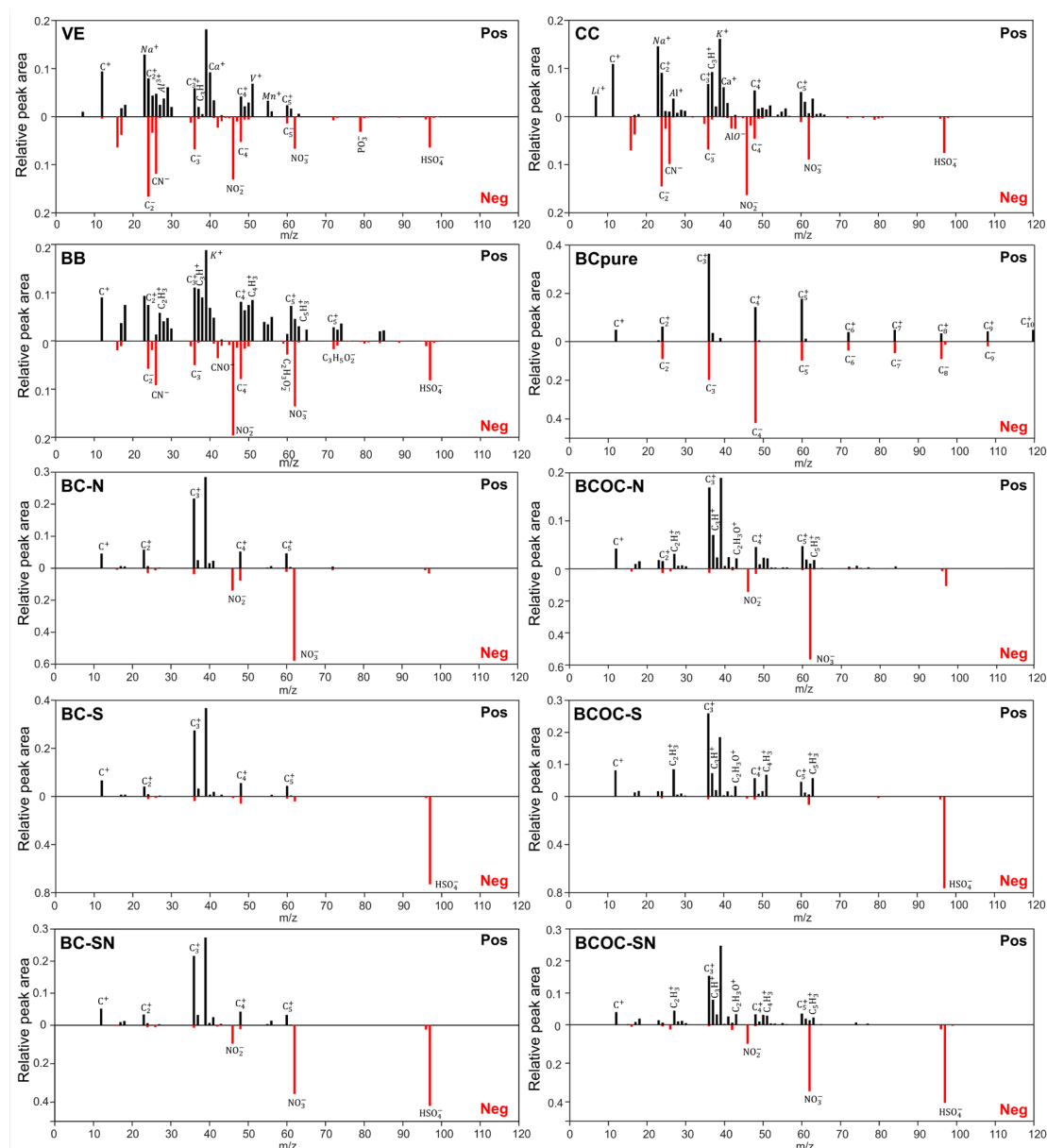
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**Table S1.** Summary of descriptions of BCc particle types

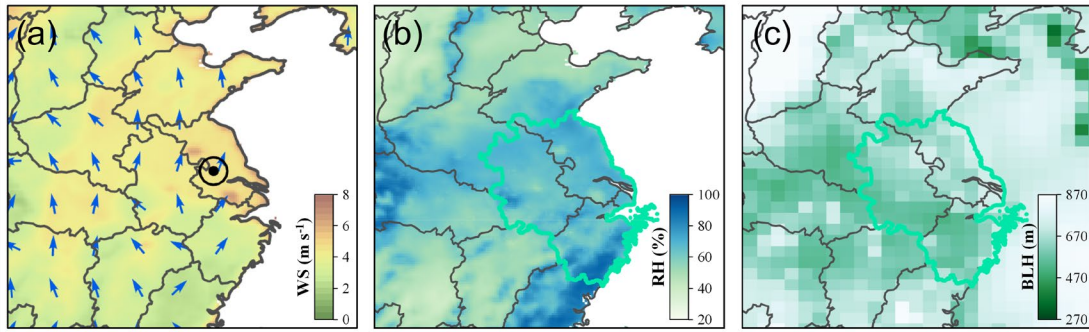
Type group	Classification of particles	Description of species	Characteristics ion markers
BC-fresh	BCpure	Almost completely BC	$[C_n]^+$ and $[C_n]^-$
	BB	BC from biomass burning	39[K] <sup>+</sup> (peak area >1500) and two of the signals in 45[CHO <sub>2</sub> ] <sup>-</sup> , 59[C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ] <sup>-</sup> and 73[C <sub>3</sub> H <sub>5</sub> O <sub>2</sub> ] <sup>-</sup> (peak area >200) 7[Li] <sup>+</sup> (peak area >200) or 23[Na] <sup>+</sup> ,
	CC	BC from coal combustion	27[Al] <sup>3+</sup> , 43[AlO] <sup>-</sup> (peak area >200) or 80[SO <sub>3</sub> ] <sup>-</sup> , 97[HSO <sub>4</sub> ] <sup>-</sup> (relative peak area >2%).
	VE	BC from traffic emission	55[Mn] <sup>+</sup> (peak area >200 without [Na] <sup>+</sup> and [Al] <sup>+</sup> ) or 40[Ca] <sup>+</sup> (with abundant nitrate) or 79[PO <sub>3</sub> ] <sup>-</sup> (with abundant nitrate) or 51[V] <sup>+</sup> and 67[VO] <sup>+</sup> (peak area >200).
	Mix	BC mixed more than one sources	Same as the above.
BC-aged	BC-S	BC internally mixed with sulfate	97[HSO <sub>4</sub> ] <sup>-</sup> (relative peak area >70%).
	BC-N	BC internally mixed with nitrate	46[NO <sub>2</sub> ] <sup>-</sup> and 62[NO <sub>3</sub> ] <sup>-</sup> (relative peak area >70%).
	BC-SN	BC internally mixed with sulfate and nitrate	46[NO <sub>2</sub> ] <sup>-</sup> and 62[NO <sub>3</sub> ] <sup>-</sup> are comparable with 97[HSO <sub>4</sub> ] <sup>-</sup> .
	BCOC-S	BC internally mixed with OC and sulfate	three of the signals in 37[C <sub>3</sub> H] <sup>+</sup> , 43[C <sub>2</sub> H <sub>3</sub> O] <sup>+</sup> , 51[C <sub>4</sub> H <sub>3</sub> ] <sup>+</sup> and 63[C <sub>5</sub> H <sub>3</sub> ] <sup>+</sup> (relative peak area >2%) with sulfate.
	BCOC-N	BC internally mixed with OC and nitrate	three of the signals in 37[C <sub>3</sub> H] <sup>+</sup> , 43[C <sub>2</sub> H <sub>3</sub> O] <sup>+</sup> , 51[C <sub>4</sub> H <sub>3</sub> ] <sup>+</sup> and 63[C <sub>5</sub> H <sub>3</sub> ] <sup>+</sup> (relative peak area >2%) with nitrate.
	BCOC-SN	BC internally mixed with OC, sulfate, and nitrate	three of the signals in 37[C <sub>3</sub> H] <sup>+</sup> , 43[C <sub>2</sub> H <sub>3</sub> O] <sup>+</sup> , 51[C <sub>4</sub> H <sub>3</sub> ] <sup>+</sup> and 63[C <sub>5</sub> H <sub>3</sub> ] <sup>+</sup> (relative peak area >2%) with comparable nitrate and sulfate.
BC-other	BC-other	Remaining BCc particles that do not belong to the BCc types listed above	

**Table S2** Bands of PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub> in Copernicus Atmosphere Monitoring Service (CAMS) Global Near-Real-Time dataset

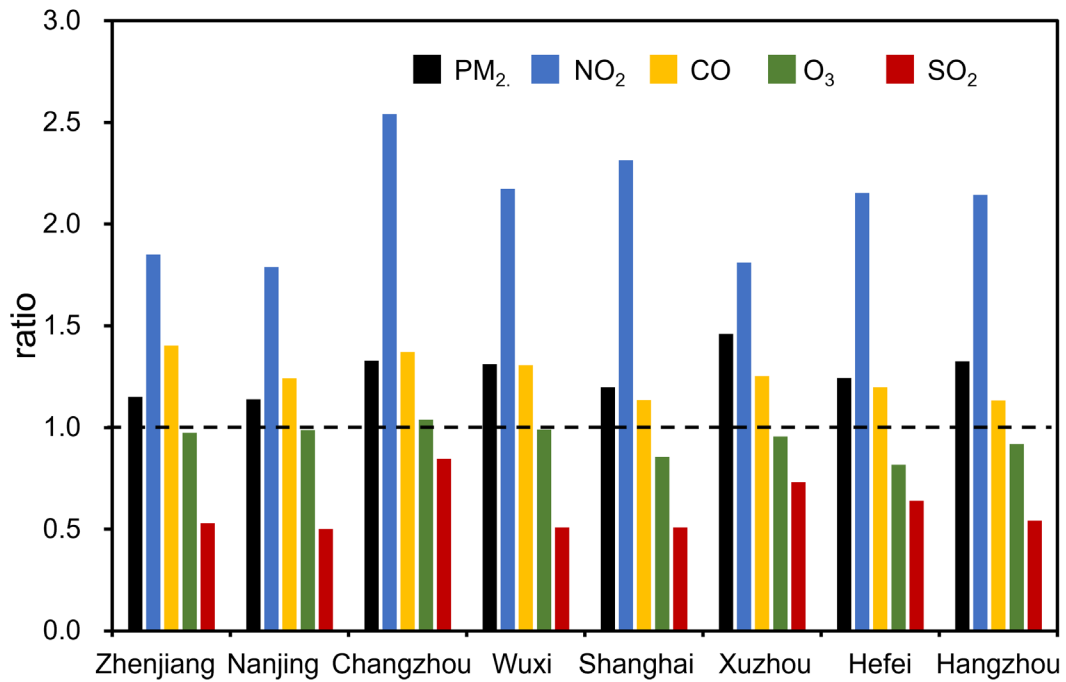
Band Names	Units	Description
particulate_matter_d_less_than_25_um_surface	kg m <sup>-3</sup>	Surface mass concentration of PM <sub>2.5</sub>
total_column_nitrogen_dioxide_surface	kg m <sup>-2</sup>	Total surface column concentration of NO <sub>2</sub>
total_column_sulphur_dioxide_surface	kg m <sup>-2</sup>	Total surface column concentration of SO <sub>2</sub>



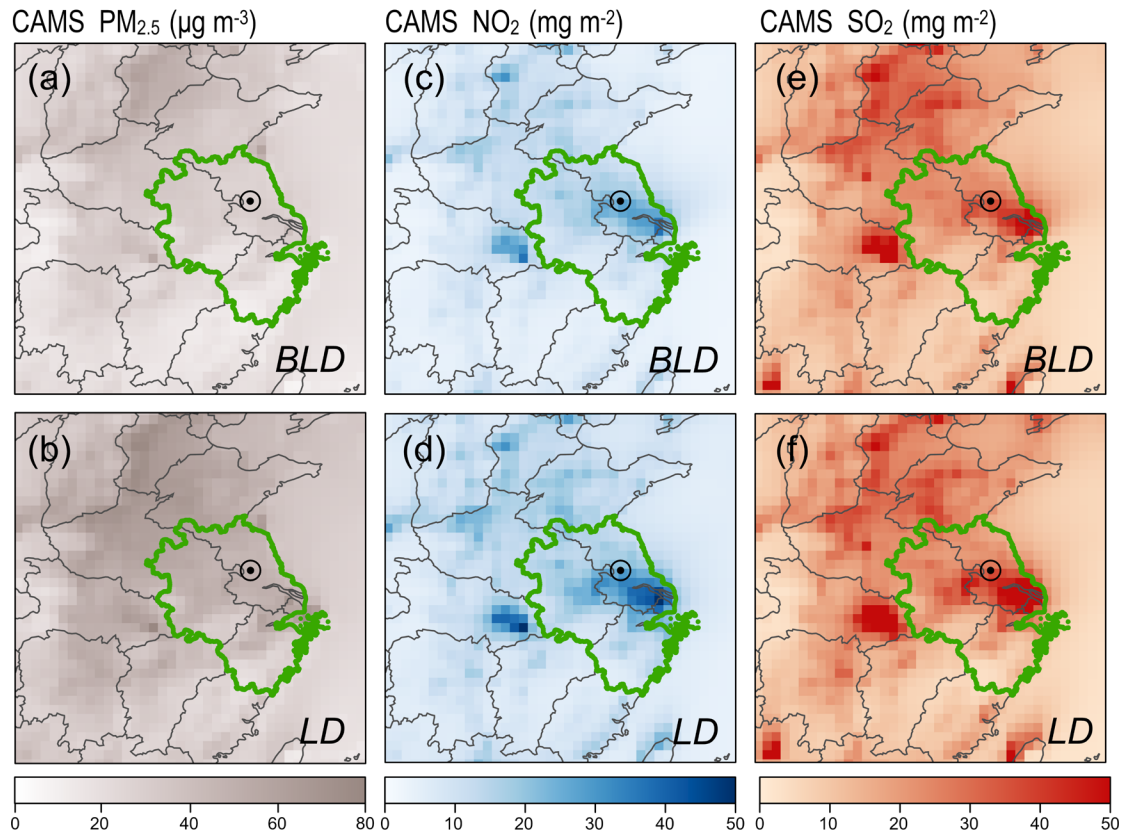
**Figure S1.** Average mass spectra of different types of BCc particles (Mass spectra of particles of Mix and BC-other types are not shown)



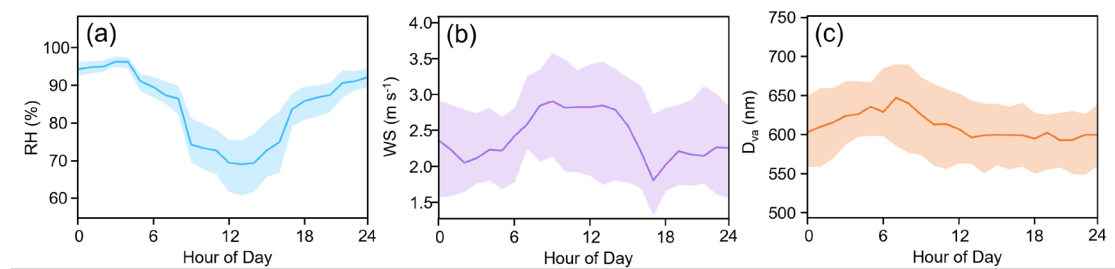
**Figure S2.** Meteorological conditions during the lockdown period (LD) based on the ERA5 reanalysis data. **(a)** Wind direction (WD, vectors) and wind speed (WS, contours) at 20 m. **(b)** Relative humidity (RH). **(c)** Boundary-layer height (BLH). The circle symbols in the maps indicate the location of Yangzhou and the green line regions represent the YRD area.



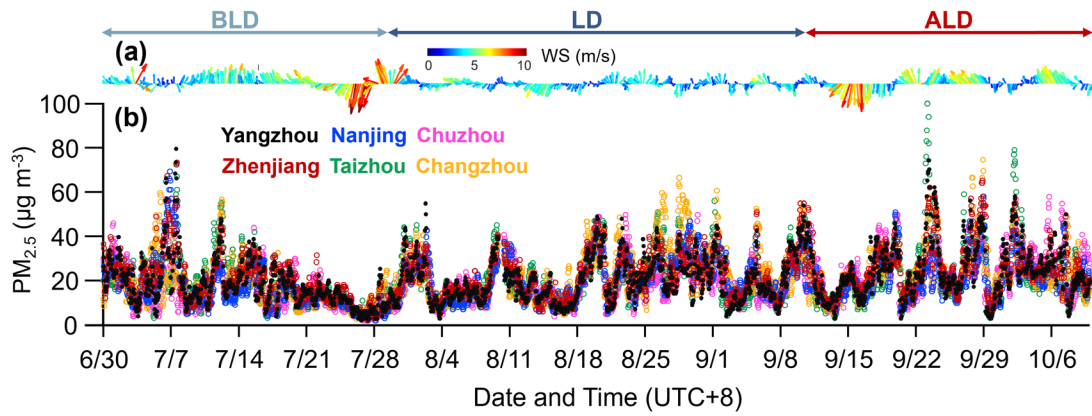
**Figure S3.** The ratios of gaseous and particulate levels in the major cities of the YRD compared to those in Yangzhou during the LD period. The black dashed line represents the pollution levels of Yangzhou.



**Figure S4.** Spaceborne measurements of  $\text{PM}_{2.5}$ ,  $\text{NO}_2$  and  $\text{SO}_2$  from Copernicus Atmosphere Monitoring Service (CMAS) during the BLD and LD periods. **(a, b)**  $\text{PM}_{2.5}$  surface concentrations. **(c, d)** Total surface column concentrations of  $\text{NO}_2$ . **(e, f)** Total surface column concentrations of  $\text{SO}_2$ . The circle symbols indicate the location of Yangzhou and the green line regions represent the YRD area.



**Figure S5.** The diurnal variation of **(a)** relative humidity (RH), **(b)** wind speed (WS), and **(c)** vacuum aerodynamic diameter ( $D_{va}$ ) during the LD period (shaded area represents one standard deviation)



**Figure S6.** Temporal variations of (a) wind direction (WD) observed at the sampling site colored by wind speed (WS), and (b) PM<sub>2.5</sub> concentration in Yangzhou and five surrounding cities in YRD, e.g., Nanjing, Zhenjiang, Changzhou, Taizhou, Chuzhou. Three campaign periods are also indicated.