

## Supplementary Material:



Figure S1. Location of the Xinzhou (XZ) sampling site.

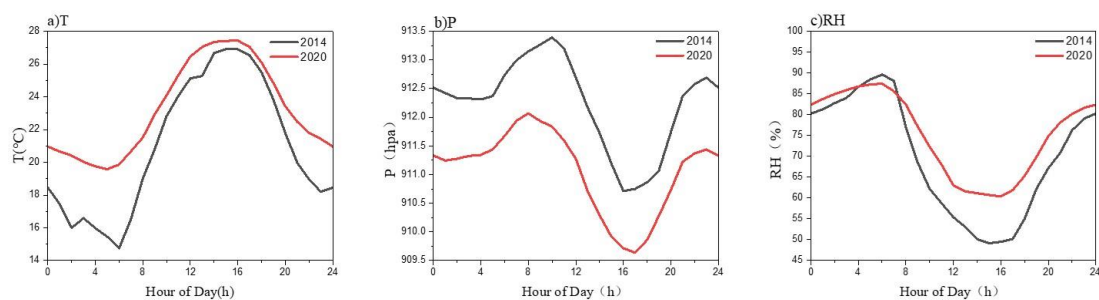


Figure S2. Diurnal variations of ambient temperature ( $T$ ), air sea-level pressure ( $P$ ) and RH in the measurement periods in 2014 and 2020 XZ.

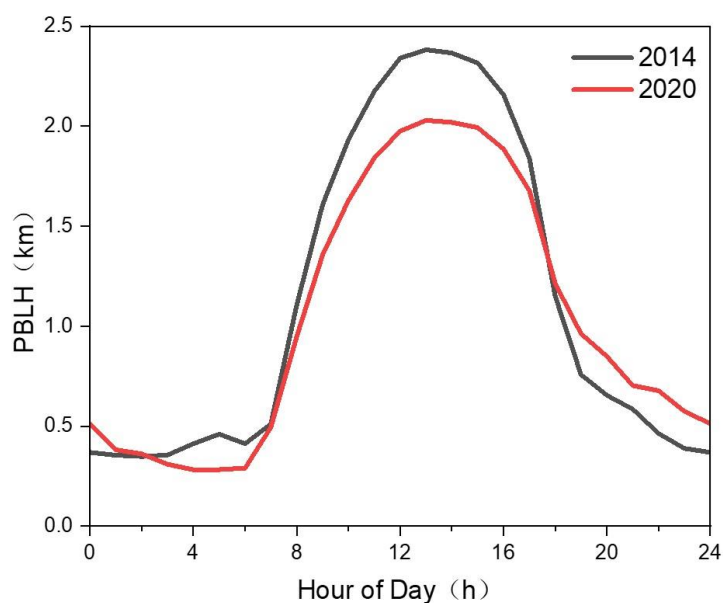
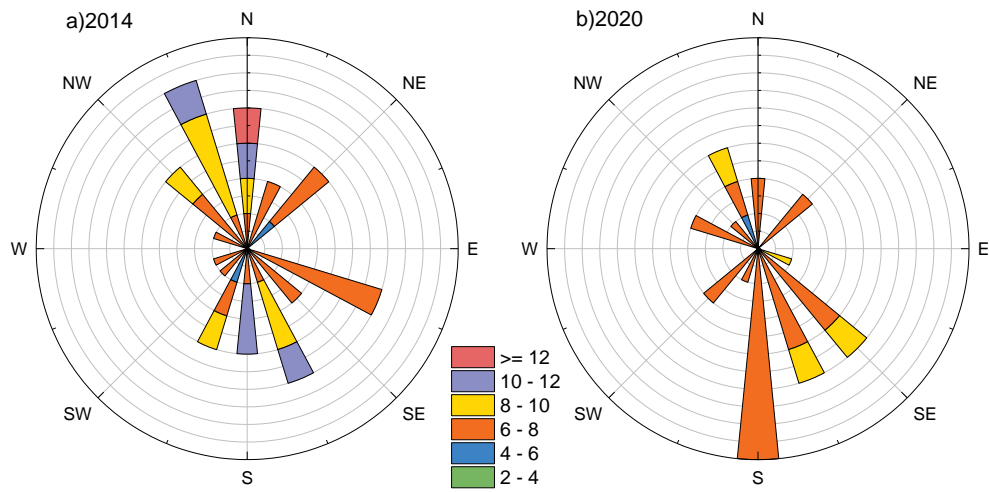
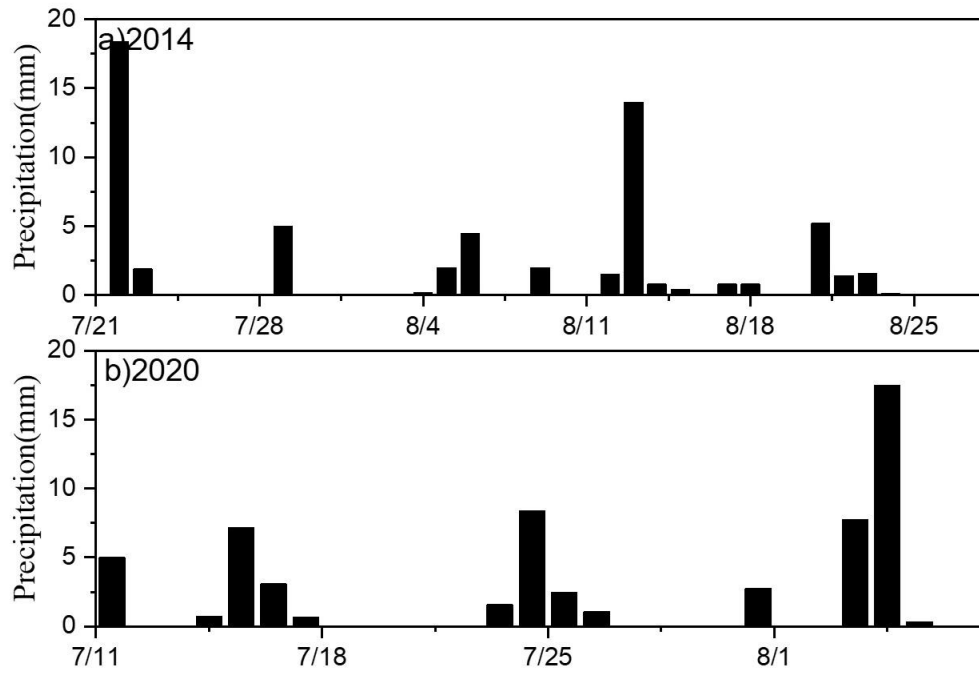


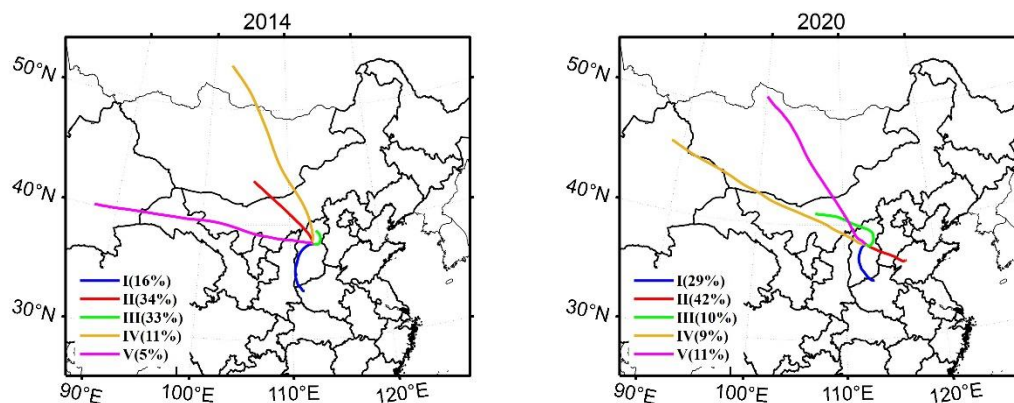
Figure S3. Diurnal variations of planetary boundary layer height (PBLH) in the measurement periods in 2014 and 2020 XZ.



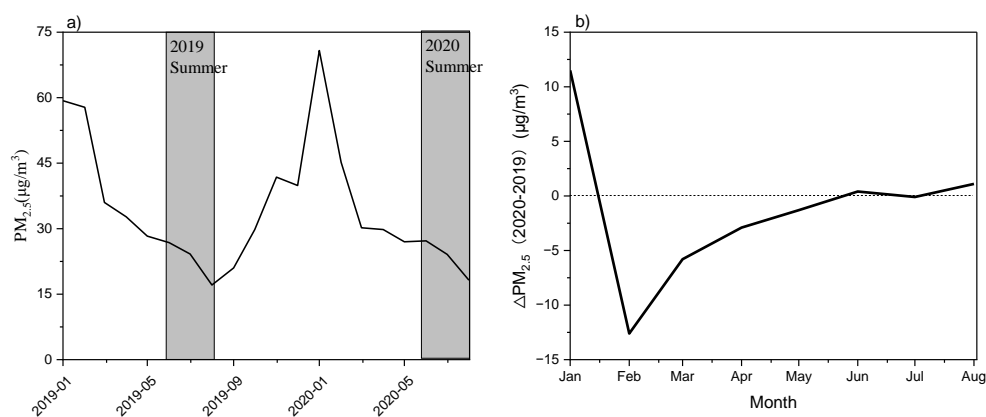
**Figure S4.** Wind-rose diagrams in XZ in the measurement periods in 2014 and 2020.



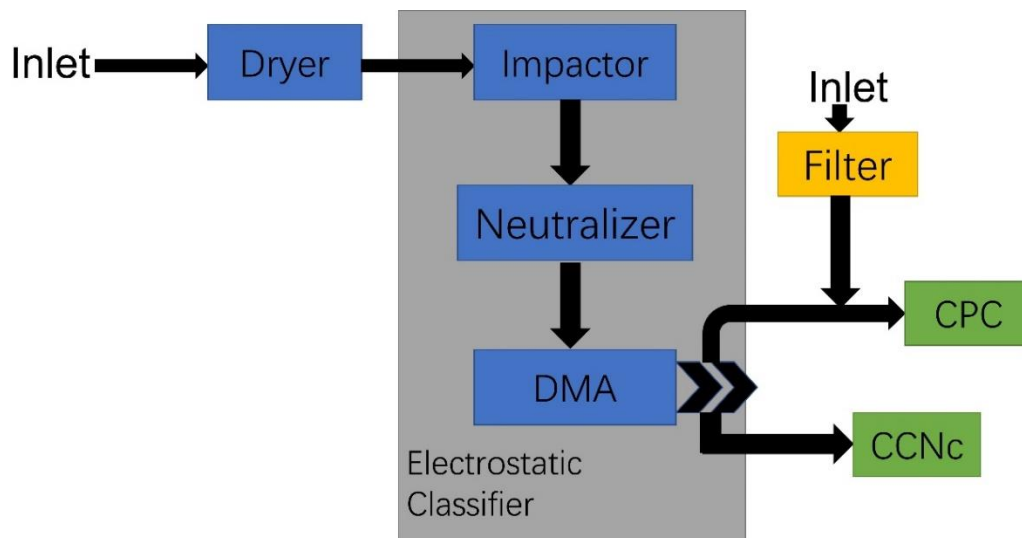
**Figure S5.** Daily precipitation in the measurement periods in 2014 and 2020 XZ.



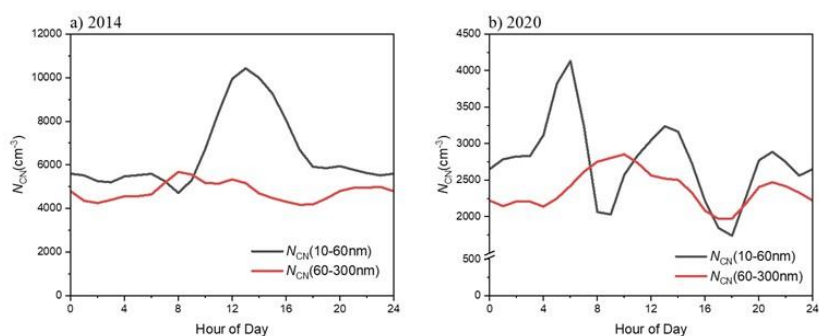
**Figure S6.** Cluster analysis of seventy-two-hour air mass backward trajectories with the time interval of 6 h and the starting altitude of 1.0 km using the HYSPLIT model in the measurement periods in 2014 and 2020 XZ. Five clusters are selected and the number percentages of trajectories in each cluster are shown in brackets. Clusters I, II, and III denote the local sources and clusters IV and V denote the long-distance transports.



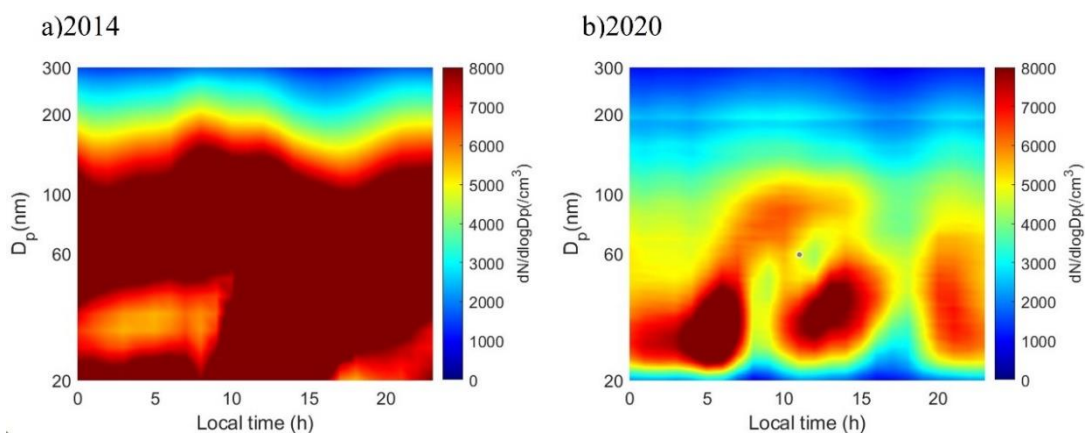
**Figure S7.** (a) Monthly mean  $PM_{2.5}$  mass concentrations from 2019 to August 2020. The shaded areas indicate the summer months. (b) The difference of monthly mean  $PM_{2.5}$  concentration between 2020 and 2019.



**Figure S8.** Schematic diagram of the SMPS-CCNc system.



**Figure S9.** The diurnal variations of total number concentrations of condensation nuclei with diameters from 10 to 60 nm and from 60 to 300 nm in the measurement periods in 2014 and 2020 XZ



**Figure S10.** Mean diurnal variations of PNSD in (a) XZ 2014 and (b) XZ 2020.

**Table S1.** Mean meteorological parameters (and standard deviation) in the measurement periods in 2014 and 2020 XZ.

	T (°C)	RH (%)	P (hpa)	WS (m/s)	PBLH (km)
2014	21.0 (±4.14)	69.4 (±14.18)	912.2 (±0.79)	7.5 (±1.75)	1.14 (±0.82)
2020	23.3 (±2.85)	75.1 (±9.95)	911.1 (±0.73)	6.6 (±0.96)	1.05 (±0.66)

**Table S2**  $\kappa$  and density ( $\rho$ ) of common chemical components

Species	$NH_4NO_3$	$(NH_4)_2SO_4$	$NH_4HSO_4$	$H_2SO_4$	Org	BC
$\rho(\text{kg/m}^3)$	1720	1769	1780	1830	1200	1700
$\kappa$	0.67	0.61	0.61	0.9	0.1	0