1   **Supplement**

2   **S1. Inter-comparison of two MOUDIs and charge balance**

3   Because two MOUDIs were sampling at two sites separately, it's necessary to

4   do the inter-comparison of two MOUDIs. Therefore, two MOUDIs were placed at

5   the same site to collect collocated 24h samples during June 7th to 9th simultaneously.

6   Figure S1 shows the inter-comparison results in the size range of 0.18～18 μm.

7   The results of linear regression of the two data sets are showed in Table S1, in

8   which y-axis represents the data of 8-stage MOUDI, x-axis represents the data of

9   10-stage MOUDI. It shows that the two data sets agree well. The slopes are around

10   one and the off-sets near zero.

11   Charge balances of analyzed ions were calculated to evaluate the results of

12   chemical analysis. The average values with standard deviations of these ratios are

13   listed in Table S2. The cation/anion ratios were almost unity in the fine particle

14   stages of 0.18-0.32 μm, 0.32-0.56 μm, 0.56-1 μm and 1-1.8 μm, indicating that

15   unanalyzed species play a minor role in fine particles. The cation/anion ratio was

16   much larger than unity in coarse particles, implicating the coarse particles

17   contained a large quantity of unanalyzed compounds which were not water-soluble,

18   such as silicate, carbonate and so on.

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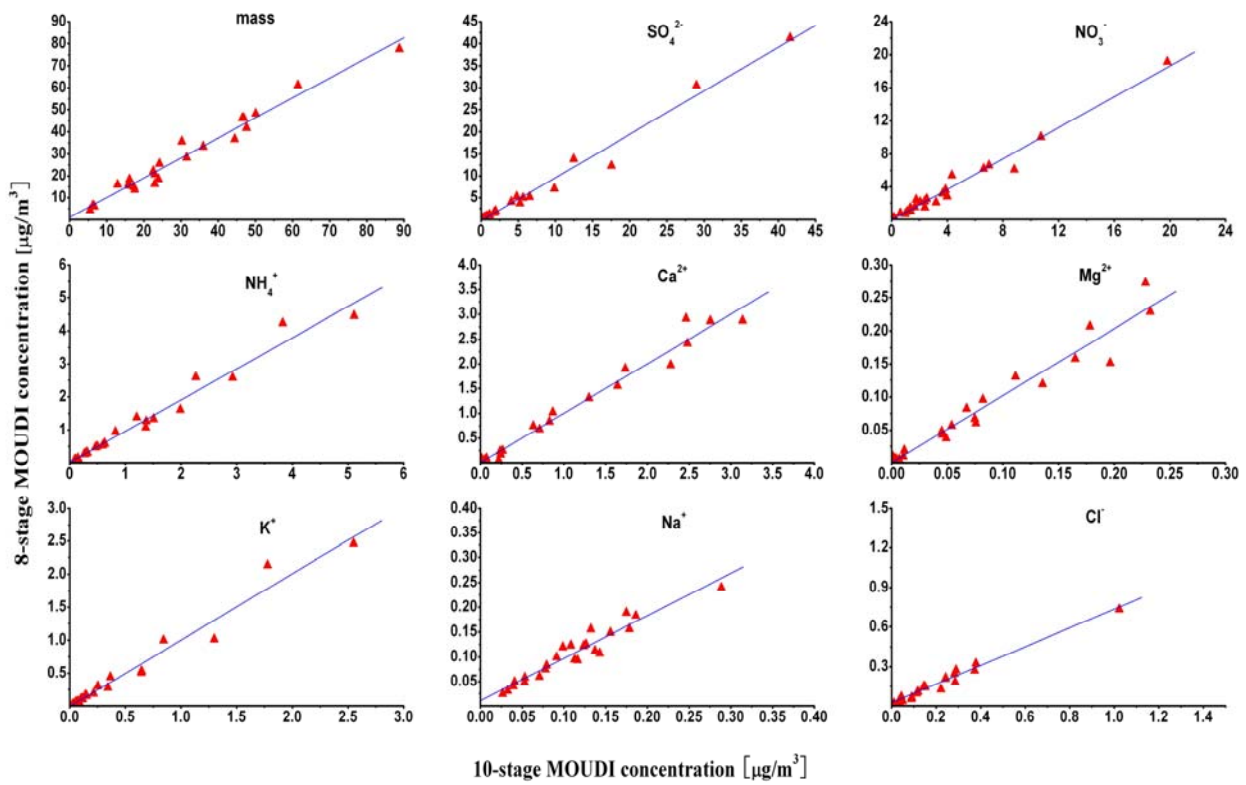
Figure S1 Correlation between 10-stage MOUDI and 8-stage MOUDI in the size

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range of 0.18 μm-18 μm. x-axis means the data of 10-stage MOUDI, and y-axis

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means those of 8-stage MOUDI. The lines are the result of linear regression.

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Table S1 Linear regression of two data sets of MOUDIs using y=bx+c, in which y represents the data of 8-stage MOUDI, x represents the data of 10-stage MOUDI, n=24 measurements.

| Mass or chemical compositions	mass	SO_4^{2-}	NO_3^-	NH_4^+	Ca^{2+}	Mg^{2+}	K^+	Na^+	Cl^-	F^-
b	0.908	0.988	0.938	0.944	0.999	1.014	1.007	0.859	0.708	0.991
c	0.921	-0.303	-0.090	0.018	0.004	0.001	-0.006	0.011	0.026	0
Correlation (R^2)	0.970	0.983	0.976	0.972	0.980	0.953	0.970	0.923	0.943	0.986

29 **Table S2 The charge balances for each stage of two MOUDIs, using the ratios of cation/anion with average values**

30 **and standard deviations**

Dp(μm)	10-18	5.6-10	3.2-5.6	1.8-3.2	1-1.8	0.56-1	0.32-0.56	0.18-0.32	0.1-0.18	0.056-0.1
PKU	2.60±0.88	2.21±0.84	1.73±0.58	1.50±0.62	1.04±0.35	0.89±0.20	0.98±0.58	1.10±0.32	1.37±0.32	1.39±0.51
Yufa	2.12±1.12	1.84±0.73	1.49±0.62	1.34±0.45	1.01±0.38	0.92±0.21	0.96±0.32	1.18±0.56	-	-

S2. General description of gaseous pollutants and meteorological conditions

The information of the instrument for gaseous species is list in table S3. The instrument was calibrated everyday during 0:00-1:00 for zero and span calibrations. Multi-calibrations were carried on every two weeks.

The mixing ratios of SO_2, NO, O_3 and temperature, relative humidity during the campaign are shown in Figure S2. SO_2 and NO are mainly from primary emission of fossil fuel burning. The mixing ratios of SO_2 were not very high during the whole campaign (9.0±6.5 ppbv at PKU, 9.0±5.2 ppbv at Yufa), and showed similar variations at two sites. NO mixing ratios clearly depended on local traffic with higher mixing ratios in the morning rush hours. The average NO mixing ratios at two sites were 6.8±9.5 ppbv at PKU and 4.3±7.5 ppbv at Yufa, respectively. The large standard deviations indicate the great variation of NO mixing ratio. O_3 indicated the photochemical process and showed distinct diurnal variation with the highest hourly concentration in the afternoon. The meteorological conditions such as temperature and RH were similar at two sites. Temperature was slightly higher and humidity was a little lower at PKU. The wind speed during the campaign was low, most of the time below 2 m/s, and the wind was from south and southwest.

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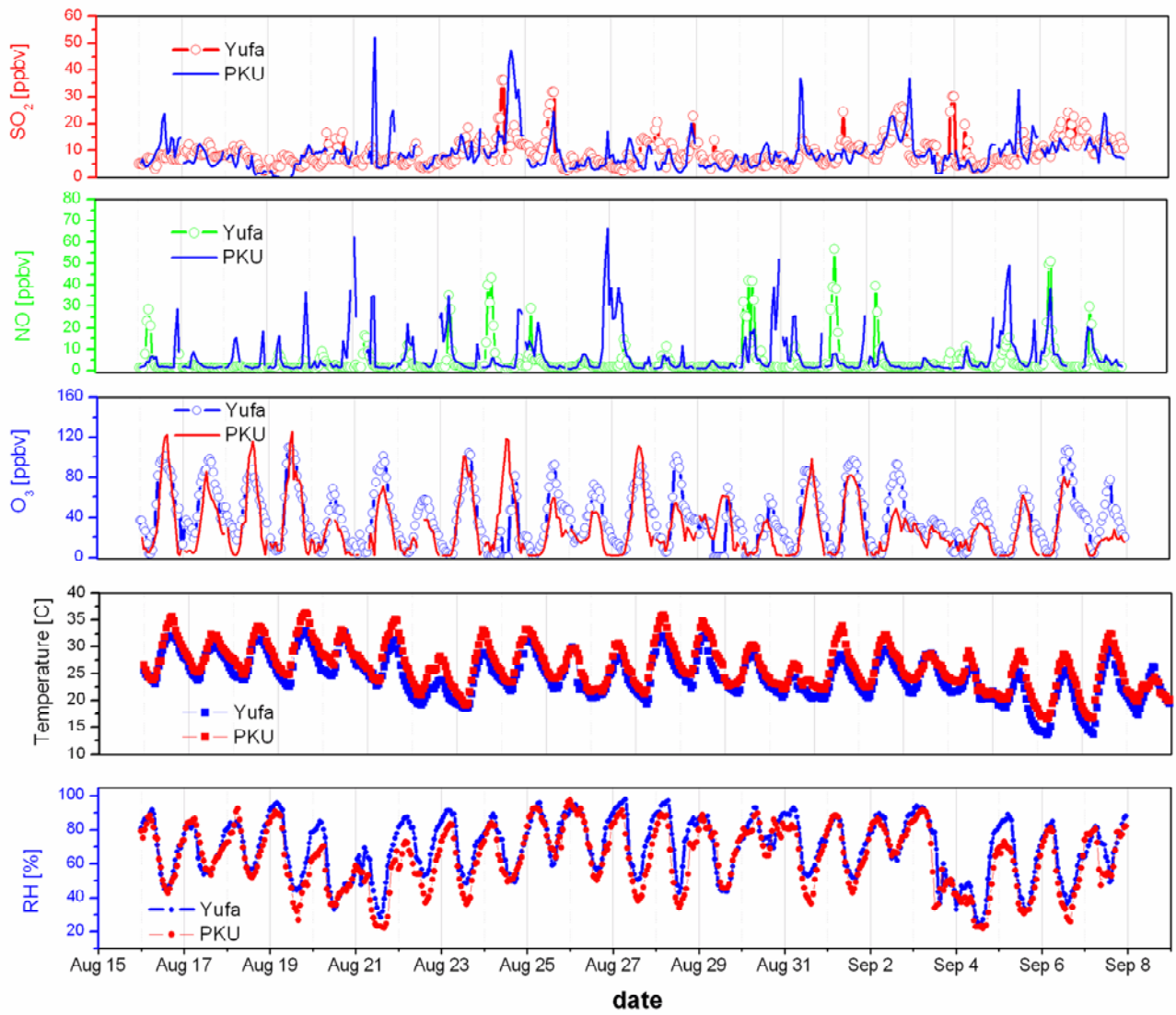
Figure S2 Mixing ratios of SO₂, NO, O₃ and temperature, humidity during the

campaign

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Table S3 Information of the instrument for gaseous species

Species	Instrument	Time resolution
SO_2	Ecotech 9850B	1 min
CO	Ecotech 9830	1 min
O_3	Ecotech 9810B	1 min
$NO-NO_x$	Ecotech 9841B	1 min

S3. Table S4 Summary of wind speed, temperature and relative humidity in polluted and clean days. The values were hourly average from 7:00 to the next day 7:00.

Date	Temperature (°C)			Relative humidity (%)			Wind speed (m/s)		
	Max	Min	Average	Max	Min	Average	Max	Min	Average
8/18-8/19	33.8	24.9	29.1	92.0	52.0	73.0	2.2	0.2	1.0
8/19-8/20	36.2	24.8	30.8	89.3	42.8	61.2	2.6	0.2	1.0
8/24-8/25	33.3	23.4	28.5	92.7	49.6	67.3	1.6	0.1	0.8
8/25-8/26	29.7	24.2	26.9	97.0	64.0	82.8	2.6	0.5	1.2
9/2-9/3	28.6	23.4	25.8	90.7	64.7	78.2	1.5	0.3	1.0
9/3-9/4	29.2	21.7	25.4	91.2	42.0	62.4	2.8	0.8	1.4
9/6-9/7	32.4	16.5	25.3	81.1	25.7	53.5	3.3	0.1	1.4
8/20-8/21	33.2	23.9	28.4	70.2	36.0	48.7	7.3	1.0	3.8
8/21-8/22	35.1	21.1	28.0	72.9	21.9	44.2	5.3	0.8	2.2
9/4-9/5	29.0	17.0	22.3	72.8	21.9	43.2	4.0	1.2	2.4