Supplementary Materials

Simultaneous measurements of new particle formation in 1-second time resolution at a street site and a rooftop site

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To calculate 25% minimum coefficient of variation

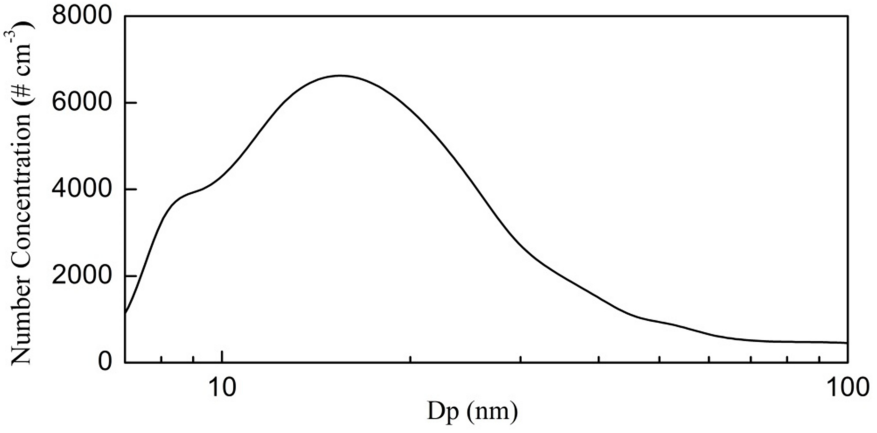
Coefficient of variation (CV) is the ratio of standard deviation to mean for particle number concentration in every 60s. 25% minimum CV values reflect small changes of particle number concentration. Large CV values reflect dramatic changes of particle number concentration and are usually caused by turbulence or short-term source emissions (Meng et al., 2015). In this study, 25% minimum CV was used as an indicator to eliminate the vehicle-caused spikes inside street canyon. For example, in Fig. 5c, all data points on the black solid lines represent the one-minute average number concentration of particles and their CV values in every minute was subject to 25% minimum CV.

To deduct the contribution of vehicle spikes

The measured number concentrations and size distributions of vehicle particles vary a lot at the street site. Here we considered that particles with the total number concentration larger than 5×10^4 particle cm^{-3} were mainly from the vehicle emissions. During the winter sampling period, we thereby selected eighteen vehicle spikes covering total 20 minutes and plot the averaged vehicle particle size distributions (following figure). In this particle size distribution, $N_{dp}/N_{16.5nm}$ is shown in the following table. Thus we do the calculation as the following equation:

$$N_{dp,deduct} = N_{dp,original} - \frac{N_{dp}}{N_{16.5nm}} \times N_{16.5nm,original}$$

where the $N_{dp,deduct}$ is the number concentration of Dp(nm) particles deducted the vehicle particles, $N_{dp,original}$ is the original number concentration of Dp(nm) particles, $N_{16.5nm,original}$ is the original number concentration of 16.5 nm particles.



Dp(nm)	$N_{dp}/N_{16.5nm}$	Dp(nm)	$N_{dp}/N_{16.5nm}$
6.04	0.156186	25.5	0.613456
6.98	0.167354	29.4	0.432448
8.06	0.506914	34	0.318763
9.31	0.609134	39.2	0.238996
10.8	0.734096	45.3	0.165393
12.4	0.90152	52.3	0.134049
14.3	0.995841	60.4	0.097849
16.5	1	69.8	0.07806
19.1	0.925529	92.5	0.071186
22.1	0.789295	114.1	0.056596

References:

Meng, H., Zhu, Y., Evans, G, J., and Yao, X.: An approach to investigate new particle formation in the vertical direction on the basis of high time-resolution measurements at ground level and sea level. Atmos. Environ., 102, 366-375, 2015

Support figures

Fig. S1 Variations of Temperature during sampling days.

Fig. S2 NPF events in Class I at the rooftop site. (a: 12 April 2012, b: 13 April 2012, c: 14 April 2012, d: 16 April 2012. Black dots were the fitted geometric median diameter of new particles (D_{pg}), yellow dots were the mixing ratio of NO_2+O_3, magenta dots were the mixing ratio of SO_2)

Fig. S3 Meteorological conditions on 27 April 2012

Fig. S4 Meteorological conditions on 25 April 2012.

Fig. S5 Number concentrations and size distributions of atmospheric particles at two sampling sites on 23 Decemebr 2011 (a and b: Contour plots of particle number concentration at street site and at rooftop site (# cm^{-3}); c: time series of nucleation mode particles and SO_2 mixing ratios; black solid line represents those data for which the coefficient of variation in every 60s was subject to the minimum 25%. c: net increase of particles size distributions at street site (t_{s1}-t_{s0}) and at the rooftop site (t_{r1}-t_{r0}).)

Fig. S6 Meteorological conditions on 22 December 2011.

Table S1 Correction factors for one FMPS

Table S2 Characteristics of NPF events at two sites in April 2012 and December 2011.

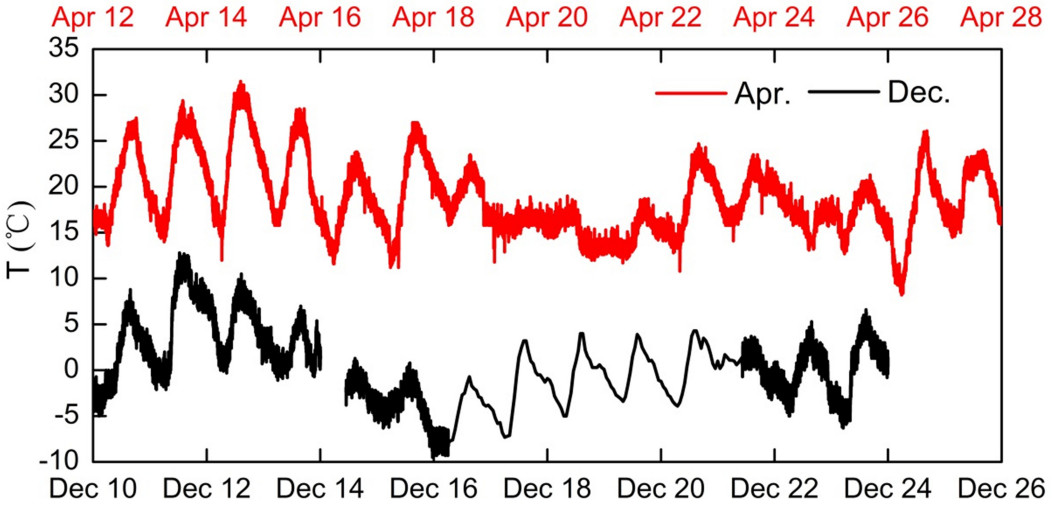


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Fig. S1 Variations of Temperature during sampling days.

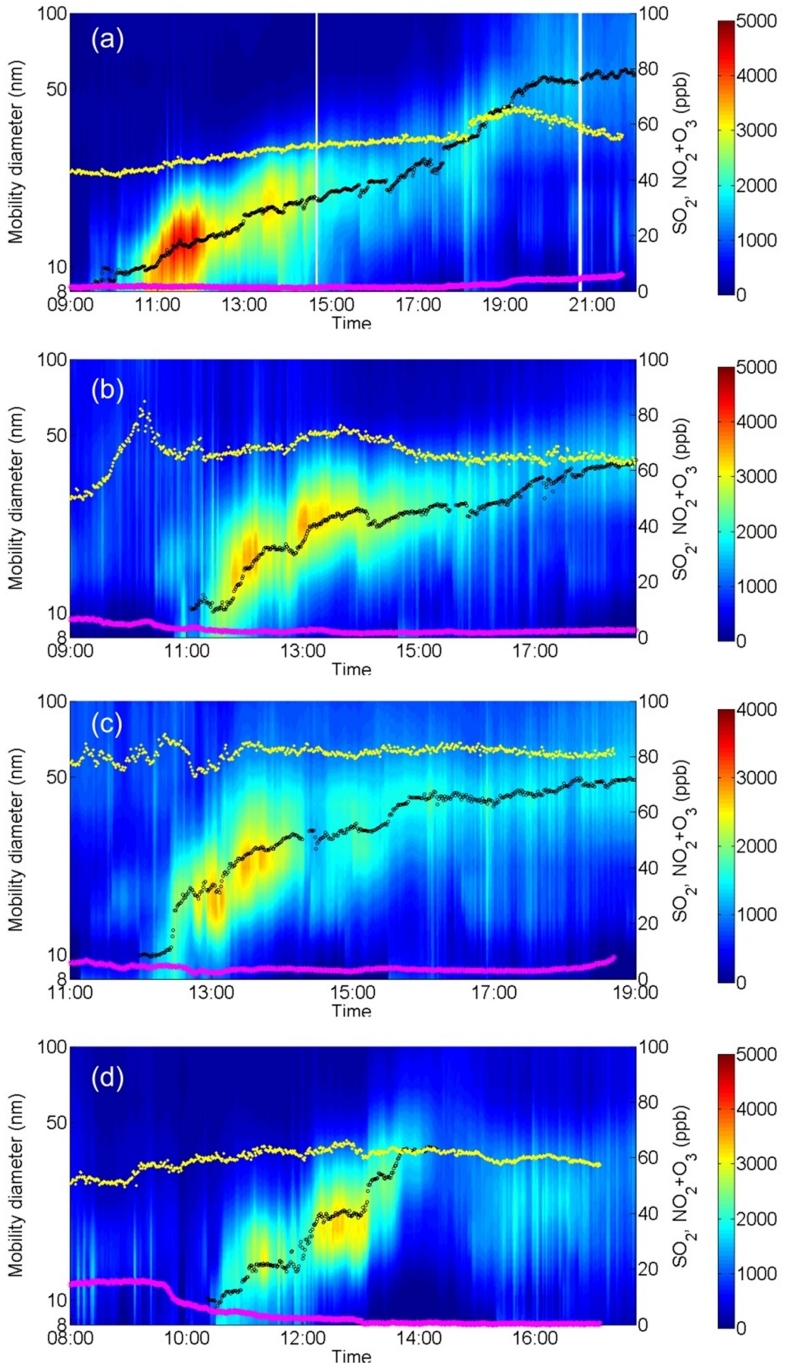

Fig. S2 NPF events in Class I at the rooftop site. (a: 12 April 2012, b: 13 April 2012, c: 14 April 2012, d: 16 April 2012. Black dots were the fitted geometric median diameter of new particles (D_{pg}), yellow dots were the mixing ratio of NO_2+O_3, magenta dots were the mixing ratio of SO_2)

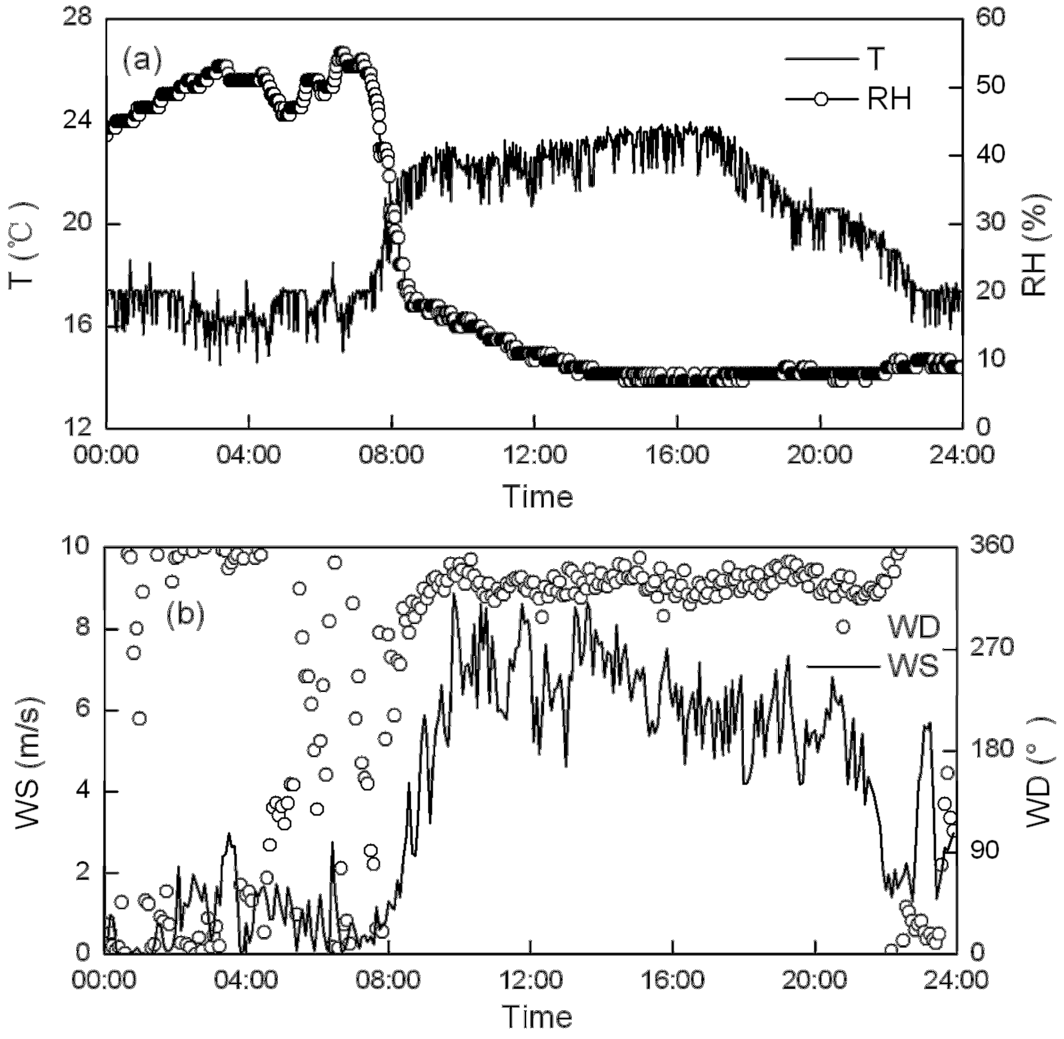

Fig. S3 Meteorological conditions on 27 April 2012

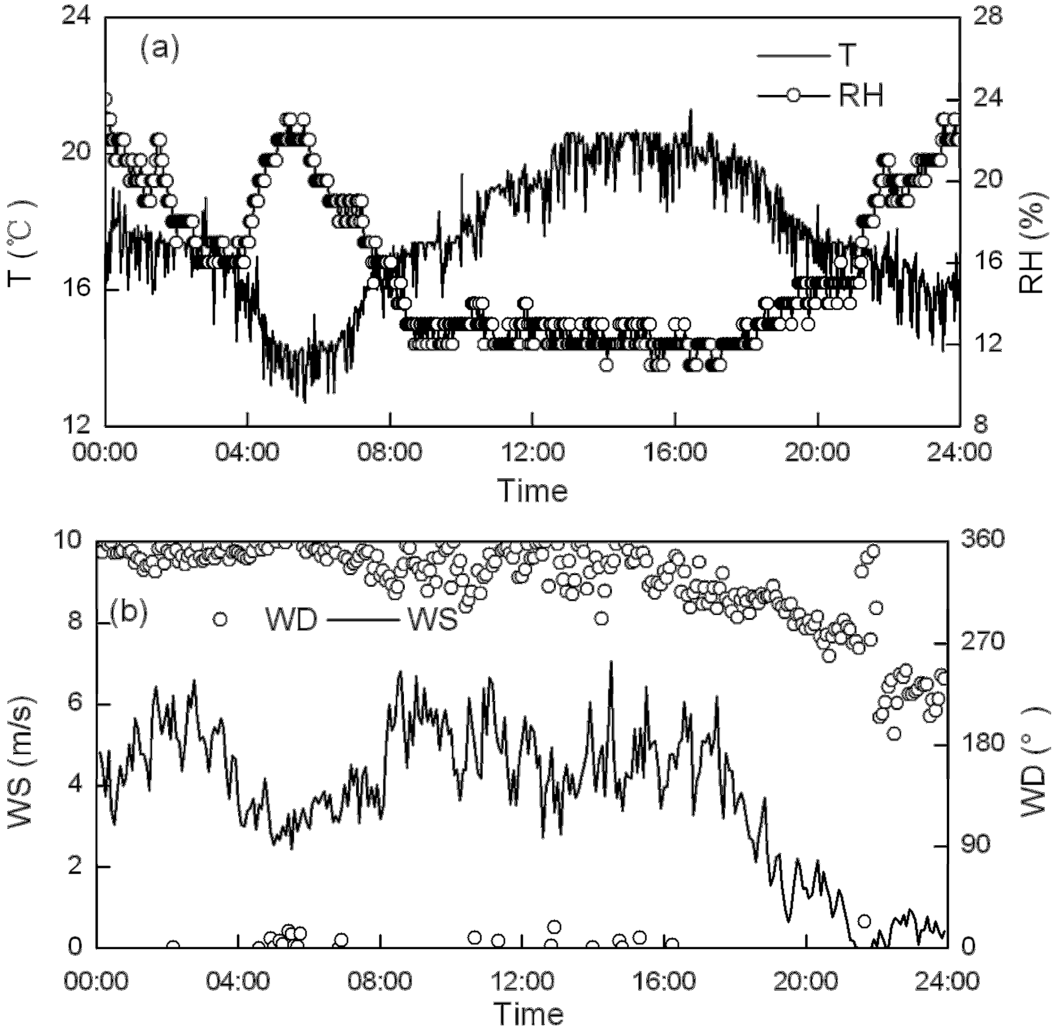

Fig. S4 Meteorological conditions on 25 April 2012.

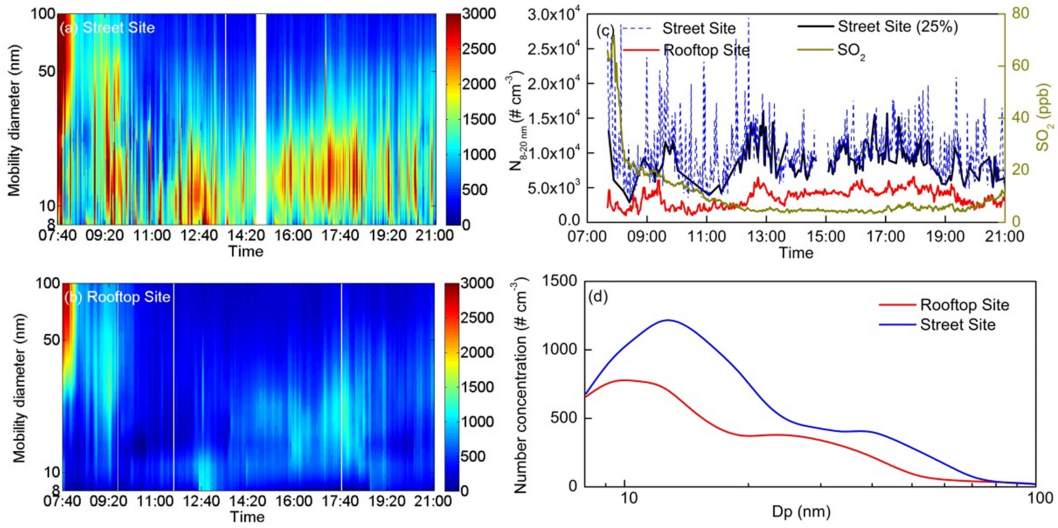

Fig. S5 Number concentrations and size distributions of atmospheric particles at two sampling sites on 23 Decemebr 2011 (a and b: Contour plots of particle number concentration at street site and at rooftop site (# cm^{-3}); c: time series of nucleation mode particles and SO_2 mixing ratios; black solid line represents those data for which the coefficient of variation in every 60s was subject to the minimum 25%. c: net increase of particles size distributions at street site (t_{s1}-t_{s0}) and at the rooftop site (t_{r1}-t_{r0}).)

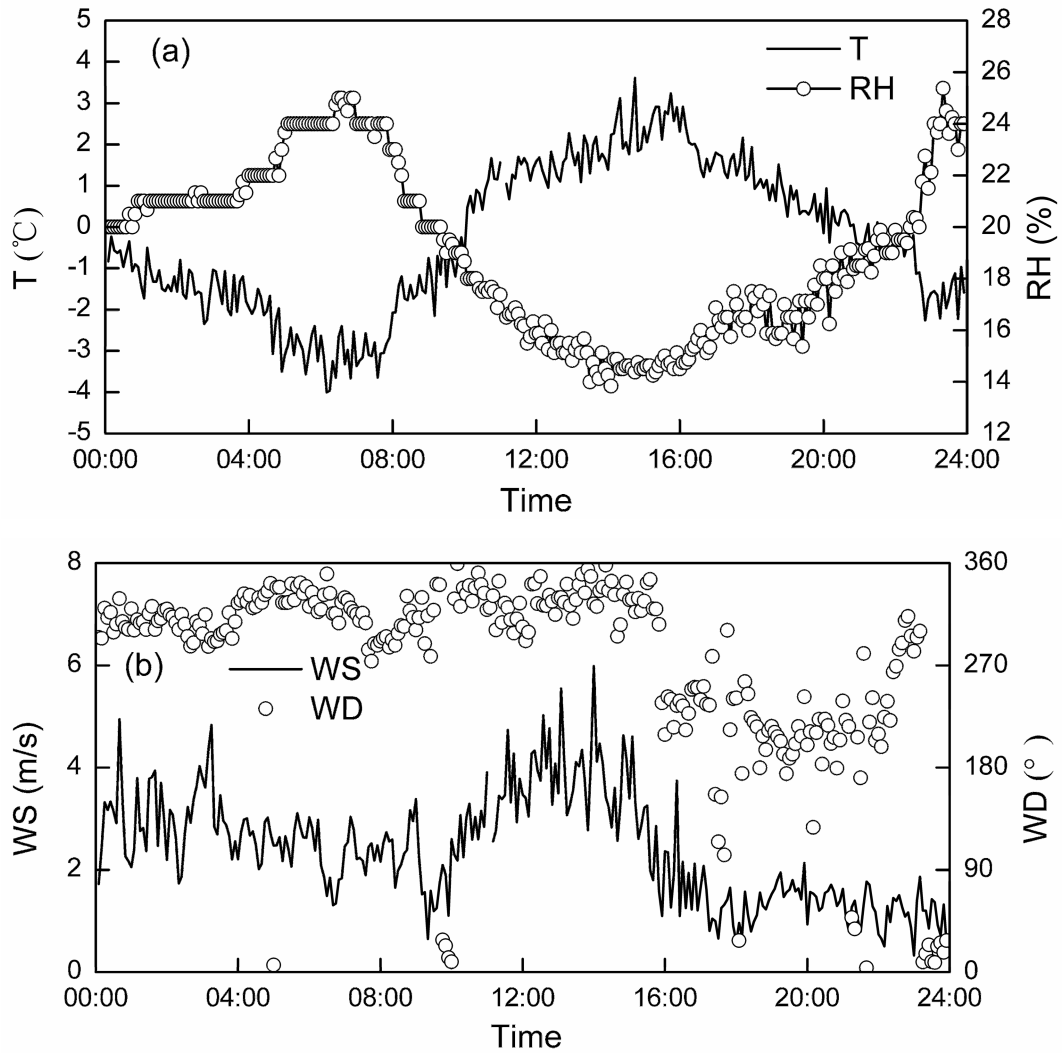

Fig. S6 Meteorological conditions on 22 December 2011.

Table S1 Correction factors for one FMPS

D_p	r	D_p	r
8.06	1.294	34	1.222
9.31	1.178	39.2	1.237
10.8	1.134	45.3	1.261
12.4	1.100	52.3	1.292
14.3	1.067	60.4	1.284
16.5	1.051	69.8	1.230
19.1	1.069	80.6	1.200
22.1	1.134	93.1	1.194
25.5	1.189	107.5	1.244
29.4	1.207		

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Table S2 Characteristics of NPF events at two sites in April 2012 and December 2011.

Date	Location	J_8 (particle $cm^{-3}s^{-1}$)	GR (nm h^{-1})	CS (10^{-2} s^{-1})[a]
12 April 2012	Rooftop Site	5	2.2	0.27±0.07
13 April 2012	Rooftop Site	12.2	6	1.4±0.65
14 April 2012	Rooftop Site	9.7	9.3	1.7±0.59
15 April 2012	Rooftop Site	8.4	-	1.3±0.25
16 April 2012	Rooftop Site	8.5	7.9	0.44±0.11
25 April 2012	**Rooftop Site**	**14/49/36/34/1.9***	**-**	**0.16±0.02**
	Street Site	**13/38/19/17/1.9***	**-**	**0.65±0.23**
27 April 2012	**Rooftop Site**	**10.2**	**-**	**0.75±0.21**
	Street Site	**8.1**	**-**	**1.2±0.37**
10 December 2011	Street Site	5.7	-	2.3±0.51
11 December 2011	Street Site	11	-	8.9±2.5
14 December 2011	Street Site	10.7	-	1.6±0.25
15 December 2011	Street Site	5	-	1.5±0.46
21 December 2011	**Rooftop Site**	**0.9**	**-**	**0.45±0.04**
	Street Site	**4**	**-**	**1.3±0.23**
22 December 2011	**Rooftop Site**	**1.9**	**-**	**0.78±0.17**
	Street Site	**7.9**	**-**	**1.3±0.33**
23 December	**Rooftop Site**	**0.8**	**-**	**0.98±0.12**

2011	**Street Site**	**4.4**	**-**	**1.3±0.23**

[a]: Condensation sink was averaged 1-h prior to the NPF event.

-: NPF in Class II.

*: J_8 of four short-term NPF events and one long-term NPF event.