

1

## 2 SUPPLEMENTARY INFORMATION

3

### 4 An Analysis of New Particle Formation (NPF) at Thirteen European Sites

5

6 **Dimitrios Bousiotis, Francis D. Pope, David C. Beddows, Manuel Dall’Osto,**  
7 **Andreas Massling, Jacob Klenø Nøjgaard, Claus Nørdstrom, Jarkko V. Niemi,**  
8 **Harri Portin, Tuukka Petäjä, Noemi Perez, Andrés Alastuey, Xavier Querol,**  
9 **Giorgos Kouvarakis, Stergios Vratolis, Konstantinos Eleftheriadis, Alfred**  
10 **Wiedensohler, Kay Weinhold, Maik Merkel, Thomas Tuch and**  
11 **Roy M. Harrison**

12

13

14 **Table S1:** Meteorological conditions and condensation sink on average (upper) and NPF event days  
 15 (lower).

16

Site	Temperature (°C)	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
DENRU	9.80 ± 6.75	115 ± 98.0	4.17 ± 1.49	75.7 ± 11.7	9.46E-03 ± 6.56E-03
DENUB	9.82 ± 6.76	115 ± 98.0	4.17 ± 1.49	75.7 ± 11.7	1.42E-02 ± 8.80E-03
DENRO	10.0 ± 6.68	117 ± 98.5	4.16 ± 1.48	75.7 ± 11.4	3.10E-02 ± 1.79E-02
GERRU	10.3 ± 7.83	130 ± 94.0	2.58 ± 1.32	81.9 ± 10.4	7.02E-03 ± 3.54E-03
GERUB	11.1 ± 8.37	114 ± 86.3	2.33 ± 0.84	78.7 ± 14.7	9.11E-03 ± 4.48E-03
GERRO	11.1 ± 8.37	114 ± 86.3	2.33 ± 0.84	78.7 ± 14.7	1.20E-02 ± 5.58E-03
FINRU	4.79 ± 8.79	91 ± 89.0	1.31 ± 0.86	80.1 ± 15.7	2.32E-03 ± 1.25E-03
FINUB	6.52 ± 8.34	111 ± 110	3.43 ± 1.53	76.5 ± 13.9	6.34E-03 ± 3.20E-02
FINRO	7.72 ± 7.55	114 ± 103	4.26 ± 1.44	71.1 ± 11.4	8.96E-03 ± 3.70E-02
SPARU	13.9 ± 6.27	162 ± 82.3	0.94 ± 0.56	66.4 ± 15.6	5.49E-03 ± 2.70E-03
SPAUB	18.2 ± 5.68	180 ± 93.3	2.05 ± 0.99	69.2 ± 11.7	1.00E-02 ± 4.00E-03
GRERU	18.2 ± 6.01	201 ± 104	6.06 ± 3.38	70.0 ± 8.59	4.66E-03 ± 2.08E-03
GREUB	17.6 ± 7.37	183 ± 92.3	1.87 ± 0.74	60.5 ± 15.5	7.55E-03 ± 3.23E-03

17

Site	Temperature (°C)	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
DENRU	13.5 ± 4.61	218 ± 71.0	4.29 ± 1.31	65.1 ± 9.38	8.67E-03 ± 5.46E-03
DENUB	13.4 ± 5.17	206 ± 76.4	4.59 ± 1.43	64.6 ± 9.96	1.12E-02 ± 5.80E-03
DENRO	13.6 ± 4.82	226 ± 78.5	4.49 ± 1.33	66.2 ± 8.48	2.66E-02 ± 1.41E-02
GERRU	15.4 ± 5.90	229 ± 68.3	2.05 ± 0.98	71.2 ± 7.75	8.61E-03 ± 2.98E-03
GERUB	17.6 ± 5.66	215 ± 60.6	2.08 ± 0.71	62.0 ± 10.5	9.96E-03 ± 3.86E-03
GERRO	18.7 ± 6.44	217 ± 65.70	1.96 ± 0.62	60.6 ± 11.1	1.42E-02 ± 4.51E-03
FINRU	3.48 ± 6.74	149 ± 80.8	1.44 ± 0.93	64.8 ± 14.6	2.15E-03 ± 9.52E-03
FINUB	5.32 ± 5.44	150 ± 85.5	3.28 ± 1.42	62.0 ± 13.3	4.33E-03 ± 2.01E-03
FINRO	11.6 ± 6.28	169 ± 91.9	4.47 ± 1.46	64.2 ± 14.0	6.89E-03 ± 2.62E-03
SPARU	12.0 ± 4.71	169 ± 67.3	1.00 ± 0.47	59.2 ± 13.4	4.68E-03 ± 2.34E-03
SPAUB	17.7 ± 5.29	196 ± 76.2	2.58 ± 1.04	57.9 ± 10.3	8.45E-03 ± 3.57E-03
GRERU	18.1 ± 4.99	233 ± 91.5	6.49 ± 3.33	67.6 ± 7.98	4.80E-03 ± 1.73E-03
GREUB	16.8 ± 7.50	192 ± 74.9	1.79 ± 0.72	54.6 ± 12.0	9.31E-03 ± 3.49E-03

18

19

20 **Table S2:** Average (top panel) and NPF event day (lower panel) concentrations of chemical  
 21 components (\*refers to  $\text{NO}_2$ , <sup>+</sup>refers to Organic Mass in  $\text{PM}_{1}$  measurements, \*refers to measurements  
 22 at the Kalio site).

Site	$\text{NO}_x/\text{NO}_2$ ( $\mu\text{g m}^{-3}$ )	$\text{SO}_2$ ( $\mu\text{g m}^{-3}$ )	$\text{O}_3$ ( $\mu\text{g m}^{-3}$ )	Organic carbon ( $\text{PM}_{2.5}$ ) ( $\mu\text{g m}^{-3}$ )	Sulphate ( $\text{PM}_{2.5}$ ) ( $\mu\text{g m}^{-3}$ )
DENRU	$5.42 \pm 4.55$	$0.26 \pm 0.37$	$30.1 \pm 9.32$	$1.48 \pm 1.37$	$0.52 \pm 0.46$
DENUB	$10.5 \pm 6.24$	-	$28.2 \pm 9.36$	-	-
DENRO	$68.5 \pm 30.4$	$0.97 \pm 0.78$	$31.1 \pm 7.13$	$2.59 \pm 1.81$	$0.55 \pm 0.50$
GERRU	-	-	-	$2.18 \pm 2.08$	$0.83 \pm 0.12$
GERUB	-	-	-	-	-
GERRO	-	-	-	-	-
FINRU	$0.72 \pm 0.55$	$0.09 \pm 0.16$	$27.4 \pm 8.07$	$1.78 \pm 1.24^+$	$1.02 \pm 0.82$
FINUB	-	-	-	-	-
FINRO	$88.1 \pm 54.4$	$0.93 \pm 1.27^*$	$37.1 \pm 14.0$	-	-
SPARU	$3.26 \pm 2.46^*$	$0.95 \pm 0.57$	$75.9 \pm 20.0$	$2.69 \pm 1.34$	$1.21 \pm 0.97$
SPAUB	$31.4 \pm 14.2^*$	$1.99 \pm 0.88$	$54.9 \pm 19.0$	-	-
GRERU	$0.52 \pm 0.22^*$	-	$49.5 \pm 8.61$	$1.58 \pm 0.97$	-
GREUB	-	-	-	-	-

23

Site	$\text{NO}_x/\text{NO}_2$ ( $\mu\text{g m}^{-3}$ )	$\text{SO}_2$ ( $\mu\text{g m}^{-3}$ )	$\text{O}_3$ ( $\mu\text{g m}^{-3}$ )	Organic carbon ( $\text{PM}_{2.5}$ ) ( $\mu\text{g m}^{-3}$ )	Sulphate ( $\text{PM}_{2.5}$ ) ( $\mu\text{g m}^{-3}$ )
DENRU	$2.59 \pm 1.64$	$0.18 \pm 0.19$	$37.0 \pm 6.10$	$0.74 \pm 0.45$	$0.33 \pm 0.15$
DENUB	$6.55 \pm 2.77$	-	$35.5 \pm 5.54$	-	-
DENRO	$53.9 \pm 22.7$	$0.66 \pm 0.54$	$36.3 \pm 4.09$	$2.13 \pm 0.87$	$0.34 \pm 0.18$
GERRU	-	-	-	$1.83 \pm 0.98$	$0.69 \pm 0.28$
GERUB	-	-	-	-	-
GERRO	-	-	-	-	-
FINRU	$0.50 \pm 0.42$	$0.13 \pm 0.20$	$33.8 \pm 7.12$	$1.21 \pm 0.63^+$	$0.66 \pm 0.45$
FINUB	-	-	-	-	-
FINRO	$52.9 \pm 31.6$	$0.66 \pm 0.60^*$	$45.1 \pm 16.0$	-	-
SPARU	$3.27 \pm 3.39^*$	$0.96 \pm 0.71$	$78.1 \pm 15.0$	$1.47 \pm 0.76$	$0.53 \pm 0.68$
SPAUB	$25.4 \pm 12.7^*$	$1.95 \pm 0.81$	$59.6 \pm 16.2$	-	-
GRERU	$0.56 \pm 0.28^*$	-	$50.8 \pm 7.48$	$1.46 \pm 0.74$	-
GREUB	-	-	-	-	-

24

25

26

27 **Table S3:** Seasonal meteorological conditions and chemical compound concentrations

<b>DENRU</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Organic carbon (PM <sub>2.5</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	24	4.60	2.26	82.2	7.29	25.5	1.99	8.34E-03
Spring	163	4.06	8.69	69.4	5.07	36.3	1.43	1.09E-02
Summer	210	3.80	17.8	70.7	3.16	34.9	1.10	1.07E-02
Autumn	68	4.21	10.8	80.0	6.09	24.2	1.43	8.03E-03

28

<b>DENUB</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	24	4.62	2.19	82.2	12.08	22.7	1.37E-02
Spring	163	4.06	8.69	69.4	10.12	34.1	1.45E-02
Summer	210	3.80	17.8	70.7	8.25	33.5	1.61E-02
Autumn	68	4.21	10.8	80.0	11.71	22.2	1.25E-02

29

<b>DENRO</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	SO <sub>2</sub> (µg m <sup>-3</sup> )	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Organic carbon (PM <sub>2.5</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	23	4.61	2.40	82.6	0.90	68.99	32.4	2.84	3.19E-02
Spring	166	4.04	8.91	69.4	0.79	65.07	28.8	2.44	2.96E-02
Summer	210	3.80	17.8	70.7	0.94	61.40	31.2	2.19	3.08E-02
Autumn	68	4.21	10.8	80.0	1.24	78.45	32.0	2.89	3.21E-02

30

<b>GERRU</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	Organic carbon (PM <sub>2.5</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	39	2.94	0.69	89.6	3.37	7.94E-03
Spring	164	2.68	9.83	79.1	2.01	7.03E-03
Summer	215	2.12	19.0	74.8	1.44	6.92E-03
Autumn	85	2.62	10.3	85.3	1.81	6.28E-03

31

32

<b>GERUB</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
Winter	39	2.94	0.69	89.6	1.12E-02
Spring	164	2.68	9.83	79.1	7.63E-03
Summer	215	2.12	19.0	74.8	8.58E-03
Autumn	85	2.62	10.3	85.3	9.19E-03

33

<b>GERR</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
Winter	30	2.45	0.52	92.3	1.42E-02
Spring	150	2.42	11.1	74.2	1.16E-02
Summer	194	2.19	20.2	66.1	1.16E-02
Autumn	70	2.27	11.0	83.5	1.11E-02

34

<b>FINRU</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	SO <sub>2</sub> (µg m <sup>-3</sup> )	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Organic carbon (PM <sub>1</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	12	1.34	-5.56	93.1	0.14	1.14	27.3	NA	1.84E-03
Spring	131	1.34	3.74	72.0	0.12	0.69	35.5	1.52	2.52E-03
Summer	179	1.24	14.5	71.4	0.05	0.37	26.0	4.69	2.94E-03
Autumn	43	1.31	4.36	86.8	0.05	0.81	20.7	1.81	1.85E-03

35

<b>FINUB</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
Winter	17	3.76	-2.54	84.5	5.97E-03
Spring	158	3.25	5.35	70.0	8.59E-03
Summer	213	3.18	16.2	70.0	5.79E-03
Autumn	55	3.52	6.94	81.7	4.84E-03

36

37

<b>FINRO</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	SO <sub>2</sub> *	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	17	4.65	-0.68	77.2	1.35	102.34	32.9	8.67E-03
Spring	156	4.10	6.16	65.1	1.11	85.28	46.6	8.94E-03
Summer	212	3.98	16.3	67.2	0.69	77.13	39.6	9.39E-03
Autumn	56	4.37	7.53	76.0	0.64	89.79	28.4	8.76E-03

38 \*SO<sub>2</sub> data are from the nearby Kalio station

39

<b>SPARU</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	SO <sub>2</sub> (µg m <sup>-3</sup> )	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	94	0.83	6.87	62.3	0.86	3.89	61.5	3.60E-03
Spring	179	1.03	11.6	68.6	1.06	3.21	83.1	5.04E-03
Summer	234	0.97	20.6	63.2	0.89	2.86	91.2	7.67E-03
Autumn	129	0.90	15.3	71.4	1.02	2.99	66.9	5.00E-03

40

<b>SPAUB</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	SO <sub>2</sub> (µg m <sup>-3</sup> )	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Organic carbon (PM <sub>2.5</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	96	2.32	11.6	65.7	1.50	35.05	39.9	4.23	9.29E-03
Spring	220	2.22	15.9	69.5	1.86	30.73	63.0	3.67	1.00E-02
Summer	277	1.81	24.8	68.6	2.67	26.07	70.6	4.05	9.91E-03
Autumn	143	1.93	20.0	72.3	1.91	33.27	48.4	3.96	1.06E-02

41

<b>GRERU</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	NO <sub>x</sub> (µg m <sup>-3</sup> )	O <sub>3</sub> (µg m <sup>-3</sup> )	Organic carbon (PM <sub>2.5</sub> ) (µg m <sup>-3</sup> )	Condensation sink (s <sup>-1</sup> )
Winter	100	6.29	13.2	71.9	0.59	40.8	1.36	2.95E-03
Spring	239	5.21	17.1	69.5	0.58	51.6	1.53	4.04E-03
Summer	301	7.33	23.9	67.4	0.48	58.0	2.16	6.38E-03
Autumn	161	5.67	19.7	71.4	0.50	46.5	1.51	4.33E-03

42

43

<b>GREUB</b>	Solar radiation (W m <sup>-2</sup> )	Wind speed (m s <sup>-1</sup> )	Temperature (°C)	Relative humidity (%)	Condensation sink (s <sup>-1</sup> )
Winter	88	1.86	9.30	71.9	8.81E-03
Spring	215	1.96	15.9	59.2	8.02E-03
Summer	282	2.00	26.5	46.0	6.93E-03
Autumn	144	1.68	18.5	65.2	6.73E-03

44

45

46 **Table S4:** Average conditions as a function of incoming wind direction at each site.

47

DENRU	WS (m s <sup>-1</sup> )	RH (%)	T (°C)	CS (s <sup>-1</sup> )	OC (µg m <sup>-3</sup> )	NPF probability (%)	GR (nm h <sup>-1</sup> )	J <sub>10</sub> (N cm <sup>-3</sup> s <sup>-1</sup> )
N	3.45	72.8	7.85	6.62E-03	1.35	2.88%	3.47	9.58E-03
NE	3.92	74.2	8.35	9.57E-03	1.81	3.19%	3.30	2.21E-02
E	3.93	74.2	9.19	1.20E-02	2.41	2.33%	3.27	2.24E-02
SE	3.92	74.1	10.5	1.35E-02	2.39	1.36%	3.52	1.69E-02
S	4.15	77.9	10.5	1.16E-02	1.40	3.54%	3.47	2.50E-02
SW	4.34	80.1	9.64	7.61E-03	0.96	6.54%	3.07	3.19E-02
W	4.87	75.1	10.1	6.21E-03	0.94	10.4%	3.05	2.97E-02
NW	3.71	70.2	9.06	6.65E-03	1.06	8.01%	3.26	1.84E-02

48

DENUB	WS (m s <sup>-1</sup> )	RH (%)	T (°C)	CS (s <sup>-1</sup> )	NPF probability (%)	GR (nm h <sup>-1</sup> )	J <sub>10</sub> (N cm <sup>-3</sup> s <sup>-1</sup> )
N	3.45	72.8	7.86	1.07E-02	3.14%	3.28	1.95E-02
NE	3.92	74.2	8.36	1.32E-02	1.81%	3.36	2.74E-02
E	3.93	74.2	9.19	1.67E-02	1.85%	3.21	2.63E-02
SE	3.93	74.1	10.5	2.06E-02	2.05%	3.31	2.52E-02
S	4.16	77.9	10.6	1.70E-02	2.01%	3.22	2.45E-02
SW	4.34	80.0	9.69	1.27E-02	3.04%	3.02	1.69E-02
W	4.87	75.0	10.1	1.04E-02	7.76%	2.94	2.27E-02
NW	3.71	70.2	9.10	1.04E-02	5.20%	3.47	2.90E-02

49

DENRO	WS (m s <sup>-1</sup> )	RH (%)	T (°C)	CS (s <sup>-1</sup> )	OC (µg m <sup>-3</sup> )	NPF probability (%)	GR (nm h <sup>-1</sup> )	J <sub>10</sub> (N cm <sup>-3</sup> s <sup>-1</sup> )
N	3.47	72.7	8.02	2.46E-02	2.42	1.92%	4.33	5.46E-02
NE	3.92	74.3	8.56	3.62E-02	2.91	2.41%	5.27	1.04E-01
E	3.92	74.4	9.50	3.46E-02	3.43	2.95%	5.02	1.07E-01
SE	3.90	74.3	10.9	3.53E-02	3.30	2.16%	5.16	1.23E-01
S	4.15	77.9	10.7	3.18E-02	2.51	2.57%	4.56	7.35E-02
SW	4.34	80.2	9.91	3.08E-02	2.17	2.81%	4.00	5.76E-02
W	4.84	75.0	10.3	2.36E-02	2.12	7.44%	3.95	7.09E-02
NW	3.72	70.2	9.36	2.79E-02	2.20	3.49%	5.02	8.74E-02

50

GERRU	WS (m s <sup>-1</sup> )	RH (%)	T (°C)	CS (s <sup>-1</sup> )	OC (µg m <sup>-3</sup> )	NPF probability (%)	GR (nm h <sup>-1</sup> )	J <sub>10</sub> (N cm <sup>-3</sup> s <sup>-1</sup> )
N	2.00	84.5	9.08	7.47E-03	2.68	13.0%	4.40	7.21E-02
NE	2.19	81.9	8.86	9.30E-03	3.47	21.6%	4.47	8.48E-02
E	2.08	77.5	10.3	9.30E-03	3.34	25.0%	4.61	1.17E-01
SE	1.64	81.3	11.2	7.90E-03	2.18	21.9%	4.41	1.08E-01
S	2.45	81.6	10.8	6.48E-03	1.89	13.8%	4.33	1.23E-01
SW	3.24	82.7	10.3	6.49E-03	1.66	10.9%	4.29	1.02E-01
W	3.23	81.7	10.5	5.05E-03	1.38	12.5%	3.81	4.81E-02
NW	2.35	79.7	11.8	5.28E-03	1.55	10.3%	4.27	3.53E-02

51

52

<b>GERUB</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	1.99	84.3	9.18	8.67E-03	13.8%	4.21	7.86E-02
NE	2.19	82.1	8.73	1.00E-02	26.7%	4.58	6.74E-02
E	2.07	77.3	10.4	1.14E-02	28.4%	4.67	1.05E-01
SE	1.64	81.1	11.3	1.12E-02	22.9%	4.04	1.31E-01
S	2.45	81.4	10.9	9.99E-03	11.4%	3.96	1.87E-01
SW	3.22	82.8	10.3	8.64E-03	8.7%	3.97	1.35E-01
W	3.21	81.6	10.6	6.82E-03	12.5%	3.66	6.84E-02
NW	2.38	79.8	11.7	6.72E-03	11.1%	4.08	3.76E-02

53

<b>GERRO</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	2.10	81.6	9.84	1.55E-02	2.69%	4.94	6.71E-02
NE	2.09	79.8	9.10	1.59E-02	7.32%	4.97	1.30E-01
E	1.75	72.6	12.4	1.54E-02	15.5%	4.92	1.23E-01
SE	1.62	77.1	11.9	1.40E-02	10.4%	5.05	1.73E-01
S	2.05	80.1	10.9	8.95E-03	3.36%	5.36	1.90E-01
SW	2.99	78.7	11.3	8.41E-03	3.17%	5.53	1.24E-01
W	2.85	77.5	12.0	1.17E-02	5.72%	5.31	1.04E-01
NW	2.70	79.9	11.5	1.32E-02	4.50%	5.12	1.25E-01

54

<b>FINRU</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	1.96	73.7	3.20	1.82E-03	14.6%	2.98	7.20E-03
NE	1.37	80.0	1.84	1.95E-03	10.9%	3.21	1.54E-02
E	0.98	81.8	3.21	2.49E-03	7.10%	3.09	1.41E-02
SE	1.19	83.4	4.66	2.97E-03	4.49%	3.08	1.47E-02
S	1.19	82.8	6.11	2.60E-03	5.20%	2.93	9.35E-03
SW	1.39	78.5	6.99	2.23E-03	8.42%	2.97	1.39E-02
W	1.26	78.0	4.75	1.75E-03	12.3%	2.61	1.23E-02
NW	1.88	73.9	3.41	1.78E-03	18.5%	2.91	9.58E-03

55

<b>FINUB</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	2.95	72.1	4.31	5.49E-03	8.06%	2.61	2.85E-02
NE	2.86	77.5	3.17	6.82E-03	5.11%	2.67	3.66E-02
E	3.26	77.2	7.09	7.48E-03	1.57%	3.66	2.60E-02
SE	3.29	76.9	7.08	6.82E-03	1.73%	4.18	2.84E-02
S	3.77	81.0	6.98	6.67E-03	1.44%	4.14	3.55E-02
SW	4.14	79.0	9.34	4.86E-03	1.92%	3.21	1.39E-02
W	3.59	77.5	6.72	7.96E-03	7.53%	2.67	2.38E-02
NW	3.13	70.2	5.52	4.51E-03	13.3%	2.78	2.17E-02

56

57

<b>FINRO</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	3.89	66.8	5.54	7.38E-03	9.31%	4.06	6.21E-02
NE	3.74	71.2	2.75	6.64E-03	8.52%	3.44	5.52E-02
E	4.21	70.3	9.30	7.87E-03	6.22%	3.75	4.29E-02
SE	4.23	72.3	7.94	9.41E-03	3.69%	4.00	6.76E-02
S	4.62	74.8	7.71	1.04E-02	1.81%	3.47	1.23E-01
SW	4.64	72.1	10.1	9.90E-03	3.22%	3.48	8.51E-02
W	4.12	72.4	8.07	9.64E-03	3.27%	3.83	8.64E-02
NW	4.23	67.0	6.61	8.44E-03	4.47%	3.99	7.07E-02

58

<b>SPARU</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	0.46	72.3	13.0	4.64E-03	12.8%	3.57	2.54E-02
NE	0.26	72.1	13.1	5.00E-03	10.9%	3.67	8.75E-03
E	0.37	72.2	13.7	5.26E-03	10.8%	3.91	1.74E-02
SE	1.47	64.8	18.0	7.43E-03	9.28%	3.97	1.48E-02
S	0.93	58.7	17.1	6.46E-03	10.7%	3.68	1.67E-02
SW	0.45	60.9	13.7	4.45E-03	14.0%	3.23	2.07E-02
W	0.59	59.0	13.6	4.33E-03	17.5%	3.62	1.94E-02
NW	0.99	64.5	12.8	4.19E-03	16.7%	3.52	1.23E-02

59

<b>SPAUB</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	1.24	73.8	15.9	1.14E-02	9.22%	3.02	8.62E-03
NE	2.56	79.0	17.1	9.39E-03	5.49%	3.30	2.63E-02
E	2.80	74.2	20.1	9.71E-03	6.83%	3.25	1.40E-02
SE	1.94	68.5	21.2	1.19E-02	8.42%	2.79	2.13E-02
S	1.63	63.6	22.3	1.22E-02	12.4%	3.32	3.35E-02
SW	1.60	65.9	21.6	1.13E-02	12.3%	3.91	2.59E-02
W	2.37	65.9	16.3	9.12E-03	21.5%	3.30	2.12E-02
NW	2.30	64.1	14.4	7.52E-03	22.0%	3.50	9.87E-03

60

<b>GRERU</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>OC (µg m<sup>-3</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	6.23	72.3	17.0	3.75E-03	1.39	5.51%	2.99	4.65E-03
NE	2.52	68.8	19.6	3.78E-03	1.42	5.87%	2.34	1.71E-03
E	3.36	70.6	18.7	3.82E-03	1.47	3.37%	2.68	5.41E-03
SE	8.44	65.5	18.1	3.28E-03	1.58	5.15%	3.60	2.38E-03
S	4.44	69.9	17.6	3.10E-03	1.53	5.25%	3.54	3.84E-02
SW	5.20	72.7	19.0	4.43E-03	1.79	5.56%	3.63	1.23E-02
W	6.39	69.5	21.1	5.41E-03	1.86	6.68%	3.97	2.69E-03
NW	7.08	67.9	17.7	4.51E-03	1.53	10.3%	3.42	5.25E-03

61

62

<b>GREUB</b>	<b>WS (m s<sup>-1</sup>)</b>	<b>RH (%)</b>	<b>T (°C)</b>	<b>CS (s<sup>-1</sup>)</b>	<b>NPF probability (%)</b>	<b>GR (nm h<sup>-1</sup>)</b>	<b>J<sub>10</sub>(N cm<sup>-3</sup> s<sup>-1</sup>)</b>
N	1.90	48.8	7.28	7.57E-03	9.35%	3.20	3.62E-02
NE	2.54	55.2	17.6	6.29E-03	4.82%	3.30	3.86E-02
E	1.56	60.7	22.3	7.12E-03	4.73%	3.69	3.33E-02
SE	1.99	64.6	21.1	7.61E-03	7.44%	3.57	1.38E-02
S	0.88	68.5	17.3	8.23E-03	7.78%	3.62	4.53E-02
SW	1.55	65.0	17.4	7.53E-03	8.61%	3.87	4.44E-02
W	2.05	53.5	16.4	9.01E-03	10.6%	3.98	5.07E-02
NW	1.30	51.8	20.6	1.01E-02	11.8%	3.99	6.56E-02

63

64

65 **Table S5:** Average conditions for local and region-wide events (\*refers to NO<sub>2</sub>).

Site		WS (m s <sup>-1</sup> )		T (°C)		RH (%)		SR (W m <sup>-2</sup> )	
		Local	Regional	Local	Regional	Local	Regional	Local	Regional
DEN	RU	4.20 ± 1.29	4.72 ± 1.34	14.1 ± 4.51	10.6 ± 4.05	65 ± 9.51	65.6 ± 8.90	223 ± 69.3	197 ± 76.1
	UB	4.54 ± 1.47	4.72 ± 1.34	12.2 ± 5.49	10.6 ± 4.05	64.3 ± 10.4	65.6 ± 8.90	210 ± 76.8	197 ± 76.1
GER	RU	2.18 ± 1.59	1.97 ± 1.50	14.6 ± 8.44	15.9 ± 7.64	74.4 ± 20.2	69.2 ± 21.8	196 ± 247	251 ± 287
	UB	2.12 ± 1.55	1.97 ± 1.50	15.6 ± 8.14	15.9 ± 7.64	72.5 ± 21.3	69.2 ± 21.8	225 ± 269	251 ± 287
FIN	RU	1.37 ± 1.02	1.67 ± 1.12	4.3 ± 7.69	0.87 ± 5.93	64.7 ± 21.5	64.3 ± 19.8	153 ± 202	148 ± 197
	UB	3.38 ± 1.89	3.14 ± 1.54	6.25 ± 6.15	3.75 ± 5.24	65.4 ± 17.6	56.4 ± 17.5	142 ± 206	168 ± 224
SPA	RU	1.16 ± 0.51	1.07 ± 0.25	11.8 ± 4.76	13.6 ± 5.41	63.2 ± 12.2	55.2 ± 13.1	149 ± 66.3	167 ± 65.1
	UB	2.49 ± 1.06	3.13 ± 0.80	17.9 ± 5.41	17.5 ± 4.99	58.6 ± 9.44	54.2 ± 10.2	199 ± 77.3	194 ± 69.7

66

Site		CS (s <sup>-1</sup> )		GR (nm h <sup>-1</sup> )		J <sub>10</sub> (N cm <sup>-3</sup> s <sup>-1</sup> )	
		Local	Regional	Local	Regional	Local	Regional
DEN	RU	9.03E-03 ± 5.69E-03	6.94E-03 ± 3.84E-03	3.26 ± 1.49	2.89 ± 1.12	2.39E-02 ± 3.27E-02	2.00E-02 ± 2.45E-02
	UB	1.17E-02 ± 6.35E-03	1.01E-02 ± 3.86E-03	3.36 ± 1.59	2.78 ± 0.92	2.67E-02 ± 4.01E-02	2.16E-02 ± 2.76E-02
GER	RU	7.36E-03 ± 3.42E-03	9.42E-03 ± 4.22E-03	4.11 ± 1.71	4.48 ± 1.71	7.58E-02 ± 3.76E-02	1.02E-01 ± 1.65E-01
	UB	9.63E-03 ± 1.03E-02	1.01E-02 ± 5.24E-03	4.19 ± 1.71	4.27 ± 1.66	1.00E-01 ± 2.02E-01	1.03E-01 ± 2.28E-01
FIN	RU	2.26E-03 ± 1.33E-03	1.85E-03 ± 1.17E-03	2.96 ± 1.76	2.75 ± 1.37	1.03E-02 ± 1.82E-02	1.29E-02 ± 2.34E-02
	UB	4.46E-03 ± 3.16E-03	4.04E-03 ± 2.70E-03	3.06 ± 1.53	2.60 ± 0.87	2.19E-02 ± 3.33E-02	2.45E-02 ± 3.67E-02
SPA	RU	4.00E-03 ± 2.13E-03	4.30E-03 ± 1.59E-03	3.98 ± 2.22	3.38 ± 1.32	1.32E-02 ± 1.74E-02	1.32E-02 ± 1.68E-02
	UB	8.92E-03 ± 3.60E-03	6.66E-03 ± 2.12E-03	3.37 ± 1.56	3.31 ± 0.81	2.28E-02 ± 2.67E-02	1.44E-02 ± 1.42E-02

67

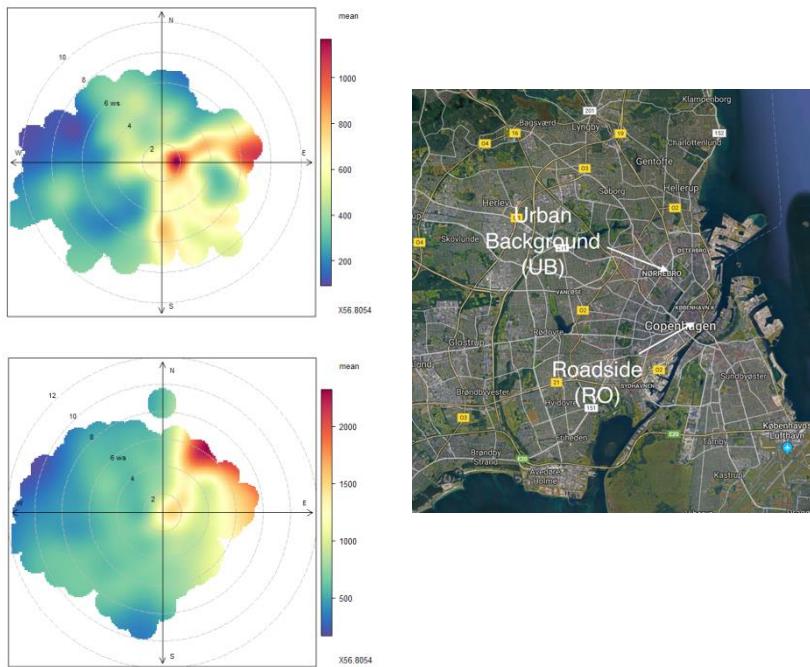
Site		NOx / NO <sub>2</sub> (μg m <sup>-3</sup> )		O <sub>3</sub> (μg m <sup>-3</sup> )		SO <sub>2</sub> (μg m <sup>-3</sup> )	
		Local	Regional	Local	Regional	Local	Regional
DEN	RU	2.65 ± 1.73	2.35 ± 1.23	36.6 ± 6.37	38.3 ± 4.91	0.19 ± 0.21	0.14 ± 0.07
	UB	6.89 ± 2.96	5.89 ± 2.24	35.3 ± 5.78	35.7 ± 5.09	-	-
GER	RU	-	-	-	-	-	-
	UB	-	-	-	-	-	-
FIN	RU	0.51 ± 0.54	0.51 ± 0.59	33.4 ± 8.59	35.6 ± 6.63	0.13 ± 0.27	0.13 ± 0.19
	UB	-	-	-	-	-	-
SPA	RU	2.38 ± 1.01*	2.74 ± 0.66*	72.2 ± 8.54	81.4 ± 14.2	0.95 ± 0.89	0.90 ± 0.66
	UB	26.5 ± 13.1*	19.6 ± 7.21*	59.2 ± 15.8	67.6 ± 15.4	1.94 ± 0.81	1.94 ± 0.93

68

69

70

71

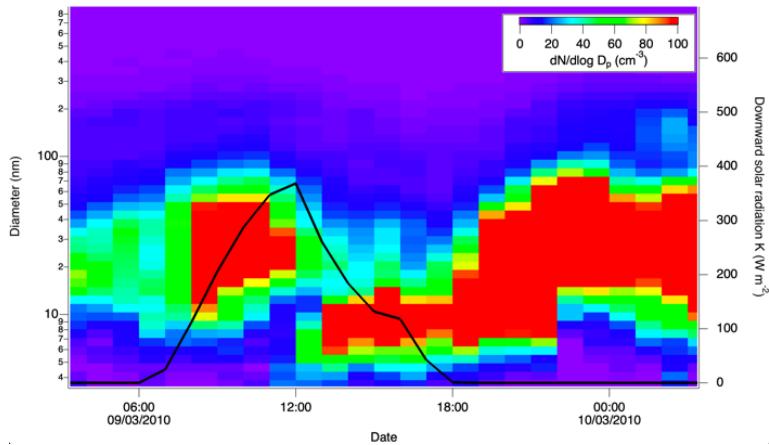


72

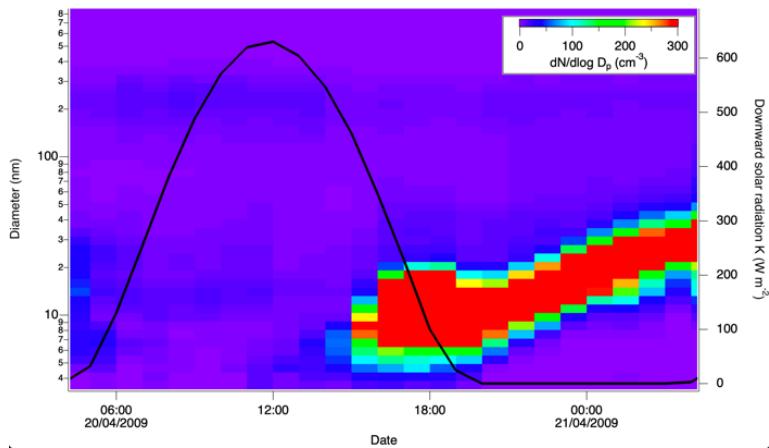
73

74 **Figure S1:** Sources of 56 nm particles at DENUB and DENRO (map provided by ©Google Maps)  
75

76



77

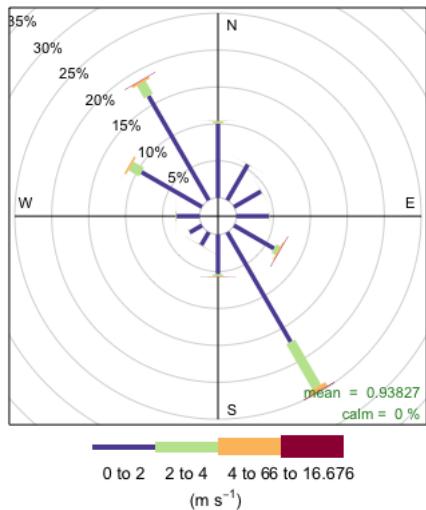


78

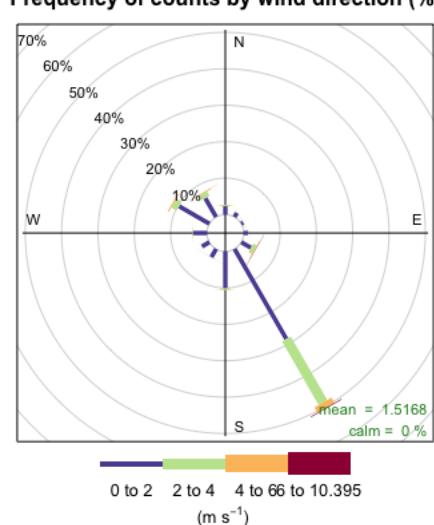
79

80 **Figure S2:** Examples of NPF events with late growth of the particles at FINRU.

81



82



83

Frequency of counts by wind direction (%)

84

85 **Figure S3:** Average wind profile (top panel) and wind profile for the time window 9:00 to 15:00 (bottom panel) for SPARU.

86