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Drivers of cloud droplet number variability in the summertime in the southeastern United States

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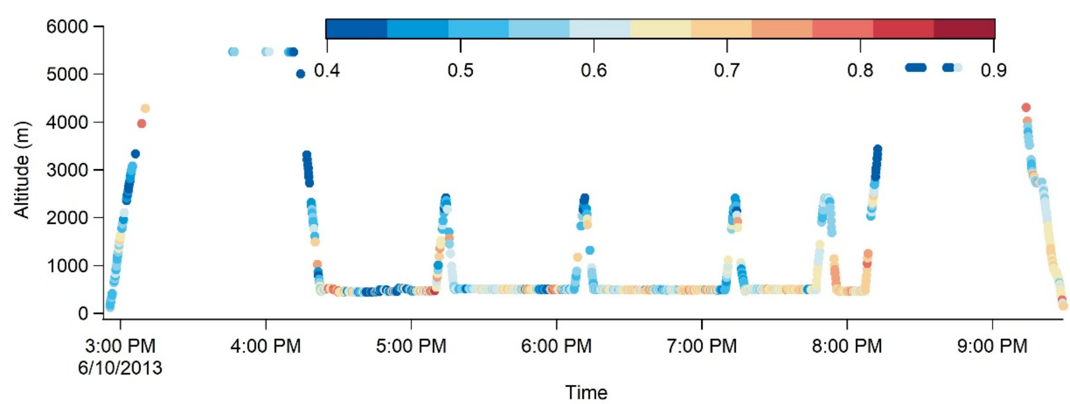
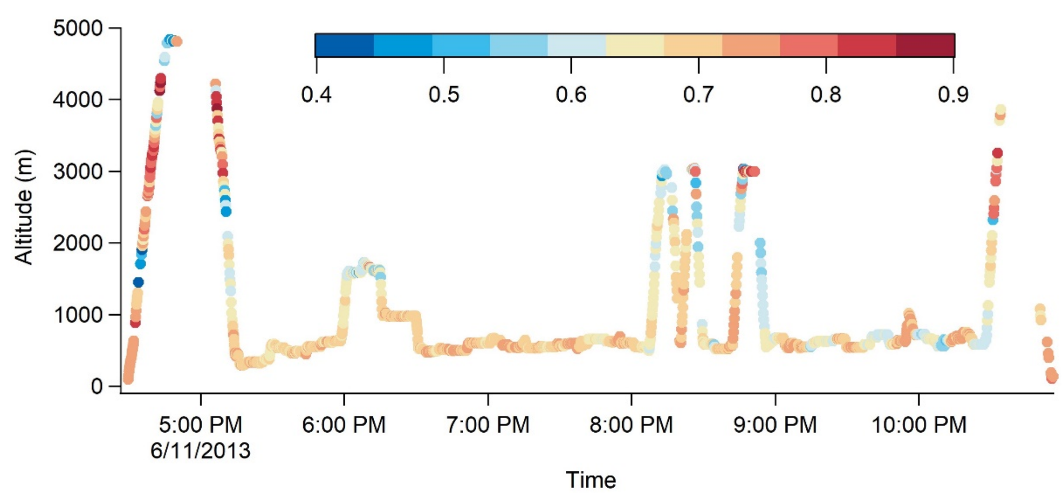
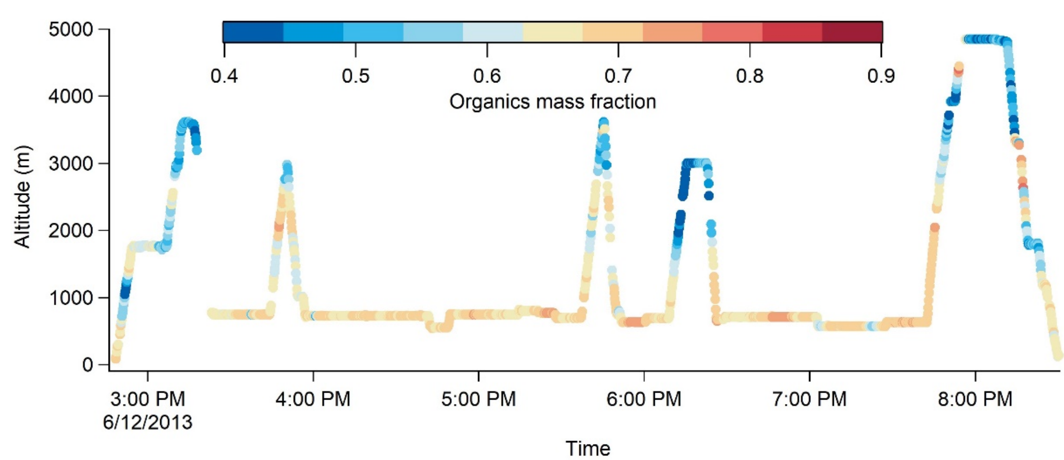
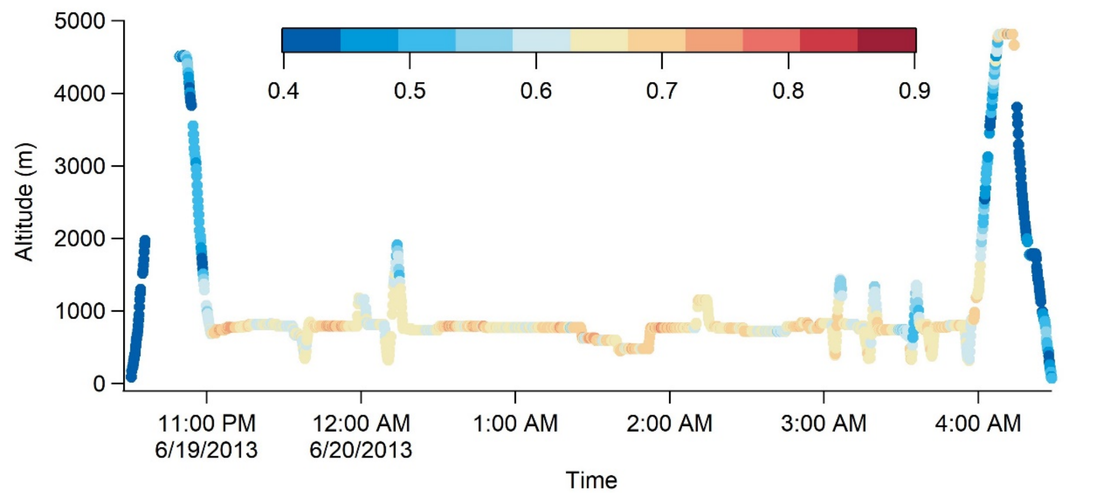
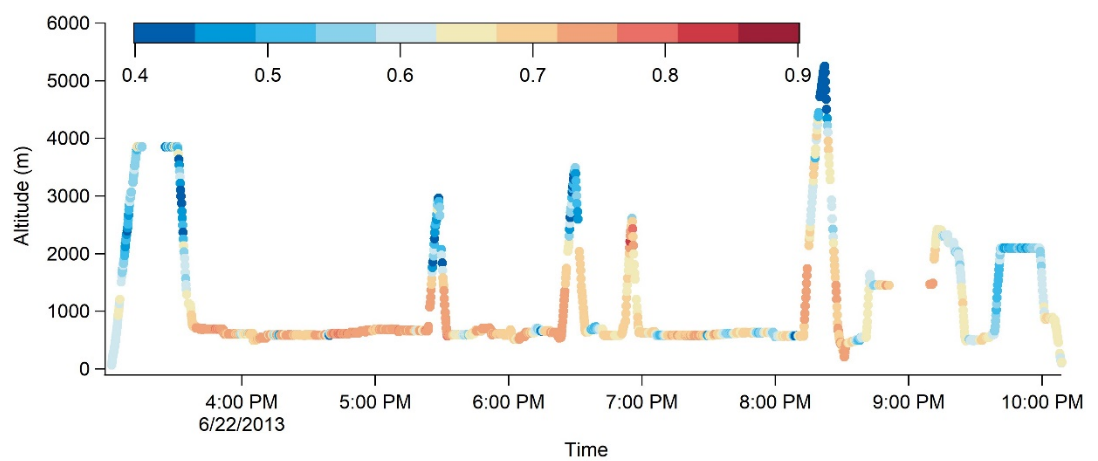
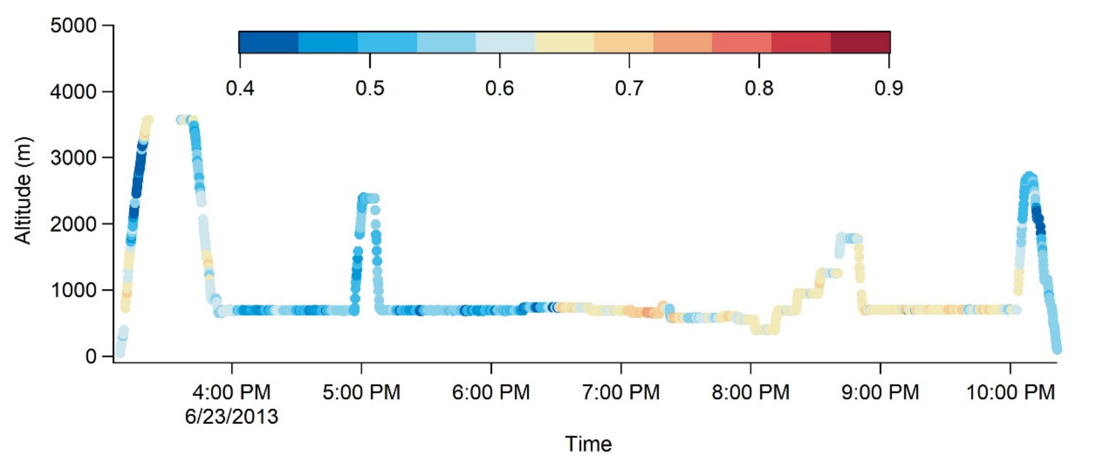
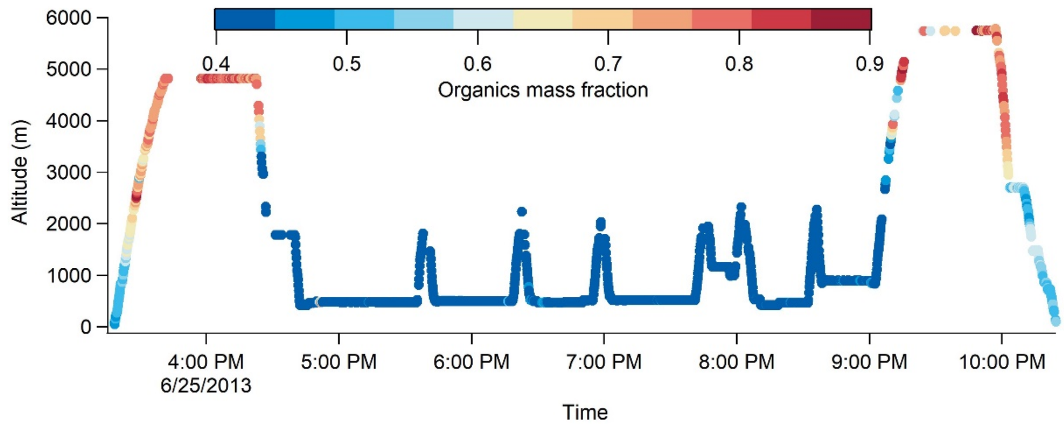
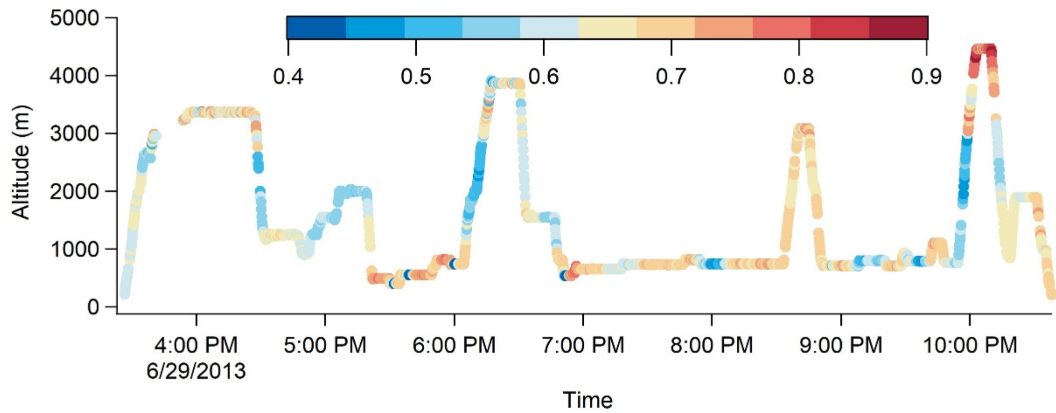
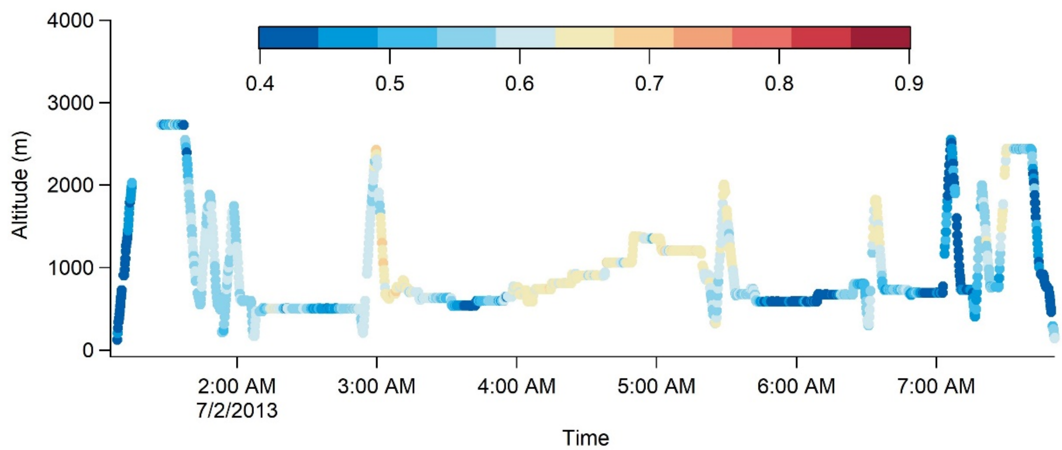
SP.1 Organics mass fraction variability

Overall, organic aerosol was found to dominate during all flights, contributing 66%-75% of the total aerosol volume, with the organics mass fraction found to vary with height. The altitude-time distribution of the organic mass fraction for all flights is presented in Figure S1. Overall, 5 of 13 flights were found to exhibit higher organic mass fractions at higher altitudes (>4000 m a.s.l.) (Flights 5, 12, 16, 14 and 17). Four of 13 flights were found to exhibit lower organic mass fractions at higher altitudes (Flights 4, 6, 9 and 10). For all figures the color scale represents the organic mass fraction.

Flight 4☼	
Flight 5☼	
Flight 6☼	

Flight 9☾	
Flight 10☼	
Flight 11☼	

Flight 12☼	
Flight 14☼	
Flight 15☾	

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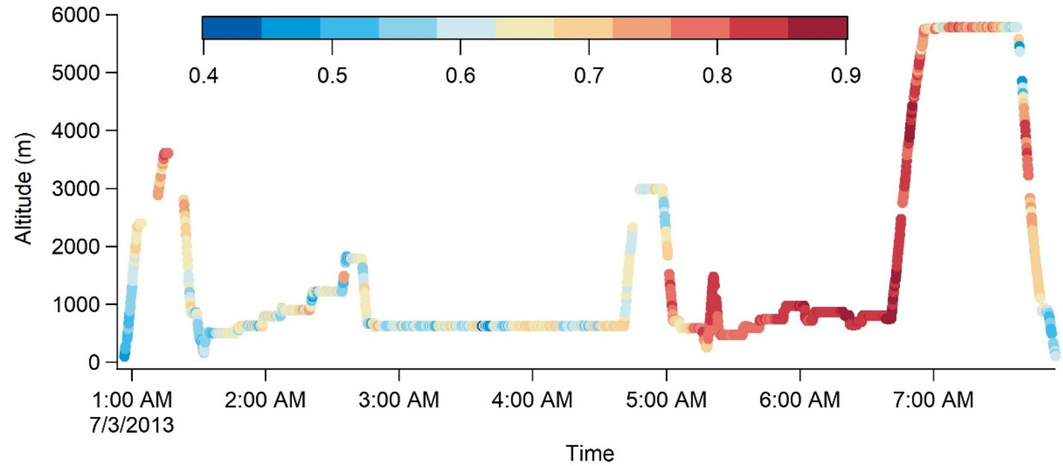

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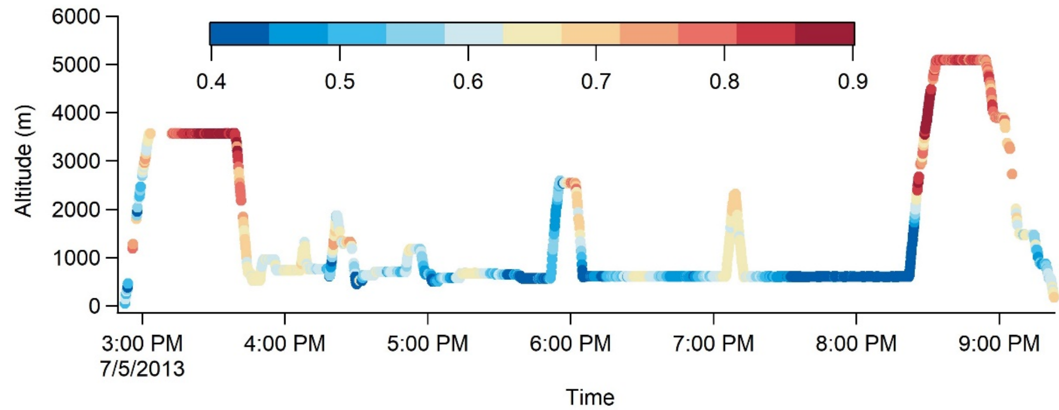

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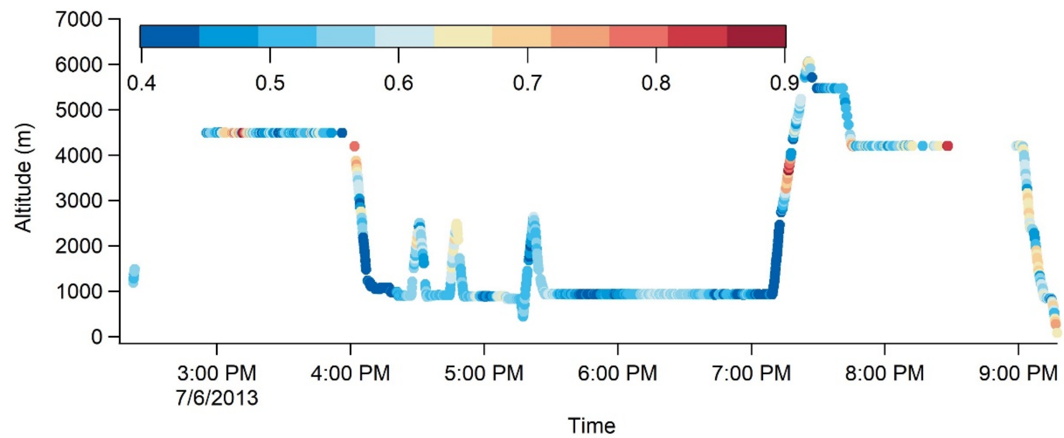


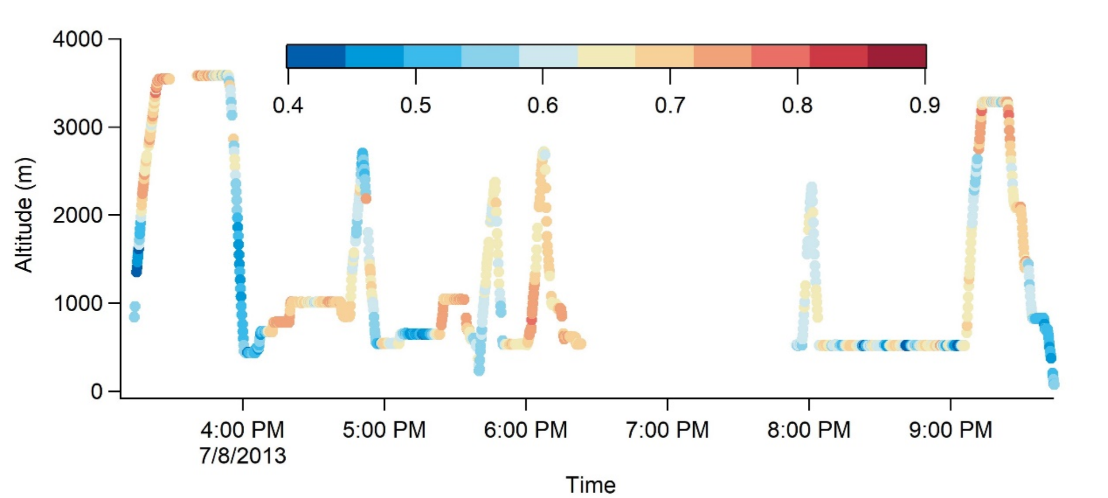
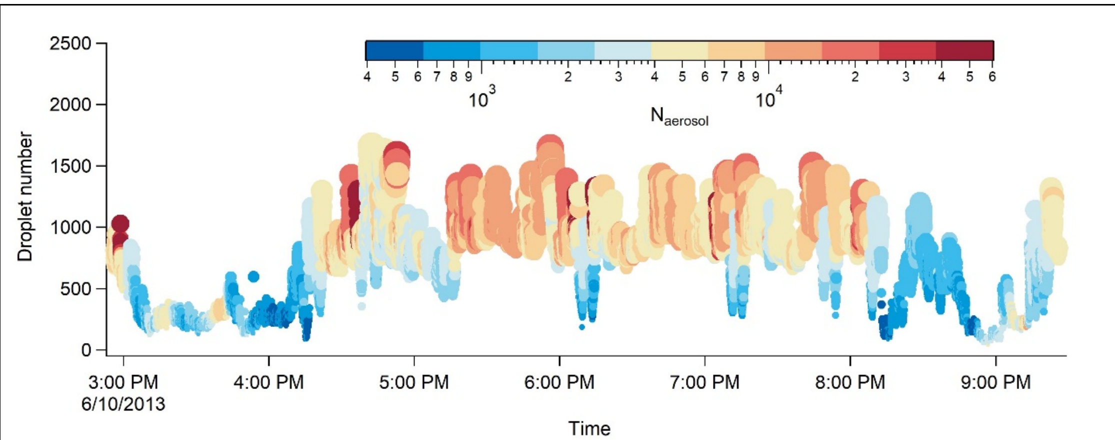
Flight 19☼	

Figure S1: Altitude as a function of flight time (UTC), colored by organic mass fraction.

SP.2 Variability of estimated droplet number

The time evolution of the estimated droplet number for all flights is presented in Figure S2. The size of the markers is indicative of the droplet number N_d while the color scale denotes the total aerosol number N_a. Decrease in droplet number are indicative of higher altitudes and correlate with lower N_a.

Flight 4☼	

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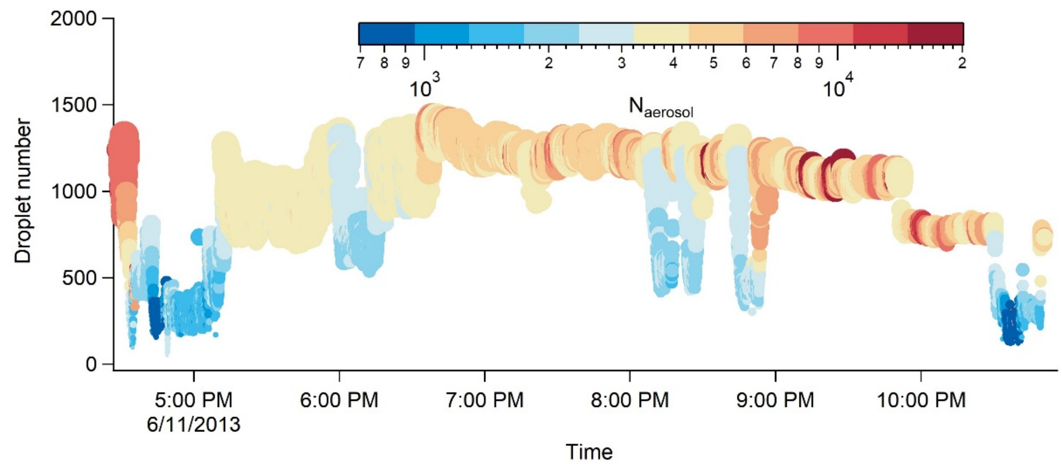
<tr><td>Flight 5☼</td><td>
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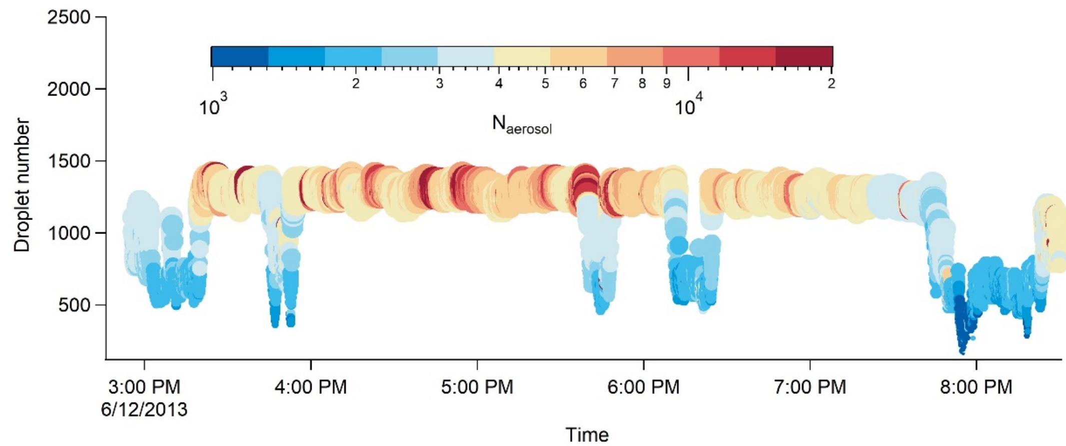
<tr><td>Flight 6☼</td><td>
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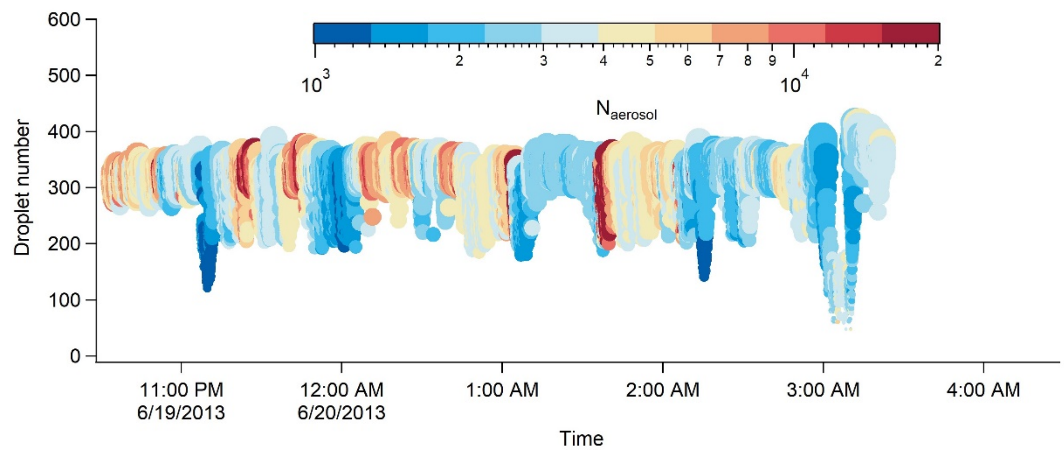
<tr><td>Flight 9☾</td><td>
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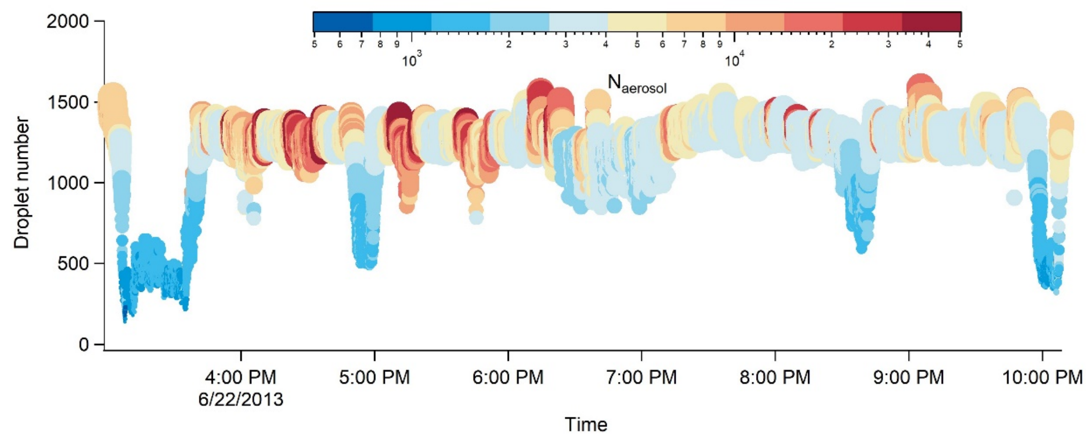
Flight 10☼



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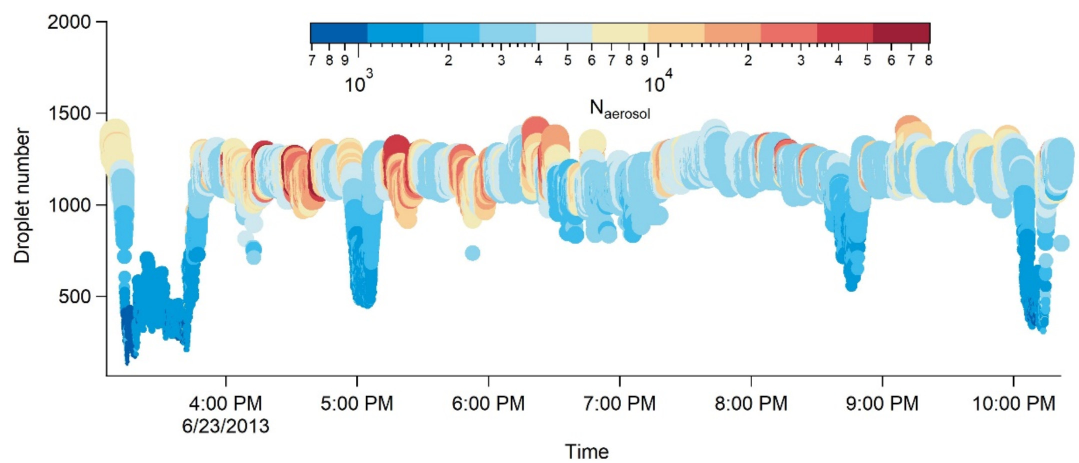

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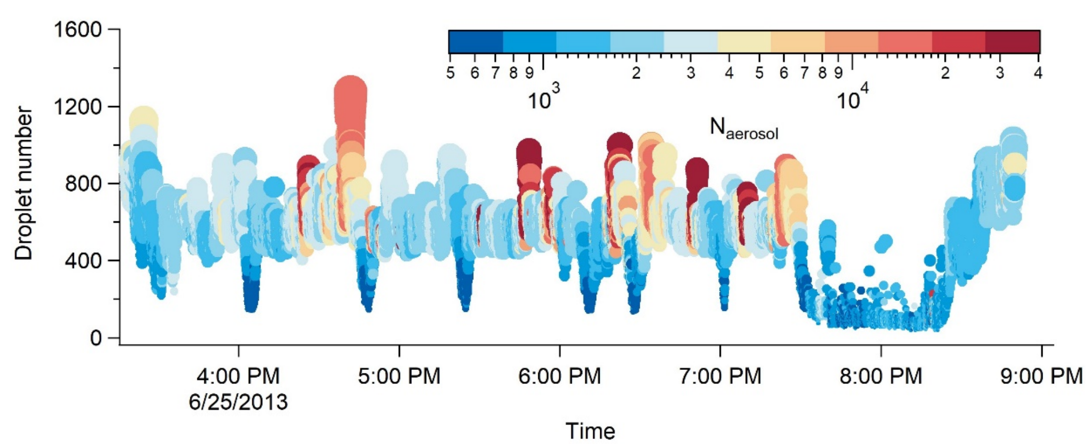
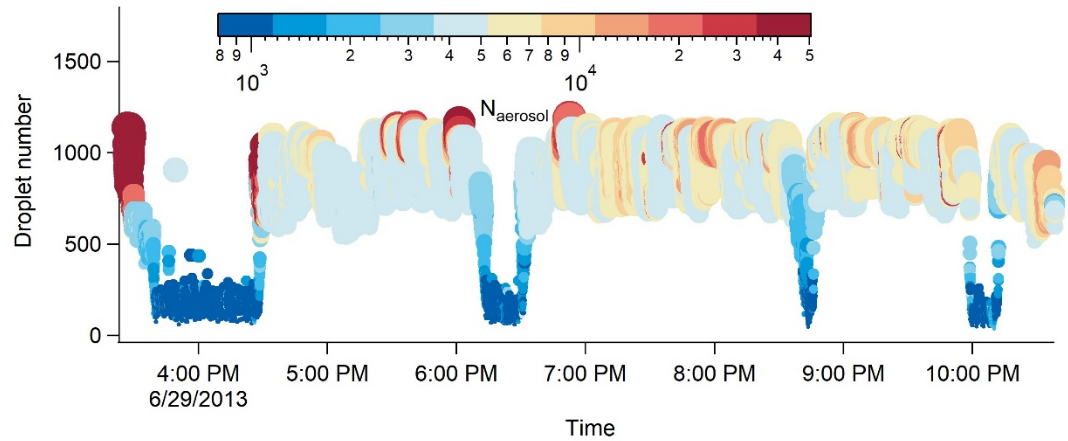
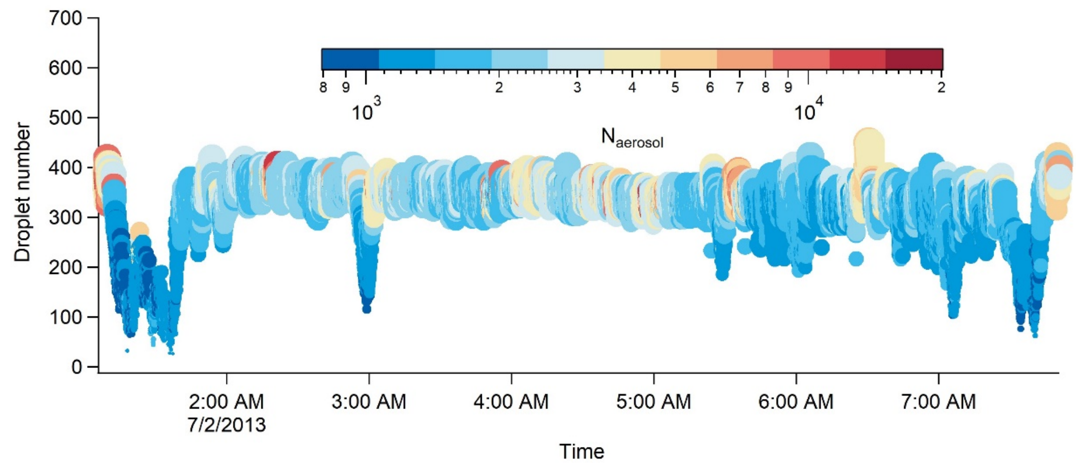
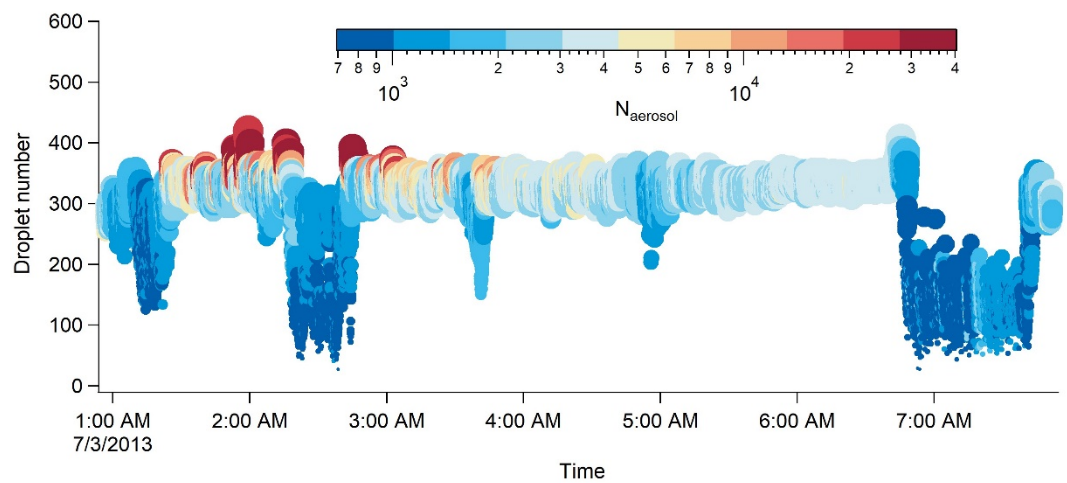


Flight 14☼	
Flight 15☾	
Flight 16☾	

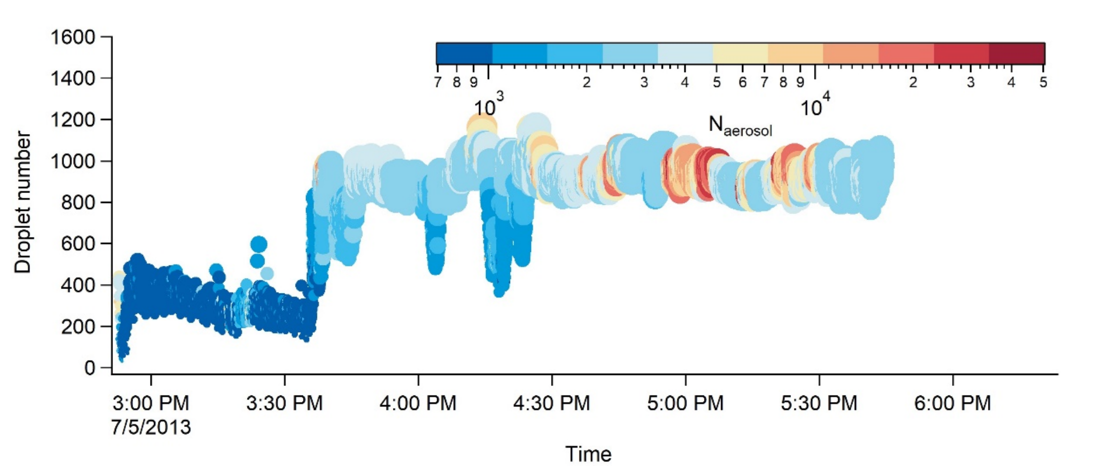
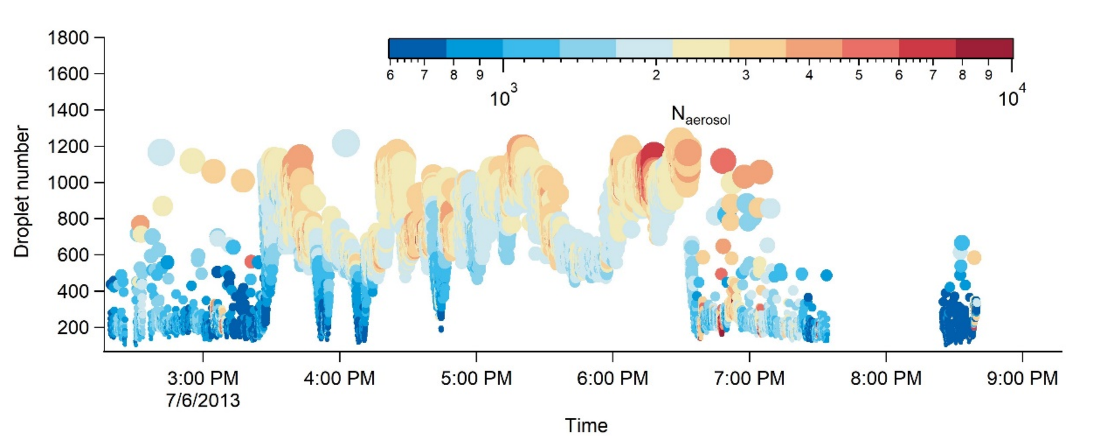
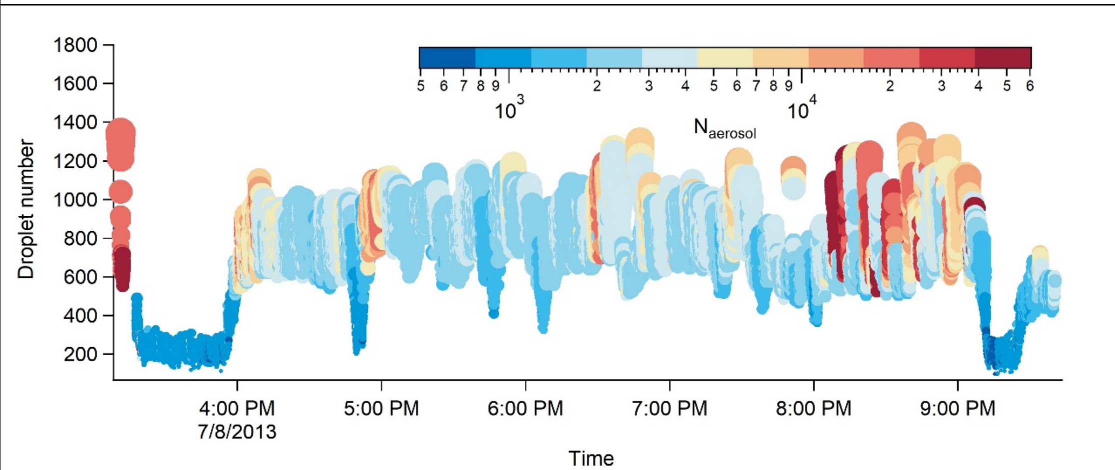
Flight 17☼	
Flight 18☼	
Flight 19☼	

Figure S2: Droplet number-time plot (UTC) colored by total aerosol concentration N_a. Size of marker is proportional to the calculated droplet number concentration N_d.

SP.3 Segments of all flights conducted at a constant altitude

The following table contains all flight segments conducted at a constant altitude, from which the standard deviation of vertical velocity, σ_w, is calculated. The respective characteristic vertical velocity (w*) and altitude above mean sea level are provided.

Flight (segment)	Time interval(LT)	σ_w (m s^{-1})	w* (m s^{-1})	Altitude (m)	Flight (segment)	Time interval(LT)	σ_w (m s^{-1})	w* (m s^{-1})	Altitude (m)
☼4 (1)	11:20-11:41	0.67	0.53	529±26	☼5 (1)	12:31-12:58	1.02	0.81	549± 58
4 (2)	12:09-12:23	1.22	0.96	569±2	5 (2)	13:16-13:29	0.82	0.65	982±11
4 (3)	12:50-13:09	1.17	0.92	579±27	5 (3)	13:34-13:50	1.01	0.80	502±13
4 (4)	14:40-16:06	1.05	0.83	561±41	5 (4)	13:53-14:08	1.03	0.81	614±27
					5 (5)	14:20-15:00	0.91	0.72	603±40
☼6 (1)	10:23-10:44	0.73	0.58	749± 3.5	5 (6)	15:35-15:41	0.87	0.69	533±18
6 (2)	11:01-11:46	1.06	0.84	729±53	5 (7	16:17-16:30	0.77	0.61	638±23
6 (3)	11:52-12:19	0.87	0.69	736±23	5 (8)	16:31-16:39	0.55	0.44	559±18
6 (4)	13:40-14:02	1.13	0.89	706±3	5 (9)	17:10-17:22	0.53	0.42	686±40
6 (5)	14:06-14:27	0.74	0.58	574±3					
6 (6)	14:33-14:42	0.98	0.78	634±3	☾9 (1)	18:44-18:58	0.25	0.20	797±2.01
					9 (2)	19:20-19:29	0.25	0.20	740±1.23
☼10 (1)	10:41-10:52	1.07	0.85	696± 3	9 (3)	19:33-19:48	0.22	0.17	740±1.23
10 (2)	11:10-11:56	1.26	1.00	597±22	9 (4)	19:51-20:25	0.22	0.17	776±1.22
☼10 (3)	12:01-12:22	1.25	0.98	675±3	☾9 (5)	20:34-20:39	0.23	0.18	597±1.19
10 (4)	12:34-12:55	1.31	1.04	630±42	9 (6)	20:44-20:52	0.16	0.12	484±1.14
10 (5)	13:01-13:22	1.31	1.04	653±54	9 (7)	20:56-21:10	0.20	0.16	773±1.11
10 (6)	13:31-13:51	0.99	0.78	633±38	9 (8)	21:31-21:45	0.19	0.15	725±1.18
10 (7)	13:58-14:19	1.16	0.91	599± 23	9 (9)	22:24-22:31	0.26	0.20	745± 1.36
10 (8)	14:25-14:47	1.29	1.02	608±18	9 (10)	22:48-22:54	0.22	0.17	804± 1.37
10 (9)	14:52-15:12	1.15	0.91	592±28	☼12 (1)	11:50-12:34	0.96	0.75	484±3
					12 (2)	12:48-13:18	1.09	0.86	503±3
☼11 (1)	11:02-11:56	1.05	0.83	695± 2.5	12 (3)	13:34-13:50	1.12	0.88	894±3
11 (2)	12:12-13:13	1.05	0.83	694±3	12 (4)	14:06-14:40	1.04	0.82	479±4
11 (3)	13:19-13:45	1.13	0.90	730±5	12 (5)	15:21-15:32	1.10	0.87	521±3
11 (4)	13:50-14:04	1.11	0.88	691±3.3	12 (6)	15:43-16:02	0.99	0.78	475±3
11 (5)	14:27-14:46	0.96	0.76	585±2.3					
11 (6)	15:02-15:10	1.12	0.89	403±2.8	☼14 (1)	12:34-12:49	0.94	0.75	558±2
11 (7)	15:12-15:20	1.01	0.80	729± 3.2	14 (2)	13:57-14:17	0.97	0.77	658±3
11 (8)	15:22-15:30	0.95	0.75	952±2.3	14 (3)	14:22-14:46	0.95	0.75	737±3
11 (9)	15:58-16:12	0.96	0.76	707±2.2	14 (4)	14:58-15:33	0.55	0.43	746±23
					14 (5)	15:55-16:08	0.57	0.45	714±3
☾15 (1)	21:09-21:52	0.24	0.19	505±6.64	14 (6)	16:11-16:21	0.77	0.61	801±3
15 (2)	22:19-22:31	0.30	0.24	633±1.21	14 (7)	16:33-16:41	0.45	0.35	793± 2
15 (3)	22:42-22:54	0.25	0.20	600±1.17					
15 (4)	23:26-23:37	0.33	0.26	908±1.56	☾16 (1)	20:36-20:46	0.26	0.20	558±2
15 (5)	00:02-00:19	0.30	0.23	1208±1.2	16 (2)	21:07-21:20	0.16	0.13	658±3
15 (6)	00:43-01:08	0.25	0.20	592±1.4	16 (3)	21:22-21:34	0.17	0.13	737±3
15 (7)	01:10-01:24	0.28	0.22	676±1.0	16 (4)	21:48-23:41	0.21	0.17	746±23
15 (8)	01:37-02:02	0.21	0.16	713±19	16 (5)	01:02-01:20	0.21	0.17	714±3
					16 (6)	01:22-01:26	0.19	0.15	801±3
☼17 (1)	10:59-11:06	0.36	0.28	742±2.5					
17 (2)	11:40-11:51	0.75	0.59	710±2.5	☼18 (1)	11:35-11:44	0.96	0.76	919±2.3
17 (3)	12:06-12:13	0.73	0.58	680±16.5	18 (2)	11:51-12:09	0.91	0.72	895±2.4
17 (4)	12:15-12:37	0.99	0.78	667±2.9	18 (3)	12:28-14:09	0.83	0.66	940±3.3
17 (5)	12:41-12:51	1.29	1.02	617±2.9					
☼19 (1)	11:20-11:41	0.62	0.49	1014±2.3	☼19 (4)	13:22-13:49	1.29	1.02	518±22.6
19 (2)	12:09-12:23	1.20	0.95	652±3.3	19 (5)	14:44-14:57	1.36	1.07	528±3.3
19 (3)	12:51-13:10	0.87	0.69	537±2.5	19 (6)	15:04-16:06	0.90	0.71	524±2.8

Table S1: Flight segments conducted at a constant altitude (a.s.l.) and the derived σ_w and w^*.

SP.4 Covariance of total aerosol number and vertical velocity

Figure S3 comprises the different segments of the flights when the aircraft sampled at practically the same altitude within the boundary layer. It can be seen that total aerosol concentrations are enhanced as the *w** increases. The lowest *w** values (shaded area) correspond to the segments of the flights during nighttime. This covariance may be a result of more effective convective transfer of aerosol-rich air to cloud forming regions.

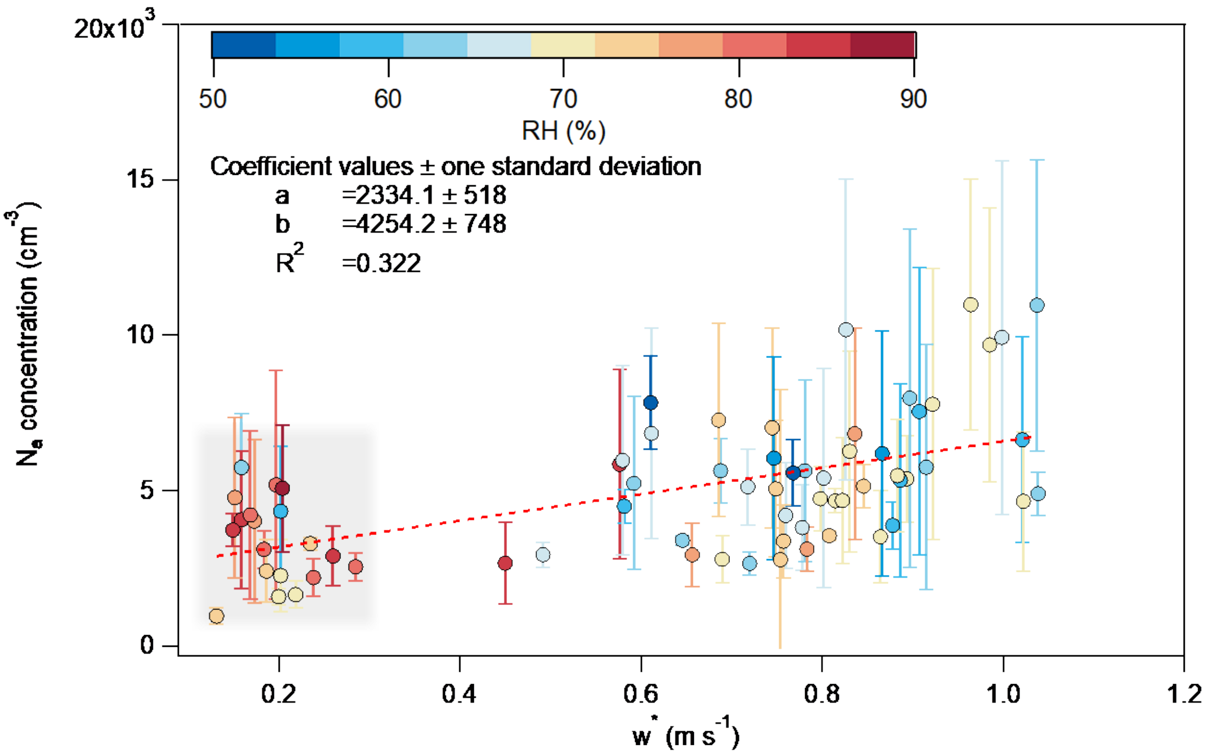


Figure S3: Total aerosol number vs. characteristic velocity during the flight segments from Table S1, colored by relative humidity. The shaded area represents the segments of the flights conducted during nighttime.