

Using Aircraft Measurements to Characterize Subgrid-Scale Variability of Aerosol Properties Near the ARM Southern Great Plains Site

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Supplemental Information

Table S1. Flight-averaged bulk aerosol composition ($\mu\text{g m}^{-3}$), aerosol number ($\# \text{ cm}^{-3}$), and CCN ($\# \text{ cm}^{-3}$) during IOP 1 for constant altitude flight legs within the boundary layer. Dash denotes missing data for that flight.

Flight	AMS OM	AMS SO ₄	AMS NO ₃	AMS NH ₄	CPC >3 nm	CPC >10 nm	FIMS 9-426 nm	FIMS 49-426 nm	CCN 0.24%	CCN 0.46%
April 25	2.08	1.32	0.27	0.58	3105.7	2296.6	1623.5	1068.4	147.4	283.3
April 27	0.24	0.16	0.03	0.12	16881.3	11066.0	-	-	133.8	168.6
April 28	0.83	0.09	0.09	0.11	18907.1	12846.8	8207.7	878.6	93.6	152.7
May 1	0.48	0.23	0.17	0.15	2434.2	1445.8	1117.2	320.8	26.0	31.4
May 2	0.79	0.35	0.26	0.23	1692.0	1213.5	1075.5	736.6	-	-
May 3	1.17	0.39	0.29	0.22	11982.1	5760.8	4340.6	935.3	371.0	503.8
May 6	1.69	0.29	0.10	0.15	8392.6	5234.8	3954.0	1772.6	273.8	367.8
May 7	3.12	0.50	0.14	0.19	4784.9	3382.7	2657.4	1745.7	-	-
May 8	2.04	0.96	0.17	0.34	2586.1	1962.5	1631.4	1272.3	868.9	1099.0
May 10	1.07	0.28	0.07	0.12	8254.8	5080.0	3813.3	1290.2	288.6	470.7
May 11	2.42	0.90	0.25	0.36	4213.4	2926.7	1940.5	1089.7	442.4	679.4
May 13	2.23	0.39	0.14	0.13	10670.5	6681.1	4876.8	2036.5	250.0	495.3
May 14	0.39	0.36	0.23	0.21	19122.9	11008.5	6422.8	347.3	185.4	231.3
May 16	1.64	0.66	0.30	0.32	2479.2	1761.9	1463.8	883.6	241.9	333.7
May 17	1.10	0.47	0.37	0.30	5669.0	2722.0	-	-	200.6	253.5
May 19	1.35	0.81	0.62	0.51	1987.2	1475.4	1306.3	960.6	169.5	243.2
May 20	1.56	0.40	0.38	0.30	1434.3	1050.1	837.2	624.4	177.4	199.3
average	1.42	0.50	0.23	0.26	7329.3	4583.2	3017.9	1064.2	258.0	367.5

Table S2. Same as Table S1, except for IOP 2.

Flight	AMS OM	AMS SO ₄	AMS NO ₃	AMS NH ₄	CPC >3 nm	CPC >10 nm	FIMS 9-426 nm	FIMS 49-426 nm	CCN 0.24%	CCN 0.46%
Aug 29	3.49	0.76	0.15	0.29	6172.7	4143.7	2885.8	1204.1	716.4	920.5
Aug 30	-	-	-	-	6218.9	4744.7	3029.0	1658.1	748.1	920.8
Aug 30	-	-	-	-	5865.3	5342.8	3707.5	1845.5	-	-
Sept 1	-	-	-	-	1534.2	1282.0	811.3	635.7	303.1	390.4
Sept 3	-	-	-	-	4388.5	4247.1	2621.4	2141.9	877.1	1302.9
Sept 4	-	-	-	-	4193.1	3150.5	2476.2	2134.6	516.7	593.6

Sept 4	-	-	-	-	5291.8	4078.6	3113.9	2286.8	793.3	927.6
Sept 6	-	-	-	-	3701.5	2751.9	2102.0	924.0	356.2	440.1
Sept 7	-	-	-	-	-	-	1414.9	690.6	107.1	195.6
Sept 7	-	-	-	-	-	-	1744.8	984.1	-	-
Sept 9	1.08	0.84	0.10	0.32	5042.4	3468.4	2696.5	1627.8	329.8	591.5
Sept 10	0.35	0.29	0.04	0.19	5461.7	3406.4	2540.3	821.2	-	-
Sept 11	1.04	0.43	0.08	0.16	15871.8	9586.2	7327.7	1587.1	-	-
Sept 13	3.37	0.31	0.25	0.47	5324.2	3842.2	2996.7	1966.4	-	-
Sept 15	2.65	0.22	0.24	0.37	5654.8	3977.9	3209.4	1653.1	-	-
Sept 15	2.74	1.19	0.13	0.39	5899.2	3312.5	2058.2	1665.8	364.8	465.5
Sept 17	1.26	0.13	0.15	0.26	16889.3	11729.6	9487.8	1755.2	377.9	574.7
Sept 20	2.79	1.08	0.15	0.37	7586.7	4914.8	4435.1	2295.9	-	-
Sept 20	2.32	0.94	0.11	0.31	3752.8	2638.2	2372.5	1864.8	-	-
Sept 21	5.03	2.73	0.23	0.82	4333.2	3245.8	2853.0	2287.6	-	-
Sept 22	4.08	1.32	0.17	0.40	6165.6	4131.6	-	-	-	-
average	2.52	0.85	0.15	0.36	6281.5	4420.8	3194.2	1601.5	499.1	665.7

Table S3. Flight-averaged particle class fraction during IOP 1 where 1 = Soot, 2 = Sulfate_org, 3 = Nitrate_org, 4 = Org1, 5 = Org2, 6 = BB, 7 = BB_SOA, 8 = Org_amines, 9 = IEPOX_SOA, 10 = Dust, 11=Pyr.

Flight	1	2	3	4	5	6	7	8	9	10	11
April 25	0.021	0.288	0.129	0.159	0.233	0.082	0.035	0.007	0.030	0.016	0.000
April 27	0.030	0.457	0.114	0.097	0.109	0.106	0.048	0.007	0.016	0.017	0.000
April 28	0.044	0.292	0.039	0.029	0.251	0.170	0.121	0.011	0.011	0.030	0.000
May 1	0.022	0.642	0.041	0.045	0.160	0.034	0.016	0.010	0.022	0.009	0.000
May 2	0.012	0.707	0.033	0.026	0.049	0.069	0.029	0.013	0.047	0.015	0.000
May 3	0.009	0.624	0.032	0.022	0.140	0.095	0.040	0.006	0.016	0.017	0.000
May 6	0.013	0.029	0.017	0.046	0.201	0.377	0.260	0.008	0.009	0.036	0.005
May 7	0.014	0.026	0.047	0.019	0.295	0.361	0.197	0.012	0.008	0.015	0.007
May 8	0.018	0.133	0.170	0.050	0.309	0.142	0.065	0.010	0.050	0.046	0.008
May 10	0.022	0.176	0.043	0.162	0.295	0.159	0.087	0.010	0.009	0.030	0.007
May 11	0.013	0.164	0.076	0.041	0.305	0.206	0.119	0.013	0.040	0.022	0.000
May 13	0.018	0.148	0.040	0.103	0.440	0.118	0.071	0.009	0.012	0.018	0.022
May 14	0.010	0.667	0.018	0.022	0.050	0.117	0.066	0.006	0.006	0.008	0.030
May 16	0.023	0.270	0.112	0.048	0.085	0.154	0.089	0.035	0.082	0.091	0.011
May 17	0.015	0.282	0.033	0.013	0.107	0.124	0.014	0.021	0.356	0.015	0.020
May 19	0.017	0.286	0.062	0.028	0.046	0.092	0.072	0.068	0.158	0.114	0.057
May 20	0.022	0.474	0.110	0.017	0.098	0.127	0.086	0.016	0.030	0.020	0.000
average	0.019	0.333	0.066	0.055	0.187	0.149	0.083	0.015	0.053	0.030	0.010

Table S4. Same as Table S3, except for IOP 2.

Flight	1	2	3	4	5	6	7	8	9	10	11
Aug 29	0.023	0.025	0.032	0.351	0.256	0.115	0.088	0.015	0.049	0.047	0.000
Aug 30	0.018	0.058	0.118	0.220	0.309	0.088	0.066	0.013	0.064	0.024	0.021
Aug 30	0.015	0.050	0.113	0.211	0.350	0.101	0.073	0.014	0.021	0.020	0.032
Sept 1	0.028	0.190	0.115	0.272	0.163	0.065	0.070	0.030	0.034	0.023	0.009
Sept 3	0.017	0.086	0.043	0.309	0.280	0.112	0.086	0.011	0.034	0.021	0.000
Sept 4	0.035	0.095	0.080	0.252	0.185	0.110	0.069	0.014	0.125	0.024	0.011
Sept 4	0.026	0.086	0.158	0.240	0.201	0.082	0.094	0.010	0.084	0.015	0.005
Sept 6	0.027	0.150	0.025	0.240	0.338	0.097	0.046	0.008	0.016	0.027	0.027
Sept 7	0.035	0.094	0.015	0.465	0.210	0.073	0.038	0.008	0.009	0.024	0.029
Sept 7	0.026	0.077	0.039	0.398	0.288	0.078	0.045	0.008	0.012	0.030	0.000
Sept 9	0.033	0.197	0.015	0.315	0.236	0.100	0.051	0.010	0.014	0.029	0.000
Sept 10	-	-	-	-	-	-	-	-	-	-	-
Sept 11	0.017	0.126	0.015	0.193	0.406	0.114	0.068	0.008	0.009	0.025	0.018
Sept 13	0.021	0.090	0.061	0.182	0.387	0.131	0.078	0.011	0.012	0.017	0.010
Sept 15	0.022	0.204	0.082	0.258	0.193	0.098	0.084	0.010	0.027	0.022	0.000
Sept 15	0.033	0.167	0.073	0.374	0.178	0.090	0.046	0.009	0.018	0.013	0.000
Sept 17	-	-	-	-	-	-	-	-	-	-	-
Sept 20	0.031	0.076	0.024	0.407	0.242	0.111	0.063	0.010	0.014	0.022	0.000
Sept 20	0.035	0.056	0.024	0.495	0.212	0.087	0.043	0.009	0.023	0.016	0.000
Sept 21	0.032	0.130	0.056	0.410	0.145	0.094	0.063	0.015	0.040	0.016	0.000
Sept 22	0.029	0.079	0.025	0.411	0.101	0.192	0.111	0.012	0.022	0.018	0.000
average	0.026	0.107	0.059	0.316	0.246	0.102	0.067	0.012	0.033	0.023	0.009

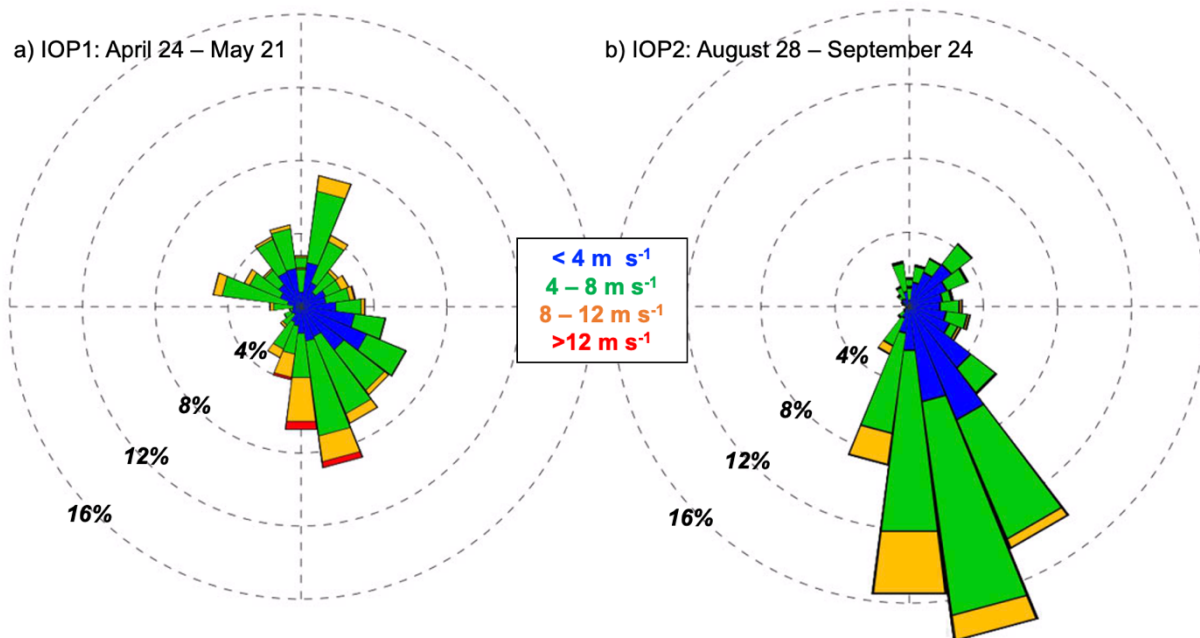


Figure S1. Wind roses over surface winds measured at the ARM Central Facility during a) IOP 1 and b) IOP2).

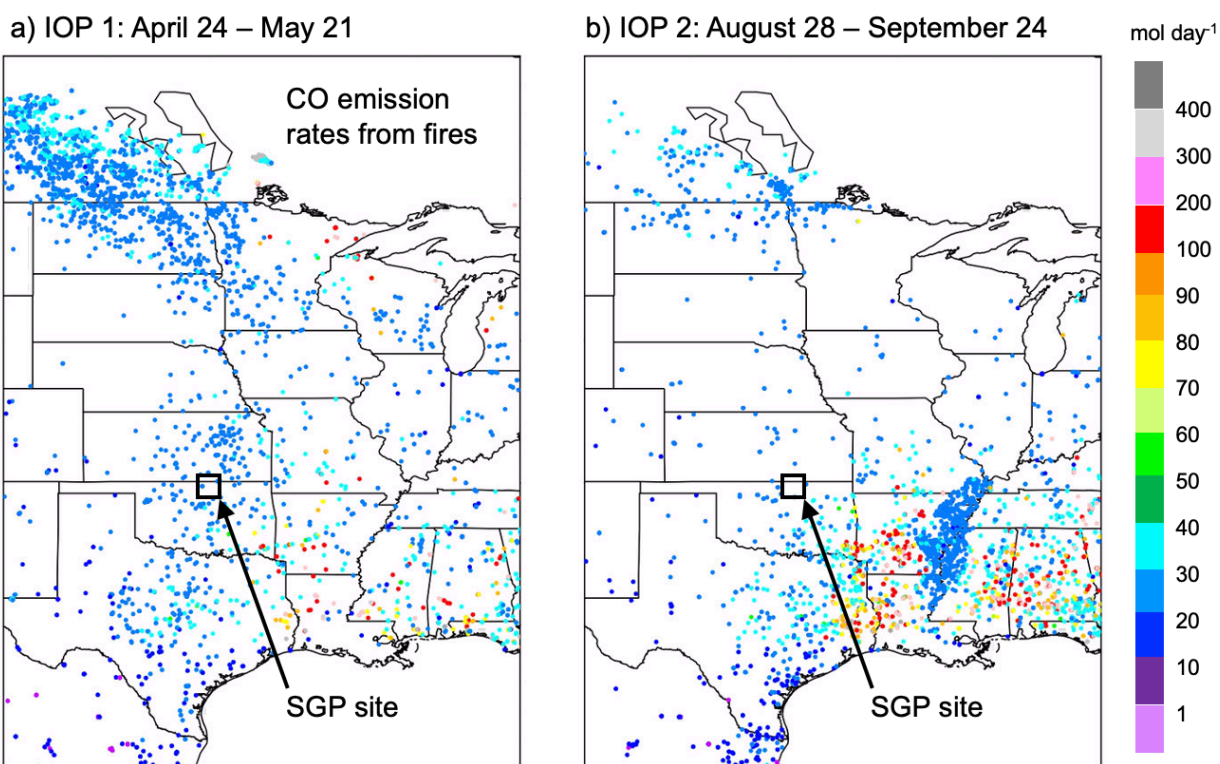


Figure S2. Accumulated daily emission rates of carbon monoxide (CO) from the Fire Inventory from NCAR (FINN) during a) IOP 1 and b) IOP 2.

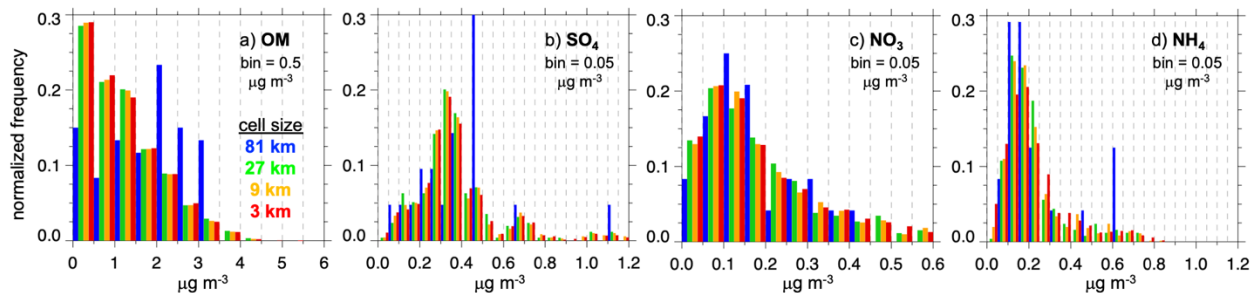


Figure S3. Normalized frequency of a) OM, b) SO_4 , c) NO_3 , d) NH_4 along all the constant altitude boundary layer flight legs within the 81 km cell over the SGP site during IOP 1.

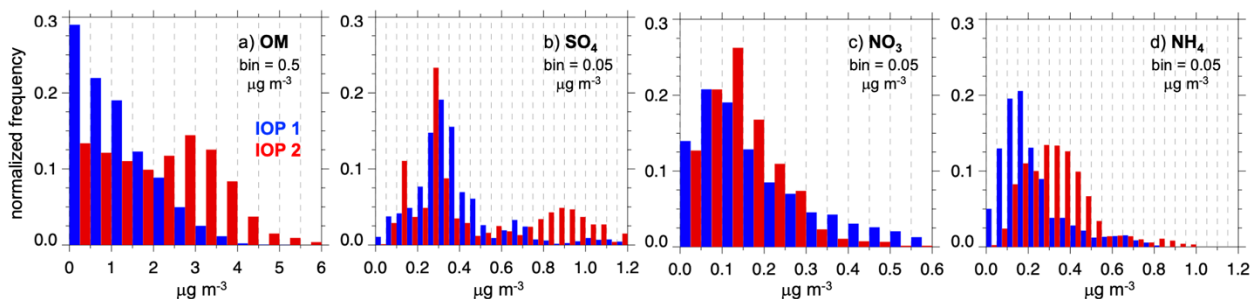


Figure S4. Normalized frequency of a) OM, b) SO_4 , c) NO_3 , d) NH_4 along all the constant altitude boundary layer flight legs during IOP 1 (blue) and IOP 2 (red) for the 3 km cells within the 81 km cell over the SGP site.

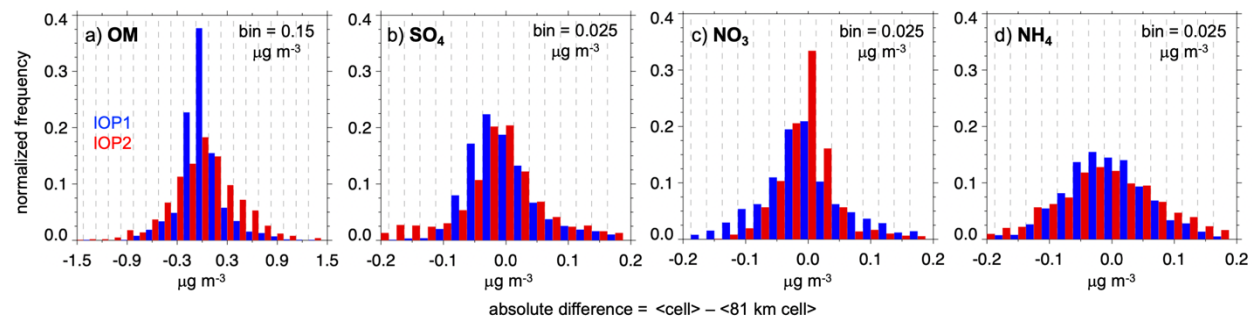


Figure S5. Normalized frequency of the absolute difference between the 3 and 81 km cell means for a) OM, b) SO_4 , c) NO_3 , and d) NH_4 within the 81 km cell over the SGP site, where blue is for IOP 1 and red is for IOP 2. Dashed lines denote bin size ranges.

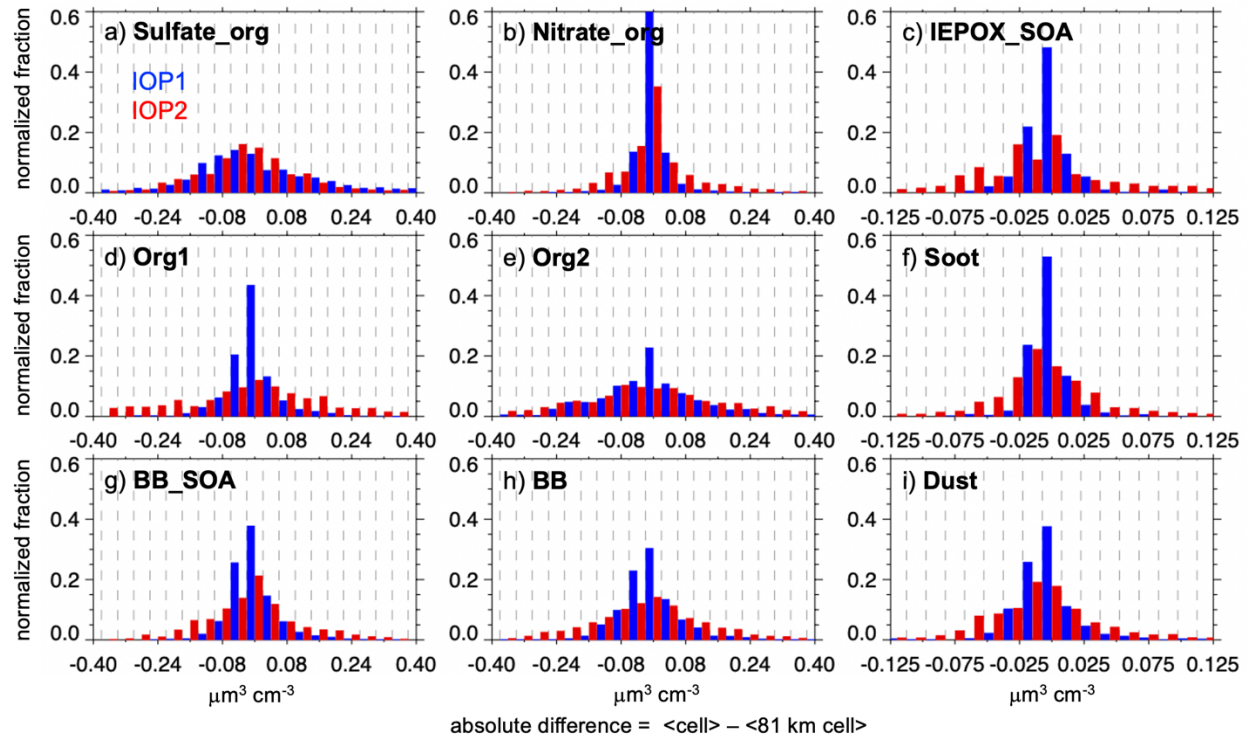


Figure S6. Normalized frequency of the absolute difference between the 3 and 81 km cell means for a) Sulfate_org, b) Nitrate_Org, c) IEPOX_SOA, d) Org1, e) Org2, f) soot, g) BB_SOA, h) BB, and i) dust within the 81 km cell over the SGP site, where blue is for IOP 1 and red is for IOP 2. Dashed lines denote bin size ranges

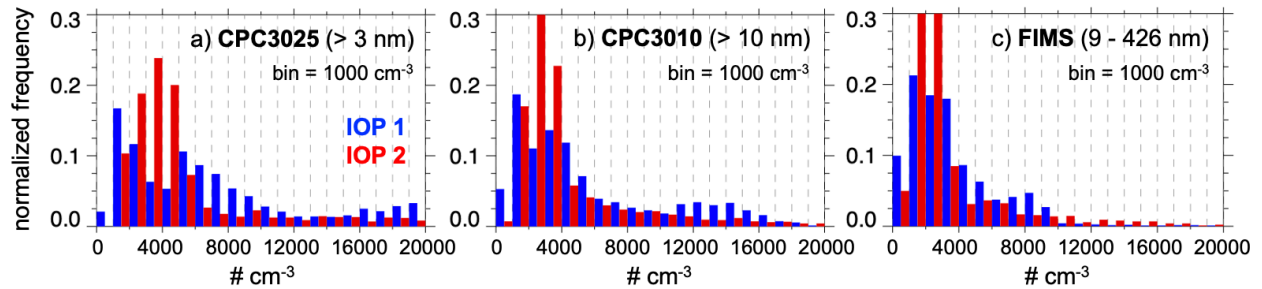


Figure S7. Normalized frequency of a) aerosol number > 3 nm, b) aerosol number > 10 nm, c) aerosol number between 9 and 426 nm, and d) aerosol number between 49 and 426 nm along all the constant altitude boundary layer flight legs during IOP 1 (blue) and IOP 2 (red) for the 3 km cells within the 81 km cell over the SGP site.

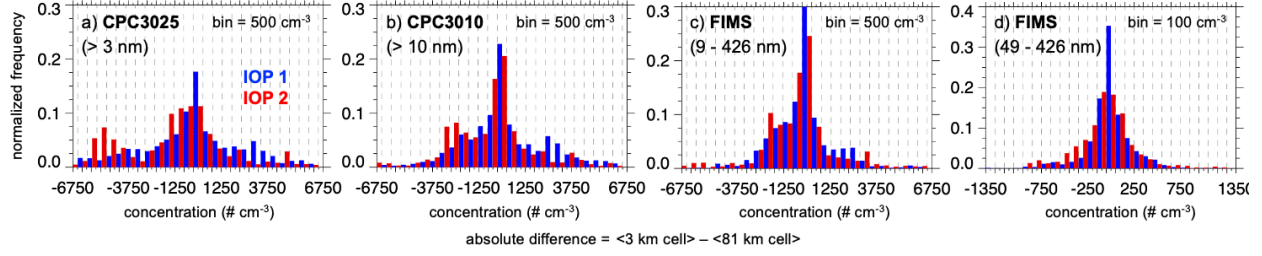


Figure S8. Normalized frequency of the absolute difference between the 3 and 81 km cell means for number concentrations a) > 3 nm, b) > 10 nm, c) $9 - 426$ nm, and d) $49 - 426$ nm for the 3 km cells within the 81 km cell over the SGP site, where blue is for IOP 1 and red is for IOP 2. Dashed lines denote bin size ranges

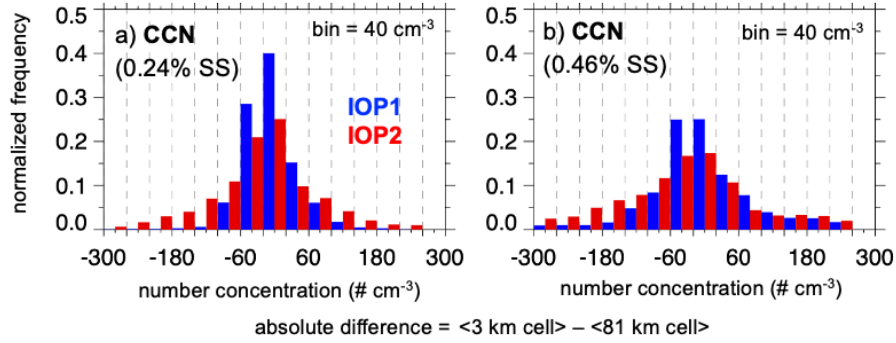


Figure S9. Normalized frequency of the absolute difference between the 3 and 81 km cell means for CCN at a) 0.24 % supersaturation and b) 0.46% supersaturation for all the 3 km cells within the 81 km cell over the SGP site, where blue is for IOP 1 and red is for IOP 2. Dashed lines denote bin size ranges.