

# Vertical distribution of sub-micron aerosol chemical composition from North-Western Europe and the North-East Atlantic

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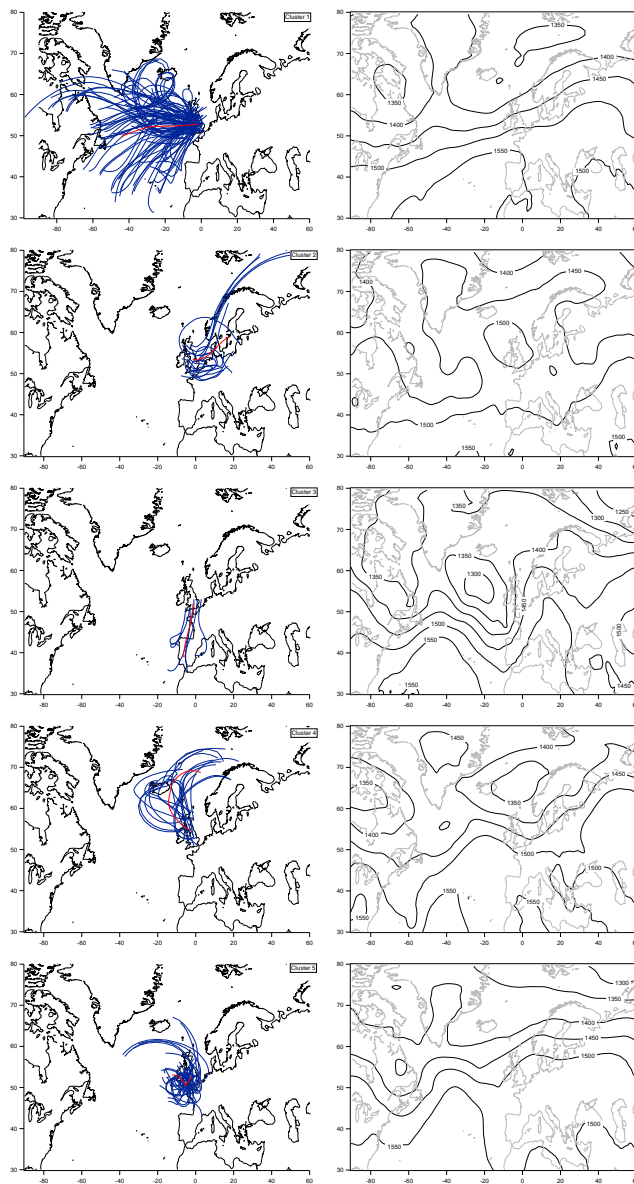


Figure S1: Maps of all back trajectories for each cluster along with the mean trajectory (red line). Also shown are average ECMWF\* 850hPa geopotential height fields based on a 2.5 by 2.5 horizontal grid. \*European Centre for Medium-Range Weather Forecasts. ECMWF Operational Analysis data, [Internet]. BADC, .2006-2008.

Available from <http://badc.nerc.ac.uk/data/ecmwf-op/>

Species	Statistic	Altitude (km)											
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5	
Organics	25 <sup>th</sup> percentile	0.066	-0.121	-0.201	-0.280	-0.218	-0.348	-0.378	-0.609	-1.067	-0.846	-1.420	
	50 <sup>th</sup> percentile	0.768	0.558	0.535	0.415	0.441	0.333	0.228	0.033	-0.013	-0.070	-0.309	
	75 <sup>th</sup> percentile	1.632	1.470	1.445	1.323	1.383	0.904	1.081	1.037	1.048	1.075	0.731	
	Mean	1.052	0.801	0.799	0.716	0.610	0.446	0.382	0.264	0.206	0.199	0.188	
Sulphate	$MAE/\sqrt{n}$	0.049	0.047	0.054	0.060	0.083	0.084	0.067	0.146	0.175	0.191	0.208	
	25 <sup>th</sup> percentile	0.302	0.200	0.203	0.142	0.107	0.075	0.053	0.030	-0.042	-0.030	-0.041	
	50 <sup>th</sup> percentile	0.800	0.678	0.663	0.482	0.450	0.254	0.311	0.189	0.117	0.185	0.148	
	75 <sup>th</sup> percentile	1.504	1.365	1.358	1.103	0.925	0.687	0.532	0.512	0.412	0.374	0.524	
Nitrate	Mean	1.093	1.029	0.964	0.782	0.642	0.409	0.341	0.330	0.176	0.182	0.254	
	$MAE/\sqrt{n}$	0.032	0.031	0.032	0.028	0.035	0.030	0.026	0.049	0.035	0.049	0.047	
	25 <sup>th</sup> percentile	0.027	0.014	0.017	-0.004	-0.009	-0.015	-0.017	-0.030	-0.032	-0.082	-0.030	
	50 <sup>th</sup> percentile	0.140	0.099	0.079	0.045	0.049	0.027	0.033	0.017	0.020	0.005	0.028	
Ammonium	75 <sup>th</sup> percentile	0.619	0.516	0.623	0.170	0.178	0.119	0.090	0.076	0.136	0.115	0.151	
	Mean	0.911	0.696	0.657	0.328	0.310	0.099	0.052	0.022	0.038	0.017	0.052	
	$MAE/\sqrt{n}$	0.033	0.025	0.026	0.015	0.019	0.012	0.007	0.012	0.016	0.019	0.019	
	25 <sup>th</sup> percentile	-0.028	-0.072	-0.110	-0.176	-0.220	-0.186	-0.348	-0.470	-0.464	-0.402	-0.418	
Ammonium	50 <sup>th</sup> percentile	0.375	0.306	0.352	0.274	0.262	0.157	0.045	0.106	0.092	0.197	0.180	
	75 <sup>th</sup> percentile	0.910	0.879	0.935	0.782	0.729	0.593	0.564	0.548	0.725	0.596	0.640	
	Mean	0.646	0.550	0.514	0.384	0.303	0.234	0.062	0.001	0.100	0.137	0.156	
	$MAE/\sqrt{n}$	0.030	0.028	0.033	0.034	0.051	0.046	0.043	0.115	0.101	0.127	0.119	

Table S1a: Profile statistics summary for the full dataset from 0.0-5.5km. MAE refers to the Mean Absolute Error and  $n$  refers to the number of points.

Species	Statistic	Altitude (km)										
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0
Organics	25 <sup>th</sup> percentile	-1.400	-1.392	-1.118	-0.931	-1.629	-1.262	-1.568	-1.322	-2.032	-2.160	-1.857
	50 <sup>th</sup> percentile	0.275	0.139	0.535	0.661	-0.031	0.563	-0.109	0.958	0.026	-0.351	0.079
	75 <sup>th</sup> percentile	1.514	1.130	1.878	2.059	1.542	2.307	2.532	3.458	2.246	2.349	2.012
Sulphate	Mean	0.227	-0.039	0.566	0.812	0.181	0.762	0.666	1.687	0.062	-0.301	0.498
	$MAE/\sqrt{n}$	0.327	0.301	0.342	0.261	0.320	0.338	0.301	0.381	0.514	0.458	0.561
	25 <sup>th</sup> percentile	-0.063	-0.130	-0.168	-0.081	-0.212	-0.175	-0.060	-0.106	-0.424	-0.057	0.184
Nitrate	50 <sup>th</sup> percentile	0.222	0.177	0.242	0.228	0.206	0.227	0.263	0.348	0.460	0.271	0.715
	75 <sup>th</sup> percentile	0.542	0.552	0.523	0.665	0.659	0.850	0.693	0.834	0.891	0.778	1.023
	Mean	0.2123	0.162	0.188	0.264	0.216	0.321	0.315	0.301	0.409	0.423	0.603
Nitrate	$MAE/\sqrt{n}$	0.0589	0.075	0.083	0.063	0.080	0.100	0.072	0.090	0.165	0.089	0.146
	25 <sup>th</sup> percentile	-0.096	-0.112	-0.169	-0.063	-0.124	-0.067	-0.093	-0.195	-0.186	-0.252	-0.198
	50 <sup>th</sup> percentile	0.003	0.007	0.024	0.033	0.011	0.014	0.023	-0.007	0.100	0.048	0.031
Ammonium	75 <sup>th</sup> percentile	0.173	0.099	0.121	0.217	0.160	0.168	0.192	0.130	0.324	0.229	0.281
	Mean	0.031	-0.020	-0.0312	0.042	0.024	0.012	0.020	-0.035	0.094	0.048	0.101
	$MAE/\sqrt{n}$	0.026	0.048	0.080	0.031	0.030	0.034	0.036	0.046	0.070	0.060	0.056
Ammonium	25 <sup>th</sup> percentile	-0.595	-0.499	-0.612	-0.832	-0.726	-0.724	-1.023	-1.338	-1.294	-0.706	-0.860
	50 <sup>th</sup> percentile	0.146	0.176	0.148	0.204	0.364	0.008	0.253	0.016	0.334	0.159	-0.042
	75 <sup>th</sup> percentile	0.902	1.012	0.832	0.883	0.972	0.947	1.247	1.334	1.384	1.288	0.735
Ammonium	Mean	0.093	0.185	0.090	0.011	0.332	0.135	0.068	-0.083	-0.050	0.194	0.056
	$MAE/\sqrt{n}$	0.145	0.150	0.179	0.187	0.166	0.161	0.225	0.217	0.403	0.206	0.269

Table S1b: Profile statistics summary for the full dataset from 5.5-11.0km.

Species	Statistic	Altitude (km)											
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5	
Organics	25 <sup>th</sup> percentile	-0.009	-0.150	-0.239	-0.379	-0.433	-0.360	-0.429	-0.257	-0.660	-1.063	-0.852	
	50 <sup>th</sup> percentile	0.624	0.442	0.243	0.210	0.233	0.258	0.107	0.909	0.420	0.116	0.007	
	75 <sup>th</sup> percentile	1.264	1.145	0.934	0.861	0.837	0.730	0.832	1.862	2.018	1.777	1.905	
	Mean	0.673	0.479	0.336	0.287	0.281	0.3067	0.314	0.830	0.963	0.748	0.633	
Sulphate	$MAE/\sqrt{n}$	0.058	0.054	0.053	0.072	0.108	0.119	0.088	0.381	0.371	0.323	0.313	
	25 <sup>th</sup> percentile	0.299	0.243	0.193	0.189	0.105	0.087	0.095	-0.088	-0.117	-0.173	-0.011	
	50 <sup>th</sup> percentile	0.764	0.583	0.485	0.434	0.3547	0.241	0.366	0.184	0.107	0.266	0.120	
	75 <sup>th</sup> percentile	1.282	1.112	1.164	0.864	0.731	0.617	0.583	0.772	0.329	0.471	0.499	
Nitrate	Mean	0.933	0.782	0.775	0.642	0.527	0.338	0.385	0.384	0.119	0.189	0.276	
	$MAE/\sqrt{n}$	0.035	0.031	0.035	0.033	0.043	0.034	0.042	0.118	0.060	0.112	0.067	
	25 <sup>th</sup> percentile	0.030	0.013	0.016	-0.002	-0.005	-0.021	-0.010	-0.032	-0.071	-0.059	-0.170	
	50 <sup>th</sup> percentile	0.150	0.089	0.060	0.036	0.025	0.0054	0.032	0.022	0.035	0.098	0.017	
Ammonium	75 <sup>th</sup> percentile	0.495	0.392	0.329	0.091	0.086	0.043	0.090	0.079	0.167	0.196	0.161	
	Mean	0.489	0.375	0.278	0.127	0.142	-0.014	0.055	0.018	0.030	0.043	0.010	
	$MAE/\sqrt{n}$	0.024	0.019	0.016	0.009	0.014	0.038	0.010	0.022	0.035	0.071	0.052	
	25 <sup>th</sup> percentile	0.012	-0.118	-0.186	-0.119	-0.301	-0.336	-0.346	-0.733	-0.521	-0.920	-0.408	
Ammonium	50 <sup>th</sup> percentile	0.379	0.282	0.296	0.239	0.202	0.086	0.082	0.122	0.021	-0.003	0.062	
	75 <sup>th</sup> percentile	0.802	0.696	0.743	0.686	0.651	0.449	0.564	0.449	0.305	0.410	0.389	
	Mean	0.452	0.344	0.347	0.333	0.199	0.112	0.066	-0.098	-0.052	-0.209	0.095	
	$MAE/\sqrt{n}$	0.034	0.033	0.043	0.041	0.079	0.068	0.070	0.192	0.167	0.327	0.109	

Table S2a: Profile statistics summary for the Atlantic cluster from 0.0-5.5km.

Species	Statistic	Altitude (km)										
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0
Organics	25 <sup>th</sup> percentile	-1.218	-1.056	-1.439	-0.876	-1.813	-1.197	-0.909	0.006	-1.249	-1.880	-1.754
	50 <sup>th</sup> percentile	0.055	0.519	0.299	0.725	-0.116	0.538	0.630	1.654	0.026	-0.293	0.206
	75 <sup>th</sup> percentile	1.335	1.430	1.778	1.964	1.376	1.818	3.711	4.336	2.062	2.349	2.207
	Mean	0.115	0.243	0.344	1.086	-0.010	0.837	1.621	2.229	0.478	-0.118	0.856
Sulphate	$MAE/\sqrt{n}$	0.316	0.419	0.381	0.292	0.377	0.364	0.430	0.408	0.5118	0.441	0.915
	25 <sup>th</sup> percentile	-0.129	-0.147	-0.038	0.069	-0.260	-0.346	-0.191	-0.143	-0.433	-0.158	-0.065
	50 <sup>th</sup> percentile	0.129	0.111	0.279	0.293	0.251	0.184	0.217	0.235	0.505	0.2267	0.587
	75 <sup>th</sup> percentile	0.368	0.461	0.526	0.683	0.659	0.794	0.636	0.6591	1.095	0.750	0.887
Nitrate	Mean	0.115	0.093	0.240	0.338	0.166	0.308	0.253	0.270	0.492	0.394	0.3989
	$MAE/\sqrt{n}$	0.075	0.093	0.096	0.078	0.120	0.145	0.090	0.108	0.235	0.097	0.213
	25 <sup>th</sup> percentile	-0.091	-0.074	-0.020	-0.040	-0.057	-0.047	-0.059	-0.080	-0.207	-0.102	-0.211
	50 <sup>th</sup> percentile	-0.015	0.021	0.066	0.027	0.003	0.014	0.021	0.014	0.077	0.071	0.002
Ammonium	75 <sup>th</sup> percentile	0.154	0.107	0.189	0.121	0.101	0.117	0.123	0.114	0.240	0.222	0.101
	Mean	0.011	-0.005	0.060	0.048	0.035	0.036	0.037	0.023	0.037	0.106	0.029
	$MAE/\sqrt{n}$	0.033	0.060	0.038	0.029	0.027	0.019	0.024	0.031	0.084	0.040	0.050
	25 <sup>th</sup> percentile	-0.706	-0.572	-0.623	-0.911	-0.418	-0.717	-1.027	-1.021	-1.267	-0.7056	-1.172
Ammonium	50 <sup>th</sup> percentile	0.0923	0.176	-0.099	0.204	0.384	-0.001	0.0256	-0.043	0.177	0.159	-0.091
	75 <sup>th</sup> percentile	0.672	0.928	0.812	0.883	0.981	0.7489	0.739	1.260	1.748	1.288	0.626
	Mean	-0.018	0.075	-0.032	-0.025	0.439	0.082	-0.177	-0.055	0.231	0.165	-0.101
	$MAE/\sqrt{n}$	0.198	0.269	0.179	0.249	0.204	0.194	0.235	0.240	0.393	0.239	0.438

Table S2b: Profile statistics summary for the Atlantic cluster from 5.5-11.0km.

Species	Statistic	Altitude (km)										
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5
Organics	25 <sup>th</sup> percentile	0.632	0.275	0.593	0.029	0.538	-0.033	-0.036	-2.268	-0.617	-1.000	-3.025
	50 <sup>th</sup> percentile	1.171	1.135	1.591	0.796	1.358	0.843	0.296	-1.125	0.404	-0.437	-1.464
	75 <sup>th</sup> percentile	2.228	2.497	2.793	2.038	1.994	1.612	1.206	-0.152	0.589	1.771	0.341
	Mean	1.481	1.480	1.758	1.068	1.399	0.933	0.473	-1.245	0.061	0.067	-1.481
Sulphate	$MAE/\sqrt{n}$	0.112	0.121	0.153	0.121	0.171	0.194	0.180	0.690	0.654	0.461	0.853
	25 <sup>th</sup> percentile	0.570	0.179	0.588	0.331	0.619	0.294	0.157	0.314	0.243	-0.347	-0.354
	50 <sup>th</sup> percentile	1.037	0.985	1.074	0.801	1.030	0.713	0.319	0.417	0.743	-0.035	0.272
	75 <sup>th</sup> percentile	1.724	2.297	1.783	1.299	1.509	1.277	0.752	0.781	1.001	0.154	0.492
Nitrate	Mean	1.308	1.429	1.315	0.975	1.100	0.960	0.485	0.663	0.656	-0.081	0.139
	$MAE/\sqrt{n}$	0.077	0.108	0.068	0.072	0.099	0.124	0.073	0.139	0.180	0.118	0.355
	25 <sup>th</sup> percentile	0.079	0.029	0.077	0.0467	0.091	0.064	0.033	-0.027	-0.007	-0.072	0.002
	50 <sup>th</sup> percentile	0.440	0.354	0.737	0.125	0.256	0.261	0.061	0.017	0.010	-0.045	0.026
Ammonium	75 <sup>th</sup> percentile	1.255	2.323	2.708	0.815	1.194	0.560	0.141	0.038	0.027	-0.005	0.096
	Mean	1.898	1.588	1.827	0.753	1.006	0.508	0.105	0.004	0.013	-0.044	0.042
	$MAE/\sqrt{n}$	0.166	0.137	0.143	0.072	0.135	0.066	0.014	0.021	0.010	0.019	0.014
	25 <sup>th</sup> percentile	0.096	0.052	0.213	-0.030	0.090	-0.006	-0.479	-0.198	-0.789	-0.847	-0.949
Ammonium	50 <sup>th</sup> percentile	0.677	0.482	0.891	0.378	0.669	0.248	-0.007	0.266	1.245	0.093	0.277
	75 <sup>th</sup> percentile	1.713	1.611	1.328	1.239	1.444	0.992	0.760	0.923	1.917	1.106	1.386
	Mean	1.294	1.044	1.034	0.633	0.896	0.436	-0.013	0.233	0.761	0.156	0.226
	$MAE/\sqrt{n}$	0.112	0.090	0.094	0.082	0.152	0.143	0.160	0.495	1.202	0.622	0.476

Table S3a: Profile statistics summary for the easterly cluster from 0.0-5.5km.

Species	Statistic	Altitude (km)													
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0			
Organics	25 <sup>th</sup> percentile	-3.329	-1.816	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.100	-0.282	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	2.060	0.454	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean <i>MAE</i> / $\sqrt{n}$	-0.670 1.545	-0.601 0.859	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Sulphate	25 <sup>th</sup> percentile	-0.114	0.123	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.202	0.521	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	0.609	0.786	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean <i>MAE</i> / $\sqrt{n}$	0.225 0.164	0.468 0.244	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Nitrate	25 <sup>th</sup> percentile	-0.067	-0.084	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	-0.014	-0.007	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	0.059	0.018	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean <i>MAE</i> / $\sqrt{n}$	0.006 0.038	-0.028 0.040	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Ammonium	25 <sup>th</sup> percentile	-0.190	-0.640	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.499	-0.156	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	1.737	1.529	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean <i>MAE</i> / $\sqrt{n}$	0.580 0.483	0.324 0.464	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A

Table S3b: Profile statistics summary for the easterly cluster from 5.5-11.0km.



Species	Statistic	Altitude (km)											
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5	
Organics	25 <sup>th</sup> percentile	0.470	0.063	0.108	-0.242	-0.036	0.0109	-0.380	-1.026	-1.427	-0.673	-2.011	
	50 <sup>th</sup> percentile	1.555	0.678	1.255	0.681	0.959	0.424	0.424	-0.100	-0.145	0.465	-0.567	
	75 <sup>th</sup> percentile	2.312	2.280	2.337	1.861	1.883	1.568	1.285	0.306	0.803	1.527	0.741	
	Mean	1.927	1.419	1.385	1.253	1.035	0.689	0.505	-0.2156	-0.289	0.220	-0.519	
Sulphate	$MAE/\sqrt{n}$	0.208	0.174	0.248	0.204	0.282	0.218	0.180	0.376	0.451	0.538	0.349	
	25 <sup>th</sup> percentile	0.314	0.342	0.302	0.031	0.250	0.030	-0.111	0.058	-0.098	-0.054	-0.174	
	50 <sup>th</sup> percentile	1.251	1.035	0.894	0.399	0.637	0.418	0.139	0.253	0.031	0.104	0.082	
	75 <sup>th</sup> percentile	2.454	1.748	1.548	1.482	1.071	0.810	0.386	0.374	0.406	0.375	0.528	
Nitrate	Mean	1.740	1.431	1.089	1.052	0.860	0.440	0.156	0.227	0.089	0.150	0.216	
	$MAE/\sqrt{n}$	0.165	0.125	0.114	0.135	0.100	0.105	0.045	0.065	0.073	0.079	0.109	
	25 <sup>th</sup> percentile	0.019	0.022	0.019	-0.008	-0.005	-0.016	-0.029	-0.027	0.009	-0.116	-0.058	
	50 <sup>th</sup> percentile	0.108	0.115	0.086	0.026	0.061	0.072	0.019	0.060	0.057	-0.007	0.026	
Ammonium	75 <sup>th</sup> percentile	0.910	1.036	0.642	0.323	0.416	0.227	0.053	0.118	0.172	0.022	0.180	
	Mean	2.124	1.394	0.855	0.848	0.423	0.164	0.032	0.053	0.086	-0.021	0.065	
	$MAE/\sqrt{n}$	0.283	0.156	0.101	0.115	0.074	0.032	0.010	0.047	0.038	0.050	0.037	
	25 <sup>th</sup> percentile	-0.070	-0.034	-0.135	-0.342	-0.419	-0.187	-0.279	-0.778	-0.897	-0.402	-0.697	
Ammonium	50 <sup>th</sup> percentile	0.241	0.334	0.320	0.198	0.281	0.237	0.011	0.144	0.104	0.409	-0.054	
	75 <sup>th</sup> percentile	1.117	1.031	1.015	1.029	0.737	0.705	0.521	0.745	0.778	1.040	1.046	
	Mean	1.034	0.876	0.513	0.541	0.239	0.258	0.104	-0.044	-0.035	0.451	0.001	
	$MAE/\sqrt{n}$	0.134	0.116	0.102	0.110	0.184	0.108	0.069	0.370	0.335	0.157	0.240	

Table S4a: Profile statistics summary for the stagnant air mass cluster from 0.0-5.5km.

Species	Statistic	Altitude (km)										
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0
Organics	25 <sup>th</sup> percentile	-1.351	-1.701	-1.172	-1.702	-1.045	-1.644	-1.945	-2.274	-3.905	-2.822	-2.215
	50 <sup>th</sup> percentile	0.826	0.003	0.525	0.320	0.119	0.969	-0.639	-0.148	-0.476	-0.651	-0.850
	75 <sup>th</sup> percentile	2.894	0.675	2.715	2.338	2.551	2.874	1.237	2.573	2.444	3.081	1.585
	Mean	0.874	-0.321	0.792	0.306	0.386	0.624	-0.420	1.076	-0.622	-0.745	-0.025
Sulphate	$MAE/\sqrt{n}$	0.716	0.608	0.626	0.510	0.633	0.705	0.398	0.605	1.020	1.365	0.743
	25 <sup>th</sup> percentile	0.169	-0.320	-0.289	-0.318	-0.216	-0.151	-0.047	-0.105	-0.426	-0.025	0.5156
	50 <sup>th</sup> percentile	0.388	0.182	-0.049	0.082	0.203	0.260	0.424	0.454	0.429	0.462	0.865
	75 <sup>th</sup> percentile	0.651	0.612	0.488	0.660	0.598	1.039	0.715	0.909	0.832	0.991	1.255
Nitrate	Mean	0.373	0.188	0.067	0.130	0.236	0.346	0.386	0.337	0.273	0.495	0.901
	$MAE/\sqrt{n}$	0.132	0.136	0.130	0.121	0.096	0.138	0.115	0.144	0.279	0.206	0.145
	25 <sup>th</sup> percentile	-0.173	-0.275	-0.516	-0.310	-0.239	-0.275	-0.346	-0.445	-0.174	-0.474	-0.194
	50 <sup>th</sup> percentile	0.141	-0.005	-0.241	0.167	-0.006	0.051	0.094	-0.150	0.206	-0.264	0.239
Ammonium	75 <sup>th</sup> percentile	0.305	0.262	0.107	0.287	0.231	0.318	0.322	0.163	0.471	0.336	0.551
	Mean	0.105	-0.038	-0.210	0.032	-0.008	-0.031	0.001	-0.010	0.188	-0.095	0.205
	$MAE/\sqrt{n}$	0.082	0.087	0.117	0.086	0.075	0.109	0.087	0.073	0.122	0.108	0.152
	25 <sup>th</sup> percentile	-0.576	-0.350	-0.748	-0.656	-0.862	-0.733	-1.032	-1.596	-2.976	-0.697	-0.790
Ammonium	50 <sup>th</sup> percentile	0.364	0.502	0.448	0.169	0.364	0.227	0.519	0.186	0.404	0.147	0.129
	75 <sup>th</sup> percentile	1.051	1.216	1.124	0.955	0.972	1.280	1.547	1.512	1.090	1.637	0.7856
	Mean	0.231	0.417	0.305	0.047	0.224	0.231	0.347	-0.114	-0.510	0.267	0.286
	$MAE/\sqrt{n}$	0.254	0.276	0.599	0.319	0.315	0.287	0.331	0.393	1.127	0.340	0.375

Table S4b: Profile statistics summary for the stagnant air mass cluster from 5.5-11.0km.

Species	Statistic	Altitude (km)											
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5	
Organics	25 <sup>th</sup> percentile	1.274	-1.415	-1.214	0.032	-0.468	-1.238	-0.782	-0.180	-1.400	-2.032	-1.919	
	50 <sup>th</sup> percentile	2.588	0.915	0.401	1.100	0.620	0.465	-0.277	0.291	-0.228	-0.669	-0.344	
	75 <sup>th</sup> percentile	5.263	2.101	2.231	2.268	1.276	2.133	1.080	1.448	1.089	0.275	0.999	
	Mean	3.290	0.884	0.810	1.153	0.722	0.713	0.734	0.438	-0.231	-1.018	-0.555	
	$MAE/\sqrt{n}$	0.420	0.459	0.395	0.313	0.415	0.745	0.530	0.246	0.426	0.693	0.993	
Sulphate	25 <sup>th</sup> percentile	1.393	0.847	0.491	0.652	0.124	-0.285	0.164	-0.044	0.012	0.159	0.044	
	50 <sup>th</sup> percentile	1.740	1.740	1.133	1.225	0.620	0.323	0.315	0.527	0.090	0.317	0.455	
	75 <sup>th</sup> percentile	2.643	2.418	2.440	1.982	1.105	0.488	0.459	0.583	0.396	0.448	0.798	
	Mean	2.068	2.176	1.903	1.443	0.681	0.060	0.302	0.383	0.156	0.289	0.379	
	$MAE/\sqrt{n}$	0.145	0.181	0.220	0.138	0.131	0.284	0.059	0.226	0.055	0.092	0.188	
Nitrate	25 <sup>th</sup> percentile	0.167	-0.155	-0.145	-0.073	-0.083	-0.056	0.020	-0.027	-0.112	-0.013	-0.049	
	50 <sup>th</sup> percentile	0.575	0.047	0.032	0.088	0.037	0.109	0.089	0.027	0.001	0.073	0.058	
	75 <sup>th</sup> percentile	2.947	0.204	0.174	0.342	0.209	0.394	0.135	0.100	0.061	0.171	0.245	
	Mean	1.867	0.361	0.150	0.185	0.210	0.121	0.092	0.031	-0.013	0.072	0.113	
	$MAE/\sqrt{n}$	0.281	0.064	0.046	0.041	0.045	0.110	0.026	0.025	0.048	0.042	0.067	
Ammonium	25 <sup>th</sup> percentile	0.290	0.069	-0.110	0.091	-0.217	-0.159	-0.429	-0.429	0.027	-0.322	0.342	
	50 <sup>th</sup> percentile	1.051	0.490	0.444	0.637	0.262	0.300	0.373	0.414	0.462	0.167	0.543	
	75 <sup>th</sup> percentile	2.177	1.160	1.064	1.244	0.832	1.229	0.637	0.623	0.985	0.699	1.270	
	Mean	1.237	0.760	0.635	0.635	0.215	0.673	0.166	0.212	0.455	0.092	0.797	
	$MAE/\sqrt{n}$	0.155	0.164	0.162	0.126	0.151	0.312	0.258	0.353	0.235	0.241	0.177	

Table S5a: Profile statistics summary for the southerly air mass cluster from 0.0-5.5km.

Species	Statistic	Altitude (km)														
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0				
Organics	25 <sup>th</sup> percentile	-3.059	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	-0.344	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	-1.489	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	-2.274	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sulphate	$MAE/\sqrt{n}$	0.785	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	-0.006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.455	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	1.403	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitrate	Mean	0.698	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.704	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	-0.009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.058	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonium	75 <sup>th</sup> percentile	0.117	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	0.054	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.063	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	-0.535	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonium	50 <sup>th</sup> percentile	0.543	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	0.146	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	-0.194	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.341	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table S5b: Profile statistics summary for the southerley air mass cluster from 5.5-11.0km.

Species	Statistic	Altitude (km)											
		0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-5.5	
Organics	25 <sup>th</sup> percentile	-0.403	-0.498	-0.226	-0.547	-0.416	-0.531	-0.293	-0.565	-1.231	-0.472	-0.818	
	50 <sup>th</sup> percentile	0.034	0.078	0.308	0.278	0.037	-0.243	0.134	-0.251	-0.380	-0.227	-0.265	
	75 <sup>th</sup> percentile	0.706	0.860	1.198	1.692	0.456	0.311	1.179	1.037	0.513	0.832	0.420	
	Mean	0.253	0.483	0.652	0.761	0.166	0.082	0.235	0.253	-0.369	0.114	-0.271	
Sulphate	$MAE/\sqrt{n}$	0.102	0.125	0.162	0.149	0.165	0.154	0.193	0.218	0.296	0.248	0.321	
	25 <sup>th</sup> percentile	0.014	-0.019	-0.043	-0.106	0.009	-0.015	-0.025	0.041	0.051	0.123	0.001	
	50 <sup>th</sup> percentile	0.147	0.130	0.043	0.106	0.104	0.094	0.241	0.100	0.197	0.215	0.194	
	75 <sup>th</sup> percentile	0.538	0.597	0.378	0.361	0.324	0.236	0.522	0.257	0.489	0.303	0.380	
Nitrate	Mean	0.500	0.470	0.494	0.266	0.235	0.256	0.332	0.177	0.287	0.252	0.275	
	$MAE/\sqrt{n}$	0.054	0.065	0.075	0.039	0.044	0.040	0.064	0.034	0.081	0.052	0.065	
	25 <sup>th</sup> percentile	-0.016	-0.016	-0.046	-0.079	-0.077	-0.018	-0.105	-0.046	-0.059	-0.093	0.021	
	50 <sup>th</sup> percentile	0.020	0.036	0.051	0.018	-0.013	0.036	-0.011	0.002	0.020	0.003	0.053	
Ammonium	75 <sup>th</sup> percentile	0.070	0.153	0.153	0.099	0.060	0.079	0.084	0.047	0.111	0.111	0.106	
	Mean	0.064	0.203	0.383	0.106	-0.004	0.042	0.005	0.001	0.027	0.019	0.075	
	$MAE/\sqrt{n}$	0.010	0.026	0.058	0.018	0.017	0.021	0.029	0.022	0.036	0.033	0.017	
	25 <sup>th</sup> percentile	-0.230	-0.183	-0.201	-0.635	-0.244	-0.066	-0.241	-0.323	-0.165	0.003	-0.027	
Ammonium	50 <sup>th</sup> percentile	0.014	0.186	0.078	0.012	0.066	0.138	0.045	-0.121	0.029	0.519	0.238	
	75 <sup>th</sup> percentile	0.368	0.839	0.430	0.510	0.480	0.599	0.550	0.256	0.475	0.641	0.464	
	Mean	0.071	0.243	0.220	-0.070	0.070	0.266	0.013	0.051	0.133	0.276	0.199	
	$MAE/\sqrt{n}$	0.057	0.087	0.071	0.118	0.099	0.080	0.117	0.108	0.137	0.186	0.132	

Table S6a: Profile statistics summary for the northerly air mass cluster from 0.0-5.5km.

Species	Statistic	Altitude (km)													
		5.5-6.0	6.0-6.5	6.5-7.0	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-10.0	10.0-10.5	10.5-11.0			
Organics	25 <sup>th</sup> percentile	0.281	-1.212	0.759	0.014	-0.838	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.390	-0.047	1.835	1.094	1.069	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	1.270	0.935	2.596	1.862	1.445	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	0.699	-0.108	1.730	0.990	0.559	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sulphate	$MAE/\sqrt{n}$	0.220	0.589	0.971	1.330	1.396	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	0.028	0.079	0.018	0.223	0.102	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	0.133	0.261	0.161	0.302	0.721	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	0.456	0.390	0.831	0.333	1.058	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitrate	Mean	0.220	0.243	0.336	0.286	0.627	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.091	0.098	0.175	0.085	0.525	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	-0.176	-0.103	-0.084	-0.040	0.066	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	50 <sup>th</sup> percentile	-0.125	-0.037	0.034	0.039	0.185	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonium	75 <sup>th</sup> percentile	0.071	0.027	0.061	0.092	0.355	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	-0.067	-0.038	0.004	0.030	0.202	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.053	0.044	0.088	0.033	0.054	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	25 <sup>th</sup> percentile	-0.449	-0.544	-0.162	-0.699	-1.036	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonium	50 <sup>th</sup> percentile	0.057	-0.464	0.192	0.349	-0.120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	75 <sup>th</sup> percentile	0.547	-0.366	0.508	0.942	1.301	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	0.051	-0.458	0.179	0.198	0.048	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$MAE/\sqrt{n}$	0.353	0.051	0.341	0.456	0.443	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table S6b: Profile statistics summary for the northerly air mass cluster from 5.5-11.0km.