

SCHMÜCKE HILL CAP CLOUD AND VALLEY STATIONS AEROSOL CHEMICAL COMPOSITION DURING FEBUKO (II): ORGANIC COMPOUNDS

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ELECTRONIC SUPPLEMENTARY MATERIAL (ESM)

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Table I: Mixing ratios of organic carbonyl compounds at the FEBUKO upwind site, all data in ppbV,
 <DL: mixing ratio below analytical detection limit, NA: sample not available

start time (UTC)	sampling	formaldehyde	acetaldehyde	propionaldehyde	butyraldehyde	isobutyraldehyde	valeraldehyde	isovaleraldehyde	hexanal	heptanal	octanal	nonanal
	time (min)											
Event I												
26.10.2001 22:00	120	0.858	0.482	0.060	0.042	0.011	0.020	0.033	0.041	0.040	0.017	0.057
27.10.2001 00:00	120	0.931	0.489	0.079	0.066	0.018	0.033	0.037	0.063	0.070	0.030	0.080
27.10.2001 02:00	120	0.75	0.445	0.082	0.055	0.015	0.028	0.038	0.048	0.047	0.028	0.071
27.10.2001 04:00	120	0.692	0.313	0.033	0.024	0.013	0.036	0.032	0.03	0.029	0.009	0.008
27.10.2001 06:00	120	0.738	0.348	0.061	0.026	0.012	0.018	0.036	0.028	0.034	0.057	0.024
27.10.2001 08:00	120	1.171	0.648	0.073	0.102	0.012	0.037	0.056	0.08	0.069	0.025	0.074
27.10.2001 10:00	120	1.474	0.835	0.137	0.206	0.014	0.048	0.077	0.113	0.095	0.043	0.137
27.10.2001 12:00	60	0.975	0.520	0.114	0.172	0.014	0.027	0.05	0.056	0.037	0.022	0.055
Event II												
07.10.2001 18:00	120	0.382	0.368	0.014	0.043	NA	<DL	0.013	0.037	0.019	0.010	0.024
07.10.2001 20:00	120	0.638	0.412	0.039	0.004	0.011	0.022	0.026	0.040	0.029	0.012	0.039
07.10.2001 22:00	120	1.207	0.719	0.086	0.008	0.013	0.043	0.036	0.133	0.045	0.057	0.172
08.10.2001 00:00	120	1.378	0.726	0.125	<DL	0.009	0.067	0.006	0.146	0.027	0.068	0.213
08.10.2001 02:00	120	0.456	0.301	0.021	0.009	0.002	<DL	<DL	0.027	0.017	0.009	0.014
08.10.2001 04:00	120	0.435	0.336	0.049	0.009	0.014	<DL	<DL	0.036	0.038	0.013	0.038
08.10.2001 06:00	120	0.535	0.461	0.054	<DL	0.009	<DL	0.029	0.03	0.028	0.015	0.035
08.10.2001 08:00	120	0.653	0.599	0.072	0.025	<DL	0.037	0.025	0.039	0.034	0.015	0.039
08.10.2001 10:00	60	0.909	0.674	0.078	0.045	0.015	0.026	0.024	0.059	0.039	0.032	0.087
Event III												
16.10.2002 21:00	120	0.587	0.505	0.018	<DL	0.006	0.015	0.015	0.064	0.018	0.119	0.192
16.10.2002 23:00	120	0.360	0.277	<DL	0.006	0.004	0.001	0.009	0.009	0.015	0.009	0.041
17.10.2002 01:00	120	0.343	0.221	0.012	0.006	0.005	0.014	0.018	0.027	0.015	0.022	0.048
17.10.2002 03:00	60	0.174	0.122	<DL	0.013	0.005	0.008	0.008	0.018	0.014	0.009	0.036

Table I continued

start time (UTC)	sampling time (min)	decanal	undecanal	dodecanal	glycolaldehyde	acrolein	methacrolein	crotonaldehyde	pinonaldehyde	glyoxal	methylglyoxal	diacetyl	benzaldehyde
Event I													
26.10.2001 22:00	120	0.020	0.007	<DL	0.044	0.040	0.016	0.009	0.011	0.026	0.020	0.005	0.030
27.10.2001 00:00	120	0.032	0.010	0.009	0.05	0.049	0.021	0.010	0.009	0.021	0.020	0.006	0.034
27.10.2001 02:00	120	0.039	0.006	0.006	0.047	0.037	0.026	0.012	0.014	0.021	0.021	0.007	0.034
27.10.2001 04:00	120	<DL	0.005	<DL	0.039	0.032	0.023	0.009	<DL	0.017	0.015	0.005	0.023
27.10.2001 06:00	120	<DL	<DL	<DL	0.046	0.040	0.018	0.009	0.020	0.016	0.022	0.006	0.025
27.10.2001 08:00	120	0.015	0.005	0.005	0.071	0.043	0.024	0.010	0.009	0.026	0.036	0.008	<DL
27.10.2001 10:00	120	0.039	0.014	0.010	0.085	0.045	0.018	0.009	0.009	0.031	0.060	0.012	0.081
27.10.2001 12:00	60	0.024	0.007	<DL	0.091	0.066	0.046	0.014	0.007	0.028	0.060	0.013	0.037
Event II													
07.10.2001 18:00	120	<DL	<DL	<DL	NA	<DL	0.015	0.027	<DL	NA	<DL		0.025
07.10.2001 20:00	120	0.004	<DL	<DL	0.037	0.022	0.012	0.005	<DL	0.007	0.036	<DL	0.048
07.10.2001 22:00	120	0.061	<DL	<DL	0.044	0.028	0.018	0.006	<DL	0.010	0.055	0.005	0.176
08.10.2001 00:00	120	0.073	0.010	0.008	0.028	0.020	0.012	0.007	0.014	0.006	0.043	<DL	0.197
08.10.2001 02:00	120	<DL	<DL	<DL	0.055	0.018	0.012	0.006	<DL	0.009	0.053	<DL	0.002
08.10.2001 04:00	120	0.005	<DL	<DL	0.04	0.023	0.027	0.008	<DL	0.008	0.064	0.006	0.015
08.10.2001 06:00	120	0.006	<DL	<DL	0.042	0.026	0.016	0.006	<DL	0.009	0.077	0.006	0.013
08.10.2001 08:00	120	0.015	<DL	<DL	0.057	0.027	0.018	0.007	<DL	0.019	0.121	0.008	0.017
08.10.2001 10:00	60	0.025	<DL	<DL	0.083	0.027	0.025	0.020	<DL	0.021	0.147	0.015	0.025
Event III													
16.10.2002 21:00	120	0.140	0.003	0.001	0.011	0.010	0.003	0.005	<DL	0.006	0.018	0.003	<DL
16.10.2002 23:00	120	0.032	0.003	<DL	0.009	0.008	0.004	0.004	<DL	0.005	0.015	0.003	<DL
17.10.2002 01:00	120	0.056	0.003	0.001	0.007	0.008	0.001	0.005	<DL	0.004	0.016	0.004	<DL
17.10.2002 03:00	60	0.0380	0.001	<DL	0.011	0.015	<DL	0.005	<DL	0.008	0.019	0.003	<DL

Table I continued

start time (UTC)	sampling time (min)	m-tolualdehyde	p-tolualdehyde	acetone	hydroxyacetone	methyl ethyl ketone	methyl vinyl ketone	diethyl ketone	methyl propyl ketone	ethyl propol ketone	cyclohexanone
Event I											
26.10.2001 22:00	120	0.008	0.008	0.389	0.018	0.114	0.008	0.010	0.014	0.007	0.035
27.10.2001 00:00	120	0.008	0.008	0.375	0.011	0.104	0.014	0.011	0.016	<DL	0.038
27.10.2001 02:00	120	0.007	0.007	0.44	0.014	0.130	0.010	0.010	0.014	0.007	0.045
27.10.2001 04:00	120	0.007	0.006	0.370	0.008	0.134	0.007	0.009	0.012	0.009	0.037
27.10.2001 06:00	120	0.008	0.008	0.376	0.015	0.139	0.007	0.004	0.010	0.005	0.034
27.10.2001 08:00	120	0.008	0.008	0.579	0.024	0.163	0.007	0.009	0.014	0.007	0.056
27.10.2001 10:00	120	0.009	<DL	0.507	0.035	0.156	0.011	0.009	0.018	<DL	0.064
27.10.2001 12:00	60	0.007	0.009	0.499	0.052	0.156	0.013	<DL	0.012	0.006	0.034
Event II											
07.10.2001 18:00	120	<DL	<DL	0.241	NA	<DL	<DL	<DL	<DL	0.037	<DL
07.10.2001 20:00	120	0.006	<DL	0.352	0.022	0.094	0.007	<DL	0.009	0.009	<DL
07.10.2001 22:00	120	0.013	<DL	0.303	0.024	0.121	0.011	0.005	0.009	0.012	0.025
08.10.2001 00:00	120	0.005	<DL	0.319	0.020	0.112	0.004	0.008	0.005	<DL	0.029
08.10.2001 02:00	120	0.006	<DL	0.259	0.024	0.127	<DL	<DL	0.005	0.007	<DL
08.10.2001 04:00	120	0.018	<DL	0.367	0.027	0.082	0.007	0.007	0.017	0.015	<DL
08.10.2001 06:00	120	0.006	<DL	0.407	0.024	0.094	0.008	0.007	0.006	0.011	<DL
08.10.2001 08:00	120	0.006	<DL	0.591	0.031	0.101	0.007	<DL	0.008	0.003	<DL
08.10.2001 10:00	60	0.005	<DL	0.651	0.032	0.147	0.023	<DL	0.022	0.007	<DL
Event III											
16.10.2002 21:00	120	<DL	<DL	0.652	0.006	0.048	0.004	0.036	0.002	0.002	0.023
16.10.2002 23:00	120	<DL	<DL	0.292	0.005	0.056	0.004	0.025	0.005	0.002	0.021
17.10.2002 01:00	120	<DL	<DL	0.235	0.005	0.031	0.003	0.042	0.003	<DL	0.052
17.10.2002 03:00	60	0.002	<DL	0.304	0.006	0.103	0.008	0.020	0.010	0.003	0.021

Table II: Concentrations of organic carbonyl compounds in bulk cloud water during FEBUKO, all data in $\mu\text{mol l}^{-1}$,
 <DL: concentration below analytical detection limit, NA: sample not available

start time (UTC)	sampling	formaldehyde	acetaldehyde	propionaldehyde	glycolaldehyde	methacrolein	pinonaldehyde	glyoxal	methylglyoxal	diacetyl
	time (min)									
Event I										
26.10.2001 22:00	120	3.36	0.95	0.31	4.91	<DL	0.73	6.03	2.29	0.48
27.10.2001 00:00	120	2.43	0.45	0.19	3.32	<DL	0.48	3.75	1.33	0.28
27.10.2001 02:00	120	1.58	0.23	0.12	2.51	<DL	0.53	1.89	0.70	0.18
27.10.2001 04:00	120	4.80	0.46	0.15	3.02	<DL	0.28	3.05	1.68	0.21
27.10.2001 06:00	120	4.81	0.42	0.17	3.32	0.01	NA	3.00	1.63	0.21
27.10.2001 08:00	120	3.50	0.52	0.17	3.97	0.01	0.37	2.69	1.93	0.24
27.10.2001 10:00	120	3.02	0.83	0.37	4.79	0.04	0.42	5.13	2.51	0.42
27.10.2001 12:00	60	3.49	0.57	0.23	3.08	0.03	0.38	5.93	2.32	0.30
Event II										
07.10.2001 18:00	120	NA	NA	NA	NA	NA	NA	NA	NA	NA
07.10.2001 20:00	120	2.15	0.34	0.11	0.81	<DL	0.10	1.89	0.56	0.15
07.10.2001 22:00	120	2.29	0.09	0.06	0.84	<DL	0.21	5.15	0.59	0.17
08.10.2001 00:00	120	1.29	0.13	0.06	0.35	<DL	0.32	1.81	0.60	0.13
08.10.2001 02:00	120	1.06	0.08	0.04	0.42	<DL	0.37	1.36	0.55	0.11
08.10.2001 04:00	120	0.10	0.41	0.15	1.10	0.01	0.52	1.34	0.83	0.16
08.10.2001 06:00	120	2.87	0.43	0.16	1.52	0.01	0.54	2.56	1.50	0.20
08.10.2001 08:00	120	2.53	0.13	0.10	1.11	0.03	NA	5.07	1.96	0.21
08.10.2001 10:00	60	3.58	0.34	0.28	1.86	0.09	NA	11.31	3.34	0.36
Event III										
16.10.2002 21:00	120	1.39	1.19	0.14	0.43	0.01	0.76	1.21	0.60	0.12
16.10.2002 23:00	120	0.95	0.32	0.07	0.23	0.01	0.65	0.77	0.41	0.06
17.10.2002 01:00	120	1.09	0.23	0.07	0.28	0.01	0.65	1.01	0.58	0.08
17.10.2002 03:00	60	1.39	0.35	0.10	0.25	0.01	0.76	0.76	0.40	0.07

Table II continued

start time (UTC)	sampling time (min)	acetone	hydroxyacetone	methyl ethyl ketone	methy vinyl ketone	3-hydroxy-2-butanone	4-hydroxy-2-butanone
Event I							
26.10.2001 22:00	120	NA	0.71	0.11	0.18	0.21	NA
27.10.2001 00:00	120	NA	0.52	0.06	0.13	0.18	NA
27.10.2001 02:00	120	NA	0.48	0.05	0.07	0.16	NA
27.10.2001 04:00	120	NA	0.44	0.07	0.08	0.12	NA
27.10.2001 06:00	120	NA	0.49	0.06	0.07	0.13	NA
27.10.2001 08:00	120	NA	0.56	0.08	0.06	0.15	NA
27.10.2001 10:00	120	NA	0.72	0.09	0.11	0.18	NA
27.10.2001 12:00	60	NA	0.44	0.07	0.08	0.11	NA
Event II							
07.10.2001 18:00	120	NA	NA	NA	NA	NA	NA
07.10.2001 20:00	120	NA	0.17	0.05	0.02	0.08	NA
07.10.2001 22:00	120	NA	0.19	0.03	0.04	0.08	NA
08.10.2001 00:00	120	NA	0.11	0.05	0.05	0.05	NA
08.10.2001 02:00	120	NA	0.07	0.05	0.03	0.03	NA
08.10.2001 04:00	120	NA	0.24	0.07	0.07	0.09	NA
08.10.2001 06:00	120	NA	0.30	0.08	0.09	0.10	NA
08.10.2001 08:00	120	NA	0.07	0.10	0.09	0.09	NA
08.10.2001 10:00	60	NA	0.18	0.14	0.13	0.09	NA
Event III							
16.10.2002 21:00	120	0.77	0.23	0.97	0.05	0.12	0.10
16.10.2002 23:00	120	0.45	0.13	0.15	0.04	0.07	0.08
17.10.2002 01:00	120	0.40	0.16	0.06	0.05	0.08	0.09
17.10.2002 03:00	60	0.49	0.15	0.16	0.05	0.08	0.08

Table III: Cloud water loadings of organic carbonyl compounds, determined from evaporating droplets after CVI inlet during FEBUKO, all data in $\mu\text{g m}^{-3}$,
 <DL: concentration below analytical detection limit

start time (UTC)	sampling	formaldehyde	acetaldehyde	propionaldehyde	butyraldehyde	isobutyraldehyde	valeraldehyde	hexanal	heptanal	octanal	trans-hexenal
	time (min)										
Event I											
26.10.2001 21:50	130	0.043	0.017	<DL	<DL	0.018	<DL	<DL	<DL	<DL	0.004
27.10.2001 00:00	120	0.071	0.014	0.010	<DL	0.027	<DL	<DL	<DL	<DL	0.009
27.10.2001 02:00	120	0.085	0.011	<DL	<DL	0.027	0.008	<DL	<DL	0.007	0.011
27.10.2001 04:00	120	0.059	0.012	<DL	<DL	0.025	0.008	<DL	0.010	<DL	<DL
27.10.2001 06:00	120	0.083	0.018	<DL	<DL	0.030	0.006	<DL	<DL	<DL	0.010
27.10.2001 08:00	120	0.075	0.017	<DL	<DL	0.038	<DL	<DL	<DL	0.006	0.022
27.10.2001 10:00	120	0.031	0.011	<DL	<DL	0.026	<DL	<DL	<DL	0.004	0.011
Event II											
07.10.2001 22:00	240	0.028	0.015	0.010	0.012	0.010	<DL	<DL	<DL	0.005	0.045
08.10.2001 02:00	120	0.030	0.021	<DL	0.017	0.015	<DL	<DL	<DL	<DL	0.063
08.10.2001 04:00	120	0.026	0.016	<DL	0.015	0.019	<DL	<DL	<DL	<DL	0.086
08.10.2001 06:00	120	0.018	0.014	<DL	<DL	0.011	<DL	<DL	<DL	<DL	0.005
Event II											
16.10.2002 20:55	425	0.014	0.008	<DL	<DL	<DL	<DL	0.007	0.014	0.005	<DL

Table III continued

start time (UTC)	sampling	pinonaldehyde	benzaldehyde	acetone	methyl ethyl ketone
	time (min)				
Event I					
26.10.2001 21:50	130	<DL	0.092	0.020	<DL
27.10.2001 00:00	120	0.013	0.154	0.027	<DL
27.10.2001 02:00	120	0.031	0.226	0.022	<DL
27.10.2001 04:00	120	<DL	0.141	0.016	<DL
27.10.2001 06:00	120	<DL	0.201	0.029	<DL
27.10.2001 08:00	120	0.011	0.143	0.028	<DL
27.10.2001 10:00	120	0.012	0.020	0.021	<DL
Event II					
07.10.2001 22:00	240	0.037	0.012	0.054	<DL
08.10.2001 02:00	120	0.036	0.010	0.058	<DL
08.10.2001 04:00	120	0.044	<DL	0.050	<DL
08.10.2001 06:00	120	0.035	0.006	0.045	0.008
Event II					
16.10.2002 20:55	425	<DL	<DL	0.018	0.006

Table IV: Interstitial cloud phase mixing ratios of organic carbonyl compounds during FEBUKO, all data in ppbV,
 <DL: mixing ratio below analytical detection limit

sampling		formaldehyde	acetaldehyde	propionaldehyde	butyraldehyde	valeraldehyde	isovaleraldehyde	hexanal	heptanal	octanal	trans-hexenal
start time (UTC)	time (min)										
Event I											
26.10.2001 21:50	130	0.752	0.216	<DL	0.015	0.019	0.029	0.042	0.032	<DL	0.018
27.10.2001 00:00	120	0.381	0.244	0.038	<DL	0.024	0.026	0.022	0.025	0.015	<DL
27.10.2001 02:00	120	0.943	0.225	0.050	<DL	0.025	0.044	0.037	0.040	0.019	0.011
27.10.2001 04:00	120	1.216	0.224	0.060	<DL	0.022	0.038	<DL	0.033	0.017	0.017
27.10.2001 06:00	120	1.294	0.198	0.064	<DL	0.006	0.029	<DL	0.029	0.014	0.009
27.10.2001 08:00	120	0.738	0.233	0.066	0.015	0.016	0.028	0.000	0.043	<DL	0.016
27.10.2001 10:00	120	0.674	0.315	0.043	0.011	0.025	0.025	0.019	0.032	0.014	0.009
Event II											
07.10.2001 22:00	240	0.088	0.056	<DL	0.033	<DL	<DL	<DL	<DL	<DL	0.039
08.10.2001 02:00	120	0.091	0.078	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.059
08.10.2001 04:00	120	0.281	0.054	<DL	0.036	<DL	<DL	<DL	<DL	<DL	0.080
08.10.2001 06:00	120	0.133	0.058	<DL	0.039	<DL	<DL	<DL	<DL	<DL	0.094
08.10.2001 08:00	120	0.323	0.101	0.032	0.045	<DL	0.018	<DL	<DL	<DL	<DL
Event II											
16.10.2002 20:55	425	0.295	0.195	0.019	0.014	<DL	<DL	0.006	0.007	<DL	0.004

Table IV continued

sampling		pinonaldehyde	benzaldehyde	acetone	methyl ethyl ketone
start time (UTC)	time (min)				
Event I					
26.10.2001 21:50	130	<DL	0.344	0.246	0.098
27.10.2001 00:00	120	<DL	0.106	0.339	0.066
27.10.2001 02:00	120	0.004	0.401	0.315	0.089
27.10.2001 04:00	120	<DL	0.581	0.381	0.082
27.10.2001 06:00	120	<DL	0.742	0.313	0.086
27.10.2001 08:00	120	<DL	0.309	0.327	0.103
27.10.2001 10:00	120	<DL	0.293	0.478	0.075
Event II					
07.10.2001 22:00	240	<DL	0.104	0.040	0.091
08.10.2001 02:00	120	<DL	0.063	0.084	0.103
08.10.2001 04:00	120	<DL	0.068	0.092	0.110
08.10.2001 06:00	120	<DL	0.071	0.139	0.138
08.10.2001 08:00	120	0.008	0.171	0.205	0.187
Event II					
16.10.2002 20:55	425	<DL	0.016	0.115	0.007

Table V: Mixing ratios of organic carbonyl compounds at the FEBUKO downwind site, all data in ppbV,

<DL: mixing ratio below analytical detection limit, NA: sample not available

start time (UTC)	sampling	formaldehyde	acetaldehyde	propionaldehyde	butyraldehyde	isobutyraldehyde	valeraldehyde	isovaleraldehyde	hexanal	heptanal	octanal	nonanal
	time (min)											
Event I												
26.10.2001 22:00	120	0.621	0.418	0.047	0.012	0.021	<DL	0.034	0.021	0.006	<DL	<DL
27.10.2001 00:00	120	0.632	0.355	0.078	0.017	0.023	0.009	0.028	0.026	<DL	<DL	0.008
27.10.2001 02:00	120	0.514	0.396	0.042	0.029	0.042	<DL	0.038	0.023	0.006	0.012	0.019
27.10.2001 04:00	120	0.686	0.340	0.050	0.034	0.027	<DL	0.036	0.017	0.006	0.004	0.009
27.10.2001 06:00	120	0.593	0.330	0.040	0.015	0.025	0.019	0.039	0.022	0.009	0.004	0.007
27.10.2001 08:00	120	0.657	0.327	0.029	0.027	0.026	0.021	0.029	0.026	0.008	0.005	0.002
27.10.2001 10:00	120	0.660	0.390	0.054	0.026	0.021	0.027	0.013	0.015	0.006	0.003	<DL
27.10.2001 12:00	60	0.701	0.417	0.031	0.034	0.016	0.014	0.022	0.016	0.005	0.001	<DL
Event II												
07.10.2001 18:00	120	0.491	0.241	0.017	0.014	NA	0.020	0.022	<DL	<DL	0.007	0.014
07.10.2001 20:00	120	0.363	0.158	0.017	0.004	0.007	<DL	0.022	0.018	0.041	0.007	0.004
07.10.2001 22:00	120	0.412	0.201	0.026	0.008	0.024	0.002	0.017	<DL	0.040	0.007	0.011
08.10.2001 00:00	120	0.467	0.299	0.017	0.018	0.020	<DL	0.015	0.019	0.022	0.009	0.022
08.10.2001 02:00	120	0.537	0.261	<DL	0.010	0.011	<DL	0.017	0.012	0.012	0.011	0.036
08.10.2001 04:00	120	0.404	0.241	0.025	0.026	0.019	<DL	0.017	<DL	0.032	<DL	<DL
08.10.2001 06:00	120	0.543	0.354	0.026	0.034	0.027	0.018	0.015	<DL	0.023	<DL	<DL
08.10.2001 08:00	120	0.589	0.477	0.036	0.030	0.026	0.031	0.014	<DL	0.022	0.001	<DL
08.10.2001 10:00	60	0.624	0.516	0.036	0.024	0.023	0.030	0.015	<DL	0.036	<DL	<DL
Event III												
16.10.2002 21:00	120	0.537	0.383	0.046	0.021	NA	<DL	0.009	0.024	0.041	<DL	<DL
16.10.2002 23:00	120	0.213	0.236	0.000	0.001	NA	0.010	0.016	0.027	0.054	<DL	<DL
17.10.2002 01:00	120	0.329	0.211	0.000	0.014	NA	<DL	0.009	0.023	0.041	0.007	0.021
17.10.2002 03:00	60	0.476	0.241	0.030	0.011	NA	<DL	0.008	0.015	0.027	0.006	0.007

Table V continued

start time (UTC)	sampling	decanal	undecanal	dodecanal	glycolaldehyde	acrolein	methacrolein	crotonaldehyde	pinonaldehyde	glyoxal	methyl glyoxal	diacetyl	benzaldehyde
	time (min)												
Event I													
26.10.2001 22:00	120	0.060	<DL	<DL	0.040	0.030	0.010	0.009	<DL	0.020	0.018	<DL	0.012
27.10.2001 00:00	120	<DL	0.006	<DL	0.049	0.046	0.020	0.008	<DL	0.016	0.019	0.005	0.017
27.10.2001 02:00	120	0.056	0.006	0.006	0.053	0.058	0.026	0.012	<DL	0.008	0.021	0.010	0.019
27.10.2001 04:00	120	0.046	<DL	0.003	0.079	0.031	0.026	0.011	<DL	0.009	0.025	0.005	0.014
27.10.2001 06:00	120	0.023	0.007	<DL	0.068	0.042	0.025	0.009	<DL	0.017	0.029	0.008	0.019
27.10.2001 08:00	120	<DL	0.006	0.004	0.067	0.047	0.017	0.007	0.007	0.019	0.038	0.006	0.021
27.10.2001 10:00	120	<DL	<DL	<DL	0.088	0.043	0.013	0.008	0.006	0.031	0.045	<DL	0.022
27.10.2001 12:00	60	0.092	0.003	<DL	0.077	0.038	0.010	0.007	0.008	0.028	0.038	<DL	0.018
Event II													
07.10.2001 18:00	120	0.057	<DL	<DL	NA	NA	<DL	<DL	<DL	NA	NA	NA	0.026
07.10.2001 20:00	120	0.045	<DL	<DL	0.024	0.015	<DL	<DL	<DL	0.003	0.001	<DL	0.007
07.10.2001 22:00	120	0.209	<DL	<DL	0.038	0.018	0.005	0.005	<DL	0.003	0.003	<DL	0.009
08.10.2001 00:00	120	<DL	<DL	<DL	0.030	0.021	0.007	0.005	<DL	0.005	0.005	<DL	0.011
08.10.2001 02:00	120	0.018	<DL	<DL	0.032	0.018	0.007	0.005	<DL	0.001	0.001	<DL	0.008
08.10.2001 04:00	120	0.026	<DL	<DL	0.030	0.015	0.005	0.005	<DL	0.003	0.006	<DL	0.009
08.10.2001 06:00	120	0.036	<DL	<DL	0.067	0.025	0.009	0.007	<DL	0.008	0.017	0.005	0.019
08.10.2001 08:00	120	0.176	<DL	<DL	0.105	0.040	0.015	0.008	<DL	0.022	0.028	0.006	0.033
08.10.2001 10:00	60	0.057	<DL	<DL	0.092	0.028	0.008	0.006	<DL	0.023	0.030	<DL	0.038
Event III													
16.10.2002 21:00	120	<DL	<DL	<DL	0.013	0.012	0.005	0.006	<DL	0.010	0.020	0.006	0.002
16.10.2002 23:00	120	0.010	0.006	0.011	0.011	0.011	0.010	0.005	<DL	0.013	0.020	0.007	0.009
17.10.2002 01:00	120	0.024	0.008	<DL	0.014	0.011	0.013	0.006	<DL	0.012	0.021	0.005	0.006
17.10.2002 03:00	60	0.011	<DL	<DL	0.017	0.052	0.015	0.012	<DL	0.013	0.028	0.011	0.010

Table V continued

start time (UTC)	sampling time (min)	m-tolualdehyde	p-tolualdehyde	acetone	hydroxyacetone	methyl ethyl ketone	methyl vinyl ketone	diethyl ketone	methyl propyl ketone	ethyl propol ketone	cyclohexanone
Event I											
26.10.2001 22:00	120	0.009	<DL	0.503	<DL	0.099	0.009	0.006	0.017	0.005	0.058
27.10.2001 00:00	120	0.008	0.008	0.326	0.014	0.074	0.013	0.014	0.019	<DL	<DL
27.10.2001 02:00	120	0.010	0.006	0.578	0.017	0.083	0.030	<DL	0.016	<DL	0.066
27.10.2001 04:00	120	0.046	0.006	0.522	0.016	0.089	0.008	<DL	0.017	<DL	0.075
27.10.2001 06:00	120	0.009	<DL	0.500	0.018	0.089	0.012	0.017	0.023	0.012	0.034
27.10.2001 08:00	120	0.007	<DL	0.443	0.014	0.084	0.009	0.015	0.019	0.009	0.017
27.10.2001 10:00	120	0.008	<DL	0.518	0.017	0.119	0.009	0.015	0.016	0.012	0.019
27.10.2001 12:00	60	0.011	<DL	0.558	0.020	0.157	0.006	0.014	0.013	0.010	0.023
Event II											
07.10.2001 18:00	120	0.008	0.008	0.306	NA	0.084	<DL	<DL	<DL	NA	<DL
07.10.2001 20:00	120	0.008	0.007	0.163	0.023	0.039	<DL	<DL	0.005	<DL	<DL
07.10.2001 22:00	120	0.019	0.007	0.226	0.022	0.066	<DL	<DL	0.008	<DL	0.026
08.10.2001 00:00	120	0.005	0.005	0.282	0.017	0.072	<DL	<DL	0.011	<DL	<DL
08.10.2001 02:00	120	0.008	0.007	0.307	0.018	0.099	<DL	<DL	0.004	<DL	0.019
08.10.2001 04:00	120	0.007	0.007	0.333	0.023	0.073	<DL	<DL	0.010	<DL	0.025
08.10.2001 06:00	120	0.007	<DL	0.517	0.030	0.080	0.012	0.007	0.016	<DL	0.014
08.10.2001 08:00	120	0.021	0.007	0.687	0.030	0.113	0.018	0.005	0.011	<DL	<DL
08.10.2001 10:00	60	0.008	0.008	0.930	0.031	0.123	0.006	<DL	0.010	<DL	<DL
Event III											
16.10.2002 21:00	120	<DL	0.001	0.325	0.006	0.120	0.006	0.021	0.025	<DL	0.006
16.10.2002 23:00	120	<DL	0.002	0.247	0.008	0.186	0.007	0.031	0.001	<DL	0.054
17.10.2002 01:00	120	<DL	0.003	0.428	0.009	0.137	0.008	0.011	0.017	<DL	0.000
17.10.2002 03:00	60	<DL	0.003	0.000	0.009	0.099	0.031	0.016	0.000	<DL	0.000

Table VI: Henry constants and thermodynamic data for organic carbonyl compounds and monocarboxylic acids

	H (M atm ⁻¹)	$\Delta H(298K)$ (kJ mol ⁻¹)	$\Delta H R^{-1}$ (K)	
formaldehyde	2,970	-59.8		Betterton und Hoffmann, 1988
acetaldehyde	11.4	-52.1		Betterton und Hoffmann, 1988
propionaldehyde	13	-47.4	-5700	Zhou and Mopper 1990, recalculated by Sander
butyraldehyde	9.6	-51.5	-6200	Zhou and Mopper 1990, recalculated by Sander
valeraldehyde	6.4	-52.4	-6300	Zhou and Mopper 1990, recalculated by Sander
isovaleraldehyde	6.4	-52.4	-6300	same as valeraldehyde
hexanal	4.9	-54.0	-6500	Zhou and Mopper, 1990, recalculated by Sander
heptanal	3.3	-62.4	-7500	Zhou and Mopper, 1990, recalculated by Sander
octanal	2.1	-61.5	-7400	Zhou and Mopper, 1990, recalculated by Sander
methacrolein	4.3	-44.1	-5300	Allen 1998, estimated
glycolaldehyde	41,400	-38.5		Betterton und Hoffmann, 1988
benzaldehyde	37.4	-42.2		Betterton und Hoffmann, 1988
glyoxal	300,000			Betterton und Hoffmann, 1988
methylglyoxal	3,710	-62.7		Betterton und Hoffmann, 1988
diacetyl	74	-47.4	-5700	Betterton, 1991
acetone	32	-48.0	-5770	Betterton, 1991
hydroxyacetone	7,800			Lee and Zhou, 1993
methyl vinyl ketone	21	-64.8	-7800	Allen 1998, estimated
methyl ethyl ketone	20	-41.6	-5000	Zhou and Mopper, 1990, recalculated by Sander
formic acid	5,530	-5630		Khan and Brimblecombe, 1992
acetic acid	5,500	-5890		Khan and Brimblecombe, 1992

Allen, J.M., Balcavage, W.X., Ramachandran, B.R., Shrout, A.L., 1998. Determination of Henry's law constants by equilibrium partitioning in a closed system using a new in situ optical absorbance method. *Environmental Toxicology and Chemistry* 17(7), 1216-1221.

Betterton, E.A., 1991. The partitioning of ketones between the gas and aqueous Phases. *Atmospheric Environment Part a-General Topics* 25(8), 1473-1477.

Betterton, E.A., Hoffmann, M.R., 1988. Henry's law constants of some environmentally important aldehydes. *Environmental Science & Technology* 22(12), 1415-1418.

Khan, I., Brimblecombe, P., 1992. Henry's law constants of low molecular weight. *Journal of Aerosol Science* 23(1), S897-S900.

Lee, Y.N., Zhou, X.L., 1993. Method for the determination of some soluble atmospheric carbonyl compounds. *Environmental Science & Technology* 27(4), 749-756.

Sander, R., <http://www.mpch-mainz.mpg.de/~sander/res/henry.html>

Zhou, X.L., Mopper, K., 1990. Apparent partition coefficients of 15 carbonyl compounds between air and seawater and between air and fresh water - Implications for air sea exchange. *Environmental Science & Technology* 24(12), 1864-1869.

Table VII: Additional data for E I – E III

start time (UTC)	sampling time min	LWC g m ⁻³	T K	pH
Event I				
26.10.2001 22:00	120	0.237	279.4	4.3
27.10.2001 00:00	120	0.336	279.1	5.0
27.10.2001 02:00	120	0.473	278.8	4.6
27.10.2001 04:00	120	0.321	278.7	4.0
27.10.2001 06:00	120	0.407	278.9	4.0
27.10.2001 08:00	120	0.402	279.2	4.2
27.10.2001 10:00	120	0.297	279.9	4.2
27.10.2001 12:00	60	0.234	280.5	4.0
Event II				
07.10.2001 20:00	120	0.259	282.9	4.5
07.10.2001 22:00	120	0.291	282.9	4.6
08.10.2001 00:00	120	0.237	282.9	4.6
08.10.2001 02:00	120	0.268	282.9	4.8
08.10.2001 04:00	120	0.240	282.7	4.7
08.10.2001 06:00	120	0.204	282.6	5.0
08.10.2001 08:00	120	0.121	282.7	4.8
08.10.2001 10:00	60			
Event III				
16.10.2002 21:00	120	0.172	282.4	4.1
16.10.2002 23:00	120	0.212	281.5	4.5
17.10.2002 01:00	120	0.211	281.3	4.6
17.10.2002 03:00	60	0.189	280.7	4.5

Table VIII: Mixing ratios of monocarboxylic acids at the upwind site during FEBUKO, all data in pptV,

<DL: mixing ratio below analytical detection limit, NA: sample not available

start time (UTC)	sampling time (min)	formic acid	acetic acid	propionic acid	butyric acid
Event I					
26.10.2001 22:00	120	179	145	<DL	20
27.10.2001 00:06	114	139	95	<DL	<DL
27.10.2001 02:05	115	138	78	<DL	<DL
27.10.2001 04:09	111	197	168	<DL	20
27.10.2001 06:05	115	201	122	<DL	<DL
27.10.2001 08:05	115	180	257	<DL	<DL
27.10.2001 10:05	115	292	329	20	23
27.10.2001 12:04	116	408	391	26	29
Event II					
07.10.2001 20:00	120	249	224	20	22
07.10.2001 22:09	111	164	207	<DL	<DL
08.10.2001 00:07	113	133	200	<DL	<DL
08.10.2001 02:07	126	145	225	<DL	<DL
08.10.2001 04:20	100	151	178	<DL	<DL
08.10.2001 06:07	113	247	289	20	24
08.10.2001 08:05	115	312	417	23	41
08.10.2001 10:05	115	308	428	26	36
Event III					
16.10.2002 21:00	120	158	98	15	<DL
16.10.2002 23:00	120	122	83	<DL	<DL
17.10.2002 01:00	110	108	72	<DL	<DL
17.10.2002 03:00	79	139	91	<DL	<DL

Table IX: Concentrations of monocarboxylic acids in bulk cloud water during FEBUKO, all data in $\mu\text{mol l}^{-1}$,
 <DL: concentration below detection limit, NA: sample not available

start time (UTC)	sampling	formic acid	acetic acid	propionic acid	butyric acid	lactic acid
	time (min)					
Event I						
26.10.2001 22:00	120	10.0	4.4	0.3	0.2	NA
27.10.2001 00:00	120	8.1	3.9	0.2	0.3	NA
27.10.2001 02:00	120	5.8	2.1	0.2	0.2	NA
27.10.2001 04:00	120	5.0	2.2	<DL	0.2	NA
27.10.2001 06:00	120	6.0	1.6	<DL	<DL	NA
27.10.2001 08:00	120	4.9	2.8	<DL	<DL	NA
27.10.2001 10:00	120	9.2	4.0	0.3	0.5	NA
27.10.2001 12:00	60	NA	NA	NA	NA	NA
Event II						
07.10.2001 18:00	120	NA	NA	NA	NA	NA
07.10.2001 20:00	120	12.9	8.3	0.4	0.3	NA
07.10.2001 22:00	120	9.6	8.2	<DL	<DL	NA
08.10.2001 00:00	120	11.8	12.3	0.4	0.3	NA
08.10.2001 02:00	120	9.2	10.1	0.3	0.3	NA
08.10.2001 04:00	120	11.3	9.5	0.4	0.3	NA
08.10.2001 06:00	120	19.7	18.7	0.6	0.4	NA
08.10.2001 08:00	120	39.1	41.4	0.9	0.8	NA
08.10.2001 10:00	60	NA	NA	NA	NA	NA
Event III						
16.10.2002 21:00	120	10.4	5.3	0.3	<DL	1.1
16.10.2002 23:00	120	7.1	2.2	<DL	<DL	0.9
17.10.2002 01:00	120	6.8	2.0	<DL	0.2	0.5
17.10.2002 03:00	60	8.9	2.5	0.2	<DL	<DL

Table X: Mixing ratios of monocarboxylic acids at the downwind site during FEBUKO, all data in pptV,

<DL: mixing ratios below analytical detection limit, NA: sample not available

start time (UTC)	sampling time (min)	formic acid	acetic acid	propionic acid	butyric acid
Event I					
26.10.2001 22:06	114	171	120	20	20
27.10.2001 00:05	115	118	104	<DL	<DL
27.10.2001 02:05	115	115	72	<DL	<DL
27.10.2001 04:05	115	127	193	<DL	<DL
27.10.2001 06:05	115	126	125	<DL	<DL
27.10.2001 08:05	115	132	220	20	<DL
27.10.2001 10:05	115	230	311	20	20
27.10.2001 12:05	115	251	418	24	28
Event II					
07.10.2001 20:00	115	214	217	<DL	25
07.10.2001 22:01	114	122	205	<DL	<DL
08.10.2001 00:00	115	117	178	<DL	<DL
08.10.2001 02:00	115	115	216	<DL	<DL
08.10.2001 04:00	115	NA	NA	NA	NA
08.10.2001 06:00	115	187	313	<DL	21
08.10.2001 08:00	115	184	325	<DL	<DL
08.10.2001 10:00	115	237	358	20	26
Event III					
16.10.2002 21:06	120	173	102	<DL	15
16.10.2002 23:06	120	112	95	15	<DL
17.10.2002 01:06	104	110	101	<DL	<DL
17.10.2002 03:00	68	121	107	<DL	15

Table XI: Concentrations of dicarboxylic acids at the upwind site during FEBUKO, all data in ng m⁻³,
 <DL: concentration below analytical detection limit, NA: sample not available

start time (UTC)	sampling time (min)	oxalic acid	malonic acid	succinic acid	glutaric acid	suberic acid	azelaic acid
Event I							
26.10.2001 22:00	120	44.2	9.5	4.5	<DL	3.5	<DL
27.10.2001 00:06	114	63.2	10.2	4.4	<DL	<DL	<DL
27.10.2001 02:05	115	56.1	9.1	5.8	<DL	<DL	2.2
27.10.2001 04:09	111	55.8	8.4	5.6	<DL	<DL	<DL
27.10.2001 06:05	115	65.2	12.9	6.9	<DL	<DL	<DL
27.10.2001 08:05	115	80.1	21.2	12.2	2.2	2.8	3.3
27.10.2001 10:05	115	91.3	23.8	11.9	2.1	3.1	4.1
27.10.2001 12:04	116	104.4	23.1	15.5	2.8	3.2	8.3
Event II							
07.10.2001 20:00	120	22.5	5.1	<DL	<DL	<DL	<DL
07.10.2001 22:09	111	31.5	7.2	4.5	<DL	<DL	<DL
08.10.2001 00:07	113	28.3	5.3	4.0	<DL	<DL	<DL
08.10.2001 02:07	126	38.1	6.1	4.0	<DL	<DL	<DL
08.10.2001 04:20	100	27.5	6.2	<DL	<DL	<DL	<DL
08.10.2001 06:07	113	41.1	5.8	<DL	<DL	<DL	2.4
08.10.2001 08:05	115	68.9	11.2	6.5	<DL	<DL	4.1
08.10.2001 10:05	115	101.8	14.5	8.7	2.0	<DL	8.0
EventIII							
16.10.2002 21:00	120	31.5	11.6	13.9	2.8	2.2	28.1
16.10.2002 23:00	120	39.0	7.3	6.8	2.4	1.9	18.6
17.10.2002 01:00	110	28.1	5.4	7.9	2.0	2.0	15.4
17.10.2002 03:00	79	28.4	4.4	4.9	2.0	1.8	10.0

Table XII: Size-resolved concentrations of dicarboxylic acids at the upwind site during FEBUKO, all data in ng m^{-3} ,
 <DL: concentration below analytical detection limit

	Compound	impactor stage 1	impactor stage 2	impactor stage 3	impactor stage 4	impactor stage 5	sum
		(0.05-0.14 μm)	(0.14-0.42 μm)	(0.42-1.2 μm)	(1.2-3.5 μm)	(3.5-10 μm)	(0.05-10 μm)
Event I	oxalate	1.6	8.0	20.8	5.0	<DL	35.3
	malonate	<DL	4.5	17.0	3.4	0.8	25.6
	succinate (incl. isomer)	0.4	3.4	14.7	1.6	0.5	20.6
	glutarate (incl. isomers)	<DL	5.9	17.2	<DL	<DL	23.1
	tartronate	<DL	1.0	2.9	<DL	<DL	3.8
	malate	0.5	2.0	6.5	1.2	0.7	10.9
	tartrate	<DL	1.2	3.3	<DL	<DL	4.5
	citramalate	<DL	<DL	1.7	<DL	<DL	1.7
	maleinate	<DL	1.1	5.3	0.4	<DL	6.8
Event II	oxalate	1.8	9.7	15.6	3.2	0.4	30.6
	malonate	<DL	3.4	8.7	1.7	0.5	14.3
	succinate (incl. isomer)	0.2	1.8	4.4	0.5	0.1	7.1
	glutarate (incl. isomers)	<DL	6.1	9.0	<DL	<DL	15.1
	tartronate	<DL	0.8	1.1	<DL	<DL	1.9
	malate	0.3	2.7	4.7	2.0	1.1	10.8
	tartrate	<DL	1.7	2.2	<DL	<DL	3.9
	citramalate	<DL	0.8	1.2	<DL	<DL	2.0
	maleinate	<DL	0.5	0.7	<DL	<DL	1.2
Event III	oxalate	<DL	6.2	10.8	6.6	<DL	23.6
	malonate	<DL	1.4	2.3	1.5	<DL	5.2
	succinate (incl. isomer)	<DL	1.0	1.3	0.6	<DL	2.9
	glutarate (incl. isomers)	<DL	<DL	<DL	<DL	<DL	<DL
	tartronate	<DL	<DL	0.3	<DL	<DL	0.3
	malate	<DL	1.4	2.2	1.6	0.7	5.9
	tartrate	<DL	0.4	0.4	<DL	<DL	0.8
	citramalate	<DL	<DL	<DL	<DL	<DL	<DL
	maleinate	<DL	<DL	<DL	<DL	<DL	<DL

Table XIII: Concentrations of dicarboxylic acids in bulk cloud water during FEBUKO, all data in $\mu\text{mol l}^{-1}$,
 <DL: concentration below detection limit, NA: sample not available

start time (UTC)	sampling time (min)	oxalic acid ¹	oxalic acid ²	malonic acid ¹	malonic acid ²	succinic acid ¹	succinic acid ²	glutaric acid ¹	glutaric acid ²	azelaic acid ²	tartronic acid ¹	malic acid ¹	tartaric acid ¹	maleic acid ¹	pinic acid ³
Event I															
26.10.2001 22:00	120	3.6	1.8	1.3	0.4	0.5	0.2	0.9	<DL	<DL	<DL	0.2	0.1	0.2	0.04
27.10.2001 00:00	120	2.3	2.2	0.8	0.3	0.2	<DL	<DL	<DL	<DL	<DL	0.1	<DL	0.2	0.003
27.10.2001 02:00	120	1.4	1.5	0.3	0.2	0.2	<DL	<DL	<DL	<DL	0.1	0.1	<DL	0.2	0.03
27.10.2001 04:00	120	2.1	2.0	0.6	0.2	0.3	<DL	<DL	<DL	<DL	<DL	0.1	<DL	0.4	0.02
27.10.2001 06:00	120	2.2	2.0	0.6	0.3	0.3	0.2	0.5	<DL	<DL	<DL	0.1	<DL	0.3	NA
27.10.2001 08:00	120	2.1	2.3	0.6	0.5	0.3	0.4	<DL	<DL	<DL	<DL	0.1	<DL	0.3	0.03
27.10.2001 10:00	120	3.9	3.3	1.1	0.7	0.5	0.4	0.8	<DL	0.2	<DL	0.3	<DL	0.3	0.04
27.10.2001 12:00	60	6.1	NA	2.1	NA	0.5	NA	1.1	NA	NA	<DL	0.2	0.2	0.4	0.05
Event II															
07.10.2001 13:15	55	2.3	NA	0.8	NA	0.6	NA	0.5	NA	NA	<DL	0.2	<DL	0.1	NA
07.10.2001 18:00	120	3.4	NA	1.3	NA	0.8	NA	<DL	NA	NA	<DL	0.3	0.2	0.2	NA
07.10.2001 20:00	120	2.7	1.2	0.7	0.3	0.4	<DL	<DL	<DL	<DL	<DL	0.1	<DL	0.1	0.03
07.10.2001 22:00	120	2.3	1.2	0.6	0.3	0.3	<DL	<DL	<DL	<DL	<DL	0.2	<DL	0.2	0.04
08.10.2001 00:00	120	1.4	1.2	0.6	0.2	0.4	<DL	<DL	<DL	<DL	<DL	0.2	<DL	0.2	0.08
08.10.2001 02:00	120	2.2	1.6	0.5	0.2	0.3	<DL	<DL	<DL	<DL	<DL	0.2	<DL	0.1	0.05
08.10.2001 04:00	120	2.3	1.3	0.6	0.3	0.3	<DL	<DL	<DL	<DL	<DL	0.2	<DL	0.2	0.07
08.10.2001 06:00	120	2.9	2.5	0.9	0.4	0.4	<DL	<DL	<DL	<DL	<DL	0.3	<DL	<DL	0.10
08.10.2001 08:00	120	4.4	5.8	1.6	0.9	0.7	0.5	0.7	<DL	0.3	0.1	0.4	0.2	0.2	NA
08.10.2001 10:00	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Event III															
16.10.2002 21:00	120	3.8	1.7	0.8	0.5	0.5	0.5	<DL	0.1	0.7	<DL	0.3	<DL	0.1	0.08
16.10.2002 23:00	120	2.6	1.9	0.5	0.2	0.2	0.2	<DL	<DL	0.5	<DL	0.2	<DL	0.0	0.03
17.10.2002 01:00	120	2.2	1.5	0.4	0.2	0.2	0.2	<DL	<DL	0.4	<DL	0.2	<DL	0.1	0.03
17.10.2002 03:00	60	2.1	1.7	0.3	0.2	0.2	0.2	<DL	<DL	0.4	<DL	0.2	<DL	0.1	0.11

¹determined following procedure A, see text

²determined following procedure B, see text

³determined by GC-MS

Table XIV: Concentrations of dicarboxylic acids at the downwind site during FEBUKO, all data in ng m⁻³,
 <DL: concentration below analytical detection limit, NA: sample not available

start time (UTC)	sampling time (min)	oxalic acid	malonic acid	succinic acid	glutaric acid	suberic acid	azelaic acid
Event I							
26.10.2001 22:06	114	41.0	9.6	<DL	<DL	2.2	<DL
27.10.2001 00:05	115	55.3	9.6	<DL	<DL	<DL	<DL
27.10.2001 02:05	115	48.5	7.0	4.5	<DL	<DL	<DL
27.10.2001 04:05	115	51.1	7.4	5.0	<DL	<DL	<DL
27.10.2001 06:05	115	57.8	8.9	<DL	<DL	<DL	<DL
27.10.2001 08:05	115	70.7	14.3	8.9	2.2	2.5	3.2
27.10.2001 10:05	115	81.9	20.2	10.5	<DL	2.6	5.1
27.10.2001 12:05	115	98.3	25.1	14.1	2.4	3.3	7.3
Event II							
07.10.2001 20:00	115	18.6	4.4	5.5	<DL	<DL	<DL
07.10.2001 22:01	114	31.5	7.2	4.5	<DL	<DL	<DL
08.10.2001 00:00	115	22.9	4.6	4.0	<DL	<DL	<DL
08.10.2001 02:00	115	37.1	6.1	4.0	<DL	<DL	<DL
08.10.2001 04:00	115	24.3	5.9	5.2	<DL	<DL	<DL
08.10.2001 06:00	115	36.6	5.2	5.0	2.0	<DL	<DL
08.10.2001 08:00	115	67.0	11.3	6.3	<DL	<DL	3.5
08.10.2001 10:00	115	85.1	11.1	7.2	2.4	<DL	6.5
Event III							
16.10.2002 21:06	120	27.3	9.1	12.4	2.5	2.2	26.0
16.10.2002 23:06	120	32.3	5.6	6.5	<DL	2.0	18.6
17.10.2002 01:06	104	26.8	5.3	6.2	<DL	<DL	20.5
17.10.2002 03:00	68	25.6	4.1	4.4	<DL	<DL	14.1

Table XV: Size-resolved concentrations of dicarboxylic acids at the downwind site during FEBUKO, all data in ng m^{-3} ,
 <DL: concentration below analytical detection limit

	Compound	impactor stage 1	impactor stage 2	impactor stage 3	impactor stage 4	impactor stage 5	sum
		(0.05-0.14 μm)	(0.14-0.42 μm)	(0.42-1.2 μm)	(1.2-3.5 μm)	(3.5-10 μm)	(0.05-10 μm)
Event I	oxalate	1.9	7.8	13.5	4.9	<DL	28.0
	malonate	<DL	3.8	12.0	2.4	0.4	18.6
	succinate (incl. isomer)	0.4	3.5	9.5	0.8	0.2	14.4
	glutarate (incl. isomers)	<DL	4.3	11.9	<DL	<DL	16.2
	tartronate	<DL	0.8	2.3	<DL	<DL	3.1
	malate	0.5	2.3	5.1	0.9	0.2	9.0
	tartrate	<DL	1.4	2.6	<DL	<DL	4.1
	citramalate	<DL	<DL	1.4	<DL	<DL	1.4
	maleinate	<DL	1.4	5.2	<DL	<DL	6.6
Event II	oxalate	1.1	6.4	9.2	2.6	<DL	19.4
	malonate	<DL	2.3	4.0	1.5	0.5	8.3
	succinate (incl. isomer)	0.2	1.2	2.0	0.2	0.2	3.9
	glutarate (incl. isomers)	<DL	3.5	4.2	<DL	<DL	7.7
	tartronate	<DL	0.7	0.7	<DL	<DL	1.4
	malate	0.2	1.7	2.6	1.2	1.0	6.7
	tartrate	<DL	1.0	1.1	<DL	<DL	2.2
	citramalate	<DL	<DL	<DL	<DL	<DL	<DL
	maleinate	<DL	0.3	0.3	<DL	<DL	0.7
Event III	oxalate	<DL	4.6	5.8	2.5	0.8	13.7
	malonate	<DL	0.7	0.9	1.1	<DL	2.7
	succinate (incl. isomer)	<DL	0.4	0.6	<DL	<DL	1.0
	glutarate (incl. isomers)	<DL	<DL	<DL	<DL	<DL	<DL
	tartronate	<DL	<DL	<DL	<DL	<DL	<DL
	malate	<DL	0.8	1.4	1.2	0.4	3.8
	tartrate	<DL	<DL	<DL	<DL	<DL	<DL
	citramalate	<DL	<DL	<DL	<DL	<DL	<DL
	maleinate	<DL	<DL	<DL	<DL	<DL	<DL