DISPERSION EXPERIMENTS WITH SULPHUR HEXAFLUORIDE FROM THE 213 m HIGH METEOROLOGICAL MAST AT CABAUW IN THE NETHERLANDS

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1 Introduction

In a combined effort of the Royal Netherlands Meteorological Institute and the KEMA Laboratories dispersion experiments were performed with sulphur hexafluoride (SF_6) from the 200 m meteorological mast at Cabauw in The Netherlands. The object of these experiments was to obtain data on the dispersion from high sources. Such data are important for the calculation of tall stacks, which are presently constructed in large numbers to reduce the local concentration levels.

In each experiment the tracer SF_6 was released from the mast at a height of 80 m or 200 m. The ground level concentration distribution was sampled along one measuring arc situated at about 4 km down wind from the mast. During the experiment an extensive meteorological measuring program was executed. It consisted of the profiles of wind speed, wind direction, temperature and turbulence measured along the mast. Radiosonde soundings, acoustic radar observations, radiation measurements and synoptical observations were also taken.

This report contains the complete data set of the tracer measurements and the meteorological observations obtained during fifteen runs, which were performed from 28 April 1977 until 31 October 1978. All runs consist of two consecutive dispersion experiments of 30 minutes each.

It is not the intention of this report to present analysis of the data or to compare the results with other experimental or theoretical investigations. This may be found in the studies of Nieuwstadt and Van Duuren (1979) and Van Duuren and Nieuwstadt (1980).

2 Description of the Cabauw mast and its location

The meteorological mast at Cabauw is located at 51°58' N and 4°56' E in the centre of The Netherlands. The surroundings are topographically flat within a radius of 20 km or more and consist of meadows, with occasionally lines of trees, river dikes, and small villages. The surface roughness, which is determined by a method proposed by Wieringa (1976), is shown as a function of wind direction and season in Table 1.

The general construction of the mast, which has a height of 213 m, is shown in Figure 1. Along the mast measurement platforms are installed with height intervals of 20 m starting at 20 m from ground level. A measuring platform, which is shown in Figure 2, consists of three booms, which extend 9.4 m beyond the mast. The instruments are mounted on the end of the upwind boom. Additional measurements are performed on an auxiliary 20 m mast in order to obtain surface layer characteristics.

A more extensive description of the mast and its instruments is given by Driedonks et al. (1978).

Table 1 The surface roughness parameter z_o as a function of wind direction and season.

wind direction (degrees)	z_o (m)	
	summer	winter
350 - 020	0.21	0.20
020 - 050	0.18	0.14
050 - 080	0.23	0.17
080 - 110	0.25	0.12
110 - 140	0.19	0.12
140 - 170	0.19	0.10
170 - 200	0.19	0.10
200 - 230	0.17	0.10
230 - 260	0.07	0.06
260 - 290	0.08	0.10
290 - 320	0.12	0.11
320 - 350	0.11	0.09

summer : May - October winter: November - April

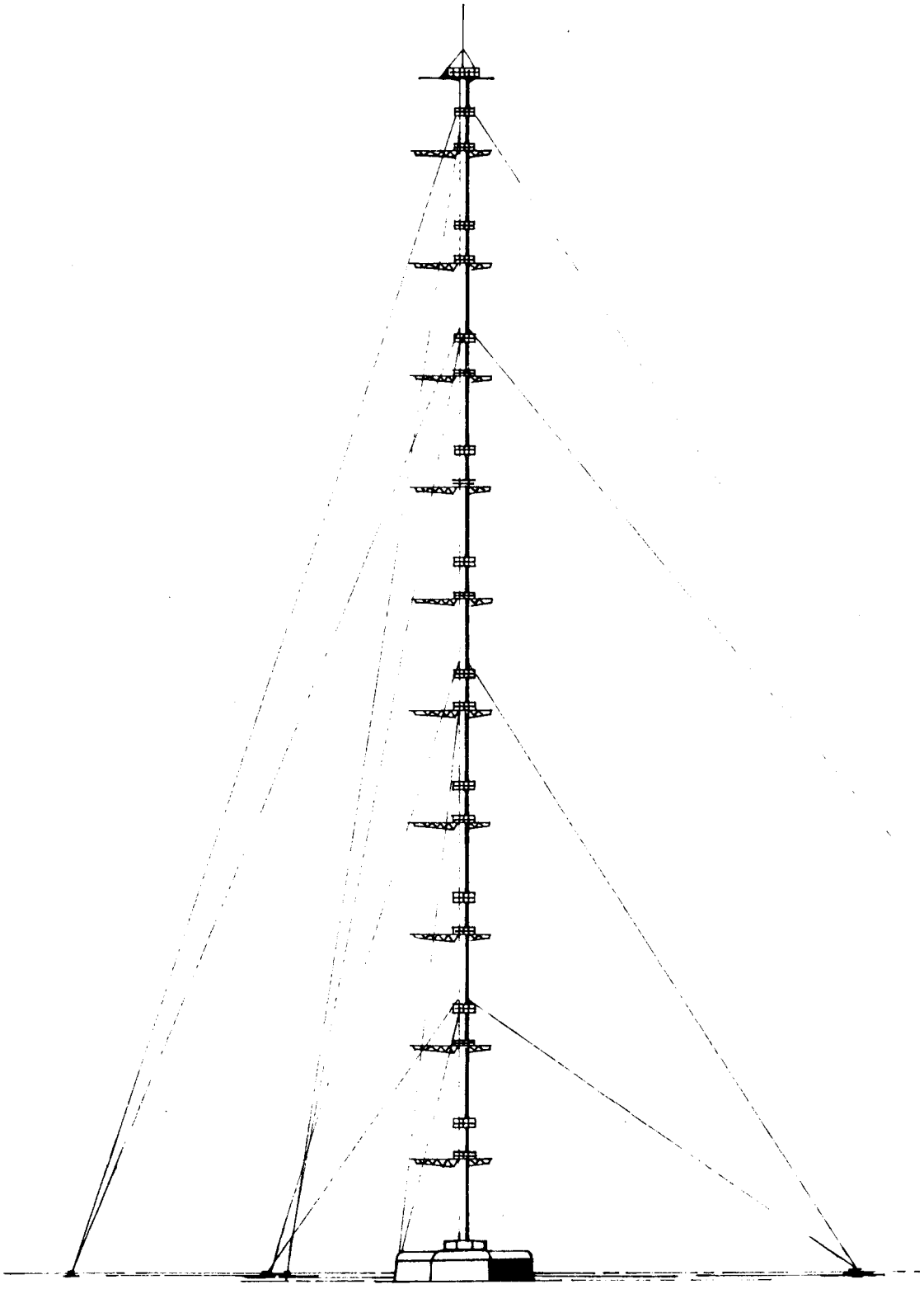


Figure 1 General contruction of the 213 m meteorological mast at Cabauw in The Netherlands

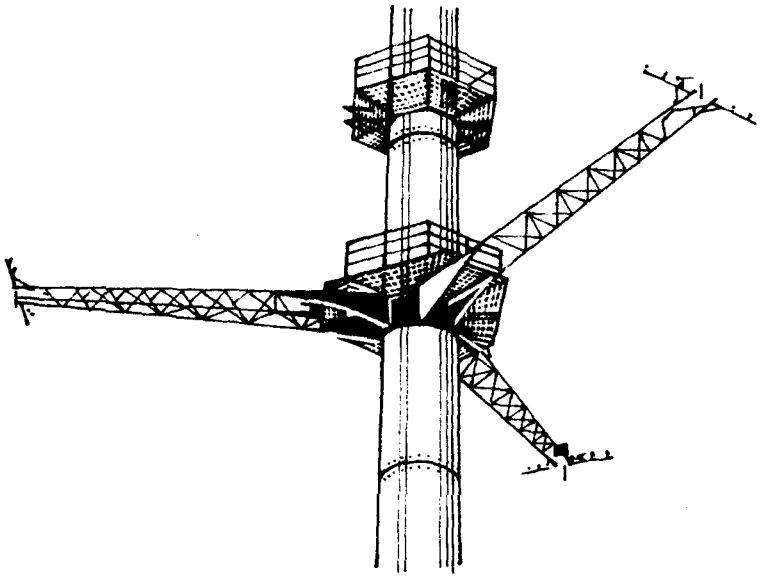


Figure 2 A platform with measuring booms

3 General design of the experiment

The tracer is released from the mast at a height of 80 m or 200 m depending on the meteorological circumstances. The continuous emission is stabilized at least 45 minutes before sampling. The air is sampled down wind from the mast at measuring stations which are installed at preselected locations along a public road. The angular separation between the measuring points is about 1.5^{o}. Figure 3 shows the sampling grid. The distances between these sampling points, which are nesessary to calculate the plume characteristics, are given in Table 2.

Usually 24 manually operated sampling stations (described in chapter 12) are used to measure the ground level concentration distribution. One sampling station was located near the mast to measure the background concentration. Each measuring station takes two consecutive 30-minutes samples of air. So each experiment consists of two consecutive plume measurements. The day in which a dispersion experiment takes place is called run in this report. Fifteen runs are described. For one run concentration measurements are missing due to malfunction of the gaschromatograph.

All times in this report are given in GMT (Greenwich Mean Time). The local time is GMT + 2 hours on 3 April -25 September 1977 and 2 April - 1 October 1978 and GMT + 1 hour otherwise.

Table 2 Distances between the preselected measuring locations shown in Figure 3

Points	Distance(m)
1	0
2	225
3	366
4	587
5	736
6	881
7	1047
8	1179
9	1319
10	1393
11	1539
12	1674
13	1788
14	1904
15	2010
16	2165
17	2267
18	2361
19	2481
20	2555
21	2662
22	2742
23	2830
24	2913
25	3004
26	3090
27	3162

Points	Distance (m)
28	3231
29	3299
30	3396
31	3511
32	3611
33	3678
34	3793
35	3868
36	3937
37	4032
38	4119
39	4200
40	4295
41	4379
42	4481
43	4562
44	4633
45	4721
46	4801
47	4870
48	4971
49	5039
50	5108
51	5175
52	5296
53	5405
54	5505

Points	Distance (m)
55	5602
56	5664
57	5754
58	5868
59	5939
60	6027
61	6144
62	6253
63	6360
64	6431
65	6561
66	6643
67	6793
68	6935
69	7063
70	7186
71	7322
72	7463
73	7641
74	7810
75	7931
76	8115
77	8271
78	8417
79	8563
80	8693
81	8817

Table 2 (continued)

Points	Distance(m)
82	8942
83	9067
84	9192
85	9319
86	9424
87	9526
88	9626
89	9725
90	9825
91	9930
92	10026
93	10126
94	10226
95	10327
96	10428
97	10528
98	10616
99	10719
100	10809
101	10887
102	10954
103	11048
104	11187
105	11373
106	11527
107	11691
108	11806

Points	Distance (m)

Points	Distance (m)

Table 2 (continued)

Points	Distance(m)
110	0
111	249
112	476
113	609
114	864
115	1055
116	1273
117	1411
118	1586
119	1758
120	1909
121	2061
122	2205
123	2369
124	2523
125	2726
126	2923
127	3081
128	2363
129	3421
130	3590
131	3761
132	3928
133	4076
134	4255
135	4408
136	4609

Points	Distance (m)
137	4744
138	4889
139	4975
140	5132
141	5236
142	5336
143	5412
144	5529
145	5649
146	5758
147	5880
148	5970
149	6070
150	6175
151	6274
152	6359
153	6476
154	6563
155	6675
156	6788
157	6909
158	7083
159	7570
160	7802
161	8054
162	8319
163	8526

Points	Distance (m)
164	8719
165	8955
166	9190
167	9453
168	9695

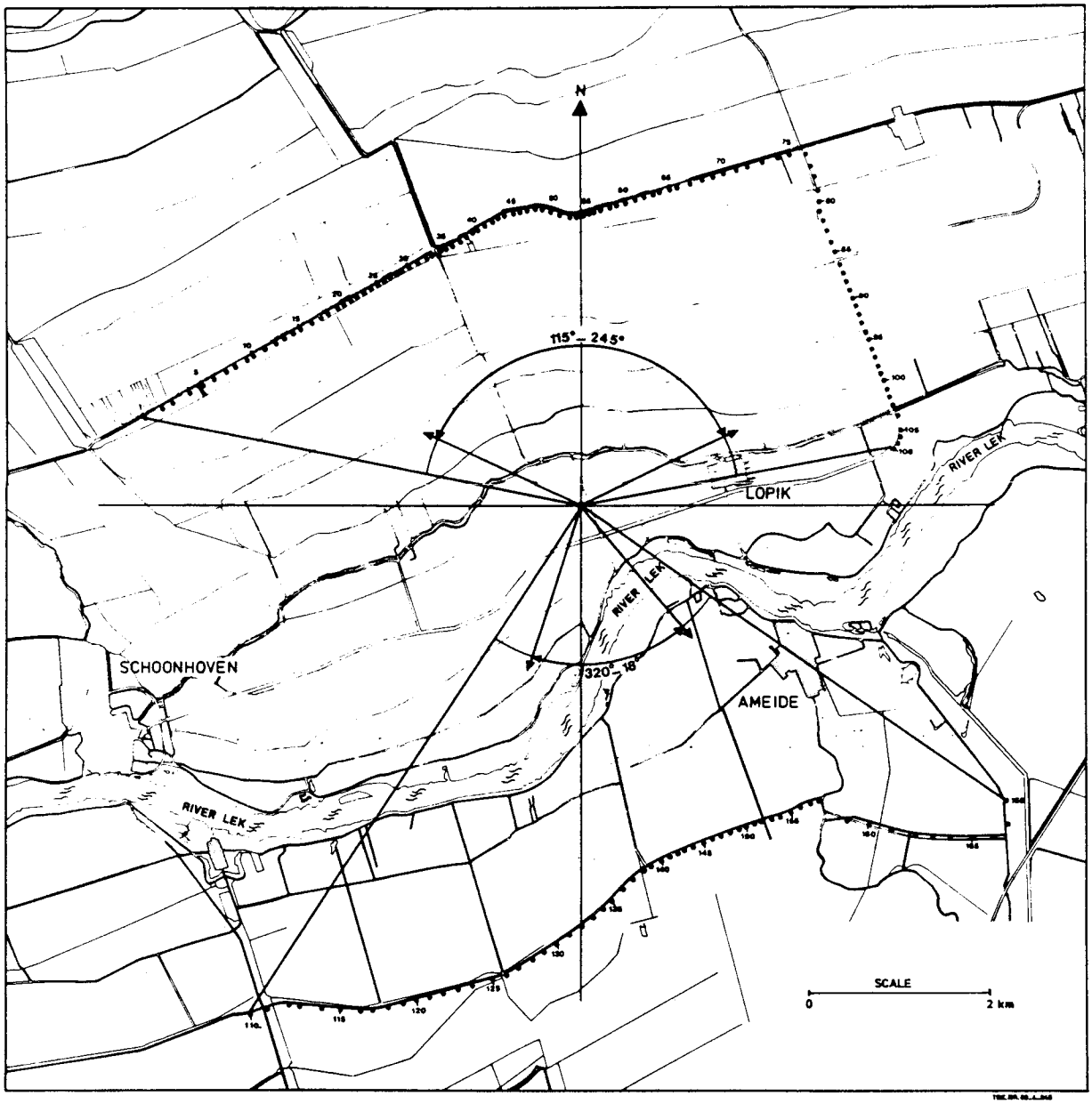


Figure 3 Map of the area in the neighbourhood of Cabauw with the preselected locations of the sampling stations

4 Profile data

The 30-minutes average wind speed U (m/s), wind direction α (degrees) and temperature T (^{o}C) are presented as a function of height for each run in the Tables 3 to 17.

The wind speed is measured with a cup anemometer with a starting speed of less than 0.6 m/s and a response length of 2.9 m (Monna and Driedonks, 1979). Wind direction is measured by a wind vane. Its damping ratio is 0.4 and the damped wave length is 3.8 m (Monna and Driedonks, 1979). On the levels where trivanes are installed, wind direction is no longer measured by the vanes but by the trivanes. Temperature is measured with ventilated, shielded thermocouples (Slob, 1978). The inaccuracy is about 0.05 K in dry weather conditions.

The signals of these instruments are recorded as two minutes averages and stored on paper tape. This paper tape registration is processed and checked by a computer, which calculates the 30-minutes averages.

RUN 1 (28 April 1977). Table 3

time in GMT

	height in m	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	
U	200	7.5	8.3	7.8	7.4	7.8	8.1	8.5	
	160	7.5	8.3	8.0	7.5	7.8	7.9	8.3	
	120	7.3	8.1	8.0	7.4	7.6	7.6	8.0	
	80	---	7.8	7.6	6.9	7.0	7.3	8.2	
	40	6.8	7.5	7.2	6.5	6.4	6.1	7.2	
	20	6.0	6.7	6.3	5.7	5.5	5.0	5.9	
	10	5.6	6.2	5.8	5.2	5.0	4.5	5.4	
	5	5.3	5.8	5.4	4.8	4.5	4.2	4.9	
	1.5	4.1	4.7	4.3	3.9	3.5	3.3	3.8	
∝	200	158	162	164	153	161	153	164	
	160	157	158	159	148	156	148	160	
	120	156	156	159	147	156	146	159	
	80	---	158	160	148	157	147	161	
	40	---	---	---	---	---	---	---	
	20	149	150	153	141	151	141	152	
T	213	----	10.3	10.6	10.9	11.2	11.4	11.6	
	200	9.9	10.4	10.8	11.1	11.4	11.6	11.7	
	160	10.3	10.8	11.2	11.4	11.7	11.9	12.1	
	120	10.8	11.3	11.7	11.9	12.2	12.4	12.5	
	80	11.1	11.7	12.0	12.3	12.5	12.7	12.9	
	40	11.6	12.1	12.4	12.8	12.9	13.1	13.2	
	20	11.7	12.3	12.6	13.0	13.1	13.2	13.3	
	10	11.9	12.4	12.8	13.1	13.2	13.3	13.4	
	5	12.0	12.6	12.9	13.3	13.3	13.3	13.4	
	2	12.2	12.7	13.1	13.5	13.4	13.3	13.3	
	0.6	12.5	13.1	13.4	13.8	13.5	13.3	13.3	

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in °C

RUN 2 (12 October 1977).

Table 4

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00		
U	200	8.2	8.4	9.1	9.6	9.0	8.4		
	160	7.9	8.3	9.0	9.3	8.8	8.2		
	120	7.7	8.3	9.0	9.1	8.8	8.1		
	80	7.3	8.0	8.5	8.5	8.4	7.7		
	40	6.8	7.4	7.8	7.7	7.9	7.0		
	20	6.8	7.1	7.1	7.2	7.3	6.7		
	10	6.4	6.6	6.4	6.7	6.6	6.0		
	5	5.9	6.1	6.0	6.2	6.1	5.4		
	1.5	4.9	5.1	5.0	5.1	5.1	4.6		
α	200	200	200	195	195	205	214		
	160	198	198	193	191	203	212		
	120	194	194	195	192	197	204		
	80	193	194	194	193	197	204		
	40	---	---	---	---	199	203		
	20	193	193	187	185	197	202		
T	213	12.1	12.6	13.1	13.9	14.3	---		
	200	12.3	12.8	13.3	14.0	14.4	---		
	160	12.7	13.2	13.7	14.4	14.8	15.1		
	120	13.2	13.7	14.2	14.9	15.3	15.5		
	80	13.5	14.1	14.6	15.3	15.7	15.9		
	40	14.0	14.5	15.0	15.7	16.1	16.3		
	20	14.2	14.7	15.2	15.9	16.2	16.4		
	10	14.3	14.9	15.3	16.0	16.4	16.5		
	5	14.5	15.0	15.5	16.1	16.5	16.6		
	2	14.6	15.1	15.6	16.2	16.6	16.6		
	0.6	14.9	15.4	15.9	16.5	16.7	16.6		

U is wind velocity in $^{m}/_{s}$

α is wind direction in degrees

T is temperature in °C

RUN 3 (18 October 1977). Table 5

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30			
U	200	6.5	6.0	5.9	5.7	5.4			
	160	6.1	5.8	5.7	5.4	5.1			
	120	6.2	5.9	5.7	5.5	5.0			
	80	6.0	5.6	5.4	4.9	4.5			
	40	5.5	5.1	5.1	4.6	4.1			
	20	4.6	4.3	4.1	4.0	3.5			
	10	4.2	4.0	4.0	3.7	3.2			
	5	3.9	3.8	3.9	3.4	2.9			
	1.5	3.3	3.1	3.1	2.8	2.4			
∝	200	146	154	153	156	159			
	160	144	151	151	153	156			
	120	146	151	154	153	156			
	80	150	152	157	155	157			
	40	---	---	---	---	---			
	20	140	140	145	143	141			
T	213	11.8	12.1	12.7	13.2	13.6			
	200	11.9	12.2	12.9	13.3	13.7			
	160	12.1	12.6	13.3	13.7	14.1			
	120	12.6	13.0	13.7	14.1	14.5			
	80	12.9	13.4	14.1	14.5	14.9			
	40	13.3	13.8	14.5	14.9	15.2			
	20	13.6	14.1	14.7	15.1	15.4			
	10	13.8	14.2	14.9	15.2	15.5			
	5	13.9	14.4	15.0	15.3	15.6			
	2	14.1	14.5	15.1	15.4	15.6			
	0.6	14.4	14.8	15.3	15.5	15.6			

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 4 (27 October 1977). Table 6

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00	15.00 / 15.30	
U	200	4.3	4.4	4.5	4.8	4.2	4.3	4.4	
	160	4.1	4.2	4.1	4.5	3.9	3.8	3.7	
	120	3.9	4.2	4.0	4.2	3.8	3.5	3.5	
	80	3.6	3.8	3.5	3.6	3.4	3.1	2.7	
	40	3.2	3.5	3.3	3.1	3.0	2.6	2.3	
	20	2.9	3.2	3.0	2.9	2.6	2.2	2.0	
	10	2.8	2.9	2.8	2.7	2.4	2.0	1.9	
	5	2.6	2.7	2.6	2.4	2.2	1.8	1.7	
	1.5	2.2	2.3	2.1	2.0	1.8	1.6	1.4	
∝	200	186	182	179	181	175	184	184	
	160	184	177	175	174	164	170	174	
	120	185	178	173	172	163	159	165	
	80	186	179	172	171	162	157	168	
	40	---	---	---	---	---	---	---	
	20	169	163	154	151	147	141	156	
T	213	9.3	9.4	9.5	9.7	9.7	9.7	9.8	
	200	9.4	9.5	9.6	9.7	9.8	9.7	9.8	
	160	9.6	9.7	9.8	10.0	10.0	10.0	10.1	
	120	9.9	9.9	10.0	10.2	10.3	10.3	10.4	
	80	10.4	10.3	10.4	10.5	10.5	10.6	10.7	
	40	10.5	10.4	10.5	10.7	10.8	10.8	11.0	
	20	10.9	10.9	11.0	11.1	11.3	11.4	11.5	
	10	10.7	10.7	10.9	11.2	11.4	11.5	11.6	
	5	11.1	11.1	11.1	11.3	11.5	11.6	11.6	
	2	10.8	10.8	10.9	11.1	11.3	11.6	11.6	
	0.6	10.9	10.9	11.2	11.4	11.5	11.6	11.7	

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 5 (22 December 1977). Table 7

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00			
U	200	11.9	11.3	10.5	10.2	9.3			
	160	11.0	10.2	9.5	9.3	8.3			
	120	10.1	9.3	8.6	8.6	7.6			
	80	8.5	7.9	7.2	7.3	6.5			
	40	6.8	6.4	5.9	5.8	5.3			
	20	6.4	5.7	5.3	5.5	4.8			
	10	5.8	5.1	4.8	5.0	4.2			
	5	5.3	4.8	4.4	4.6	3.9			
	1.5	4.4	3.9	3.6	3.8	3.2			
∝	200	220	221	219	216	224			
	160	217	217	215	214	223			
	120	209	209	207	209	217			
	80	211	209	208	211	219			
	40	198	196	---	201	204			
	20	198	196	195	198	202			
T	213	8.0	8.0	8.0	8.0	8.4			
	200	8.0	8.2	8.2	8.2	8.5			
	160	8.0	8.0	8.1	8.3	8.7			
	120	8.0	8.1	8.3	8.6	8.9			
	80	8.3	8.4	8.5	8.8	9.2			
	40	8.5	8.7	8.8	9.1	9.5			
	20	8.7	8.8	8.9	9.3	9.6			
	10	8.8	8.9	9.0	9.3	9.6			
	5	8.8	9.0	9.0	9.4	9.6			
	2	8.8	9.0	9.0	9.3	9.6			
	0.6	8.8	8.9	9.0	9.3	9.6			

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 6 (17 January 1978). Table 8

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30		
U	200	10.0	9.1	8.0	8.3	8.7	8.6		
	160	9.4	8.7	7.5	7.9	8.3	8.2		
	120	8.3	7.8	6.9	7.2	7.6	7.6		
	80	7.4	7.0	6.2	6.5	6.8	6.9		
	40	6.4	6.1	5.5	5.6	5.8	6.1		
	20	5.7	5.6	5.0	5.0	5.0	5.1		
	10	5.2	5.2	4.6	4.5	4.5	4.5		
	5	4.9	4.9	4.3	4.2	4.2	4.2		
	1.5	4.0	3.9	3.4	3.3	3.3	3.4		
α	200	202	196	197	196	194	195		
	160	195	192	195	194	188	188		
	120	191	191	195	194	189	188		
	80	187	188	192	193	187	188		
	40	---	---	---	---	---	---		
	20	187	189	192	192	187	190		
T	213	3.5	3.5	3.7	3.9	3.9	4.0		
	200	3.6	3.6	3.8	4.0	4.0	4.1		
	160	3.7	3.8	4.1	4.3	4.4	4.4		
	120	3.9	4.1	4.5	4.7	4.8	4.8		
	80	4.2	4.5	4.8	5.0	5.1	5.1		
	40	4.5	4.8	5.2	5.4	5.5	5.5		
	20	---	---	---	---	---	---		
	10	5.3	5.1	5.5	5.6	5.7	5.8		
	5	5.4	5.2	5.6	5.6	5.7	5.8		
	2	5.4	5.2	5.6	5.6	5.7	5.8		
	0.6	5.4	5.3	5.6	5.5	5.7	5.7		

U is wind velocity in $^{m}/_{s}$

α is wind direction in degrees

T is temperature in ^{o}C

RUN 7 (18 April 1978). Table 9

time in GMT

	height in m	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30		
U	200	8.5	9.3	7.5	7.8	8.2	---		
	160	8.4	9.2	7.4	7.8	8.1	---		
	120	8.6	9.1	7.4	7.6	7.8	---		
	80	8.0	8.6	7.0	7.1	7.3	---		
	40	7.4	8.4	6.7	7.0	6.9	---		
	20	6.4	7.3	5.9	6.1	6.0	---		
	10	6.0	6.8	5.5	5.7	5.6	---		
	5	5.7	6.4	5.3	5.4	5.3	---		
	1.5	4.7	5.2	4.4	4.4	4.5	---		
∝	200	146	145	145	143	136	---		
	160	147	147	147	145	137	---		
	120	150	150	149	147	139	---		
	80	149	149	147	146	138	---		
	40	---	---	---	---	---	---		
	20	145	145	143	143	135	---		
T	213	---	---	---	---	---	---		
	200	7.2	7.7	8.0	8.3	8.5	---		
	160	7.7	8.0	8.4	8.7	8.9	---		
	120	8.2	8.6	8.9	9.2	9.5	---		
	80	8.5	8.9	9.2	9.5	9.8	---		
	40	9.0	9.3	9.7	10.0	10.3	---		
	20	9.2	9.6	9.9	10.2	10.5	---		
	10	9.4	9.8	10.1	10.4	10.7	---		
	5	9.6	10.0	10.3	10.6	10.9	---		
	2	9.9	10.3	10.6	11.0	11.2	---		
	0.6	10.4	11.0	11.3	11.7	12.0	---		

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 8 (25 May 1978). Table 10

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00		
U	200	---	7.4	7.2	7.0	6.8	7.8		
	160	6.8	7.1	6.8	6.8	6.5	7.7		
	120	6.5	6.8	6.6	6.6	6.4	7.7		
	80	6.1	6.3	6.4	6.3	6.2	7.4		
	40	5.5	5.7	5.8	5.8	5.8	6.7		
	20	---	---	---	---	---	---		
	10	---	---	---	---	---	---		
	5	---	---	---	---	---	---		
	1.5	---	---	---	---	---	---		
α	200	354	352	351	356	353	357		
	160	348	346	345	352	348	353		
	120	343	343	343	350	346	350		
	80	337	339	340	347	343	347		
	40	332	335	336	344	340	343		
	20	328	330	331	340	337	339		
T	213	---	---	---	---	---	---		
	200	7.3	7.3	7.4	7.4	7.6	7.7		
	160	7.5	7.5	7.6	7.6	7.8	7.9		
	120	7.7	7.8	7.8	7.9	8.0	8.1		
	80	8.1	8.1	8.4	8.5	8.6	8.4		
	40	8.7	8.9	9.0	8.9	9.0	9.1		
	20	8.9	9.2	9.3	9.1	9.2	9.4		
	10	9.0	9.3	9.4	9.3	9.3	9.5		
	5	9.1	9.4	9.4	9.3	9.4	9.6		
	2	8.9	9.5	9.5	9.4	9.5	9.6		
	0.6	9.1	9.7	9.6	9.5	9.6	9.7		

U is wind velocity in $^{m}/_{s}$

α is wind direction in degrees

T is temperature in ^{o}C

RUN 9 (13 June 1978). Table 11

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00		
U	200	6.6	6.8	6.8	6.0	6.4	6.6		
	160	6.7	6.7	6.2	5.9	6.2	6.5		
	120	6.8	6.7	6.2	5.8	6.2	6.4		
	80	6.5	6.6	6.3	5.8	6.2	6.3		
	40	6.4	6.5	6.2	5.5	6.1	6.1		
	20	---	---	---	---	---	---		
	10	---	---	---	---	---	---		
	5	---	---	---	---	---	---		
	1.5	---	---	---	---	---	---		
∝	200	316	321	320	329	328	331		
	160	315	319	319	325	324	328		
	120	312	320	316	322	322	326		
	80	313	320	316	319	322	324		
	40	312	324	318	318	325	326		
	20	314	324	319	319	324	323		
T	213	---	---	---	---	---	---		
	200	10.1	9.9	9.9	10.2	10.3	10.3		
	160	10.4	10.2	10.2	10.5	10.7	10.7		
	120	10.9	10.6	10.7	11.0	11.1	11.1		
	80	11.3	11.0	11.1	11.4	11.5	11.5		
	40	11.8	11.6	11.6	12.0	12.0	12.1		
	20	12.1	11.9	11.8	12.3	12.3	12.3		
	10	12.5	12.1	12.2	12.6	12.6	12.6		
	5	12.8	12.5	12.6	13.0	13.0	12.9		
	2	13.1	13.0	13.0	13.4	13.4	13.2		
	0.6	13.6	13.7	13.7	14.1	14.0	13.8		

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 10 (26 July 1978). Table 12

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30			
	200	8.5	8.4	9.6	9.2	10.9			
	160	8.1	8.1	9.2	9.0	10.7			
	120	7.4	7.5	8.8	8.5	10.3			
	80	6.3	6.7	8.0	7.5	9.7			
U	40	5.0	6.0	7.3	6.7	8.9			
	20	4.3	5.1	6.7	5.8	8.0			
	10	3.8	4.6	6.1	5.3	7.3			
	5	3.5	4.3	5.7	4.9	6.6			
	1.5	2.9	3.5	4.6	3.9	5.5			
	200	196	197	195	196	200			
	160	---	---	---	---	---			
∝	120	194	190	196	192	201			
	80	198	191	195	193	196			
	40	---	---	---	---	---			
	20	192	184	194	187	198			
	213	---	---	---	---	---			
	200	19.7	19.7	20.2	20.6	20.8			
	160	20.0	20.0	20.6	20.9	21.2			
	120	20.3	20.4	21.0	21.3	21.6			
	80	20.6	20.8	21.4	21.6	22.0			
T	40	20.9	21.1	21.8	22.0	22.4			
	20	21.1	21.3	21.9	22.1	22.6			
	10	21.1	21.5	22.1	22.2	22.8			
	5	21.1	21.6	22.2	22.3	22.9			
	2	21.1	21.6	22.2	22.3	23.0			
	0.6	21.1	21.8	22.3	22.3	23.1			

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 11 (2 August 1978). Table 13

time in GMT

	height in m	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30		
U	200	10.7	10.9	11.7	10.6	9.8	11.5		
	160	10.6	10.9	11.7	10.6	9.7	11.6		
	120	10.2	10.8	11.4	10.4	9.5	11.5		
	80	9.6	10.0	10.5	9.8	9.1	10.9		
	40	8.8	8.7	9.5	8.8	8.1	9.7		
	20	7.6	8.0	8.1	7.8	7.3	8.3		
	10	6.9	7.3	7.4	7.1	6.5	7.6		
	5	6.5	6.8	6.9	6.6	6.0	7.2		
	1.5	5.4	5.7	5.7	5.6	5.2	6.0		
∝	200	191	191	193	195	195	193		
	160	188	188	192	199	198	195		
	120	185	185	191	199	198	196		
	80	187	187	191	195	196	196		
	40	---	---	---	196	---	---		
	20	179	180	188	198	198	193		
T	213	---	---	---	---	---	---		
	200	18.4	18.4	18.3	17.6	17.3	17.2		
	160	18.8	18.8	18.7	18.0	17.7	17.6		
	120	19.3	19.2	19.1	18.4	18.1	18.0		
	80	19.7	19.6	19.5	18.8	18.5	18.4		
	40	20.2	20.1	19.9	19.3	18.9	19.0		
	20	20.5	20.3	20.1	19.5	19.1	19.3		
	10	20.8	20.5	20.3	19.7	19.3	19.6		
	5	21.0	20.6	20.4	19.8	19.3	19.7		
	2	21.3	20.9	20.5	19.9	19.5	20.0		
	0.6	21.9	21.3	20.7	20.2	19.7	20.4		

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 12 (16 August 1978). Table 14

time in GMT

	height in m	08.30 / 09.00	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30		
U	200	9.2	9.8	10.1	8.7	10.3	10.5		
	160	9.1	9.7	10.0	8.6	9.9	10.4		
	120	9.0	9.6	9.8	8.4	9.5	10.2		
	80	8.7	9.2	9.3	7.7	8.3	9.6		
	40	8.4	8.6	9.1	6.8	7.5	9.2		
	20	8.6	---	---	6.2	6.8	9.2		
	10	7.9	---	---	5.4	6.1	8.4		
	5	7.2	---	---	4.9	5.5	7.5		
	1.5	5.3	6.1	5.4	3.7	4.3	5.7		
α	200	229	223	236	257	250	245		
	160	225	219	233	255	245	241		
	120	227	219	236	260	247	243		
	80	229	222	240	265	251	246		
	40	219	213	232	259	243	236		
	20	223	217	236	266	246	240		
T	213	---	---	---	---	---	---		
	200	14.6	14.9	14.5	12.7	12.7	15.6		
	160	15.0	15.3	14.8	12.9	13.5	16.3		
	120	15.4	15.8	15.2	13.0	13.2	16.0		
	80	15.8	16.2	15.5	13.2	13.5	16.0		
	40	16.3	16.8	15.9	13.5	13.8	16.2		
	20	16.5	17.0	16.9	14.5	14.0	16.1		
	10	16.7	17.3	17.0	14.5	14.7	16.4		
	5	17.0	17.6	17.1	14.8	14.5	15.4		
	2	17.2	18.0	16.8	14.0	14.7	14.8		
	0.6	17.5	18.5	17.2	14.2	15.1	14.3		

U is wind velocity in $^{m}/_{s}$

α is wind direction in degrees

T is temperature in ^{o}C

RUN 13 (10 October 1978). Table 15

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00	15.00 / 15.30
U	200	10.5	9.7	9.6	8.2	8.9	10.5	10.2	9.8
	160	8.8	8.0	7.9	7.2	8.6	9.8	9.2	8.9
	120	7.1	6.6	6.7	6.3	8.0	8.8	8.1	7.8
	80	5.8	5.7	5.8	5.3	7.5	8.0	6.7	6.4
	40	4.3	4.2	4.3	3.7	6.0	6.0	4.8	4.5
	20	3.2	3.0	3.1	2.8	4.4	4.3	3.7	3.3
	10	2.8	2.6	2.7	2.8	3.8	3.6	3.1	2.7
	5	---	---	---	---	---	---	---	2.5
	1.5	2.2	2.1	2.0	1.7	2.9	2.7	2.5	2.0
∝	200	137	136	133	126	129	132	125	126
	160	131	132	129	121	125	130	121	125
	120	120	120	120	112	117	121	112	120
	80	110	111	110	103	109	112	103	115
	40	---	---	---	---	---	---	---	---
	20	109	113	107	101	112	113	97	112
T	213	---	---	---	---	---	---	---	---
	200	20.0	19.5	19.8	19.4	18.8	18.7	18.7	18.6
	160	19.1	19.2	19.4	19.3	19.0	18.9	18.8	---
	120	18.8	19.2	19.4	19.4	19.2	19.1	18.9	---
	80	18.8	19.3	19.6	19.7	19.5	19.3	19.1	---
	40	19.0	19.5	19.8	19.8	19.6	19.3	---	---
	20	19.1	19.6	19.8	20.0	19.7	19.4	19.3	19.2
	10	19.2	19.7	19.9	20.0	19.7	19.4	19.3	19.2
	5	19.2	19.8	19.9	20.0	19.7	19.4	19.3	19.2
	2	19.3	19.8	19.9	20.0	19.7	19.4	19.3	19.1
	0.6	19.3	19.8	19.9	20.0	19.5	19.2	19.1	18.9

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

RUN 14 (12 October 1978). Table 16

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00	15.00 / 15.30
U	200	4.1	4.8	6.2	6.9	6.8	7.1	6.7	6.7
	160	3.8	4.5	6.0	6.6	6.5	6.6	6.2	6.0
	120	3.6	4.3	5.9	6.4	6.2	6.2	5.6	5.4
	80	3.5	4.2	5.9	6.2	5.9	5.8	4.8	4.4
	40	3.2	3.9	5.2	5.4	4.9	4.7	3.9	3.1
	20	2.9	3.3	4.2	4.3	3.9	3.6	3.0	2.0
	10	2.8	3.0	3.8	3.7	3.4	3.1	2.6	1.5
	5	2.7	2.9	3.6	3.5	3.3	2.9	2.4	1.4
	1.5	2.2	2.5	3.0	3.0	2.8	2.4	2.0	1.1
∝	200	130	115	120	117	125	133	137	140
	160	126	113	119	116	124	132	136	140
	120	120	110	116	113	119	127	132	137
	80	121	115	119	116	120	128	135	140
	40	---	---	---	---	---	---	---	---
	20	121	114	111	110	114	122	130	130
T	213	---	---	---	---	---	---	---	---
	200	15.0	15.7	16.2	16.9	17.5	17.9	18.0	18.1
	160	15.3	16.0	16.6	17.2	17.9	18.3	18.3	18.4
	120	15.6	16.4	17.0	17.7	18.3	18.7	18.7	18.7
	80	16.1	16.7	17.3	18.0	18.6	19.0	19.0	18.9
	40	16.5	17.2	17.7	18.4	19.0	19.3	19.3	19.0
	20	16.7	17.4	18.0	18.6	19.2	19.5	19.4	19.0
	10	16.8	17.6	18.1	18.7	19.3	19.5	19.5	19.0
	5	17.0	17.7	18.3	18.8	19.3	19.6	19.5	19.0
	2	17.2	17.9	18.4	19.9	19.4	19.6	19.4	18.8
	0.6	17.6	18.2	18.6	19.2	19.5	19.6	19.3	18.6

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

19.0 looks more in line

RUN 15 (31 October 1978). Table 17

time in GMT

	height in m	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30
U	200	5.6	5.5	5.2	5.1	4.3	4.6	4.2	4.1
	160	5.7	5.5	5.1	5.0	4.4	4.6	4.2	4.3
	120	---	---	5.1	4.9	4.3	4.5	4.0	4.3
	80	5.6	---	4.9	4.8	4.0	4.4	3.9	4.2
	40	5.2	5.0	4.8	4.7	4.0	4.3	3.7	3.9
	20	4.9	4.8	4.7	4.4	3.6	4.0	3.4	3.8
	10	4.5	4.4	4.3	4.1	3.4	3.7	3.2	2.8
	5	4.2	4.1	4.1	3.9	3.3	3.4	3.0	2.6
	1.5	3.4	3.3	3.3	3.2	2.6	2.7	2.4	2.0
∝	200	185	186	184	180	182	187	187	189
	160	186	189	186	182	181	189	189	191
	120	---	---	189	184	182	192	190	192
	80	191	---	188	182	178	190	189	190
	40	---	---	---	---	---	---	---	---
	20	183	185	187	183	179	191	190	189
T	213	---	---	---	---	---	---	---	---
	200	8.2	8.3	8.4	8.6	8.9	9.1	9.3	9.4
	160	8.6	8.7	8.8	9.0	9.3	9.5	9.7	9.8
	120	9.0	9.1	9.2	9.4	9.7	9.9	10.1	10.1
	80	9.3	---	9.6	9.8	10.1	10.3	10.5	10.5
	40	9.7	9.8	10.0	10.2	10.5	10.7	10.8	10.9
	20	10.1	10.2	10.4	10.6	10.8	11.0	11.0	11.1
	10	10.1	10.2	10.4	10.6	10.9	11.0	11.1	11.1
	5	10.2	10.4	10.6	10.8	11.0	11.1	11.2	11.1
	2	10.3	10.5	10.7	10.9	11.0	11.2	11.2	11.1
	0.6	10.6	10.8	11.0	11.2	11.2	11.2	11.3	11.0

U is wind velocity in $^{m}/_{s}$

∝ is wind direction in degrees

T is temperature in ^{o}C

5 Turbulence data

Turbulence is observed with a trivane (Wiering, 1972). It measures the wind vector: the magnitude by a propeller and the direction by the azimuth and elevation angle. The response length of the propeller is 0.5 m. The direction response has a damping ratio of 0.56 and a damped wavelength of 4 m (Monna and Driedonks, 1979). Temperature fluctuations are measured with two fast response thermocouples, which are installed on both sides of the trivane. The response of this temperature array is primarily determined by the distance between the thermocouples (1 m) and can be considered equivalent to a response length of 0.5 m. The trivane and thermocouples form a matched array, which can reliably measure turbulent fluctuations down to 3 m wavelength.

All turbulence data are handled by a H.P. 21 MX minicomputer and stored on magnetic tape. The registration frequency is 5 Hz.

The levels, at which trivanes and thermocouples were installed, vary for each run. Data presented as 30-minutes averages are given in the Tables 18 to 46.

The first set of tables, Tables 17 to 32, gives the standard deviation of the velocity, azimuth, elevation and temperature. The second set of tables, Tables 33 to 46, shows the absolute value of the Reynold stress, its direction and the horizontal and vertical heatflux (for run 4 no turbulent fluxes are available).

RUN 1 (28 April 1977). Table 18

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00				
σ_U	200	0.77	0.93	0.82	1.05				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.79	1.00	1.07	1.26				
	40	---	---	---	---				
	20	1.02	1.16	1.35	1.26				
σ_A	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	7.6	6.2	7.9	6.8				
	40	---	---	---	---				
	20	9.2	8.0	9.5	8.8				
σ_E	200	4.7	5.9	6.4	4.4				
	160	---	---	---	---				
	120	---	---	---	---				
	80	4.8	4.5	6.0	5.2				
	40	---	---	---	---				
	20	4.6	4.4	5.9	5.4				
σ_T	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	---	---	---	---				
	40	---	---	---	---				
	20	---	---	---	---				

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 2 (12 October 1977). Table 19

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30				
σ_U	200	0.64	0.82	0.87	0.63				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.84	0.82	1.15	0.88				
	40	---	---	---	---				
	20	1.01	1.09	1.24	1.20				
σ_A	200	4.7	5.7	6.9	4.2				
	160	---	---	---	---				
	120	4.7	5.0	7.0	4.1				
	80	5.8	5.8	7.6	5.3				
	40	---	---	---	---				
	20	7.0	7.6	9.6	7.8				
σ_E	200	3.8	3.2	3.4	2.7				
	160	---	---	---	---				
	120	4.2	3.4	3.9	2.9				
	80	4.1	4.1	4.2	3.2				
	40	---	---	---	---				
	20	4.8	5.6	5.6	5.1				
σ_T	200	0.18	0.21	0.16	0.12				
	160	---	---	---	---				
	120	0.14	0.26	0.11	0.11				
	80	0.15	0.29	0.14	0.11				
	40	---	---	---	---				
	20	0.24	0.26	0.18	0.13				

σ_U is standard deviation of the wind velocity fluctuations in $^m/_s$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^\circ C$

RUN 3 (18 October 1977). Table 20

time in GMT

	height in m	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00					
σ_U	200	0.48	0.52	0.47					
	160	---	---	---					
	120	---	---	---					
	80	0.56	0.73	0.61					
	40	---	---	---					
	20	0.86	0.79	0.81					
σ_A	200	5.4	6.5	5.1					
	160	---	---	---					
	120	5.1	6.0	5.8					
	80	6.2	6.2	7.1					
	40	---	---	---					
	20	9.4	10.4	8.0					
σ_E	200	4.0	4.5	3.7					
	160	---	---	---					
	120	4.4	5.1	5.3					
	80	4.8	5.2	5.7					
	40	---	---	---					
	20	6.8	6.7	6.6					
σ_T	200	0.20	0.18	0.07					
	160	---	---	---					
	120	0.20	0.17	0.10					
	80	0.21	0.17	0.13					
	40	---	---	---					
	20	0.26	0.19	0.11					

σ_U is standard deviation of the wind velocity fluctuations in $^m/_s$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in ^oC

RUN 4 (27 October 1977). Table 21

time in GMT

	height in m	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00			
σ_U	200	0.31	0.42	0.47	0.43	0.14			
	160	---	---	---	---	---			
	120	---	---	---	---	---			
	80	0.59	0.36	0.42	0.48	0.33			
	40	---	---	---	---	---			
	20	0.41	0.42	0.48	0.53	0.49			
σ_A	200	4.5	5.2	5.3	5.4	4.3			
	160	---	---	---	---	---			
	120	4.5	5.4	5.5	6.3	4.3			
	80	6.0	5.7	6.7	7.6	4.8			
	40	---	---	---	---	---			
	20	7.3	5.4	8.0	9.2	7.8			
σ_E	200	2.4	2.9	2.5	2.6	1.0			
	160	---	---	---	---	---			
	120	2.5	3.1	3.1	3.8	2.5			
	80	3.5	3.6	3.8	4.2	3.3			
	40	---	---	---	---	---			
	20	5.1	4.2	5.2	6.0	6.2			
σ_T	200	---	---	---	---	---			
	160	---	---	---	---	---			
	120	---	---	---	---	---			
	80	0.07	0.06	0.08	0.05	0.04			
	40	---	---	---	---	---			
	20	---	---	---	---	---			

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 5 (22 December 1977). Table 22

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30					
σ_U	200	0.40	0.52	0.36					
	160	---	---	---					
	120	---	---	---					
	80	0.59	0.64	0.69					
	40	---	---	---					
	20	0.75	0.73	0.62					
σ_A	200	2.9	4.5	2.7					
	160	---	---	---					
	120	3.5	4.3	3.2					
	80	4.0	4.5	4.3					
	40	---	---	---					
	20	5.7	5.7	6.2					
σ_E	200	1.1	1.8	1.6					
	160	---	---	---					
	120	2.0	2.4	2.4					
	80	2.7	2.8	3.1					
	40	---	---	---					
	20	4.8	4.6	5.0					
σ_T	200	---	---	---					
	160	---	---	---					
	120	---	---	---					
	80	---	---	---					
	40	---	---	---					
	20	0.06	0.06	0.05					

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 6 (17 January 1978). Table 23

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00				
σ_U	200	0.57	0.58	0.48	0.51				
	160	---	---	---	---				
	120	0.71	0.63	0.55	0.71				
	80	0.70	0.69	0.65	0.71				
	40	---	---	---	---				
	20	0.88	0.86	0.76	0.82				
σ_A	200	4.2	4.6	3.5	4.0				
	160	---	---	---	---				
	120	4.4	5.1	4.6	4.7				
	80	5.1	5.4	5.0	5.3				
	40	---	---	---	---				
	20	6.7	6.3	6.3	6.9				
σ_E	200	1.9	2.7	2.0	1.8				
	160	---	---	---	---				
	120	3.2	3.7	2.8	2.8				
	80	3.8	4.3	3.6	3.4				
	40	---	---	---	---				
	20	5.3	5.2	5.1	5.6				
σ_T	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.28	0.12	0.11	0.13				
	40	---	---	---	---				
	20	---	---	---	---				

σ_U is standard deviation of the wind velocity fluctuations in $^m/_s$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in ^oC

RUN 7 (18 April 1978). Table 24

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30			
σ_U	200	0.72	1.24	1.26	1.07	1.21			
	160	0.82	1.17	1.26	1.06	1.31			
	120	0.94	1.05	1.40	1.08	1.47			
	80	0.95	1.20	1.54	1.14	1.57			
	40	---	---	---	---	---			
	20	1.21	1.38	1.52	1.31	1.51			
σ_A	200	6.7	12.8	11.5	9.5	9.2			
	160	6.7	12.5	11.7	10.2	9.1			
	120	7.4	13.5	12.9	11.0	10.0			
	80	8.6	14.1	13.5	12.0	11.5			
	40	---	---	---	---	---			
	20	10.4	14.5	12.9	14.5	13.6			
σ_E	200	5.2	9.6	9.3	9.0	7.8			
	160	5.3	8.7	8.4	8.5	7.5			
	120	5.6	8.5	7.8	8.7	8.0			
	80	5.5	8.0	7.8	7.9	8.1			
	40	---	---	---	---	---			
	20	5.9	7.4	7.5	7.8	8.7			
σ_T	200	0.20	0.20	0.26	0.19	0.18			
	160	---	---	---	---	---			
	120	0.19	0.22	0.26	0.20	0.22			
	80	0.19	0.25	---	0.24	0.26			
	40	---	---	---	---	---			
	20	---	---	---	---	---			

σ_U is standard deviation of the wind velocity fluctuations in m/s

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in °C

RUN 8 (25 May 1978).

Table 25

time in GMT

	height in m	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00			
σ_U	200	0.74	0.58	0.71	---	---			
	160	0.79	0.61	0.79	0.78	0.74			
	120	---	---	---	---	---			
	80	0.79	0.68	0.76	0.80	0.80			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
σ_A	200	5.6	5.2	6.7	6.9	5.6			
	160	5.6	5.3	6.7	7.4	5.7			
	120	---	---	---	---	---			
	80	7.4	5.7	7.5	7.3	6.1			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
σ_E	200	4.4	3.6	3.5	4.4	3.3			
	160	4.5	4.0	3.7	4.6	3.1			
	120	---	---	---	---	---			
	80	5.0	4.0	4.2	4.1	3.8			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
σ_T	200	0.14	0.11	0.16	0.12	0.13			
	160	---	---	---	---	---			
	120	---	---	---	---	---			
	80	---	---	---	---	---			
	40	---	---	---	---	---			
	20	---	---	---	---	---			

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 9 (13 June 1978). Table 26

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00		
σ_U	200	0.80	0.61	0.63	0.68	0.76	0.55		
	160	0.81	0.62	0.60	0.63	0.77	0.51		
	120	0.75	0.62	0.63	0.69	0.68	0.54		
	80	0.77	0.68	0.65	0.75	0.71	0.63		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
σ_A	200	7.4	6.0	7.2	11.7	10.0	7.7		
	160	7.7	6.7	8.2	12.8	11.3	8.4		
	120	8.4	7.4	8.8	14.0	11.9	9.0		
	80	10.3	8.5	9.9	15.7	12.3	10.4		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
σ_E	200	9.1	8.7	8.2	11.8	11.7	8.3		
	160	8.3	9.0	8.1	11.3	11.2	8.0		
	120	7.8	9.0	8.2	10.3	10.2	8.0		
	80	7.6	7.9	7.9	9.8	8.9	7.4		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
σ_T	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	0.19	0.18	0.17	0.27	0.23	0.16		
	80	---	---	---	---	---	---		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		

σ_U is standard deviation of the wind velocity fluctuations in m/s

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in ^{o}C

RUN 10 (26 July 1978). Table 27

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00					
σ_U	200	0.96	1.04	0.98					
	160	---	---	---					
	120	0.93	1.19	1.15					
	80	0.96	1.31	1.12					
	40	---	---	---					
	20	1.06	1.53	1.32					
σ_A	200	4.7	6.1	4.5					
	160	---	---	---					
	120	5.6	6.7	4.9					
	80	6.8	7.2	5.7					
	40	---	---	---					
	20	9.5	9.8	8.4					
σ_E	200	4.2	6.6	4.5					
	160	---	---	---					
	120	4.6	5.2	3.5					
	80	5.3	5.8	4.4					
	40	---	---	---					
	20	7.2	6.5	6.6					
σ_T	200	0.13	0.12	0.23					
	160	---	---	---					
	120	0.11	0.13	0.14					
	80	0.14	0.10	0.14					
	40	---	---	---					
	20	0.20	0.11	0.09					

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 11 (2 August 1978). Table 28

time in GMT

	height in m	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30		
σ_U	200	1.06	1.16	1.24	1.37	1.54	1.17		
	160	1.20	1.14	1.29	---	---	---		
	120	1.30	1.20	1.34	1.40	1.64	1.42		
	80	1.38	1.21	1.84	1.89	---	---		
	40	---	---	---	---	---	---		
	20	1.59	1.49	1.80	1.77	2.01	2.11		
σ_A	200	7.1	7.1	8.3	4.7	7.6	5.5		
	160	7.6	7.7	8.1	4.9	7.5	5.6		
	120	8.4	8.5	9.0	5.2	8.3	6.9		
	80	9.5	8.8	10.2	6.2	8.8	8.2		
	40	---	---	---	---	---	---		
	20	11.9	11.5	11.3	8.3	10.5	9.8		
σ_E	200	8.5	6.7	5.0	5.6	6.1	7.3		
	160	6.2	4.6	3.8	4.3	4.9	6.0		
	120	5.6	4.6	4.3	4.5	5.2	6.2		
	80	5.9	5.4	5.0	5.0	5.0	6.3		
	40	---	---	---	---	---	---		
	20	7.4	7.2	7.2	7.3	6.9	7.5		
σ_T	200	0.24	0.18	0.14	0.23	0.19	0.25		
	160	0.21	0.15	0.11	0.23	0.16	0.26		
	120	0.24	0.15	0.12	0.24	0.17	0.28		
	80	0.28	0.20	0.16	0.25	0.19	0.31		
	40	---	---	---	---	---	---		
	20	0.44	0.32	0.16	0.24	0.18	0.48		

σ_U is standard deviation of the wind velocity fluctuations in m/s

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in °C

RUN 12 (16 August 1978). Table 29

time in GMT

	height in m	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00				
σ_U	200	0.78	2.60	2.86	1.46				
	160	---	---	---	---				
	120	0.86	2.45	1.82	1.16				
	80	0.95	1.09	1.60	0.85				
	40	---	---	---	---				
	20	1.28	1.43	1.49	1.13				
σ_A	200	5.4	6.0	10.8	5.9				
	160	---	---	---	---				
	120	4.8	7.9	8.4	6.6				
	80	5.2	8.2	7.6	7.3				
	40	---	---	---	---				
	20	7.2	8.1	10.0	9.5				
σ_E	200	5.5	4.6	5.5	3.1				
	160	---	---	---	---				
	120	4.4	4.1	3.6	2.6				
	80	5.3	4.2	3.4	2.9				
	40	---	---	---	---				
	20	5.4	3.5	4.5	3.6				
σ_T	200	0.32	---	---	---				
	160	---	---	---	---				
	120	0.23	---	---	---				
	80	0.24	---	---	---				
	40	---	---	---	---				
	20	0.31	---	---	---				

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in $^{\circ}C$

RUN 13 (10 October 1978). Table 30

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	
σ_U	200	0.44	0.22	0.37	0.56	0.29	0.63	0.31	
	160	0.40	0.49	0.47	0.52	0.32	0.75	0.32	
	120	0.47	0.51	1.63	0.44	0.41	0.78	0.45	
	80	0.47	0.57	0.54	0.43	0.60	1.02	0.47	
	40	---	0.71	0.86	0.75	0.67	1.18	0.78	
	20	0.61	0.66	0.73	0.80	0.56	1.05	0.83	
σ_A	200	3.4	2.5	1.8	2.3	3.9	3.5	1.8	
	160	3.2	2.9	2.9	3.5	3.5	4.3	2.1	
	120	4.4	3.5	4.3	4.6	4.1	4.9	2.8	
	80	5.4	5.2	5.6	5.6	5.8	5.3	3.4	
	40	---	7.7	7.8	8.6	8.7	7.8	6.1	
	20	9.0	9.0	9.8	10.4	10.6	9.5	8.1	
σ_E	200	1.1	0.7	1.3	1.0	1.0	0.8	1.0	
	160	1.5	1.0	2.0	1.6	1.7	1.3	1.2	
	120	2.2	1.6	2.5	2.3	2.6	1.7	1.9	
	80	3.0	2.9	3.4	3.3	4.3	2.9	2.4	
	40	---	5.8	7.1	5.9	6.7	5.9	5.3	
	20	8.0	7.0	8.5	7.7	8.0	7.5	7.2	
σ_T	200	0.47	0.37	0.29	0.38	0.32	0.23	0.15	
	160	0.36	0.17	0.17	0.16	0.10	0.09	0.07	
	120	0.18	0.10	0.18	0.12	0.13	0.08	0.07	
	80	0.21	0.15	0.25	0.14	0.14	0.17	0.15	
	40	---	0.41	0.31	0.24	0.29	0.18	0.17	
	20	0.22	0.14	0.18	0.08	0.13	0.20	0.08	

σ_U is standard deviation of the wind velocity fluctuations in m/s

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in °C

RUN 14 (12 October 1978). Table 31

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00	15.00 / 15.30
σ_U	200	0.56	0.54	0.91	0.66	0.82	0.68	0.41	0.40
	160	0.61	0.64	0.89	0.73	0.87	0.73	0.54	0.40
	120	0.57	0.63	0.86	0.78	0.82	0.70	0.64	0.38
	80	0.63	0.64	0.96	0.99	0.89	0.73	0.78	0.47
	40	0.54	0.73	1.05	1.06	1.07	0.89	0.73	0.52
	20	0.63	0.68	1.03	1.03	1.00	0.80	0.68	0.50
σ_A	200	7.2	6.1	4.3	4.8	5.8	5.8	4.4	2.6
	160	8.6	5.8	4.4	4.6	5.5	6.4	5.0	2.9
	120	7.7	5.7	4.7	4.7	5.2	6.7	6.3	3.4
	80	8.5	5.7	5.8	6.6	5.8	8.2	7.7	3.9
	40	11.8	8.1	8.8	8.8	10.0	10.9	9.5	6.6
	20	15.3	9.8	10.4	11.1	11.4	12.4	10.5	8.8
σ_E	200	4.9	3.3	3.7	3.8	4.3	5.4	2.5	1.9
	160	5.5	3.9	3.6	3.5	4.1	5.3	3.0	2.2
	120	7.4	5.0	3.5	4.1	4.0	5.0	4.3	2.4
	80	9.3	5.8	4.4	5.0	4.8	6.3	5.5	3.1
	40	11.1	8.2	7.0	6.6	7.4	7.9	8.0	4.7
	20	10.5	8.8	8.1	8.3	9.2	8.4	8.5	6.2
σ_T	200	0.19	0.21	0.19	0.27	0.18	0.15	0.11	0.13
	160	0.17	0.21	0.15	0.21	0.15	0.07	0.08	0.07
	120	0.16	0.23	0.18	0.23	0.17	0.08	0.07	0.06
	80	0.22	0.25	0.22	0.24	0.19	0.13	0.11	0.11
	40	0.26	0.32	0.23	0.26	0.20	0.15	0.16	0.14
	20	0.25	0.28	0.18	0.22	0.14	0.08	0.10	0.08

σ_U is standard deviation of the wind velocity fluctuations in $^{m}/_{s}$

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in ^{o}C

RUN 15 (31 October 1978). Table 32

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00		
σ_U	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	---	---	---	---	---	---		
	80	---	0.86	0.60	0.66	0.50	0.58		
	40	---	---	---	---	---	---		
	20	0.67	0.90	0.67	0.70	0.60	0.60		
σ_A	200	4.9	5.2	4.8	8.2	5.9	7.6		
	160	---	---	---	---	---	---		
	120	---	6.7	5.7	8.6	5.5	8.5		
	80	---	6.7	6.8	9.7	6.1	9.6		
	40	---	---	---	---	---	---		
	20	7.8	9.2	7.9	10.3	8.3	10.9		
σ_E	200	5.4	7.1	5.0	7.3	5.1	6.5		
	160	---	---	---	---	---	---		
	120	---	6.4	6.5	7.7	5.2	6.5		
	80	---	6.1	6.5	8.2	5.4	6.8		
	40	---	---	---	---	---	---		
	20	5.7	6.3	6.1	7.1	4.5	6.5		
σ_T	200	0.14	0.14	0.16	0.17	0.15	0.15		
	160	---	---	---	---	---	---		
	120	---	---	0.11	0.13	0.08	0.06		
	80	---	0.16	0.18	0.18	0.16	0.14		
	40	---	---	---	---	---	---		
	20	0.16	0.16	0.15	0.16	0.14	0.09		

σ_U is standard deviation of the wind velocity fluctuations in m/s

σ_A is standard deviation of the azimuth fluctuations in degrees

σ_E is standard deviation of the elevation fluctuations in degrees

σ_T is standard deviation of the temperature fluctuations in °C

RUN 1 (28 April 1977)

Table 33

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00				
$\overline{U'W'}$	200	0.14	0.13	0.10	0.03				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.17	0.15	0.23	0.19				
	40	--	---	---	---				
	20	0.21	0.18	0.24	0.18				
α_T	200	139	135	120	328				
	160	---	---	---	---				
	120	---	---	---	---				
	80	121	162	166	134				
	40	---	---	---	---				
	20	156	172	147	172				
$\overline{W'T'}$	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	---	---	---	---				
	40	---	---	---	---				
	20	---	---	---	---				
$\overline{U'T'}$	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	---	---	---	---				
	40	---	---	---	---				
	20	---	---	---	---				

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^{\circ}C\,m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^{\circ}C\,m/s$

RUN 2 (12 October 1977) Table 34

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30				
$\overline{u'w'}$	200	0.13	0.13	0.19	0.08				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.19	0.17	0.25	0.14				
	40	---	---	---	---				
	20	0.21	0.29	0.34	0.28				
α_T	200	215	210	217	239				
	160	---	---	---	---				
	120	---	---	---	---				
	80	215	204	186	225				
	40	---	---	---	---				
	20	202	192	188	206				
$\overline{w'T'}$	200	0.02	0.01	0.01	0.00				
	160	---	---	---	---				
	120	0.02	0.01	0.01	0.00				
	80	0.03	0.02	0.03	0.01				
	40	---	---	---	---				
	20	0.04	0.04	0.04	0.03				
$\overline{u'T'}$	200	0.04	0.03	0.06	0.01				
	160	---	---	---	---				
	120	0.03	0.05	0.04	0.01				
	80	0.05	0.03	0.09	0.02				
	40	---	---	---	---				
	20	0.09	0.09	0.12	0.06				

$\overline{u'w'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{w'T'}$ is vertical turbulent temperature flux in $^{\circ}C\,m/s$

$\overline{u'T'}$ is horizontal turbulent temperature flux in $^{\circ}C\,m/s$

Table 35

time in GMT

	height in m	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00					
$\overline{U'W'}$	200	0.05	0.09	0.05					
	160	---	---	---					
	120	0.02	0.03	0.08					
	80	0.07	0.09	0.12					
	40	---	---	---					
	20	0.15	0.14	0.16					
α_T	200	146	190	155					
	160	---	---	---					
	120	173	135	147					
	80	178	170	158					
	40	---	---	---					
	20	137	146	141					
$\overline{W'T'}$	200	0.01	0.01	0.01					
	160	---	---	---					
	120	0.00	0.01	0.01					
	80	0.02	0.02	0.02					
	40	---	---	---					
	20	0.03	0.02	0.02					
$\overline{U'T'}$	200	0.02	0.02	0.01					
	160	---	---	---					
	120	0.02	0.03	0.01					
	80	0.03	0.05	0.06					
	40	---	---	---					
	20	0.08	0.05	0.05					

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in m^2/s^2

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30					
$\overline{U'W'}$	200	0.02	0.06	0.04					
	160	---	---	---					
	120	0.05	0.05	0.07					
	80	0.06	0.06	0.09					
	40	---	---	---					
	20	0.13	0.12	0.10					
α_T	200	298	253	277					
	160	---	---	---					
	120	252	266	238					
	80	240	220	225					
	40	---	---	---					
	20	198	199	196					
$\overline{W'T'}$	200	---	---	---					
	160	---	---	---					
	120	---	---	---					
	80	---	---	---					
	40	---	---	---					
	20	0.00	0.00	0.00					
$\overline{U'T'}$	200	---	---	---					
	160	---	---	---					
	120	---	---	---					
	80	---	---	---					
	40	---	---	---					
	20	0.00	0.02	0.00					

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 6 (17 January 1978) Table 37

time in GMT

	height in m	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00				
$\overline{u'w'}$	200	0.02	0.04	0.03	0.03				
	160	---	---	---	---				
	120	0.16	0.06	0.06	0.06				
	80	0.10	0.09	0.08	0.05				
	40	---	---	---	---				
	20	0.15	0.15	0.10	0.12				
α_T	200	211	213	237	216				
	160	---	---	---	---				
	120	191	196	209	187				
	80	205	211	196	199				
	40	---	---	---	---				
	20	180	191	179	190				
$\overline{w'T'}$	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.00	0.00	0.00	0.00				
	40	---	---	---	---				
	20	---	---	---	---				
$\overline{u'T'}$	200	---	---	---	---				
	160	---	---	---	---				
	120	---	---	---	---				
	80	0.02	0.01	0.02	0.01				
	40	---	---	---	---				
	20	---	---	---	---				

$\overline{u'w'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{w'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{u'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 7 (18 April 1978)

Table 38

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30			
$\overline{U'W'}$	200	0.12	0.14	0.12	0.17	0.44			
	160	0.11	0.08	0.15	0.22	0.35			
	120	0.09	0.09	0.20	0.28	0.37			
	80	0.13	0.17	0.35	0.32	0.46			
	40	---	---	---	---	---			
	20	0.23	0.23	0.32	0.29	0.38			
α_T	200	228	068	172	127	157			
	160	209	071	191	115	143			
	120	175	089	160	117	145			
	80	142	134	164	121	147			
	40	---	---	---	---	---			
	20	142	148	160	124	139			
$\overline{W'T'}$	200	0.06	0.06	0.11	0.12	0.09			
	160	---	---	---	---	---			
	120	0.04	0.08	0.08	0.10	0.08			
	80	0.04	0.11	0.17	0.09	0.09			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
$\overline{U'T'}$	200	0.03	0.00	0.08	0.05	0.07			
	160	---	---	---	---	---			
	120	0.02	0.07	0.10	0.08	0.11			
	80	0.04	0.09	1.37	0.13	0.19			
	40	---	---	---	---	---			
	20	---	---	---	---	---			

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

time in GMT

	height in m	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00			
$\overline{u'w'}$	200	0.11	0.09	0.15	---	---			
	160	0.13	0.12	0.16	0.21	0.11			
	120	---	---	---	---	---			
	80	0.14	0.10	0.14	0.11	0.12			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
α_T	200	038	024	027	---	---			
	160	025	015	017	028	066			
	120	---	---	---	---	---			
	80	345	014	005	356	030			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
$\overline{w'T'}$	200	0.02	0.01	0.01	---	---			
	160	---	---	---	---	---			
	120	---	---	---	---	---			
	80	---	---	---	---	---			
	40	---	---	---	---	---			
	20	---	---	---	---	---			
$\overline{u'T'}$	200	0.04	0.02	0.05	---	---			
	160	---	---	---	---	---			
	120	---	---	---	---	---			
	80	---	---	---	---	---			
	40	---	---	---	---	---			
	20	---	---	---	---	---			

$\overline{u'w'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{w'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{u'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 9 (13 June 1978)

Table 40

time in GMT

	height in m	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00		
$\overline{U'W'}$	200	0.14	0.12	0.09	0.28	0.17	0.07		
	160	0.10	0.11	0.05	0.24	0.23	0.06		
	120	0.17	0.15	0.12	0.20	0.22	0.06		
	80	0.22	0.13	0.05	0.21	0.15	0.20		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
α_T	200	015	342	143	067	061	174		
	160	308	319	174	039	048	121		
	120	290	297	186	006	064	326		
	80	286	332	281	353	041	338		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
$\overline{W'T'}$	200	0.02	0.15	-0.01	-0.01	0.02	-0.11		
	160	---	---	---	---	---	---		
	120	0.08	0.12	0.08	0.14	0.14	0.08		
	80	---	---	---	---	---	---		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		
$\overline{U'T'}$	200	0.48	0.17	0.11	0.40	0.23	0.22		
	160	---	---	---	---	---	---		
	120	0.07	0.04	0.01	0.04	0.05	0.02		
	80	---	---	---	---	---	---		
	40	---	---	---	---	---	---		
	20	---	---	---	---	---	---		

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^{\circ}C\,m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^{\circ}C\,m/s$

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00					
$\overline{u'w'}$	200	0.12	0.36	0.24					
	160	---	---	---					
	120	0.15	0.26	0.21					
	80	0.18	0.33	0.22					
	40	---	---	---					
	20	0.24	0.44	0.32					
α_T	200	214	214	214					
	160	---	---	---					
	120	201	191	202					
	80	198	206	200					
	40	---	---	---					
	20	188	199	197					
$\overline{w'T'}$	200	0.00	0.00	-0.01					
	160	---	---	---					
	120	0.00	0.01	-0.01					
	80	0.01	0.01	-0.01					
	40	---	---	---					
	20	0.02	0.02	0.00					
$\overline{u'T'}$	200	0.04	0.05	0.03					
	160	---	---	---					
	120	0.02	0.02	0.04					
	80	0.02	0.02	0.03					
	40	---	---	---					
	20	0.04	0.06	0.01					

$\overline{u'w'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{w'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{u'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 11 (2 August 1978) Table 42

time in GMT

	height in m	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30		
$\overline{U'W'}$	200	0.98	0.65	0.38	0.36	0.43	0.78		
	160	0.63	0.29	0.24	---	---	--		
	120	0.60	0.38	0.32	0.31	0.49	0.74		
	80	0.58	0.44	0.45	---	---	---		
	40	---	---	---	---	---	---		
	20	0.65	0.47	0.55	0.70	0.51	0.91		
α_T	200	180	167	175	212	218	203		
	160	180	164	178	---	---	---		
	120	179	161	178	184	214	189		
	80	177	167	181	---	---	---		
	40	---	---	---	---	---	---		
	20	175	176	195	199	207	196		
$\overline{W'T'}$	200	0.21	0.09	0.00	0.02	0.03	0.11		
	160	0.12	0.04	0.01	---	---	---		
	120	0.11	0.04	0.01	0.02	0.04	0.10		
	80	0.11	0.07	0.02	---	---	---		
	40	---	---	---	---	---	---		
	20	0.17	0.11	0.04	0.06	0.05	0.14		
$\overline{U'T'}$	200	0.19	0.11	0.03	0.07	0.09	0.15		
	160	0.18	0.08	0.01	---	---	---		
	120	0.22	0.09	0.02	0.08	0.17	0.21		
	80	0.28	0.14	0.01	---	---	---		
	40	---	---	---	---	---	---		
	20	0.44	0.22	0.12	0.15	0.17	0.42		

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in m^2/s^2

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 12 (16 August 1978). Table 43

time in GMT

	height in m	09.00 / 09.30	09.30 / 10.00						
$\overline{u'w'}$	200	0.11	0.33						
	160	---	---						
	120	0.04	0.52						
	80	0.22	0.14						
	40	---	---						
	20	0.36	0.14						
α_T	200	244	043						
	160	---	---						
	120	174	230						
	80	204	231						
	40	---	---						
	20	210	232						
$\overline{w'T'}$	200	0.07	---						
	160	---	---						
	120	0.06	---						
	80	0.09	---						
	40	---	---						
	20	0.09	---						
$\overline{u'T'}$	200	0.04	---						
	160	---	---						
	120	0.09	---						
	80	0.10	---						
	40	---	---						
	20	0.21	---						

$\overline{u'w'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{w'T'}$ is vertical turbulent temperature flux in $^{\circ}C\,m/s$

$\overline{u'T'}$ is horizontal turbulent temperature flux in $^{\circ}C\,m/s$

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	
$\overline{U'W'}$	200	0.01	0.00	0.01	0.01	0.00	0.01	0.01	
	160	0.16	0.01	0.04	0.02	0.01	0.01	0.01	
	120	0.03	0.02	0.09	0.02	0.04	0.02	0.03	
	80	0.04	0.05	0.05	0.04	0.09	0.06	0.04	
	40	---	0.08	0.13	0.09	0.10	0.12	0.15	
	20	0.08	0.09	0.11	0.12	0.08	0.19	0.17	
α_T	200	171	304	167	299	146	180	173	
	160	145	264	162	140	156	163	172	
	120	135	137	127	141	127	146	139	
	80	131	114	119	114	112	115	116	
	40	---	111	121	123	116	124	120	
	20	114	104	107	113	114	117	110	
$\overline{W'T'}$	200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	160	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	
	120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	80	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	
	40	---	-0.01	-0.01	-0.01	-0.01	0.01	-0.02	
	20	-0.01	0.00	0.00	-0.01	0.00	0.01	-0.02	
$\overline{U'T'}$	200	0.10	0.04	0.03	0.18	0.03	0.01	0.01	
	160	0.05	0.04	0.04	0.06	0.02	0.01	0.01	
	120	0.02	0.01	0.04	0.01	0.00	0.02	0.00	
	80	0.01	0.02	0.03	0.01	0.01	0.00	0.01	
	40	---	0.02	0.02	0.03	0.04	0.05	0.05	
	20	0.01	0.01	0.00	0.03	0.01	0.02	0.04	

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in m^2/s^2

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

RUN 14 (12 October 1978)

Table 45

time in GMT

	height in m	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30		
$\overline{U'W'}$	200	0.03	0.02	0.02	0.05	0.08	0.19		
	160	0.07	0.06	0.04	0.07	0.11	0.16		
	120	0.08	0.09	0.02	0.11	0.08	0.09		
	80	0.11	0.08	0.09	0.20	0.13	0.12		
	40	0.11	0.15	0.18	0.19	0.17	0.18		
	20	0.15	0.12	0.22	0.25	0.21	0.14		
α_T	200	074	143	080	119	137	130		
	160	083	136	051	103	140	116		
	120	087	128	059	112	135	109		
	80	107	115	109	120	124	114		
	40	101	111	117	113	119	119		
	20	109	100	107	017	113	120		
$\overline{W'T'}$	200	0.00	0.00	0.01	0.00	0.00	0.02		
	160	0.01	0.01	0.00	0.00	0.00	0.01		
	120	0.01	0.01	0.00	0.01	0.00	0.01		
	80	0.03	0.02	0.02	0.02	0.00	0.01		
	40	0.05	0.03	0.03	0.02	0.01	0.01		
	20	0.05	0.03	0.03	0.02	0.01	0.00		
$\overline{U'T'}$	200	0.01	0.03	0.03	0.02	0.02	0.04		
	160	0.03	0.02	0.01	0.01	0.02	0.02		
	120	0.02	0.01	0.00	0.00	0.00	0.01		
	80	0.06	0.02	0.03	0.04	0.02	0.01		
	40	0.05	0.05	0.06	0.05	0.04	0.01		
	20	0.08	0.05	0.06	0.05	0.03	0.00		

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in $m^2/s2$

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^{\circ}C\,m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^{\circ}C\,m/s$

RUN 15 (31 October 1978)

Table 46

time in GMT

	height in m	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00		
$\overline{U'W'}$	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	---	---	---	---	---	---		
	80	---	0.09	0.16	0.08	0.07	0.05		
	40	---	---	---	---	---	---		
	20	0.09	0.11	0.12	0.09	0.04	0.09		
α_T	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	---	---	---	---	---	---		
	80	---	189	200	226	188	190		
	40	---	---	---	---	---	---		
	20	188	180	190	192	158	214		
$\overline{W'T'}$	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	---	---	---	---	---	---		
	80	---	0.01	0.04	0.01	0.01	0.02		
	40	---	---	---	---	---	---		
	20	0.03	0.03	0.03	0.02	0.01	0.01		
$\overline{U'T'}$	200	---	---	---	---	---	---		
	160	---	---	---	---	---	---		
	120	---	---	---	---	---	---		
	80	---	0.01	0.04	0.02	0.02	0.03		
	40	---	---	---	---	---	---		
	20	0.05	0.04	0.05	0.04	0.05	0.02		

$\overline{U'W'}$ is absolute value of the horizontal turbulent stress in m^2/s^2

α_T is direction of the horizontal turbulent stress in degrees

$\overline{W'T'}$ is vertical turbulent temperature flux in $^\circ C\, m/s$

$\overline{U'T'}$ is horizontal turbulent temperature flux in $^\circ C\, m/s$

6 Radiosonde data

When visibility conditions were good, radiosondes were used to obtain meteorological data above the mast. During a run two radiosondes were launched prefarably before and after the dispersion experiment. The results are given in Tables 47 to 59.

Radiosondes of type VIZ 1207 were modified in such a way that the length of the temperature record is favoured at the cost of the humidity signal, and that the signal transmitter switches off at a height of about 3000 m. The receiver was also modified so as to give better resolution. Temperature is measured with a resistance element with an overall error of 0.2 K and a lag time of 5 s. Height is given by a pressure box.

The radiosonde ascent was observed with a theodolite with which every 30 s the azimuth and elevation angle were measured. From these observations together with height as function of time the wind speed and wind direction profiles are calculated.

Table 47

RUN 1 (28 April 1977).

Time 10.47 GMT Pressure at groundlevel 1010.8 mb Humidity at groundlevel 53 %					Time 12.52 GMT Pressure at groundlevel 1009.0 mb Humidity at groundlevel 53 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
0	12.3	53	---	---	0	13.7	53	---	---
65	12.0	47	---	---	42	13.4	45	---	---
165	11.9	41	---	---	73	13.3	44	---	---
240	12.1	44	8.0	160	209	13.3	42	7.9	153
532	12.0	49	8.4	165	401	13.3	45	8.9	157
789	12.1	58	10.0	172	721	13.4	51	9.5	162
1113	12.6	50	11.8	184	905	13.3	57	9.5	166
1466	12.9	77	12.0	193	1123	13.5	66	9.1	171
1698	13.2	100	12.0	196	1413	13.5	85	8.5	176
1785	13.6	82	12.0	197	1674	13.7	100	10.4	182
1897	13.8	71	12.0	198	1822	14.0	100	11.6	186
					2019	14.5	100	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 48

RUN 2 (12 October 1977).

Time 10.35 GMT Pressure at groundlevel 1018.1 mb Humidity at groundlevel 75 %					Time GMT Pressure at groundlevel mb Humidity at groundlevel %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	13.8	---	---	---	2533	29.3	---	---	---
39	13.8	---	---	---	2620	30.0	---	---	---
139	13.4	---	---	---	2719	30.3	---	---	---
290	13.4	---	9.6	218	2775	31.1	---	---	---
367	14.0	---	9.8	224	3197	33.9	---	---	---
436	15.6	---	9.2	228					
505	16.3	---	9.9	229					
646	17.0	---	11.5	229					
690	17.4	---	10.9	229					
996	18.1	---	10.3	230					
1237	19.1	---	10.6	234					
1407	19.3	---	11.5	235					
1570	20.3	---	11.5	236					
1667	21.3	---	11.5	237					
1726	21.4	---	11.7	234					
1896	23.5	---	14.6	230					
2058	24.2	---	15.0	230					
2140	25.5	---	---	---					
2255	26.9	---	---	---					
2446	28.0	---	---	---					

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 49

RUN 2 (12 October 1977)

Time 13.05 GMT Pressure at groundlevel 1017.4 mb Humidity at groundlevel 65 %					Time GMT Pressure at groundlevel mb Humidity at groundlevel %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	16.2	---	---	---					
305	15.9	---	7,8	206					
590	16.0	---	8,3	218					
679	16.4	---	---	---					
812	17.8	---	---	---					
1114	18.7	---	10.7	227					
1291	20.5	---	7.0	242					
1434	20.7	---	7.8	246					
1531	21.5	---	9.4	248					
1865	22.3	---	10.5	258					
2139	23.7	---	10.5	261					
2264	25.9	---	---	---					
2296	26.9	---	---	---					
2349	28.0	---	---	---					
2607	28.7	---	---	---					
2816	28.9	---	---	---					
2872	29.2	---	---	---					
2917	30.3	---	---	---					
3134	32.1	---	---	---					
3583	33.7	---	---	---					

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 50

RUN 3 (18 October 1977)

Time 10.43 GMT Pressure at groundlevel 1018.3 mb Humidity at groundlevel 82 %					Time GMT Pressure at groundlevel mb Humidity at groundlevel %				
height in m	θ	r	U	α	height in m	θ	r	U	α
5	11.2	82	---	---	2876	35.2	20	---	---
65	10.9	82	---	---	2990	36.0	20	---	---
148	10.6	81	---	---	3317	36.4	20	---	---
214	10.9	79	6.7	163	3568	37.7	20	---	---
231	12.2	79	7.1	162	3827	39.4	20	---	---
248	14.6	74	7.4	161	4029	39.7	20	---	---
265	16.0	73	7.8	160	4471	39.6	20	---	---
351	18.2	59	9.6	159					
421	19.6	54	10.0	159					
535	20.2	52	9.3	160					
768	20.9	51	12.0	170					
969	22.4	40	14.8	181					
1166	25.6	30	9.8	196					
1653	28.2	20	7.3	207					
1835	28.6	20	8.4	202					
1896	29.4	20	8.5	201					
2113	30.1	20	9.0	199					
2207	31.2	20	---	---					
2443	32.6	20	---	---					
2552	33.6	20	---	---					

θ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 51

RUN 3 (18 October 1977)

Time 14.11 GMT Pressure at groundlevel 1017.3 mb Humidity at groundlevel 68 %					Time GMT Pressure at groundlevel mb Humidity at groundlevel %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	15.4	68	---	---					
16	15.5	67	---	---					
407	16.3	68	6.1	193					
494	18.3	61	6.9	194					
726	21.0	48	8.1	196					
771	22.1	40	8.6	196					
807	22.9	37	9.0	197					
872	23.6	34	8.4	198					
1077	24.5	33	7.5	203					
1143	25.1	32	7.0	208					
1200	26.1	30	6.0	214					
1315	27.3	30	4.4	225					
1841	28.7	30	7.0	219					
2162	30.9	20	---	---					
2289	32.2	20	---	---					
2829	35.7	20	---	---					
3292	37.6	20	---	---					
3569	38.3	20	---	---					
4314	40.1	10	---	---					

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 52

RUN 6 (17 January 1978)

Time 10.53 GMT Pressure at groundlevel 1003.6 mb Humidity at groundlevel -- %					Time 12.59 GMT Pressure at groundlevel 1003,6 mb Humidity at groundlevel 86 %				
height in m	θ	r	U	α	height in m	θ	r	U	α
5	---	---	---	---	5	5.7	86	---	---
220	---	---	9.5	207	477	6.6	92	9.5	215
360	---	---	13.0	221	904	7.2	100	---	---
510	---	---	10.5	222	1229	9.0	87	---	---
650	---	---	11.5	222	1303	9.8	89	---	---
800	---	---	10.0	222	1538	10.8	79	---	---
930	---	---	11.0	222	1576	11.6	78	---	---
1090	---	---	9.5	217	1692	12.2	76	---	---
1240	---	---	9.0	210	1741	13.3	55	---	---
1390	---	---	10.0	206	1809	14.0	52	---	---
1540	---	---	10.5	206	1869	14.3	50	---	---
1690	---	---	13.0	206	1918	14.8	47	---	---
1840	---	---	13.0	206	2079	15.1	44	---	---
					2525	16.4	41	---	---

θ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 53

RUN 7 (18 April 1978)

Time 09.52 GMT Pressure at groundlevel 1015.2 mb Humidity at groundlevel 54 %					Time 12.34 GMT Pressure at groundlevel 1013.6 mb Humidity at groundlevel 46 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	10.5	54	---	---	5	11.6	46	---	---
39	9.8	50	---	---	226	10.3	45	9.3	132
163	9.5	47	---	---	471	10.4	48	7.8	139
680	9.6	50	10.8	153	801	10.7	52	5.5	140
1077	9.5	50	8.9	168	1766	10.6	81	8.7	166
1498	10.7	46	11.4	156	1911	12.1	52	10.9	161
1545	11.1	44	12.2	155	2049	15.3	35	11.0	154
1582	11.2	41	12.4	156	2079	15.6	33	10.6	153
1639	12.2	35	12.0	160	2120	15.4	33	9.9	151
1678	12.6	30	11.8	163	2313	15.9	33	9.4	140
2221	16.7	15	9.7	161	2468	17.2	33	12.0	149
2877	21.5	35	---		2542	18.5	33	12.0	156
					2584	18.9	38	---	---
					2975	20.9	44	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 54

RUN 9 (13 June 1978)

Time 09.57 **GMT** **Pressure at groundlevel** 1019.0 **mb** **Humidity at groundlevel** 71 **%**					**Time** 12.49 **GMT** **Pressure at groundlevel** 1018,8 **mb** **Humidity at groundlevel** 72 **%**				
height in m	**ϑ**	**r**	**U**	**α**	**height in m**	**ϑ**	**r**	**U**	**α**
5	13.0	71	---	---	5	13.9	71	---	---
340	11.5	73	5.0	320	71	12.7	65	---	---
500	11.4	77	4.5	336	138	12.0	60	---	---
640	11.8	77	5.5	352	561	12.0	77	6.0	330
800	11.9	83	5.5	358	761	12.1	94	4.6	337
940	12.0	89	6.0	002	866	12.1	95	4.1	343
1090	12.1	94	4.5	351	1066	12.9	87	2.1	004
1240	12.4	95	2.0	354	1371	13.3	100	2.5	---
1400	12.5	91	2.0	310	1568	14.0	87	---	---
1540	12.5	88	1.0	234	1737	16.6	34	---	---
					1780	17.1	33	---	---
					1859	19.2	29	---	---
					1892	19.7	29	---	---
					1988	20.3	29	---	---
					2199	20.8	27	---	---
					2304	21.5	25	---	---
					2727	23.5	25	---	---
					2843	24.0	25	---	---
					3049	24.1	25	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 55

RUN 10 (26 July 1978)

Time 10.03 GMT Pressure at groundlevel 1007.6 mb Humidity at groundlevel 70 %					Time 12.59 GMT Pressure at groundlevel 1007.9 mb Humidity at groundlevel 67 %				
height in m	ϑ	r	U	∝	height in m	ϑ	r	U	∝
5	21.2	70	---	---	5	22.6	67	---	---
502	21.0	79	7.9	203	189	22.2	62	---	---
620	21.7	79	6.8	212	307	22.4	60	11.8	199
679	23.6	73	7.5	214	426	22.5	61	12.4	201
733	24.1	73	8.2	215	657	22.6	67	12.9	205
1558	26.8	77	11.3	190	1005	22.7	78	14.6	206
2036	27.5	81	---	---	1283	22.8	78	15.3	211
2242	28.1	40	---	---	1424	23.8	70	16.4	217
2456	29.4	30	---	---	1473	24.5	63	16.3	218
2722	29.7	43	---	---	1592	25.4	63	16.0	220
3242	31.4	62	---	---	2306	27.6	70	18.6	202
3490	31.9	77	---	---	2428	27.9	73	18.9	196
3775	33.5	100	---	---	2875	28.5	93	19.0	194
					3037	29.7	94	19.0	197
					3400	31.3	94	---	---
					3520	32.1	96	---	---
					3731	33.7	96	---	---
					3897	35.7	95	---	---
					4024	36.7	91	---	---
					4148	37.2	91	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

∝ wind direction in degrees

Table 56

RUN 11 (2 August 1978)

Time 10.01 GMT Pressure at groundlevel 1011.3 mb Humidity at groundlevel 54 %					Time 13.19 GMT Pressure at groundlevel 1011,2 mb Humidity at groundlevel 62 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	20.7	54	---	---	5	19.5	62	---	---
835	19.9	73	12.3	180	511	19.3	66	13.8	191
1148	19.9	86	13.2	181	737	19.6	75	15.3	191
1466	20.6	88	13.8	182	933	20.0	66	16.3	195
1539	21.3	85	15.3	182	1077	20.6	69	16.1	195
1951	22.1	88	14.9	180	1421	21.3	74	15.6	198
2105	23.9	85	17.5	179	1652	22.2	74	15.0	202
2307	24.9	78	17.9	184	1837	22.4	91	15.0	204
2358	26.1	74	18.0	188	1881	22.8	92	15.0	202
2431	26.9	72	16.9	189	2112	23.4	100	15.0	196
2981	29.9	71	---	---	2344	24.8	100	---	---
3312	30.5	85	---	---	2520	24.9	40	---	---
					2577	27.6	34	---	---
					2632	28.1	34	---	---
					2696	28.6	33	---	---
					2933	29.3	42	---	---
					3051	29.9	49	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 57

RUN 13 (10 October 1978)

Time 13.10 GMT Pressure at groundlevel 1017.0 mb Humidity at groundlevel 79 %					Time 13.54 GMT Pressure at groundlevel 1017.1 mb Humidity at groundlevel 77 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	19.9	79	---	---	5	19.1	77	---	---
201	21.0	65	---	---	203	20.0	73	---	---
247	22.1	57	---	---	246	20.6	55	---	---
275	23.2	52	---	---	322	23.6	43	9.2	135
309	23.9	46	---	---	395	25.1	35	9.7	140
415	24.7	45	---	---	655	27.7	30	10.6	149
741	29.2	30	---	---	739	28.9	30	9.4	152
1961	33.3	30	6.8	171	1139	30.3	34	8.1	158
2299	33.6	30	---	---	1420	30.7	40	10.5	154
					1823	32.6	40	9.5	167
					3228	34.1	53	---	---
					3707	34.8	55	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 58

RUN 14 (12 October 1978)

Time 12.57 GMT Pressure at groundlevel 1025.3 mb Humidity at groundlevel 66 %					Time 13.53 GMT Pressure at groundlevel 1024.6 mb Humidity at groundlevel 66 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	18.6	66	---	---	5	19.5	66	---	---
328	18.3	72	---	---	431	19.8	68	---	---
354	18.6	72	---	---	521	20.7	54	10.4	126
467	22.5	44	---	---	589	23.4	41	10.0	135
514	23.0	44	7.5	133	720	25.8	34	9.6	144
581	23.2	42	8.0	138	776	27.3	32	9.7	132
711	26.2	37	9.0	147	825	27.8	30	9.8	124
765	26.7	37	9.3	151	977	31.1	30	14.9	168
856	28.8	35	9.8	154	1097	32.3	30	17.0	180
886	29.1	35	10.0	156	1366	33.0	30	13.8	166
942	30.6	30	10.7	159	1584	33.0	30	14.3	163
1035	31.6	30	11.9	165	2030	34.7	30	10.2	157
1146	32.2	30	13.1	167	2475	34.6	30	9.6	154
1926	34.5	30	13.6	155	3041	36.6	30	---	---
3535	37.4	30	---	---	3385	36.7	30	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

Table 59

RUN 15 (31 October 1978)

Time 10.38 GMT Pressure at groundlevel 1025.2 mb Humidity at groundlevel 71 %					Time 13.19 GMT Pressure at groundlevel 1024.4 mb Humidity at groundlevel 68 %				
height in m	ϑ	r	U	α	height in m	ϑ	r	U	α
5	10.4	71	---	---	5	11.3	68	---	---
642	9.8	84	7.0	187	411	10.6	78	---	---
751	10.3	88	9.4	187	593	10.7	87	5.3	198
802	11.0	88	8.3	195	686	11.3	83	5.9	210
845	12.6	94	7.4	201	779	13.2	80	6.8	231
936	14.8	100	5.7	212	855	14.9	81	7.4	236
974	15.5	94	5.6	218	1153	17.8	65	9.0	238
1086	17.0	49	6.0	234	1222	19.1	51	9.7	239
1193	19.1	53	7.1	243	1347	19.8	45	9.7	238
1422	20.8	61	8.2	245	1494	21.5	45	11.2	241
1506	21.6	45	9.1	247	1572	23.1	45	12.5	245
1582	22.6	45	9.7	250	1666	24.0	50	11.5	258
2114	26.4	40	9.5	261	1838	25.6	47	11.7	259
2695	28.9	40	11.9	257	2142	26.9	50	11.3	270
3538	31.1	48	---	---	2963	29.2	50	---	---

ϑ potential temperature in °C

r relative humidity in %

U wind velocity in $^{m}/_{s}$

α wind direction in degrees

7 Acoustic sounder observations

A monostatic acoustic sounder from Aerovironment Inc. (option 300) is used to monitor the development of the atmospheric boundary layer. It primarily shows the boundary-layer height, when it is less than 500 m. The analog pictures of this instrument are given for each run (except runs 13, 14 and 15) in the Figures 4 to 7.

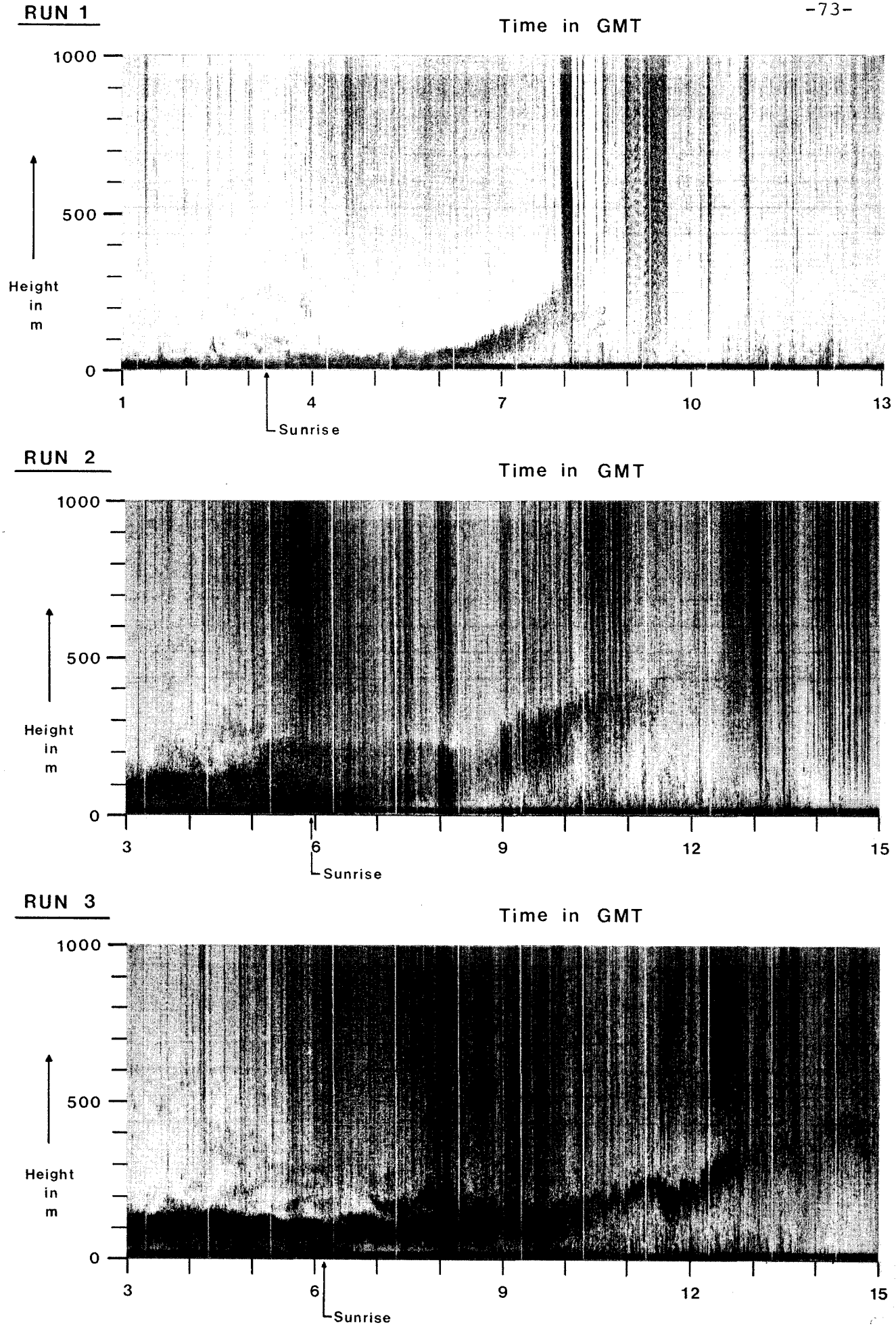


Figure 4 Acoustic sounder registrations for runs 1,2 and 3

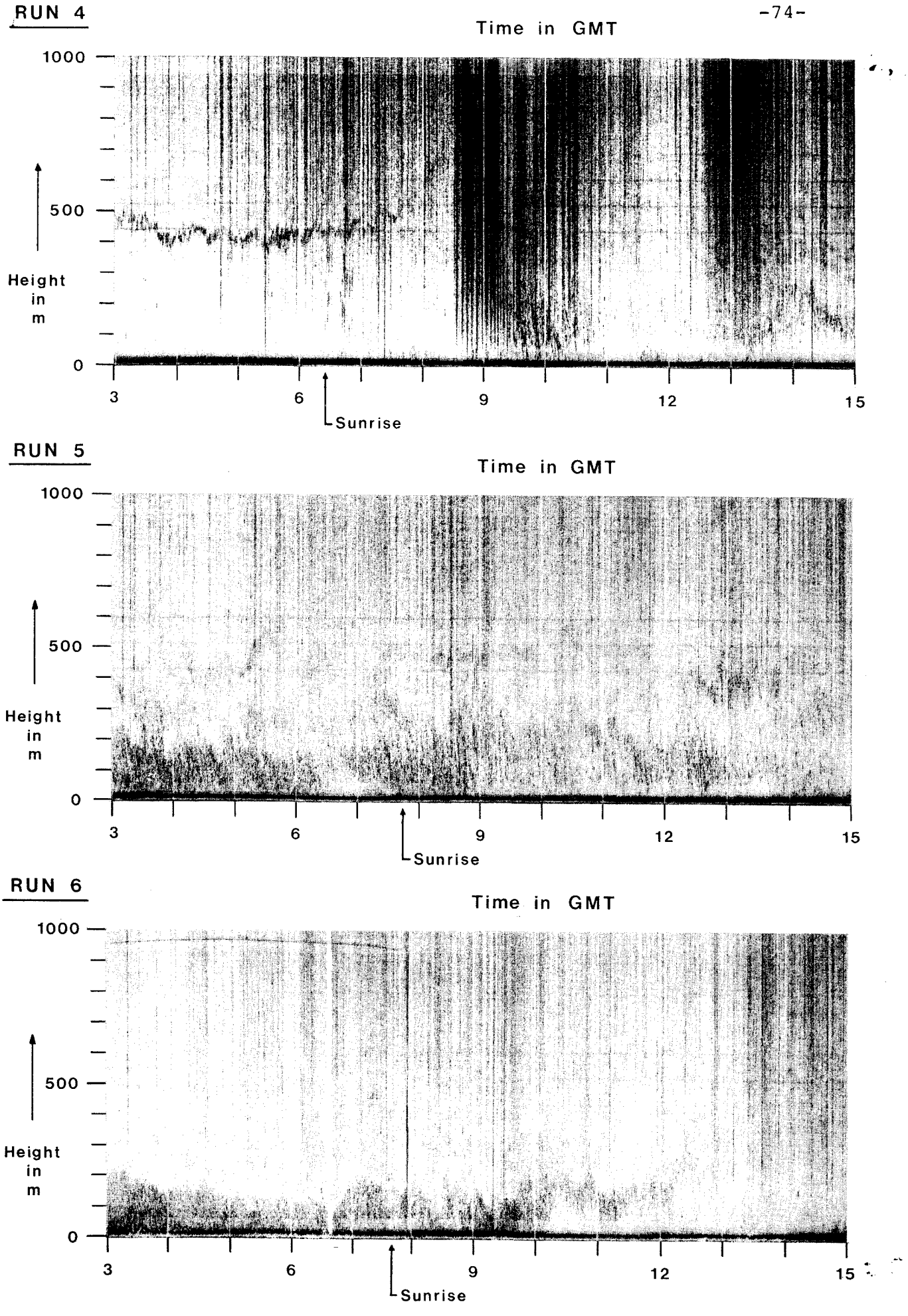


Figure 5 Acoustic sounder registrations for runs 4,5 and 6

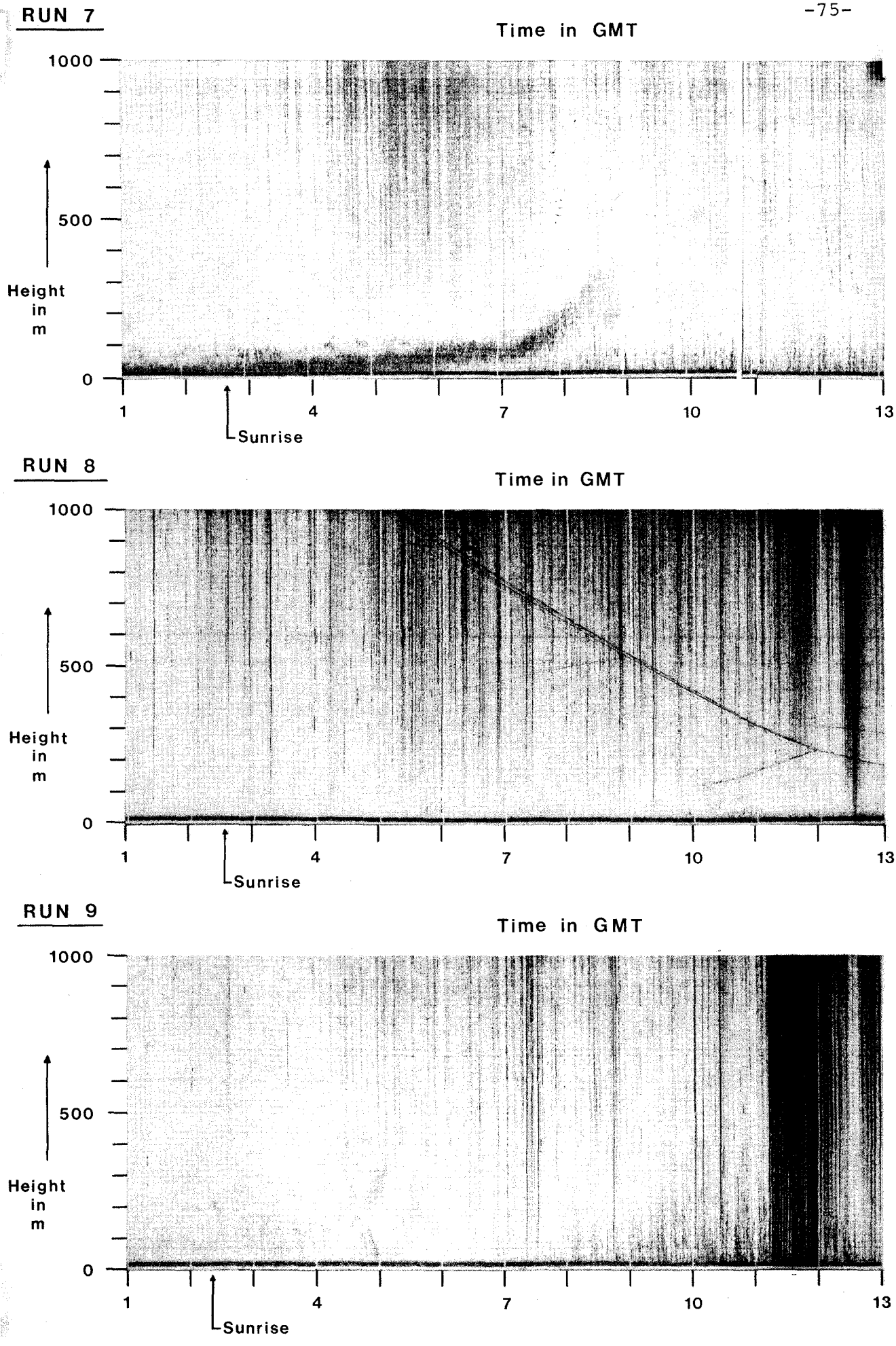


Figure 6 Acoustic sounder registrations for runs 7,8 and 9

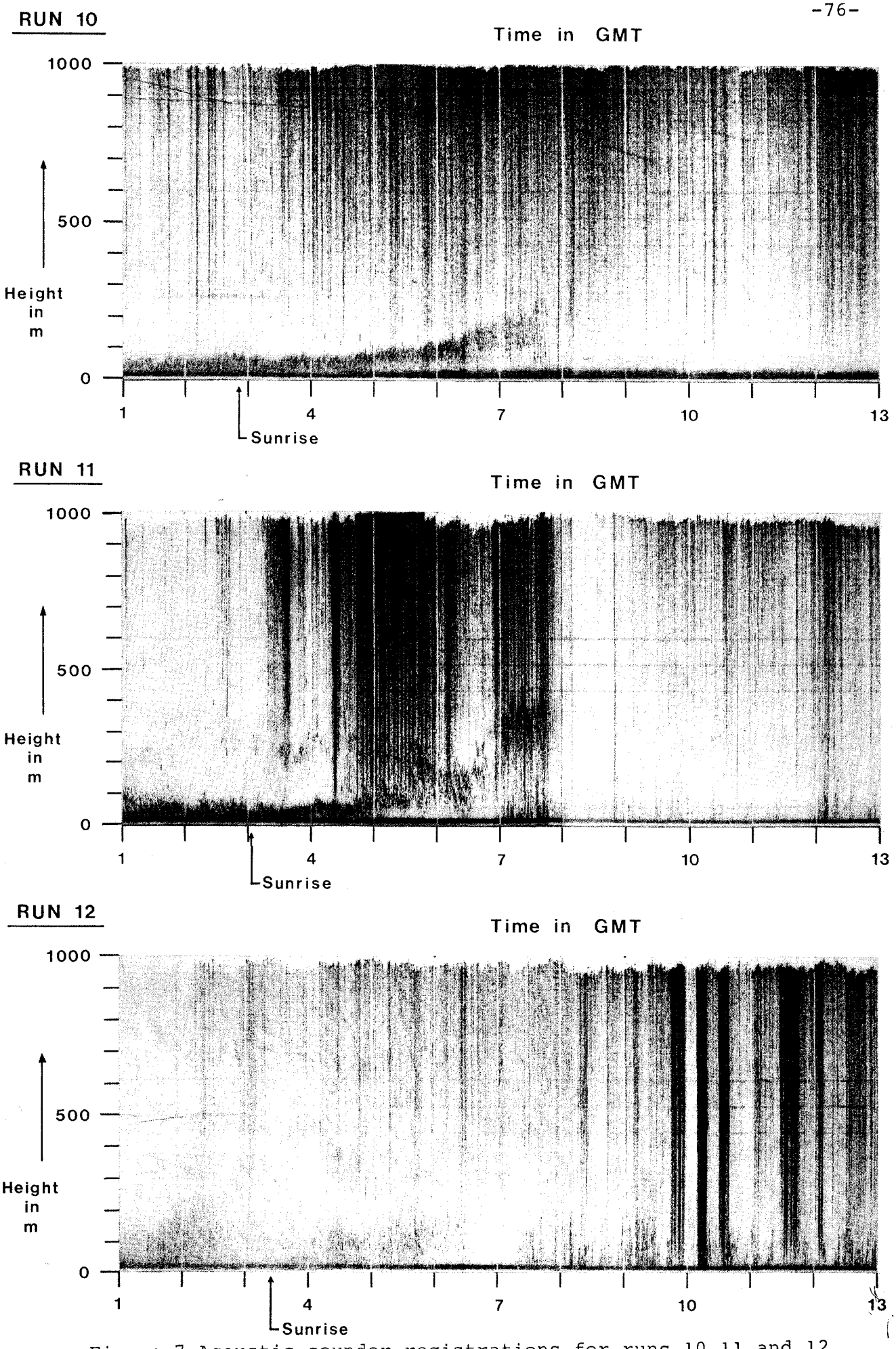


Figure 7 Acoustic sounder registrations for runs 10,11 and 12

8 Radiation data

Near the mast radiation is observed at a height of 2 m. The global radiation is measured with a Kipp (Moll-Gorzynski) and the net-radiation is measured with a Suomi. The data for each run are shown in the Tables 60 to 64.

RUN 1 (28 April 1977) Table 60

time in GMT

	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00
R	323	378	385	344	235	155	160	202
G	440	495	504	460	326	223	225	282

RUN 2 (12 October 1977)

time in GMT

	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00
R	283	276	281	280	261	226	146	130
G	433	431	439	435	413	372	275	234

RUN 3 (18 October 1977)

time in GMT

	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30
R	263	267	252	224	190	152	106	59
G	420	425	411	382	346	302	244	184

R is net-radiation in W/m^2 at a height of 2 m.

G is global radiation in W/m^2 at a height of 2 m.

Table 61

RUN 4 (27 October 1977)

time in GMT

	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00	15.00 / 15.30
R	54	52	51	47	43	37	25	15
G	52	50	46	41	37	33	21	9

RUN 5 (22 December 1977)

time in GMT

	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00
R	54	44	61	57	51	50	35	24
G	48	40	61	65	52	59	34	36

RUN 6 (17 January 1978)

time in GMT

	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30
R	61	76	99	61	37	54	27	15
G	110	121	182	127	36	87	46	21

R is net-radiation in W/m^2 at a height of 2 m.

G is global radiation in W/m^2 at a height of 2 m.

Table 62

RUN 7 (18 April 1978)

time in GMT

	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00
R	390	487	447	493	494	464	366	390
G	608	738	686	743	744	706	579	597

RUN 8 (25 May 1978)

time in GMT

	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00
R	65	89	124	67	72	88	90	92
G	76	107	152	76	81	103	106	108

RUN 9 (13 June 1978)

time in GMT

	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00
R	400	414	448	513	517	391	316	307
G	621	627	677	791	776	597	487	474

R is net-radiation in W/m^2 at a height of 2 m.

G is global radiation in W/m^2 at a height of 2 m.

RUN 10 (26 July 1978) Table 63

time in GMT

	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30
R	155	117	102	229	233	151	342	271
G	245	192	172	342	354	306	489	397

RUN 11 (2 August 1978)

time in GMT

	08.30 / 09.00	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30
R	453	408	316	222	237	190	344	280
G	681	597	464	330	344	269	486	406

RUN 12 (16 August 1978)

time in GMT

	07.30 / 08.00	08.00 / 08.30	08.30 / 09.00	09.00 / 09.30	09.30 / 10.00	10.00 / 10.30	10.30 / 11.00	11.00 / 11.30
R	281	267	436	20	- 112	183	309	- 25
G	420	415	630	286	145	455	448	318

R is net-radiation in W/m^2 at a height of 2 m.

G is global radiation in W/m^2 at a height of 2 m.

Table 64

RUN 13 (10 October 1978)

time in GMT

	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00
R	132	125	93	74	60	56	40	27
G	248	252	198	172	144	139	126	115

RUN 14 (12 October 1978)

time in GMT

	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30	14.30 / 15.00
R	237	226	210	182	134	75	32	- 2
G	472	456	431	387	320	242	182	127

RUN 15 (31 October 1978)

time in GMT

	10.30 / 11.00	11.00 / 11.30	11.30 / 12.00	12.00 / 12.30	12.30 / 13.00	13.00 / 13.30	13.30 / 14.00	14.00 / 14.30
R	143	148	138	91	75	54	16	- 23
G	322	327	314	242	213	190	137	71

R is net-radiation in **W/m²** at a height of 2 m.

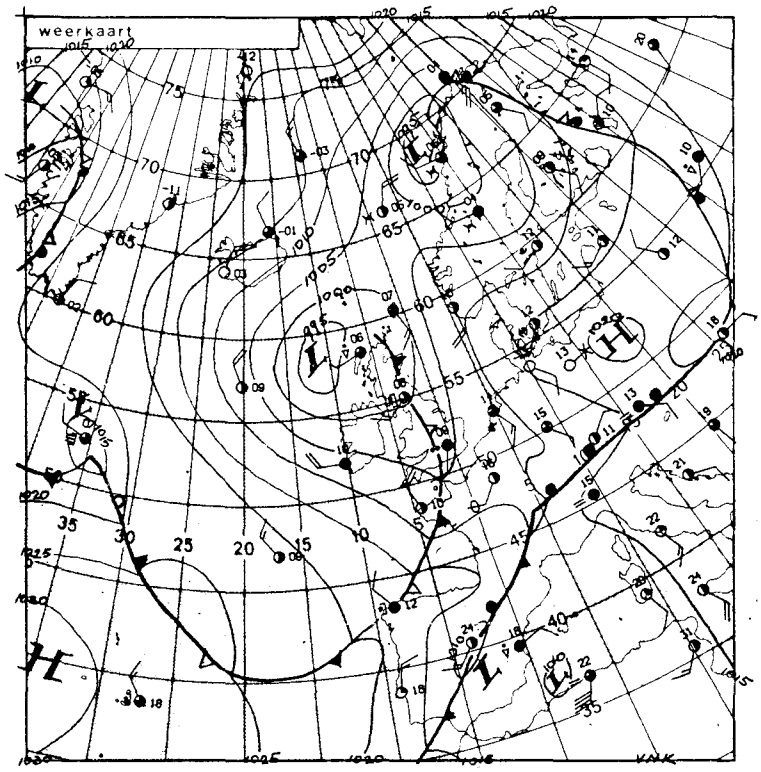
G is global radiation in **W/m²** at a height of 2 m.

9 Synoptical observations

During each run synoptical observations were made primaraly concerning the cloud cover. These observations together with a surface weather map are shown in the Figures 8 to 22.

RUN 1 (28 April 1977)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

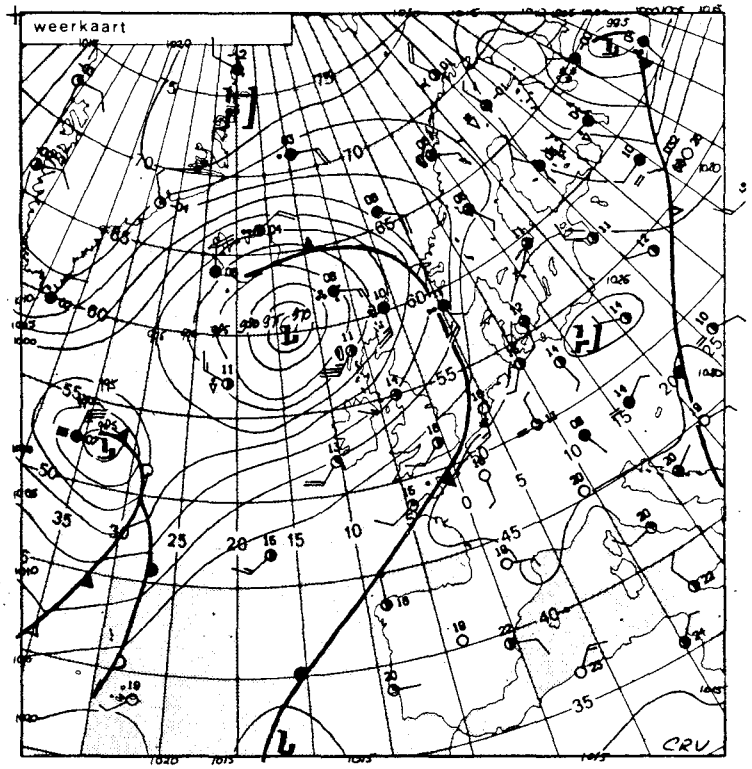
09.35 7/8 cover of cirrus and alto cumulus

12.05 5/8 cover of alto cumulus and cumulus

Figure 9

RUN 2 (12 October 1977)

Synoptic surface chart at 12 GMT



Observations during experiment

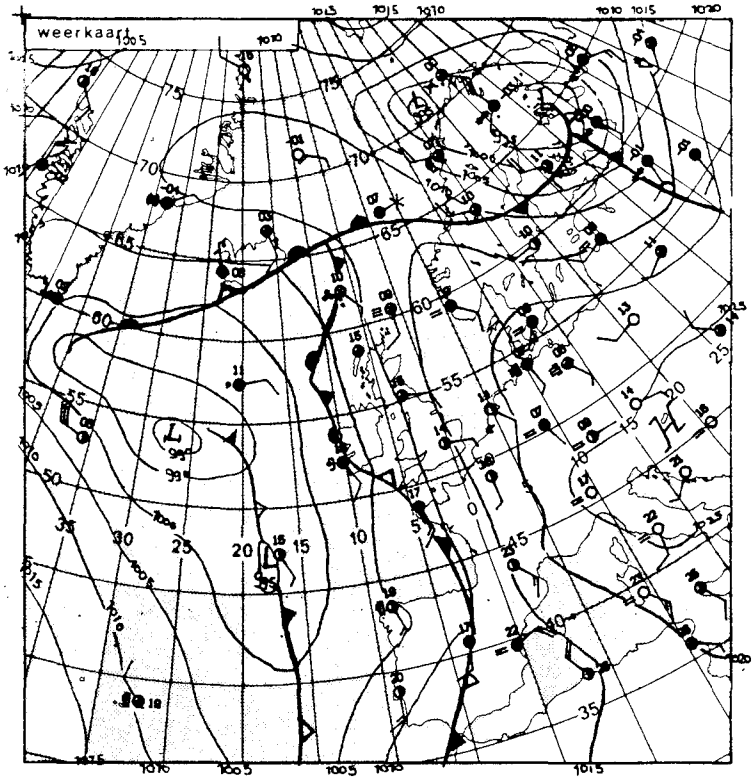
Time (G.M.T.)

Cloudiness virtually zero during the whole experiment

Figure 10

RUN 3 (18 October 1977)

Synoptic surface chart at 12 GMT



Observations during experiment

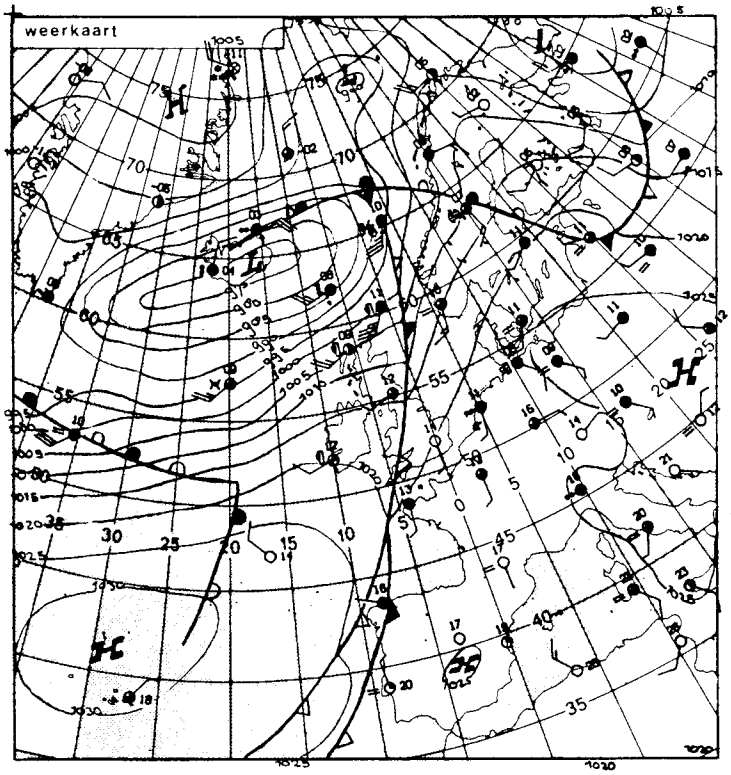
Time (G.M.T.)

Cloudiness zero during the whole experiment

Figure 11

RUN 4 (27 October 1977)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

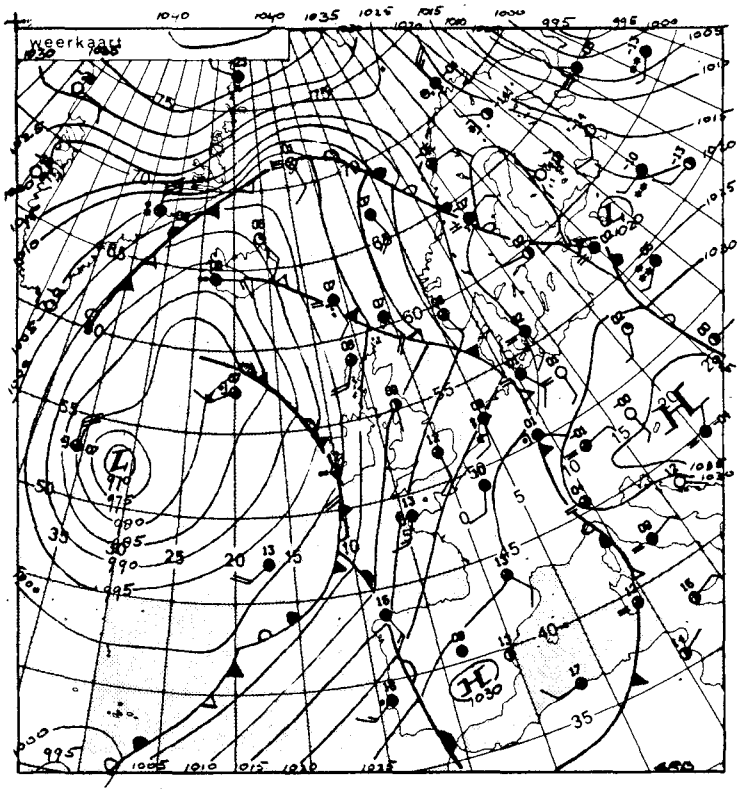
8/8 cover of stratus clouds during the whole experiment.
The base of these clouds is frequently below 200 m

11.00 light drizzle

Figure 12

RUN 5 (22 December 1977)

Synoptic surface chart at 12 GMT



Observations during experiment

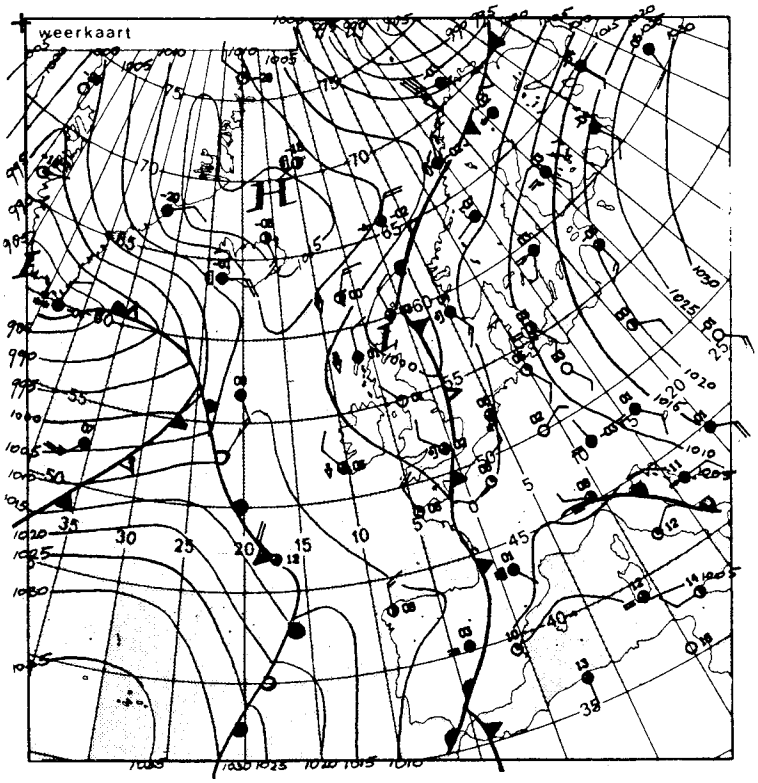
Time (G.M.T.)

Continuous fog during the experiment

Figure 13

RUN 6 (17 January 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

10.00 scattered strato cumulus clouds

12.30 3/8 cover of cumulus and strato cumulus clouds

13.00 7/8 cloud cover

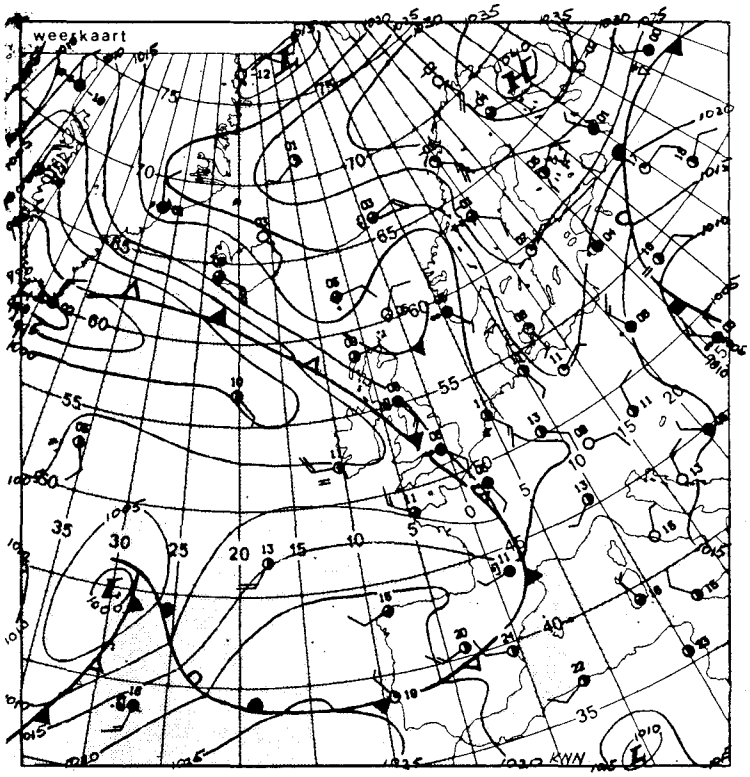
13.15 8/8 cloud cover

13.30 4/8 cloud cover

Figure 14

RUN 7 (18 April 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

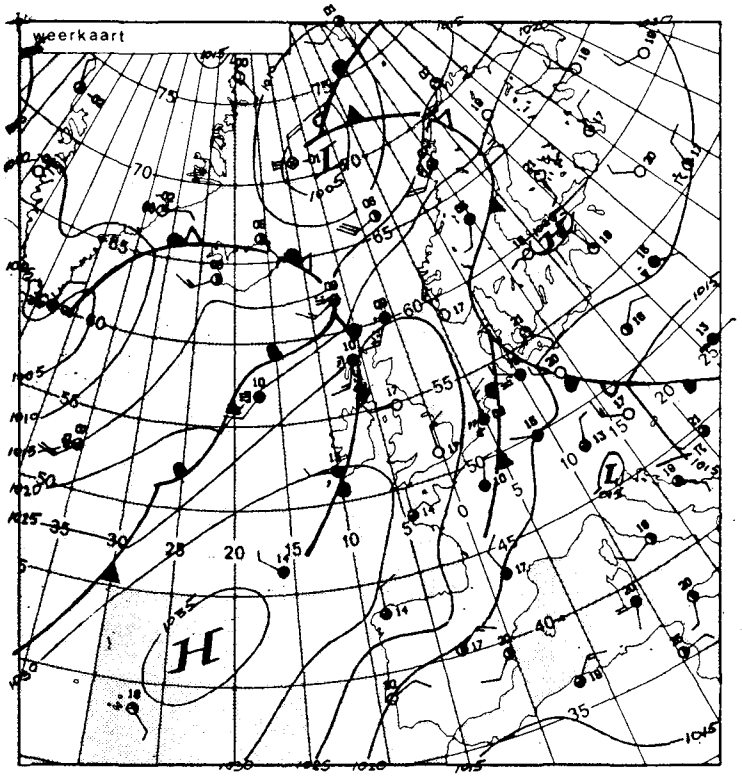
Time (G.M.T.)

10.50 1/8 cover of cumulus clouds

Figure 15

RUN 8 (25 May 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

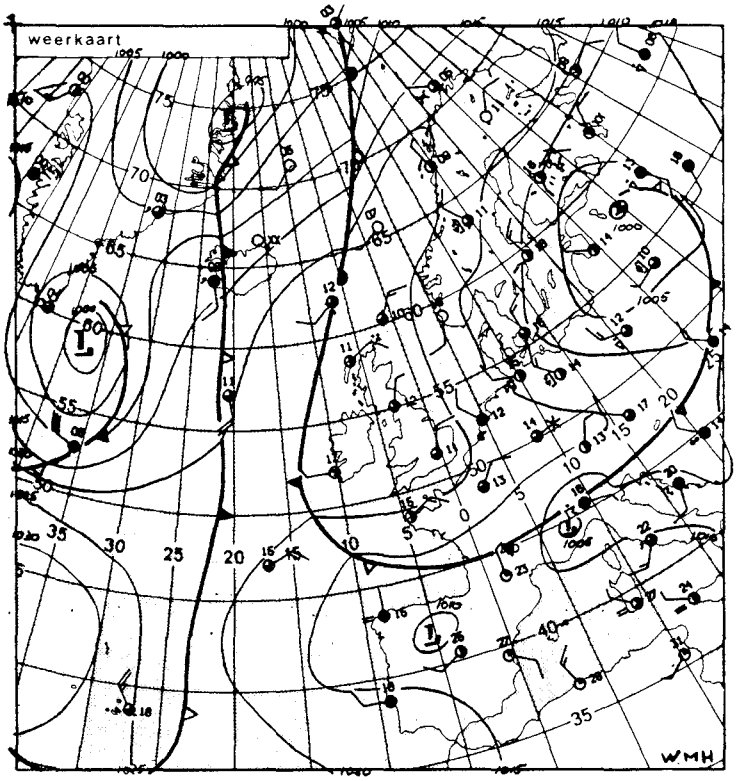
8/8 cover of stratus clouds during whole experiment

11.15 light drizzle

Figure 16

RUN 9 (13 June 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

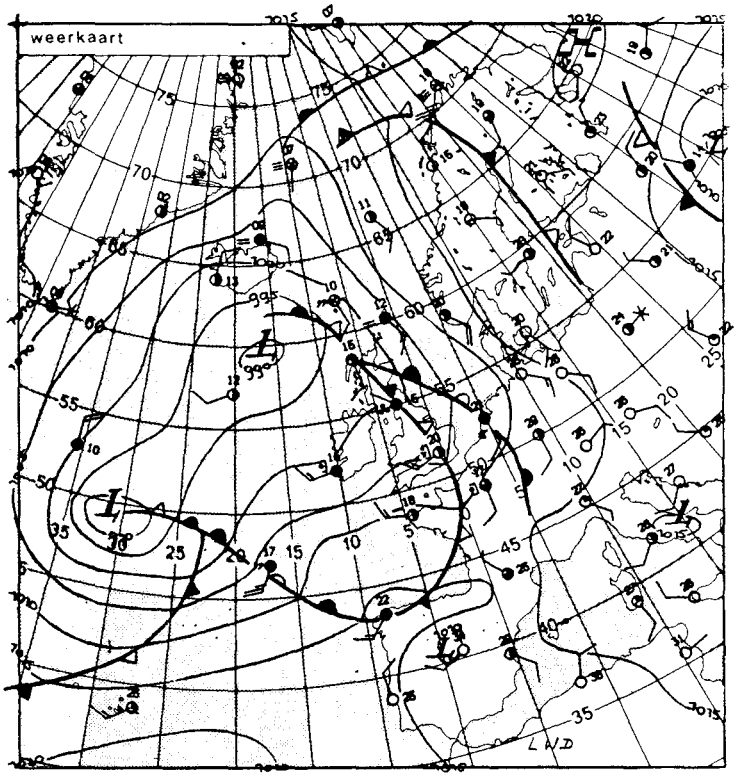
10.45 6/8 cover of heavy cumulus clouds

11.15 6/8 cover of heavy cumulus clouds

Figure 17

RUN 10 (26 July 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

11.15 8/8 cover of alto cumulus clouds

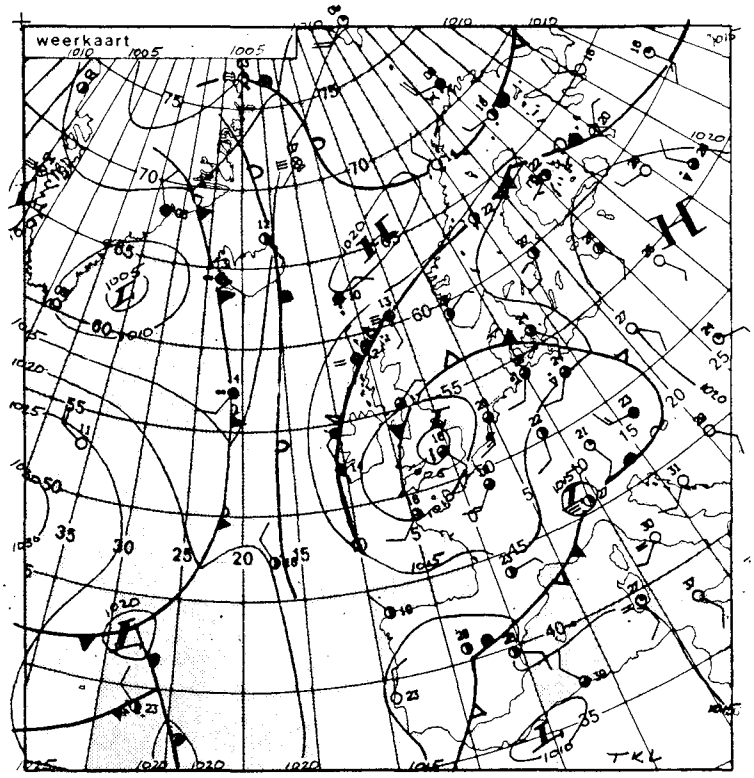
12.15 8/8 cover of alto cumulus clouds

12.26- light rain
12.42

Figure 18

RUN 11 (2 August 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

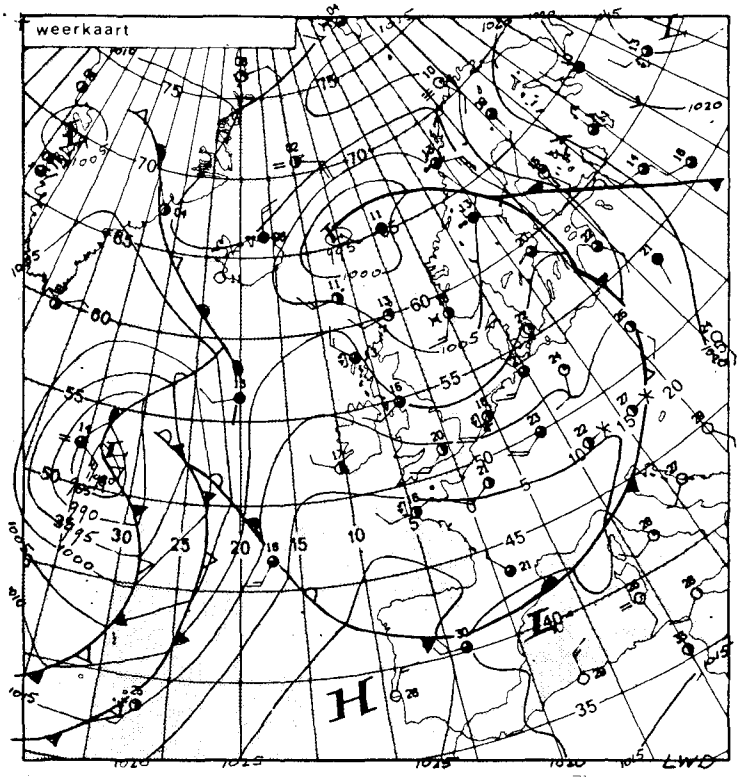
8/8 cover of clouds during the whole experiment.

Large wind direction variations.

Figure 19

RUN 12 (16 August 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

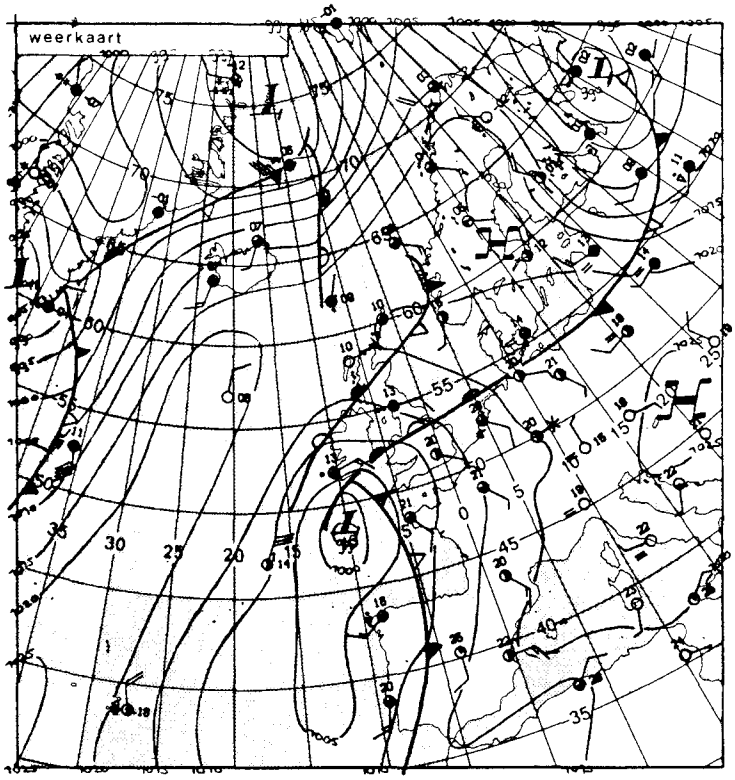
09.50- heavy rain shower
10.00

10.10- heavy rain shower
10.30

Figure 20

RUN 13 (10 October 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

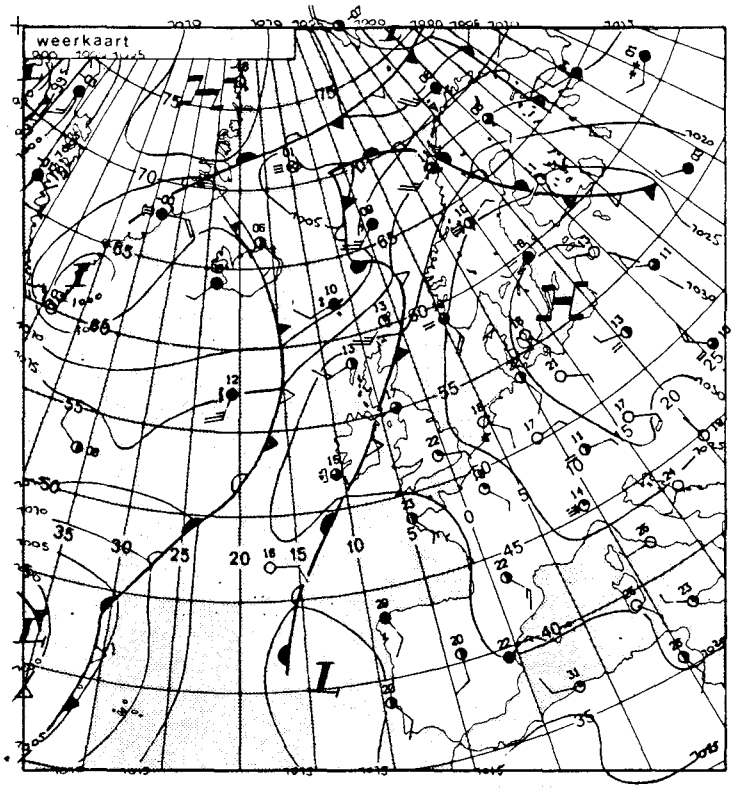
Time (G.M.T.)

12.50 8/8 cloud cover of alto stratus.
The sun is visible through cloud cover.

Figure 21

RUN 14 (12 October 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

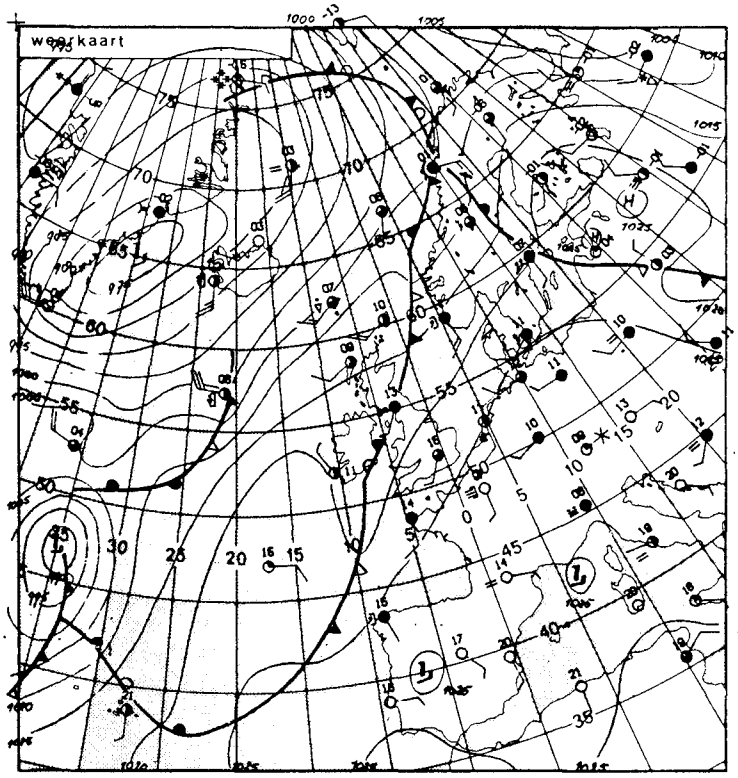
Time (G.M.T.)

Cloudiness virtually zero during the whole experiment

Figure 22

RUN 15 (31 October 1978)

Synoptic surface chart at 12 GMT



Observations during experiment

Time (G.M.T.)

Cloudiness virtually zero during the whole experiment

10 Geostrophic wind data

The geostrophic wind was calculated each hour from synoptic pressure observations at 19 stations by a method based on principal component analysis (Cats, 1977).

The data for each run are shown in Table 65.

Table 65

RUN		time in GMT						
		09.00	10.00	11.00	12.00	13.00	14.00	15.00
1	U		10.0	10.3	11.3	10.0	8.4	
	α		186	159	164	165	158	
2	U		10.8	11.9	10.3	8.2	5.0	
	α		230	234	233	245	260	
3	U			7.3	5.3	5.5	4.8	4.1
	α			181	175	176	175	162
4	U				2.9	4.1	3.6	3.2
	α				168	148	171	186
5	U		12.2	10.3	8.8	9.3	8.4	
	α		231	234	240	239	233	
6	U			8.3	7.4	6.7	6.3	5.0
	α			211	213	217	214	222
7	U	2.5	3.9	5.2	7.6	8.1		
	α	141	110	117	124	117		
8	U	11.8	11.8	11.4	10.3	11.3		
	α	358	2	0	352	10		

U is geostrophic wind velocity in m/s

α is geostrophic wind direction in degrees

Table 65 (continued)

RUN		time in GMT						
		09.00	10.00	11.00	12.00	13.00	14.00	15.00
9	U	5.3	5.2	5.4	5.2	5.7		
	α	334	344	359	357	357		
10	U	8.4	6.7	6.8	6.8	9.5	7.3	3.7
	α	184	191	207	215	225	242	275
11	U	8.3	7.2	5.0	5.2	5.1	5.3	5.0
	α	167	170	170	182	171	176	184
12	U	9.8	8.2	7.3	6.2	4.9	5.8	7.0
	α	250	260	270	281	267	266	268
13	U		7.8	8.6	8.4	7.9	8.0	7.0
	α		151	141	131	140	148	144
14	U	7.2	7.6	8.0	9.2	8.2	7.5	7.8
	α	155	150	145	153	132	127	116
15	U			3.0	3.0	4.0	3.6	3.5
	α			210	202	203	199	207

U is geostrophic wind velocity in m/s

α is geostrophic wind direction in degrees

11 Emission procedure

In the cellar of the instrumentation room of the mast ten gas cylinders are installed, each cylinder containing 40 kg of liquid SF_6. The cylinders are connected via copper tubing to a reducing valve. After reducing the pressure to 0.8 MPa, the gas flows through a copper tube to points of release situated at heights of 80 and 200 m.

At the point of release, which was 80 m or 200 m depending on the meteorological conditions, the pressure is reduced (twice) to about 0.15 MPa. Then the gas is emitted into the atmosphere via a fine metering valve and a dry gas meter. The gas meter reading is made every 10 minutes. The source strength is calculated taking into account temperature and pressure of the gas.

The emission values and the height of release are given in Table 66.

Taking into account the errors in the purity of the SF_6 used, in the gas meter readings and in the temperature and pressure the error in the emission value is estimated at 4%. During a run the variability in the source strength was very small. The coefficient of varation, the ratio of the standard deviation and the 10-minutes mean value was 0.5%.

Table 66

RUN	Q	h
1	3.88	200
2	3.51	200
3	3.54	200
4	2.47	200
5	1.79	80
6	1.34	80
7	3.22	200
8	4.61	200
9	4.42	200
10	2.80	200
11	3.80	200
12	3.42	200
13	1.42	80
14	1.06	80
15	1.27	80

Q is emission in g/s

h is emission height in m

12 Concentration distributions and related parameters

At the measuring points the air was sampled by means of a measuring station consisting of two specially constructed glass vessels. These vessels have two compartments separated by a partition in which a capillary is mounted, see Figure 23. The upper compartment is completely filled with distilled water. Air is sampled by opening stopcock A by which water flows through the capillary into the lower compartment and air is sucked into the upper one. The flow rate of water and therefore the flow rate of air is constant due to a constant pressure drop (Δp) over the capillary. The sampling time is 30 minutes during which about 60% of the upper compartment is filled with air.

After sampling the lower compartment is completely filled with distilled water through the stopcocks D. This is done to avoid suction of air from the lower into the upper compartment, due to possible temperature differences during the transport of the vessel to the laboratory.

The day after the field experiment, the air samples are analyzed by means of a gaschromatograph with an electron capture detector. The sampled air is led into the chromatograph through stopcock B by filling the vessel with water through stopcock A. Details of the gaschromatograph are described in Table 67.

The area of the SF_6 peak is measured with an integrator (Hewlett Packard, type 3370B). From the area the concentration of SF_6 in the air sample is determined with the aid of a calibration curve.

Calibration gases are made by first diluting a known quantity of SF_6 in an evacuated gas cylinder which is then compressed with nitrogen. From this so-called parent calibration gas other calibration gases are made in the same way. The range of SF_6-concentrations is 30 to 8000 ng/m^3 (1 ng = 10^{-9}g). The calculated error in the calibration gas concentrations is 3%. This figure has been checked by preparing calibration gases with an independed method using a permeation device filled with liquid SF_6 (Metronics Dynical wafer type).

To minimize errors a calibration curve is determined before and after the analysis of the air samples and the samples are analyzed in twofold. Variations in the calibration curve can occur by changes in the sensitivity of the electron capture detector due to small changes in temperature, flow rate and composition of the carrier gas. The variations in the calibration curve are usually less than 5% over a 12 hour period, but can sometimes be 10-20%.

The results of the concentration measurements are given in the Tables 68 to 81. In these tables for each run the SF_6 concentrations are given as measured on the sampling points, which are numvered according to the system of preselected locations discussed in chapter 3. Data for two calibration curves are shown. No data are availiable of Run 11 due to malfunction of the gaschromatograph.

In Table 82 for each run some quantities derived from the concentration distribution are given: C_y the cross-wind integrated concentration ; α the wind direction of the plume axis and σ_y the lateral dispersion coefficient. The plume axis is defined as the line connecting the mast and the centre of gravity of the concentration distribution. The centre of gravity or first moment of the concentration distribution is defined as:

$$\bar{y} = \left[\int_{-\infty}^{\infty} c.s.ds \right] : \left[\int_{-\infty}^{\infty} c.ds \right]$$

where c is the concentration and s the co-ordinate along the road.

The concentration distribution is projected on a line y which passes through $\bar{y}$ and which is perpendicular to x; see Figure 24. The standard deviation or second moment of the projected concentration distribution is defined as:

$$\sigma_y^2 = \left[\int_{-\infty}^{\infty} (y - \bar{y})^2 .c.dy \right] / \left[\int_{-\infty}^{\infty} c.dy \right]$$

The cross-wind integrated concentration distribution is given by:

$$C_y = \int_{-\infty}^{\infty} c.dy.$$

In Table 83 for each run the distance between the mast and the concentration distribution is given measured along the plume axis.

An estimation is made of the inaccuracy in the values of the cross-wind integrated concentration C_y and of the lateral dispersion coefficient σ_y. This inaccuracy is mainly determined by errors in the measured SF_6 concentrations and in the distance between the sampling points.

The error in the SF_6 concentration depends on the inaccuracy in the concentration of the calibration gases and in the difference between the calibration curves made before and after the analysis of the air samples. The error in the calibration gases was calculated to be 3%. The error in the SF_6 concentration is estimated to be 10% for a concentration of 100 ng/m^3 and 5% for concentrations higher than 500 ng/m^3. The inaccuracy in the distance between the measuring points is 10 m maximum.

Using the values above the error in the cross-wind integrated concentration is calculated and amounts 10-15%. The inaccuracy in the lateral dispersion coefficient is estimated to be 5-10%.

Table 67

Details of the gaschromatograph (Hewlett Packard, type 5753) used for the SF_6-analyses

	runs 1 - 10	runs 12 - 15
separating column:		
material	copper	copper
length	2 m	2 m
diameter	6.35 mm	6.35 mm
carrier	mol. sieve 5A, 45-60 mesh	mol. sieve 5A, 60-80 mesh
carrier gas	nitrogen, 55 cm^3/min	nitrogen, 20 cm^3/min
temperature	80°C	100°C
electron capture detector:		
source	2 mCi Ni 63	2 mCi Ni 63
purge gas	none	nitrogen, 18 cm^3/min
pulse interval	150 µs	150 µs
temperature	230°C	170°C

RUN 1 (28 April 1977).

Time in GMT

meas. point	period 1 11.45-12.15		period 2 12.15-12.45	
	C_1	C_2	C_1	C_2
28	245	235	350	360
29	585	575	425	430
30	1345	1360	360	370
31	1380	1390	680	695
32	1115	1235	1725	1870
33	4315	4390	1235	1320
34	615	625	1590	1595
35	1370	1405	1685	1745
36	----	----	970	965
37	2645	2725	395	390
38	1890	1920	415	425
39	815	810	170	195
40	865	650	50	55
41	630	550	105	120
42	525	535	25	20
43	315	400	15	----
44	45	60	5	5
45	180	195	0	----
46	0	0	0	0
47	0	0	0	5
48	5	5	5	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 10 ng/m^3).

Table 69

RUN 2 (12 October 1977)

Time in GMT

meas. point	period 1 12.00-12.30		period 2 12.30-13.00	
	C_1	C_2	C_1	C_2
52	0	0	0	0
53	0	0	15	10
54	0	0	110	90
55	65	50	220	190
56	140	120	240	210
57	410	370	580	535
58	380	340	900	860
59	580	530	960	920
60	1000	970	820	770
61	1800	1750	640	600
62	2000	2000	640	590
63	820	780	480	440
64	910	860	120	100
65	100	85	110	95
66	200	180	100	85
67	35	25	45	35
68	5	0	10	0
69	0	0	0	0
70	5	0	0	0
71	0	0	0	0
72	0	0	0	0
73	0	0	0	0
74	5	0	—	—
75	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 10 ng/m^3).

Table 70

RUN 3 (18 October 1977)

Time in GMT

meas. point	period 1 12.45-13.15		period 2 13.15-13.45	
	C_1	C_2	C_1	C_2
21	0	0	5	5
23	0	0	0	0
25	0	0	0	0
26	0	0	10	10
27	5	5	60	65
28	120	140	70	75
29	760	820	260	270
30	1550	1700	460	500
31	2850	3100	1250	1350
32	3050	3300	2400	2600
33	2750	3000	2550	2750
34	2900	3150	2300	2500
35	1900	2050	2600	2800
36	1250	1350	2200	2350
37	1600	1750	1550	1700
38	430	460	190	200
39	180	180	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
46	0	0	0	0
48	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 5 ng/m^3).

Table 71

RUN 4 (27 October 1977)

Time in GMT

meas. point	period 1 13.45-14.15		period 2 14.15-14.45	
	C_1	C_2	C_1	C_2
31	0		0	
33	0		0	
35	0		0	
37	0		45	
39	0		110	
41	165		170	
43	90		150	
45	40		185	
47	20		0	
49	0		0	
50	0		0	
51	0		0	
52	0		0	
53	0		0	
54	0		0	
55	0		0	
56	0		0	
57	0		0	
58	0		0	
60	0		0	
62	0		0	
64	0		0	
66	0		0	
68	0		0	

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 72

RUN 5 (22 December 1977)

Time in GMT

meas. point	period 1 12.00-12.30		period 2 12.30-13.00	
	C_1	C_2	C_1	C_2
52	5	5	0	0
54	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	30	35
59	5	5	0	0
60	5	5	0	0
61	10	10	0	0
62	0	0	0	0
63	0	0	5	5
64	0	0	5	5
65	150	160	300	320
66	640	700	840	940
67	1900	2150	2200	2500
68	2650	3000	2600	2950
69	2500	2800	2350	2650
70	2350	2650	2100	2350
71	1650	1850	1150	1300
72	850	940	640	700
73	140	160	220	240
74	20	20	20	20
76	20	25	30	30
78	5	5	0	0
80	-	-	5	5

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 5 ng/m^3).

Table 73

RUN 6 (17 January 1978)

Time in GMT

meas. point	period 1 12.30-13.00		period 2 13.00-13.30	
	C_1	C_2	C_1	C_2
41	0	0	0	0
43	0	5	0	0
45	0	5	0	0
47	5	15	0	0
49	0	0	0	0
50	0	5	0	5
51	10	15	0	0
52	5	5	0	0
53	15	30	15	25
54	200	300	280	400
55	500	720	700	1020
56	980	1400	920	1300
57	1300	1850	940	1350
58	1550	2200	1800	2550
59	1350	1900	1700	2400
60	1250	1750	1100	1600
61	900	1300	510	740
62	400	580	180	270
63	120	180	55	85
65	0	0	100	160
67	0	0	0	0
69	0	5	0	0
71	0	0	10	15

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 5 ng/m^3).

Table 74

RUN 7 (18 April 1978)

Time in GMT

meas. point	period 1 11.00-11.30		period 2 11.30-12.00	
	C_1	C_2	C_1	C_2
20	160	220	430	560
22	170	230	300	400
24	25	45	200	260
26	120	180	220	310
27	100	160	240	320
28	80	120	170	240
29	85	120	150	220
30	140	180	130	180
31	90	130	40	65
32	65	95	15	20
33	1400	1650	50	75
34	1650	1900	5	25
35	970	1200	0	0
36	860	1050	0	0
37	500	640	0	0
38	280	390	0	0
39	15	20	0	5
40	0	0	0	0
41	0	0	0	0
42	10	15	0	0
43	0	0	0	0
45	0	0	0	0
47	0	0	0	0
49	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 75

RUN 8 (25 May 1978)

Time in GMT

meas. point	period 1 11.15-11.45		period 2 11.45-12.15	
	C_1	C_2	C_1	C_2
126	0	0	0	0
128	0	0	0	0
130	0	0	0	0
132	0	0	60	75
134	0	0	880	1000
136	20	30	160	200
138	620	740	460	560
140	1100	1300	500	600
141	1800	2050	490	580
142	1950	2250	420	500
143	1550	1800	340	410
144	1150	1300	0	0
145	390	470	5	0
146	180	220	20	10
147	75	100	0	25
148	0	0	0	0
149	0	0	0	0
150	0	0	0	0
152	0	0	0	0
154	0	0	0	0
156	0	0	0	0
158	0	0	0	0
160	0	0	0	0
162	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 76

RUN 9 (13 June 1978)

Time in GMT

meas. point	period 1 10.45-11.15		period 2 11.15-11.45	
	C_1	C_2	C_1	C_2
132	0	0	0	0
134	5	5	0	0
136	5	5	10	5
138	0	0	0	0
140	-	-	-	-
142	0	0	0	0
144	0	0	0	0
146	0	0	0	0
148	0	0	0	0
149	10	5	0	0
150	20	20	0	0
151	55	60	120	120
152	390	410	40	45
153	580	600	120	130
154	790	810	450	460
155	910	930	850	880
156	1050	1050	940	970
157	1350	1350	1050	1100
158	1450	1500	1100	1100
159	1250	1250	990	1000
161	510	520	900	920
163	230	240	450	470
165	45	45	30	35
167	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 77

RUN 10 (26 July 1978)

Time in GMT

meas. point	period 1 11.45-12.15		period 2 12.15-12.45	
	C_1	C_2	C_1	C_2
40	10	15	0	0
42	0	0	0	0
44	0	0	0	0
46	0	0	-	-
48	0	0	0	0
50	0	0	0	0
52	0	0	25	25
53	30	35	0	0
54	0	0	0	0
55	550	520	0	0
56	860	770	35	35
57	1150	1000	-	-
58	620	580	320	320
59	560	520	520	490
60	500	480	910	810
61	410	400	950	840
62	35	40	1200	1020
63	70	80	1100	960
64	0	0	940	840
65	0	0	720	660
67	0	0	480	450
69	10	15	20	20
71	0	0	0	0
73	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 78

RUN 12 (16 August 1978)

Time in GMT

meas. point	period 1 09.30-10.00		period 2 10.00-10.30	
	C_1	C_2	C_1	C_2
66	0	0	0	0
68	0	0	0	0
70	0	0	5	5
72	5	5	0	0
74	0	5	0	0
76	0	0	-	-
77	10	5	-	-
78	10	10	0	0
79	45	45	0	0
80	170	180	0	0
81	100	100	0	0
82	45	45	0	10
83	70	75	0	0
84	190	190	0	0
85	540	560	0	5
86	830	850	0	0
87	750	760	0	0
88	680	700	0	0
90	95	95	0	0
92	80	80	0	0
94	120	120	5	5
96	70	70	10	10
98	0	0	80	85
100	80	85	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

Table 79

RUN 13 (10 October 1978)

Time in GMT

meas. point	period 1 13.00-13.30		period 2 13.30-14.00	
	C_1	C_2	C_1	C_2
2	35	30	1400	1500
4	1600	1700	1950	2050
6	3350	3500	510	530
8	1800	1900	650	680
9	350	360	2250	2350
10	140	160	3000	3100
11	5	5	1900	2000
12	5	5	290	300
13	50	50	10	10
14	65	65	20	20
15	10	10	10	10
16	15	15	5	5
17	130	130	5	5
18	25	25	15	15
19	35	35	15	15
20	35	35	60	60
22	5	5	15	15
24	0	0	15	15
26	25	25	10	10
28	15	15	0	0
30	5	5	5	5
32	5	5	5	5
34	5	5	10	10
36	10	10	5	5

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 10 ng/m^3).

Table 80

RUN 14 (12 October 1978)

Time in GMT

meas. point	period 1 13.00-13.30		period 2 13.30-14.00	
	C_1	C_2	C_1	C_2
1	0	0	90	95
3	120	120	240	240
5	1150	1150	260	260
7	-	-	390	390
9	1100	1100	850	850
11	900	900	2100	2100
13	100	100	1250	1250
15	0	0	460	460
17	0	0	5	5
19	10	10	5	10
21	0	0	0	0
23	0	0	0	0
25	10	10	0	0
27	0	0	5	5
29	10	10	0	0
31	0	0	0	0
33	0	0	0	0
35	0	0	0	0
37	0	0	5	5
39	10	10	0	0
41	0	0	0	0
43	0	0	0	0
45	0	0	10	10
47	5	5	15	15

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 5 ng/m^3).

Table 81

RUN 15 (31 October 1978)

Time in GMT

meas. point	period 1 12.30-13.00		period 2 13.00-13.30	
	C_1	C_2	C_1	C_2
47	75	80	0	0
49	210	220	0	0
51	380	400	200	210
52	1250	1250	110	120
53	1750	1800	280	300
54	1750	1800	800	840
55	1650	1700	650	680
56	1200	1250	560	580
57	780	820	350	370
58	200	220	380	400
59	150	160	810	840
60	120	130	760	790
61	0	0	80	90
62	20	20	10	10
63	-	-	0	0
64	0	0	0	0
65	0	0	0	0
66	0	0	0	0
67	0	0	0	0
68	10	15	0	0
69	0	0	0	0
70	0	0	0	0
72	0	0	0	0
74	0	0	0	0

C_1 is concentration in ng/m^3 determined with first calibration curve.

C_2 is concentration in ng/m^3 determined with second calibration curve.

(concentration values have been corrected by subtracting a background concentration of 0 ng/m^3).

RUN	Period	C_y	α	σ_y
1	11.45 — 12.15	1.93	151	315
	12.15 — 12.45	0.88	148	228
2	12.00 — 12.30	0.76	192	195
	12.30 — 13.00	0.51	189	238
3	12.45 — 13.15	1.85	147	212
	13.15 — 13.45	1.44	149	188
4	13.45 — 14.15	0.06	160	166
	14.15 — 14.45	0.12	162	221
5	12.00 — 12.30	1.46	203	198
	12.30 — 13.00	1.41	204	209
6	12.30 — 13.00	0.91	187	185
	13.00 — 13.30	0.87	186	206
7	11.00 — 11.30	0.70	149	367
	11.30 — 12.00	----	---	---
8	11.15 — 11.45	1.09	347	210
	11.45 — 12.15	0.70	352	401
9	10.45 — 11.15	1.19	320	330
	11.15 — 11.45	1.08	320	333
10	11.45 — 12.15	0.39	186	178
	12.15 — 12.45	0.71	193	247

C_y is cross-wind integrated concentration in mg/m^2

α is wind direction of the plume axis in degrees

σ_y is lateral dispersion coefficiet in m

Table 82 (continued)

RUN	Period	C_y	α	σ_y
11	10.30 — 11.00	----	---	---
	11.00 — 11.30	----	---	---
12	09.30 — 10.00	0.45	230	376
	10.00 — 10.30	----	---	---
13	13.00 — 13.30	1.60	107	184
	13.30 — 14.00	1.61	105	355
14	13.00 — 13.30	1.13	110	283
	13.30 — 14.00	1.16	114	373
15	12.30 — 13.00	0.90	180	202
	13.00 — 13.30	0.44	185	243

C_y is cross-wind integrated concentration in mg/m^2

α is wind direction of the plume axis in degrees

σ_y is lateral dispersion coefficiet in m

Table 83

Run	Period	X	Run	Period	X
1	11.45-12.15	3150	9	10.45-11.15	4250
	12.15-12.45	3160		11.15-11.45	4300
2	12.00-12.30	3400	10	11.45-12.15	3250
	12.30-13.00	3310		12.15-12.45	3480
3	12.45-13.15	3160	11	10.30-11.00	--
	13.15-13.45	3160		11.00-11.30	--
4	13.45-14.15	3200	12	09.30-10.00	3850
	14.15-14.45	3230		10.00-10.30	--
5	12.00-12.30	3880	13	13.00-13.30	4310
	12.30-13.00	3880		13.30-14.00	4250
6	12.30-13.00	3280	14	13.00-13.30	4200
	13.00-13.30	3250		13.30-14.00	3950
7	11.00-11.30	3160	15	12.30-13.00	3110
	11.30-12.00	--		13.00-13.30	3200
8	11.15-11.45	4100			
	11.45-12.15	4300			

X is distance in m between mast and concentration distribution, measured along the plume axis.

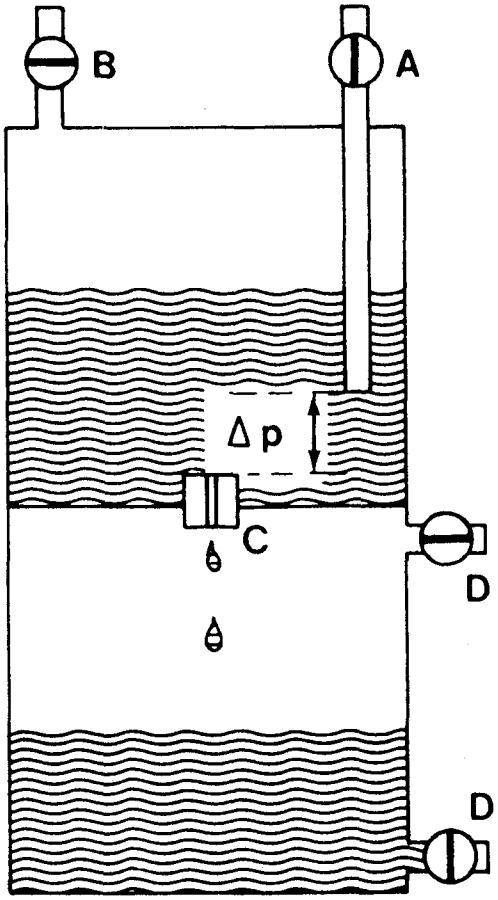


Figure 23 Schematic drawing of the sampling vessel

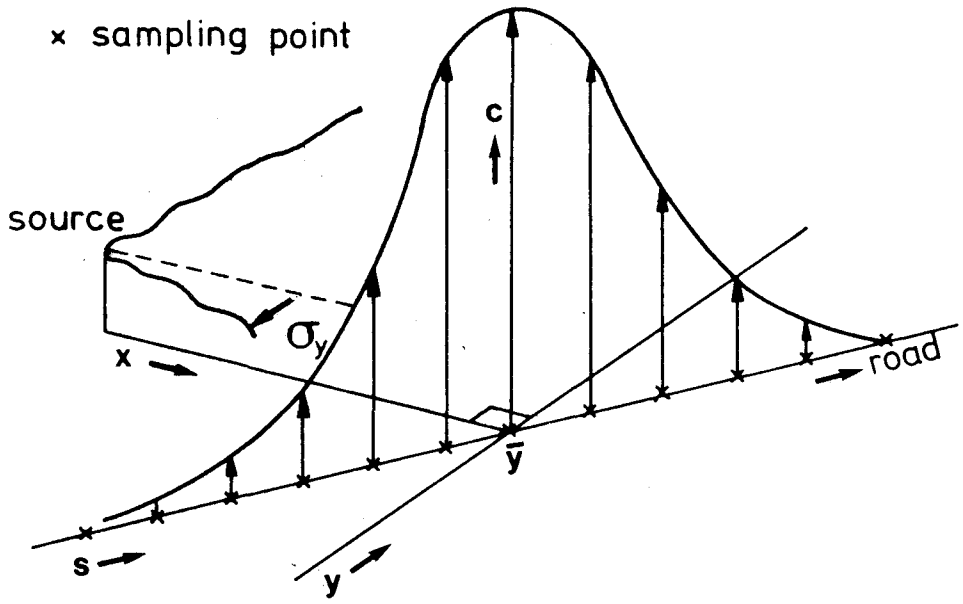


Figure 24 Configurations of the source and the sampling points. The x-axis is directed along the projection of the plume-axis. The y-axis is perpendicular to the x-axis. In calculations the concentration distribution c is projected on to the y-axis.

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