

DNMI DET NORSKE METEOROLOGISKE INSTITUTT

klima

HANØYTANGEN , FEBRUARY 1994

Knut A. Iden

RAPPORT NR. 17/94 KLIMA



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ISBN
REPORT NR. 17/94 KLIMA
DATE May 5

TITLE
HANØYTANGEN , FEBRUARY 1994

PREPARED BY
Knut A. Iden

ORDERED BY
KVÆRNER CONCRETE CONSTRUCTION
CONTRACT NO: KCC/PAC004/001

SUMMARY
Monthly summary based on the meteorological data measured at the building site of Kværner at Hanøytangen, Askøy near Bergen.

SIGNATURE
.....
Knut A. Iden
PROJ. RESPONSIBLE

.....
Bjørn Aune
HEAD OF DIVISION

MONTHLY REPORT FEBRUARY 1994

PAC 004 WEATHER ANALYSIS IN HANØYTANGEN
REPORT 4 : May 5 1994

CLIENT : DNMI
CONTRACT NO. : KCC/PAC004/001
PROJECT NO. :
DOCUMENT NAME : RAPPFEB.94
PROJ. MANAGER : Knut A. Iden
EXECUTED BY : Bjørn. H. Halvorsen and Knut A. Iden
APPROVED BY : Bjørn Aune *Bjørn Aune* 05.05.1994
COMPLETION DATE : April 22 1994
REV 1. : May 5 1994

DSU : serial no. 6601
Received : March 14 1994

Comments regarding the data :

The DSU serial no.6601 contains data for the period 26/1/94 to 1/3/94.

The DSU is read by the standard software (P3059) delivered from Aanderaa a/s. The calibration factors applied is provided by Aanderaa in a fax dated January 21 1994.

The processing is based on this data set and the following steps are conducted :

- . A SAS data set of the data for February are generated

In this step 10 min mean wind speed > 35 m/s and gust wind speed > 40 m/s are replaced with missing values. The wind speed in 30 m is also compared to the wind speed measured 18 m above the ground. If deviation is 10 m/s above or 5 m/s below the wind speed measured in 18 m, the wind speed in 30 m is replaced by missing value. The reason for this handling is there seem to be some disturbances connected to the measurements in the top of the mast (30 m above the ground).

The other meteorological parameters are checked to be inside reasonable intervals. The original data which is replaced due to the specified criterions are saved for an assessment.

- . Plots of the time series are generated and examined.
- . Un physical values (spikes) are eliminated.
- . Final plots of the time series are generated.

For wind speed and wind direction 10 min values are plotted. For the parameters air temperature (T), humidity (UU) and air pressure reduced to mean sea level (QFF), hourly means are plotted. The hourly mean for 11.00^h is defined by the measurements for 10.30^h, 10.40^h, 10.50^h, 11.00^h, 11.10^h and 11.20^h.

- . Distribution tables wind speed /direction are generated. 22.5° intervals are applied for the direction. N='348.76° - 11.25', NNE = '11.26 - 33.75' ...
- . Wind roses are generated.
- . Coefficient transfert tables are generated.
- . Duration table are generated.
- . Climatological summary table updated

Logging each 10 minute

WIND

Parameter	Height	Cover.	Unit	Mean	ST.D.	Max	Dir ¹	D.:Hour	Min	Dir ¹	D.:Hour
Wind speed	30 m	100.0 %	m/s	4.3	3.0	16.7	139	02:1043	0.4	49	10:1903
Wind speed	18 m	100.0 %	m/s	4.2	3.0	16.7	N/A	02:1043	0.4	N/A	19:2003
Wind speed	10 m	100.0 %	m/s	4.1	3.1	16.8	137	02:1043	0.5	134	09:1853
Wind gust	30 m	99.9 %	m/s	8.1	5.8	22.2	156 ²	01:1103	0.4	032 ²	25:0133
Wind gust	18 m	100.0 %	m/s	7.9	5.7	23.1	N/A	01:1943	0.4	N/A	19:2003
Wind gust	10 m	100.0 %	m/s	7.7	5.6	23.4	143 ²	02:1023	1.0	102 ²	04:1113

OTHER METEOROLOGICAL DATA

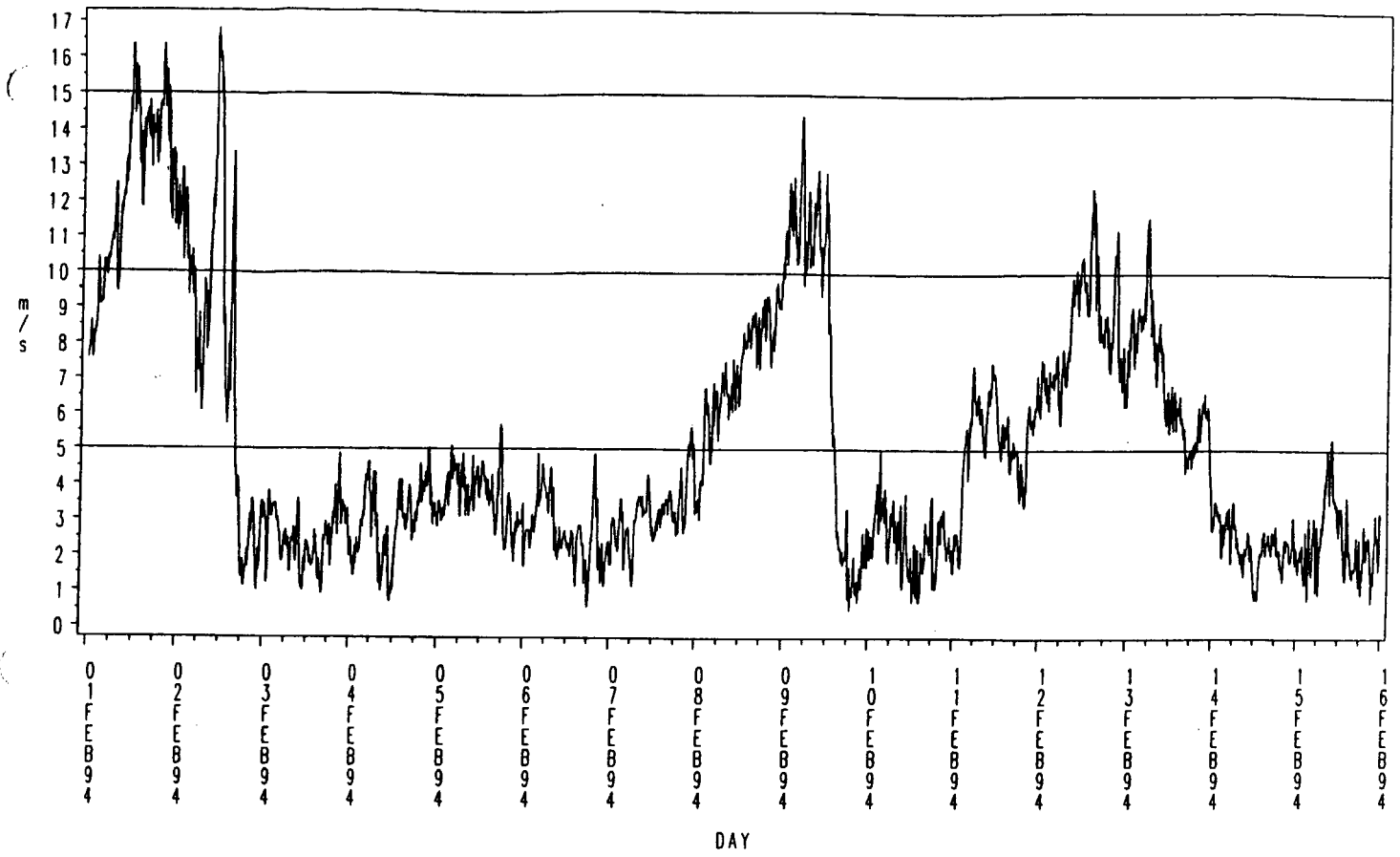
Parameter	Height	Cover.	Unit	Mean	ST.D.	Max	D.:hour	Min	D.:hour
Air Temp.	2. m ³	100.0 %	C	.1	2.3	6.4	22:1443	-6.3	14:0523
Rel. Hum.	2. m ³	100.0 %	%	60	15.6	90	18:0623	27	14:1333
Air pr.	0. m ³	100.0 %	hPa	1020.1	11.4	1045.2	14:0023	989.7	02:0203

- 1 Direction is referenced to True North (accuracy +- 2°)
 - 2 Direction of gust wind is not measured. The mean wind direction for the ten minute period when it has occurred is applied.
 - 3 Air temperature sensor and humidity sensor are placed in the mast 2 m above the reference point on the ground while the pressure sensor have the same height as the reference.
- The reference point on the ground is located 15.64 m above the mean sea level (NGO).

PLOT OF TIME SERIES

HANØYTANGEN 1994

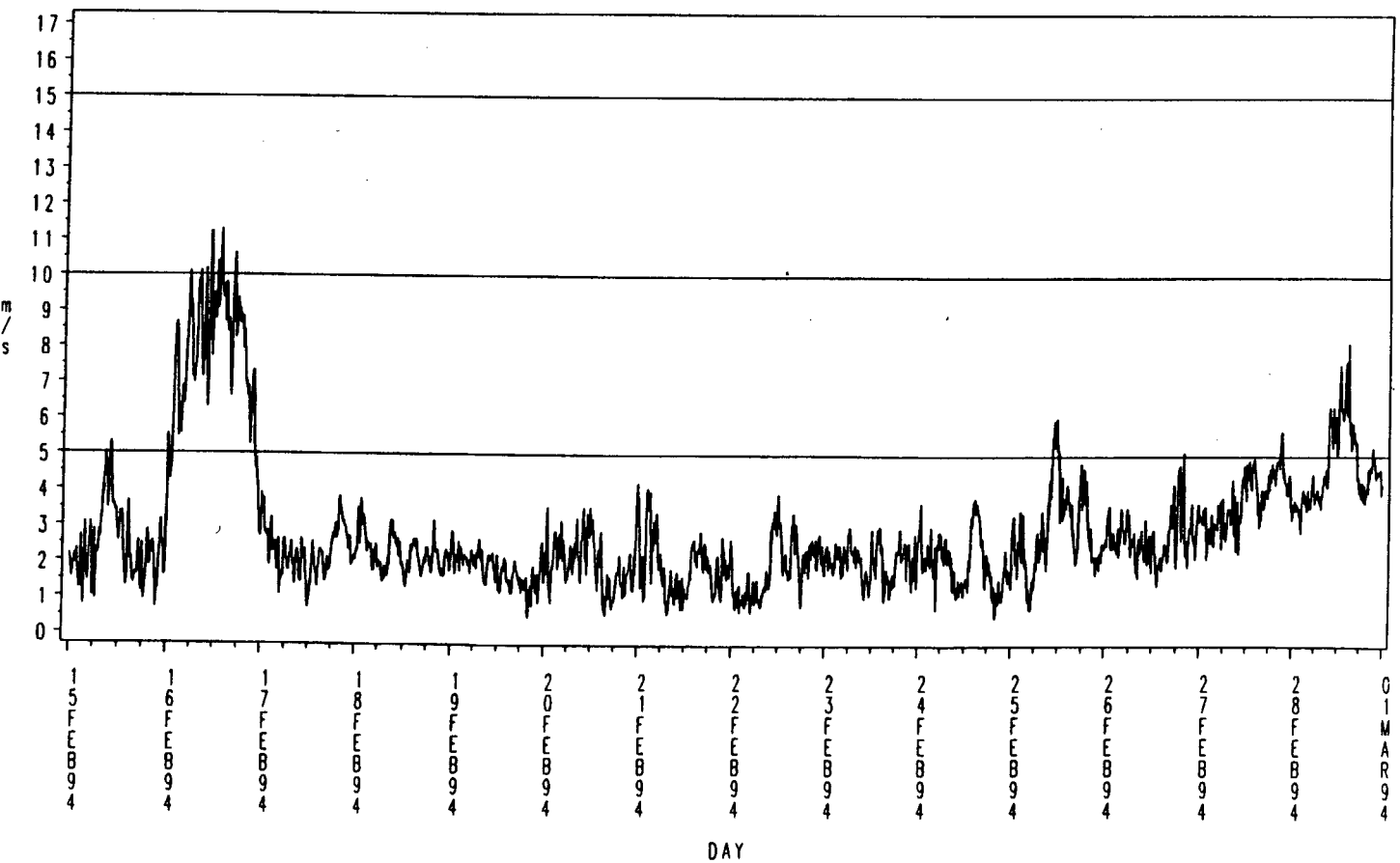
Wind speed 10 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

HANØYTANGEN 1994

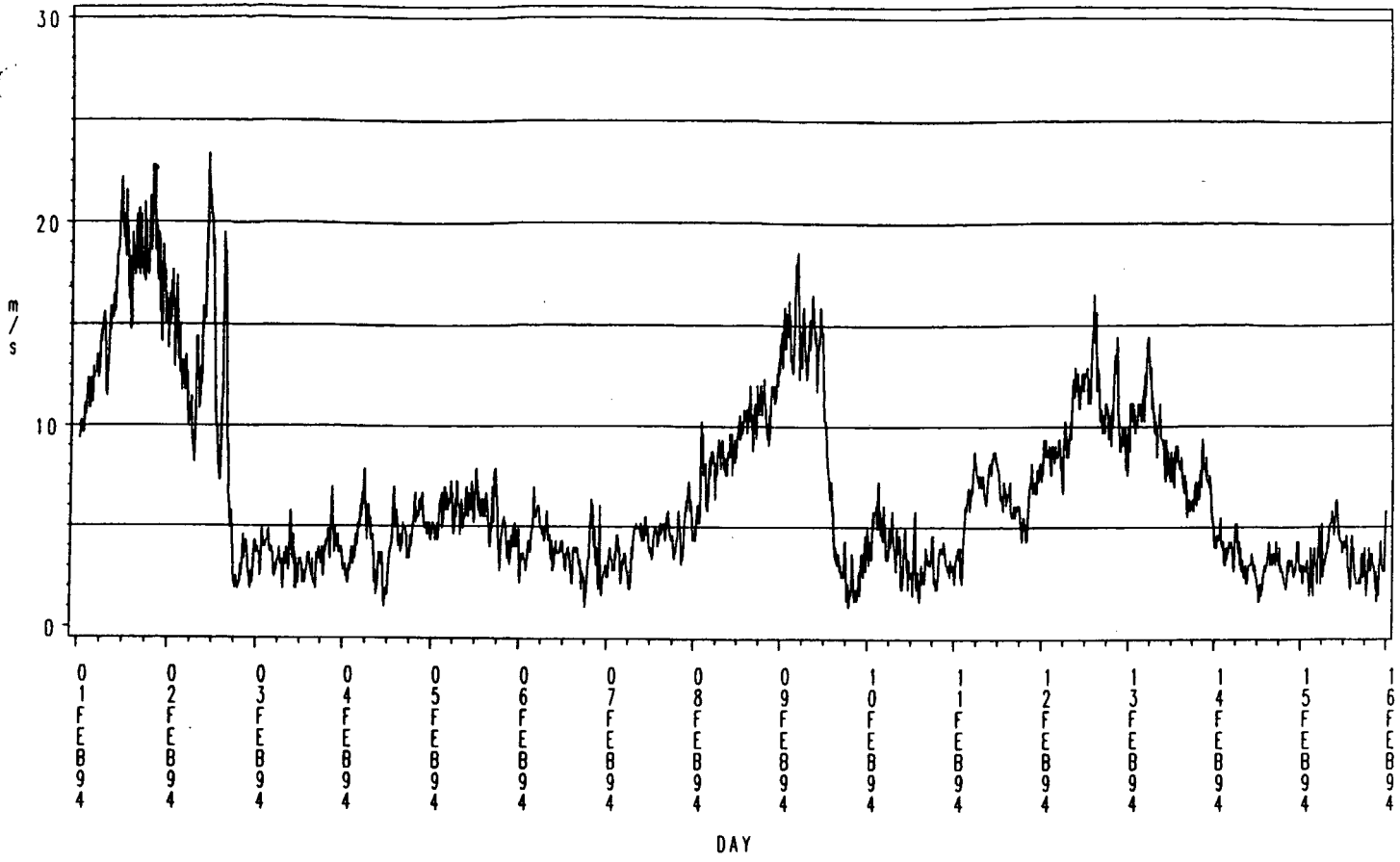
Wind speed 10 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

HANØYTANGEN 1994

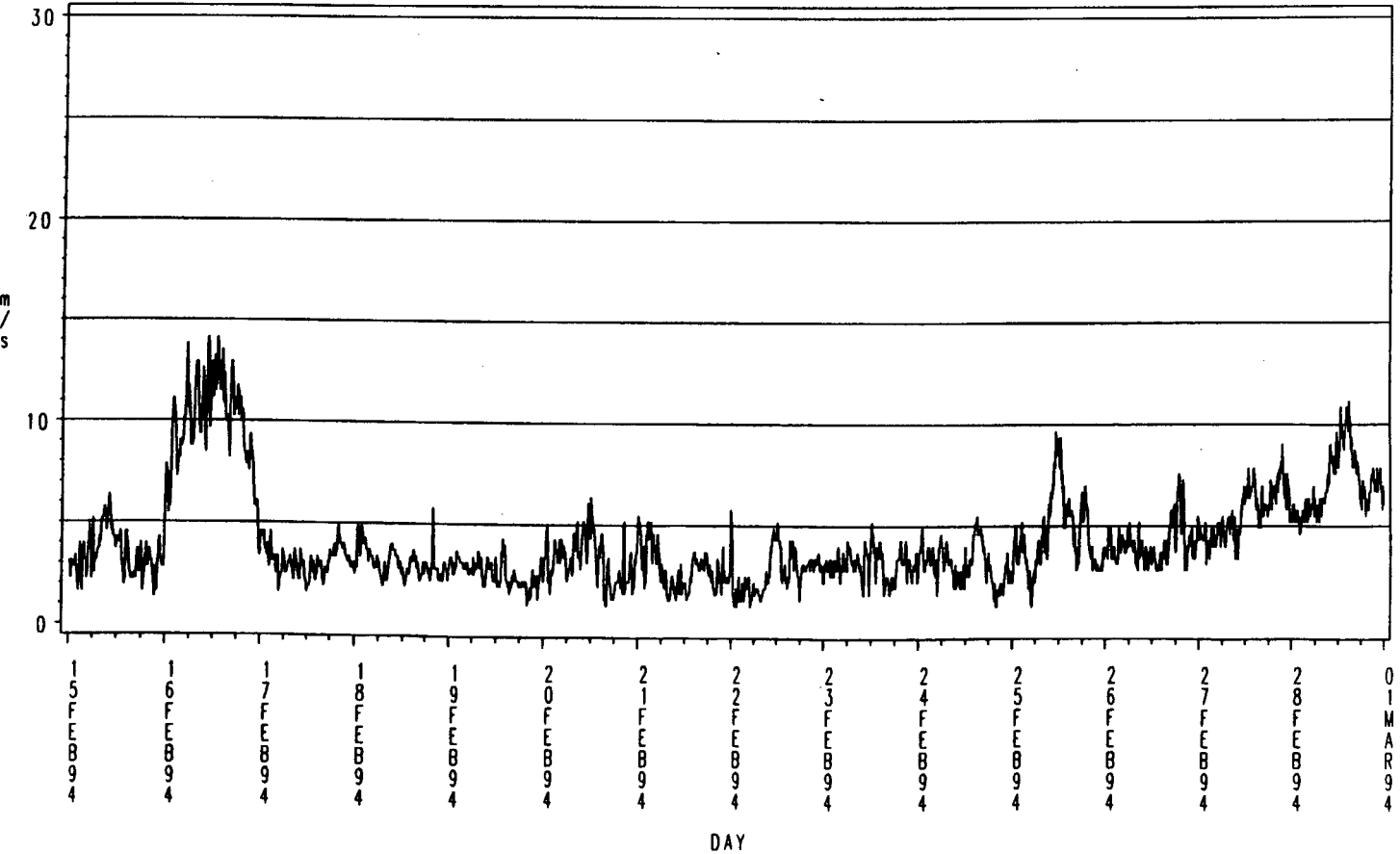
Gust wind speed 10 m above the ground (m/s)



DNMI - KLIMAARBEIDEN

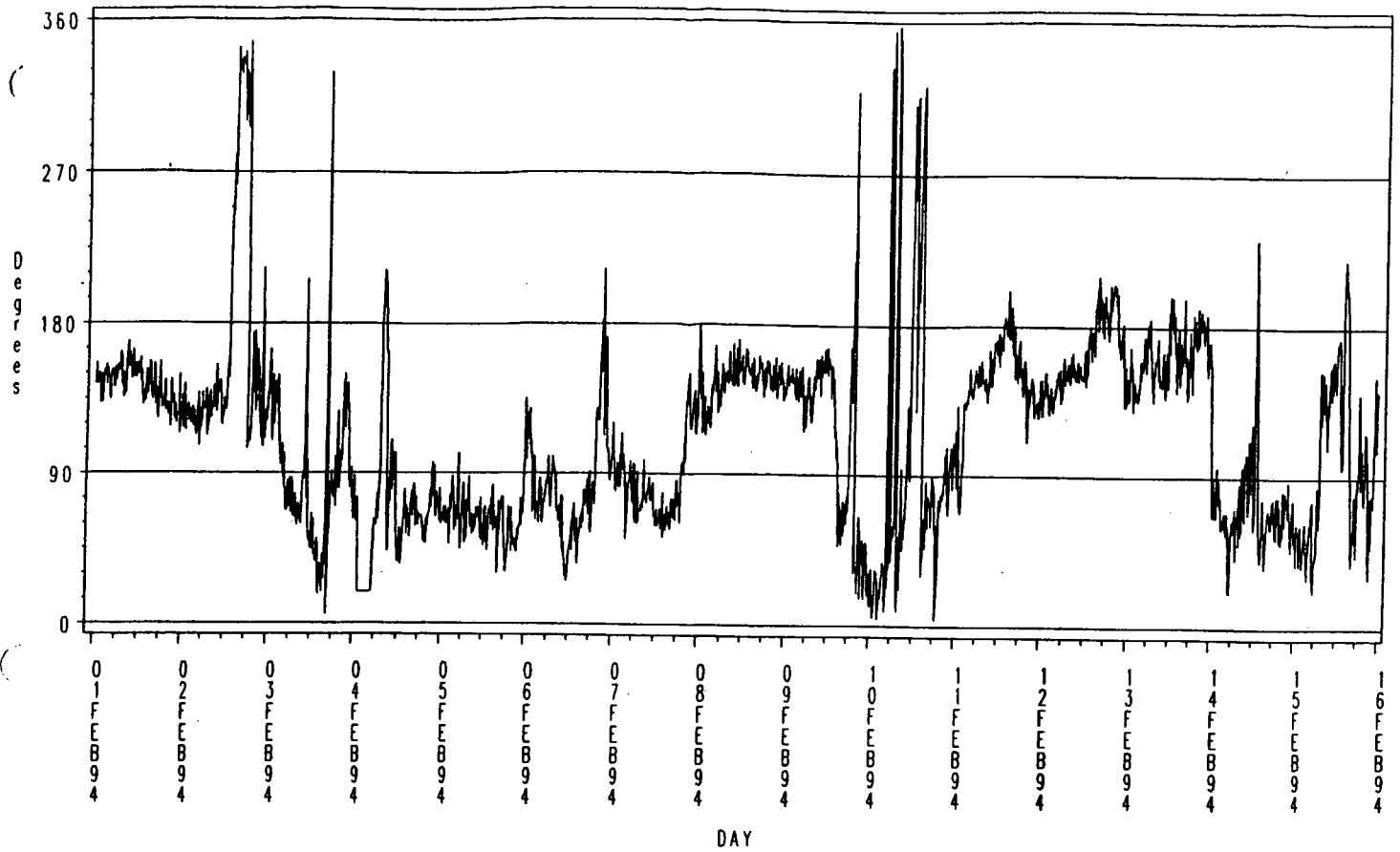
HANØYTANGEN 1994

Gust wind speed 10 m above the ground (m/s)



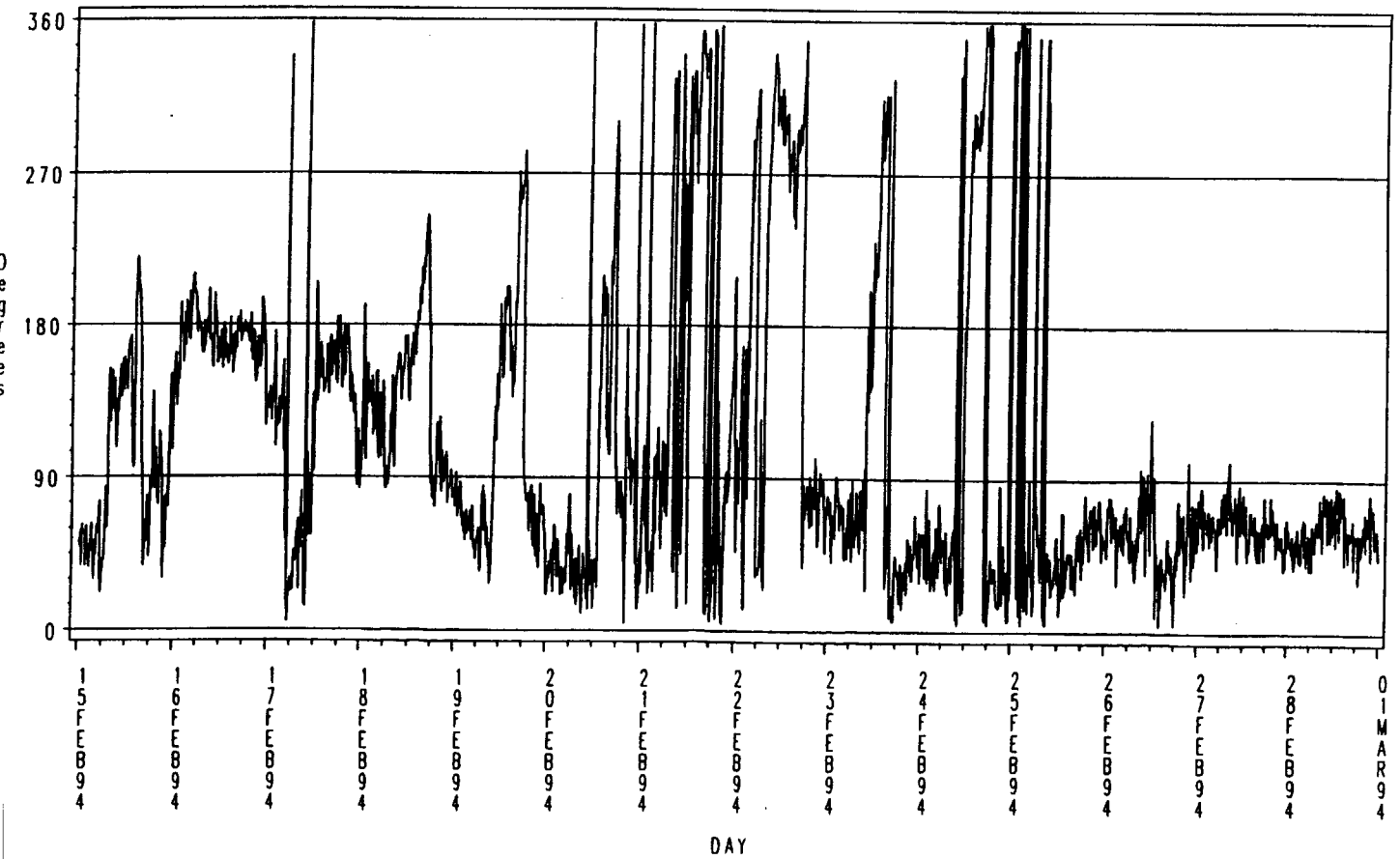
DNMI - KLIMAARBEIDEN

Wind direction 10 m above the ground



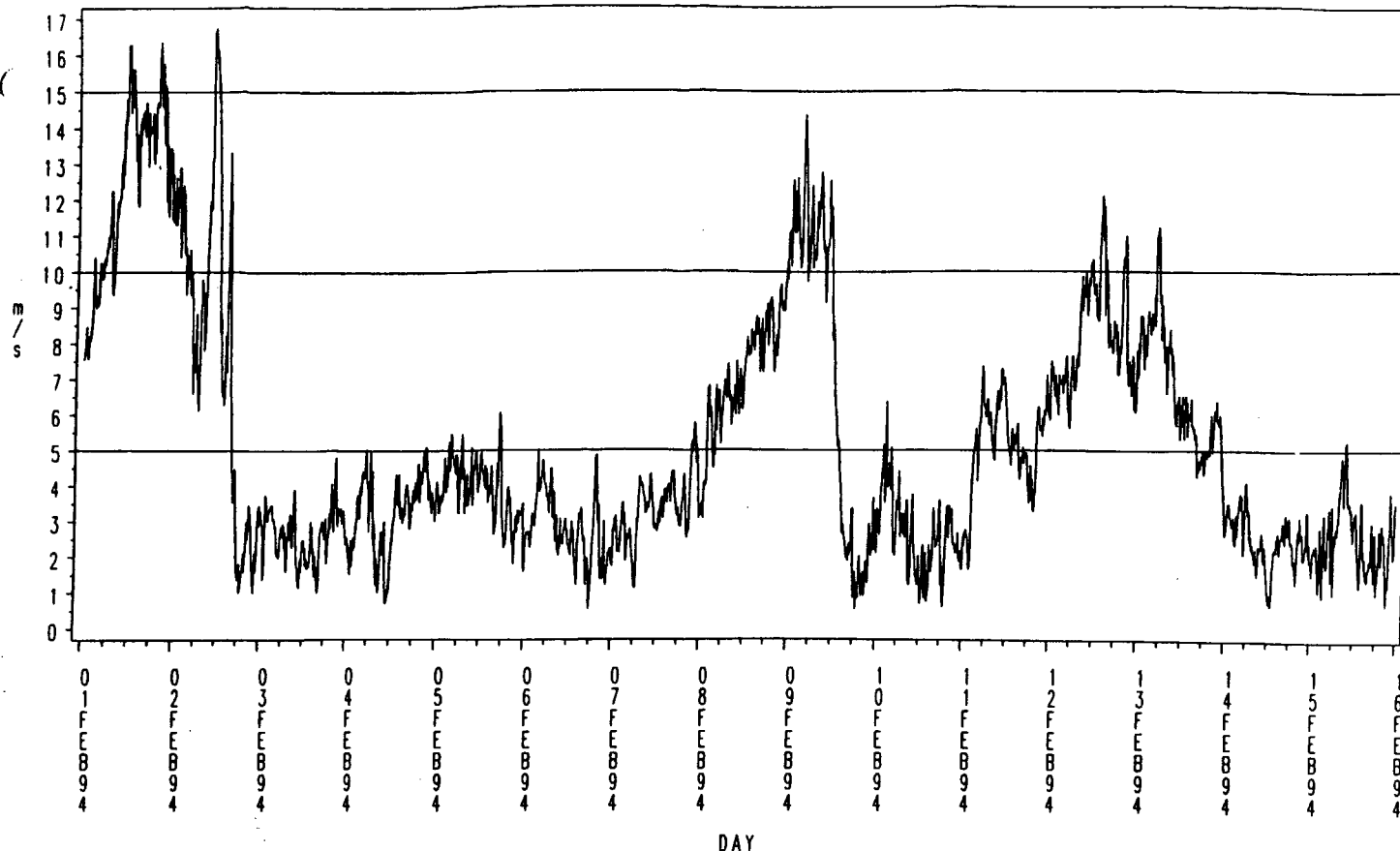
DNMI - KLIMADELINGEN

HANØYTANGEN 1994
Wind direction 10 m above the ground



DNMI - KLIMADELINGEN

Wind speed 18 m above the ground (m/s)

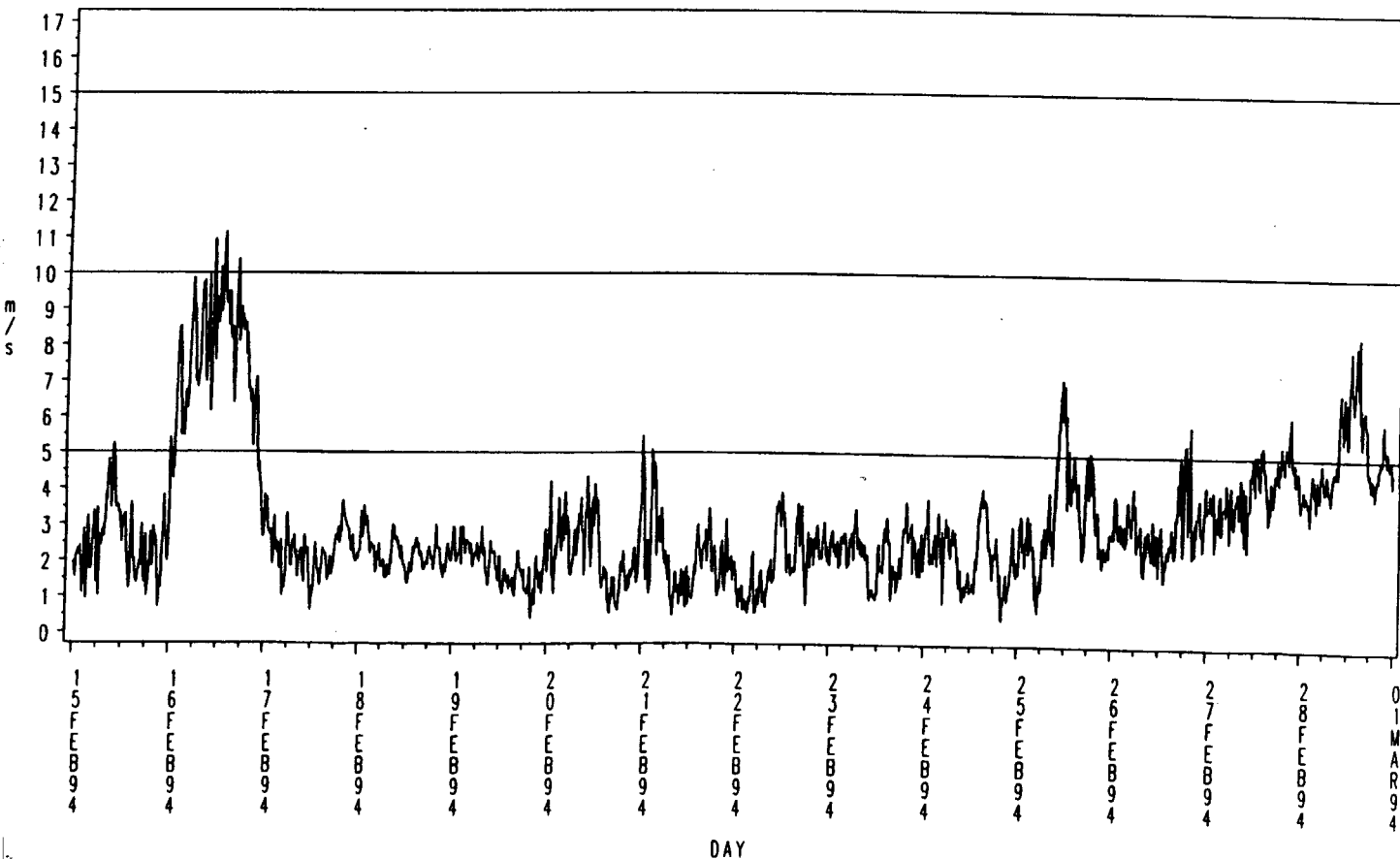


DAY

DNMI - KLIMAÅVDELINGEN

HANØYTANGEN 1994

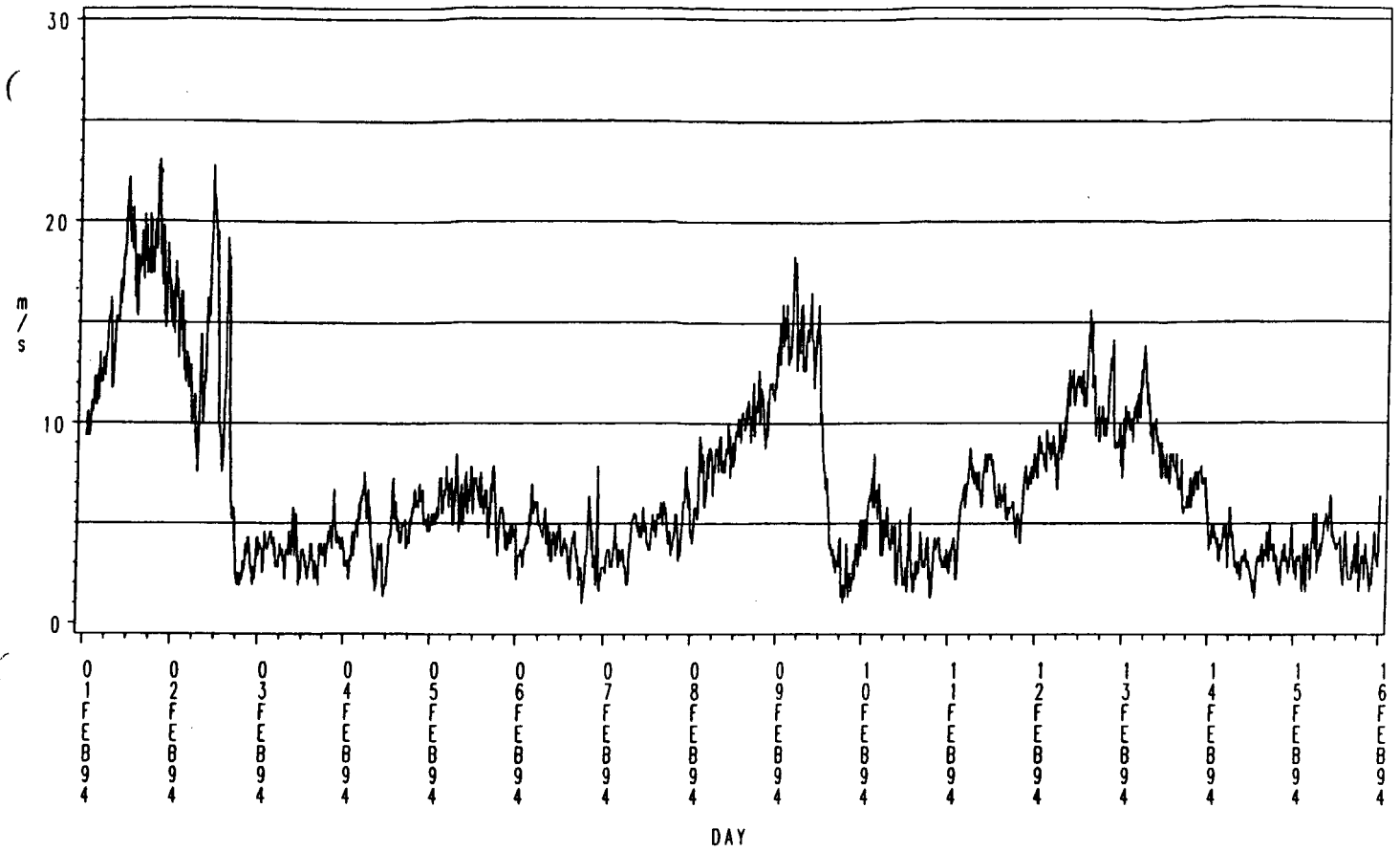
Wind speed 18 m above the ground (m/s)



DAY

DNMI - KLIMAÅVDELINGEN

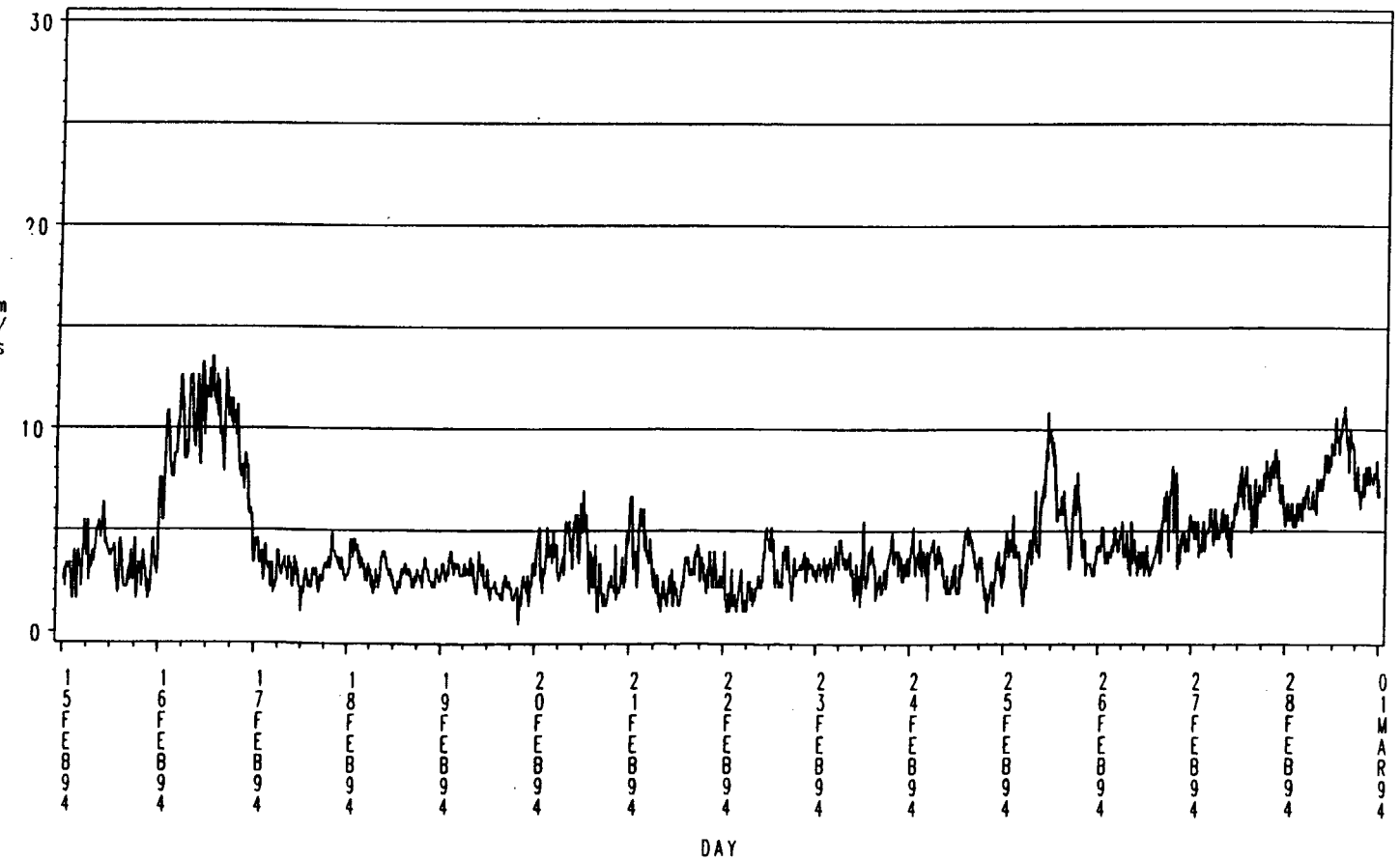
HANØYTANGEN 1994
Gust wind speed 18 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

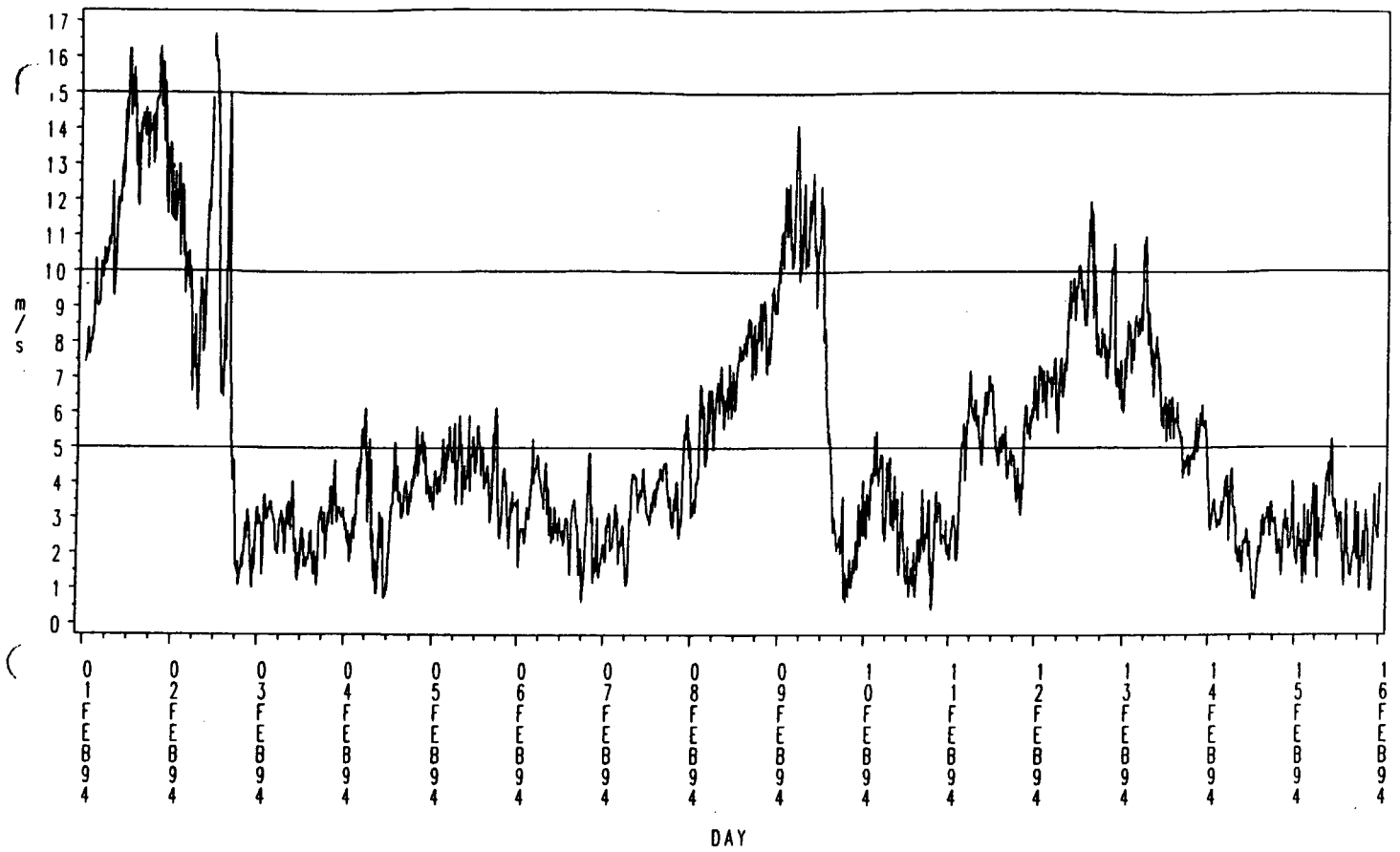
HANØYTANGEN 1994

Gust wind speed 18 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

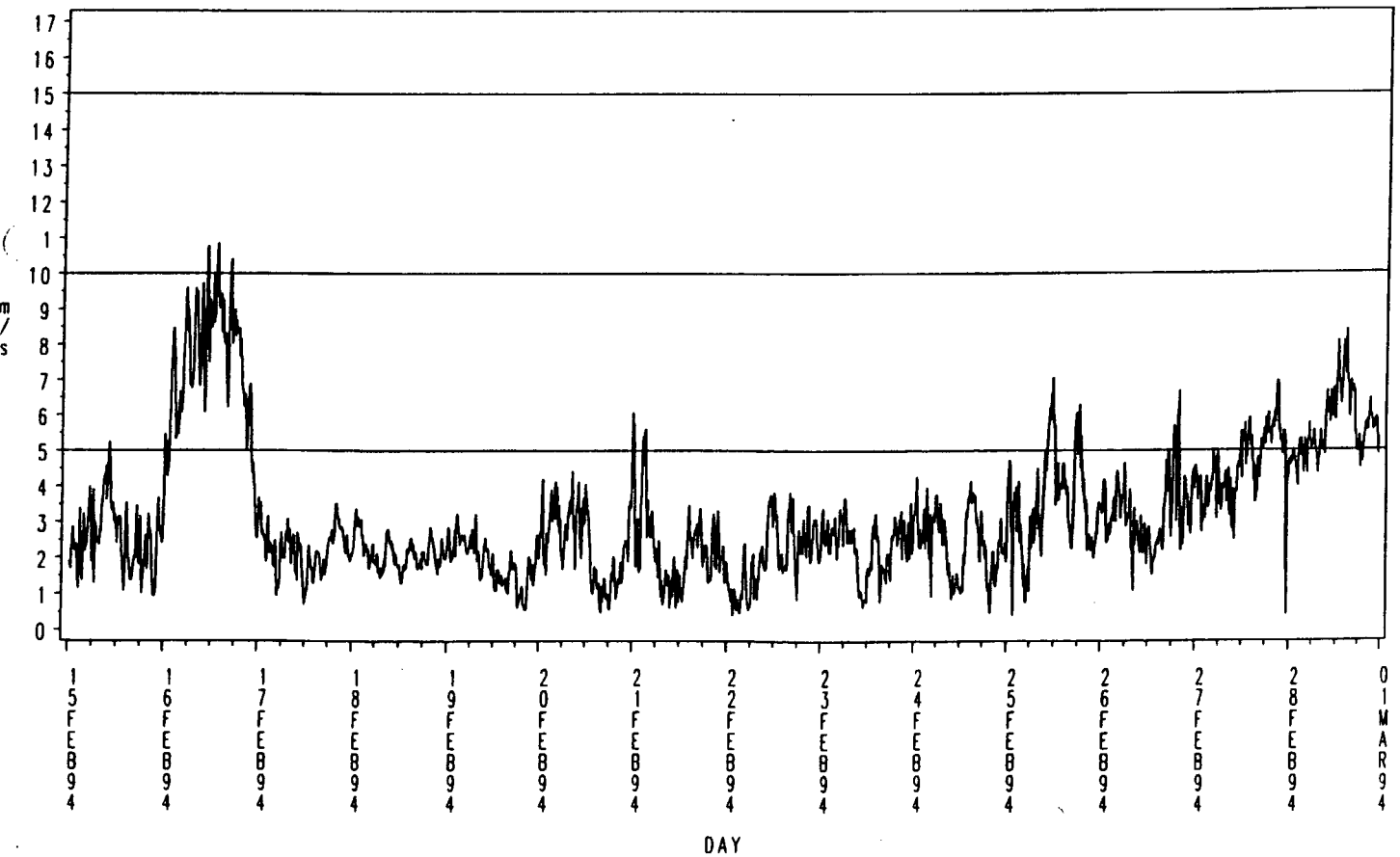
HANØYTANGEN 1994
Wind speed 30 m above the ground (m/s)



DNMI - KLIMADELINGEN

HANØYTANGEN 1994

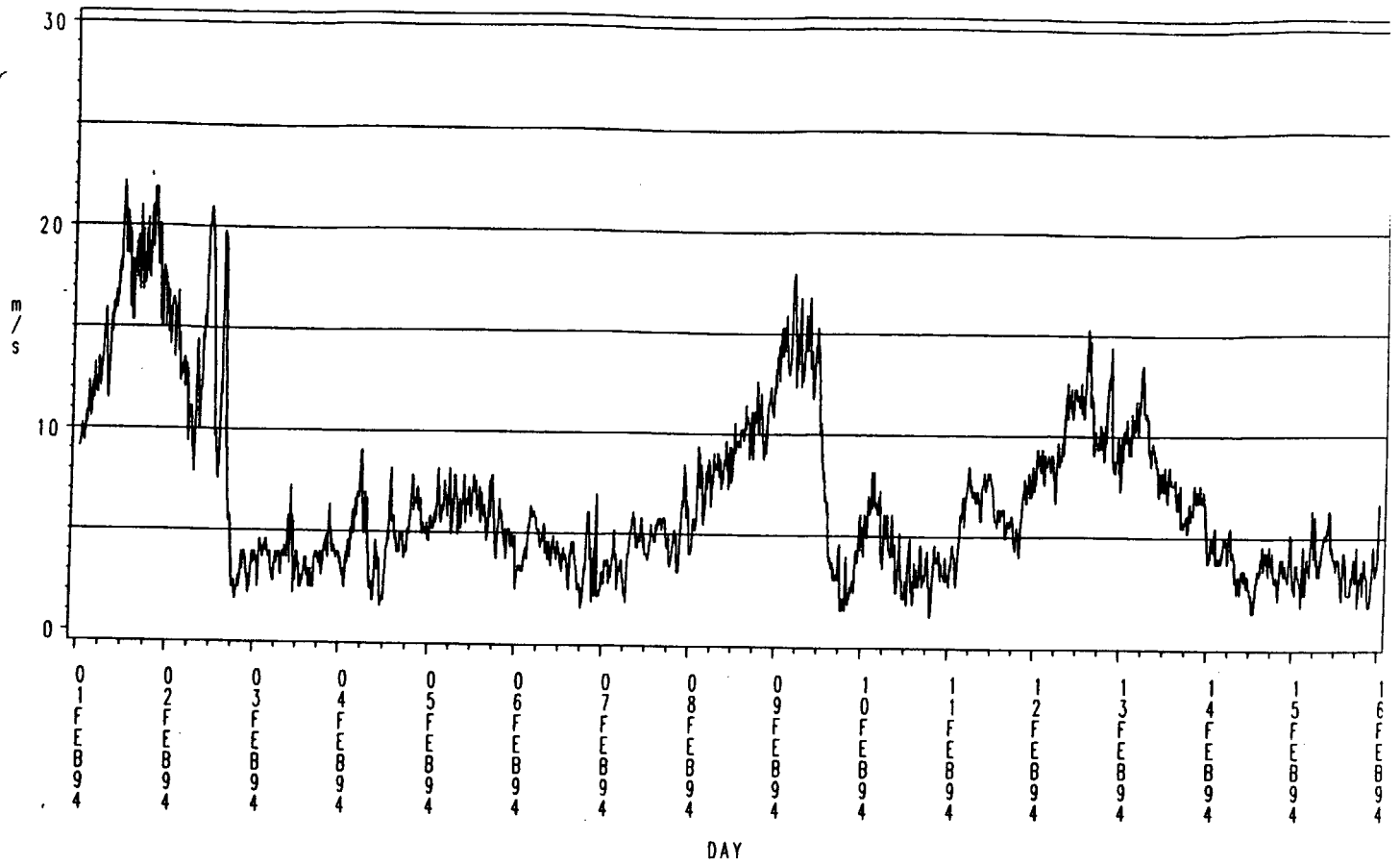
Wind speed 30 m above the ground (m/s)



DNMI - KLIMADELINGEN

HANØYTANGEN 1994

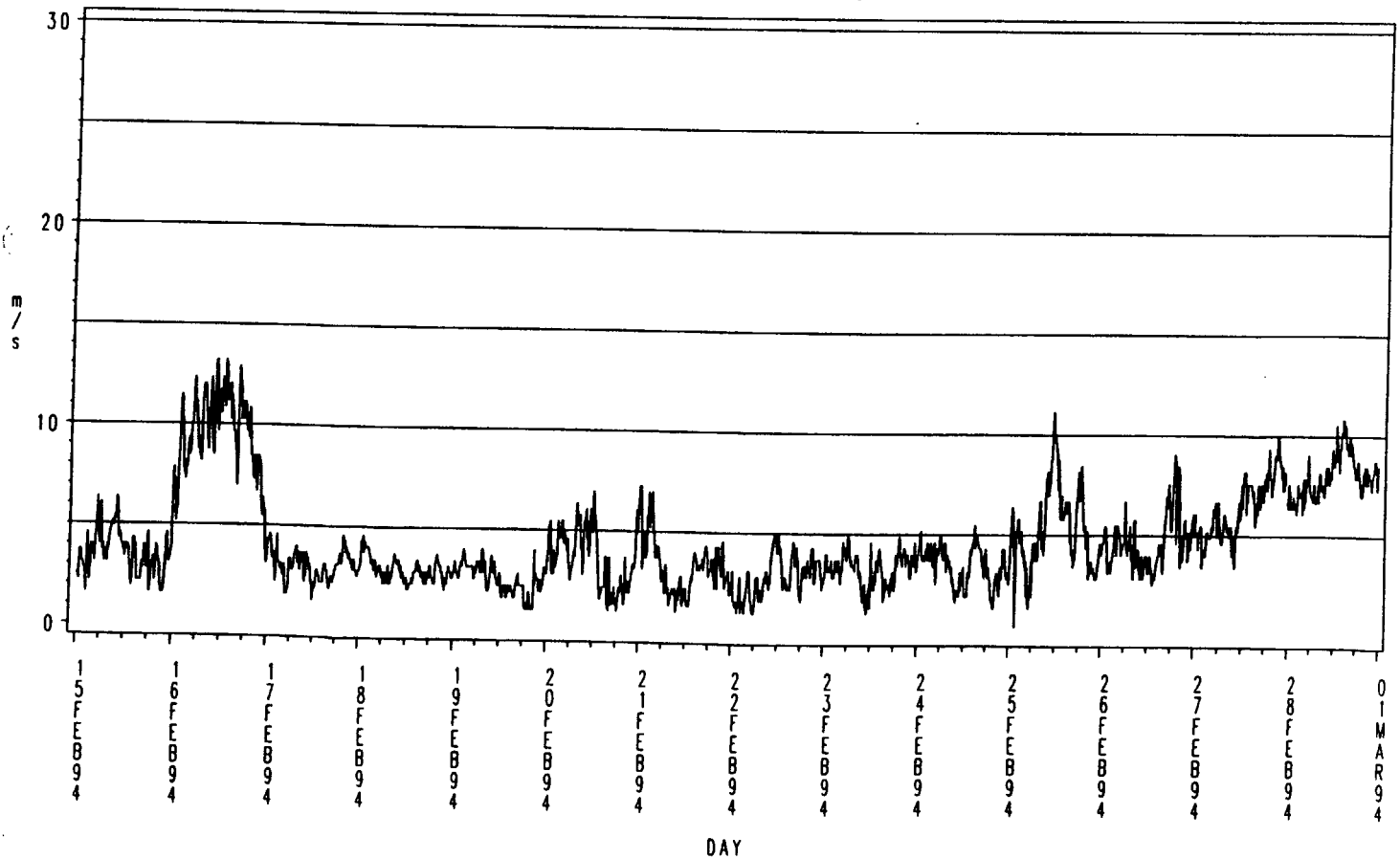
Gust wind speed 30 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

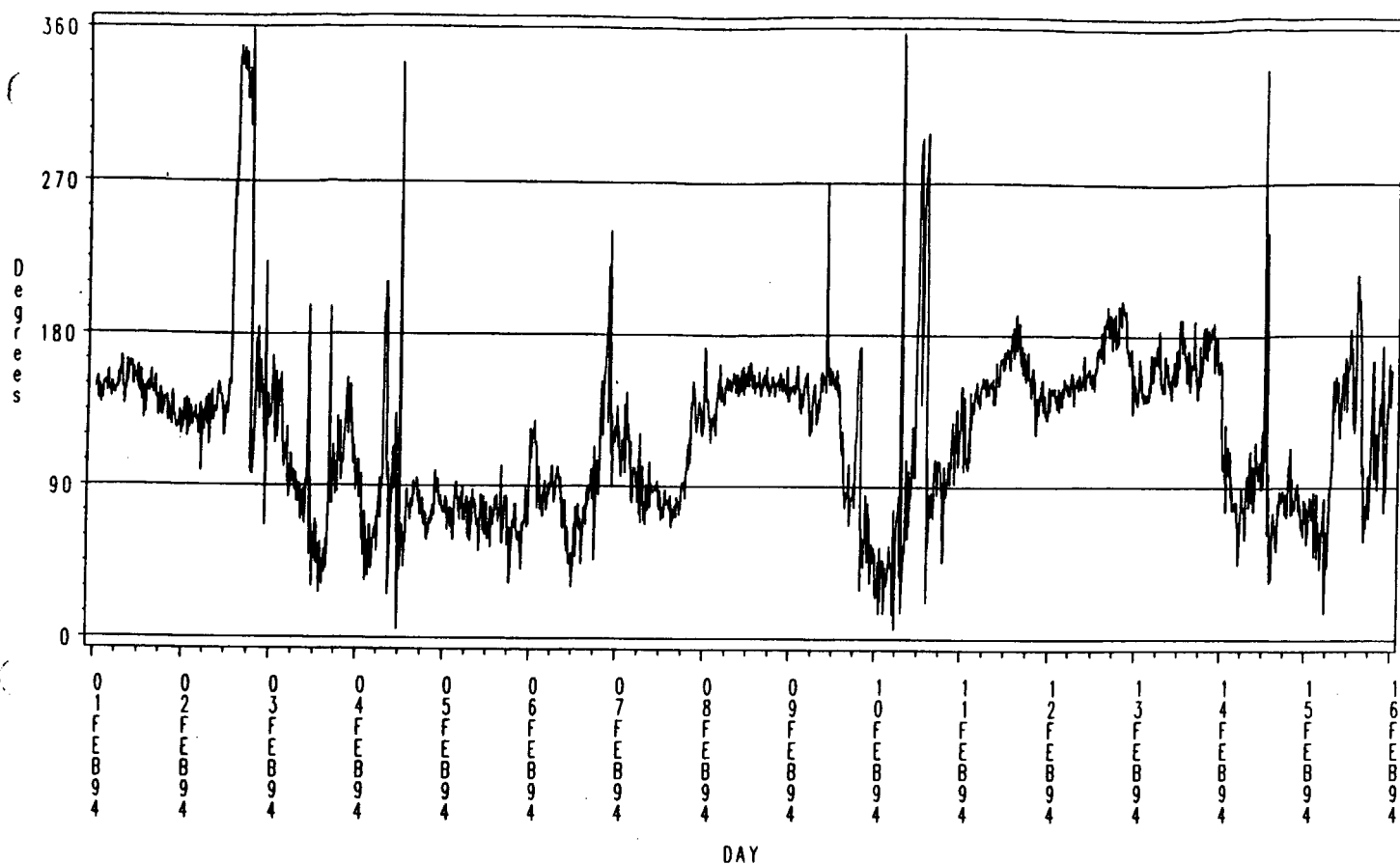
HANØYTANGEN 1994

Gust wind speed 30 m above the ground (m/s)



DNMI - KLIMA-AVDELINGEN

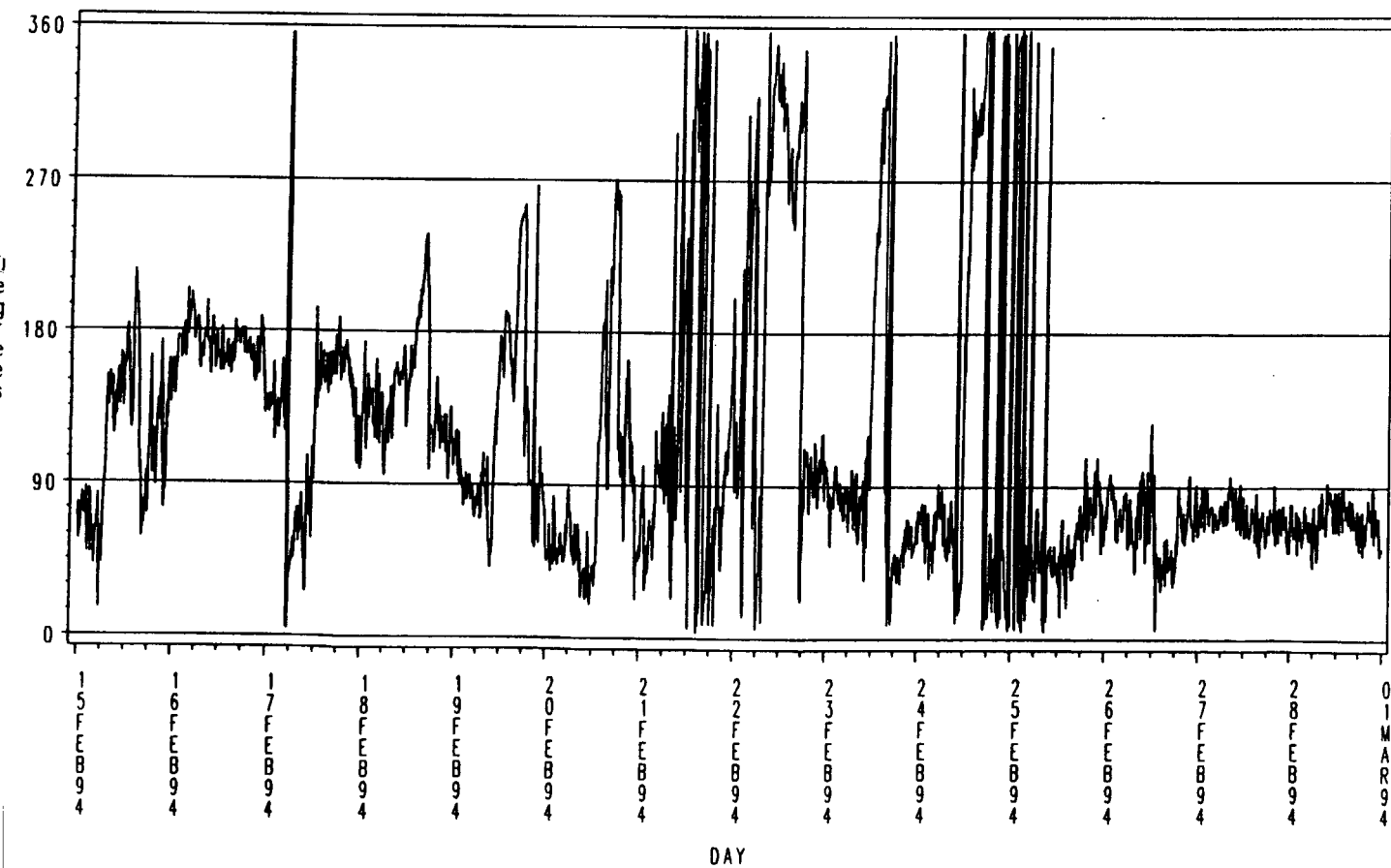
Wind direction 30 m above the ground



DNMI - KLIMAÅVDELINGEN

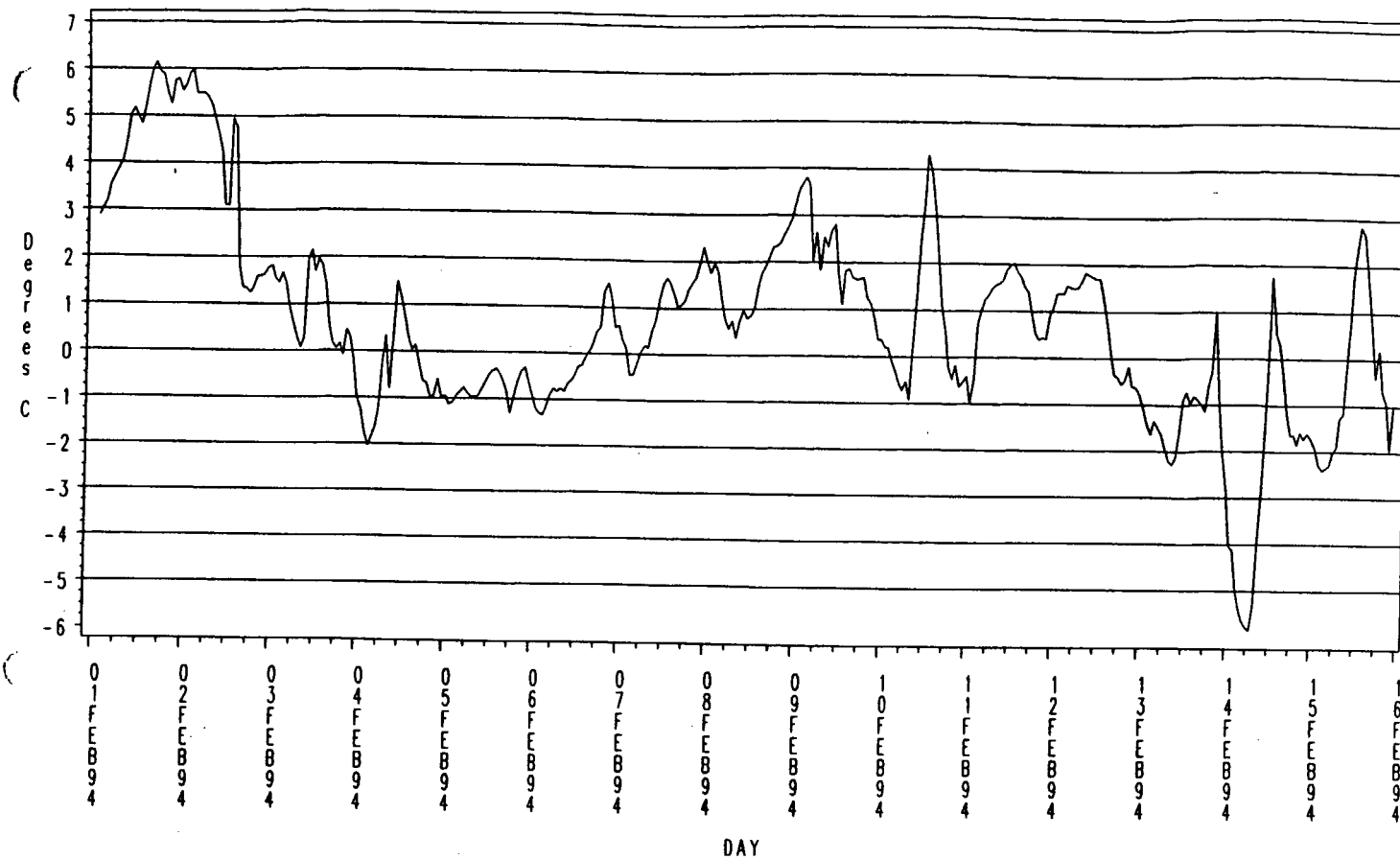
HANØYTANGEN 1994

Wind direction 30 m above the ground



DNMI - KLIMAÅVDELINGEN

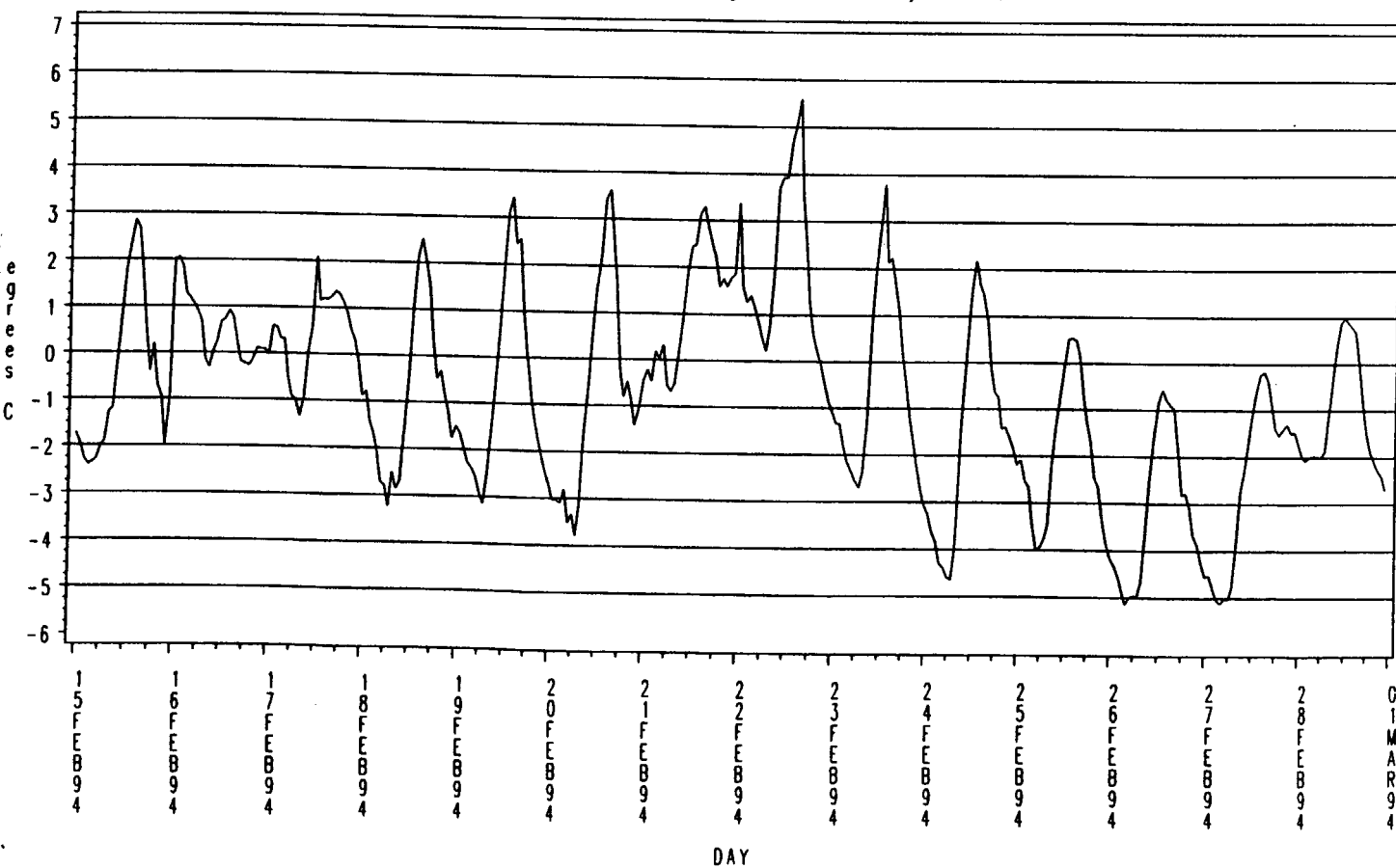
Air Temperature in degrees C (Hourly Means)



DNMI - KLIMA-AVDELINGEN

HANØYTANGEN 1994

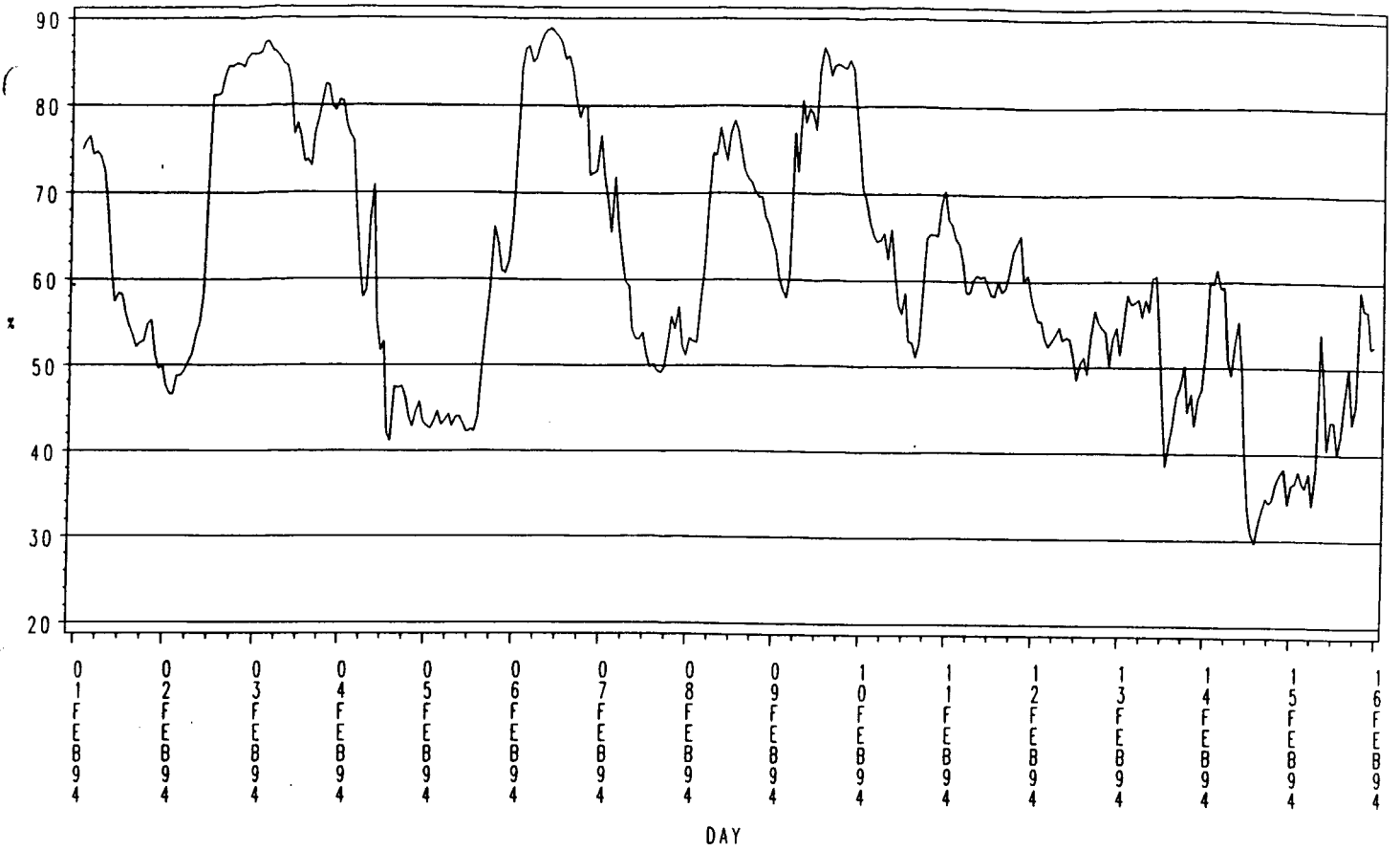
Air Temperature in degrees C (Hourly Means)



DNMI - KLIMA-AVDELINGEN

HANØYTANGEN 1994

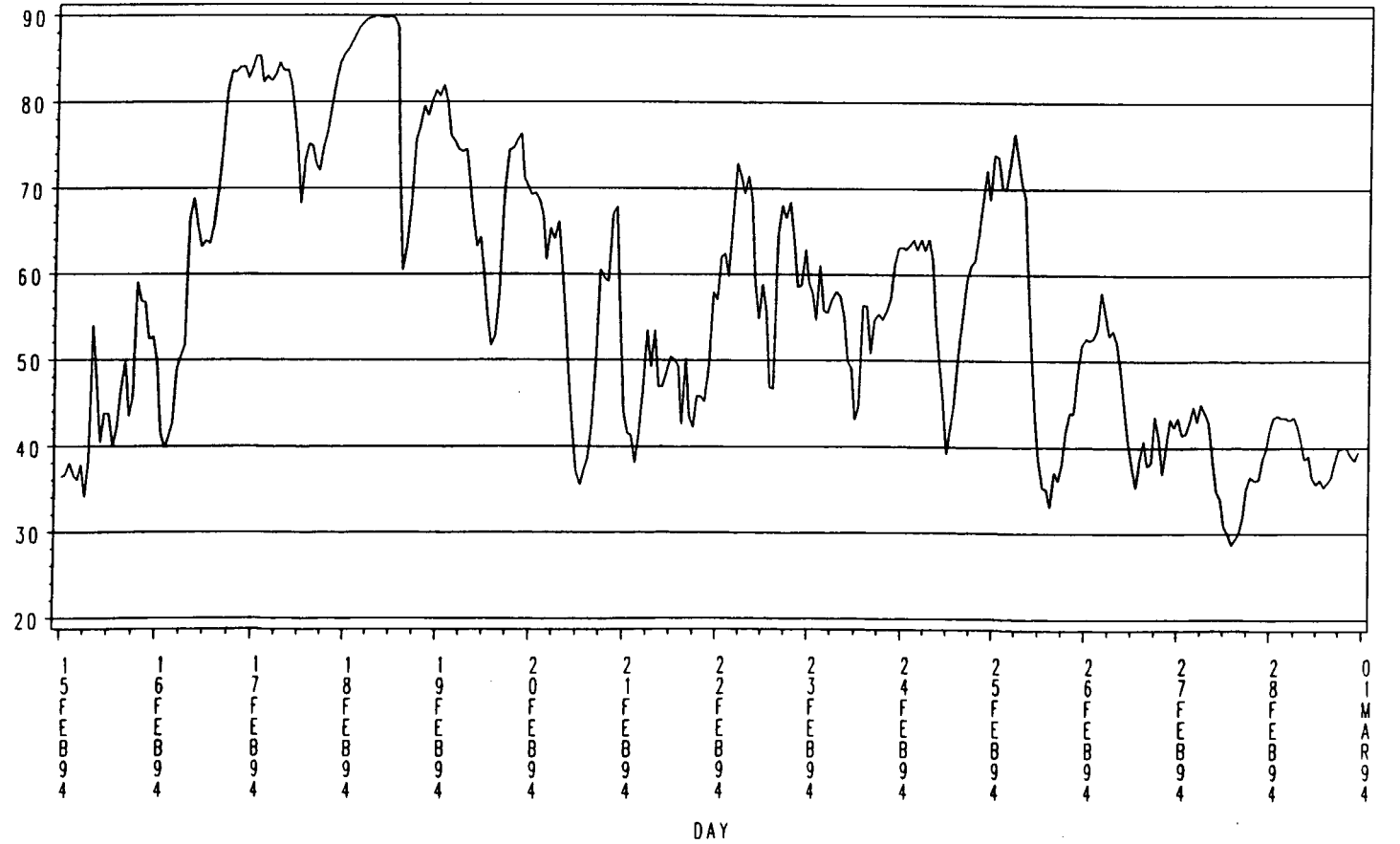
Air Humidity in % (Hourly Means)



DNMI - KLIMA-AVDELINGEN

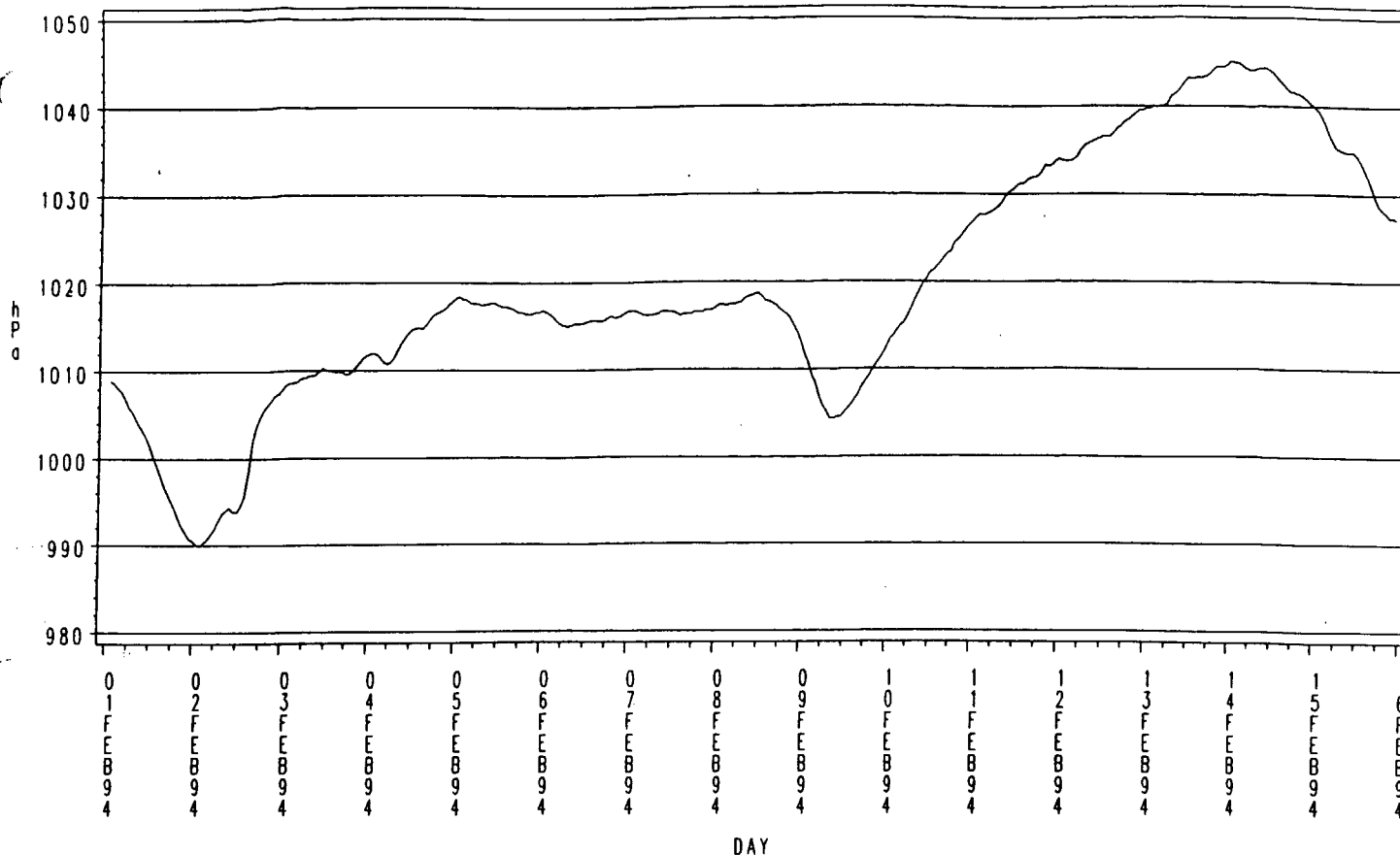
HANØYTANGEN 1994

Air Humidity in % (Hourly Means)



DNMI - KLIMA-AVDELINGEN

Air Pressure (QFF) in hPa (Hourly Means)

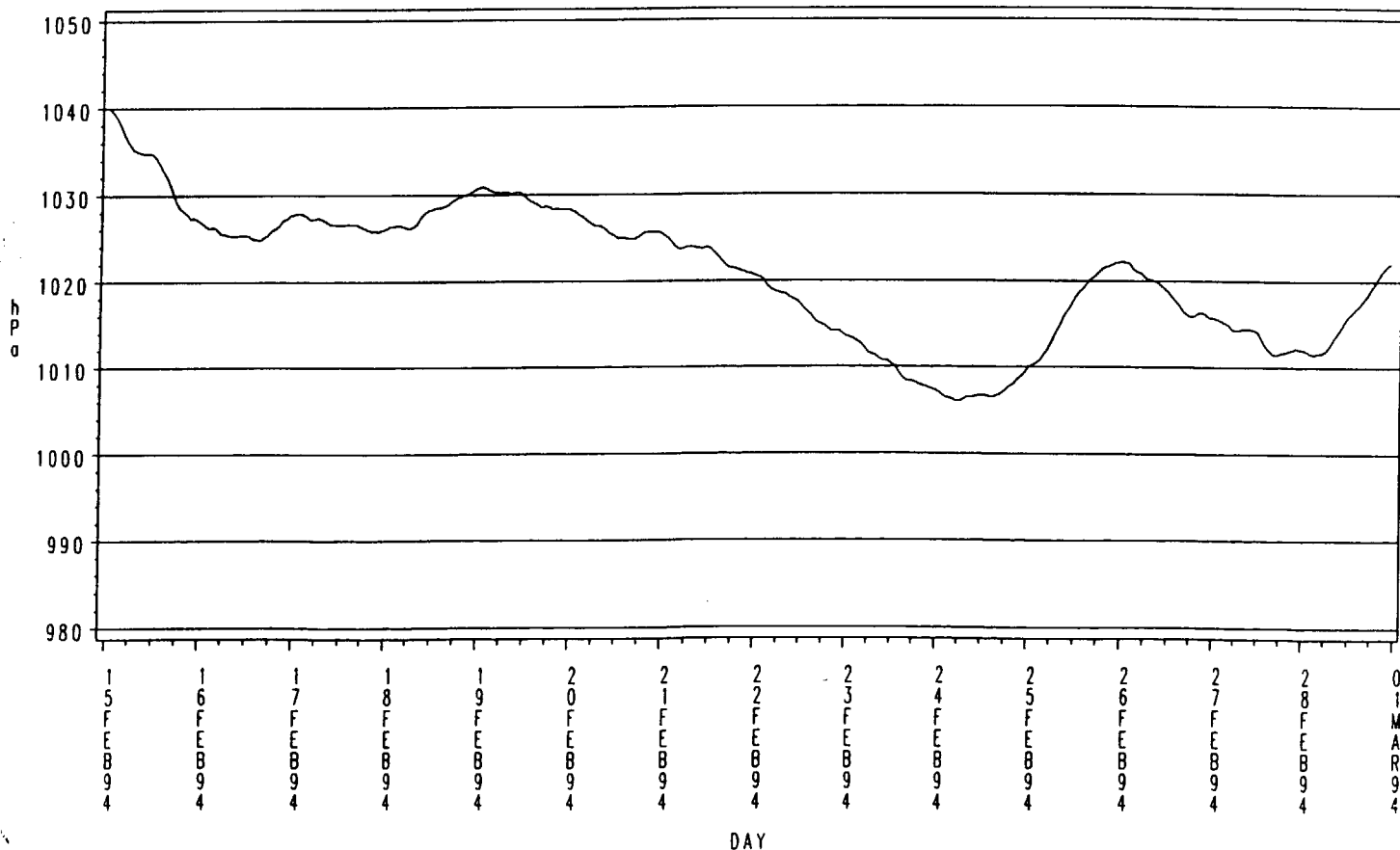


DAY

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HANØYTANGEN 1994

Air Pressure (QFF) in hPa (Hourly Means)



DAY

DNMI - KLIMA-AVDELINGEN

DISTRIBUTION TABLES / WIND ROSES

The distribution table gives details about the distribution of the wind speed for a certain wind direction or the distribution of the wind directions for a certain wind speed.

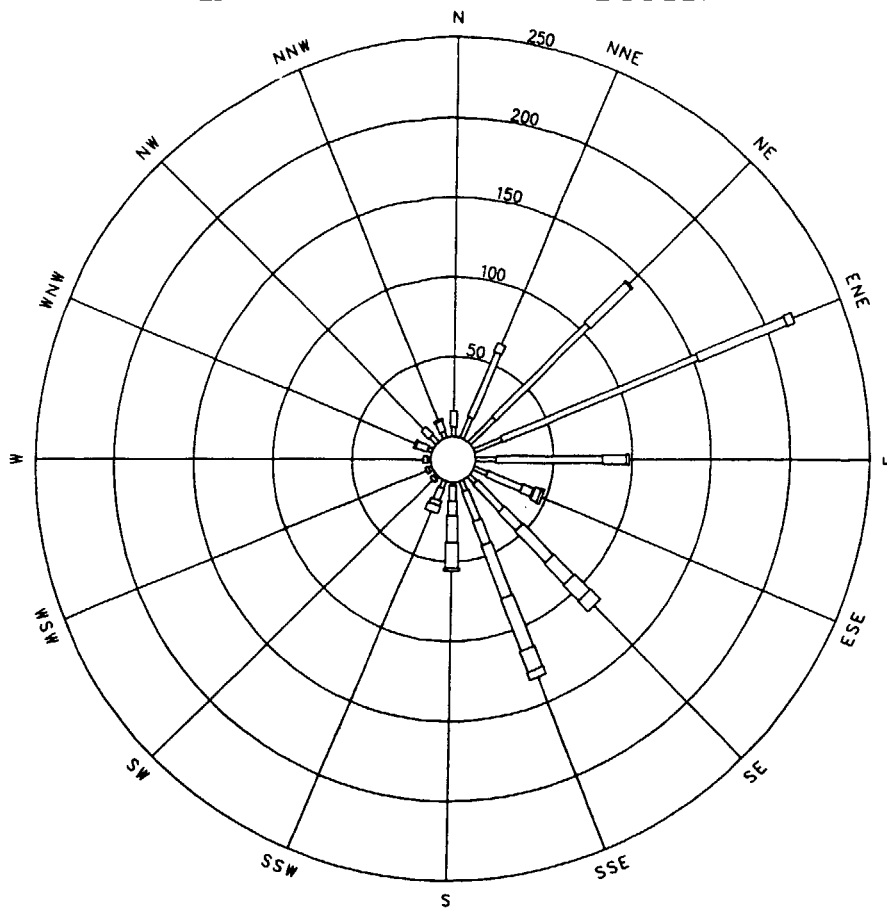
If for example, it is of interest to know the directions for which wind force 5 Beaufort have occurred this month, one has to look at the line for 5 Beaufort in the table.

If the information of the wind forces that have occurred this month for a certain direction is of interest, one has to look at the column for that specific direction.

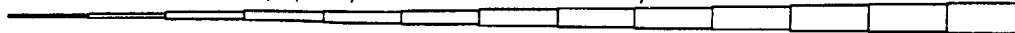
The frequencies in the table are given per thousand (Prm) of the data available this month.

The wind rose is a graphic representation of the information given in the distribution table. The same number of classes is applied. No Beaufort value is given to the centre of the wind rose. Thus, the first class outside the centre is 0 Beaufort (0-0.2 m/s). Due to the calibration of the wind sensors, this class will always be empty at Hanøytangen.

HANOYTANGEN Feb 1994 WIND DISTRIBUTION 10 M



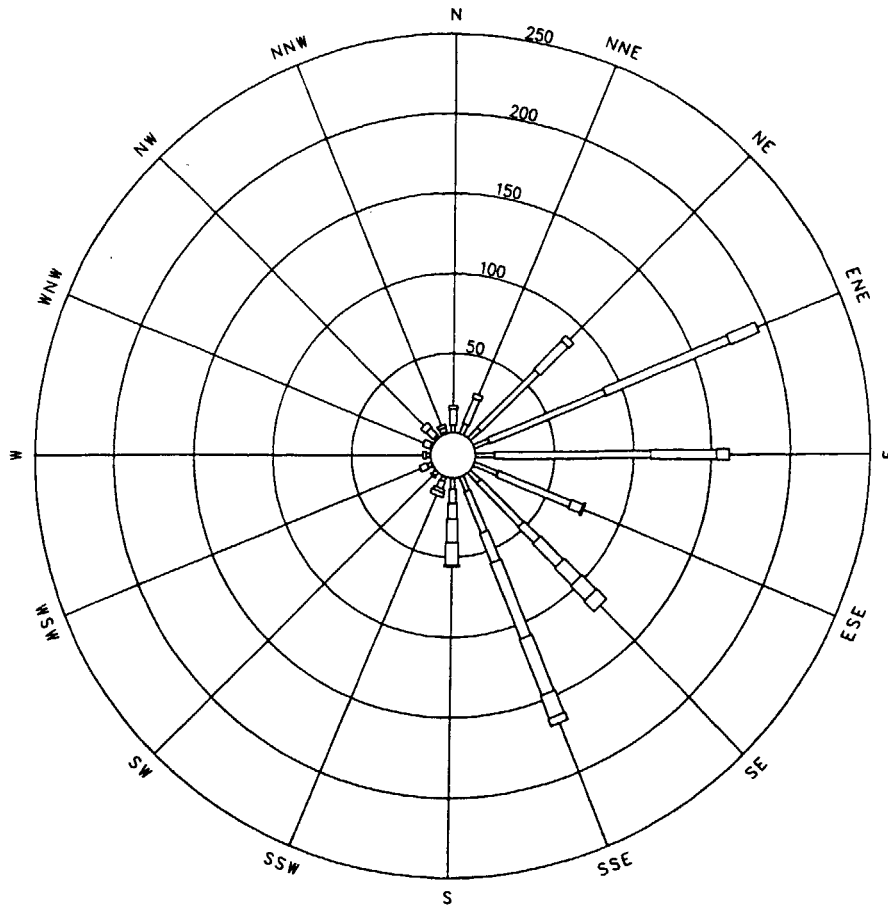
LENGTH : (NUMBER OF OBS/NUMBER OF DATA) * 1000
 WIDTH = SPEED (M/S / BEAUFORT SCALE)



Wind direction (DD) / Wind speed (Beaufort and m/s) 10 m above the ground

m	Be- au- fo- rt	DD																ALL
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
		Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	
0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.2	1	6	14	22	19	13	9	6	7	2	5	2	2	2	3	6	4	130
1.5	2	10	44	83	134	68	24	24	20	10	8	2	2	3	8	7	7	460
3.3	3	0	6	36	60	15	7	16	16	9	0	0	.	.	1	0	1	174
5.4	4	.	0	1	5	2	1	28	36	17	3	0	0	0	.	0	0	99
7.9	5	.	.	.	.	0	4	18	35	16	5	.	.	0	.	.	0	81
10.7	6	.	.	.	.	.	2	14	14	2	0	.	.	.	.	0	0	35
13.8	7	.	.	.	.	.	0	9	5	.	.	.	.	.	.	.	.	16
17.1	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20.7	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24.5	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28.4	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32.6	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	ALL	17	66	143	219	101	50	118	135	58	25	5	6	7	14	15	15	1000

HANOYTANGEN Feb 1994 WIND DISTRIBUTION 30 M

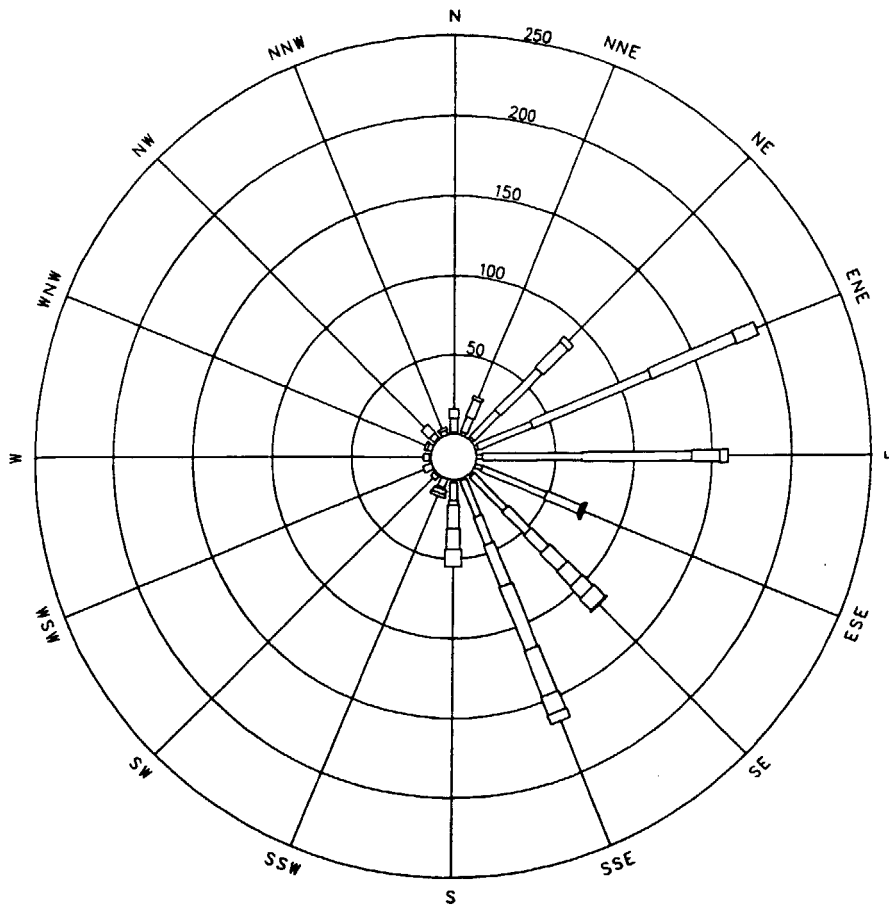


LENGTH : (NUMBER OF OBS/NUMBER OF DATA) * 1000
 WIDTH = SPEED (M/S / BEAUFORT SCALE)

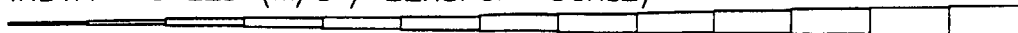
Wind direction (DD) / Wind speed (Beaufort and m/s) 30 m above the ground

m / s	Beaufort	DD																ALL
		N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
		Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	
0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.2	1	5	7	9	10	12	16	9	10	7	3	3	3	3	1	2	1	108
1.5	2	10	17	51	79	99	50	38	28	9	5	1	5	2	5	6	3	417
3.3	3	2	3	25	85	42	8	14	20	10	0	0	.	.	0	4	2	221
5.4	4	.	0	4	20	8	0	21	51	15	2	0	0	0	.	0	0	126
7.9	5	.	.	.	0	0	1	15	38	14	3	.	.	0	.	.	0	75
10.7	6	.	.	.	.	.	0	13	15	1	.	.	.	.	.	.	0	31
13.8	7	.	.	.	.	.	0	9	5	.	.	.	.	.	.	.	0	16
17.1	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20.7	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24.5	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28.4	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32.6	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	ALL	18	28	91	196	163	78	121	170	59	15	6	9	7	7	13	10	1000

HANOYTANGEN FEB 1994 GUST WIND DISTRIBUTION 30 M



LENGTH : (NUMBER OF OBS/NUMBER OF DATA) * 1000
 WIDTH = SPEED (M/S / BEAUFORT SCALE)



Wind direction (DD)/ Gust wind speed (m/s) 30 m above the ground.

m/s	DD																ALL
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	
	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	Prm	
0-.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0.3-1.5	1	2	2	2	4	5	2	1	2	0	1	0	1	0	1	0	
1.6-3.3	9	10	23	37	63	44	30	25	11	6	3	6	4	3	4	3	
3.4-5.4	6	12	37	81	70	23	20	19	3	1	0	0	0	2	7	2	
5.5-7.9	0	2	22	58	18	1	16	28	15	0	.	0	.	.	0	0	
8.0-10.7	.	0	4	15	5	0	15	43	13	3	0	0	0	.	.	0	
10.8-13.8	.	.	0	.	0	1	13	31	11	2	.	.	0	.	.	0	
13.9-17.1	.	.	.	.	.	1	10	12	0	0	.	.	.	.	.	0
17.2-20.7	.	.	.	.	.	0	10	6	0	.	.	.	.	.	0	0
20.8-24.5	.	.	.	.	.	.	1	0	.	.	.	.	.	.	.	.
24.5-28.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28.5-32.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
> 32.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ALL	18	28	91	196	163	78	121	170	59	15	6	9	7	7	13	10	

COEFFICIENT TRANSFERT TABLES

The tables are actually histograms of the quotient given in the heading of the tables, plotted horizontally. They give details about the distribution of the quotients.

The class interval is 0.5 and the frequencies for the actual class is plotted at the midpoint of the class. If the quotient is 1 the wind speed in the two heights considered have the same value.

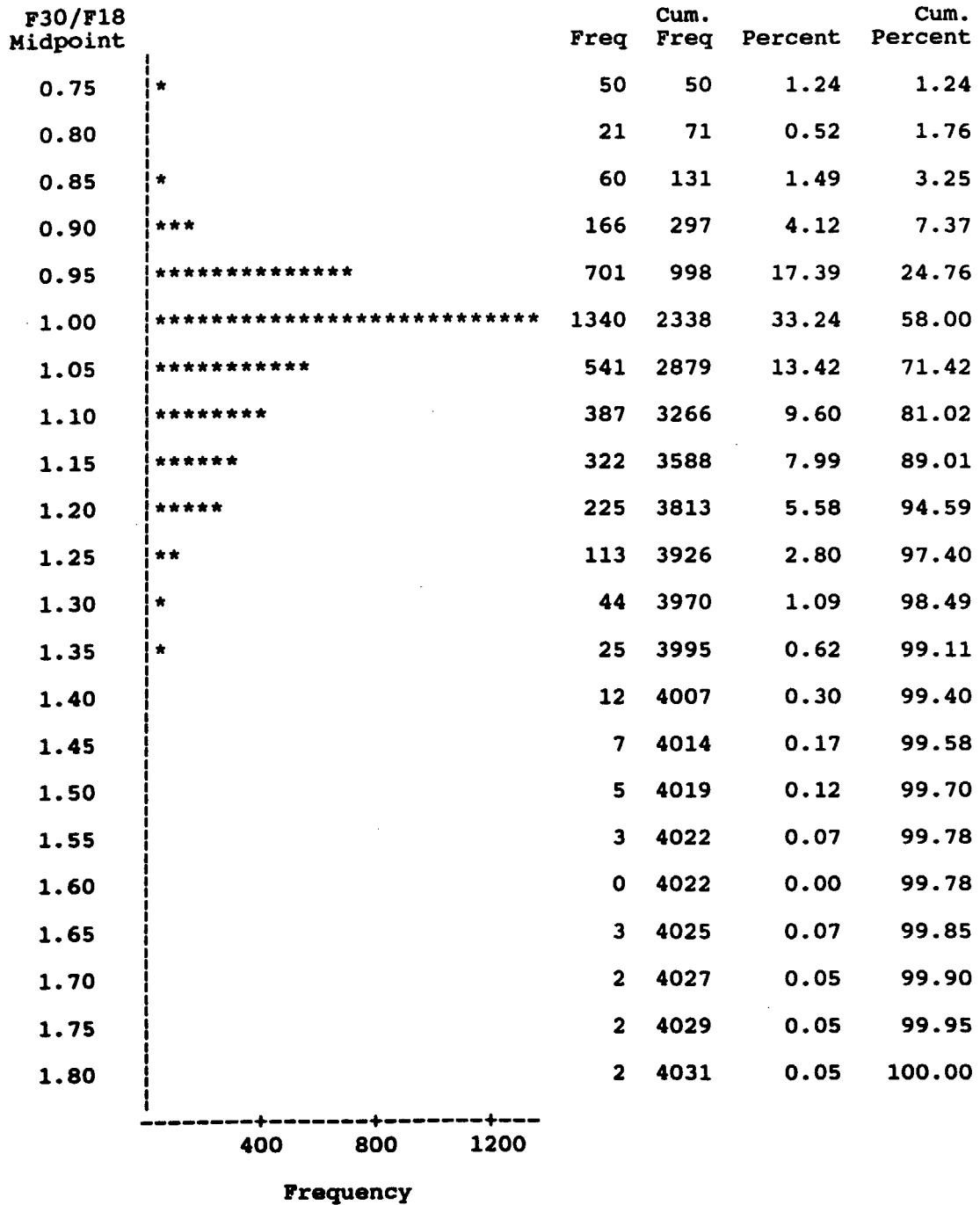
The classes start at 0.75 (.725-.774) and end at 1.80 (1.775-1.825). Quotients below or above these limits are counted in these classes respectively.

The tables are giving the frequencies in the actual classes in percent and also as cumulative frequencies in percen.

F30 = Wind speed 30 m above the ground
F18 = Wind speed 18 m above the ground
F10 = Wind speed 10 m above the ground

HANØYTANGEN FEBRUARY 1994

QUOTIENT F30/F18



HANØYTANGEN FEBRUARY 1994

QUOTIENT F30/F10

F30/F10 Midpoint		Freq	Cum. Freq	Percent	Cum. Percent
0.75	***	87	87	2.16	2.16
0.80	*	32	119	0.79	2.95
0.85	***	64	183	1.59	4.54
0.90	*****	192	375	4.76	9.30
0.95	*****	854	1229	21.19	30.49
1.00	*****	668	1897	16.57	47.06
1.05	*****	320	2217	7.94	55.00
1.10	*****	305	2522	7.57	62.57
1.15	*****	340	2862	8.43	71.00
1.20	*****	304	3166	7.54	78.54
1.25	*****	273	3439	6.77	85.31
1.30	*****	222	3661	5.51	90.82
1.35	*****	134	3795	3.32	94.15
1.40	***	85	3880	2.11	96.25
1.45	*	37	3917	0.92	97.17
1.50	**	42	3959	1.04	98.21
1.55	*	21	3980	0.52	98.73
1.60		10	3990	0.25	98.98
1.65		9	3999	0.22	99.21
1.70		2	4001	0.05	99.26
1.75		4	4005	0.10	99.35
1.80	*	26	4031	0.65	100.00

100 200 300 400 500 600 700 800

Frequency

HANØYTANGEN FEBRUARY 1994

F18/F10 Midpoint	QUOTIENT F18/F10			
	Freq	Cum. Freq	Percent	Cum. Percent
0.75	36	36	0.89	0.89
0.80	17	53	0.42	1.31
0.85	30	83	0.74	2.06
0.90	68	151	1.69	3.75
0.95	519	670	12.87	16.62
1.00	1360	2030	33.73	50.35
1.05	669	2699	16.59	66.94
1.10	624	3323	15.48	82.42
1.15	328	3651	8.13	90.55
1.20	193	3844	4.79	95.34
1.25	78	3922	1.93	97.27
1.30	57	3979	1.41	98.69
1.35	27	4006	0.67	99.36
1.40	13	4019	0.32	99.68
1.45	8	4027	0.20	99.88
1.50	4	4031	0.10	99.98
1.55	0	4031	0.00	99.98
1.60	1	4032	0.02	100.00
1.65	0	4032	0.00	100.00
1.70	0	4032	0.00	100.00
1.75	0	4032	0.00	100.00
1.80	0	4032	0.00	100.00

Frequency

OCCURRENCE TABLES

The content of the table is based on the hourly maxima (Fx) of the 10 min wind speed. First a period fulfilling the criterion $Fx < \text{Limit}$ is sought. The length of this period is divided by the length of the windows specified and may result in multiples of the actual window or zero if the length of the period is less than the length of the actual window. This procedure is repeated through the month and the number of the different windows are accumulated.

Observation Period :									Location :	
From :01/02/94	FEBRUARY 1994								Level : 10 m a.gr.	
To : 28/02/94									Coordinates:	
Coverage : 100.0%	HANØYTANGEN								X = 71908	
Number of data: 4032									Y = 47414	
OCCURRENCE TABLE										
NUMBER OF WINDOWS FROM 6 TO 72 HOURS										
Wind Speed <= Beaufort	1	2	3	4	5	6	7	8		
Duration										
6 H	0	35	78	92	100	108	112	112		
12 H	0	11	37	44	48	53	56	56		
18 H	0	6	24	28	32	34	37	37		
24 H	0	4	18	20	24	25	28	28		
48 H	0	0	8	9	11	12	14	14		
72 H	0	0	3	4	8	8	9	9		
Remarks : Based on maximum 10mn wind speed within the interval period, in any direction, at 10 metres level										

CLIMATOLOGICAL SUMMARY

Observation Period :												Location:	
From : 01/02/94												Level: 2 m a.gr.	
To : 28/02/94	HANØYTANGEN 1994												
Coverage : 100.0%													
Number of data :4032	CLIMATOLOGICAL SUMMARY												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Air Temperature													
Mean Day min.	0.2	-2.1											
Abs min.	-4	-6.3											
Mean Day max.	3.8	3.3											
Abs max.	6.7	6.4											
Mean	2.1	0.1											
Relative Humidity													
Mean Day min.	61	44											
Abs min.	44	27											
Mean Day max.	81	73											
Abs max.	89	90											
Mean	70	60											
Air pressure													
Mean Day min.	991.6	1016.7											
Abs min.	966.2	989.7											
Mean Day max.	1003.5	1023.6											
Abs max.	1019.6	1045.2											
Mean	998	1020											
Coefficient Transfert													
from level 10 to 18	1.051	1.046											
from level 10 to 30	1.117	1.088											
from level 18 to 30	1.059	1.036											
Remarks:													
The summary is based on air temperature, humidity and pressure measured each 10 minute.													

Appendix 1

BEAUFORT SCALE OF WIND

BEAUFORT NUMBER	DESCRIPTIVE TERM	MEAN VELOCITY IN KNOTS	MEAN VELOCITY IN m/s
0	Calm	< 1	0 - 0.2
1	Light air	1 - 3	0.3 - 1.5
2	Light breeze	4 - 6	1.6 - 3.3
3	Gentle breeze	7 - 10	3.4 - 5.4
4	Moder. breeze	11 - 16	5.5 - 7.9
5	Fresh breeze	17 - 21	8.0 - 10.7
6	Strong breeze	22 - 27	10.8 - 13.8
7	Near gale	28 - 33	13.9 - 17.1
8	Gale	34 - 40	17.2 - 20.7
9	Strong gale	41 - 47	20.8 - 24.4
10	Storm	48 - 55	24.5 - 28.4
11	Violent storm	56 - 63	28.5 - 32.6
12	Hurricane	64 and over	32.7 and over

Appendix 2

HANOYTANGEN 1994

.06:40 Wednesday, March 30, 1994

RECORDS WITH PARAMETERS OUTSIDE THE CRITERIONS

OBS	AAR	MND	DAG	TIME	MIN	REF	F30	G30	DD30	F18	G18	F10	G10	DD10	T	UU	P
4	1994	2	2	10	23	645	0.40	0.40	145.64	16.66	22.78	16.59	23.38	142.84	3.97	60.07	992.36
5	1994	2	27	0	23	645	4.35	38.60	69.21	3.61	5.47	3.23	4.58	53.50	-4.52	41.13	1013.67
6	1994	2	27	23	23	645	0.40	0.40	57.34	4.43	6.37	4.28	6.37	39.89	-1.46	40.11	1010.12