The Meteorological Data of the Georg von Neumayer Station for 1983 and 1984

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CONTENTS

1. Introduction

This report describes the meteorological conditions at the Georg von Neumayer Station (70°37' S, 08°22' W) for the years 1983 and 1984. The data are compiled, archived and presented in this report in close agreement with the previous issue on this subject (Gube-Lenhardt and Obleitner, 1986).

2. Observations and Instrumentation

The meteorological instrumentation at the Georg von Neumayer Station has been quite extended with the beginning of the 1983/84 overwintering season compared to the previous two years of meteorological measurements:

The 'old' 15 m mast has been supplemented by a 45 m mast to extend the profile measurements of temperature and the wind vector to higher levels above the ice surface.

1983 was also the start of the radiosonde programme. Daily upper air soundings (at around 1200 UTC) were performed using Vaisala RS80 radiosondes together with the Vaisala MicroCora receiving and processing unit. The measured quantities are pressure, temperature, humidity and the wind vector using the Omega navigation system. All data were stored on digital cassettes; the TEMP message was also fed in real time into the Global Telecommunication System (GTS).

A further newly installed device is the Data Collecting Platform (DCP) which transmits the coded meteorological data (the SYNOP and the TEMP messages) via the European satellite METEOSAT to the ground receiving station (ESOC, Darmstadt, FRG); the data are then passed on into the GTS.

The 1982 meteorological surface instrumentation remained almost unchanged: This includes the two humidity sensors, the ground pressure sensor and the radiation instrumentation. Only the firn temperature recordings had to be stopped in July 1983: The thermistor chain, originally deployed between 0.25 m and 6 m depth, had been covered by so much snow and ice in the meantime that the temperature recordings had become meaningless.

Table 1 gives a detailed list of the meteorological instrumentation and sampling rates during the years 1983 and 1984.

3. Data Processing and Archiving

The processing of the meteorological data includes several steps: The digital cassettes - the data storage device at the station -have to be read on computer compatible tapes; the actual sensor heights above or below ground are inserted into the data files; all data are validated, i.e. are corrected for obvious errors. The final file structure for the archive is chosen such that the files remain compatible with older meteorological data of the Georg-von-Neumayer-Station, although the amount of data has increased as e.g. on the meteorological masts. This guarantees that all computer programs developed for further mainipulation of the data or for graphic display can be continuously applied without modification. Also the 'compressed' archive of hourly means of selected quantities, which was started in 1981, has been continued through 1984.

Table 2 lists the entries into the 1983-1984 archive. Copies of all data tapes are available upon request from the Department of experimental physics, Alfred-Wegener-Institut.

A new set of data are the upper air soundings: Their processing also includes reading of the cassettes and a subjective validation of the data. This was done with a software package developed for an identical sounding system on RV 'Polarstern'. The radiosonde profiles collected during each year are stored chronologically in one data file. All radiosonde data gathered in 1983 and 1984 are listed on Table 3.

4. Results

The 1983 and 1984 climatological data are subsequently presented in a circumstantial list of tables and figures, again in close agreement with the 1981/82 data report to facilitate the comparison of individual years. Table 4 and Table 5 list the climatological conditions on a monthly basis. The following set of figures shows time series of monthly mean values of air temperature, air pressure, humidity, firn temperature, the radiation data, monthly histograms of cloud and wind conditions, and of surface temperature inversions. The radiosonde data are analyzed for time-height sections of air temperature, humidity, and the wind components. Additionally, time series of temperatures at different pressure levels, the thicknesses of certain relative topographies, the tropopause height are displayed together with some examples of individual soundings.

A more detailed interpretation of the figures follows in the next paragraphs.

4.1 Air Temperature (Fig. 1a and Fig. 11a)

The mean annual air temperature at 2 m height (-15.6° C in 1983, -16.6° C in 1984) is in good agreement with the 1981/82 values of -16.5° C and -15.9° C, respectively. The yearly amplitude of the monthly mean values amounted to 22.5° C (1983) and to 24.2° C (1984). The amplitude reached with single measurements is of course higher: 44.4° C (1983) and 45.2° C (1984) (see also Table 4 and Table 5).

The coldest months were July in 1983 and August in 1984. July 1984 was even warmer than both June and August causing a nonsymmetric annual temperature cycle.

The absolute minimum temperatures of -44.5° C (July 1983) and of -44.6° C. (August 1984) ranged slightly below the 1982 value of -43.6° C. The temperature never rose above freezing level in 1983, when a maximum of -0.1° C was measured in February, while temperatures above freezing were recorded during both January and December 1984.

4.2 Air Pressure (Fig. 1 b and Fig. 11b)

The pressure measurements are reduced to mean sea level, accounting for the 40 m elevation of the Georg von Neumayer Station.

The pressure values are generally much lower than the standard sea level pressure (1013.3 hPa). Even the monthly maxima exceeded 1013.3 hPa only in June 1983. This is due to the station's locality within the circum-Antarctic low pressure belt.

The yearly average pressure values of 987.5 hPa (1983) and 987.1 hPa (1984) are not significantly different from the values of the previous years. The pressure fluctuations occur on a temporal scale of a few days reflecting the synoptic variability in this region.

The lowest recorded values of 944.0 hPa (1983) and 957.6 hPa (1984) nevertheless exceed the exceptionally low value of only 930.3 hPa in 1982.

4.3 Atmospheric Humidity (Fig. 1c and Fig. 11 c)

The humidity measurements should be used with great care because the functioning of the humidity sensor is highly unreliable at temperatures below -20° C. From the synoptic observations, the mean monthly relative humidity ranges from 70 % to 90 % with the corresponding maximum values close to 100 % (saturation) and rather variable minimum values which dropped down to as low as 15 % on 29 October 1984.

The mean water vapour mixing ratio amounts to 1.1 g/kg (1983) and to 1.0 g/kg (1984).

4.4 Firn Temperature (Fig. 1d, only 1983)

As explained above, the firn temperature record terminates at the end end of July 1983, since the sensor chain was deeply covered by snow. Fig. 1d shows the monthly mean value of the thermistor that was originally deployed at 1m depth. Its actual depth at that time is not exactly known, but it was probably around 2.5 m below the snow surface, when the readings were stopped.

4.5 Cloudiness (Fig. 2 and Fig. 12)

Partly cloudy or overcast is the most frequent sky condition at the Georg von Neumayer Station. Year-to-year or month-month comparison shows no distinct features, because the synoptic variability, which determines the cloud coverage, has time scales much shorter than a month. Remarkable is the frequent occurrence of a bimodal distribution with relative maxima at the low and the high ends of the cloud cover scale. This result, however, may be an artefact, since cloud coverage is very difficult to determine during the dark winter months, and the observer tends to overestimate zero as well as total cloud coverage.

4.6 Wind Speed (Fig. 3 and Fig. 13)

The annual average wind speed was 8.5 m/s (1983) and 8.3 m/s (1984). The prevailing wind speed is lower and lies with only few exceptions between 2m/s and 6m/s, which leads to skewed frequeny distributions during all months. Contrary to the 1981/82 data these two years did not show large seasonal changes, i.e. the wind speeds during winter do not significantly exceed the summer values.

4.7 Wind Direction (Fig. 4 and Fig. 14)

From comparison with the 1981/82 data we find similar chracteristics: the annual histograms (Fig. 4m and Fig. 14m) exhibit three distinct maxima for the wind directions: 70° - 90°, 160° - 170°, 220° - 250°. The easterlies (70° - 90°) are prevailing throughout the year (see also Table 4 and Table 5) with the exception of February 1984 when south-easterly winds (165°) peaked out the easterlies by a small amount (Fig. 14b). Such findings are typical for an Antarctic coastal station with gently upward sloping terrain to the south. Only some migrating synoptic depressions with their centres south of the station give occasionally rise to westerly winds (220° - 250°). Northerly winds are generally very rare.

4.8 Vertical Temperature Gradient, Temperature Inversion (Fig. 5 and Fig. 15)

The air temperature profiles recorded on the meteorological masts allow the computation of the vertical temperature gradient, the lapse rate: Cases with a positive temperature lapse rate are defined as temperature inversions and indicate a statically stable density stratification of the atmospheric surface layer.

For the years 1983 and 1984 the lapse rates have been derived from the temperature differences between either 12m or 45 m height and at 0.25 to 0.5 m height. Temperature inversions near the Earth's surface are a common feature over Antarctica. At the Georg von Neumayer Station almost 80 % of the observed lapse rates are positive. The most stable stratifications are found during the winter months when the temperature increased by up to 1.2° C within 1 m height in the lowest 12 m of th atmosphere.

Generally, the steepness of the positive vertical temperature gradient decreases with height as can be seen by intercomparing the annual frequency distributions of the gradients for the lowest 12 m (Fig. 5m and Fig. 15m) with the corresponding measures for the lowest 45 m (Fig. 5n and Fig. 15n).

Since the general differences of the 12 m and the 45 m vertical gradients are similar during each month, the display of the annual histogram of the deeper 45 m layer may suffice in this context.

4.9 Radiation Measurements

4.9.1 Global Radiation (Fig. 6 and Fig. 16)

The global radiation is dominated by the dependence on the astronomically determined solar irradiance at that latitude, with polar day from November to January with high noon values and polar night at June and July.

Maximum values of about 700 W/m^2 occur in December. The irradiance is zero in June and July.

March and September 1984 are somewhat exceptional compared to other years, with lower than average March values and higher than average September values.

4.9.2 Longwave Radiation Flux (Fig. 7a and Fig. 17a)

The longwave radiation fluxes (L) have been computed as residuals from the shortwave (solar) radiation fluxes (K) and the fluxes of total radiation (F):

$$L_{down} = F_{down} - K_{down}$$

$$L_{up} = F_{up} - K_{up}$$

L_{up} is a measure of the snow or ice surface temperature T_s. With Stefan-Bolthmann's law and assuming an emissivity of unity (black body)

$$L_{up} = \sigma \ T_s^4 \quad (\sigma\text{: Stefan-Boltzmann's constant})$$

The black body radiation temperature of the surface ranges from 241 K during winter to 267 K during summer.

The downward fluy L_{down} describes the thermal radiation of the atmosphere and of clouds. The net longwave radiation loss is large during the summer when L_{up} exceeds L_{down} by up to 50 W/m^2; this difference is quite reduced during the winter, but still L_{down} remains smaller than L_{up}, thus resulting in a net radiative energy sink for the ice surface.

4.9.3 Albedo

The previous Georg von Neumayer Station data report (Gube-Lenhardt and Obleitner, 1986) contained a set of figures to illustrate the albedo $\alpha = 100\ K_{up}/\ K_{down}$. Such diagrams will not be repeated every year, since we find no significant interannual variation of α so that the 1982 albedo data sufficiently describe the general characteristics at the Georg-von-Neumayer-Station.

4.9.4 Radiation Budget (Fig. 7b and Fig. 17b)

The difference of the downward and upward radiation fluxes is the radiation budget of the surface (B):

$$B = (K_{down} + L_{down}) - (K_{up} + L_{up})$$

This quantity is measured by a single instrument at the Georg von Neumayer Station which is sensitive to radiation of wave-lengths from 0.3 um - 3 um for the shortwave solar radiation as well as from 3 um - 100 um for the longwave thermal radiation. The budget B is negative during all months but November and December.

On the annual average, radiation is an energy sink for the snow surface with about -9 W/m^2 in 1983 and about -7.5 W/m^2 in 1984.

4.10 Upper Air Soundings

Most of the following displays of upper air soundings are based on half-monthly average profiles of air pressure, air temperature, relative humidity, and wind velocity.

4.10.1 Time-Height Section of Temperature (Fig. 8a and Fig. 18a)

The half-monthly averages lead to a rather smooth picture of the vertical temperature stratification. The most striking feature is the drastic temperature decrease in the lower stratosphere during the winter. Values of -50° C or even higher are common during the summer, while during winter temperatures drop below -70° C. The change from summer to winter regimes occurs during April and May, and from winter to summer during October and November. The reason for the low stratospheric temperatures is the reduced or even missing solar heating and the small lateral advection of low latitude air into the stable polar circulation cell.

The lower troposphere is characterized by a near surface inversion reaching about 2 km high. During summer, the surface inversion is obviously confined to a rather shallow layer and can thus not be picked up by the radiosondes.

4.10.2 Time-Height Section of Water Vapour (Fig. 8b and Fig. 18B)

The figures show the vertical distribution of water vapour defined as the mixing ratio (grams water vapour per kilogram dry air). The water vapour content of the atmosphere is to a certain extent coupled to the temperature stratification, since the saturation mixing ratio decreases exponentially with temperature. Thus, the atmospheric moisture in the upper troposphere is very low and the measurements suffer from large instrumental uncertainties, so that these values have been omitted.

4.10.3 Time-Height Sections of the Wind Components (Fig. 8c, 8d and Fig. 18c, 18d)

The wind velocity is displayed here by the zonal u-component (positive to the east) and the meridional v-component (ppositive to the north).

Obviously the prevailing easterly flow measured near the Earth's surface extends up to at least 2000 m but sometimes even to 8000 m height. These data confirm that the circum-Antarctic belt of easterly flow is confined to the lowest few kilometers of the atmosphere. Eye inspection of the data merely indicates that high reaching easterlies coincide with strong northerly winds. One might therefore speculate that the Weddel Sea cyclone occupies a more westerly position in late fall and early summer and lies further to the east in late summer and early spring.

4.10.4 Temperature at Standard Pressure Levels and Layer Thicknesses Fig. 9a, 9b and Fig. 19a, 19b)

Since meteorologists often refer to standard pressure levels, the temperatures at these standard levels is shown in addition to the time-height section of temperature (Fig. 9a and Fig. 19a). Unfortunately, the 1984 radiosondes hardly ever reached 100 hPa so that this curve had to be omitted in Fig. 19a.

Fig. 9b and Fig. 19b depict the layer thicknesses between certain standard pressure levels, again the 100/300 hPa curve is omitted in Fig. 19b. For the pressure regime above 300 hPa the layer thicknesses do not change very much over the year, but the 100/300 hPa thickness is goverened by a distinct annual wave as a consequence of the stratospheric cooling in winter.

4.10.5 Tropopause Height (Fig. 9c and Fig. 19c)

Fig. 9c and Fig. 19c indicate the tropopause levels and depict individual soundings rather than half-monthly means.

All temperature profiles have been eye-inspected to determine the tropopause height. The tropopause as the boundary between the troposphere and the stratosphere is the level where the general tropospheric temperature lapse rate shows an abrupt change. This boundary lies generally at 8 km to 10 km height. Large variations occur even from day to day. In the winter months it is often difficult or even impossible to determine a tropopause, because there is no significant change in the temperature lapse rate at any height. Therefore large gaps in the time series are caused. It is interesting, however, to note that the tropopause does sometimes show up in the soundings which may be due to the relatively low latitude of the station at about 70° S.

4.10.6 Individual Radiosonde Profiles (Fig. 10 and Fig. 20)

The figures show one example of an atmospheric sounding for each month since the start of the radiosonde programme in February 1983. These should only serve as further illustrations to the above discussion of the atmospheric stratification and the wind regimes.

References

Gube-Lenhardt, M. and F. Obleitner (1986): The Meteorological Data of the Georg-von-Neumayer-Station for 1981 and 1982. Berichte zur Polarforschung, 30.

Table 1: Meteorological Instrumentation, 1983 and 1984

(a) Synoptic Observations

Time schedule:	Three-hourly observations at 00, 03, 09, 12, 15, 18, 21 UT
Coding:	According to WMO standard F12-VII SYNOP, extended by a first data group giving year and month of the observation
Included parameters:	Visibility, total cloud coverage, cloud height, wind direction, wind speed, air temperature, dew point temperature, air pressure, pressure tendency, cloud group (coverage of lowest cloud layer, types of low, medium high clouds), present and past weather, snowdrift

(b) Meteorological Mast

Wind vector:	Cup anemometer and wind vane (Thies, Göttingen) wind direction: in 7 heights between 1 and 5 m wind speed: in 8 heights between 0.5 and 4.5 m
Air temperature:	Pt-100 (Lambrecht, Göttingen) in 8 heights between 0.5 and 4.5 m
Registration	10 minute means on digital cassettes

Note: The actual sensor heights remained variable during the year due to snow accumulation beneath the mast

(c) Firn Temperature:	Pt-100 (Lambrecht, Göttingen) in 6 depths (only till July 1983)
Registration:	10 minute means on digital cassettes

Note: The actual sensor depths remained somewhat variable during the year due to snow accumulation; in general, an accumulation rate of about 1m/year can be assumed.

(d) Surface Observations:

Air pressure:	Precision barometer (aneroid) (Hartmann & Braun, Hamburg) reduced to mean sea level pressure
Humidity:	Hair hygrometer (Thies, Göttingen) at about 2m above the level surface
Global radiation:	Pyranometer (Eppley Laboratories)

Reflected solar radiation: Pyranometer (Eppley Laboratories)
Total radiation (up and down): Pyrradiometer (Lange, Berlin)

Registration:	10 minute means on digital cassettes

Table 2: Archived meteorological data, 1983 and 1984

(a) Synoptic Observations

- Content: Coded SYNOP messages from January 1983 to December 1984
- Archive medium: Magnetic tape
- Data amount: Approximately 24 kByte per month

(b) Meteorological Mast

- Content: 10 minute means of temperature, firn temperature, wind speed and direction, relative humidity, air pressure (after quality control, with appropriate sensor heights included) from January 1983 to December 1984.
- Archive medium: Magnetic tape
- Data amount: Approximately 1.3 MByte per month for each measured quantity

(c) Radiation Measurements

- Content: 10 minute means of sunshine duration, global radiation, reflected solar radiation, down- and upward going thermal radiation, resultant radiation budget (after quality control) from January 1983 to December 1984.
- Archive medium: Magnetic tape
- Data amount: Approximately 0.2 MByte per month

(d) Hourly Mean Values ('Climatological Archive')

- Content: Hourly mean values of air pressure, air temperature, relative humidity, 10 m wind, 1 m firn temperature, all four radiation budgets (as computed from mast and radiation measurements)
- Archive medium: Magnetic tape
- Data amount: Approximately 0.7 MByte per year

(e) Upper Air Data

- Content: Pressure, temperature, humidity and wind data of all soundings (up to 700 levels), and some header data containing date, time, etc., stored chronologically for each year
- Archive medium: Magnetic tape
- Data amount: Approximately 21 MByte per year

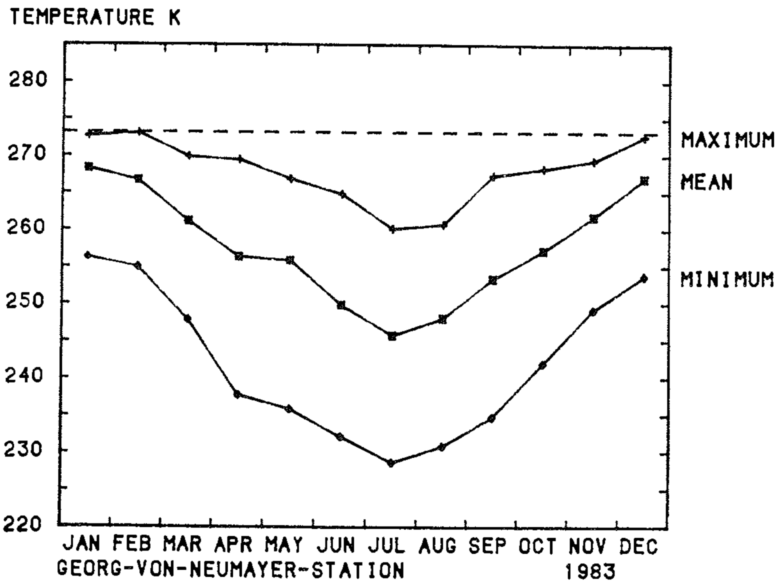
Table 3: The radiosonde data gathered during 1983 and 1984

1 9 8 3	1 9 8 4
Radiosondes were launched at least once a day between 21 February and 31 December	Radiosondes were launched at least once a day during the entire year
Missing days:	Missing days:
	17 Jan
22 Feb	15 Feb
3 Mar,12 Mar,22 Mar,23 Mar	1 Mar,7 Mar,25 Mar
5 Apr,15 Apr,19 Apr	
5 May,13 May,21 May	23 May,27 May
12 Jun,13 Jun	30 Jun
12 Jul,19 Jul	9-11 Jul,18 Jul,27 Jul
9 Aug,25 Aug,26 Aug	1 Aug,7 Aug,12 Aug
7 Sep,23 Sep,25 Sep	18 Sep
13 Oct,17-18 Oct,21-22 Oct	10 Oct,27 Oct
5 Nov,11 Nov,12 Nov,29 Nov	
	9 Dec,10 Dec
Total number of soundings:	Total number of soundings:
299	387
Distribution of maximum heights:	Distribution of maximum heights:
1000 - 800 hPa 0%	1000 - 800 hPa 0%
800 - 600 hPa 0%	800 - 600 hPa 0%
600 - 400 hPa 1%	600 - 400 hPa 1%
400 - 300 hPa 0%	400 - 300 hPa 1%
300 - 200 hPa 1%	300 - 200 hPa 2%
200 - 100 hPa 8%	200 - 100 hPa 57%
100 - 50 hPa 33%	100 - 50 hPa 16%
below 50 hPa 57%	below 50 hPa 24%
Data failures (percent of all data)	Data failures (percent of all data)
Humidity 15%	Humidity 7%
Wind 13%	Wind 19%
Pres or Temp < 1%	Pres or Temp < 1%

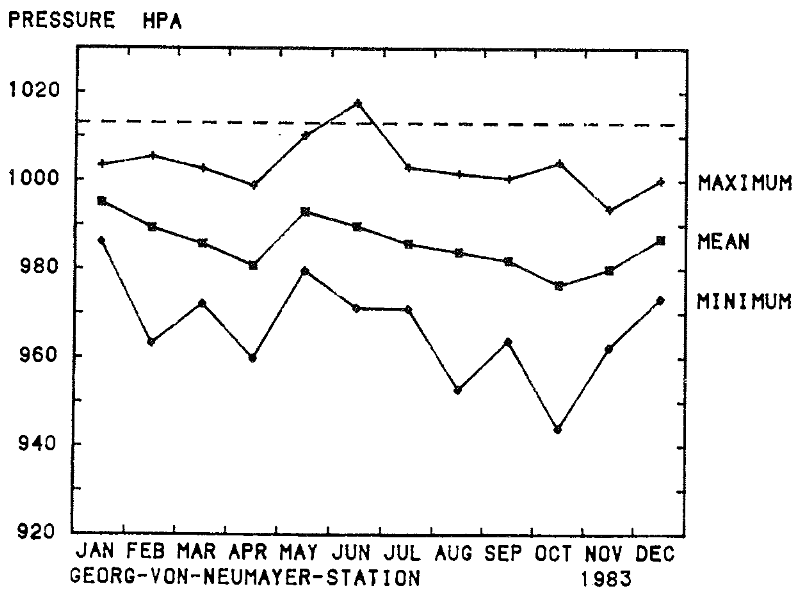
Table 4: Monthly means and extremes, 1983
(from synoptic observations

1983 GEORG-VON-NEUMAYER 70°37'S 08°22'W ELEVATION 40 M	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVERAGE TEMPERATURE (DEG C)	-4.9	-6.5	-12.0	-16.8	-17.3	-23.3	-27.4	-25.1	-19.8	-16.0	-11.4	-6.2	-15.6
TEMPERATURE MAXIMUM (DEG C) (DATE)	-0.5 (16)	-0.1 (18)	-3.3 (4)	-3.7 (25)	-6.3 (20)	-8.3 (5)	-13.0 (13)	-12.4 (18)	-5.8 (17)	-4.9 (18)	-3.8 (22)	-0.5 (30)	-0.1
TEMPERATURE MINIMUM (DEG C) (DATE)	-16.9 (30)	-18.2 (24)	-25.3 (18)	-35.4 (5)	-37.3 (11)	-41.0 (20)	-44.5 (25)	-42.3 (12)	-38.4 (8)	-31.2 (9)	-24.0 (2)	-19.4 (6)	-44.5
AVERAGE MAXIMUM TEMPERATURE (DEG C)	-2.3	-4.3	-9.3	-13.2	-14.3	-19.0	-23.2	-20.8	-16.2	-12.8	-8.7	-2.8	-12.2
AVERAGE MINIMUM TEMPERATURE (DEG C)	-8.9	-9.5	-15.4	-20.3	-20.8	-27.0	-32.4	-30.4	-24.5	-20.2	-15.0	-10.7	-19.6
AVERAGE REL. HUMIDITY (PERCENT)	085	082	084	085	084	083	086	084	086	083	085	083	084
MAXIMUM REL. HUMIDITY (DATE)	100 (20)	100 (18)	096 (4)	100 (15)	099 (22)	100 (18)	095 (2)	100 (3)	096 (3)	100 (14)	098 (14)	099 (17)	100
MINIMUM REL. HUMIDITY (DATE)	037 (24)	058 (21)	055 (26)	064 (7)	056 (5)	055 (24)	065 (18)	071 (19)	065 (2)	056 (8)	049 (16)	050 (31)	037
AVERAGE STATION PRESSURE (HPA)	995.0	989.3	985.7	980.8	993.0	989.7	985.8	983.9	982.0	976.5	980.0	986.9	985.7
MAXIMUM PRESSURE (HPA) (DATE)	1003.4 (8)	1005.4 (8)	1002.7 (6)	998.9 (10)	1010.3 (25)	1017.7 (24)	1003.1 (4)	1001.7 (21)	1000.7 (1)	1004.2 (15)	993.7 (21)	1000.2 (12)	1017.7
MINIMUM PRESSURE (HPA) (DATE)	986.1 (12)	963.2 (19)	972.1 (22)	959.8 (15)	979.6 (1)	971.2 (10)	971.0 (13)	952.9 (10)	963.8 (25)	944.0 (5)	962.3 (5)	973.3 (5)	944.0
PREVAILING WIND DIRECTION	075	075	085	095	085	085	075	085	095	085	085	075	085
AVERAGE WIND SPEED (M/S)	4.3	8.6	10.4	10.5	10.7	8.3	5.8	9.5	7.6	10.2	10.2	5.4	8.5
MAX. WIND VEL. (M/S) (DEG) (DATE)	15.9 080 (2)	24.7 090 (19)	23.7 100 (22)	26.7 100 (15)	25.2 090 (22)	24.2 080 (5)	20.1 080 (18)	28.3 090 (6)	20.6 110 (14)	27.8 090 (17)	26.7 090 (11)	19.0 230 (5)	28.3 090
AVERAGE SKY COVER (TENTH)	6.2	6.2	6.2	6.2	5.0	3.7	3.7	3.7	7.5	6.2	6.2	5.0	5.5
NUMBER OF CLEAR DAYS	01	02	02	06	03	10	09	10	03	04	00	03	53
NUMBER OF PARTLY CLOUDY DAYS	19	12	13	08	12	11	12	11	11	14	16	19	158
NUMBER OF CLOUDY DAYS	11	14	13	12	15	09	09	08	15	13	14	09	142
NUMBER OF DAYS WITH VISIBILITY LESS THAN 0.4 KM	01	05	13	10	07	05	05	14	08	09	07	00	84
NUMBER OF DAYS WITH MODERATE SNOWDRIFT	00	04	05	06	08	02	05	07	06	03	03	00	49
NUMBER OF DAYS WITH STRONG SNOWDRIFT	00	05	08	08	06	04	10	19	08	09	09	02	88

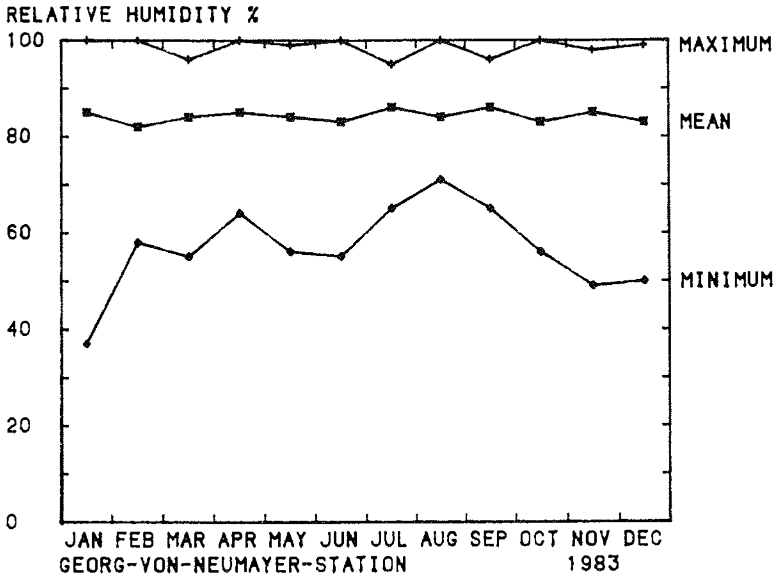
Figure 1: Time series of monthly mean temperature air pressure (b), relative humidity (c), and firn temperature at approximately 2 m depth (d), 1983 (from synoptic observations)



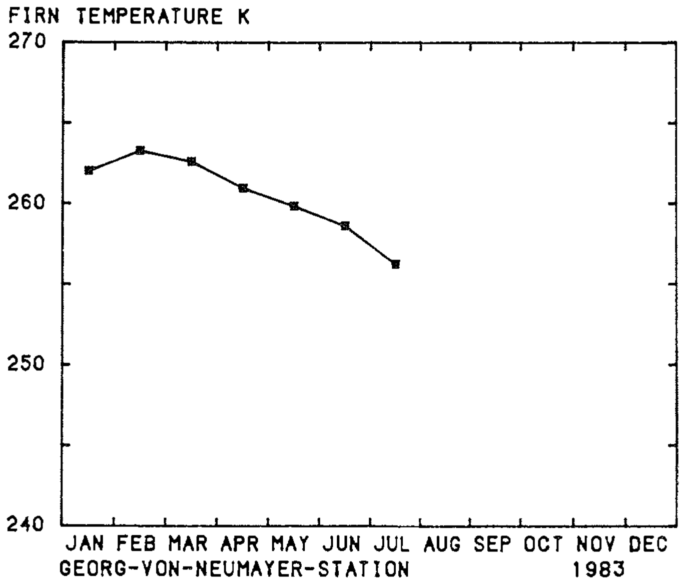
(1a)



(1b)

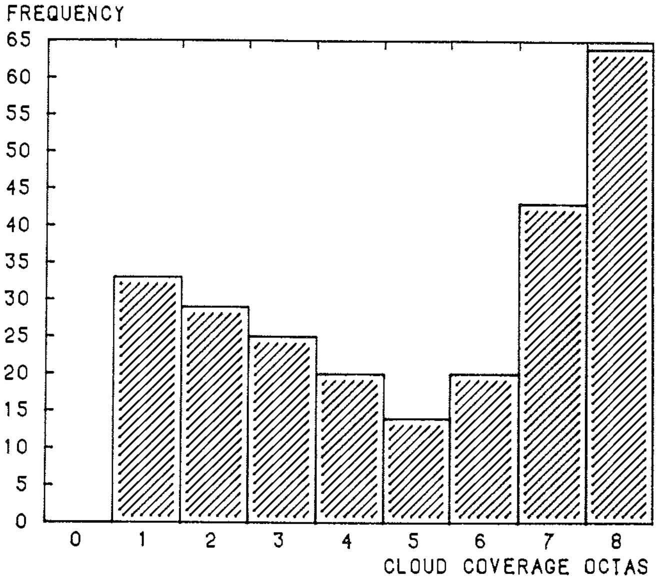

RELATIVE HUMIDITY %
100
80
60
40
20
0
MAXIMUM
MEAN
MINIMUM
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
GEORG-VON-NEUMAYER-STATION 1983

(1c)


FIRN TEMPERATURE K
270
260
250
240
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
GEORG-VON-NEUMAYER-STATION 1983

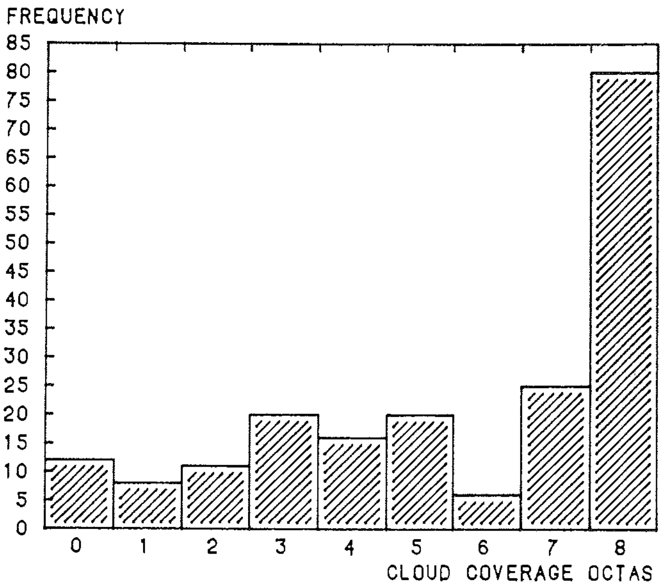
(1d)

Figure 2: Histograms of total cloud coverage, 1983
(from synoptic observations)
(a) - (l): months January - December 1983
(m): entire year 1983



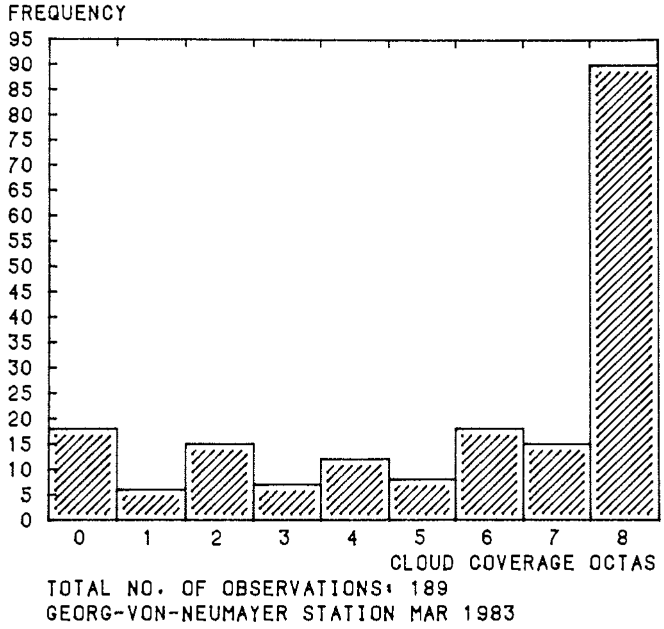
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION JAN 1983

(2a)

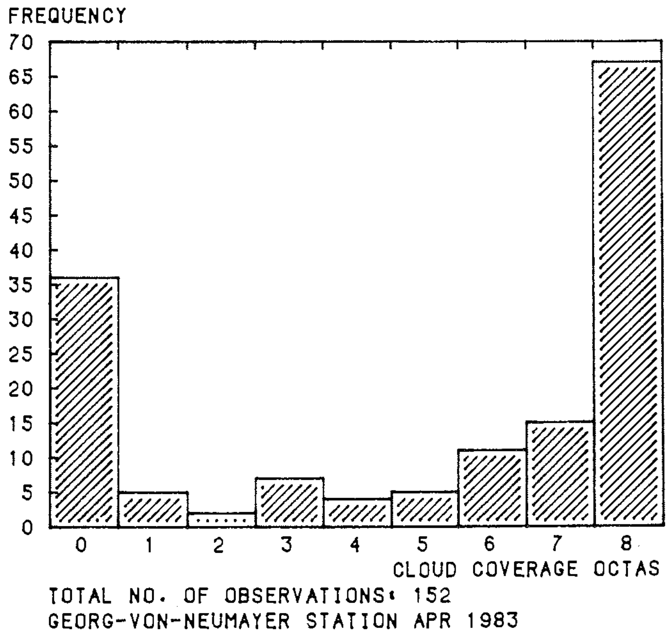


TOTAL NO. OF OBSERVATIONS: 198
GEORG-VON-NEUMAYER STATION FEB 1983

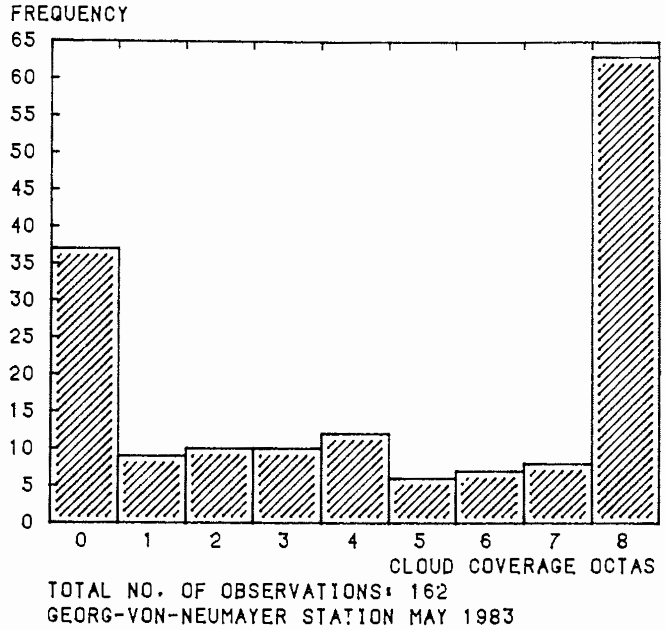
(2b)


FREQUENCY
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 189
GEORG-VON-NEUMAYER STATION MAR 1983

(2c)

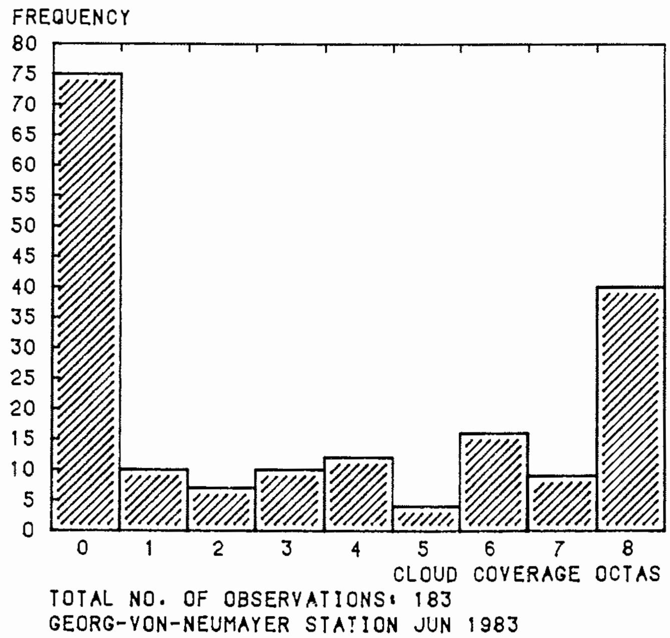

FREQUENCY
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 152
GEORG-VON-NEUMAYER STATION APR 1983

(2d)



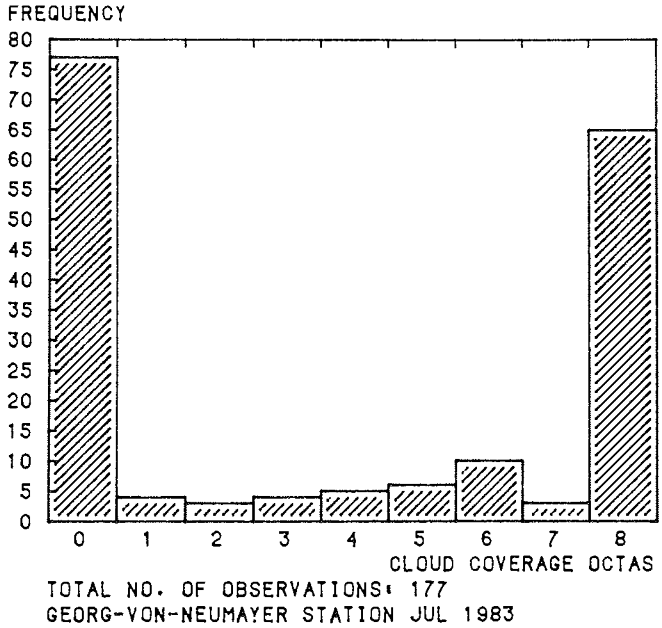
FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 162
GEORG-VON-NEUMAYER STATION MAY 1983

(2e)

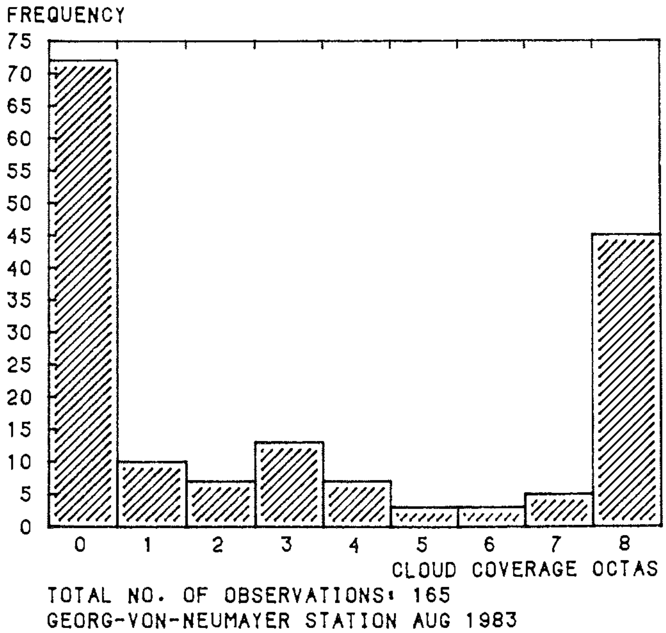


FREQUENCY
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 183
GEORG-VON-NEUMAYER STATION JUN 1983

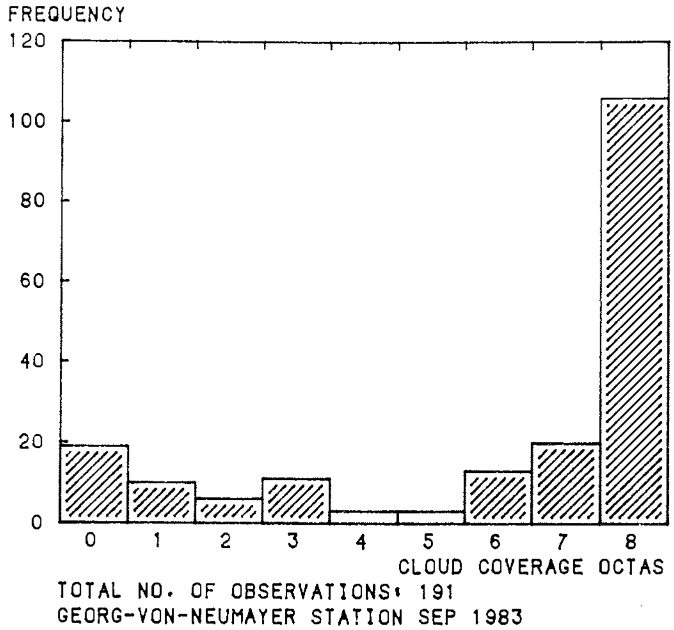
(2f)


FREQUENCY
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 177
GEORG-VON-NEUMAYER STATION JUL 1983

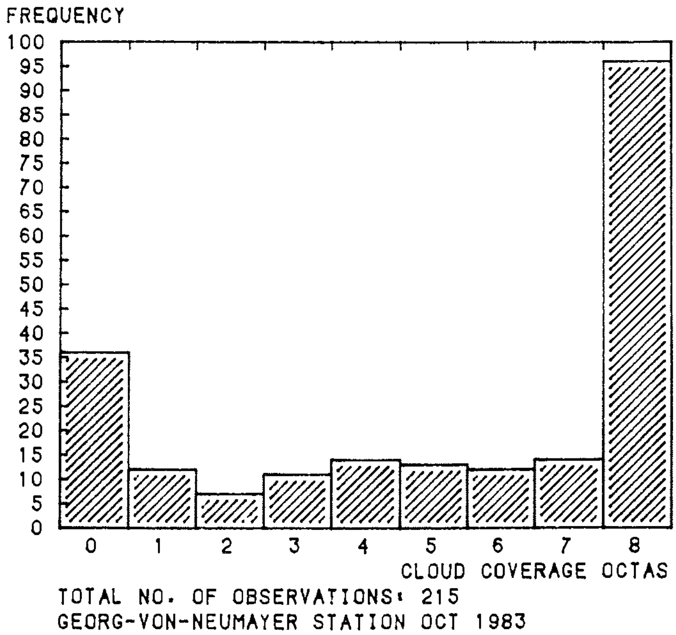
(2g)


FREQUENCY
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 165
GEORG-VON-NEUMAYER STATION AUG 1983

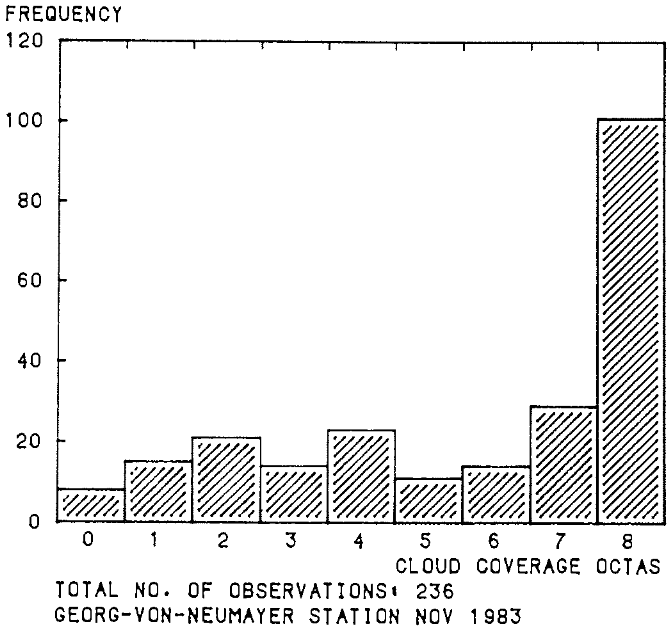
(2h)


FREQUENCY
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 191
GEORG-VON-NEUMAYER STATION SEP 1983

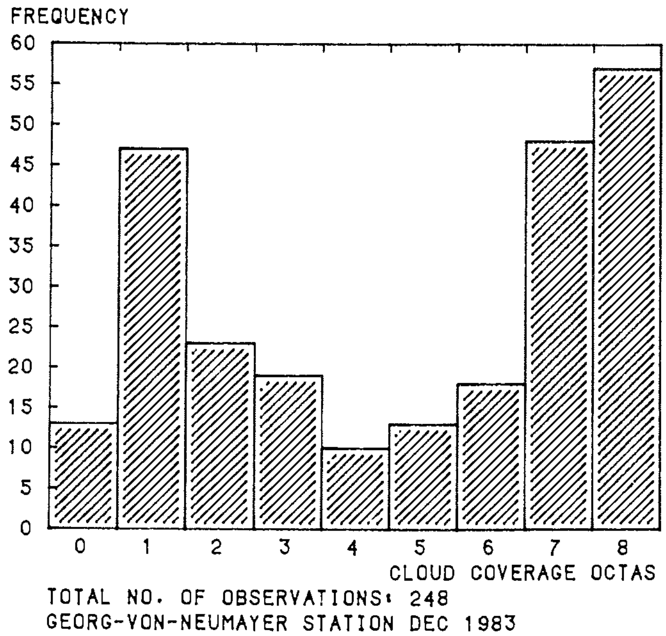
(2i)


FREQUENCY
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 215
GEORG-VON-NEUMAYER STATION OCT 1983

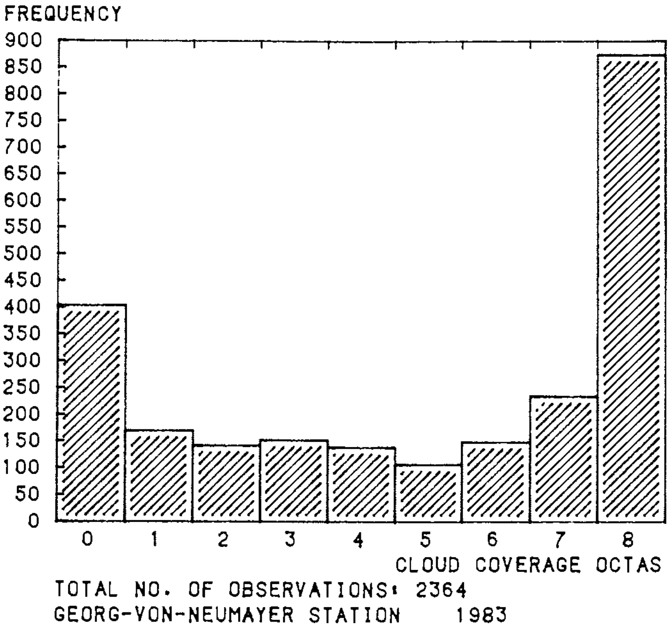
(2j)


FREQUENCY
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 236
GEORG-VON-NEUMAYER STATION NOV 1983

(2k)

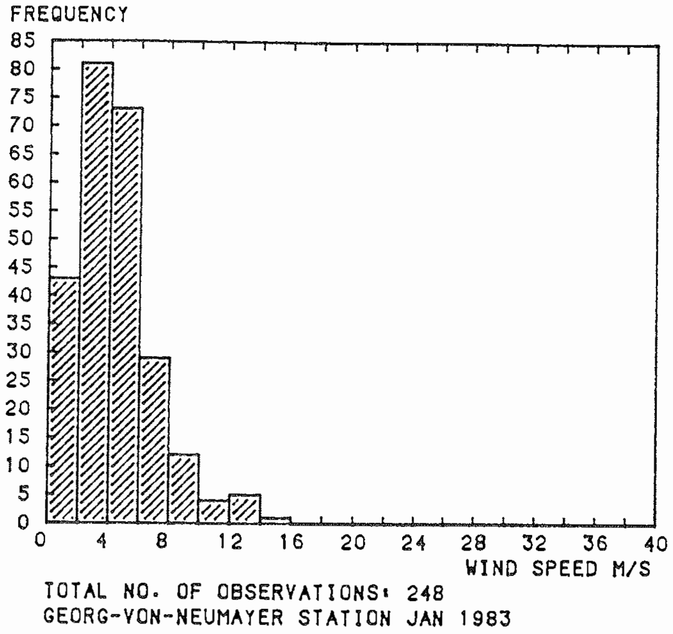

FREQUENCY
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION DEC 1983

(2l)

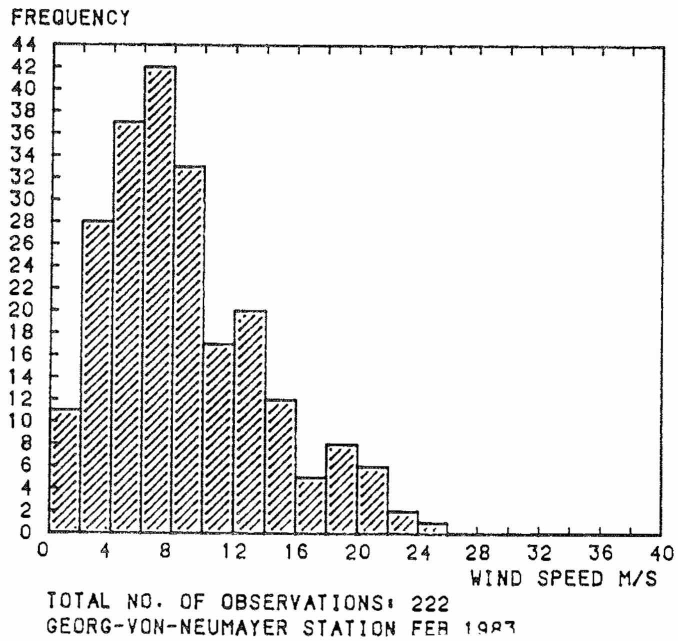

FREQUENCY
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 2364
GEORG-VON-NEUMAYER STATION 1983

(2m)

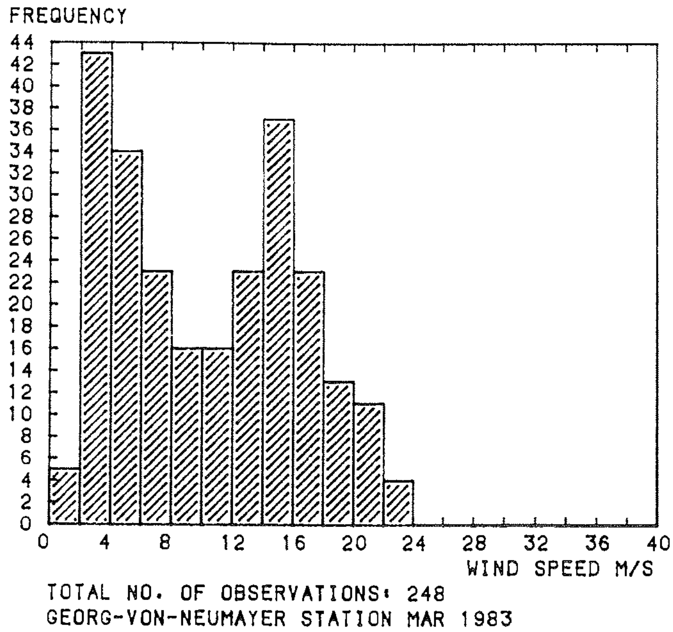
Figure 3: Histograms of wind speed, 1983
(from synoptic observations)
(a) - (l): months January - December 1983
(m): entire year 1983



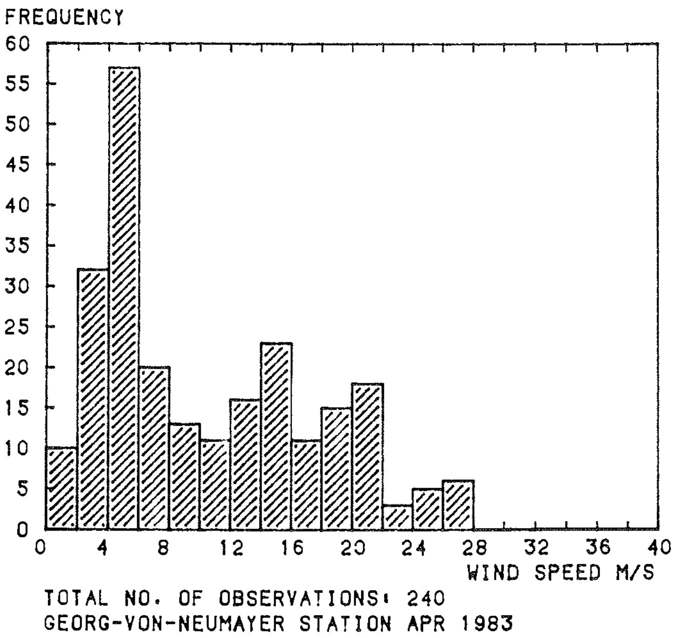
(3a)



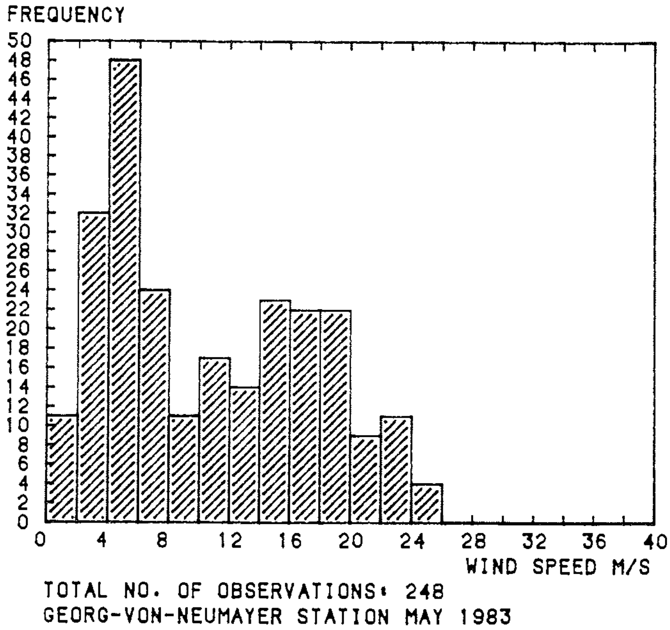
(3b)


FREQUENCY
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION MAR 1983

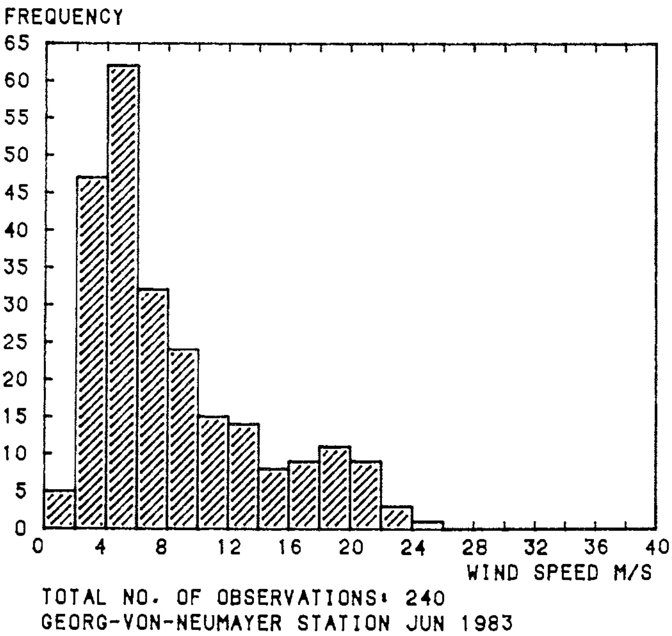
(3c)


FREQUENCY
60
55
50
45
40
35
30
25
20
15
10
5
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION APR 1983

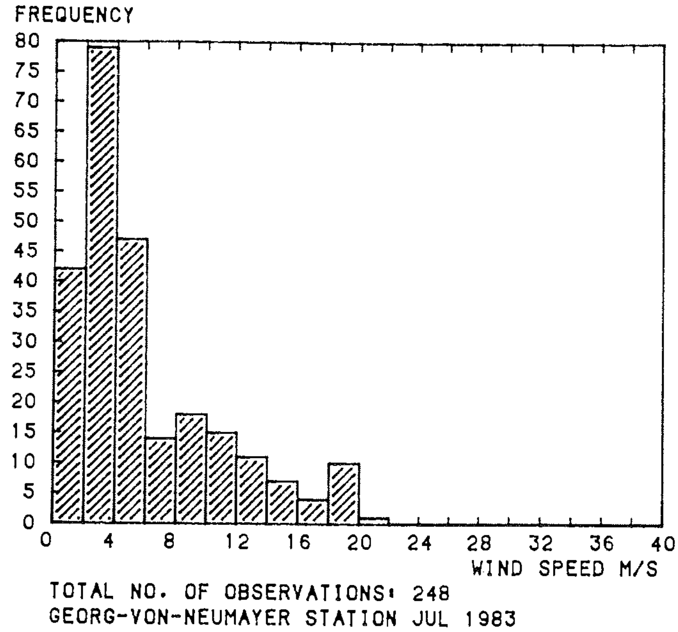
(3d)


FREQUENCY
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION MAY 1983

(3e)

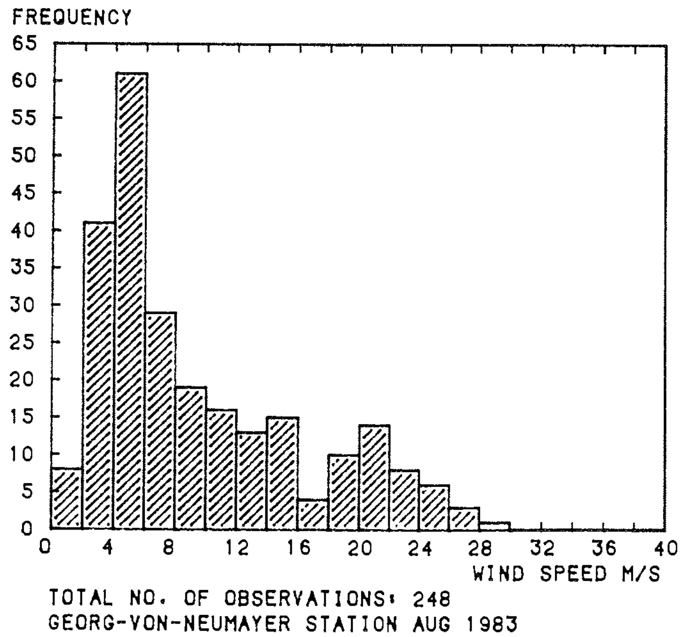

FREQUENCY
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION JUN 1983

(3f)



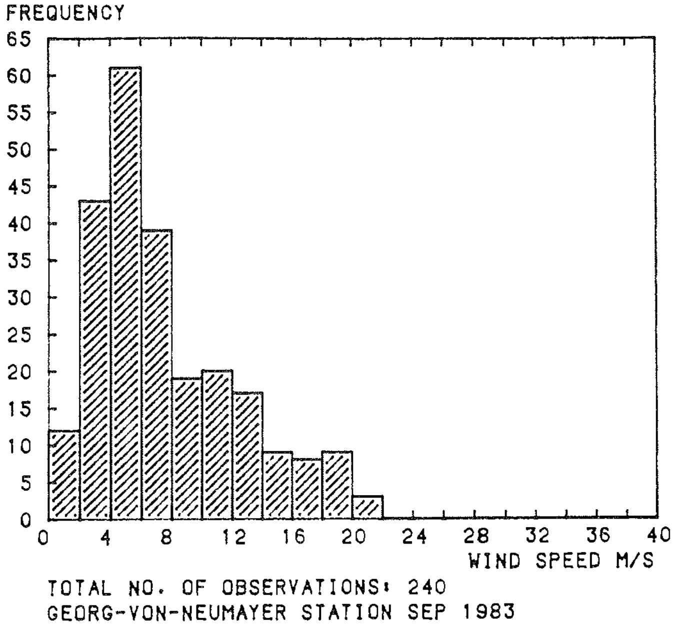
FREQUENCY
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION JUL 1983

(3g)

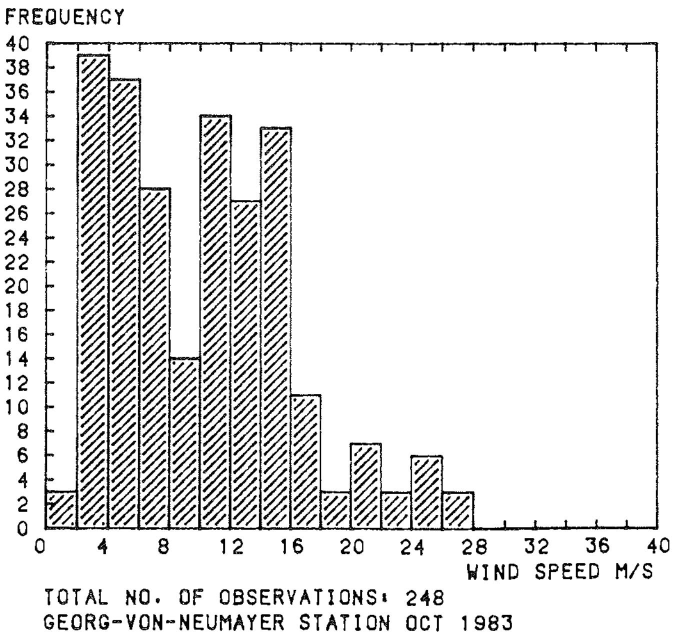


FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION AUG 1983

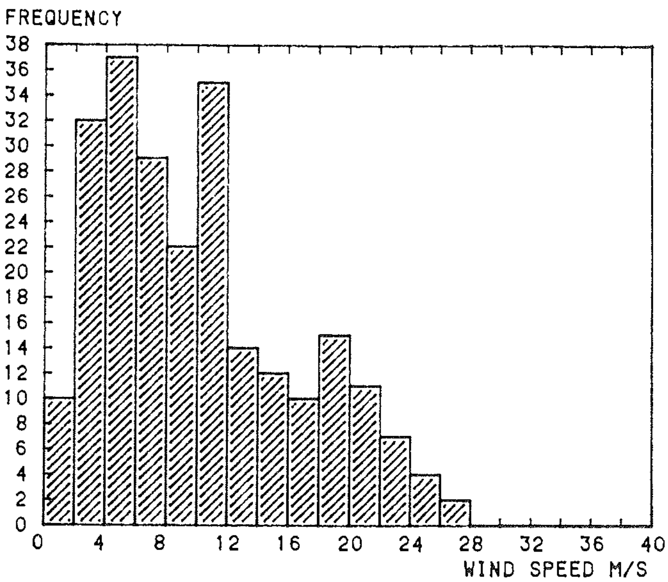
(3h)


FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION SEP 1983

(3i)

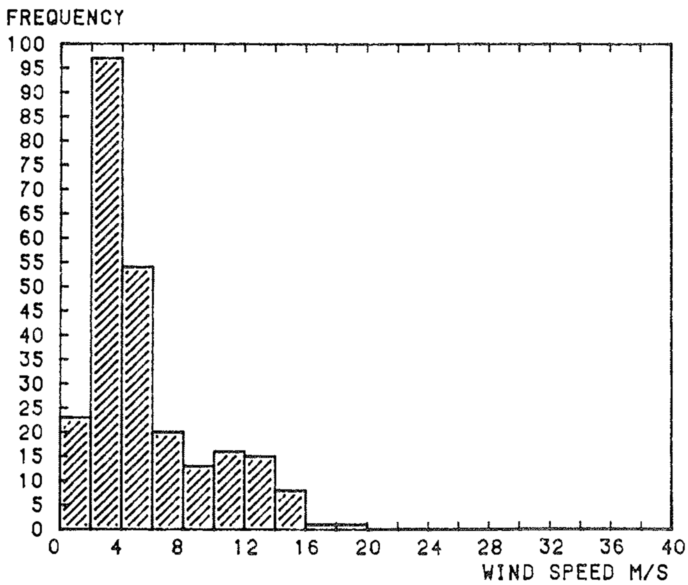

FREQUENCY
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION OCT 1983

(3j)



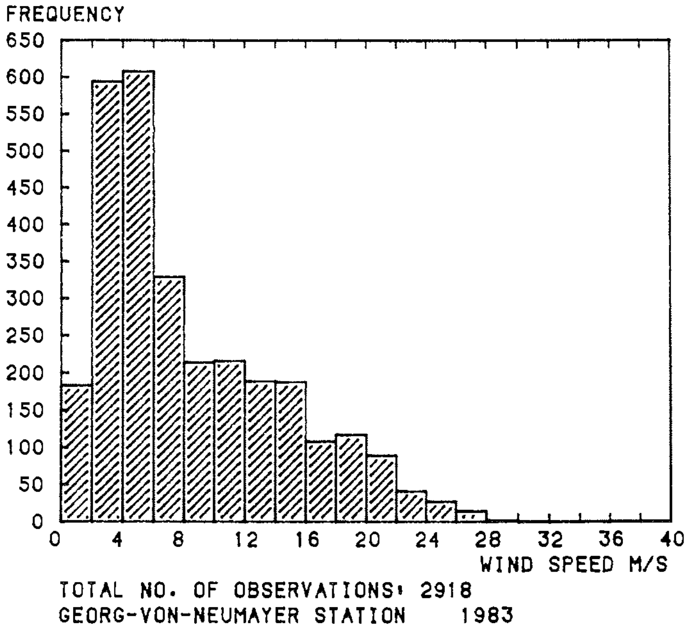
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION NOV 1983

(3k)



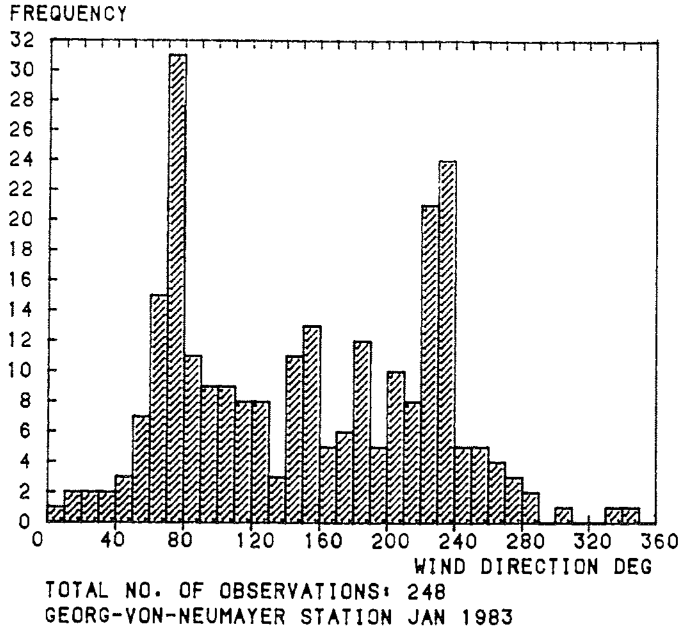
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION DEC 1983

(3l)

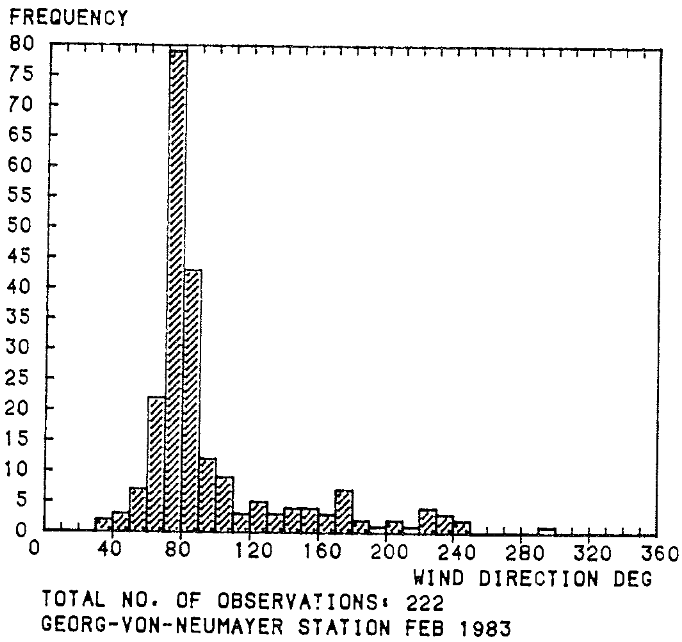

FREQUENCY
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
4
8
12
16
20
24
28
32
36
40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 2918
GEORG-VON-NEUMAYER STATION 1983

(3m)

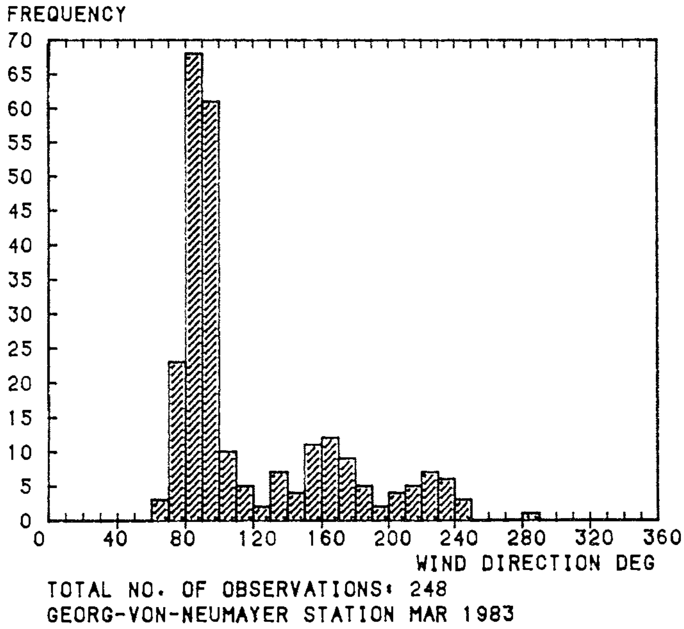
Figure 4: Histograms of wind direction, 1983
(from synoptic observations)
(a) - (l): months January - December 1983
(m): entire year 1983



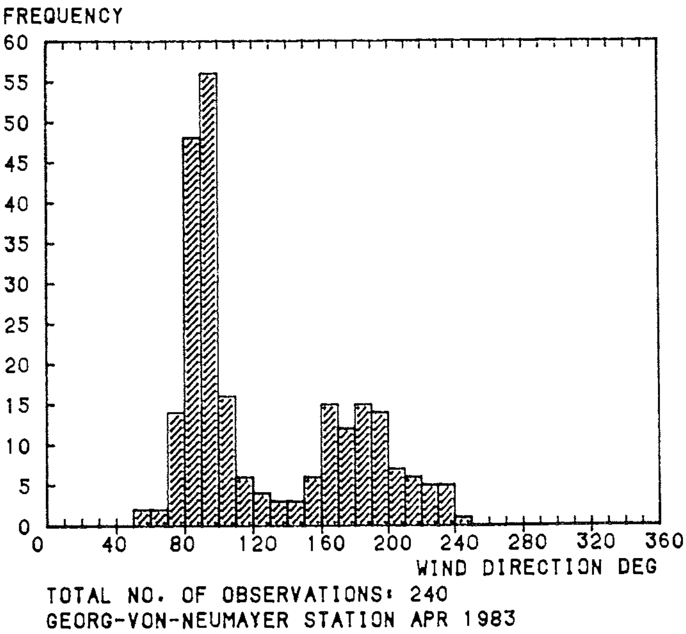
(4a)



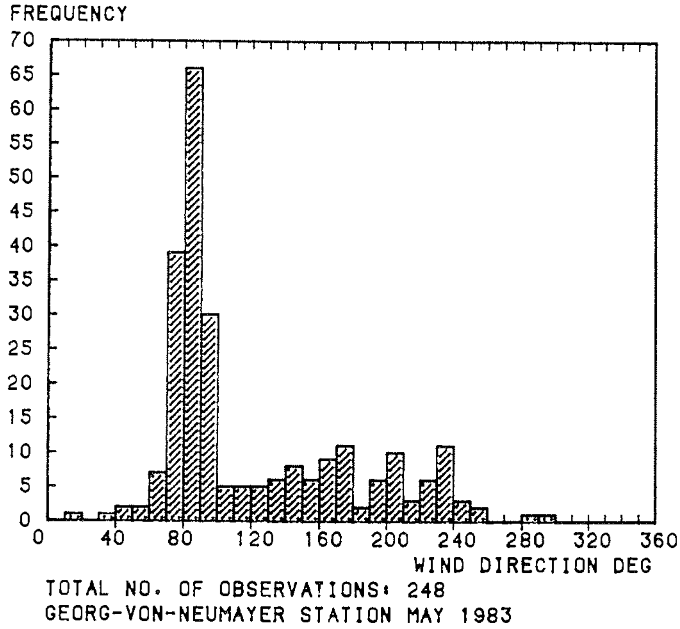
(4b)


FREQUENCY
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION MAR 1983

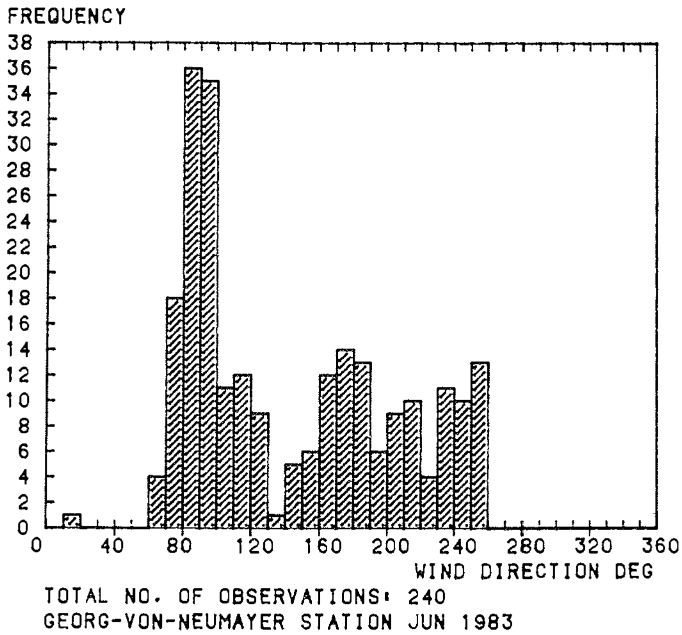
(4c)


FREQUENCY
60
55
50
45
40
35
30
25
20
15
10
5
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION APR 1983

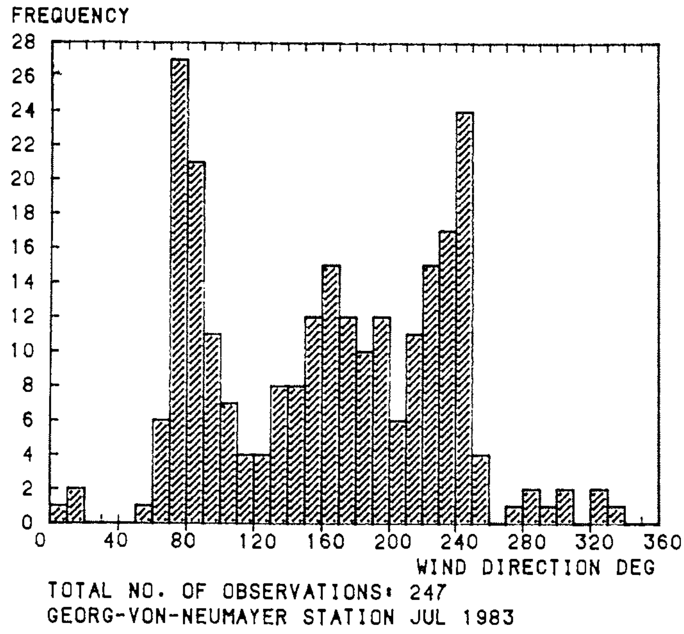
(4d)


FREQUENCY
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION MAY 1983

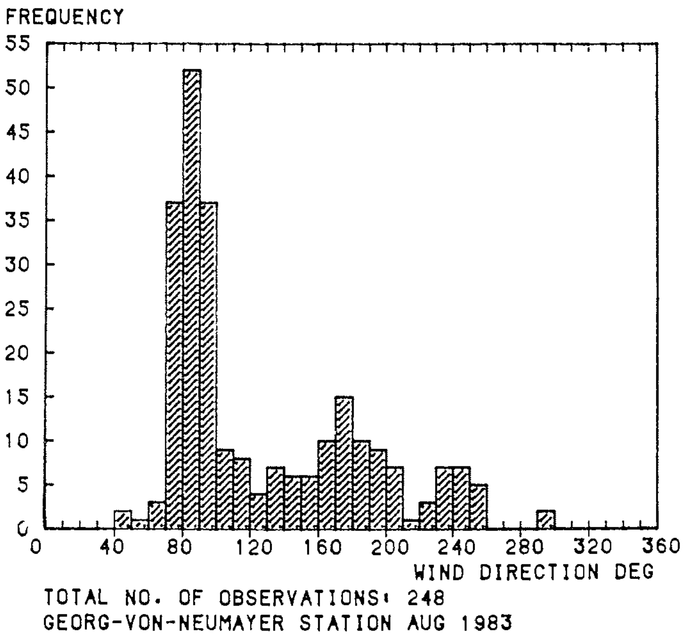
(4e)


FREQUENCY
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION JUN 1983

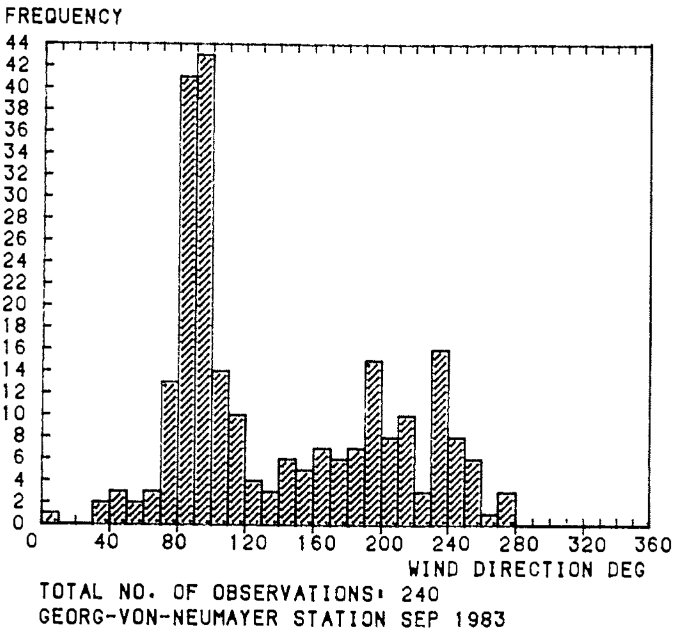
(4f)


FREQUENCY
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION JUL 1983

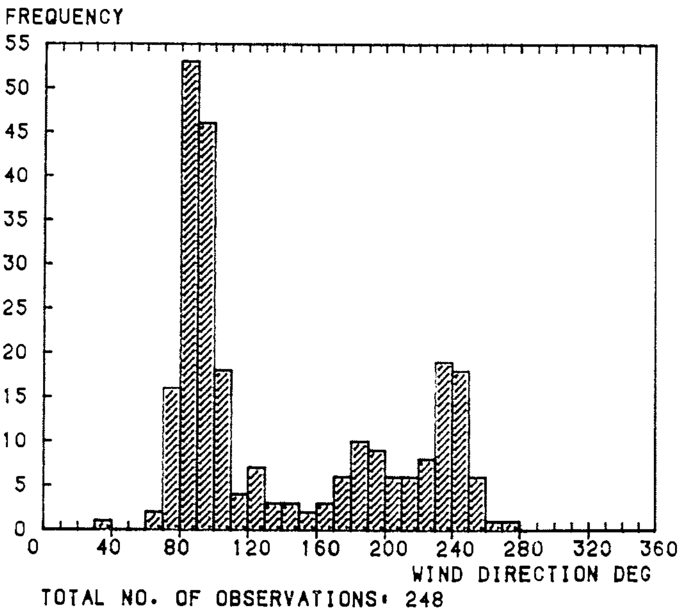
(4g)


FREQUENCY
55
50
45
40
35
30
25
20
15
10
5
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION AUG 1983

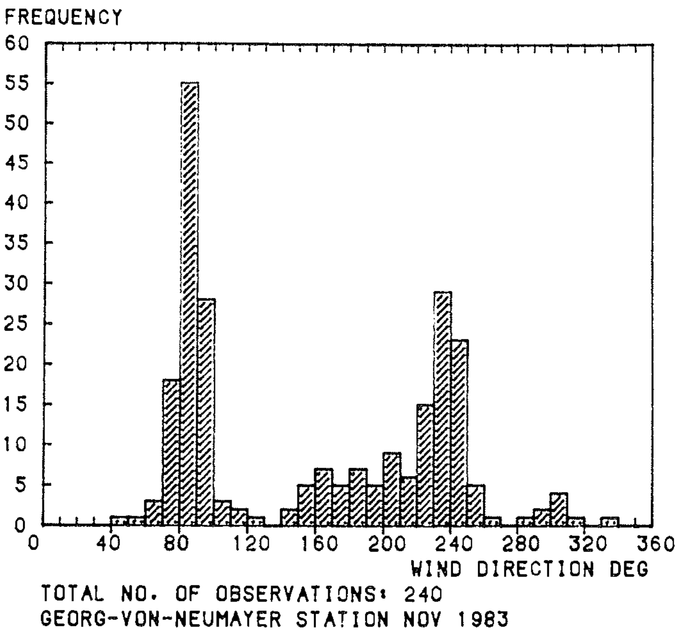
(4h)


FREQUENCY
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION SEP 1983

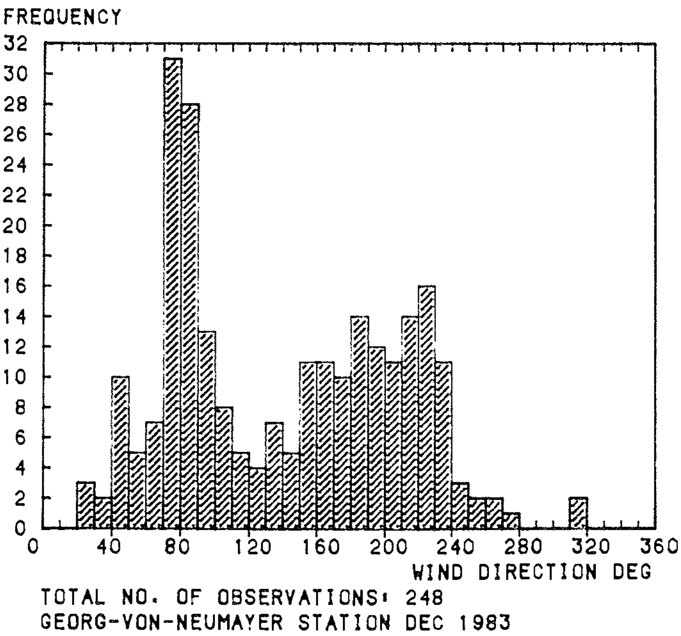
(4i)


FREQUENCY
55
50
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION OCT 1983

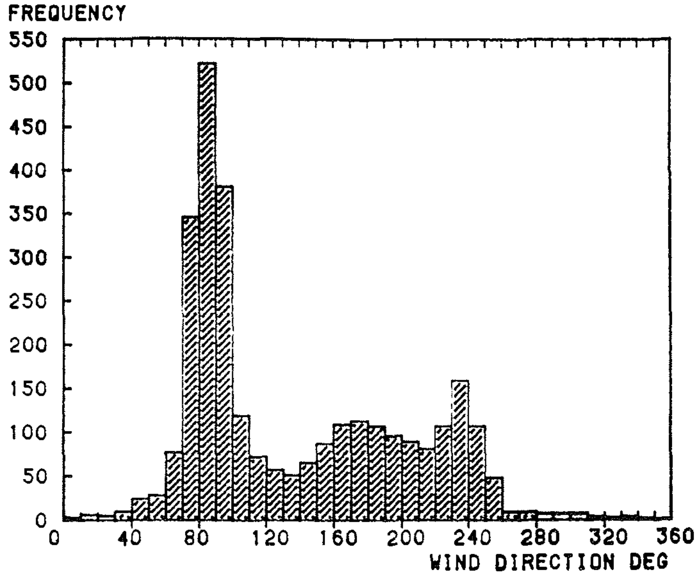
(4j)


FREQUENCY
60
55
50
45
40
35
30
25
20
15
10
5
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION NOV 1983

(4k)


FREQUENCY
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION DEC 1983

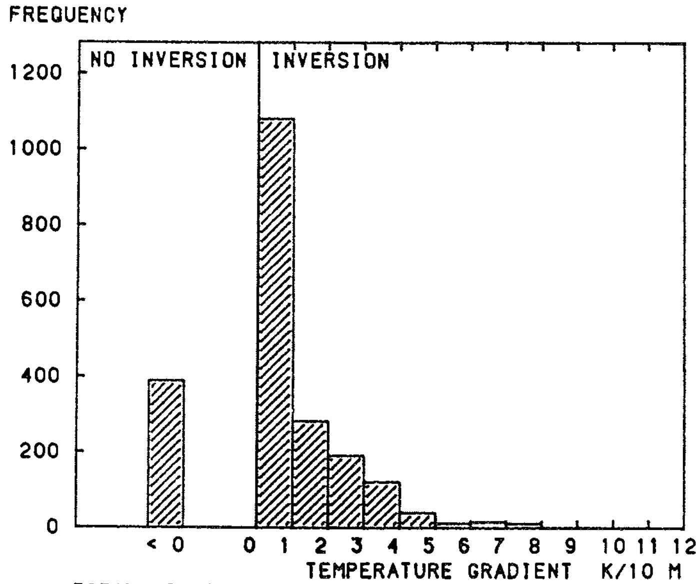
(4l)



TOTAL NO. OF OBSERVATIONS: 2917
GEORG-VON-NEUMAYER STATION 1983

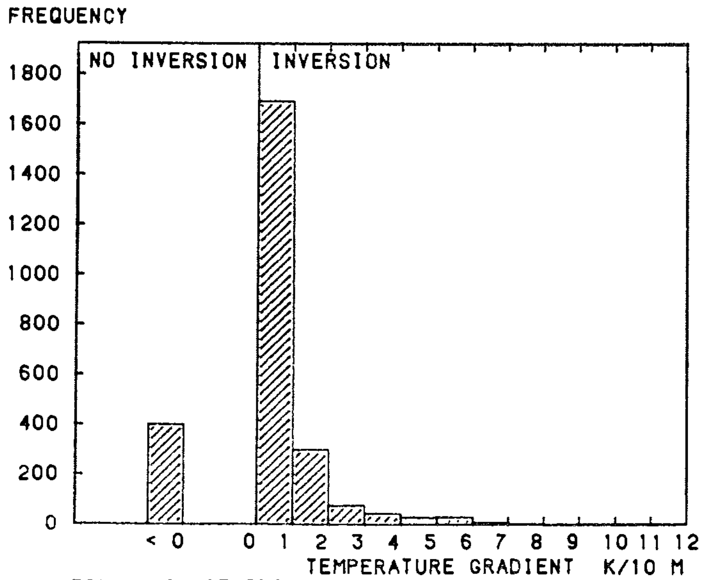
(4m)

Figure 5: Histograms of vertical temperature gradient, 1983 (from 10 minute mean registration). The gradient was computed from the temperature difference between about 12 m and 0.5 m height. The last figure (n) shows for comparison the histogram of the temperature gradient between 45 m and 0.5 m height.
(a) - (l): months January - December 1983
(m): entire year 1983
(n): entire year 1983



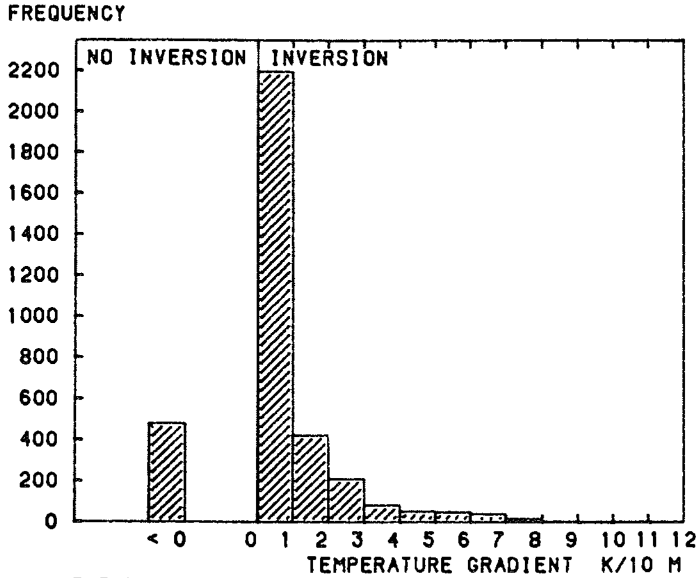
TOTAL NO. OF OBSERVATIONS: 2143
GEORG-VON-NEUMAYER STATION JAN 1983

(5a)



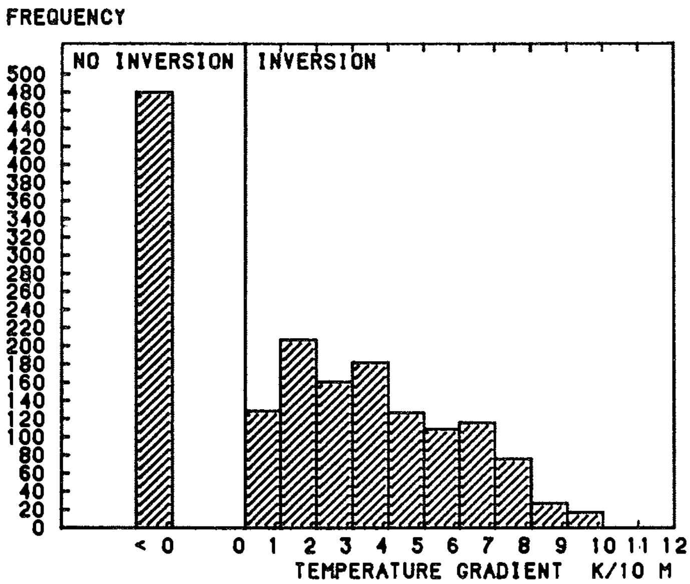
TOTAL NO. OF OBSERVATIONS: 2576
GEORG-VON-NEUMAYER STATION FEB 1983

(5b)



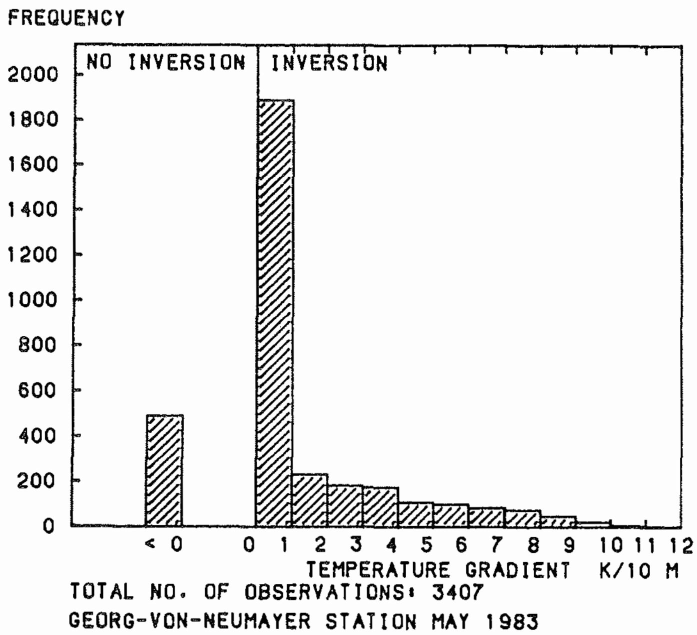
TOTAL NO. OF OBSERVATIONS: 3543
GEORG-VON-NEUMAYER STATION MAR 1983

(5c)

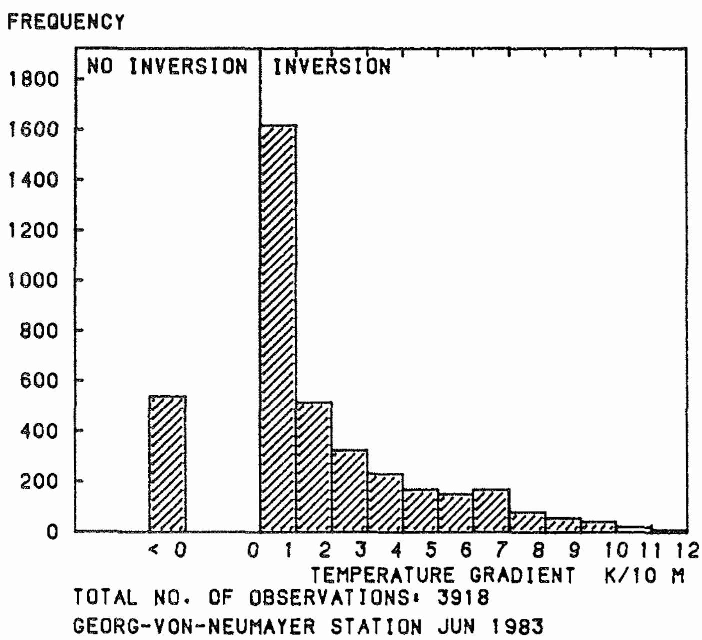


TOTAL NO. OF OBSERVATIONS: 1631
GEORG-VON-NEUMAYER STATION APR 1983

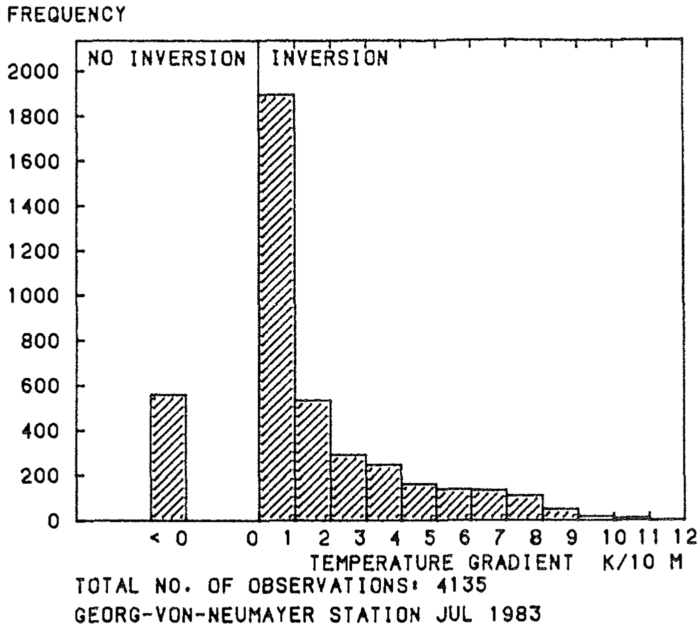
(5d)


FREQUENCY
NO INVERSION
INVERSION
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3407
GEORG-VON-NEUMAYER STATION MAY 1983

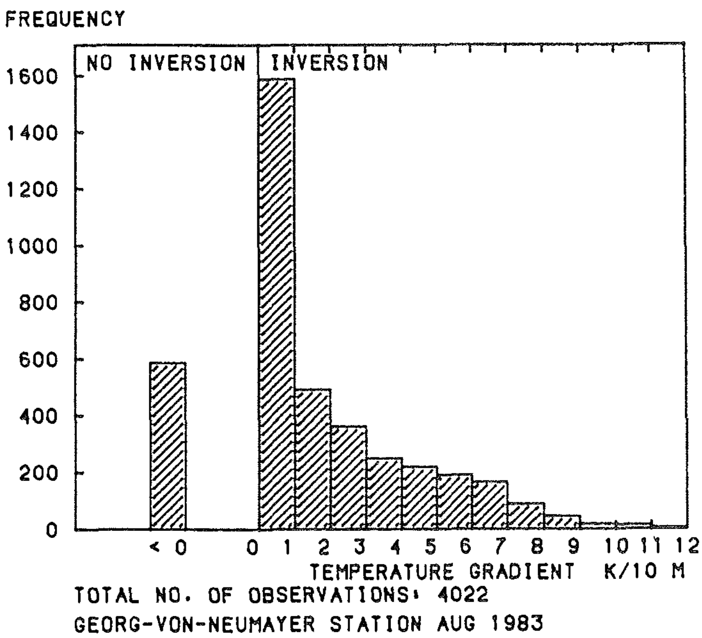
(5e)


FREQUENCY
NO INVERSION
INVERSION
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3918
GEORG-VON-NEUMAYER STATION JUN 1983

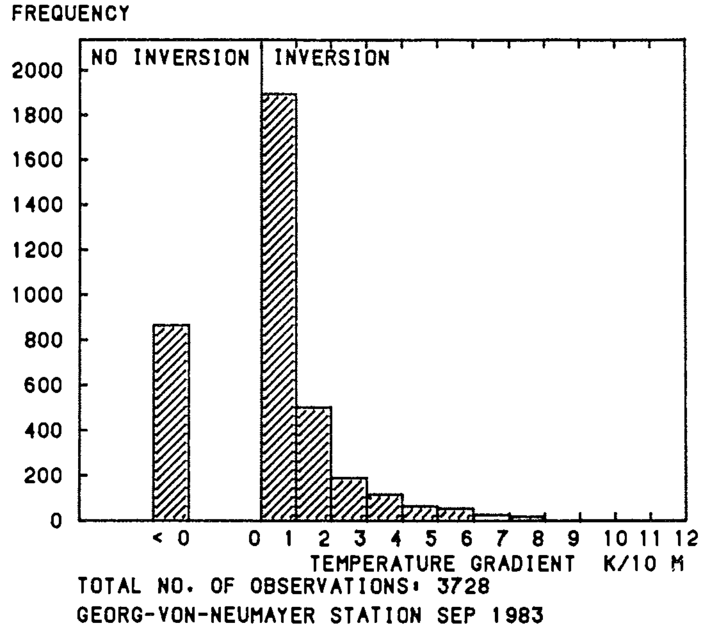
(5f)


FREQUENCY
NO INVERSION
INVERSION
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4135
GEORG-VON-NEUMAYER STATION JUL 1983

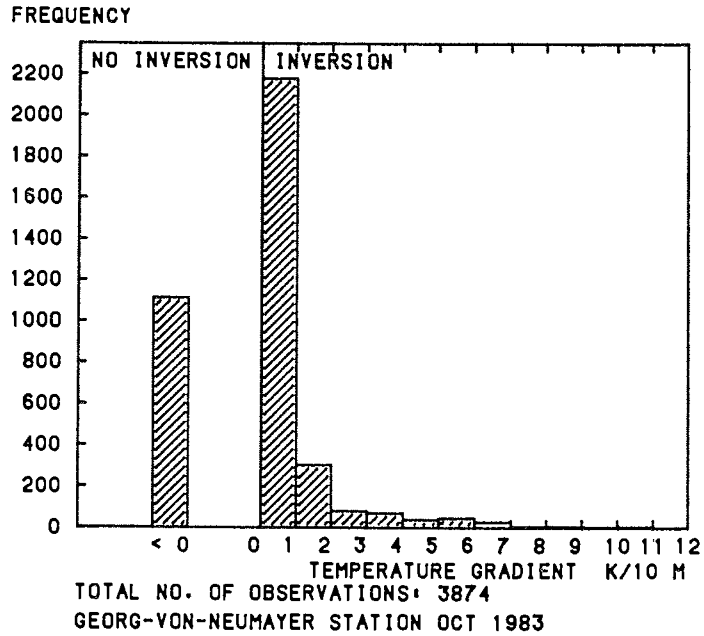
(5g)


FREQUENCY
NO INVERSION
INVERSION
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4022
GEORG-VON-NEUMAYER STATION AUG 1983

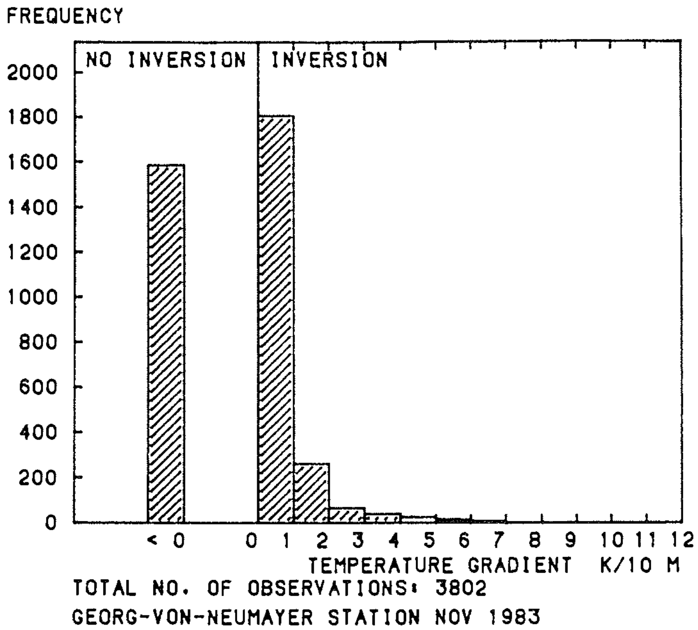
(5h)


FREQUENCY
NO INVERSION
INVERSION
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3728
GEORG-VON-NEUMAYER STATION SEP 1983

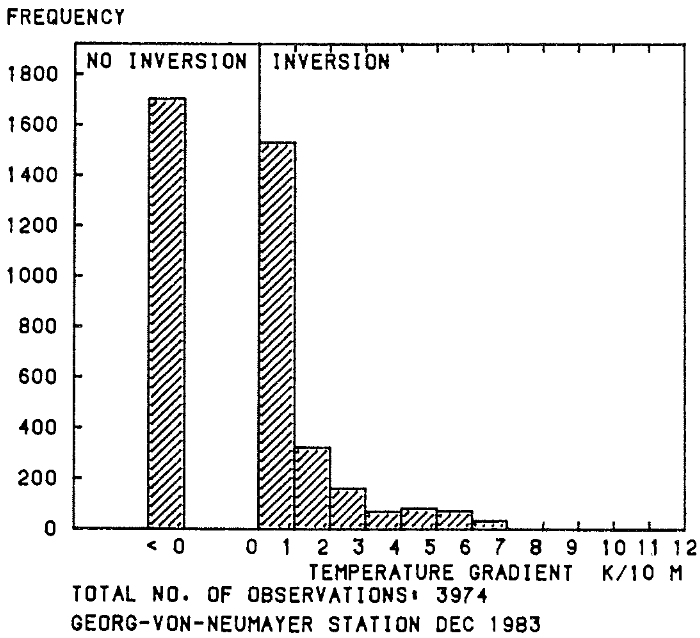
(5i)


FREQUENCY
NO INVERSION
INVERSION
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3874
GEORG-VON-NEUMAYER STATION OCT 1983

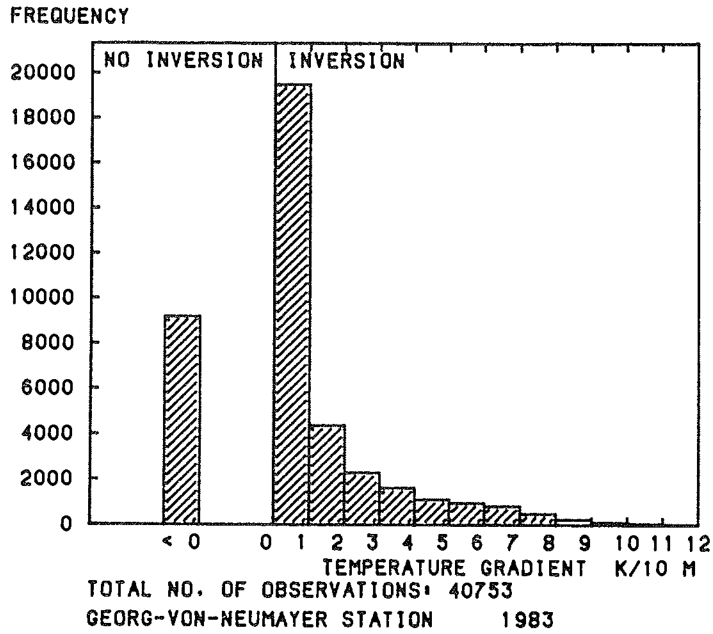
(5j)


FREQUENCY
NO INVERSION
INVERSION
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3802
GEORG-VON-NEUMAYER STATION NOV 1983

(5k)


FREQUENCY
NO INVERSION
INVERSION
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3974
GEORG-VON-NEUMAYER STATION DEC 1983

(5l)


FREQUENCY
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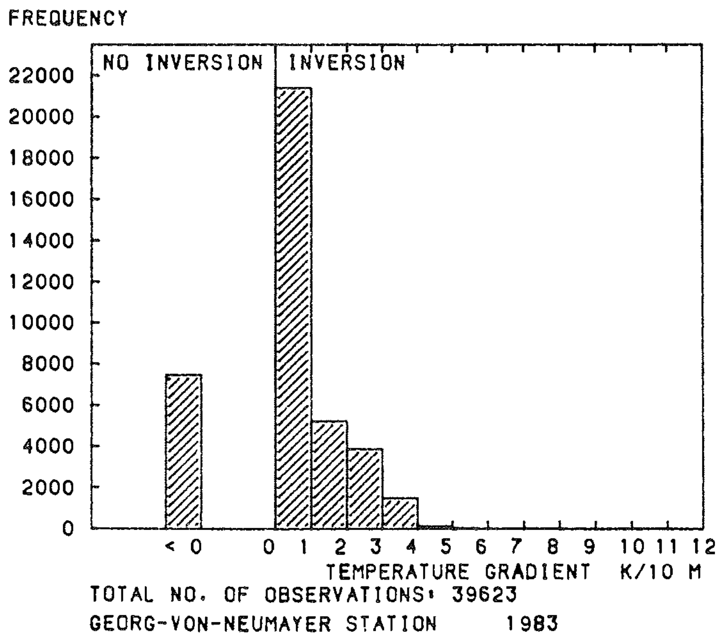
16000
14000
12000
10000
8000
6000
4000
2000
0
NO INVERSION
INVERSION
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 40753
GEORG-VON-NEUMAYER STATION 1983

(5m)


FREQUENCY
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
NO INVERSION
INVERSION
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 39623
GEORG-VON-NEUMAYER STATION 1983

(5n)

Figure 6: Monthly means of daily global radiation cycle.
Numbers on curves indicate respective months, 1983
(from 10 minute mean global radiation registration)

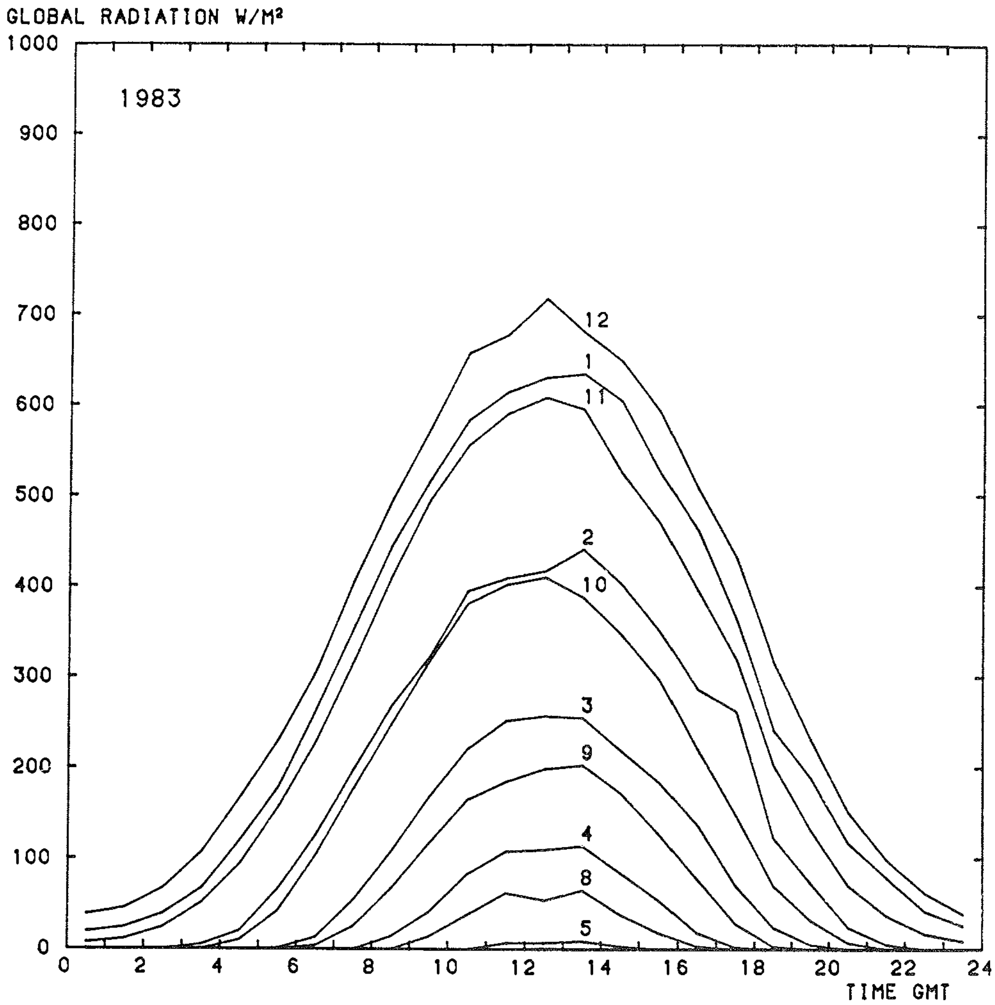
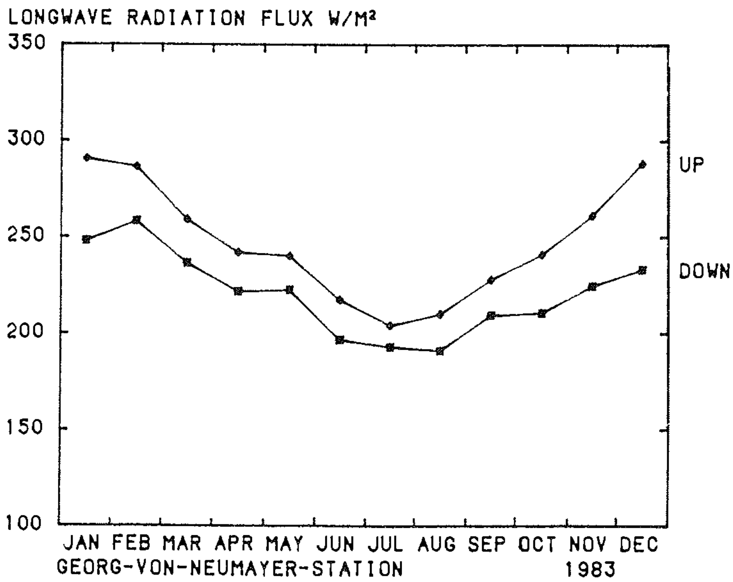
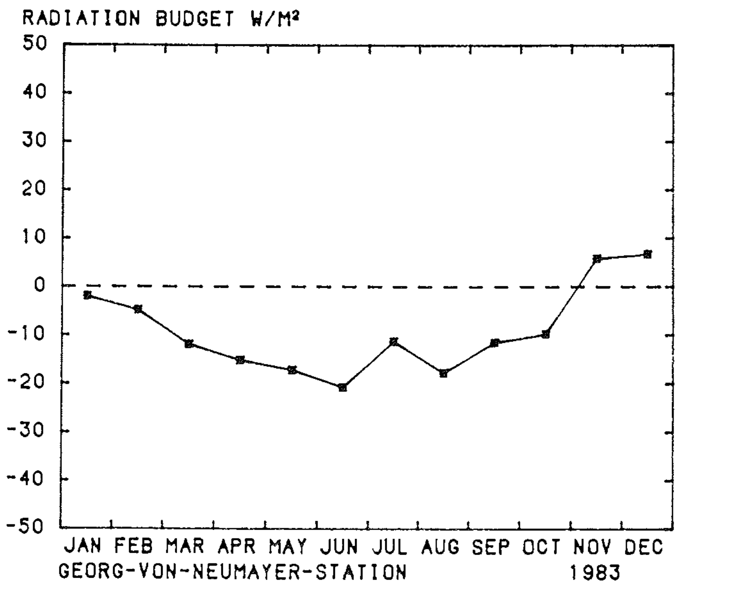


Figure 7: Time series of monthly mean longwave radiation flux (a) and the surface radiation budget (b), 1983 (from 10 minute mean radiation registration)

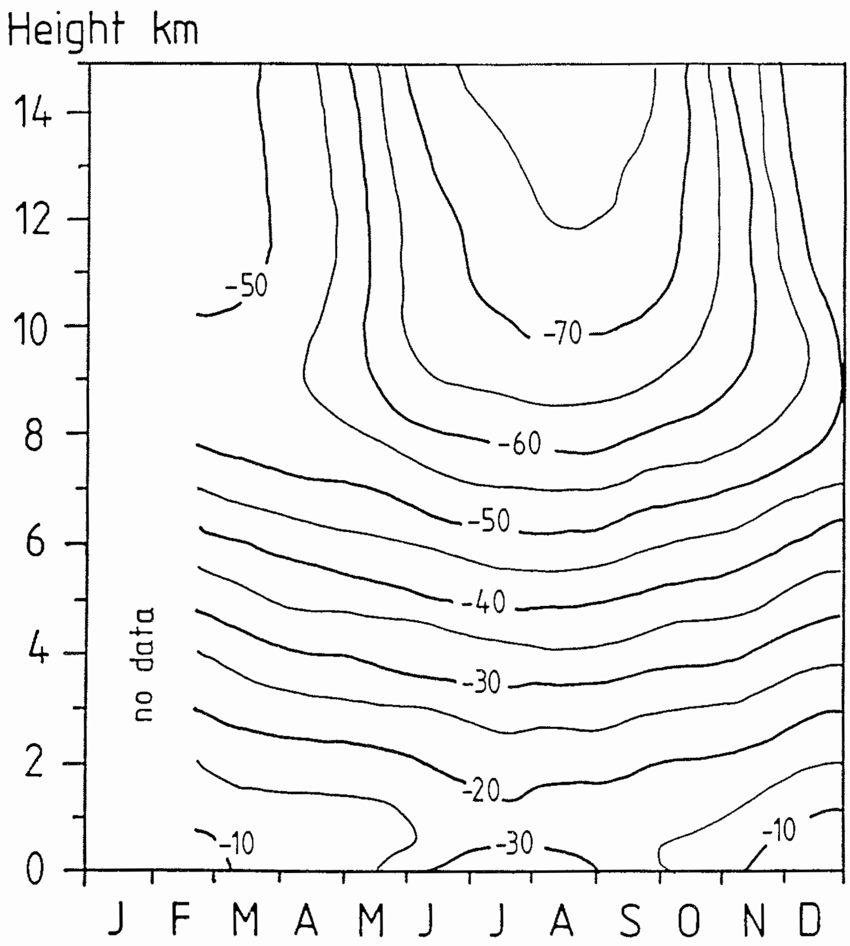


(7a)

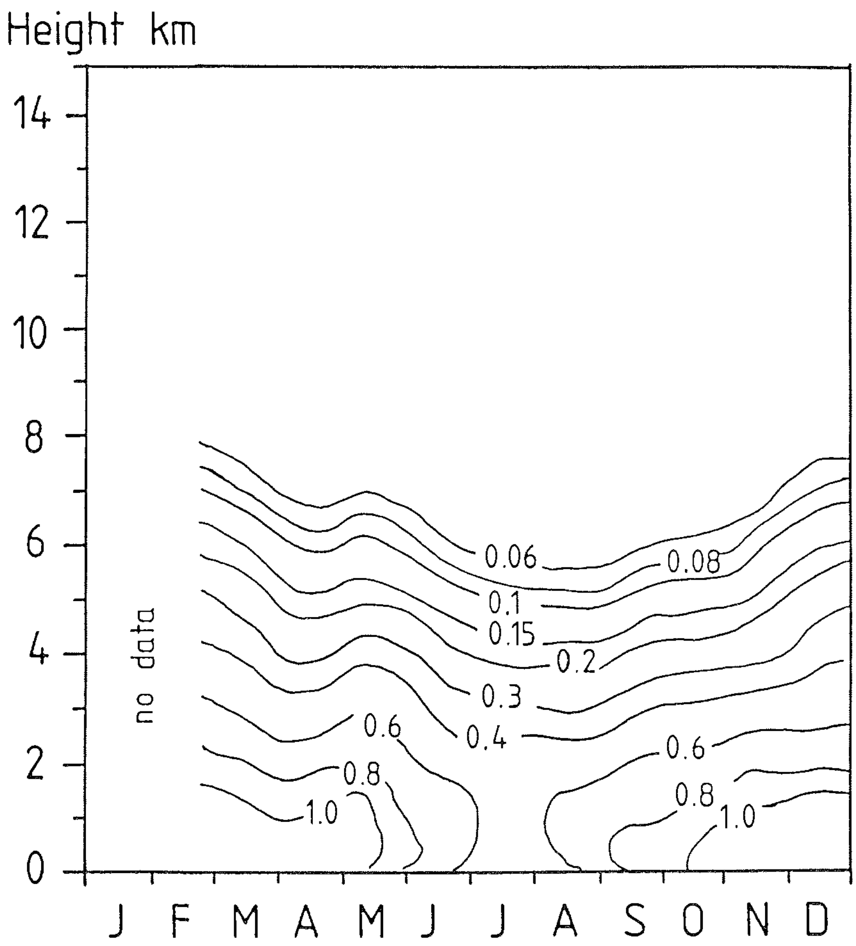


(7b)

Figure 8: Time - height sections of temperature (a), specific humidity (b), and wind components u (c) and v (d), 1983; units are deg C, g/kg, and m/s, resp. (from daily radiosonde soundings)

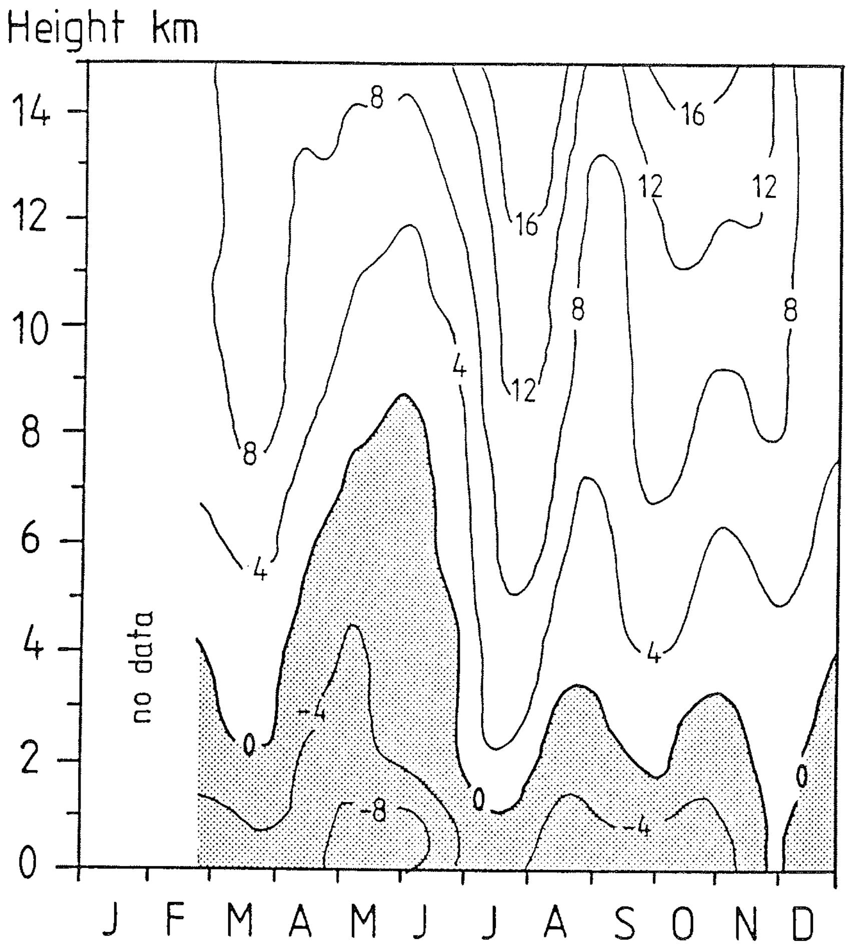


(8a)

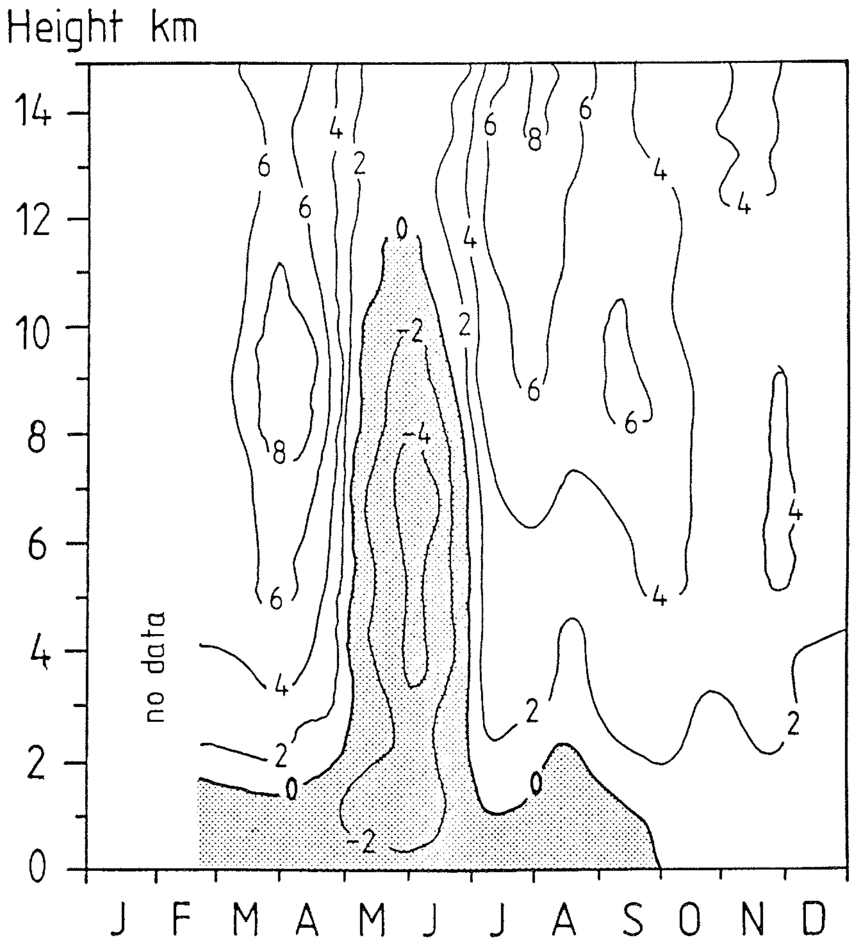


Height km
14
12
10
8
6
4
2
0
no data
0.06
0.08
0.1
0.15
0.2
0.3
0.4
0.6
0.6
0.8
0.8
1.0
1.0
J F M A M J J A S O N D

(8b)

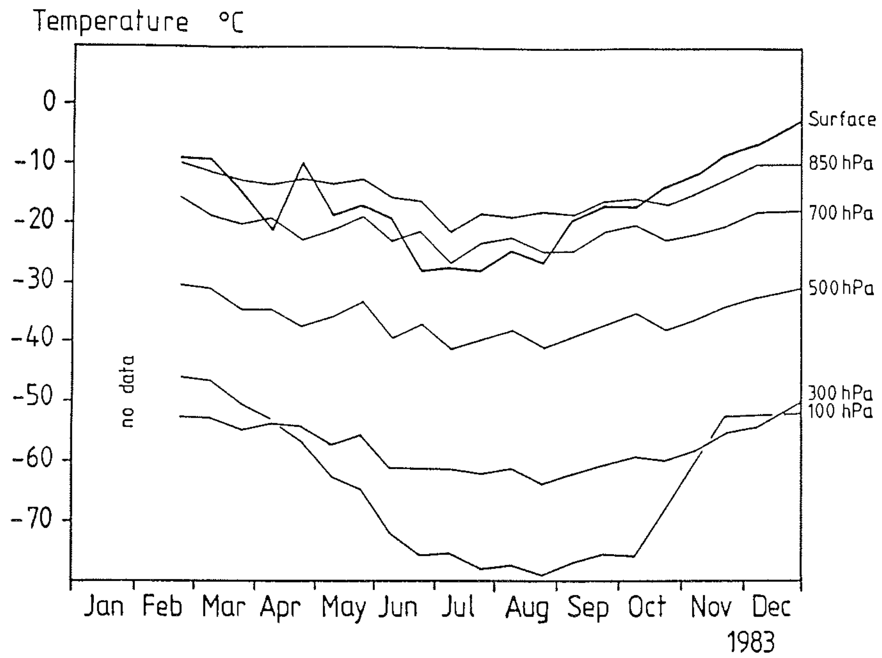

Height km
14
12
10
8
6
4
2
0
no data
8
16
16
12
12
12
8
8
8
4
4
4
0
0
0
-4
-4
-8
J F M A M J J A S O N D

(8c)

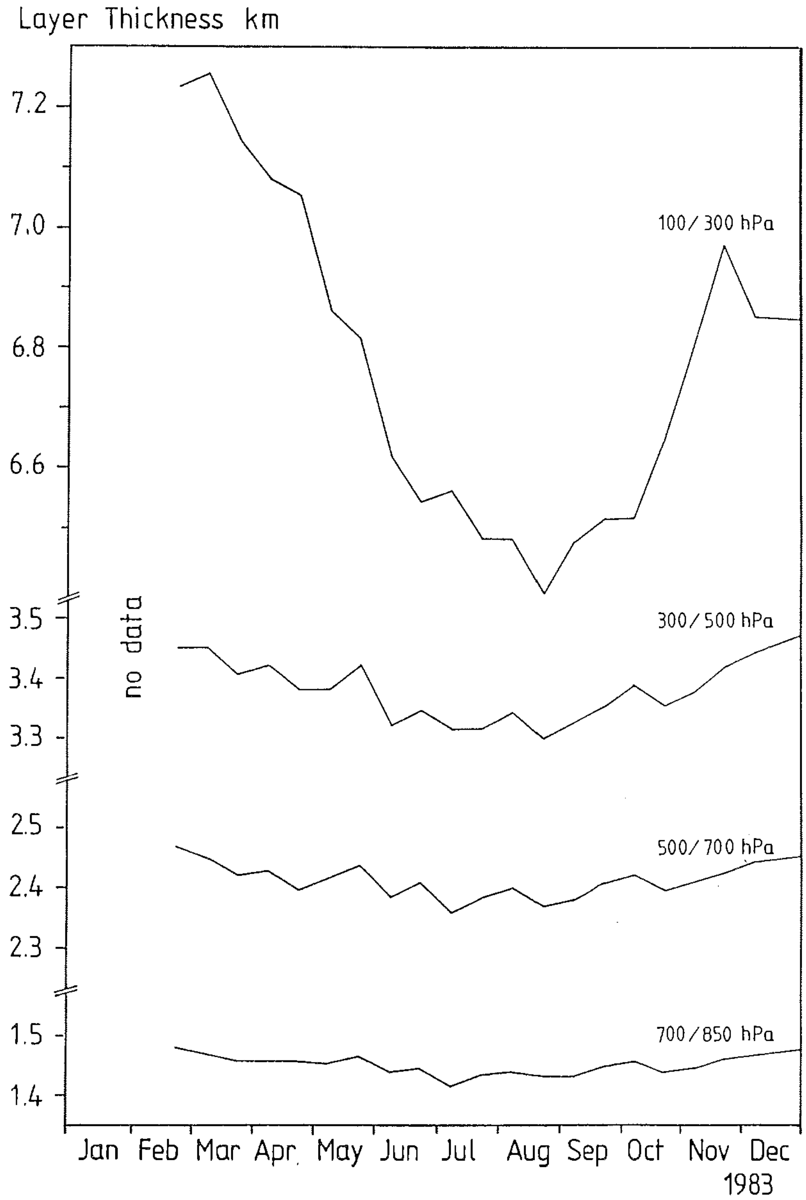


(8d)

Figure 9: Time series of temperature at different pressure levels (a) and layer thickness of different relative topographies (b), 1983 (from daily radiosonde soundings, plotted are half-monthly mean values)



(9a)



Layer Thickness km
7.2
7.0
6.8
6.6
3.5
3.4
3.3
2.5
2.4
2.3
1.5
1.4
no data
100/300 hPa
300/500 hPa
500/700 hPa
700/850 hPa
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1983

(9b)

Figure 9c: Tropopause height for all radiosonde soundings
taken during 1983
Line interruptions: Tropopause could not be
identified from the temperature profile

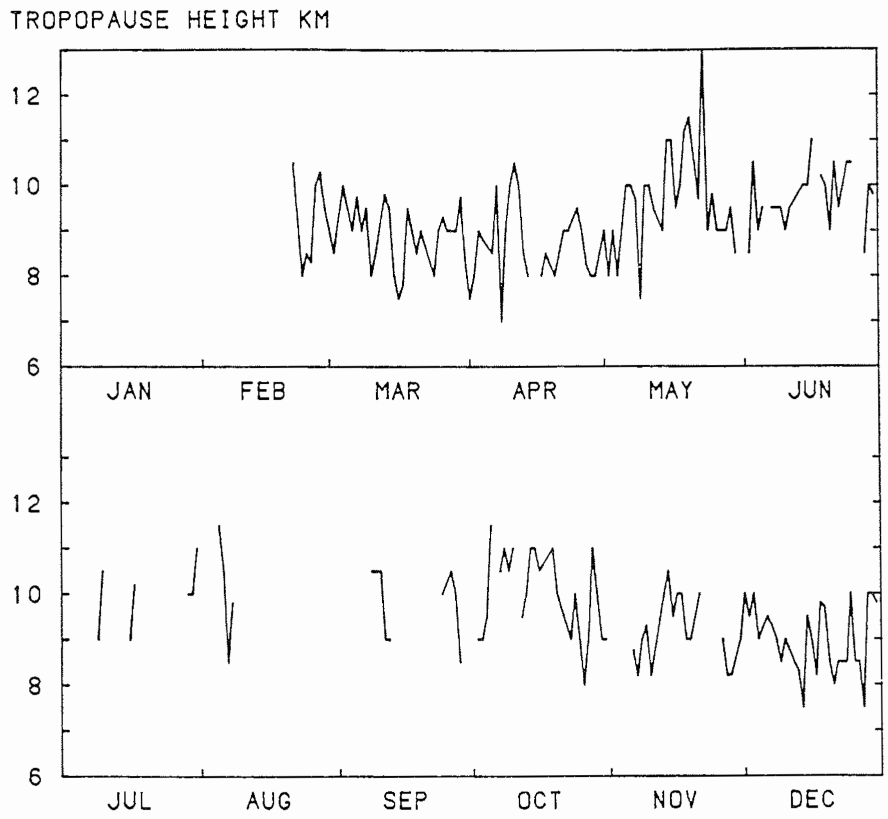
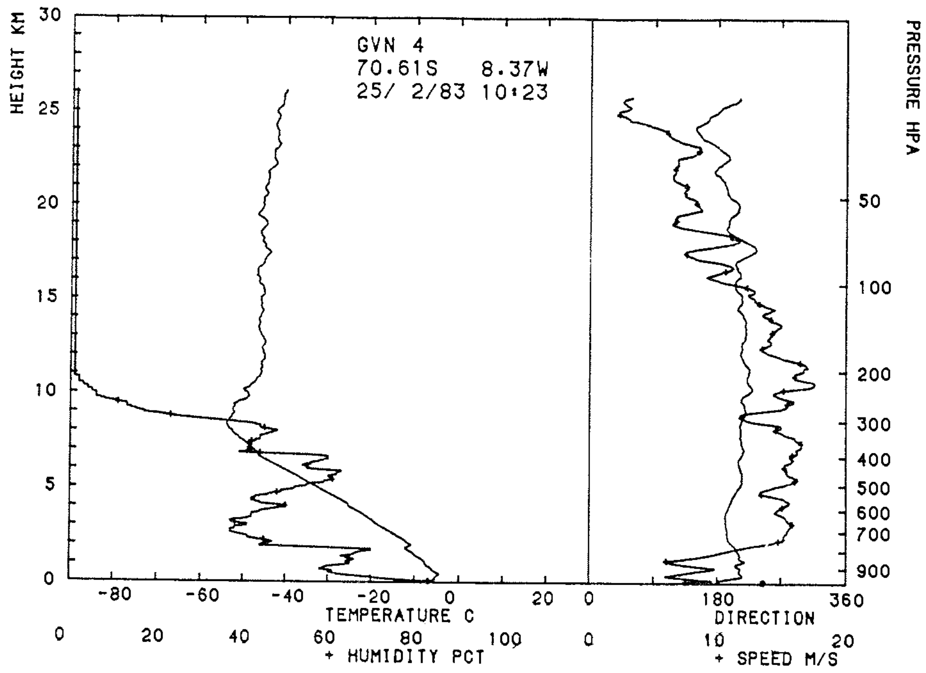
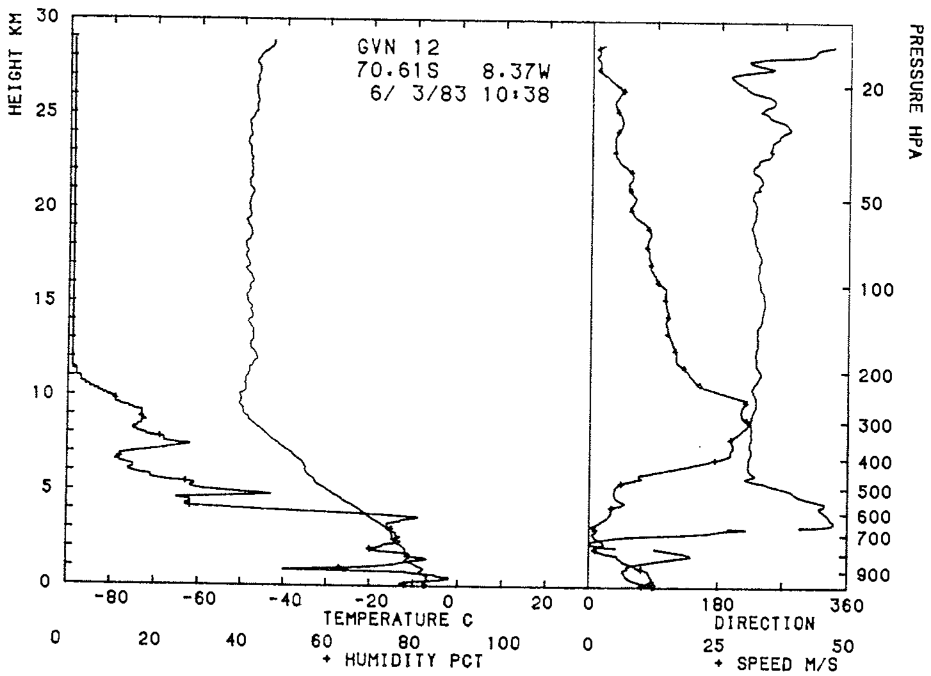


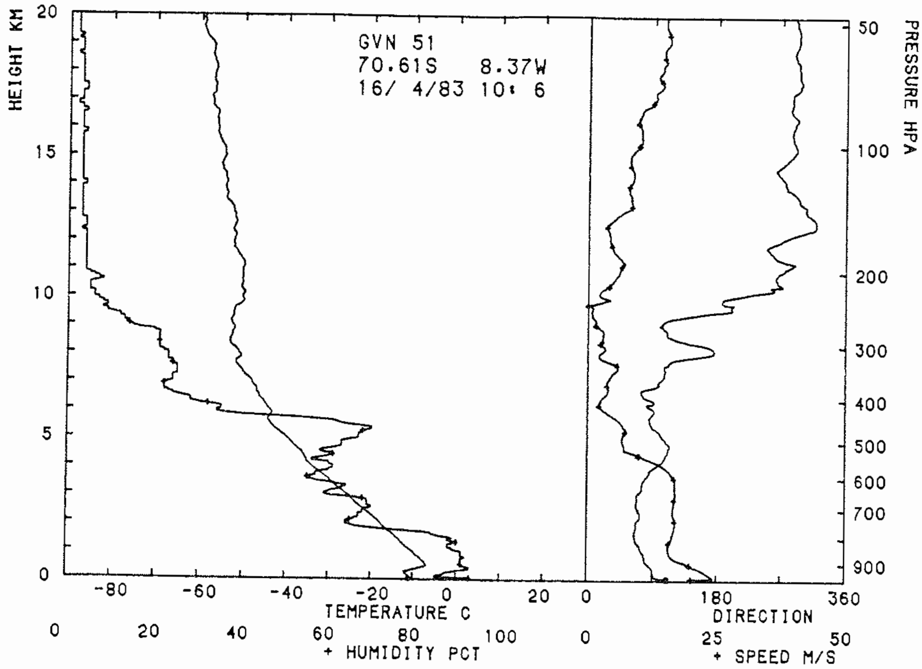
Figure 10: Selected radiosonde soundings for each month (1984)



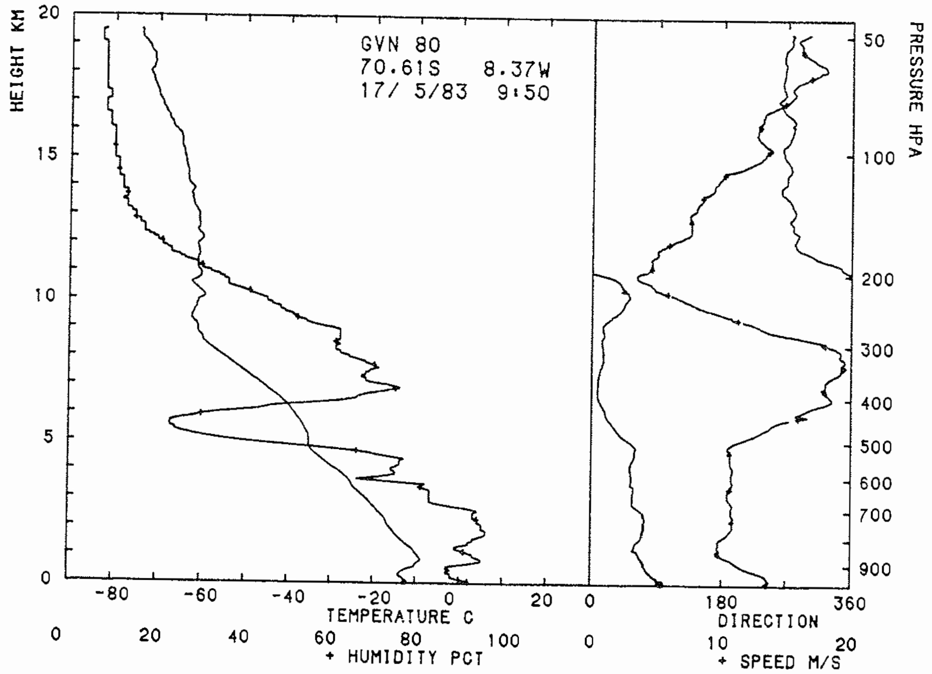
(10a)



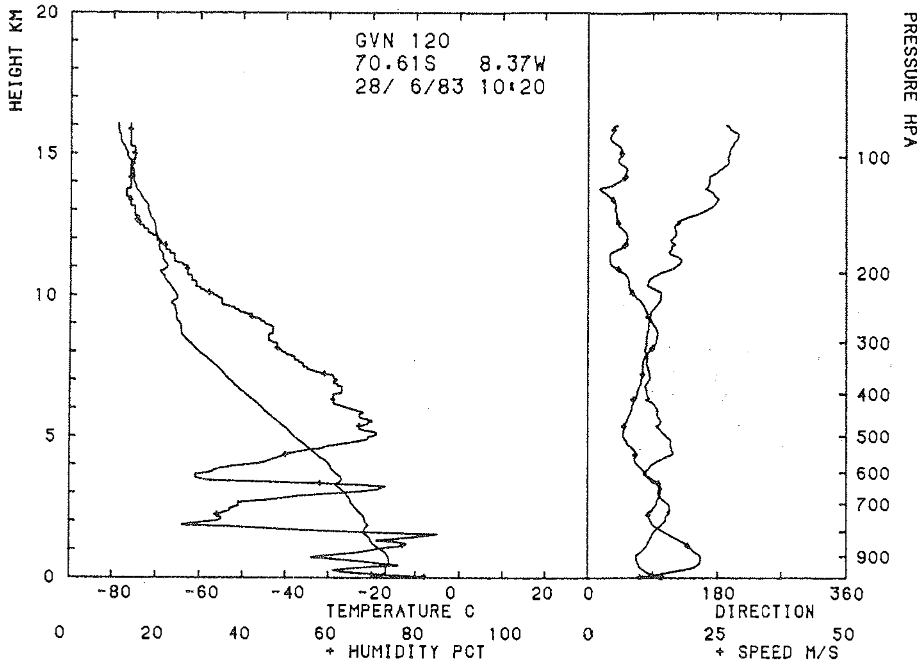
(10b)


GVN 51
70.61S 8.37W
16/ 4/83 10: 6
HEIGHT KM
20
15
10
5
0
-80
-60
-40
-20
0
20
TEMPERATURE C
0
20
40
60
80
100
+ HUMIDITY PCT
0
180
360
DIRECTION
0
25
50
+ SPEED M/S
50
100
200
300
400
500
600
700
900
PRESSURE HPA

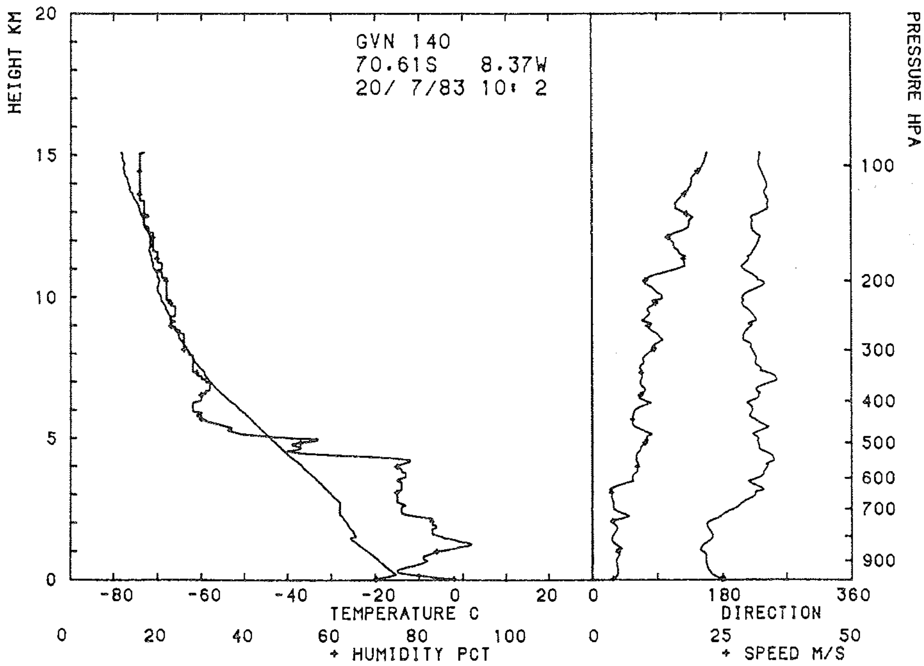
(10c)


GVN 80
70.61S 8.37W
17/ 5/83 9:50
HEIGHT KM
20
15
10
5
0
-80
-60
-40
-20
0
20
TEMPERATURE C
0
20
40
60
80
100
+ HUMIDITY PCT
0
180
360
DIRECTION
0
10
20
+ SPEED M/S
50
100
200
300
400
500
600
700
900
PRESSURE HPA

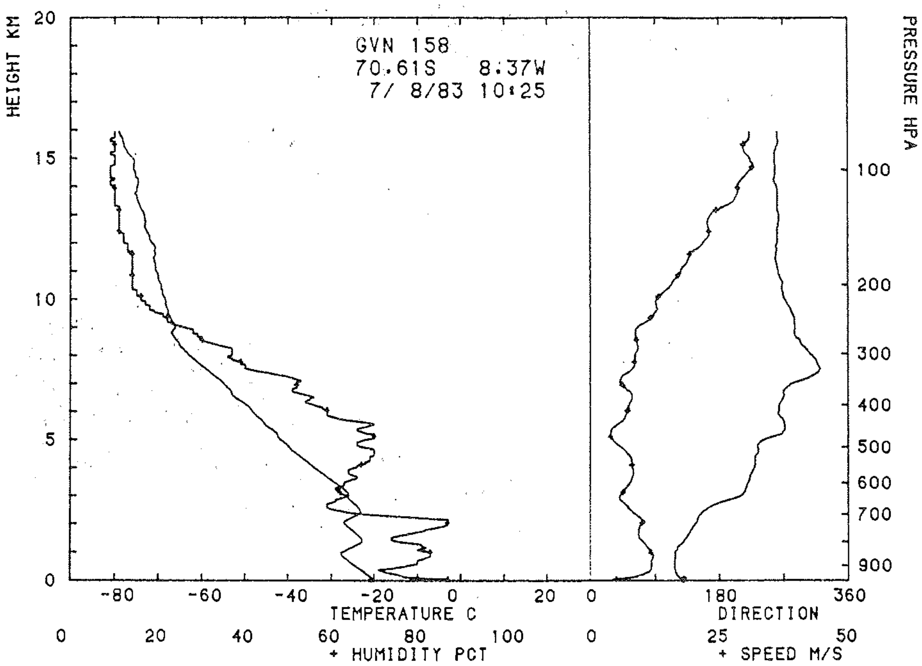
(10d)


GVN 120
70.61S 8.37W
28/ 6/83 10:20
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

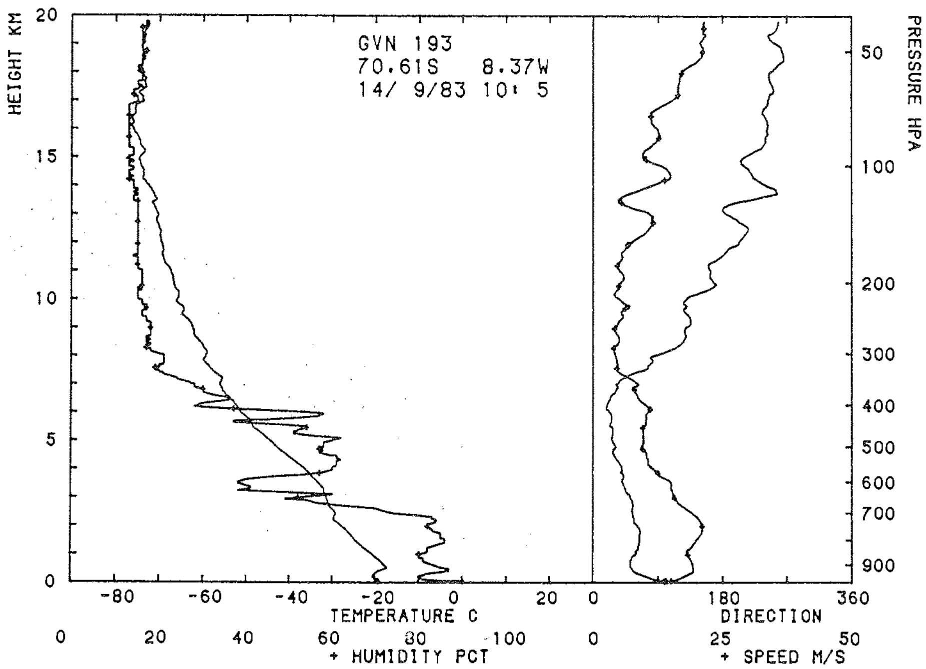
(10e)


GVN 140
70.61S 8.37W
20/ 7/83 10: 2
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

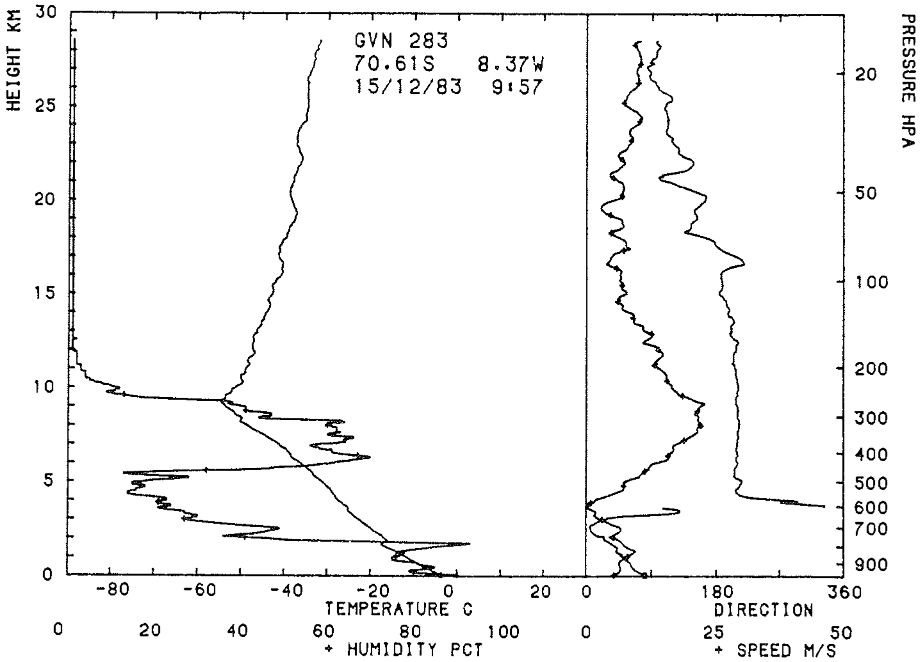
(10f)


GVN 158
70.61S 8.37W
7/ 8/83 10:25
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(10g)

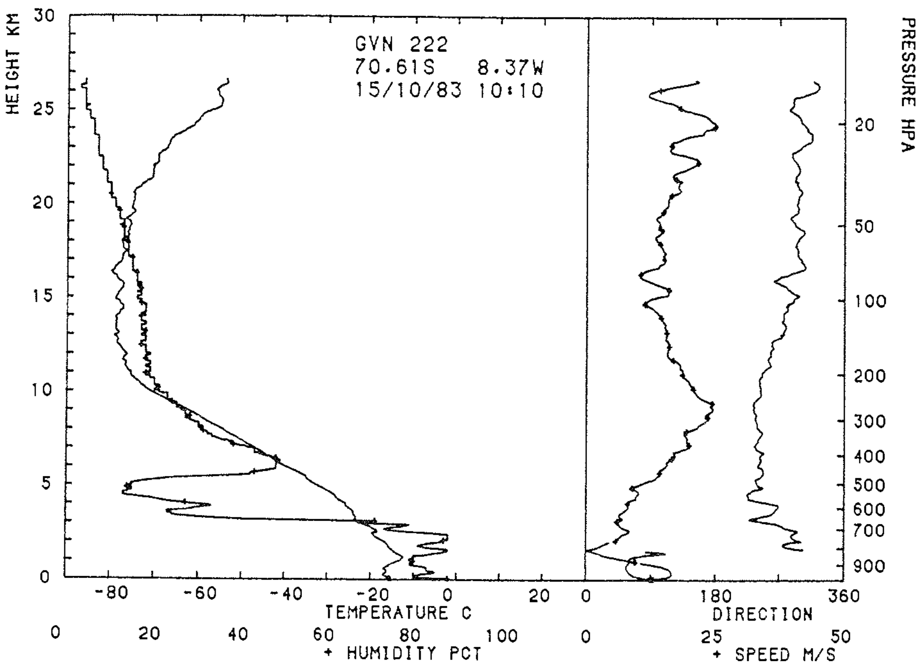

GVN 193
70.61S 8.37W
14/ 9/83 10: 5
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(10h)

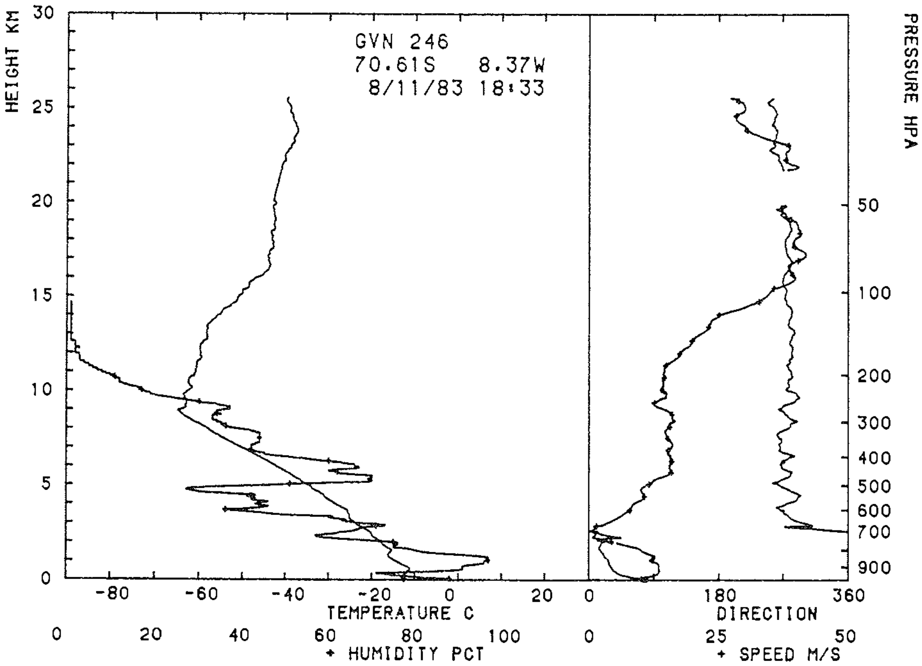


HEIGHT KM
30
25
20
15
10
5
0
GVN 283
70.61S 8.37W
15/12/83 9:57
-80 -60 -40 -20 0 20
TEMPERATURE C
0 20 40 60 80 100
+ HUMIDITY PCT
0 180 360
DIRECTION
0 25 50
+ SPEED M/S
PRESSURE HPA
20
50
100
200
300
400
500
600
700
900

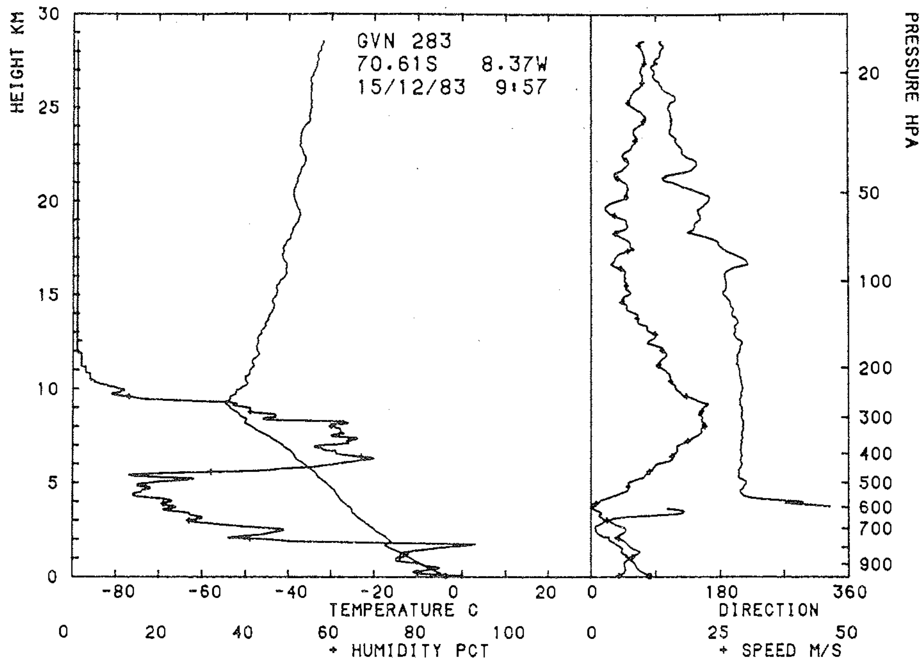
(10k)


GVN 222
70.61S 8.37W
15/10/83 10:10
HEIGHT KM
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S
PRESSURE HPA

(10i)


GVN 246
70.61S 8.37W
8/11/83 18:33
HEIGHT KM
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S
PRESSURE HPA

(10j)



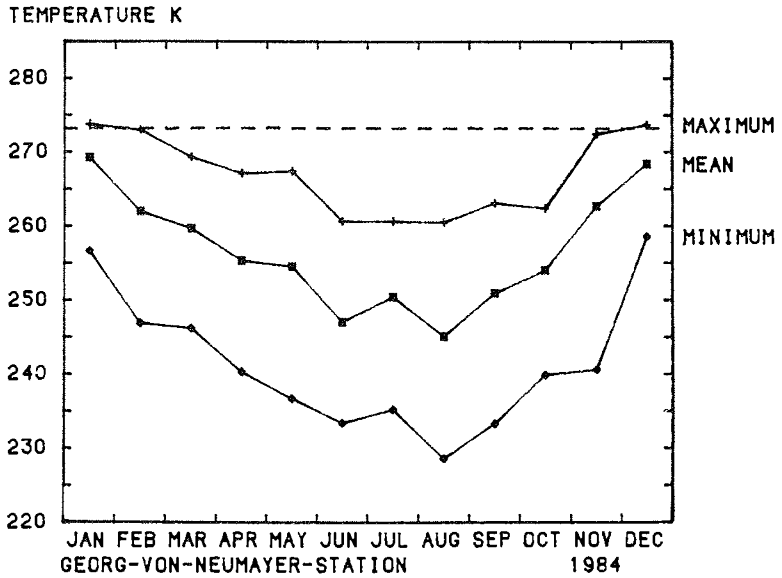
HEIGHT KM
GVN 283
70.61S 8.37W
15/12/83 9:57
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S
PRESSURE HPA

(101)

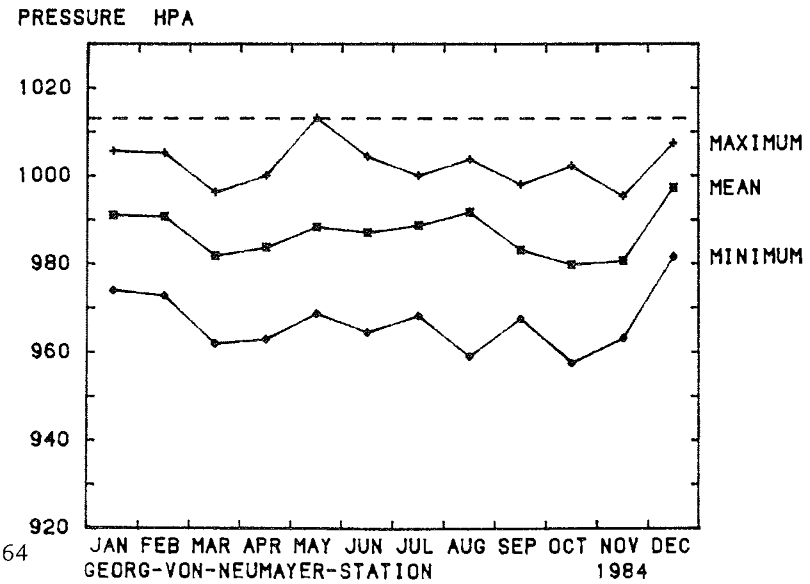
Table 5: Monthly means and extremes, 1984
(from synoptic observations)

1984 GEORG-VON-NEUMAYER 70°37'S 08°22'W ELEVATION 40 M	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVERAGE TEMPERATURE (DEG C)	-3.9	-11.2	-13.5	-17.9	-18.7	-26.2	-22.8	-28.1	-22.3	-19.2	-10.5	-4.8	-16.6
TEMPERATURE MAXIMUM (DEG C) (DATE)	0.6 (20)	-0.2 (10)	-3.9 (27)	-6.1 (18)	-5.8 (10)	-12.6 (29)	-12.6 (5)	-12.7 (28)	-10.1 (9)	-10.8 (6)	-0.7 (25)	0.5 (19)	0.6
TEMPERATURE MINIMUM (DEG C) (DATE)	-16.5 (31)	-26.3 (23)	-27.0 (15)	-32.9 (25)	-36.5 (24)	-39.8 (23)	-38.0 (3)	-44.6 (19)	-39.9 (27)	-33.3 (27)	-32.6 (3)	-14.6 (3)	-44.6
AVERAGE MAXIMUM TEMPERATURE (DEG C)	-1.8	-6.4	-10.5	-14.8	-15.1	-22.0	-19.1	-23.9	-18.3	-15.3	-8.4	-2.3	-13.2
AVERAGE MINIMUM TEMPERATURE (DEG C)	-7.3	-17.6	-17.5	-21.5	-22.0	-31.3	-27.0	-32.2	-26.9	-25.0	-14.0	-8.0	-20.9
AVERAGE REL. HUMIDITY (PERCENT)	088	080	083	082	083	076	082	083	077	073	078	071	079
MAXIMUM REL. HUMIDITY (DATE)	100 (28)	099 (28)	100 (2)	097 (18)	100 (2)	098 (9)	098 (26)	095 (3)	089 (8)	087 (6)	093 (24)	100 (3)	100
MINIMUM REL. HUMIDITY (DATE)	054 (9)	039 (19)	057 (24)	060 (24)	055 (23)	045 (6)	051 (21)	065 (22)	041 (11)	015 (29)	043 (25)	032 (17)	015
AVERAGE STATION PRESSURE (HPA)	991.1	990.8	981.9	983.8	988.5	987.2	988.8	991.8	983.2	979.9	980.7	997.3	987.1
MAXIMUM PRESSURE (HPA) (DATE)	1005.7 (29)	1005.2 (1)	996.3 (6)	1000.1 (7)	1013.2 (15)	1004.4 (10)	1000.1 (4)	1003.8 (19)	998.1 (9)	1002.3 (28)	995.4 (27)	1007.4 (19)	1013.2
MINIMUM PRESSURE (HPA) (DATE)	974.0 (17)	972.8 (29)	962.0 (8)	963.0 (18)	968.8 (4)	964.5 (26)	968.2 (18)	959.1 (21)	967.6 (22)	957.6 (6)	963.2 (23)	981.6 (7)	957.6
PREVAILING WIND DIRECTION	075	165	095	085	085	085	085	075	085	085	095	085	085
AVERAGE WIND SPEED (M/S)	8.3	4.0	8.6	11.3	11.2	7.3	8.9	7.5	8.6	7.4	10.6	5.5	8.3
MAX. WIND VEL. (M/S) (DEG) (DATE)	25.2 090 (17)	9.3 250 (29)	24.7 100 (23)	26.7 100 (17)	28.8 090 (27)	24.2 090 (3)	29.8 090 (18)	23.7 090 (28)	23.7 100 (22)	24.7 100 (13)	22.1 110 (8)	19.5 080 (7)	29.8 090
AVERAGE SKY COVER (TENTH)	6.2	5.0	5.0	6.2	5.0	5.0	6.2	5.0	5.0	6.2	7.5	6.2	5.7
NUMBER OF CLEAR DAYS	03	03	05	04	03	04	01	03	03	00	00	01	30
NUMBER OF PARTLY CLOUDY DAYS	11	22	13	12	17	16	14	18	18	19	10	16	186
NUMBER OF CLOUDY DAYS	17	04	12	14	09	09	15	10	09	11	19	13	142
NUMBER OF DAYS WITH VISIBILITY LESS THAN 0.4 KM	05	00	08	05	13	07	14	09	12	05	14	01	93
NUMBER OF DAYS WITH MODERATE SNOWDRIFT	01	00	04	04	06	05	09	07	06	00	05	00	47
NUMBER OF DAYS WITH STRONG SNOWDRIFT	04	05	08	07	07	01	04	06	06	07	06	01	62

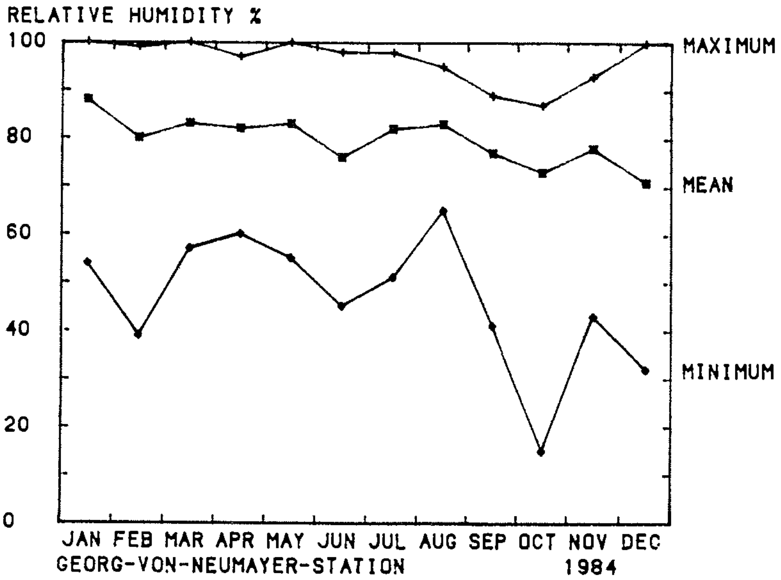
Figure 11: Time series of monthly mean temperature air pressure (b), and relative humidity (c), 1984
(from synoptic observations)



(11a)

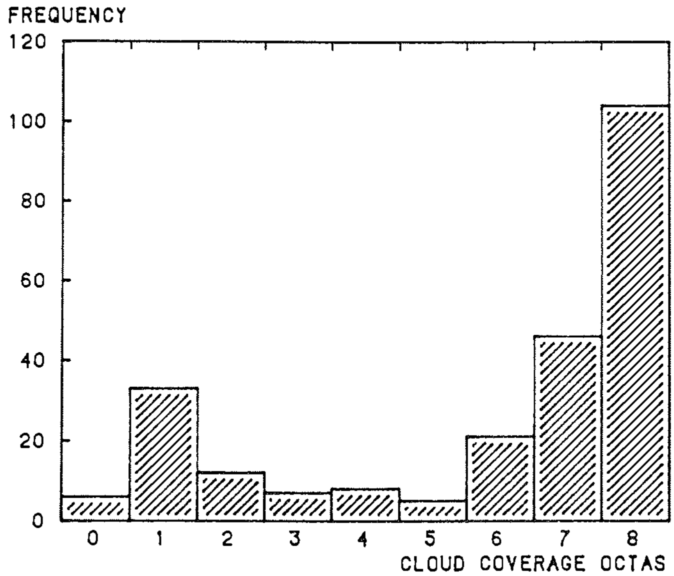


(11b)


RELATIVE HUMIDITY %
100
80
60
40
20
0
MAXIMUM
MEAN
MINIMUM
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
GEORG-VON-NEUMAYER-STATION
1984

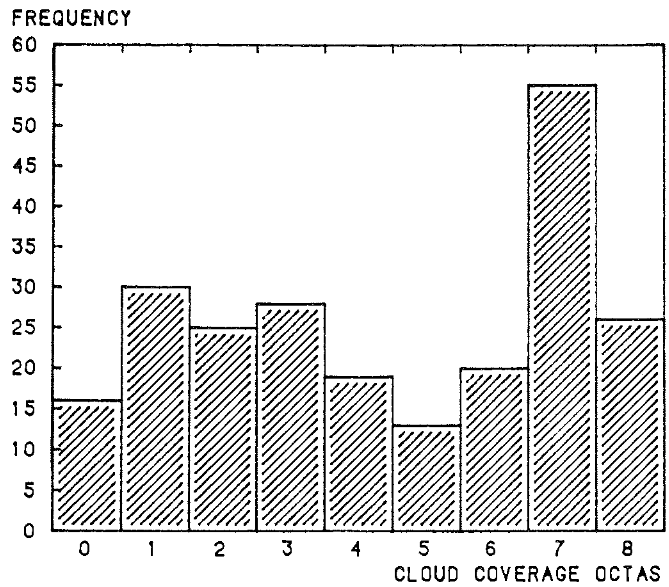
(11c)

Figure 12: Histograms of total cloud coverage, 1984
(from synoptic observations)
(a) - (l): months January - December 1984
(m): entire year 1984



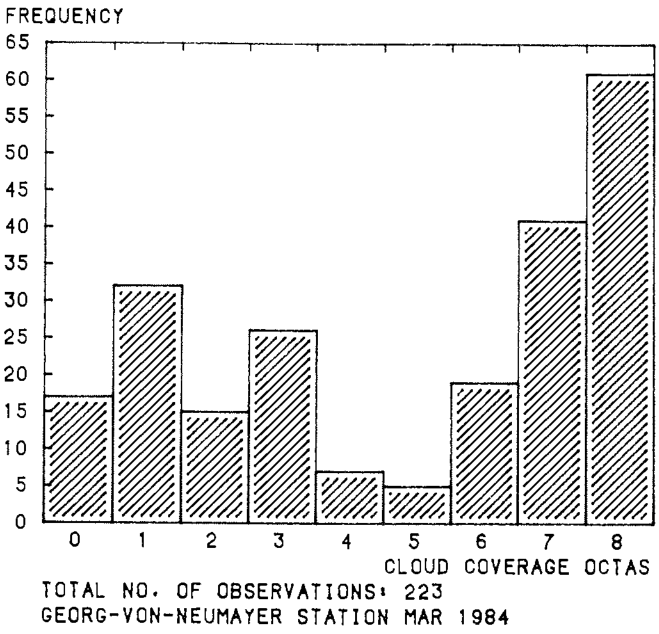
TOTAL NO. OF OBSERVATIONS: 242
GEORG-VON-NEUMAYER STATION JAN 1984

(12a)

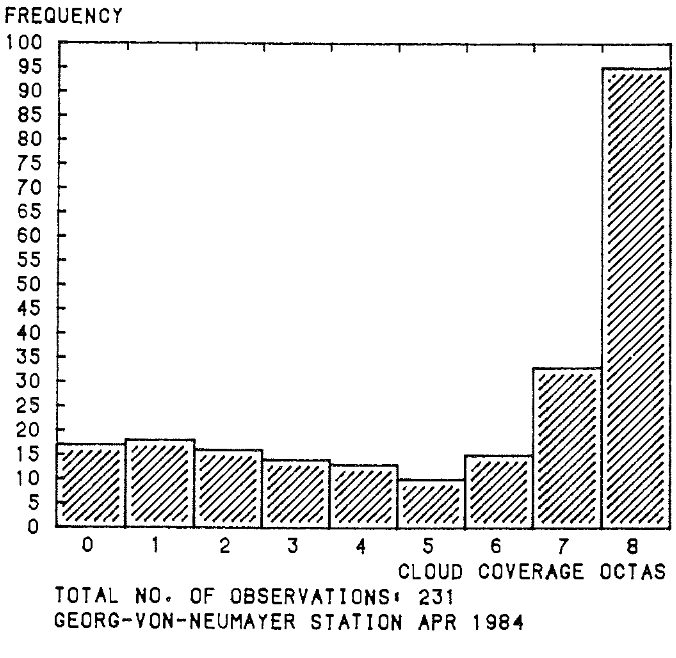


TOTAL NO. OF OBSERVATIONS: 232
GEORG-VON-NEUMAYER STATION FEB 1984

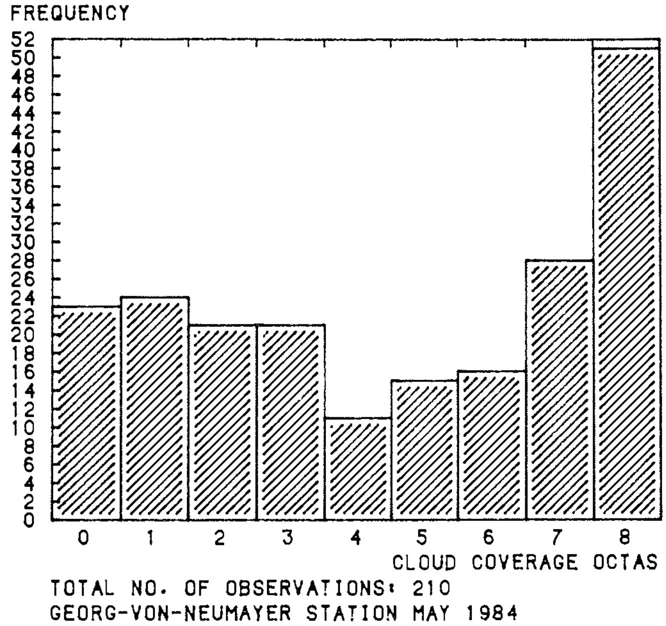
(12b)


FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 223
GEORG-VON-NEUMAYER STATION MAR 1984

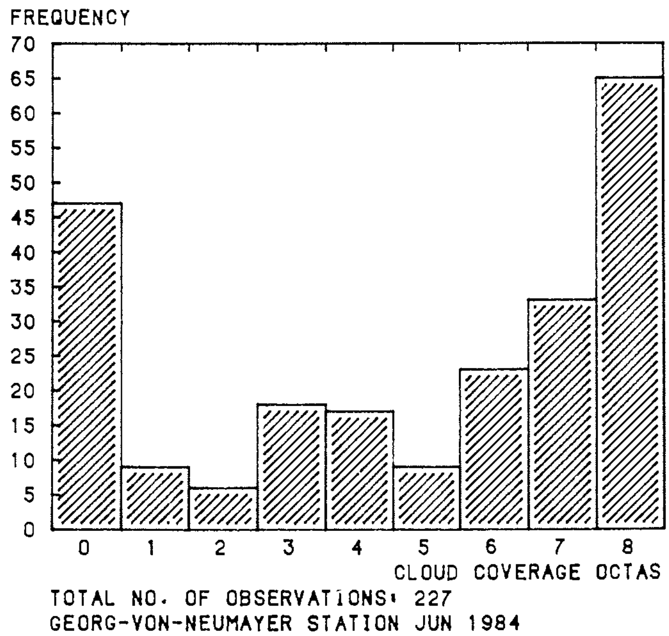
(12c)


FREQUENCY
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 231
GEORG-VON-NEUMAYER STATION APR 1984

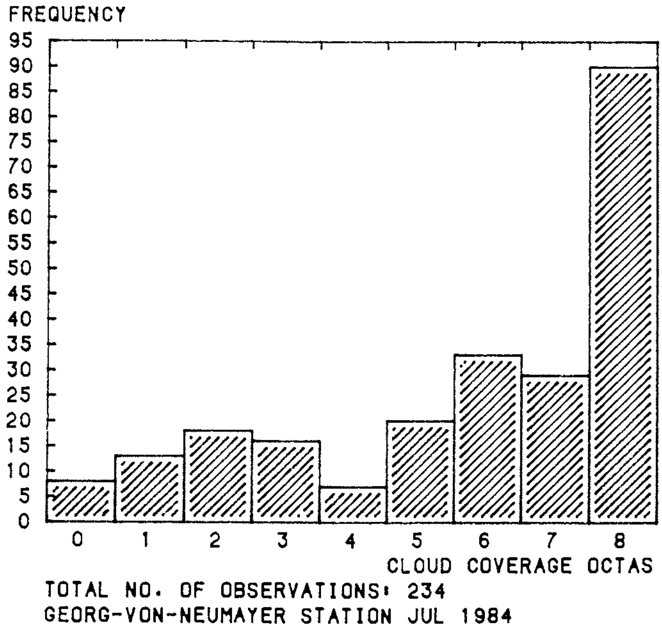
(12d)


FREQUENCY
52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 210
GEORG-VON-NEUMAYER STATION MAY 1984

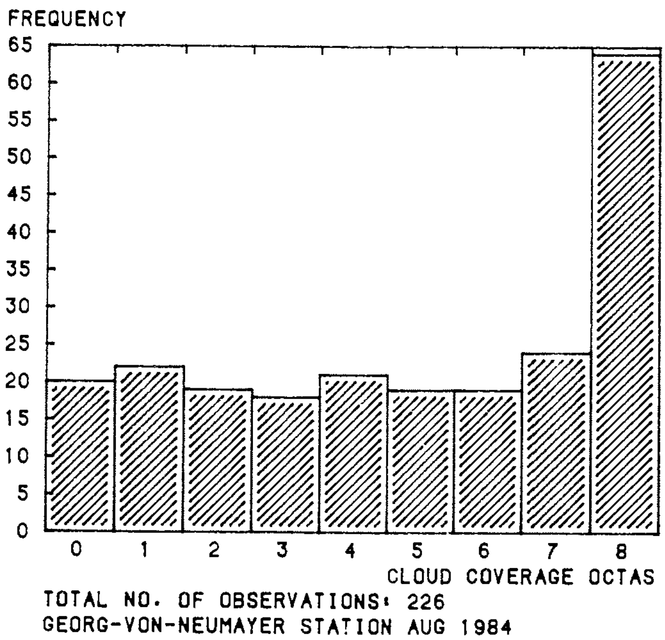
(12e)


FREQUENCY
70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 227
GEORG-VON-NEUMAYER STATION JUN 1984

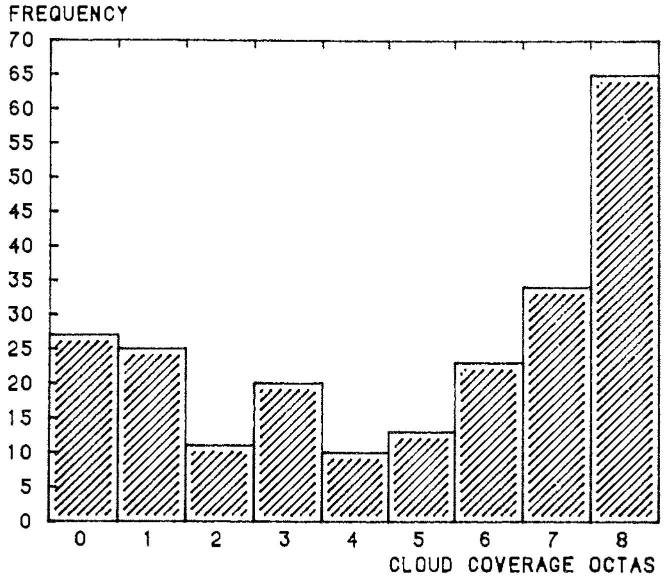
(12f)


FREQUENCY
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 234
GEORG-VON-NEUMAYER STATION JUL 1984

(12g)

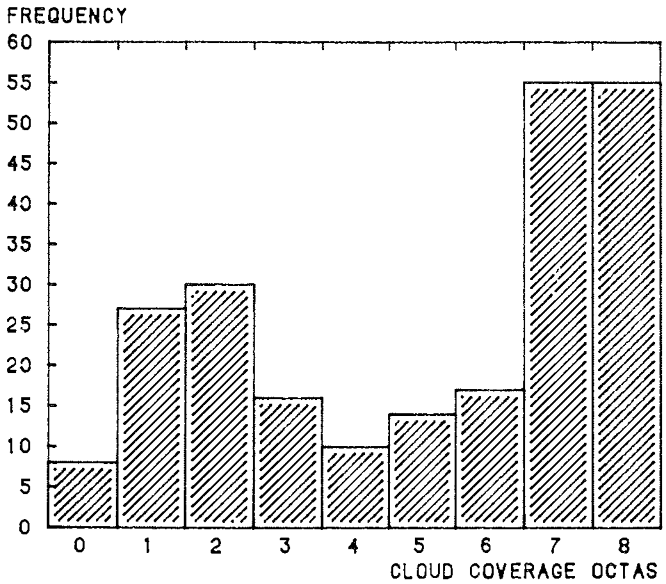

FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 226
GEORG-VON-NEUMAYER STATION AUG 1984

(12h)



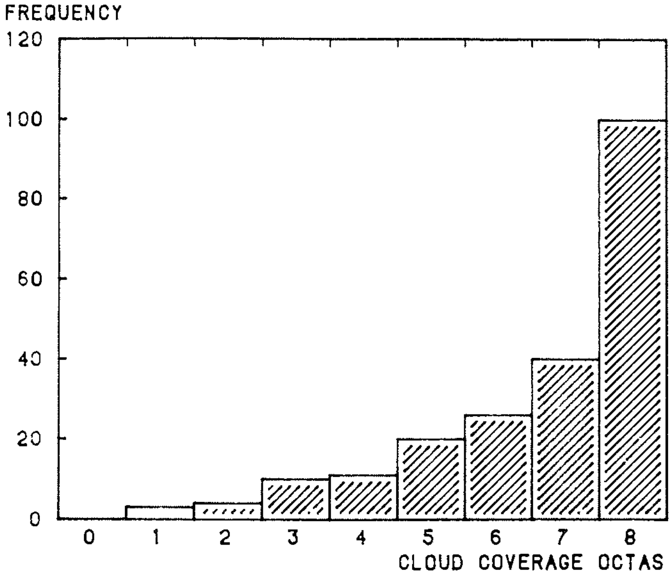
TOTAL NO. OF OBSERVATIONS: 228
GEORG-VON-NEUMAYER STATION SEP 1984

(12i)



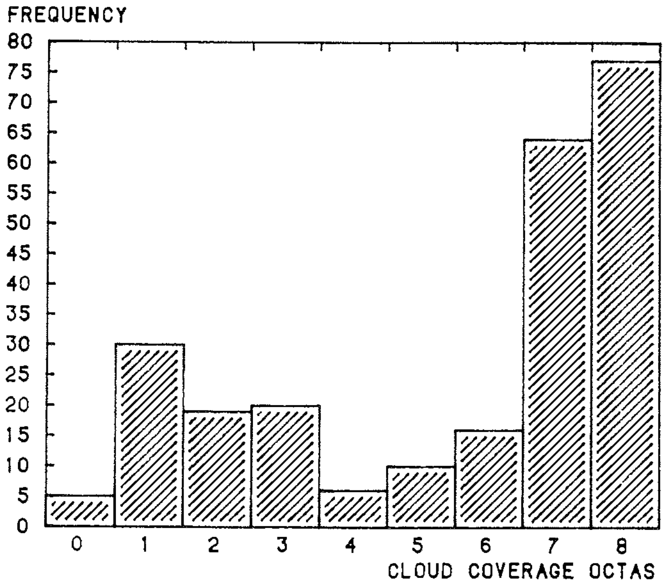
TOTAL NO. OF OBSERVATIONS: 232
GEORG-VON-NEUMAYER STATION OCT 1984

(12j)



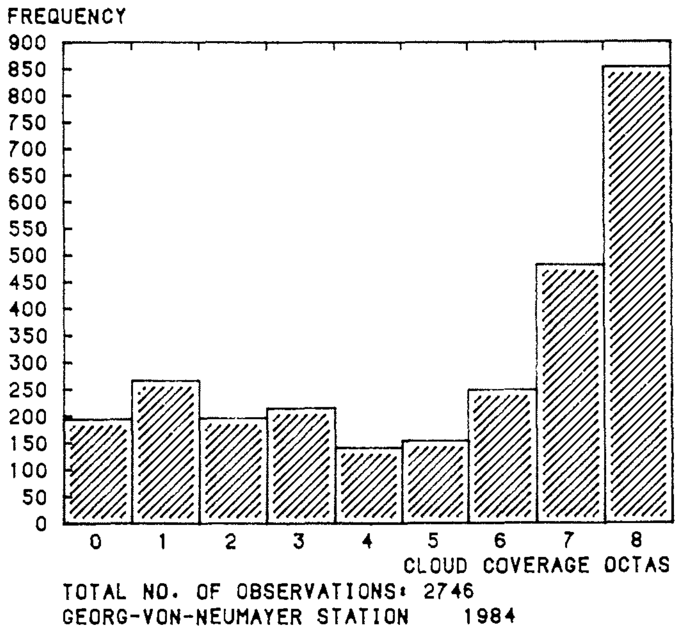
TOTAL NO. OF OBSERVATIONS: 214
GEORG-VON-NEUMAYER STATION NOV 1984

(12k)



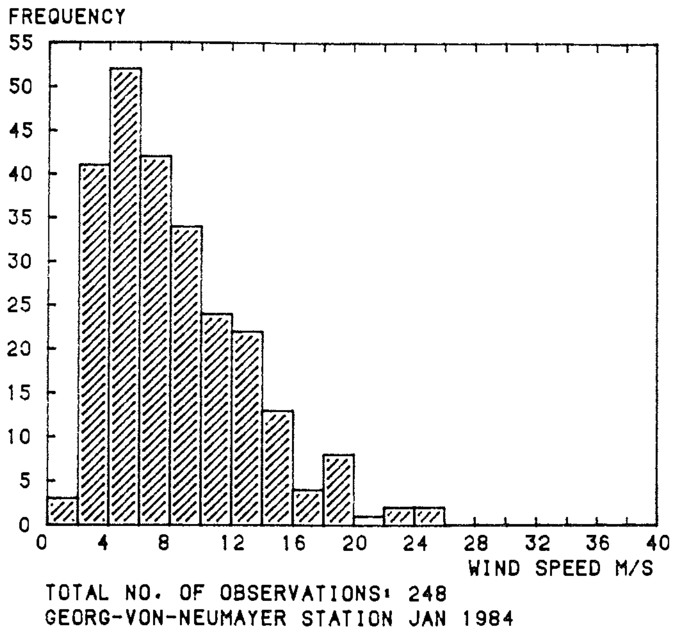
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION DEC 1984

(12l)

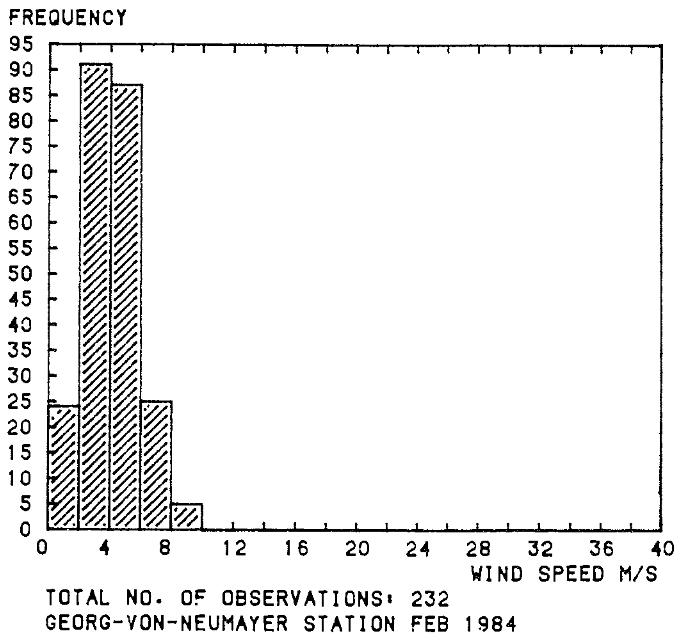

FREQUENCY
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
1
2
3
4
5
6
7
8
CLOUD COVERAGE OCTAS
TOTAL NO. OF OBSERVATIONS: 2746
GEORG-VON-NEUMAYER STATION 1984

(12m)

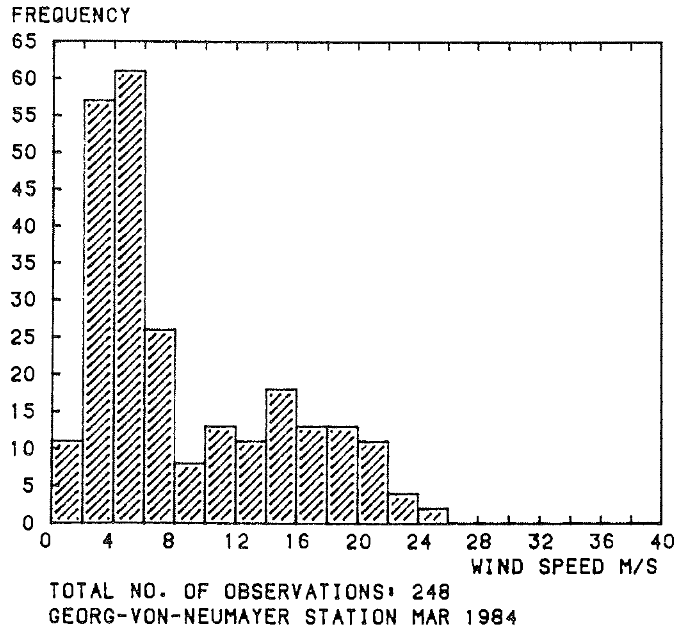
Figure 13: Histograms of wind speed, 1984
(from synoptic observations)
(a) - (l): months January - December 1984
(m): entire year 1984



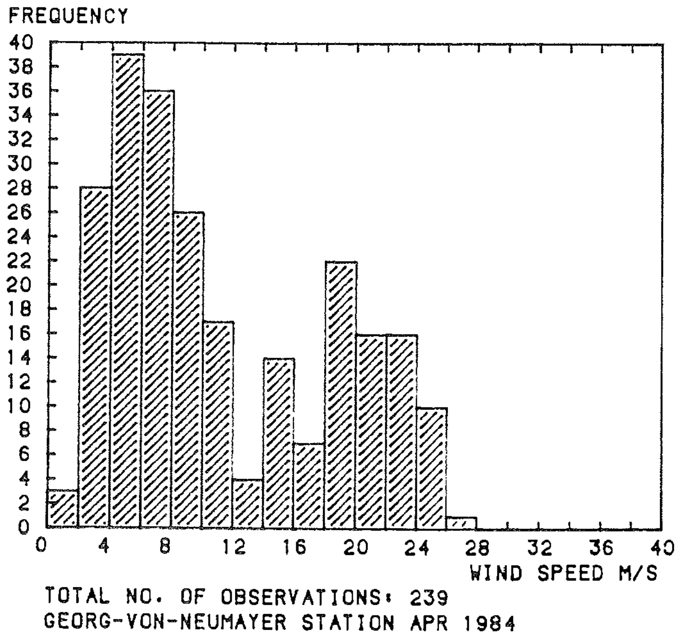
(13a)



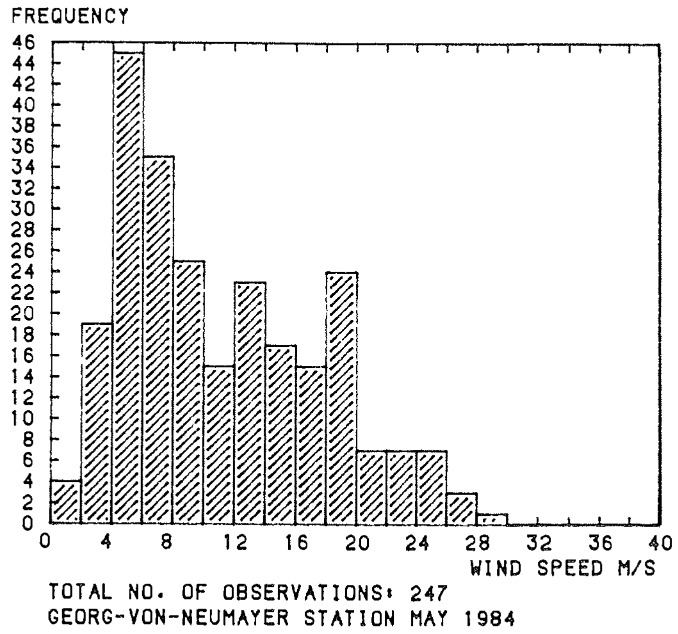
(13b)


FREQUENCY
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION MAR 1984

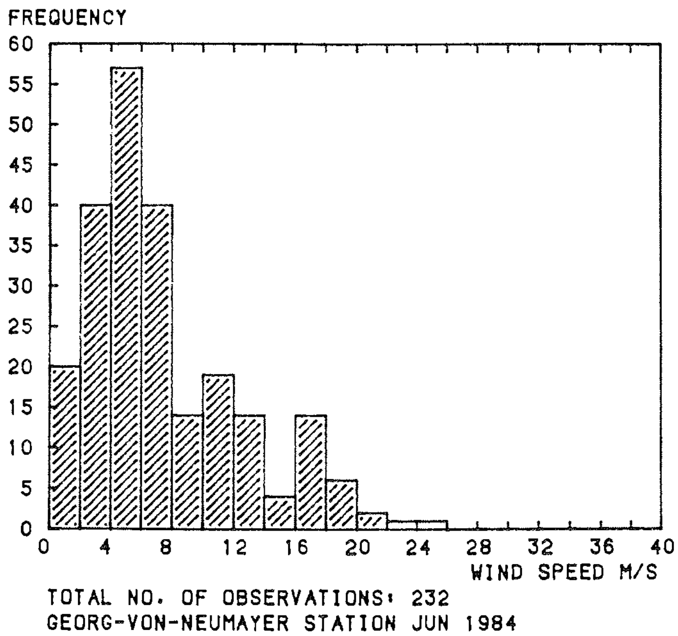
(13c)


FREQUENCY
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 239
GEORG-VON-NEUMAYER STATION APR 1984

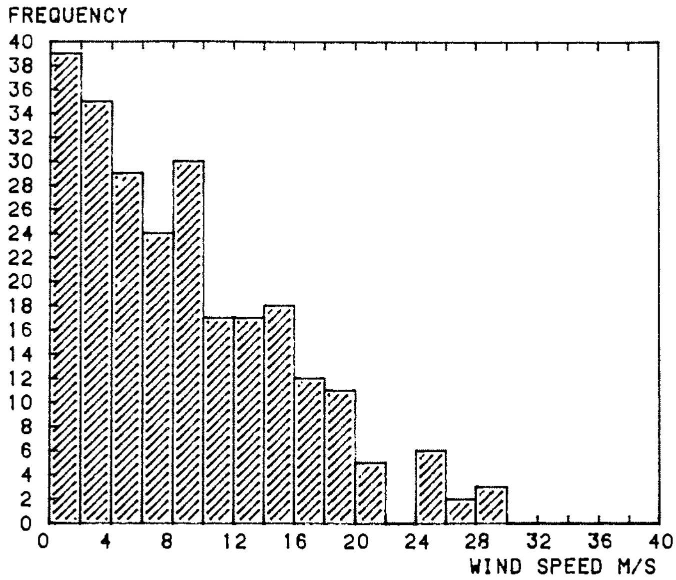
(13d)


FREQUENCY
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
4
8
12
16
20
24
28
32
36
40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION MAY 1984

(13e)

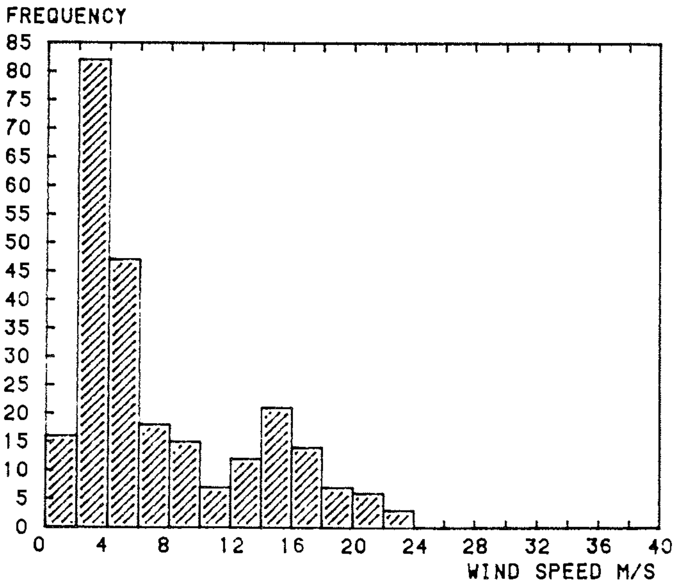

FREQUENCY
60
55
50
45
40
35
30
25
20
15
10
5
0
0
4
8
12
16
20
24
28
32
36
40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 232
GEORG-VON-NEUMAYER STATION JUN 1984

(13f)



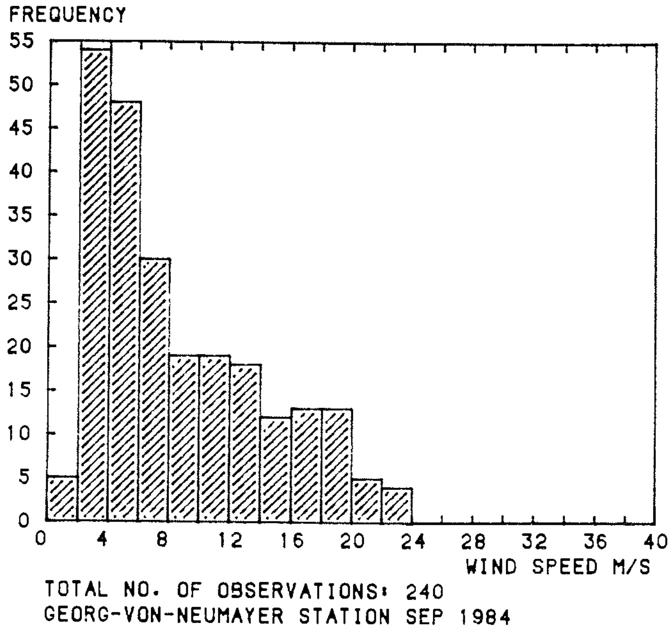
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION JUL 1984

(13g)

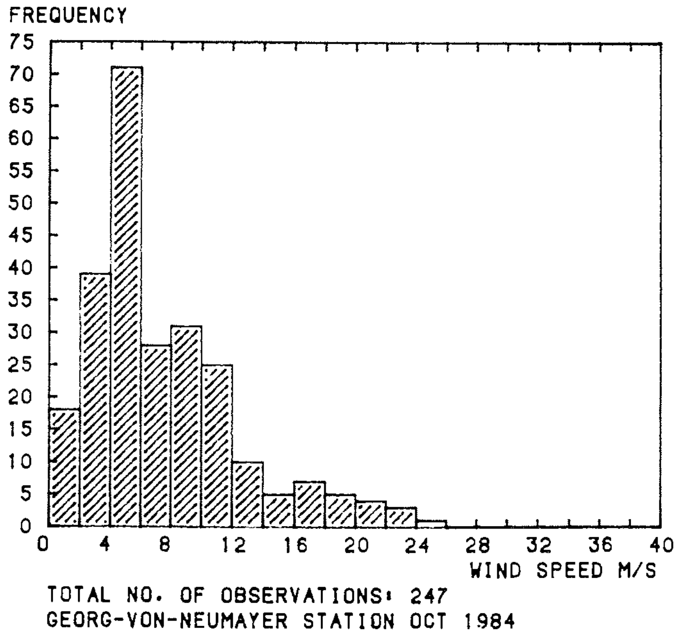


TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION AUG 1984

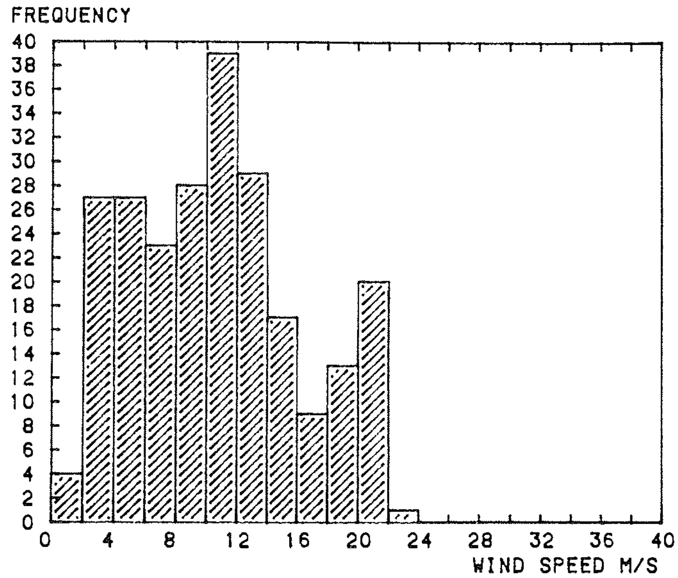
(13h)


FREQUENCY
55
50
45
40
35
30
25
20
15
10
5
0
0
4
8
12
16
20
24
28
32
36
40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION SEP 1984

(13i)

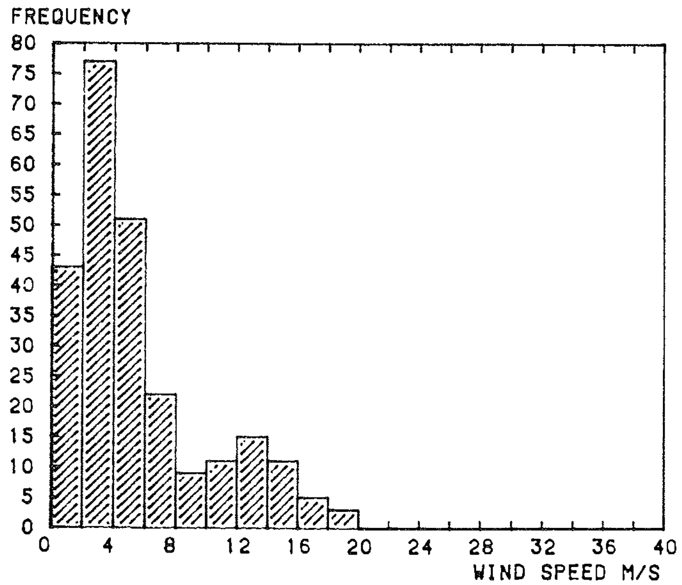

FREQUENCY
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
4
8
12
16
20
24
28
32
36
40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION OCT 1984

(13j)



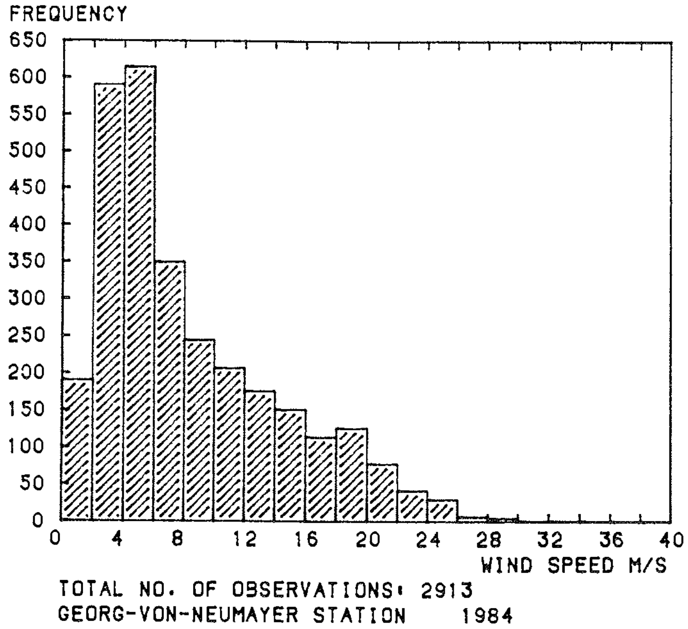
TOTAL NO. OF OBSERVATIONS: 237
GEORG-VON-NEUMAYER STATION NOV 1984

(13k)



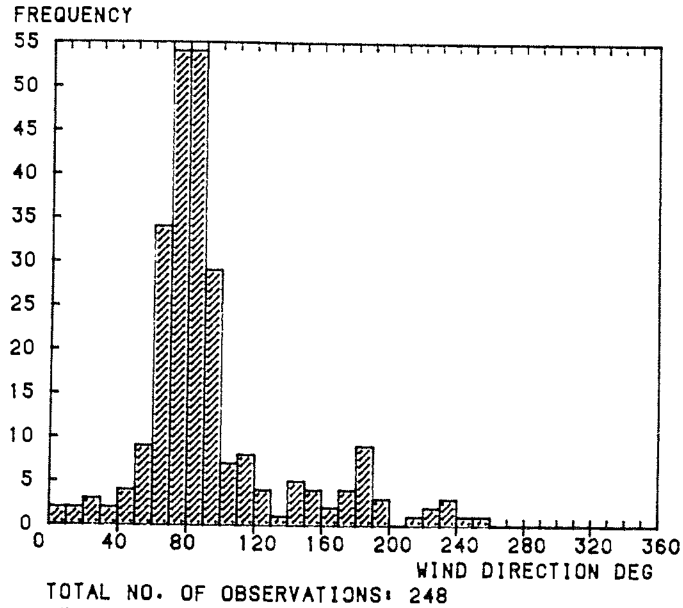
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION DEC 1984

(13l)


FREQUENCY
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0 4 8 12 16 20 24 28 32 36 40
WIND SPEED M/S
TOTAL NO. OF OBSERVATIONS: 2913
GEORG-VON-NEUMAYER STATION 1984

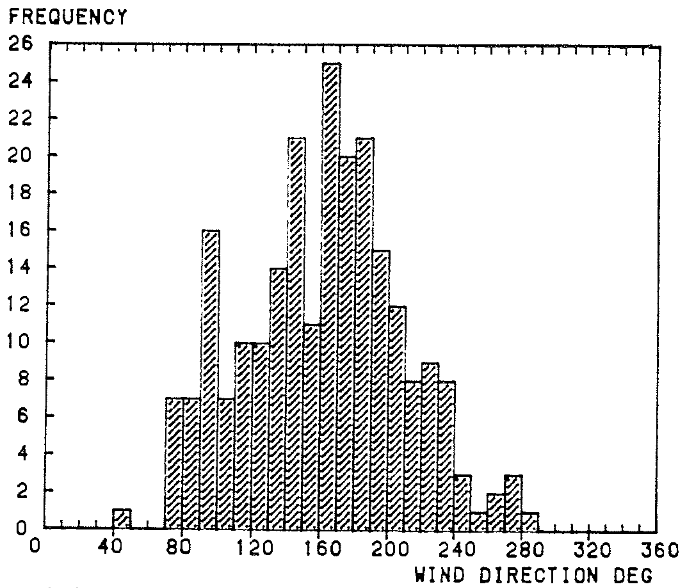
(13m)

Figure 14: Histograms of wind direction, 1984
(from synoptic observations)
(a) - (l): months January - December 1984
(m): entire year 1984



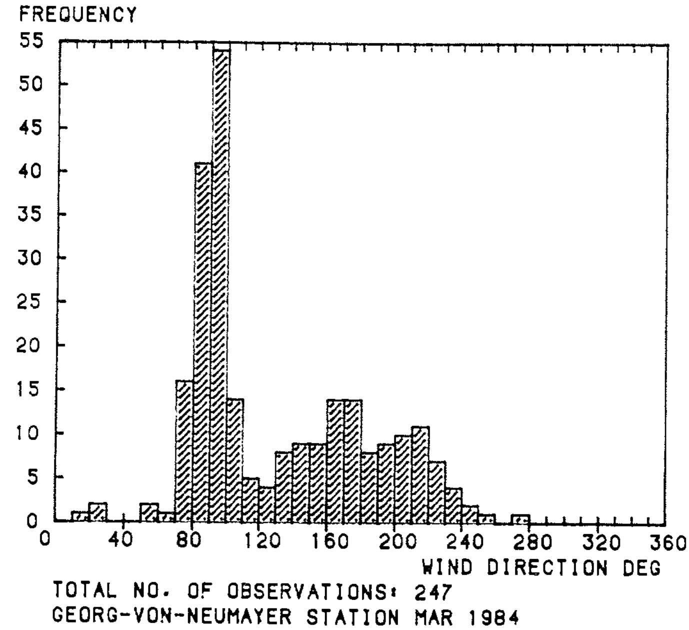
TOTAL NO. OF OBSERVATIONS: 248
GEORG-VON-NEUMAYER STATION JAN 1984

(14a)

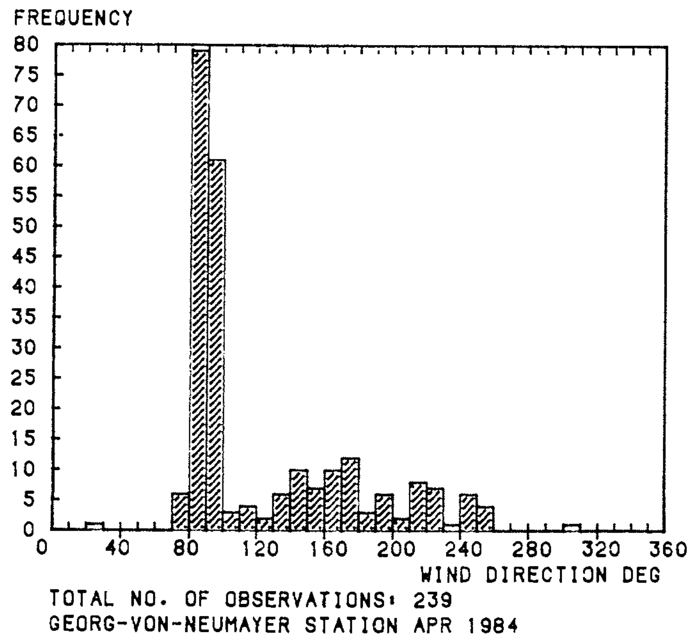


TOTAL NO. OF OBSERVATIONS: 232
GEORG-VON-NEUMAYER STATION FEB 1984

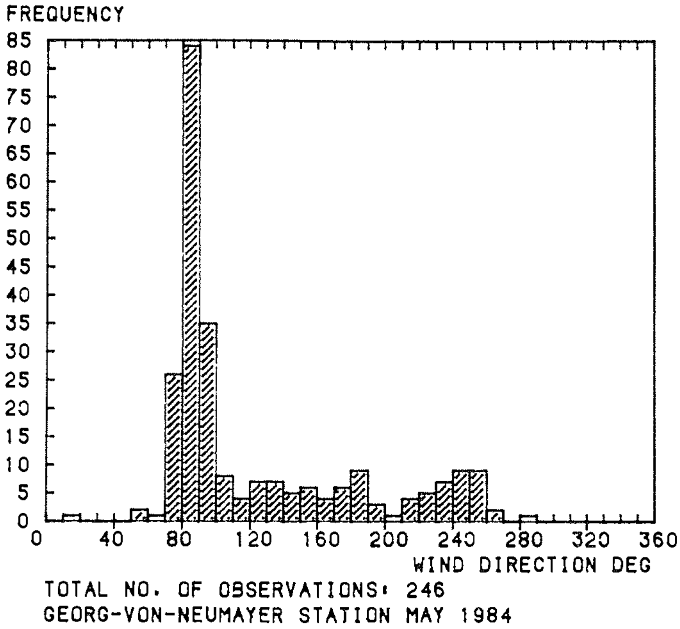
(14b)


FREQUENCY
55
50
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION MAR 1984

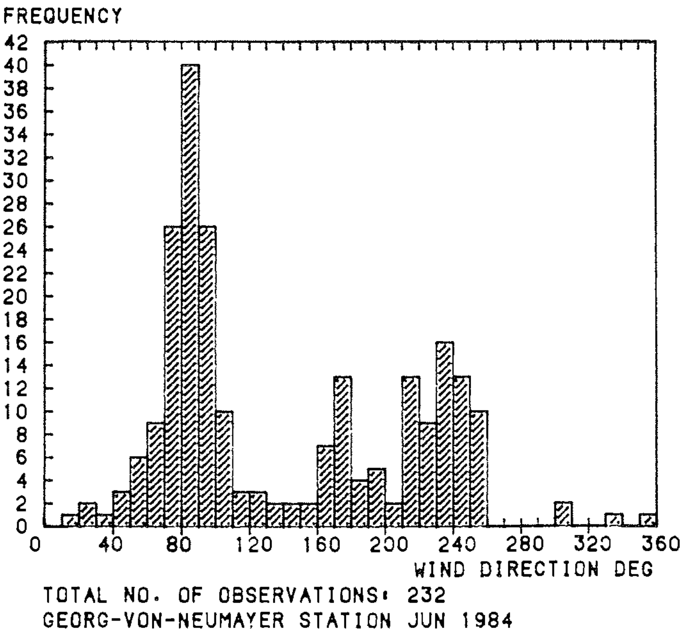
(14c)


FREQUENCY
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 239
GEORG-VON-NEUMAYER STATION APR 1984

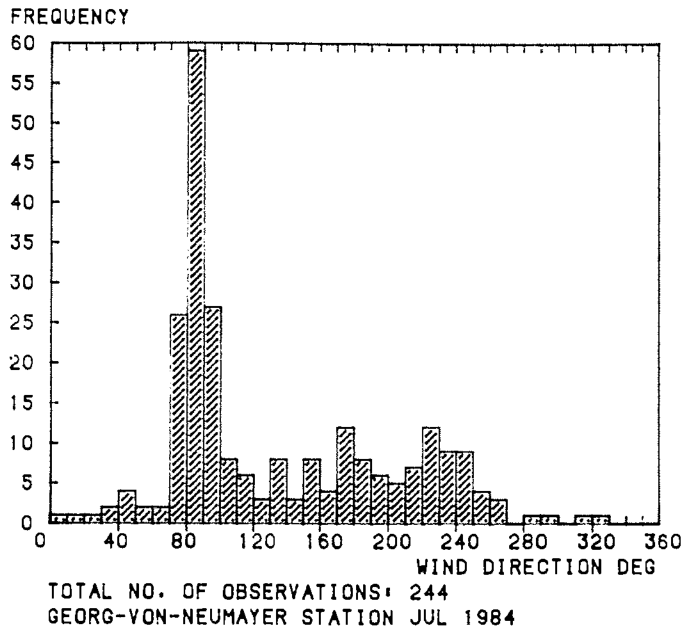
(14d)


FREQUENCY
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 246
GEORG-VON-NEUMAYER STATION MAY 1984

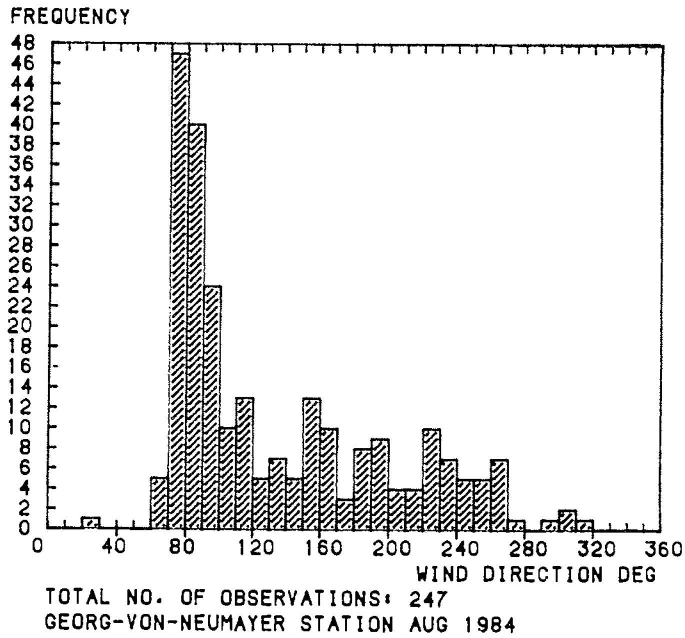
(14e)


FREQUENCY
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 232
GEORG-VON-NEUMAYER STATION JUN 1984

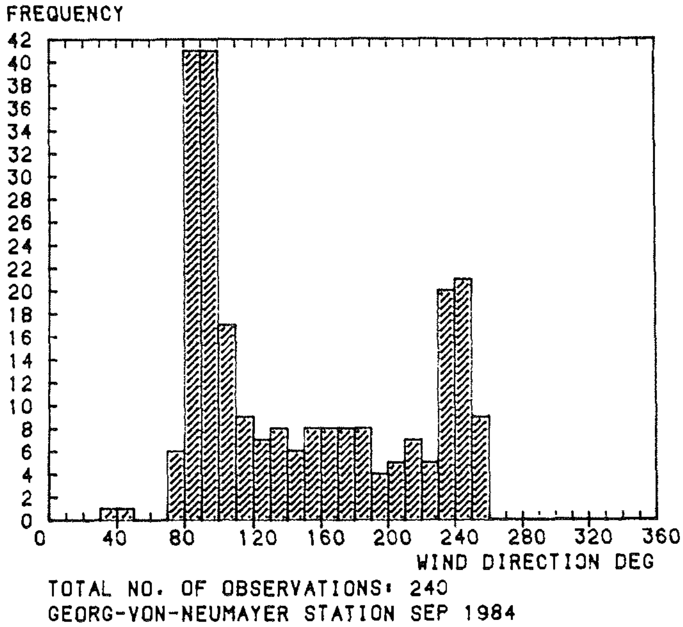
(14f)


FREQUENCY
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 244
GEORG-VON-NEUMAYER STATION JUL 1984

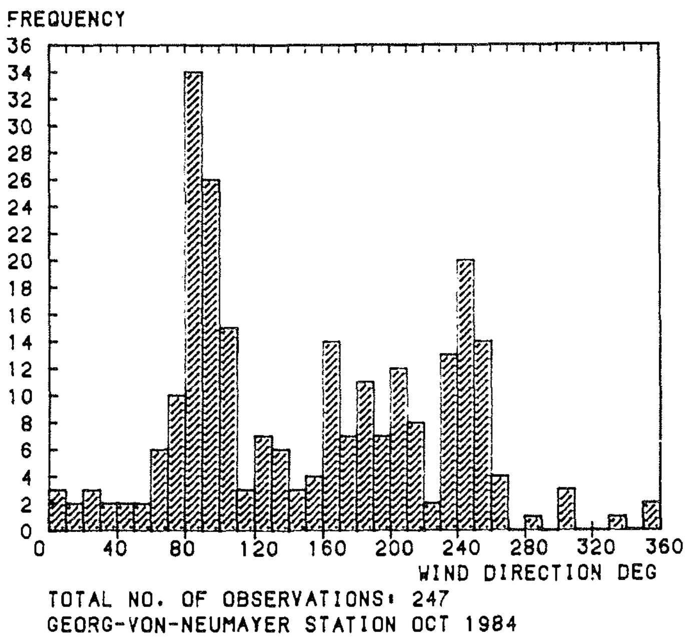
(14g)


FREQUENCY
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION AUG 1984

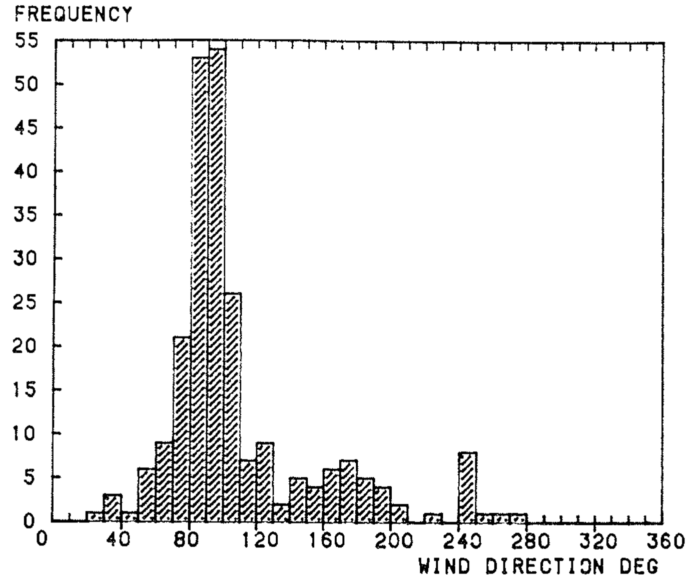
(14h)


FREQUENCY
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 240
GEORG-VON-NEUMAYER STATION SEP 1984

(14i)

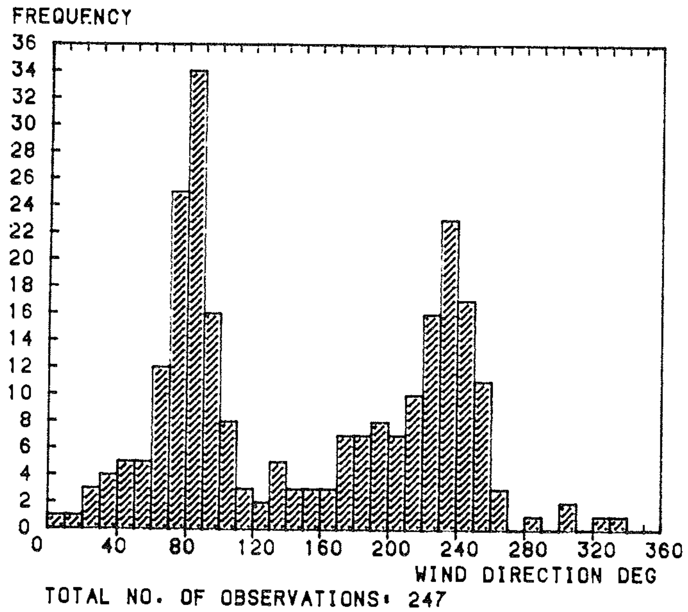

FREQUENCY
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280 320 360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION OCT 1984

(14j)



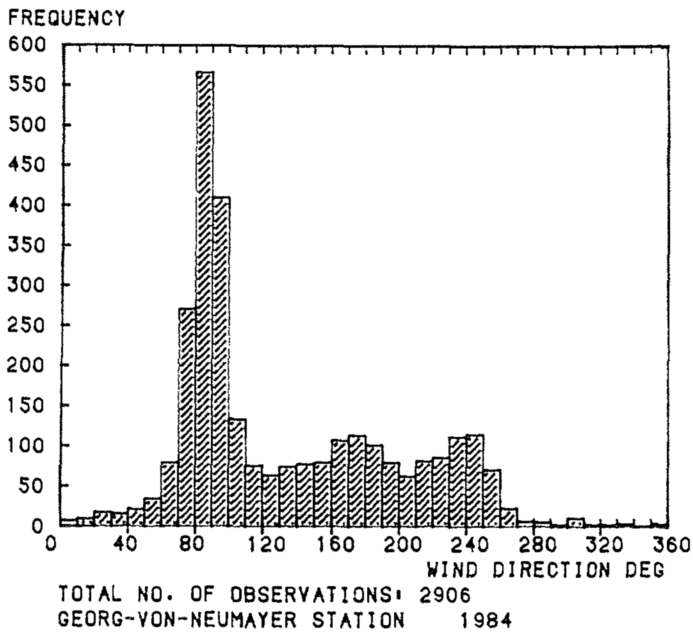
TOTAL NO. OF OBSERVATIONS: 237
GEORG-VON-NEUMAYER STATION NOV 1984

(14k)



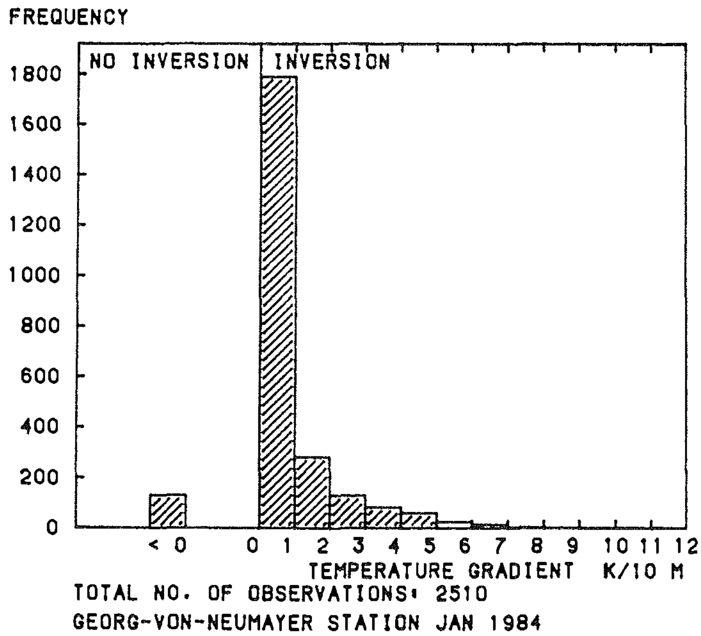
TOTAL NO. OF OBSERVATIONS: 247
GEORG-VON-NEUMAYER STATION DEC 1984

(14l)

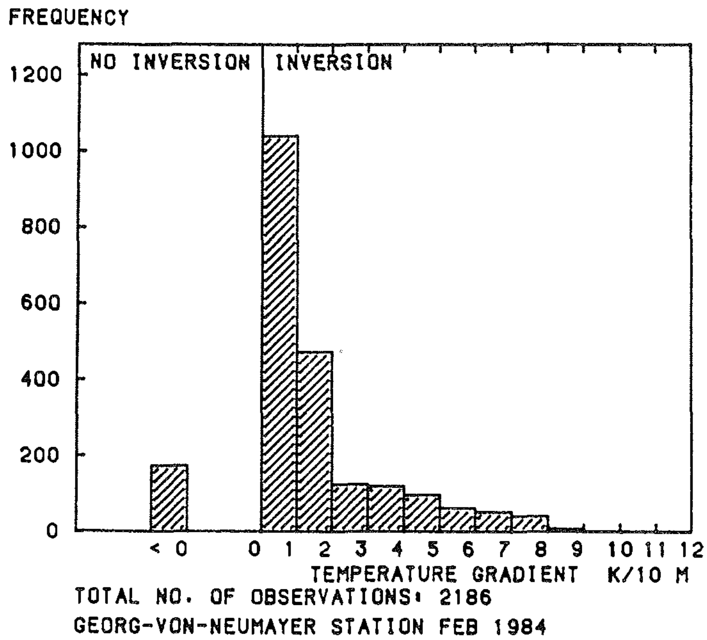

FREQUENCY
600
550
500
450
400
350
300
250
200
150
100
50
0
0
40
80
120
160
200
240
280
320
360
WIND DIRECTION DEG
TOTAL NO. OF OBSERVATIONS: 2906
GEORG-VON-NEUMAYER STATION 1984

(14m)

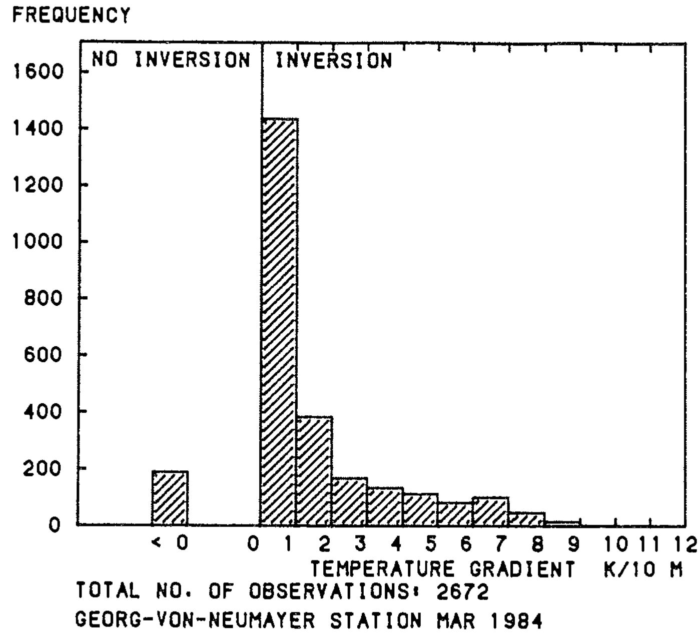
Figure 15: Histograms of vertical temperature gradient, 1984 (from 10 minute mean registration). The gradient was computed from the temperature difference between about 12 m and 0.5 m height. The last figure (n) shows for comparison the histogram of the temperature gradient between 45 m and 0.5 m height.
(a) - (l): months January - December 1984
(m): entire year 1984
(n): entire year 1984



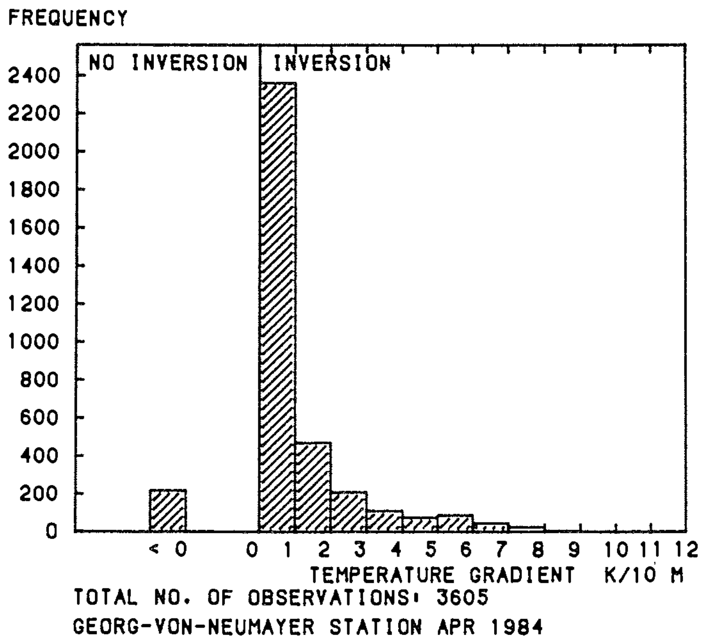
(15a)



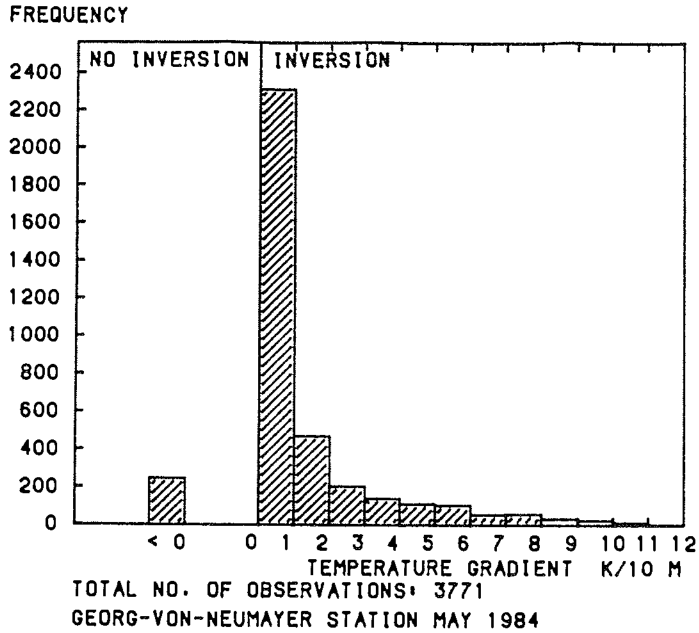
(15b)


FREQUENCY
NO INVERSION
INVERSION
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 2672
GEORG-VON-NEUMAYER STATION MAR 1984

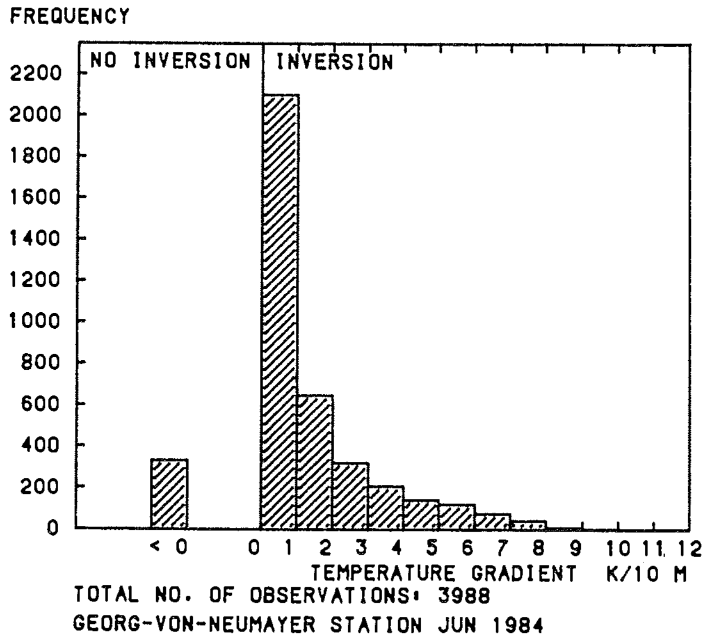
(15c)


FREQUENCY
NO INVERSION
INVERSION
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3605
GEORG-VON-NEUMAYER STATION APR 1984

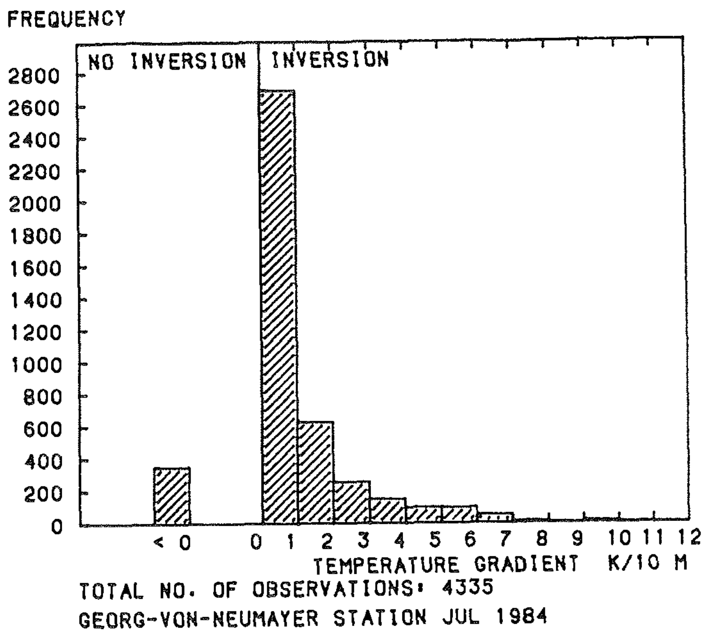
(15d)


FREQUENCY
NO INVERSION
INVERSION
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3771
GEORG-VON-NEUMAYER STATION MAY 1984

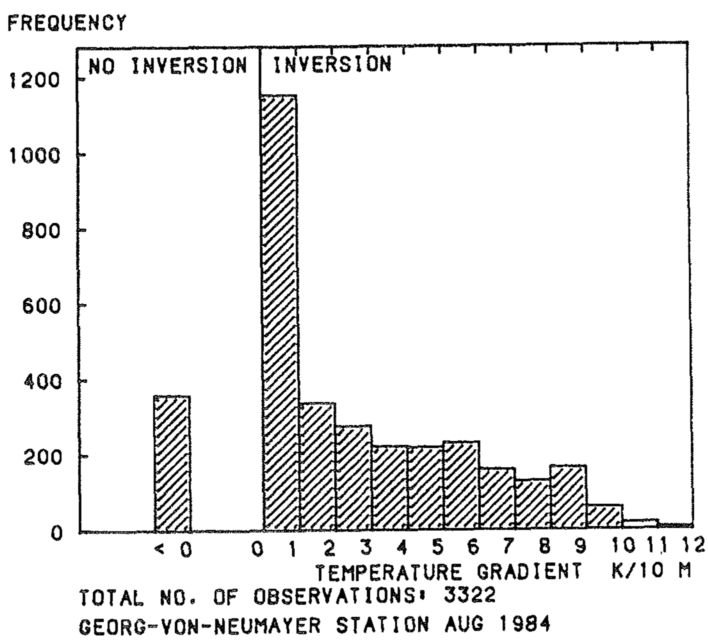
(15e)


FREQUENCY
NO INVERSION
INVERSION
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3988
GEORG-VON-NEUMAYER STATION JUN 1984

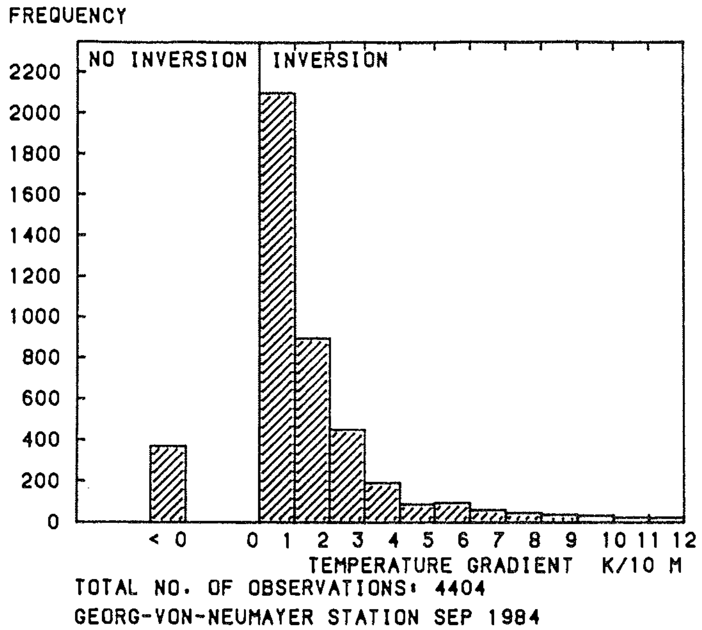
(15f)


FREQUENCY
NO INVERSION
INVERSION
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4335
GEORG-VON-NEUMAYER STATION JUL 1984

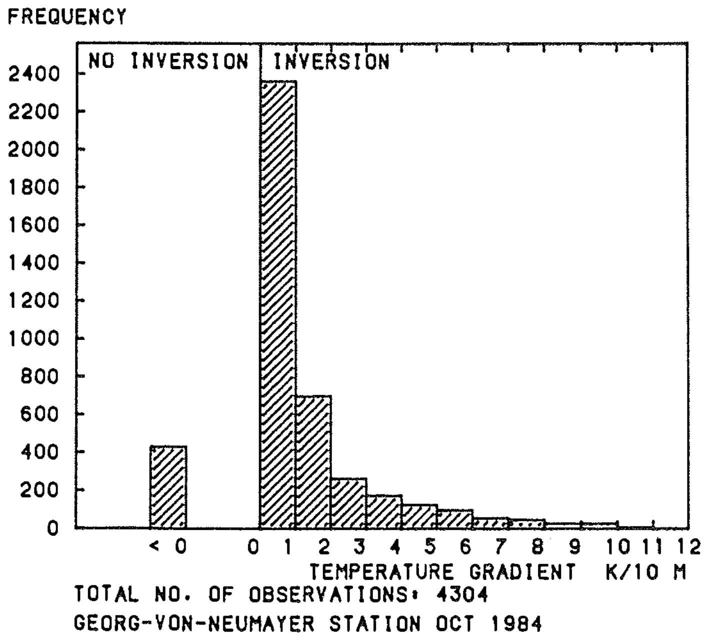
(15g)


FREQUENCY
NO INVERSION
INVERSION
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 3322
GEORG-VON-NEUMAYER STATION AUG 1984

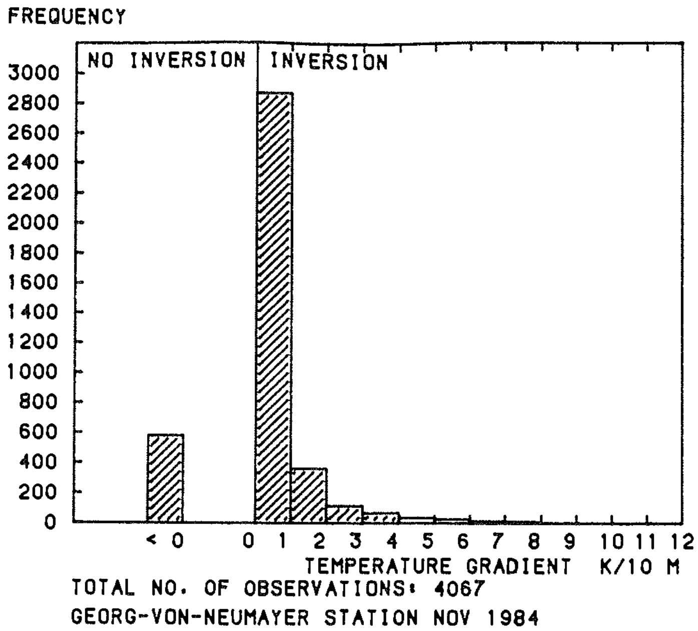
(15h)


FREQUENCY
NO INVERSION
INVERSION
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4404
GEORG-VON-NEUMAYER STATION SEP 1984

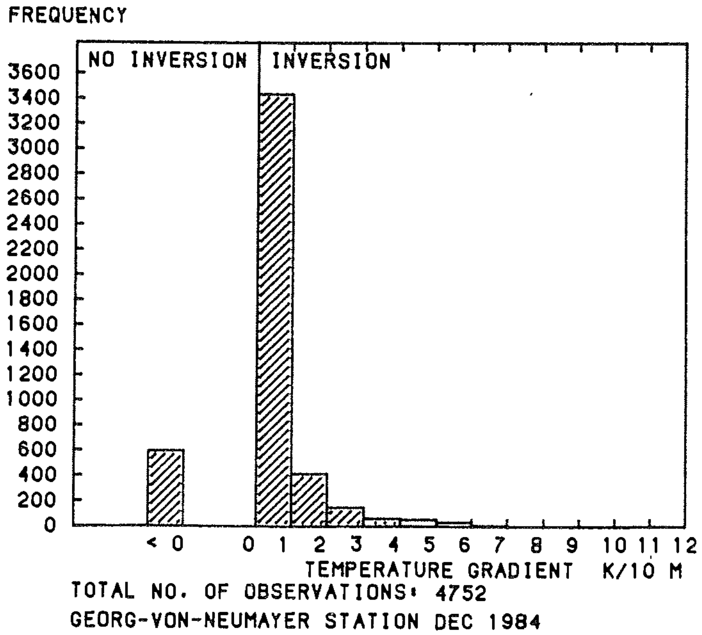
(15i)


FREQUENCY
NO INVERSION
INVERSION
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4304
GEORG-VON-NEUMAYER STATION OCT 1984

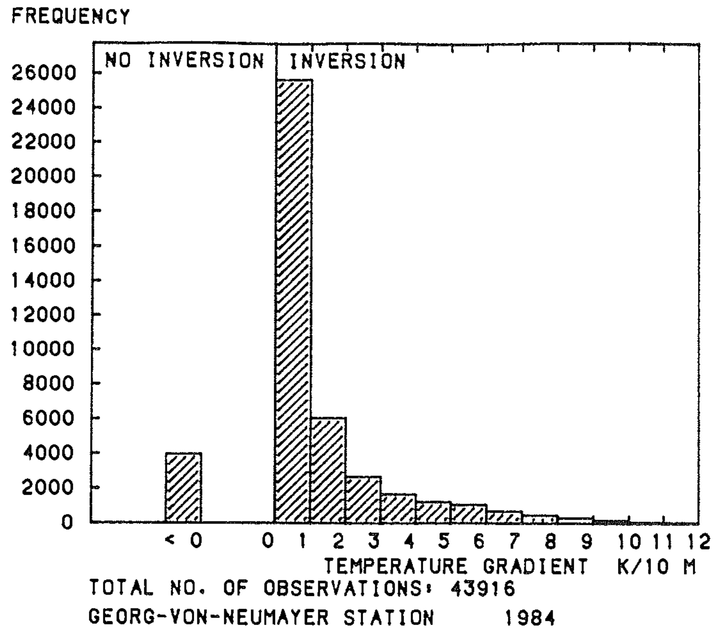
(15j)


FREQUENCY
NO INVERSION
INVERSION
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4067
GEORG-VON-NEUMAYER STATION NOV 1984

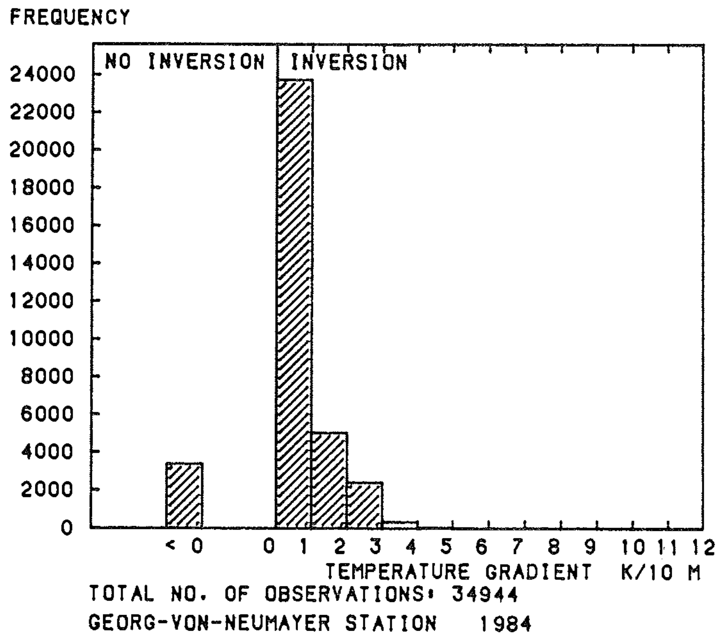
(15k)


FREQUENCY
NO INVERSION
INVERSION
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 4752
GEORG-VON-NEUMAYER STATION DEC 1984

(15l)


FREQUENCY
NO INVERSION
INVERSION
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 43916
GEORG-VON-NEUMAYER STATION 1984

(15m)


FREQUENCY
NO INVERSION
INVERSION
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
< 0
0 1 2 3 4 5 6 7 8 9 10 11 12
TEMPERATURE GRADIENT K/10 M
TOTAL NO. OF OBSERVATIONS: 34944
GEORG-VON-NEUMAYER STATION 1984

(15n)

Figure 16: Monthly means of daily global radiation cycle.
Numbers on curves indicate respective months, 1984
(from 10 minute mean global radiation registration)

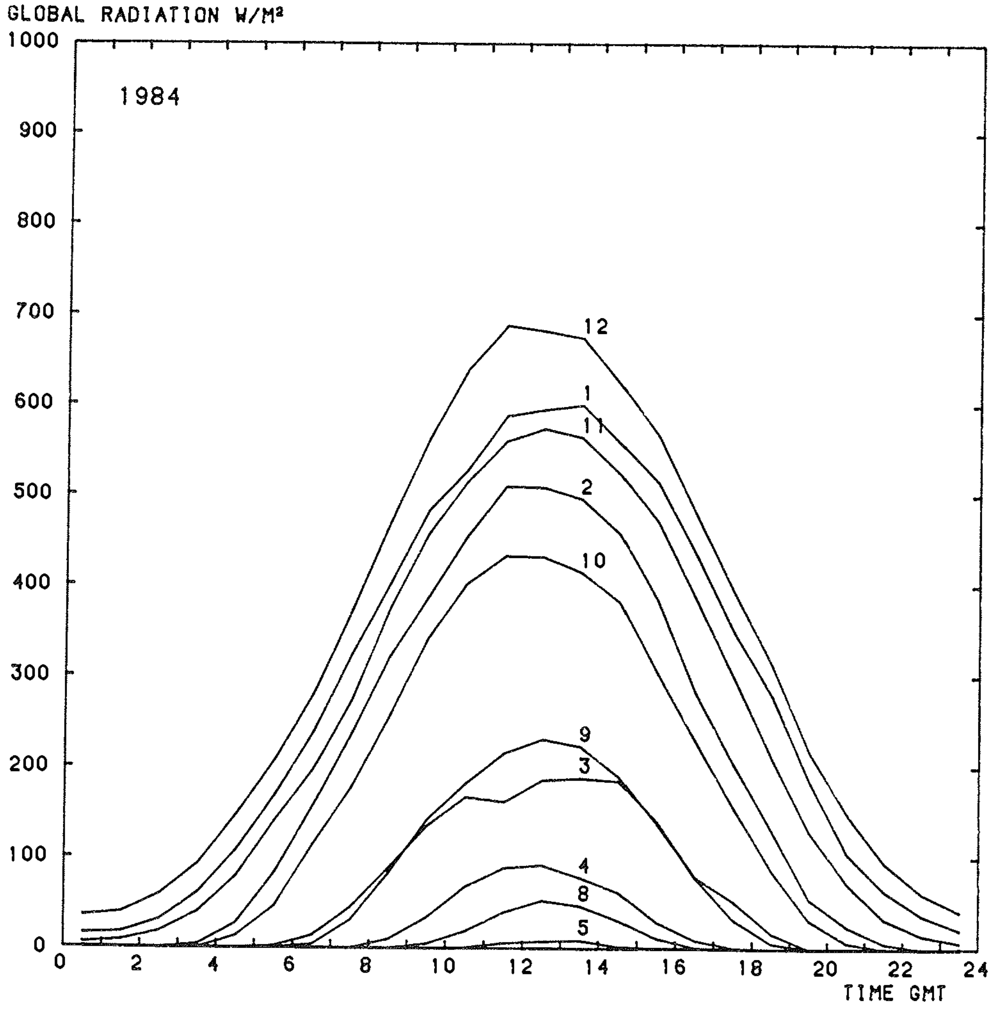
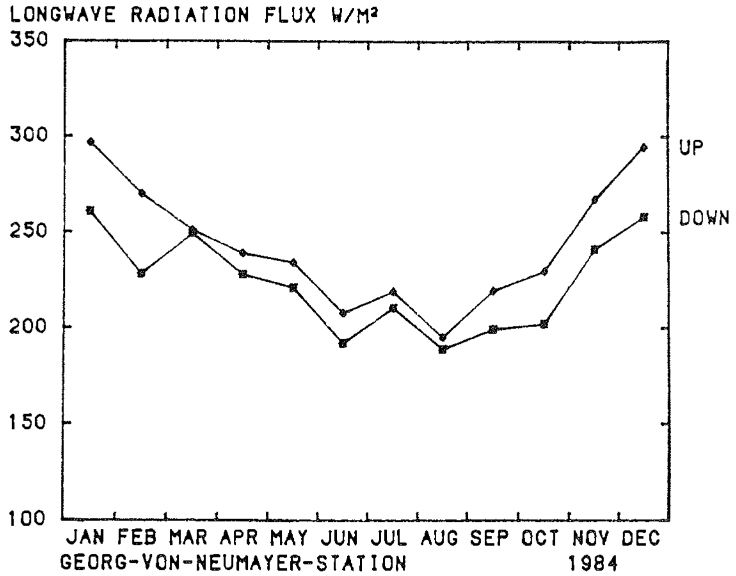
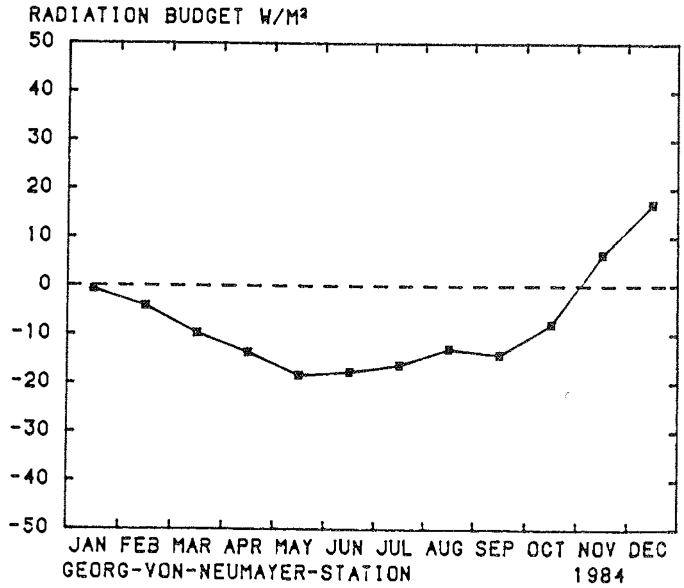


Figure 17: Time series of monthly mean longwave radiation flux (a) and the surface radiation budget (b), 1984 (from 10 minute mean radiation registration)

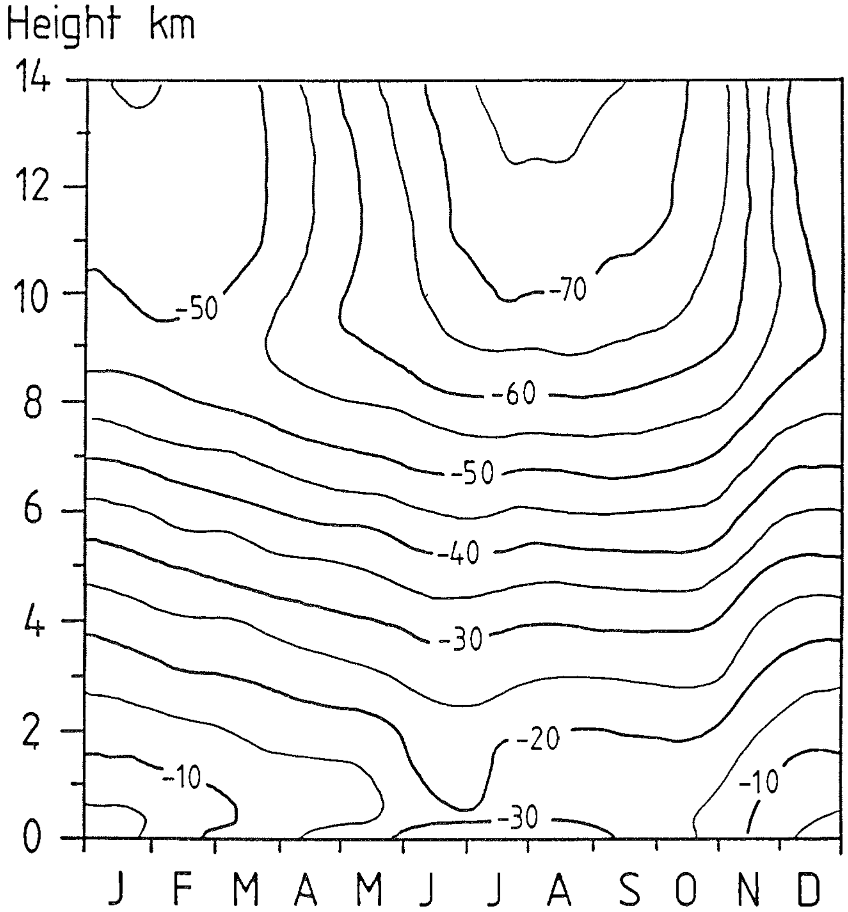


(17a)

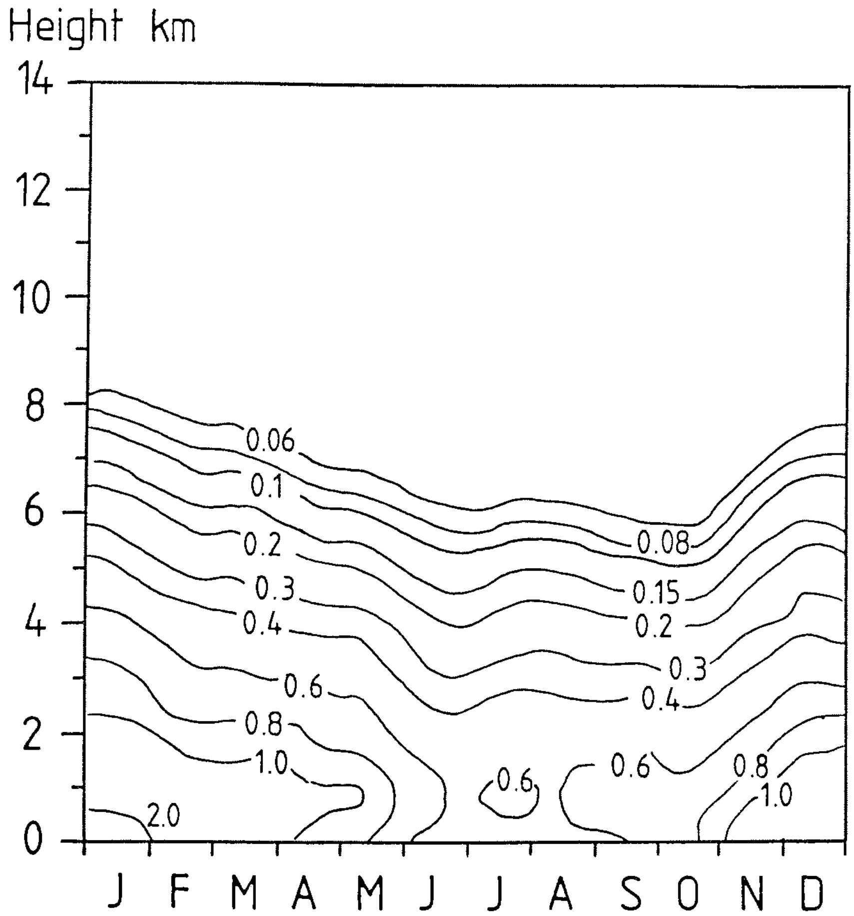


(17b)

Figure 18: Time - height sections of temperature (a), specific humidity (b), and wind components u (c) and v (d), 1984; units are deg C, g/kg, and m/s, resp. (from daily radiosonde soundings)

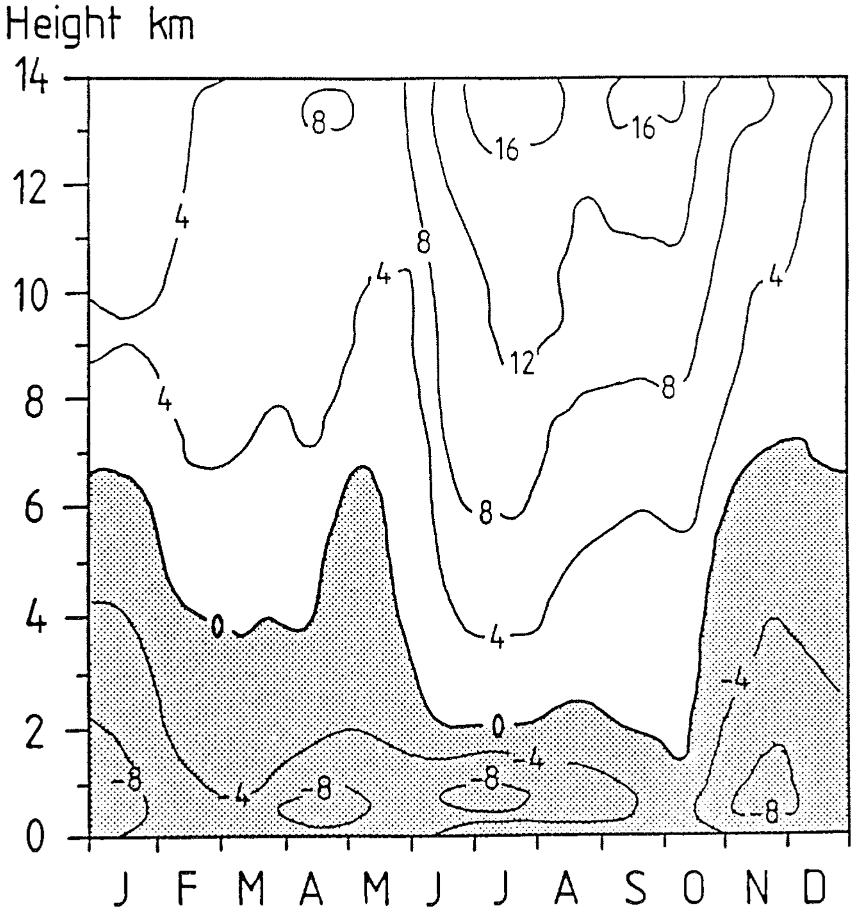


(18a)



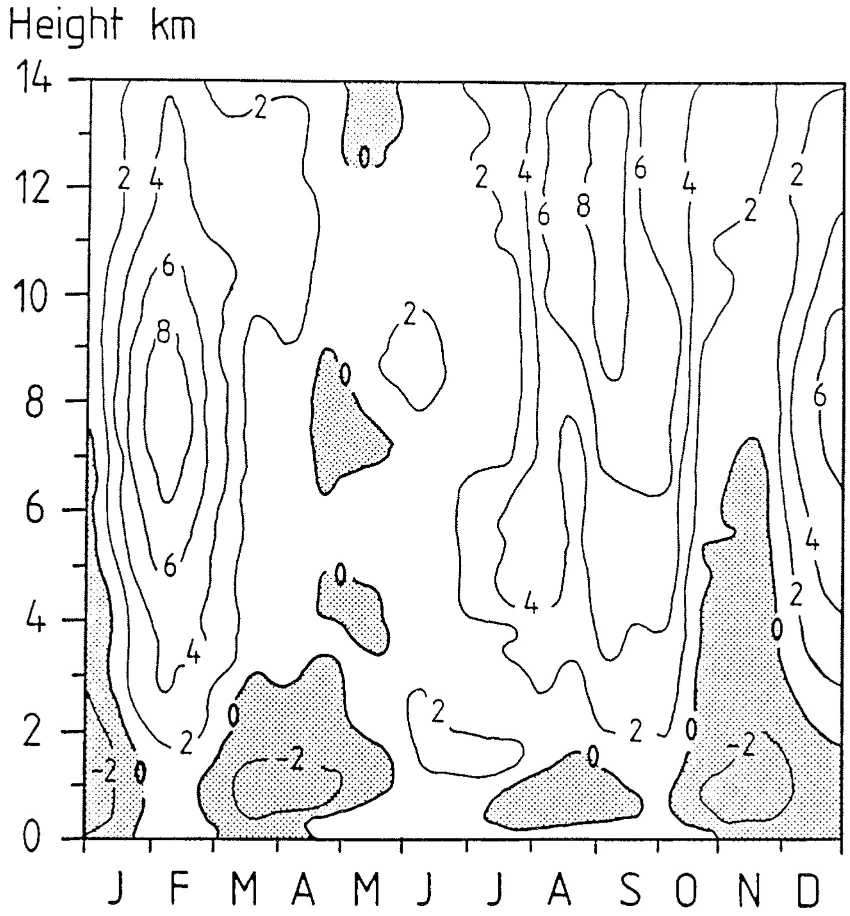
Height km
14
12
10
8
6
4
2
0
0.06
0.1
0.2
0.3
0.4
0.6
0.8
1.0
2.0
0.6
0.6
0.08
0.15
0.2
0.3
0.4
0.8
1.0
J F M A M J J A S O N D

(18b)



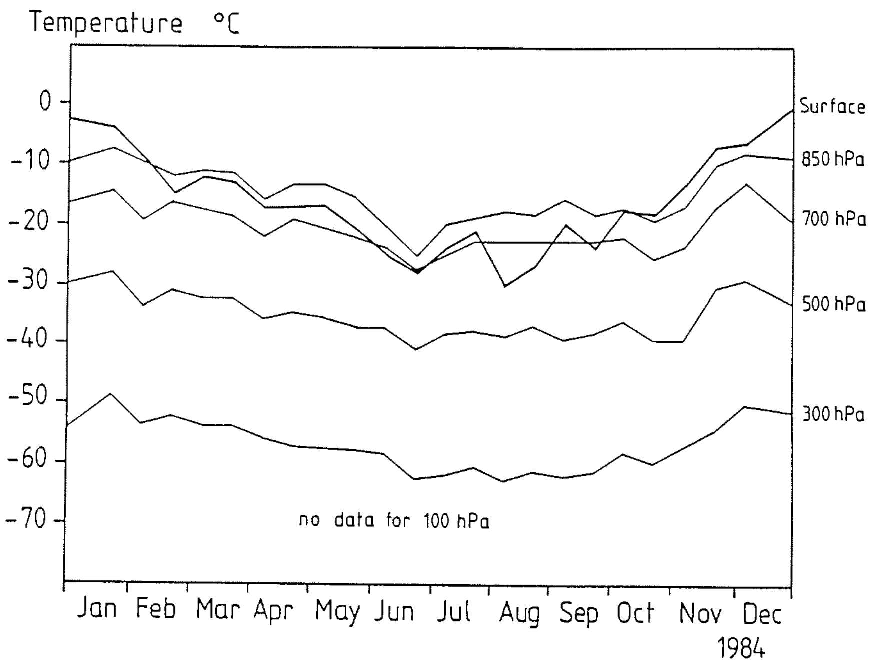
Height km
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
8
16
16
4
8
4
12
8
4
8
0
4
0
-4
-4
-8
-4
-8
-8
-4
-8

(18c)

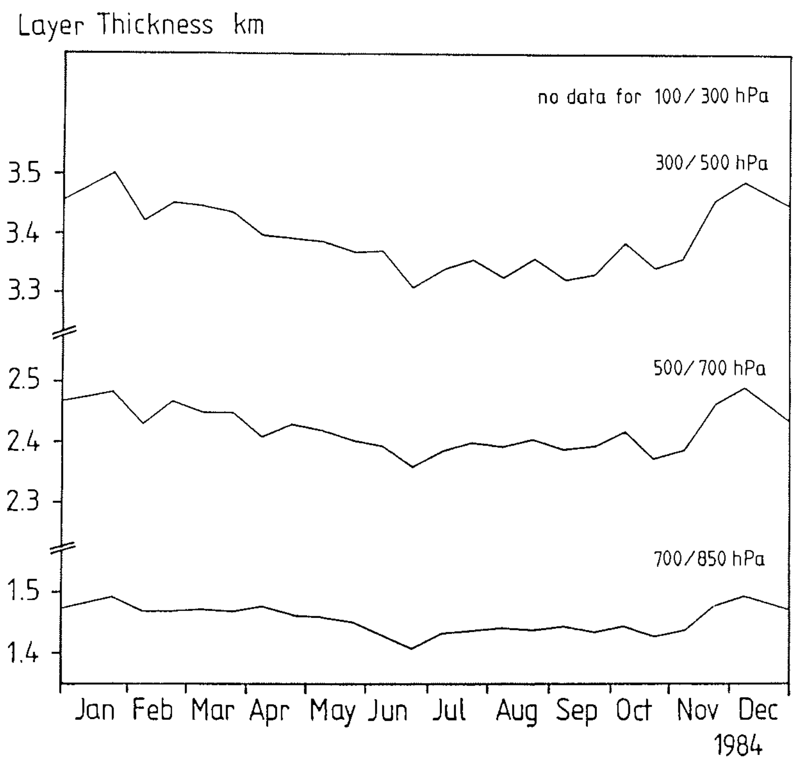


(18d)

Figure 19: Time series of temperature at different pressure levels (a) and layer thickness of different relative topographies (b), 1984 (from daily radiosonde soundings, plotted are half-monthly mean values)



(19a)



Layer Thickness km
no data for 100/300 hPa
300/500 hPa
500/700 hPa
700/850 hPa
3.5
3.4
3.3
2.5
2.4
2.3
1.5
1.4
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1984

(19b)

Figure 19c: Tropopause height for all radiosonde soundings taken during 1984
Line interruptions: Tropopause could not be identified from the temperature profile

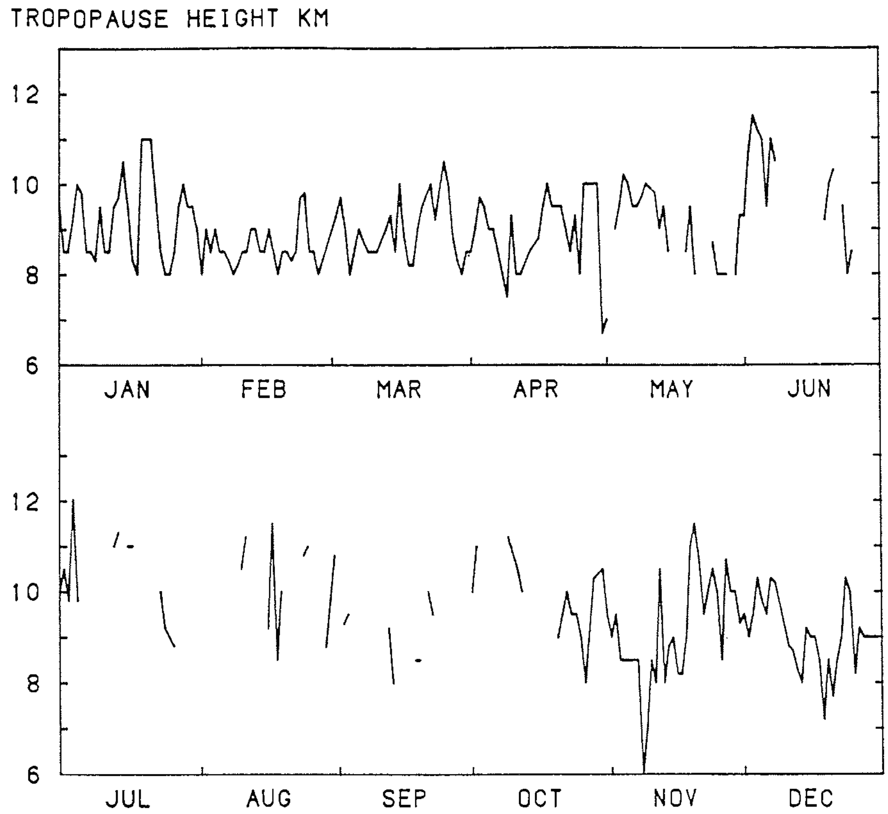
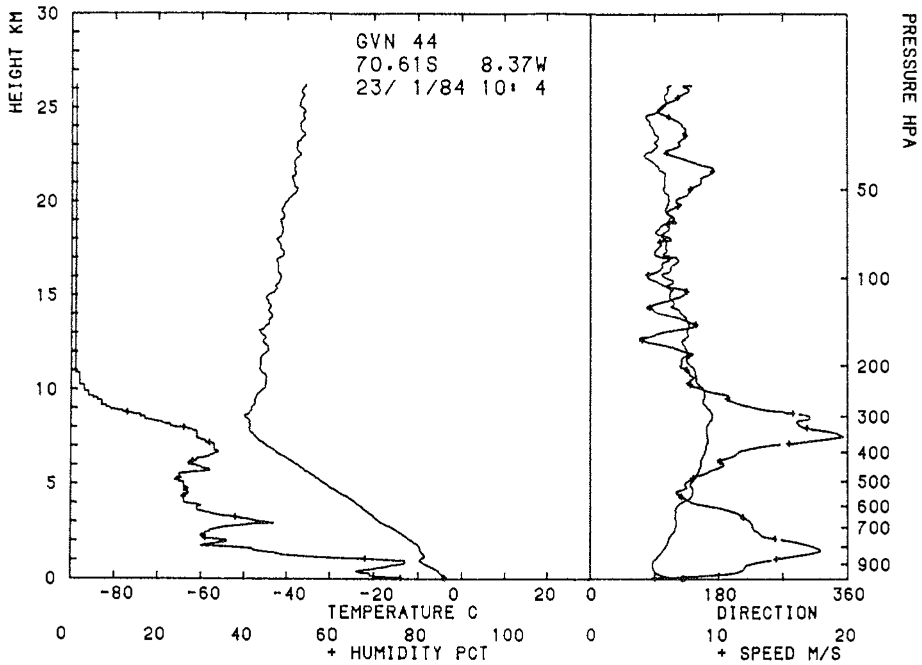
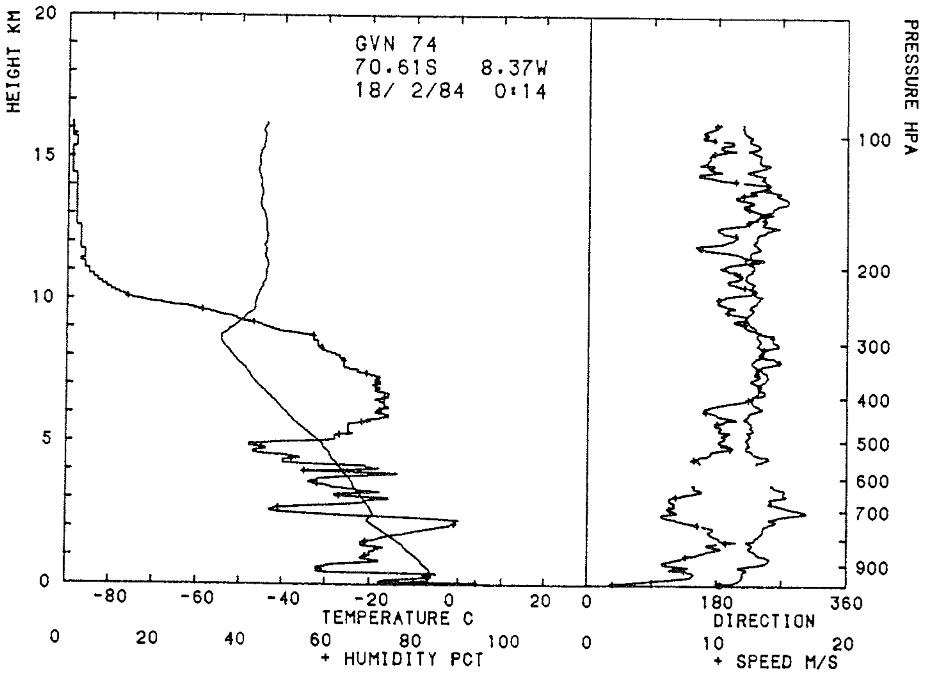


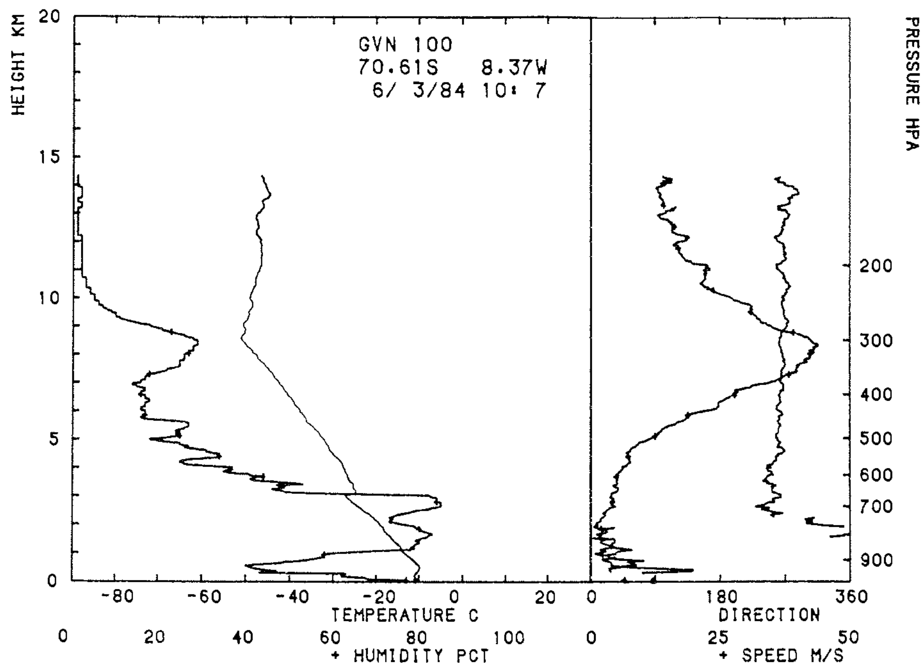
Figure 20 : Selected radiosonde soundings for each month (1984)



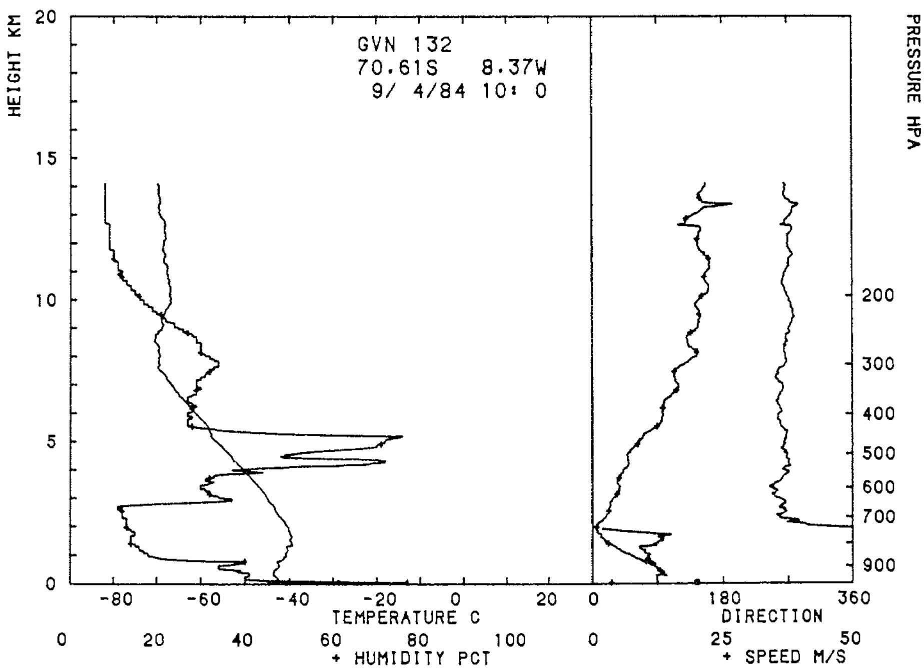
(20a)



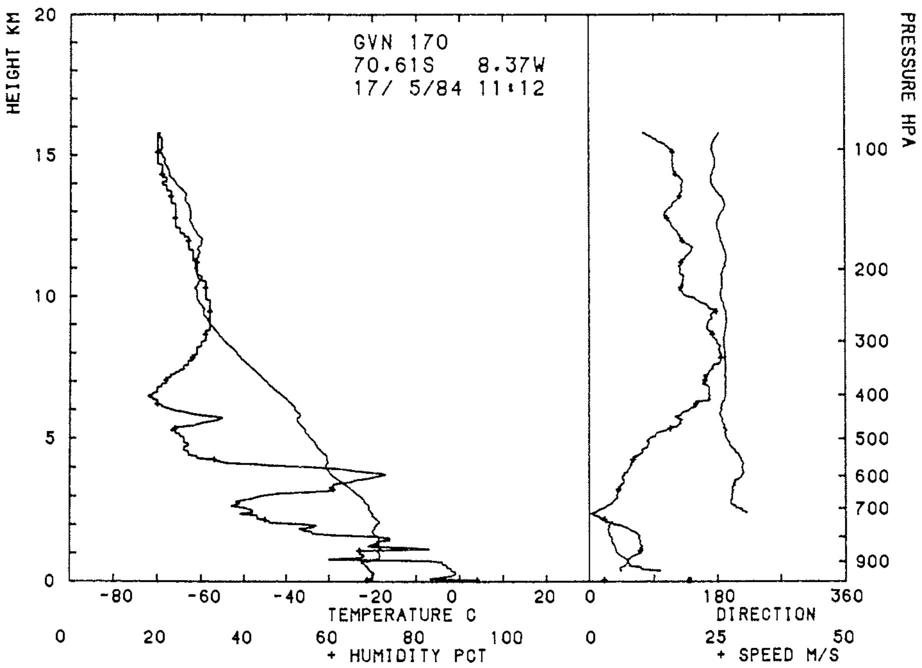
(20b)


GVN 100
70.61S 8.37W
6/ 3/84 10: 7
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

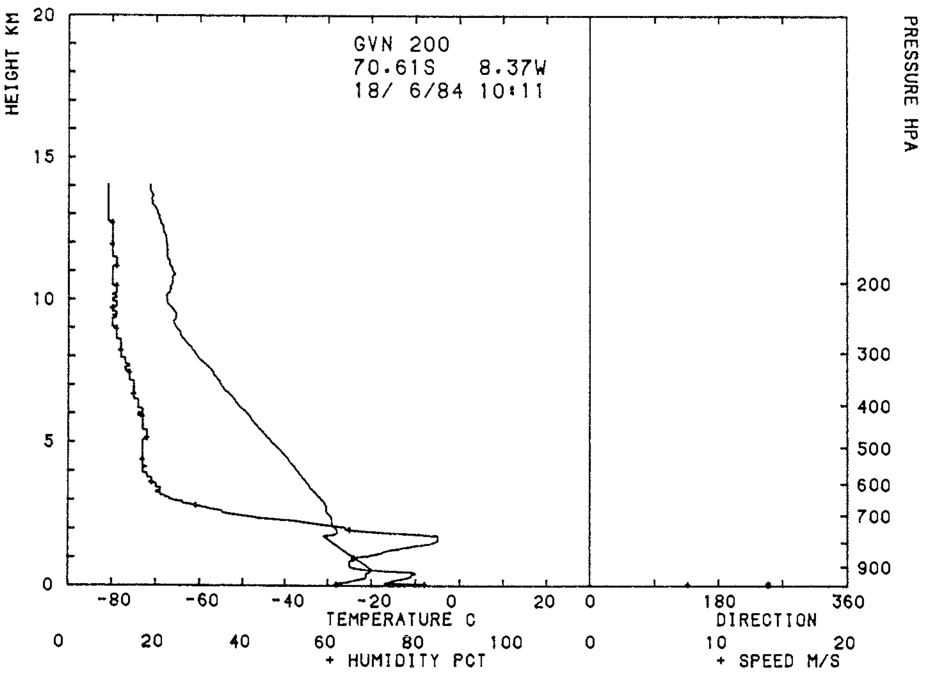
(20c)


GVN 132
70.61S 8.37W
9/ 4/84 10: 0
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

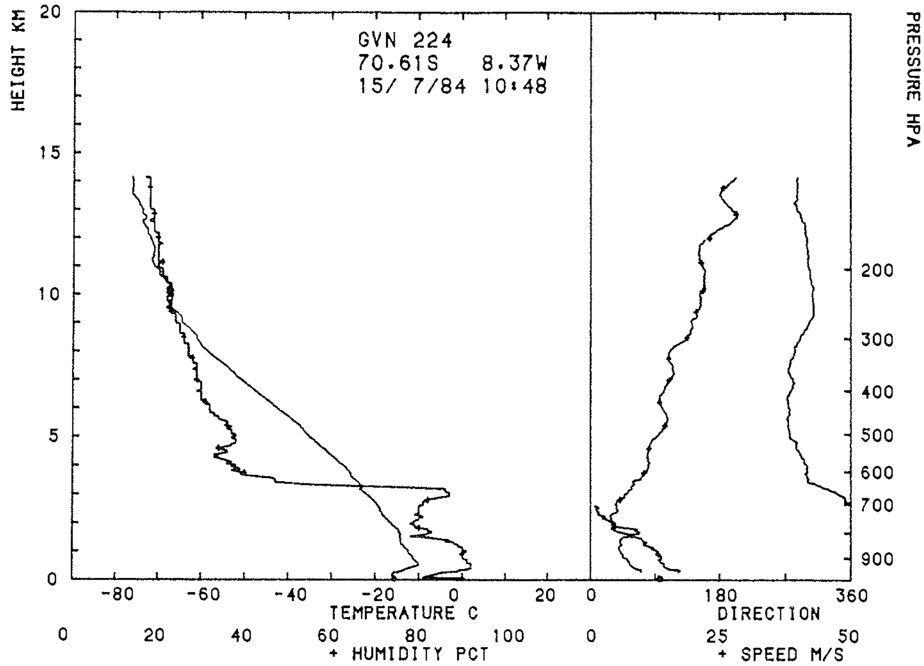
(20d)


GVN 170
70.61S 8.37W
17/ 5/84 11:12
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

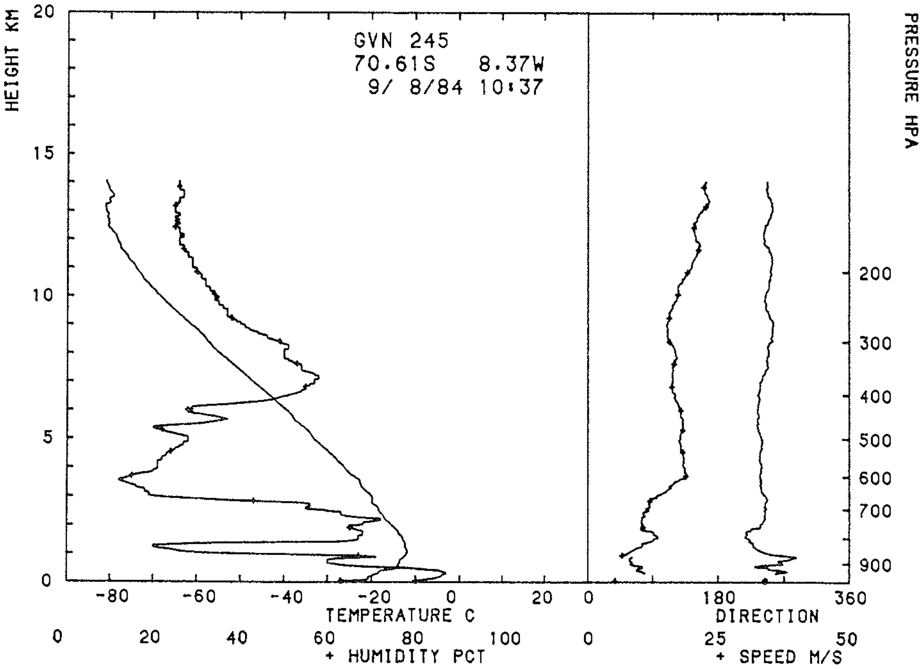
(20e)


GVN 200
70.61S 8.37W
18/ 6/84 10:11
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

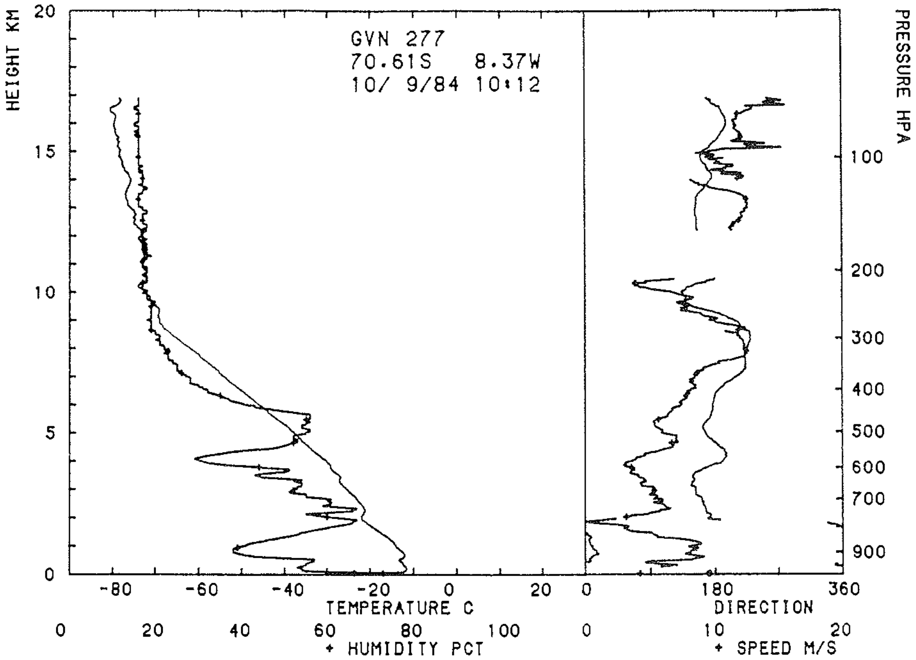
(20f)


GVN 224
70.61S 8.37W
15/ 7/84 10:48
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(20g)

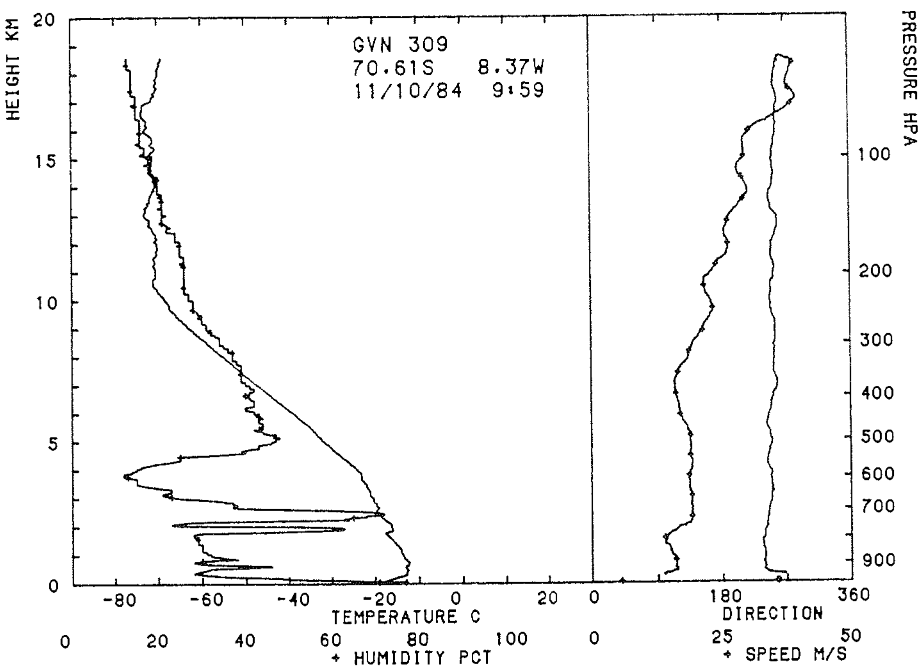

GVN 245
70.61S 8.37W
9/ 8/84 10:37
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(20h)



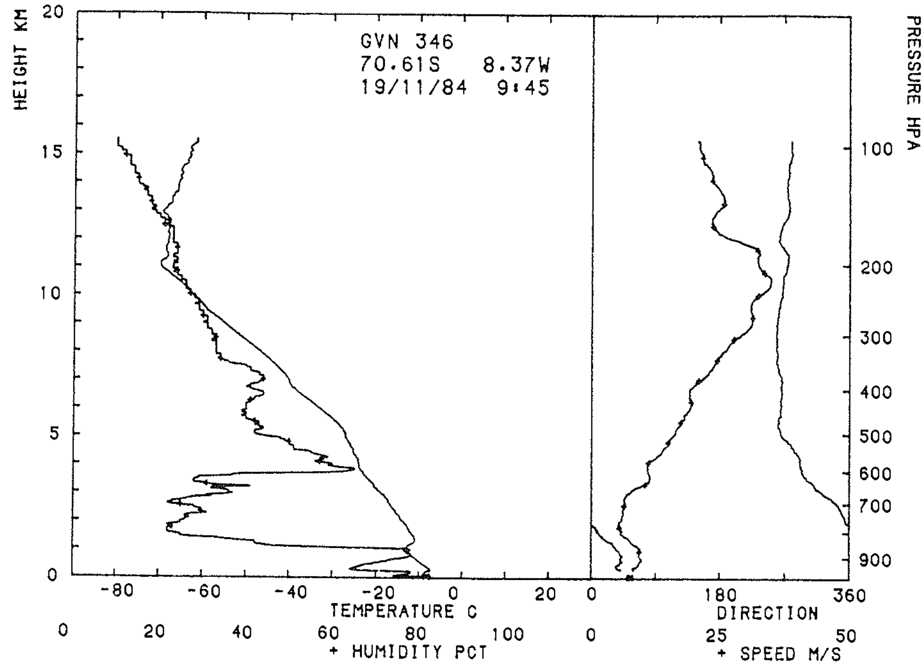
HEIGHT KM
GVN 277
70.61S 8.37W
10/ 9/84 10:12
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S
PRESSURE HPA

(20i)

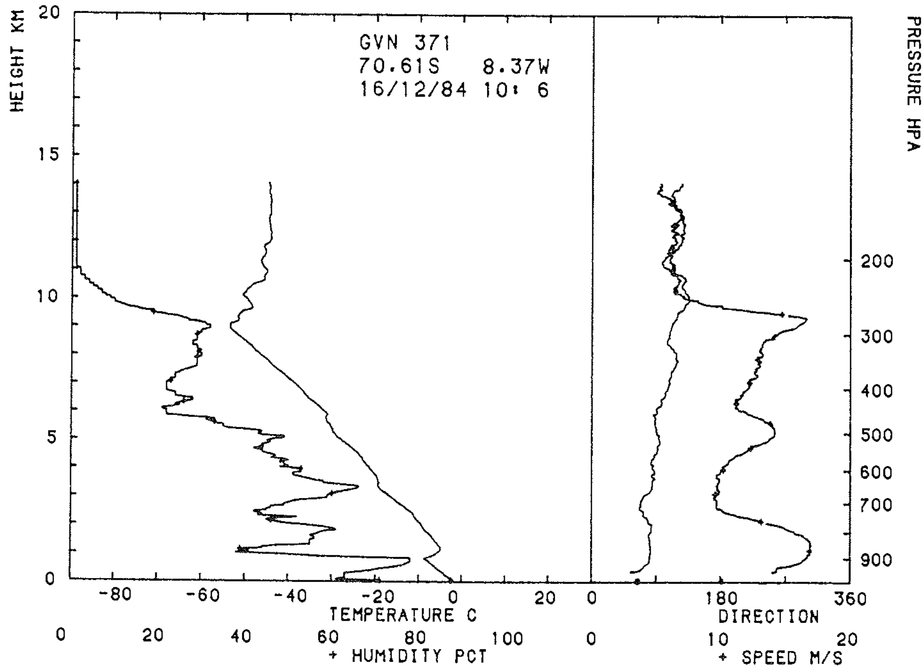


HEIGHT KM
GVN 309
70.61S 8.37W
11/10/84 9:59
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S
PRESSURE HPA

(20j)


GVN 346
70.61S 8.37W
19/11/84 9:45
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(20k)


GVN 371
70.61S 8.37W
16/12/84 10: 6
HEIGHT KM
PRESSURE HPA
TEMPERATURE C
+ HUMIDITY PCT
DIRECTION
+ SPEED M/S

(201)