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An Automatic Climatological Station for Glacier Studies,
Axel Heiberg Island, N.W.T.
(Abstract)

In 1965 the first automatic climatological stations were established on and near a high arctic glacier, to aid long-term investigation of the glacio-climatological environment. The land station (79°25' N, 90°45' W) records temperature and windspeed, while stations on White Glacier (79°29' N, 90°49' W) at 880 masl record temperature, pressure, windspeed/direction, humidity, and sunshine.

The operation and installation of the equipment are briefly described. A feasibility study of the performance of the stations includes comparisons with man observations, particularly under different weather conditions (foehn, storm) and details of unattended operation.

Data recorded over 13 months are examined statistically, and the following conclusions are drawn:

Timing accuracy is ± 11 minutes, but more reliable timer operation is desirable. Recording accuracies of temperature: ± 0.5°C (land) and ± 0.7°C (glacier); pressure: ± 0.6 mb; windspeed/direction: ± 0.2 m/s/ ± 10° (glacier), ± 0.7 m/s (land); humidity: ± 7 %; sunshine: ± 15 %, are better than expected.

Station capability is good, in accordance with WMO-specifications.

W.J.Seifert, Automatic Climatological Station for Glacier Studies,
Axel Heiberg Island.

An Automatic Climatological Station for Glacier Studies, Axel Heiberg Island, N.W.T.

by

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A thesis submitted to the Faculty of Graduate Studies and Research of McGill University in partial fulfilment of the requirements for the degree of a Master of Science.

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April 1968

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INTRODUCTION

The idea to establish long-period recording weather stations on White Glacier, Axel Heiberg Island, N.W.T (Fig. 1), originates with Dr. F. Müller. In the spring of 1965 he writes: " The world-wide programme of long term measurement of glacier variations and mass balance changes, proposed by the International Commission of Snow and Ice of the I.U.G.G., demands an intensive survey of the climatic parameters associated with a glacier"... (Müller, 1965, Preface to Meteorology Report No.4).

After careful considerations Müller chose to use, for the first time in the Canadian High Arctic, Automatical Climatological Stations supplied by the Rauchfuss Instrument Manufacturing Company, Australia. Three "Sumner" Mk II recorders, a specially designed sunshine sensing unit and a contact anemometer including the necessary accessories, were purchased. A "Pyrox-Sumner" recorder (older model of the Mk II recorder) and a standard contact anemometer, type 45 B (D.O.T., 1961) were obtained on loan from the Canadian Department of Transport.

By definition, an automatic climatological station is "an unattended station which makes and records meteorological surface observations." (WMO, 1966, Annex D, p.16). The stations do not transmit any data. The meteorological information is stored, in various graphical forms, on paper strip charts.

Among the disciplines of the research programme of the 1965/66 Expedition to Axel Heiberg Island was the establishment and testing of these stations. The main theme of this thesis is the evaluation of the Automatic Climatological Stations for the specific purpose of glacier-climate relationship studies. And it will also be of interest to investigate the feasability of this type of equipment under the given environmental conditions.

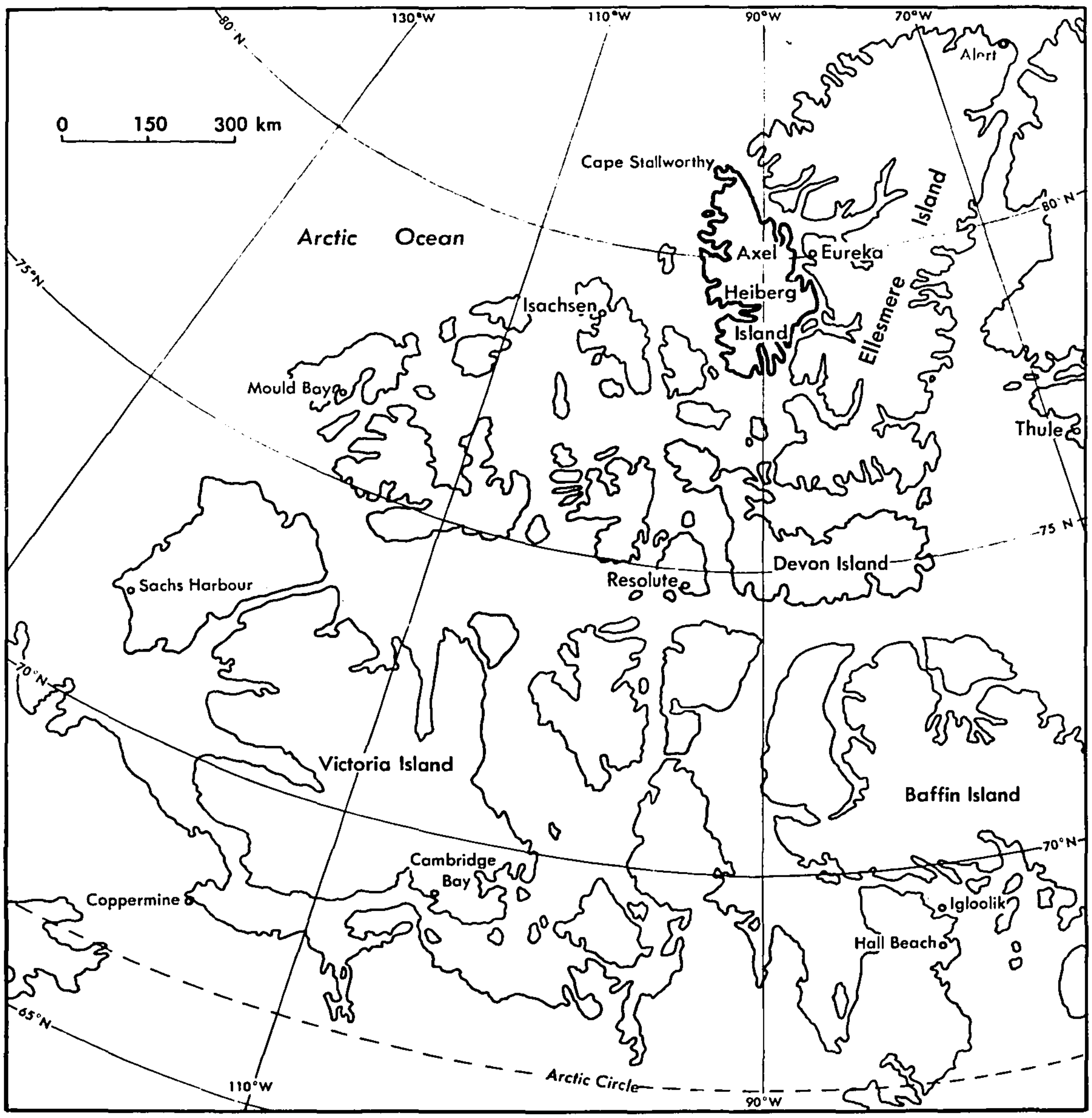


Fig. 1 Canadian Arctic Archipelago

To acquaint the reader with the automatic stations, Chapter I, entitled "The Automatic Stations and the Principles of Operation", gives a brief description of the recorders, timers, energy supplies and sensors. Chapter II, "Physical Setting of the Expedition Area and Installation of the Stations", describes the location of the Base Camp and Moraine Camp Ice sites, and consists mainly of the description of the establishment of the four stations at their respective positions.

Standard weather observations, in accordance with regulations of the Canadian Department of Transport were carried out at synoptic 6-hourly intervals during the three visits to Axel Heiberg Island in 1965 and 1966. This meteorological man-observed information, collected at Base Camp and Moraine Camp Ice is presented in Chapter III. Under the heading of this chapter, "Meteorological Observations and Automatically Registered Weather Data", a brief description of the manner in which the automatically registered data is extracted, is given. Once the general pattern of the weather in 1965 and 1966 is described, a more detailed analysis of the general behaviour of the station records can be made by comparison of the operation of the stations to man-observed data collected under different weather conditions.

The presentation of the entire data as observed by hand and by the stations, which are contained in numerous tables in the appendixes and in graphical form throughout the text of this thesis, make it possible to carry out a proper statistical analysis of each 6-hourly registration made by the stations. In Chapter IV, entitled "Discussion and Conclusion", it is shown that besides proper functioning of the sensors it is also very important to know the exact behaviour of the timers. Interesting meteorological and glacio-climatological phenomena are found through a detailed study of the unattended operation by investigating the sunshine, wind speed and bar.pressure registrations, representing the first winter records on White Glacier.

The Commission for Synoptic Meteorology, Working Group on Minimum Performance Characteristics of Automatic Weather Stations, outlines definite specifications of capability for unattended automatic weather stations. Realizing that there are no set rules and regulations of how well any automatic climatological station should operate on a glacier, it is proper to compare the operation characteristics of the Mk II and Pyrox-Summer stations to the WMO standards.

Generally it is felt that the use of automatic stations on a glacier in the High Arctic is completely justified and "whilst there remain many difficulties in operating automatic stations in polar regions, the information they could provide [is] invaluable." (WMO, 1966).

A number of abbreviations have been used in the text. Some of the more notable of these are as follows:

a) met-parameters - meteorological parameters
b) rel.humidity - relative humidity
c) bar.pressure - barometric pressure

CHAPTER I

The Automatic Stations and the Principles of Operation

An automatic climatological station is comprised of equipment designed to register certain meteorological parameters and store this information in a suitable manner. The equipment used at Axel Heiberg Island is called the "Summer Mk II" or "Pyrox-Summer" double pen, strip chart, long period recording system. Basically two sensors are used together with each recorder. The meteorological information is transferred by the lever mechanism to two separate pens which register the data on a strip chart. Each recorder has a timer and one or two energy supplies, depending on the type of sensors used. Thus it is possible to combine two different sensors with each recorder and call this equipment an Automatic Climatological Station.

Consequently four automatic stations are used which register the following met-parameters:

1) Mk II - T/H: atmospheric temperature and relative humidity
2) Mk II - BP/S: barometric pressure and sunshine duration
3) Mk II - WS/D: wind speed (actually wind run) and wind direction
4) Pyrox-Summer: atmospheric temperature and wind speed (actually wind run)

The three Mk II stations are used together at the Moraine Camp Ice site and the Pyrox-Summer station is used at the Base Camp site. The following text is a brief description of the integral parts of these stations.

I.1 Recorders

The dimensions of the recorders are: length 50.8 cm (20 in.); width 22.2 cm (8.75 in.); height 34.3 cm (13.5 in.). The average weight of the recorders is 15 kg (32 lbs.).

Each recorder consists of an assembly of three sub-units.

I.11 Mounting Base-Plate and Cover Assembly

The base-plate is made of metal and has a mounting block attached to its underside. All the electrical sockets for the energy supplies and sensor cables are located in the base-plate and are accessable through the mounting block. Attached to the underside of the Mk II-T/H recorder is a screen in which the temperature and relative humidity sensors are housed. The Mk II-BP/S recorder is equipped with a "breathing" vent in the base-plate to ensure proper pressure registration because this sensor is located inside the recorder.

The cover is secured to the base-plate by four guide rods. Cam action clamps lock the cover tightly in place. A semi-round and alongated plexiglass window in the cover is positioned properly above the solar timer device or spherical lens, when the cover is closed (Fig.I.1a). The Mk II-WS/D recorder cover incorporates a guide collar for the wind direction shaft. There are no ventilation slits in any of the covers of the four recorders.

I.12 Chopper Bar and Chart Advance Mechanism

By action of the timer (described in a later section) a current impulse is supplied to the chopper solenoid winding which in turn draws in an iron armature. Coupled to this armature is the chopper bar. The chopper bar's slam action causes the needle stylus at the end of each

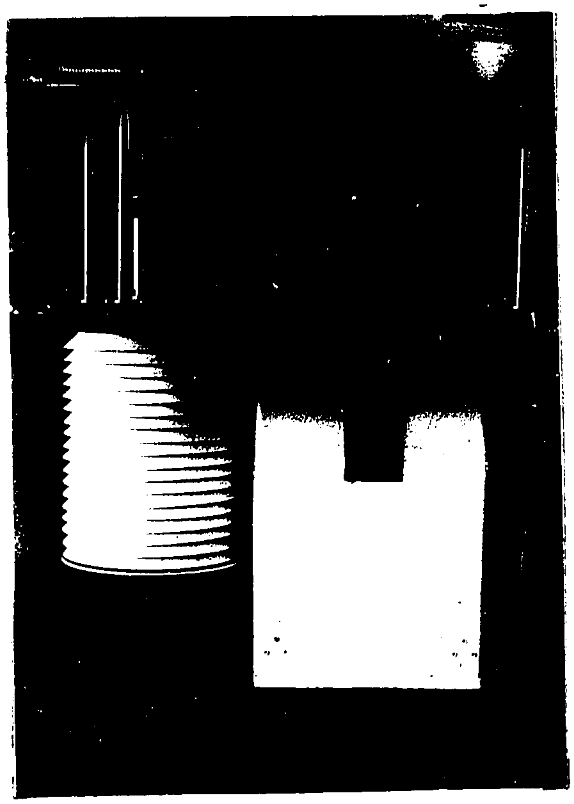


FIG.I.1a: COVER,SCREEN AND IDLER GEAR ASSEMBLY OF THE MKII-T/H STATION

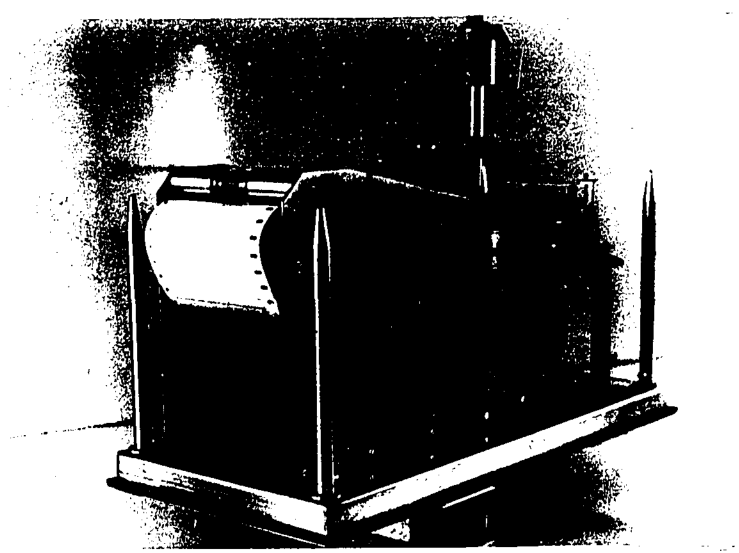


FIG.I.1b: SOLAR TIMER DEVICE AND RATCHET WHEEL ASSEMBLY OF THE MKII-WS/D STATION

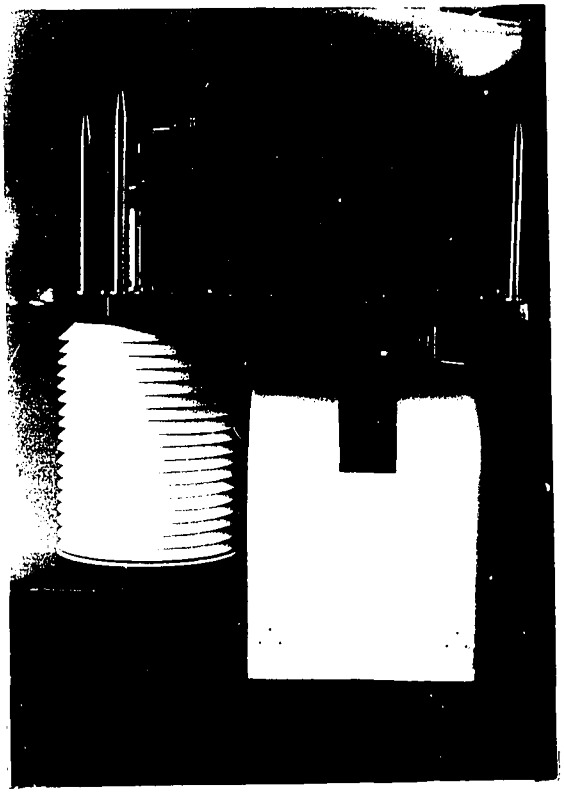


FIG.I.1a: COVER, SCREEN AND IDLER GEAR ASSEMBLY OF THE MKII-T/H STATION

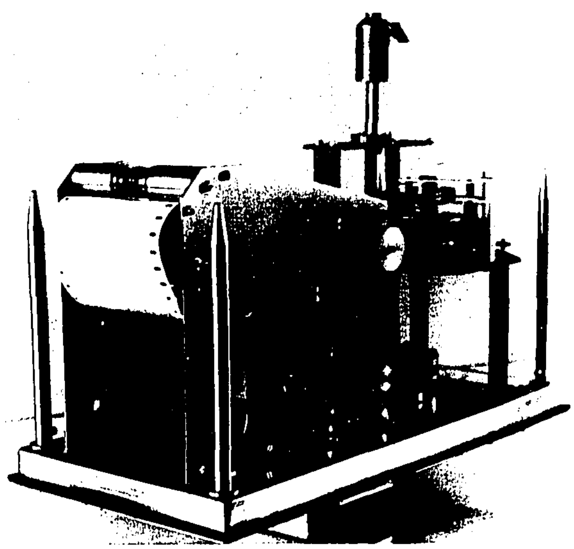


FIG.I.1b: SOLAR TIMER DEVICE AND RATCHET WHEEL ASSEMBLY OF THE MKII-WS/D STATION pen arm to perforate or mark the chart. As the current flow ceases, springs lift the chopper bar and thereby release the pen arms.

Simultaneously, the ratchet wheel, adjoined mechanically to the chopper bar, is turned. A safety pawl ensures clockwise rotation of the ratchet wheel (Fig.I.1b) and proper chart transport. The idler gear assembly coupled to the ratchet wheel rotates the chart transport wheel and its sprocket pins advance the chart. Proper chart paper tension is ensured by a spring-belt which couples the take-off spool to the transport gear assembly.

I.13 Pen Mechanism

The mechanism consists of three levers and four pivot points (fig.I.2a). This assembly is a modification of the Zschokke system (Zschokke, 1948) insofar as no sliding guides are used (Sumner, 1959).

The active operating elements (sensors) are linked to lever c'. This lever rests on the stationary pivot (4) and is attached via pivot (3) to the lower part of pen arm a'. Pen arm a' is coupled to lever b' by means of the floating pivot (1), and lever b' is held by pivot (2). At the upper end of pen arm a' is the pen stylus.

The accuracy of registration is a function of the rectilinear traverse of the pen stylus (Fig.I.2b). Assuming minimal friction in the linkage of the pen mechanism, the sensitivity to met-parameter fluctuations becomes a direct function of the sensitivity of the sensors. Good accuracy of recordings is obtained if the angular displacement made by the sensing element is kept within a range of 0° to 45° which ensures the overall accuracy of recording to be within $\pm 1\%$ of full scale reading.

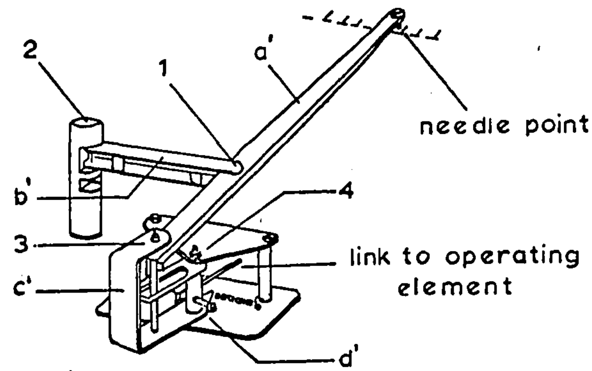


FIG I.2a: PENMECHANISM ASSEMBLY.

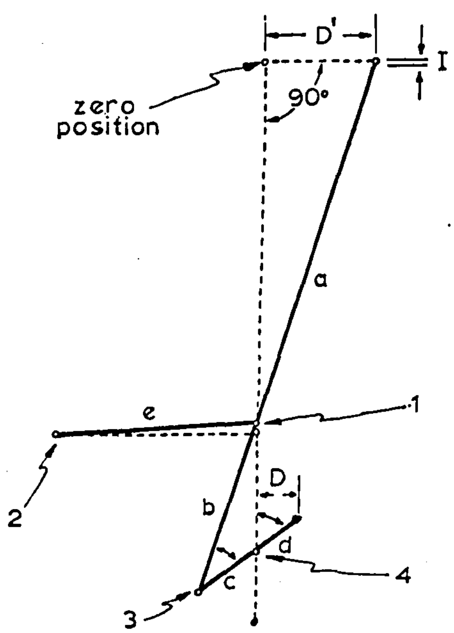


FIG I.2b: PEN ARM LEVERAGE SYSTEM.

I.2 The Electro-Mechanical Timer

The stations are triggered to record by four individual timers. The pace-maker in each timer is its clock which is a standard "Kienzle" mechanism. Every two or three minutes the spring of the clock is wound through the action of a solenoid. Excitation voltage is supplied by a standard 1.5 volt dry cell. A cam wheel having 120 teeth completes one revolution in 12 hours. Every six minutes one tooth will activate the spring-lever of a micro-switch. The timing accuracy is regulated by a lever on the clock (coarse adjustment) and the six-minute interval is regulated by adjustment of the slope of the spring-steel lever to the cam wheel (fine adjustment). Evidently, temperature changes will greatly affect correct functioning of the timer.

I.21 Solar Time-Check Device

Since the clock cannot be expected to keep exact time over a long period of months, time-check devices are used which utilize the noon sun. In the Mk II recorders a spherical lens of small diameter and short focal length (Fig.I.1b) is used. The lens focuses the sun's image on the chart paper for a short time during transit of meridian at local apparent noon. With the Pyrox-Summer recorder a photo-resistance tube together with a solenoid can be used in latitudes higher than 50°. A needle pierces the chart when the sun shines on the photo-tube.

The time-check marks are registered on the strip chart either two days (Mk II) or one day (Pyrox-Summer) before registration of the met-parameters. If the sun shone every noon for a number of consecutive days, then a timer-check mark should appear every 10.2 cm (4 in.) on the paper.

I.3 Recording Strip-Chart

The chart paper is rolled on a hollow cardboard core which has removable holder discs at each end. The paper is fed from a supply reel via the time-check lens and a series of rollers underneath the pens to a take-off drum (Figs.I.1a and b).

The strip-charts are identical for all four recorders. They are 38 m (125 ft.) in length and have a total width of 10.2 cm (4 in.) with a scale length of 8.9 cm (3.5 in.). The chart length is suitable for 12 months of recording at a transport rate of 10.2 cm (4 in.) per 24 hours. The horizontal time scale is divided into main divisions, separated by a heavy vertical line every 2.5 cm (1 in.). This main division is subdivided into three minor divisions by a light vertical line every 0.84 cm (0.33 in.). Using the chart rate of 10.2 cm per 24 hours means that each main division extends over six hours with every minor division giving two-hourly intervals. The vertical amplitude scale is arranged into five equal main divisions. Each of these is subdivided into 10 minor divisions having a line spacing of 0.175 cm (0.07 in.).

The paper is treated with a carbon base and its surface is glazed with a thin, white plastic coating. As the stylus of the recording pen punctures the paper either a dark and light circle about the pierced hole or a double dot is left behind. Char marks on the paper are easily noticible and well defined. However, the paper is very sensitive and any marks made on the charts cannot be erased. Sections of strip-charts are shown in Chapter III.

I.4 Energy Supplies

There are four energy supplies; each of these contains a timer with clock and own battery and a chopper circuit with its power pack.

FIG.I.3a: TIMER CLOCK AND ENERGY SUPPLY

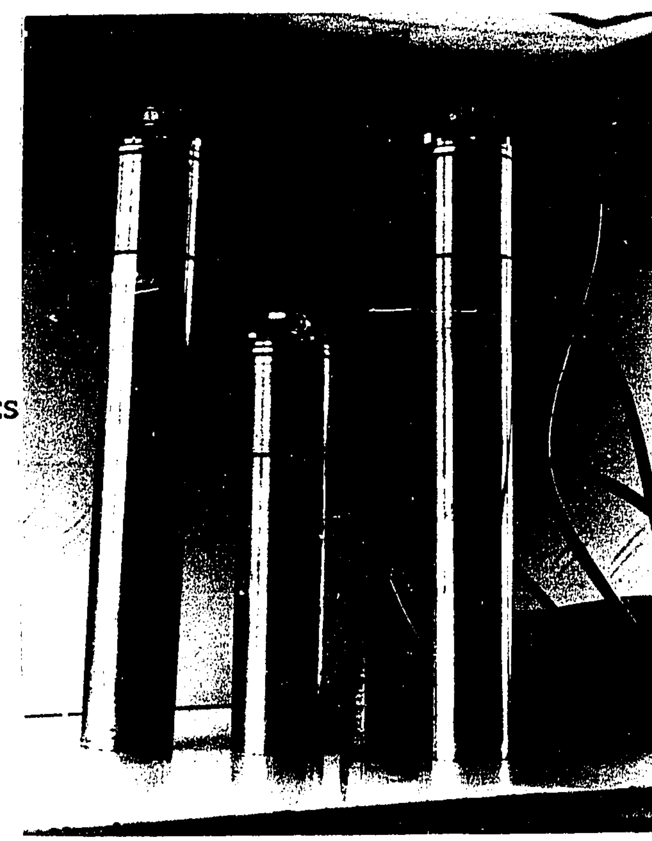


FIG.I.3b: ASSEMBLED ENERGY SUPPLIES
FOR MKII-STATIONS

FIG.I.3a: TIMER CLOCK AND ENERGY SUPPLY

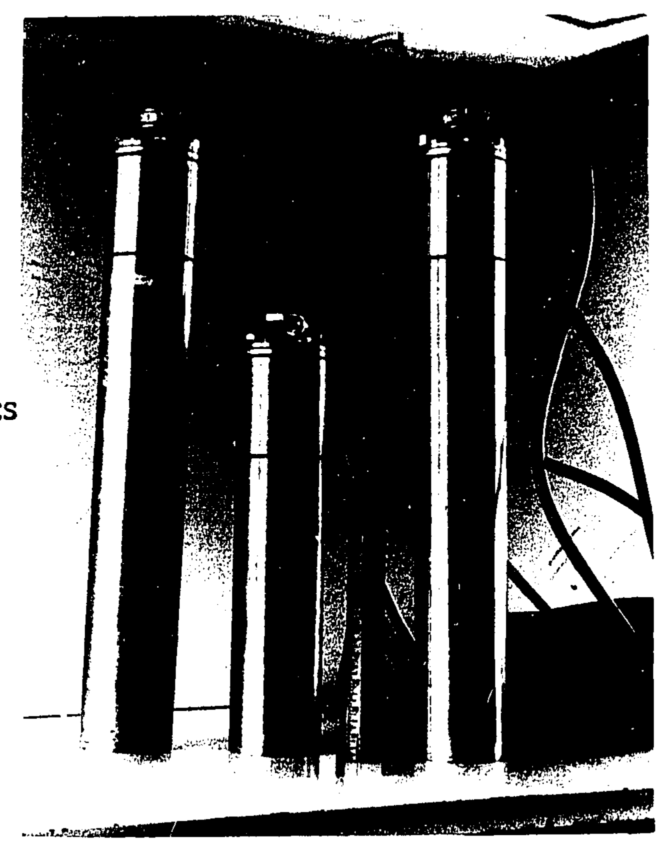


FIG.I.3b: ASSEMBLED ENERGY SUPPLIES FOR MKII-STATIONS

(Fig.I.3a). The Pyrox-Sumner and Mk II-WS/D stations' energy supply have in addition a counting-event circuit and separate power pack. A pulse-message circuit and power pack is also added to the energy supply of the Mk II-BP/S station.

The three energy supplies for the Mk II stations are shown in Fig.I.3b. These brass containers are 9 cm in diameter and 55 cm or 65 cm in length.

I.41 Circuit Details for Chopper Operation

The circuit shown in Fig.I.4a and its operation are basic to all recorders. The sequence of operation is as follows: on closure of the micro-switch on the clock, which happens after a tooth of the cam wheel is advanced, the 135 volt power pack charges the 100μF electrolytic capacitor through the 33 Kohm resistor. After a six-minute interval the next tooth on the cam wheel opens the micro-switch and so disconnects the power pack from the capacitor. The capacitor now discharges through the chopper solenoid to operate the recorder's chart advance mechanism. The diodes (in all circuits) supress sparking across the contacts of the micro-switch.

I.42 Circuit Details for Counting-Event Operation

The circuit for the Mk II-WS/D station is shown in Fig.I.4b, and the one for the Pyrox-Sumner station in Fig.I.4c. Both circuits operate on a common principle. Shortly before one revolution (equivalent to 1.6 km or one mile of wind run) of the eccentric wheel occurs, the micro-switch closes. The power pack charges the capacitor through the resistor. As the wind shaft turns, the switch is opened and so disconnects the power pack and allows the capacitor to discharge through the counting-event solenoid (relay). This counter relay is coupled mechanically to the pen mechanism. After totalisation of 324 km (200 miles) of wind run (200 pulses) the relay returns the pen to its zero position and the recording procedure is repeated.

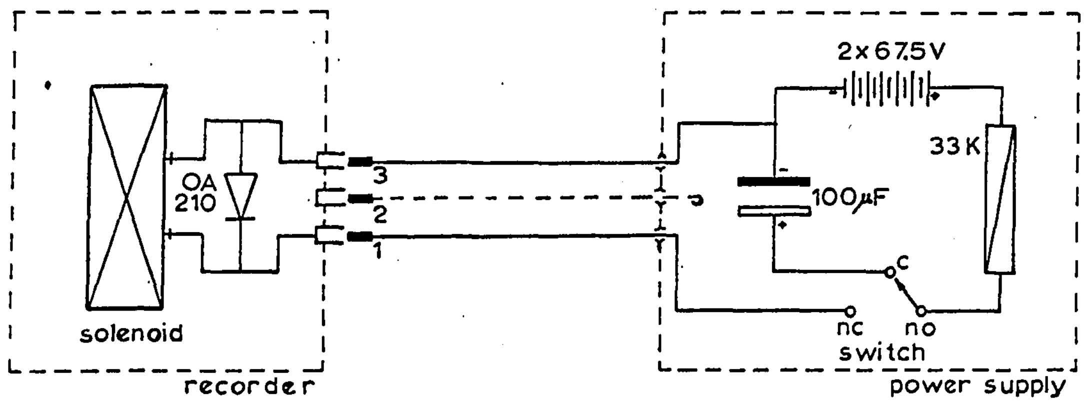


FIG I.4a: CIRCUIT FOR TEMP. & REL. HUMIDITY RECORDING.

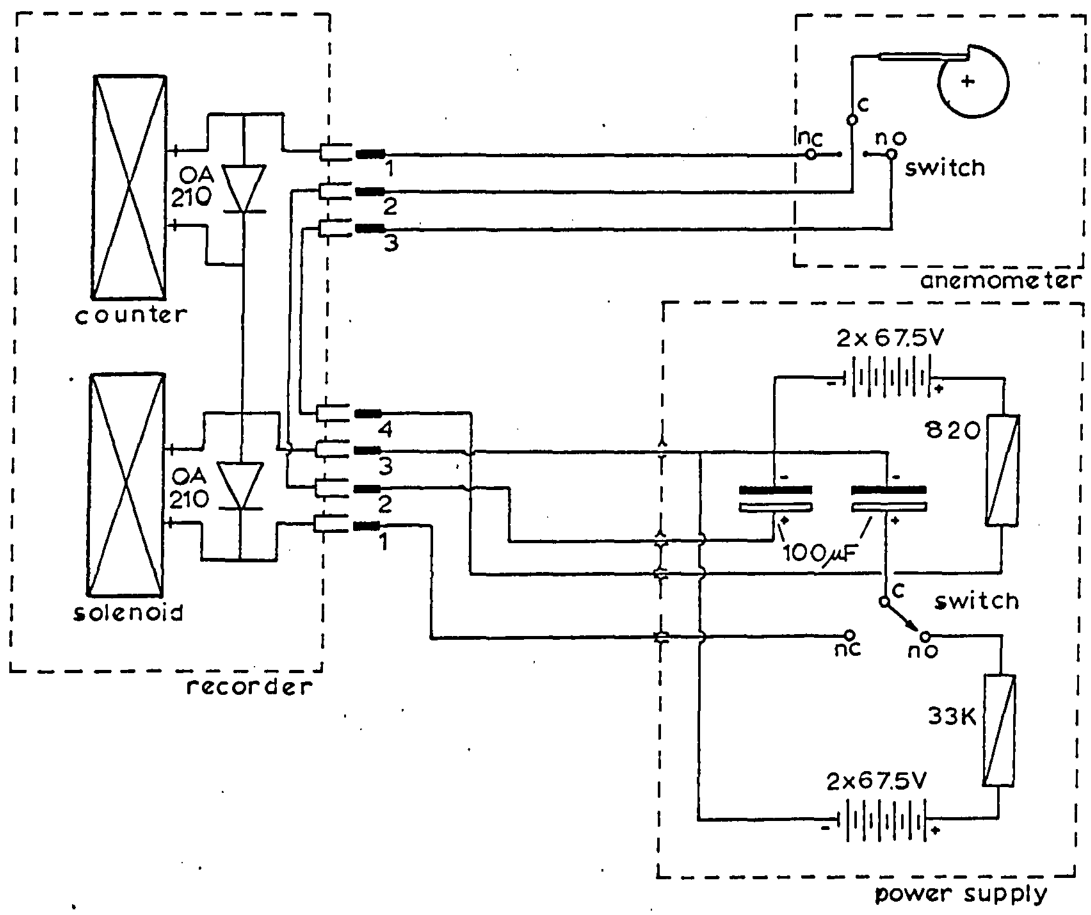


FIG I.4b: CIRCUIT FOR WIND RECORDING.

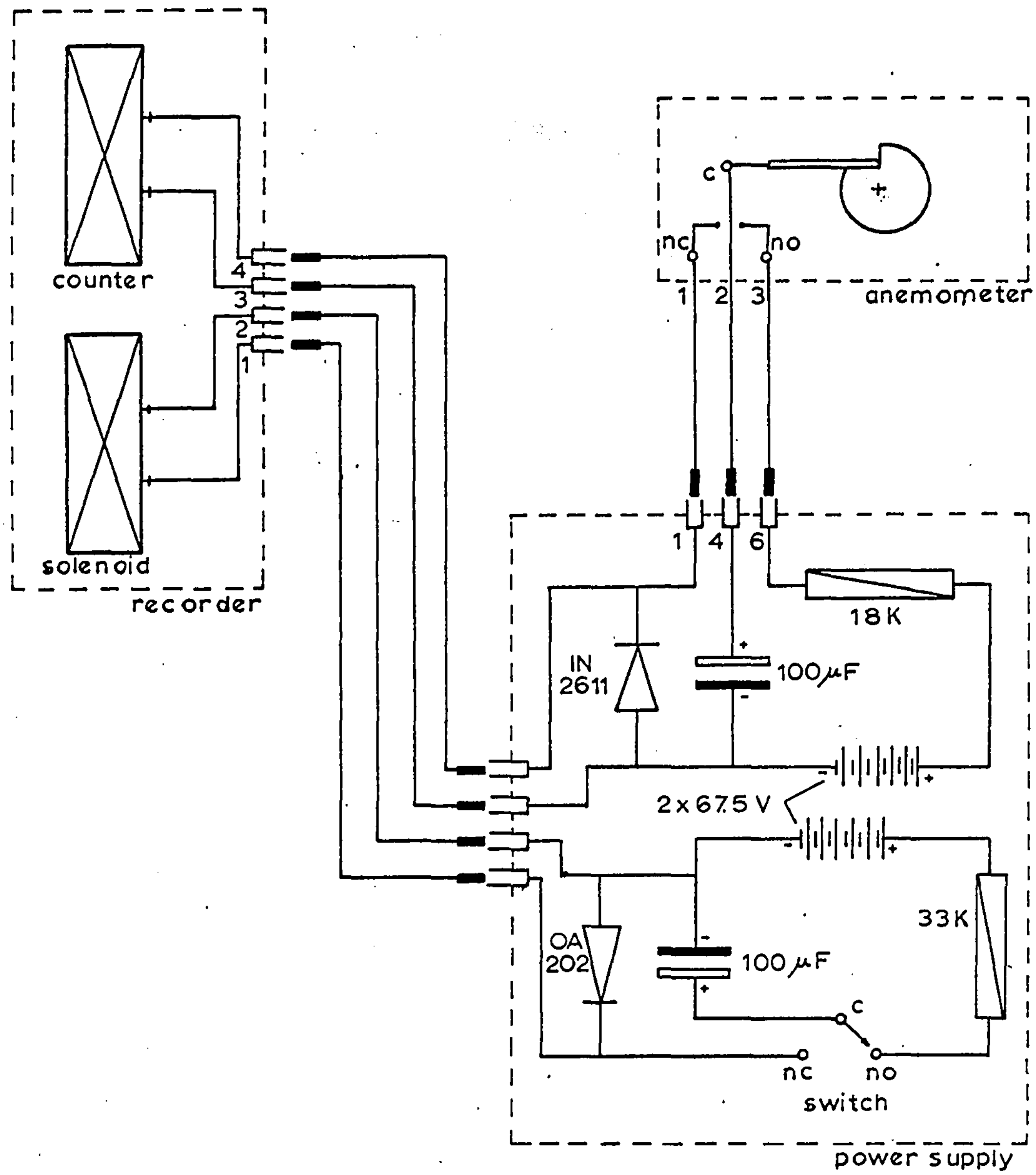


FIG I.4c: CIRCUIT FOR PYROX-SUMNER RECORDER.

I.43 Circuit Details for the Sunshine Duration Registration

Sunshine registration functions on the yes/no principle. Mounted below the chopper bar the micro-switch opens, when the chopper bar is depressed. The capacitor (charged when the micro-switch was closed) may now discharge through the pulse-message solenoid (Fig.I.4d). But this will only happen when the thermo-bimetal contacts in the sunshine sensor are also closed which occurs, when the sun shines. A pen stylus attached to the solenoid then marks the chart paper.

I.44 Cables

All cables are flexible and carry cannon receptacles at each end. The inner leads of the multitwine cables are colour coded. They are used to interconnect electrically each energy supply to its appropriate recorder and the wind run and sunshine duration sensor to their recorder and energy supplies.

I.5 Sensors

Six sensing elements are used to measure the meteorological parameters as listed in the beginning of this chapter. Each of these sensors is discussed briefly.

I.51 Atmospheric Temperature Sensing Elements

Temperature is measured with a mercury-in-steel sensor system. These so-called liquid sonde thermometers operate over the range of + 25^{o} to - 50^{o} C in the Mk II T/H station and over the range of + 27^{o} to - 38^{o}C in the Pyrox-Summer station. The latter station incorporates a 15 m long capillary tube joining the pen mechanism in the recorder to the sonde thermometer situated in the nearby weather hut. The sensitivity, accuracy and response time of the sensors is effectively the same as that of

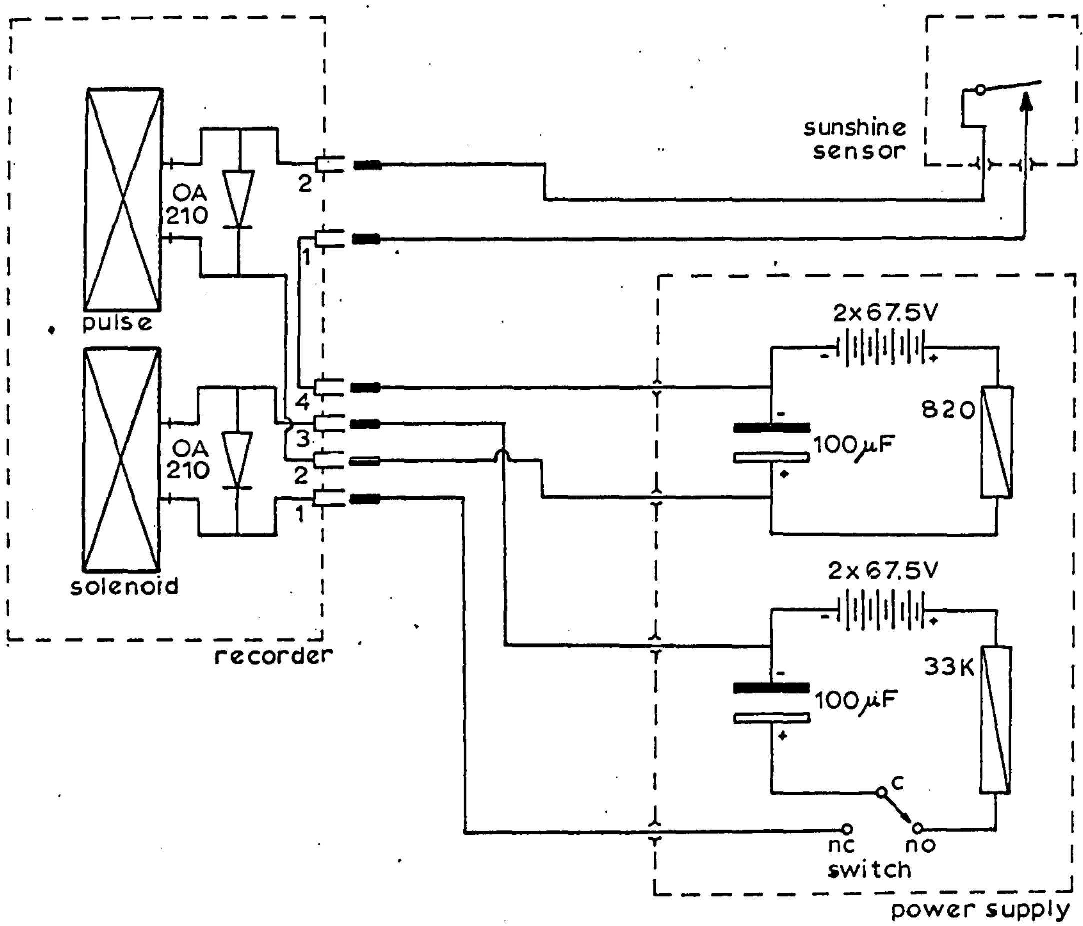


FIG I.4d: CIRCUIT FOR SUNSHINE RECORDER.

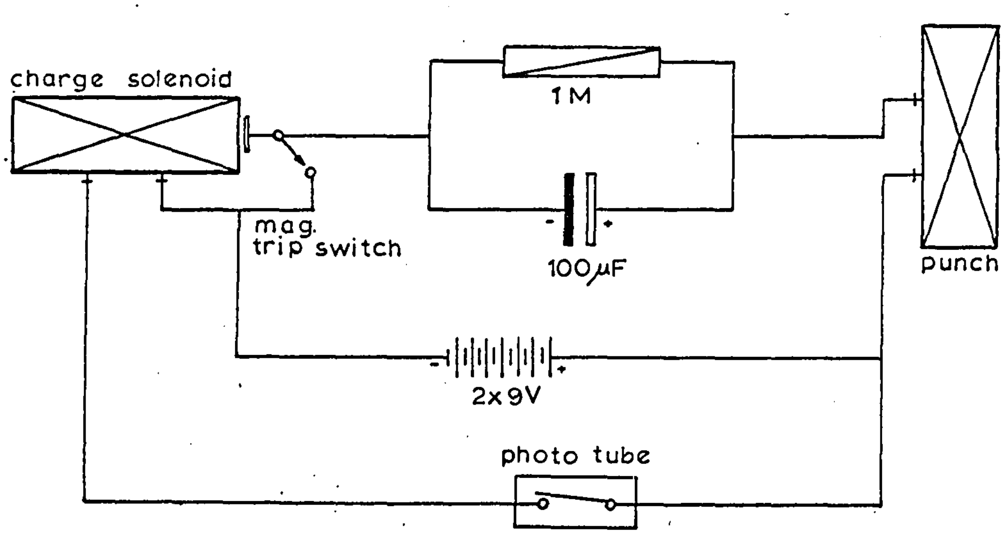


FIG I.4e: CIRCUIT FOR TIME CHECK.

ordinary mercury bulb thermometers. The sensors' accuracy is $\pm$ 1 % of full scale reading. Having nearly linear response characteristics over their full temperature range, the Mk II-T/H station records with an accuracy of $\pm$ 0.75° C and the Pyrox-Summer with an accuracy of $\pm$ 0.65° C. However, observations showed that final temperature registration as shown on the strip-charts is very much non-linear and careful corrections for this effect have to be made.

I.52 Relative Humidity Sensor

The sensor is a normal, chemically treated hair hygrometer. Its maximum recording range is 100 % RH. The accuracy of this sensor will remain poor even under favourable conditions; it may be taken as about 10 % when humidity is average and about 5 % in cases of high humidity. Operation at temperatures below 0° C is unreliable and these RH-readings are probably in great error.

I.53 Barometric Pressure Instrument

A standard, differential vidie-capsule system is used (Fig.I.5a). The elements housed in the Mk II-BP/S recorder are compensated for ambient temperature change. The calibrated deflection range is 50 mb, and the overall accuracy of the instrument is within the $\pm$ 1 % of full scale reading. This means an accuracy of $\pm$ 0.5 mb which can be considered quite satisfactory.

I.54 Sunshine Duration Sensing Head

The sensing head operates on the principle of solar radiation on thermo-metal leaves. On a circular metal base eight bimetal elements are mounted concentrically (Fig.I.5b). The elements are insulated from the base and each other and connected electrically in parallel. The outer leaves of the elements are matt black on the exposed side, only. The slightly smaller innerleaf is matt black on the underside, only. During sunshine the outer leaves will absorb heat; the inner leaves, being shaded

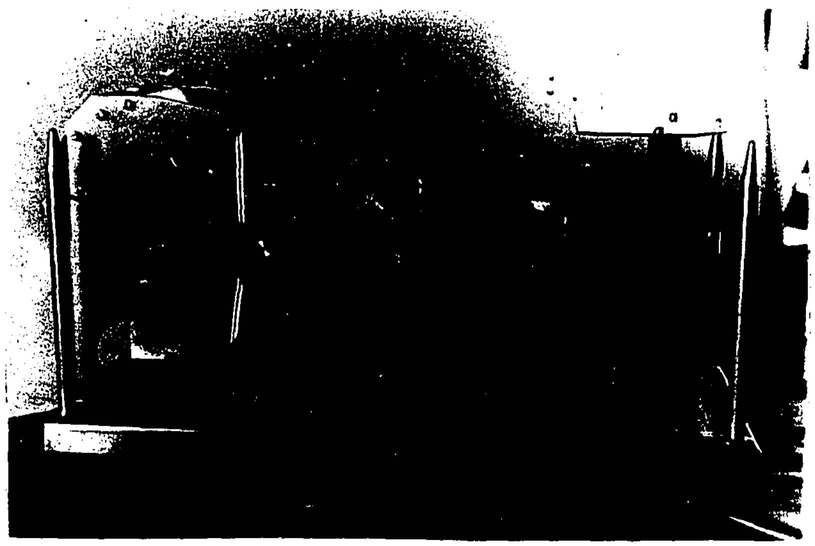


FIG.I.5a: VIDIE CAPSULE SYSTEM AND SUNSHINE RELAY OF THE MKII-BP/S STATION

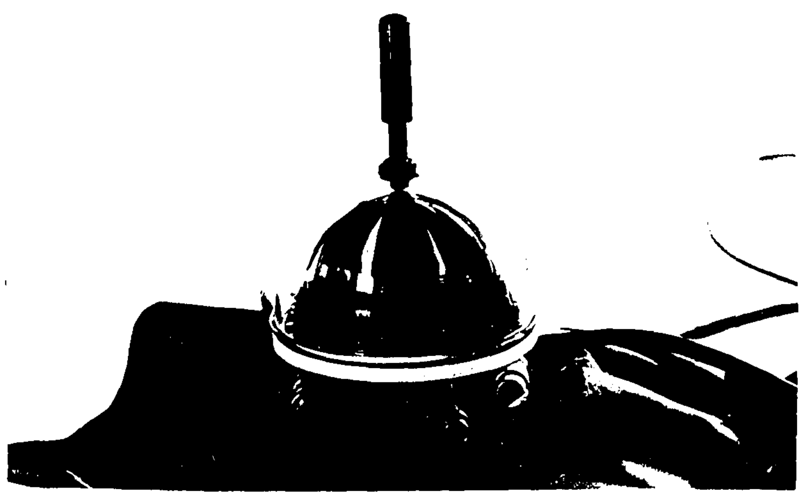


FIG.I.5b: SUNSHINE SENSING HEAD

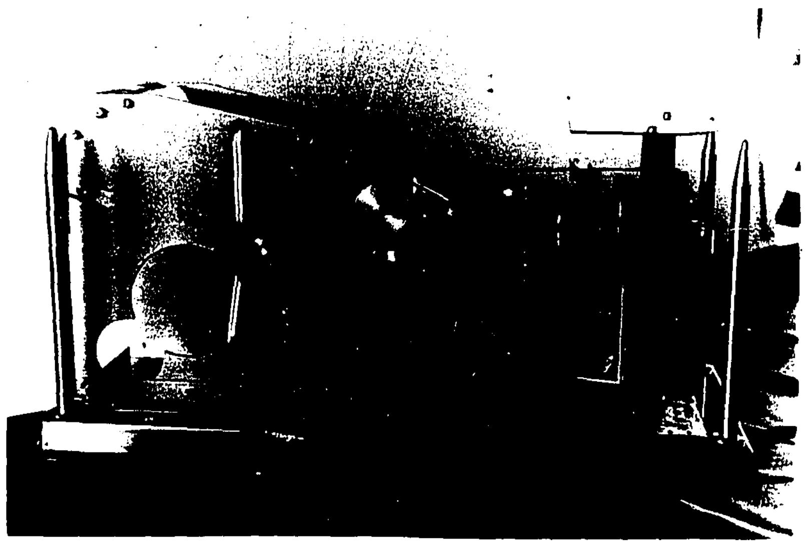


FIG.I.5a: VIDIE CAPSULE SYSTEM AND SUNSHINE RELAY OF THE MKII-BP/S STATION

FIG.I.5b: SUNSHINE SENSING HEAD

by the outer, will not expand as much. This differential expansion will cause the metal leaves to touch each other, and so each element acts as a switch. The elements are sensitive to a direct solar radiation of 10 milliwatts/cm^2 (Summer, 1965). It takes 15 to 30 seconds to make or break electrical contact when the temperature is below 4.4° C (40° F). The sensing head will not operate properly when the solar elevation is less than 5°. The sensor should not operate under diffuse light conditions.

I.55 Wind Run Instruments

Principles of operation of the M.S.C., type 45 B anemometer used with the Pyrox-Summer recorder and the "Summer" anemometer used with the Mk II-WS/D recorder are the same and follow standard techniques described in "M.S.C.Wind Equipment, Contact Type" (D.O.T., 1961). whereas the wind shaft of the type 45 B anemometer rotates 200 times for each 1.6 km (one mile) of wind run, the "Summer" wind shaft must rotate 600 times. Both instruments record wind strengths ranging to 243 km per hour (150 miles/h.). Accuracy limitations, response and threshold of the instrument and validity of registered wind run and wind speeds are described in a later section.

I.56 Wind Direction Indicator

The wind vane is mounted on the Mk II-WS/D recorder. It is attached to a cam shaft by means of a torsion spring which in turn is connected to a fan-like arrangement in an oil dash pot. Rotation of the wind vane is therefore controlled by the buffer action of the vane in gusty wind conditions. The recording pen arm is connected directly to the cam shaft and allows prevailing wind directions to be measured. The accuracy of registration is dependent on temperature (viscosity of the oil), this being especially true at extremely low temperatures.

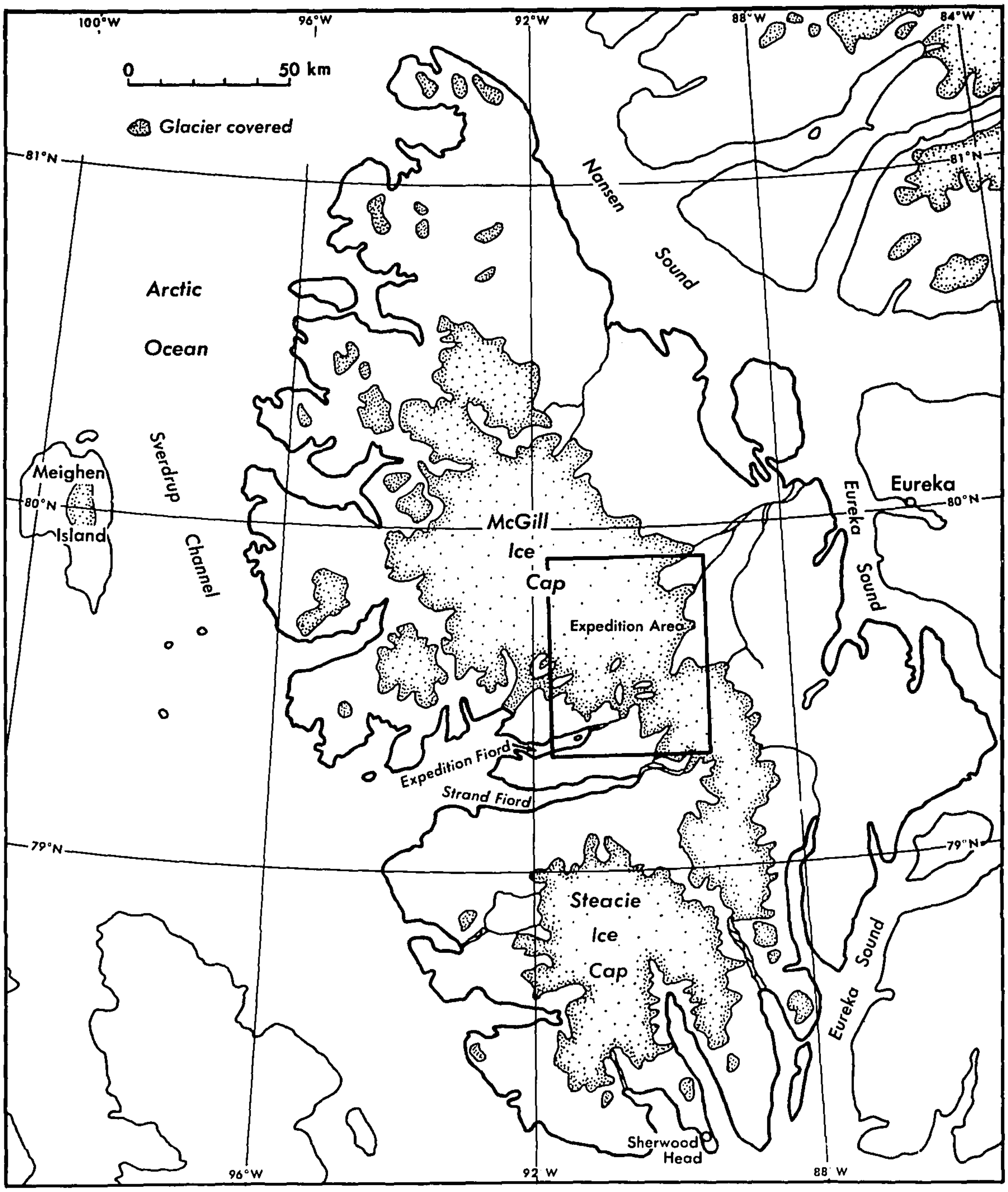


FIG. II. 1a: Axel Heiberg Island

CHAPTER II

Physical Setting of the Expedition Area and Installation of the Stations.

Axel Heiberg Island is in the High Arctic (Fig. 1); it is the second most northerly island in the Canadian Arctic Archipelago. Situated approximately between latitudes 78° and 81° North and longitudes 85° to 96° West, it has an area of approximately 40,800 km^2. The 800 km^2 Expedition Area lies in the central western part of the island at the head of Expedition Fjord.(Fig.II.1a).

Centrally, within the Expedition Area lies White Glacier, a medium sized Alpine-type valley glacier (Fig.II.1b). This ice body extends from 1,780 m to 75 m above sea level and is about 14.5 km long. Its accumulation area is on the average one kilometer in width. The main flow of the glacier is from northwest to southeast and the average gradient of the glacier surface is 12 %. Mountains in the White Glacier area reach elevations of 1,850 m.

II.1 Location of the Base Camp Station

The meteorological site at Base Camp is near the southern shore of Colour Lake. The station's position is lat.79°25' N, long. 90°45' W at 180 ± 5 m above sea level. It stands about two kilometers southwest of the terminus of White Glacier and about 6.5 km inland from the head of Expedition Fjord. Towards the north the station is somewhat protected, but in all other directions it is well exposed.

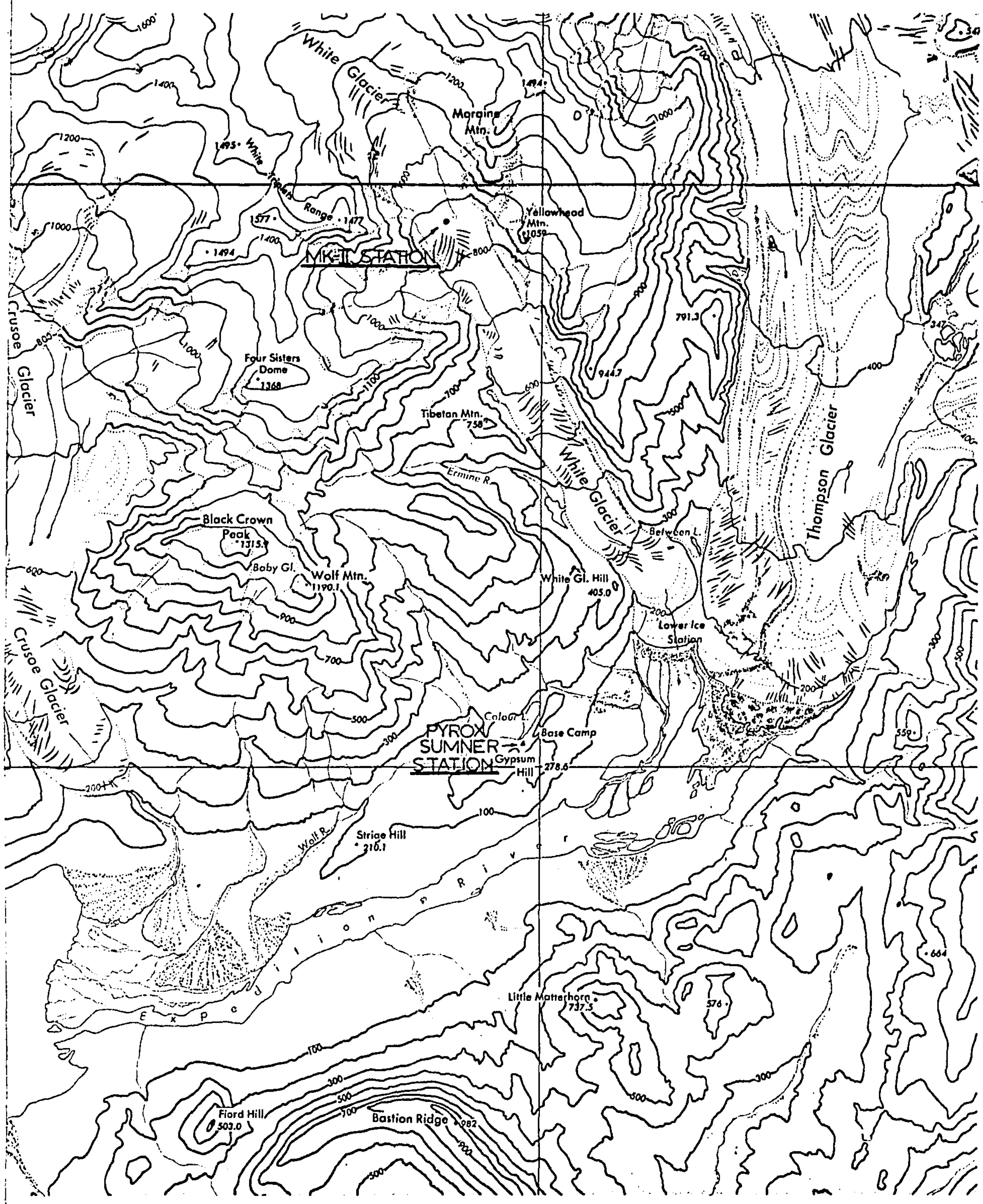


FIG. II. 1b: EXPEDITION AREA; LOCATION OF AUTOMATIC STATIONS

II.11 Layout and Installation of the Station at Base Camp

The ground plan (Fig.II.2) shows the arrangement and positions of the Pyrox-Summer recorder, weather hut and anemometer.

The wooden supports of the weather hut are placed firmly in the permafrost, keeping the base of the hut level at 1.70 m above ground. The hut is tied to ground by four guywires.

Weather hut and recorder are linked by the 15 m long microbore capillary of the temperature sensing element. The bulb of the liquid sonde thermometer, which is placed inside the hut, and the bourdon element which is inside the recorder, must be kept at the same height level. The capillary is fixed (thermally insulated) to four poles, thereby keeping it at an equal height of 1.65 m above ground. In doing so the static pressure change and heat loss in the system is negligible.

The Pyrox-Summer recorder is mounted on a wooden platform, supported by a four-legged stand which is held in position by large slabs of rock and four guywires. The recorder is positioned 14 m southwest of the weather hut at a height of 1.75 m.

The anemometer is positioned on even terrain, keeping with the rule that the distance from any influential obstruction must be 10 times the height of that obstruction. The standpipe is lowered one meter into permafrost and secured by four guywires. The wind cups of the instrument are two meters above ground. The anemometer stands 27 m west of the recorder stand and 41 m west-southwest of the weather hut.

To obtain the best arrangement between recorder and weather hut in correlation to the anemometer, it was necessary to reposition the weather hut slightly. The hut is now situated 3.60 m southwest of its former location.

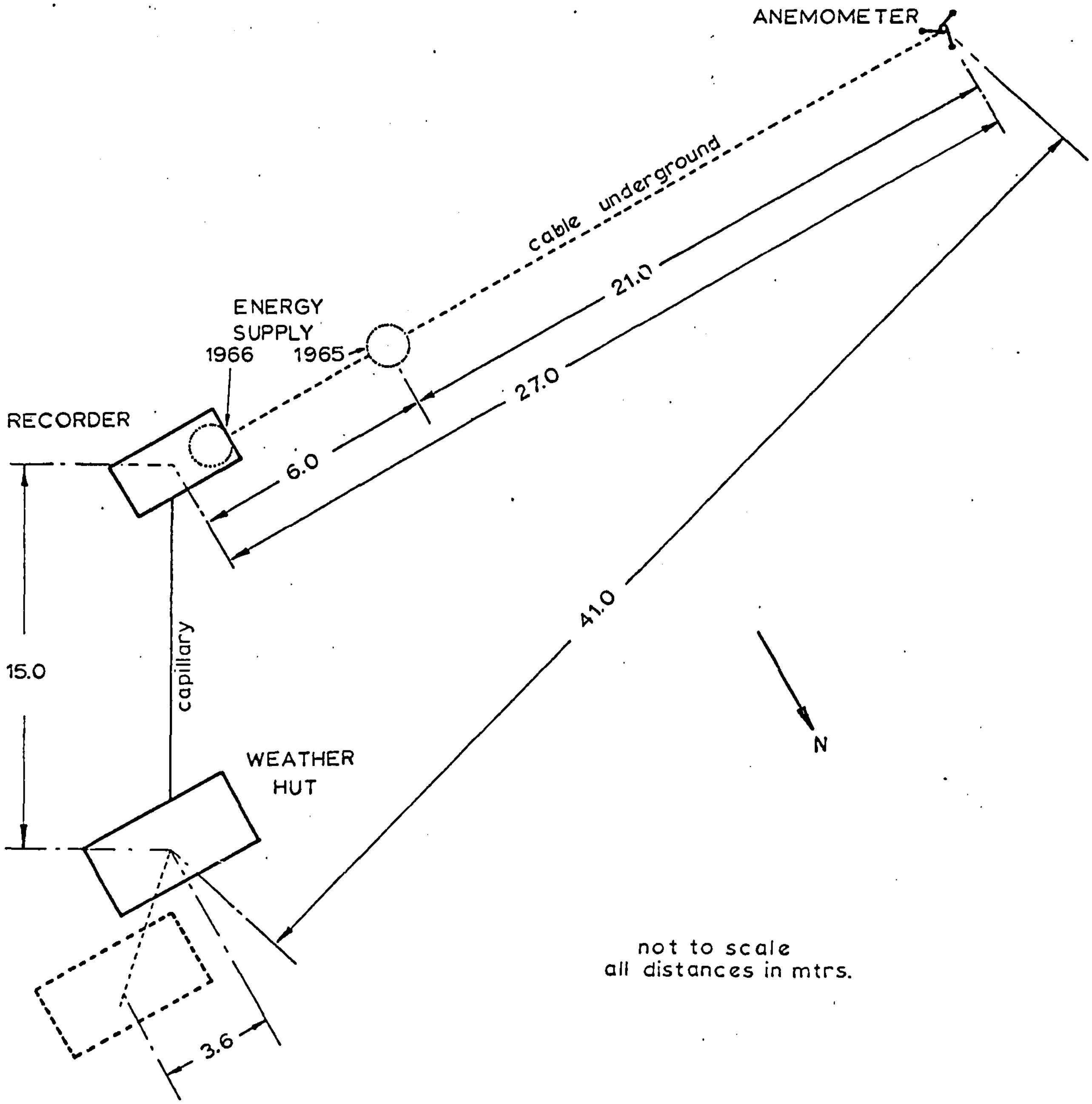


FIG II.2: GROUND PLAN, BASE CAMP MET. SITE.

II.12 Installation of Pyrox-Summer Energy Supply

The metal box (15 x 15 x 15 cm) containing the energy supply was insulated by 7.5 cm thick styrofoam padding and placed inside a 10 gallon drum. The electrical cables to the energy supply entered the drum through its filling hole. The lid of the drum was sealed with water-repellent tape and the filling hole was made airthight with dux-seal. This container was then buried 60 cm into the top layer of perma-frost and six meters west of the recorder stand in line with the ane-mometer stand pipe.

After winter operation, in May 1966, it was found that despite all protective measures taken moisture in the drum had caused corrosion at the electrical sockets, which led to electrical shorts. High humidity remains to be the cause of major electrical trouble; however, it was de-cided to mount the energy supply box, wrapped in polysterene bags, under-neath the recorder platform for the 1966 summer and 1966-67 winter opera-tion. The polysterene bags were sealed when humidity was low (foehn condition).

II.2 Location of the Moraine Camp Ice Station

Near Moraine Camp, about 880 m above sea level lies approxima-tely the equilibrium zone of White Glacier. Here the glacier is ca. 1.2 km wide and has an average ice depth of 305 m (Becker, 1963; Redpath, 1965). In August 1965 the chosen station area was situated about 0.5 km towards the centre of the glacier and 0.3 km above Moraine Camp, which occupies the lower end of the lateral moraine.

In relation to the Base Camp Station the Moraine Camp Ice Stations are about 9.5 km north and 1.5 km west, with an elevation dif-ference of 705 $\pm$ 5 m. Their position is lat. $79^{\circ}29'$ N, long. $90^{\circ}49'$ W, at 880 $\pm$ 5 m above sea level (1965).

The Moraine Mountain (1,366 m) towards the northeast, Yellowhead Mountain (1,059 m) towards the east and the high ridge (no geographic name) which is part of the White Triplets Range (1,300 m) towards the west, as well as the rising accumulation area limit horizontal visibility in the station area. The three stations are well exposed to the south.

II.21 Layout and Installation of the Stations at Moraine Camp Ice

The layout of the stations (Fig.II.3) covers an area of approximately 500 km^2. The stations are established on a smooth ice plane which has a gradient of about 1 %. There were no crevasses, glacier streams or moulins within the area in 1965 and 1966.

A reference line, 32 m long, was laid down in the north - south direction at noon August 12, 1965. The east - west reference line of the same length was established at 0600 hours on August 13, 1965. These reference lines were necessary in order to position the recorders properly so that the time check lens faces true south. Furthermore, the initial setting of the wind vane had to be such that when it was pointing west, the needle point of the recording mechanism would rest at the centre of the recording chart. The two lines formed the diagonals of the station area. At their intersection the three Mk II stations were installed.

All three recorders are mounted side by side on the platform of the recorder stand which is made of aluminium. The platform measures 60 x 80 cm. The four aluminium supports are drilled 2.8 m into the ice and secured by guywires which keep the platform horizontal. The height of the platform is adjustable and was set at a mean height of 1.60 m above the glacier's snow surface.

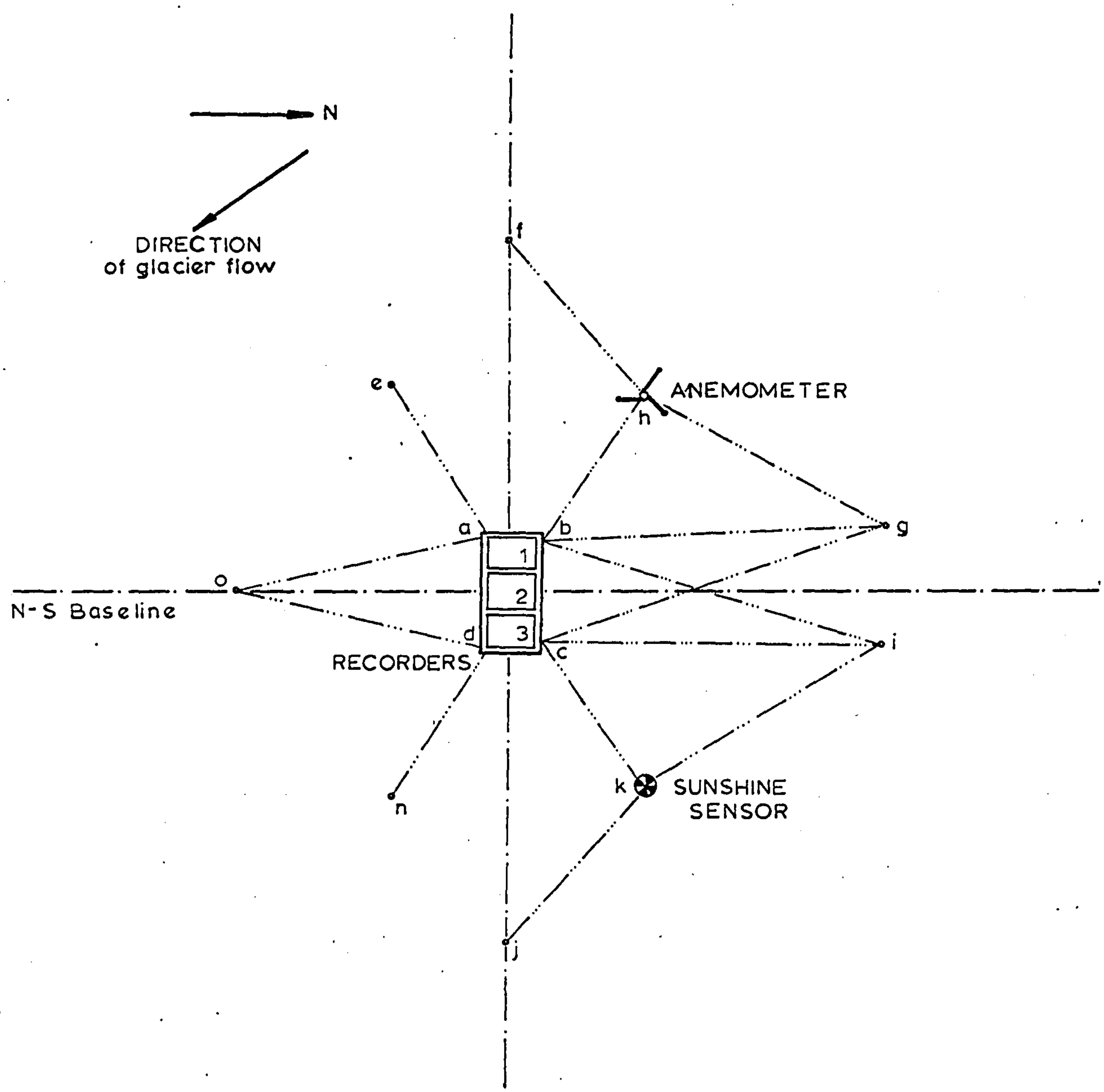


FIG II.3 LAYOUT OF MORAINE CAMP ICE STATION.

The lens windows (solar time check) at the front of the recorders all face south. When looking north (up-glacier) the arrangement of the recorders is from left to right:

1) BP/S (barometric pressure and sunshine)
2) WS/D (wind speed (run) and wind direction)
3) T/H (temperature and relative humidity)

The height of the sensors above the snow surface in August 1965, May and September 1966 was: temperature element and rel.humdity sensor 1.50 m; bar.pressure indicator 1.65 m; time check lens 1.75 m , and wind vane 1.80 m.

The stand pipe of the anemometer was drilled 2.50 m into ice, 1.90 m northwest of the recorder platform. The anemometer cups were two meters above the snow surface. The standpipe of the sunshine sensing head was lowered 2.40 m into the ice and was located 1.35 m northeast of the recorder platform. To prevent the anemometer cups from casting a shadow on the sunshine sensing head (evening hours), the sunshine sensor was raised 2.10 m above the snow surface. Both standpipes were secured by three guywires each. Fig.II.4 shows the complete installation of the three automatic stations.

II.22 Installation of the Mk II Energy Supplies

For the 1965-66 winter operation a hole, 11 m deep, was drilled with a SIPRE-corer (diameter approximately 10 cm) into the ice directly underneath the stations' platform. The brass containers, as shown in Fig.I.3b, were tied together on top of each other with guywires. After the energy supplies were in place, the hole was filled with slushy snow. The two cables connecting the anemometer and sunshine sensor to the individual recorders were buried about 30 cm in snow. The extra lengths of the cables from the energy supplies were coiled and buried in the snow beneath the platform.

· FIG.II.4: THE AUTOMATIC CLIMATOLOGICAL STATIONS ON THE GLACIER NEAR MORAINE CAMP, 880 MASL.

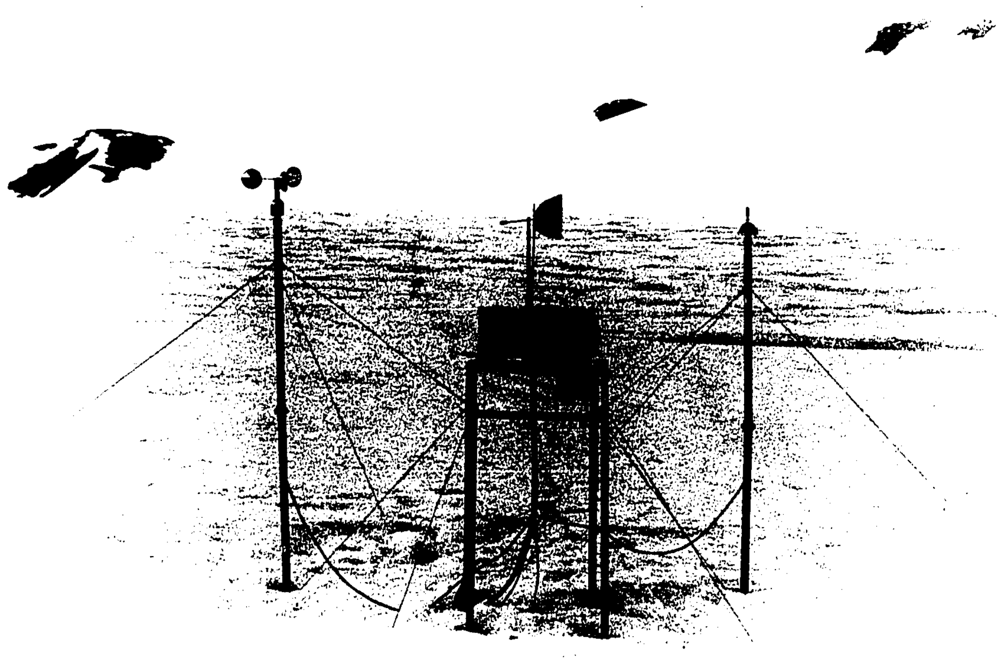


FIG.II.4: THE AUTOMATIC CLIMATOLOGICAL STATIONS ON THE GLACIER NEAR MORAINE CAMP, 880 MASL.

Great care was taken in lowering the energy supplies into the hole. Unfortunately, the assembly of the units inside the containers was not shock-proof and later it was found that the battery connection to the condenser of the event circuit in the Mk II-WS/D energy supply had shaken loose. To remedy the situation a prototype power pack and accompanying circuit was constructed and mounted inside the WS/D recorder.

Normally, after nine months of operation the batteries are spent, and since their containers cannot be retrived from the ice, the decision had to be made whether to drill a new hole and install similar energy supplies into the ice. However, the prototype external power pack of the Mk II-WS/D recorder had withstood the cold of the winter 1965-66 favourably, and since spare energy supplies, housed in differently shaped brass containers of identical electrical design were at hand, it was logical to use these new energy supplies after May 1966. During the summer the new containers were tied to the supports of the station platform and buried in snow. This worked out extremely well and thus the energy supplies remained in this position for the winter operation of 1966-67. A comparison of relative operation of the timers during summer and winter, when in ice or on the surface of the glacier, is made in a later chapter.

CHAPTER III

Meteorological Observations and Automatically Registered Weather Data.

The mechanics of the automatic stations and their principles of specific operation were briefly described in Chapter I. Their installation at specific locations was treated in Chapter II. The main theme of this chapter is the presentation of the meteorological data collected by hand and by the automatic station equipment.

The man-observations were planned to meet the following requirements: collection of reliable and accurate weather data for testing and calibrating the automatic stations and gathering meteorological information from Base Camp and Moraine Camp Ice sites by following similar procedures adopted in previous summers. All observations were carried out according to procedures recommended by the Meteorological Branch of the Canadian Department of Transport. In fulfilment of these requirements, a complete weather hut was also maintained about 45 m east of the Mk II stations on White Glacier.

After testing and calibrating the automatic equipment, the stations were left to operate without major interference. Frequent checks on timer operation and parameter registration were made, but the stations were never turned off nor readjusted until shortly before the end of each manned period, when new batteries were installed and the necessary corrective adjustments made. Proper operation of the equipment was then once more checked for one day before abandonning the stations. During the periods of manned operation in 1965 and 1966 enough hand-observed weather data were collected to allow reasonable comparison of individual parameter registrations between man-observed and automatically recorded weather data.

The enormous amount of data collected by the automatic stations every six minutes, i.e. 411,080 registrations representing six meteorological parameters recorded by the Mk II stations and 32,320 registrations representing two met-parameters recorded by the Pyrox-Summer stations, needs to be examined and compared in a proper manner to man-observed data. For climatological purposes, and particularly for this study, it is quite sufficient to make comparisons of parameters every six hours (W.M.O.,1966; Annex D, p.12). The amount of comparable data is thereby reduced to 8,430 separate six-hourly readings, representative for the intervening operation periods of 1965 and 1966.

The results are shown in the form of graphs which are extracts of the 39 tables given in Appendix A. The weather data collected by the automatic stations are contained in 57 tables in Appendix B, and graphs demonstrate the monthly trend of met-parameter registration. Furthermore, three particular periods are chosen in which man-observed data are compared graphically to registered station information. Hereby, synoptic weather data from the Joint Arctic Weather Stations Eureka and Isachsen are utilized.

III.1 The Synoptic Observation Programme

Main observations were made at regular six-hourly intervals: 0000, 0600, 1200 and 1800 hrs. Central Standard Time (GMT - 6 hours). The six-hourly synoptic routine was the following:

1) Reading of current temperature; reading and resetting of maximum and minimum thermometers; time check on thermohygrograph.
2) Reading of the dry- and wet-bulb temperatures of the aspirated psychrometer.
3) Reading of average wind run of previous six-hour period; reading of instanteneous 100-second wind speed; observation of prevailing wind direction.

4) Visual observation of cloud amounts, -types and their heights; observation of sky opacity, visibility and general weather conditions.

5) Reading of aneroid barometer or altimeter.

6) A double-Campbell Stokes sunshine recorder operated continuously at Base Camp. Its cards were changed twice daily at 0600 and 1800 hrs CST.

7) The rain gauge was checked at the six-hourly routine if precipitation had occurred.

III.11 Instrumentation

Temperatures were measured with ordinary mercurial glass thermometers. Fahrenheit readings were converted to degrees Centigrade. All temperature measurements were corrected by the use of their proper calibration cards. Haenni aspirated psychrometers were used for humidity measurements, and the dry-bulb temperature readings were used to check the thermohygrograph trace and the automatic station's temperature registration. Readings were taken in the shade to eliminate the possibility of error caused by direct radiation. On the average, two wet-bulb temperatures were taken and after calculation of the relative humidity percentage, the thermohygrograph trace and the station's relative humidity registration were checked.

Fuess cup anemometers with mechanical counters were used for wind run and wind speed measurements. Wind speed was measured over a time interval of 100 seconds. Using calibration graphs the registered wind speeds were corrected accordingly. The total wind run of the past six hours was compared to the wind run registered by the stations. The mean wind speeds in the six hour interval recorded by the stations were calculated and checked against the corrected average of two synoptic wind speed observations, made six hours apart.

The Fuess aneroid barometer, located at Base Camp (176 m a.s.l.) was set to approximate sea level pressure. A Thommen altimeter was used at Moraine Camp Ice for some of the pressure readings. Calibration checks of Mk II barometric pressure readings were made with the aneroid barometer. Both instruments are temperature compensated. A calibration card was used with the aneroid barometer. The altimeter has a relative accuracy of ± 5 m which corresponds to about ± 0.6 mb.

III.12 Manned Observation Periods

The hand-observed meteorological data were collected during three expeditions to Axel Heiberg Island. Observations were made at Base Camp and Moraine Camp Ice in the following intervening periods:

1965

Base Camp: 0000 CST July 22 to 1500 CST August 29.

Moraine Camp Ice: 0000 CST August 4 to 1800 CST August 26.

Met-data are available for 39 days at Base Camp and 23 days at Moraine Camp Ice.

1966

Base Camp: 0000 CST April 13 to 1800 CST June 2.

Moraine Camp Ice: 1200 CST May 22 to 1200 CST May 31.

Base Camp: 0000 CST August 22 to 1200 CST August 28.

Moraine Camp Ice: 1800 CST August 23 to 0000 CST August 25.

Observation period covered is 58 days at Base Camp and 11 days at Moaraine Camp Ice.

Consequently, 97 days with data from Base Camp and 34 days with data from Moraine Camp Ice are used to compare, re-calibrate and test the Automatic Climatological Stations.

III.13 Periods of Automatic Recording

Weather data recorded by the Pyrox-Sumner station at Base Camp and the Mk II stations, when they were operating for a short while at Base Camp, and thereafter at Moraine Camp Ice, are available for the following intervening periods:

1965

Base Camp:

Pyrox-Sumner station: July 27 to 30
August 14 to 17 *)
August 22 to 28 *)

*) no wind run and wind speed available for this period.

Mk II stations: July 29 to August 5

Moraine Camp Ice:

Mk II stations: August 10 to September 4 *)
September 4 to December 31 **)

*) no wind run and wind speed registration from August 11 to 23.
**) no temperature and rel.humidity registration in this period.

1966

Base Camp:

Pyrox-Sumner station: May 14 to 31
June 2 to 17
Dateless, summer: 19 days *)
August 22 to 28

*) through analysis found to be representative for the period June 20 to July 8.

Moraine Camp Ice:

Mk II stations: January 1 to May 23 *)
May 24 to 31
June 1 to August 24 **)

*) no temperature and rel.humidity registration in this period.

**) no wind run and wind speed registration in this period.

III.14 Extraction of Recorded Data

Data extraction and evaluation is very subjective and largely dependent on proper timer operation, which assures constancy in chart transport. The charts are transported from left to right; the recorded data are therefore read in the unconventional manner from right to left. Sections of chart are shown in Figs.III.1a, b and c.

In reading the charts it is important to establish a time reference check. For registrations made during the summer months, the burn-marks made at 12 noon on days the sun shone are used. During the manned observation periods descriptive marks were placed on the charts at the same time a six-hourly or six-minute synoptic observation was made. But for days of unattended operation and periods of no sunshine it is very difficult to determine the day or proper synoptic times on the charts. However, in measuring 10.2 cm (timer operation assumed normal) from the last burnmarkon a known date, a 12 noon (relative) time-fix can be made for any day without sunshine. After these time reference points are established, markers are equally and progressively spaced at about 2.5 cm intervals along the centre line of the chart. Each of the partitions so obtained represents an interval of six hours and, in turn, each marker represents the time check for the particular synoptic hour, either 0000, 0600, 1200 or 1800 hrs. CST.

The two-hourly divisions provided on the chart paper could not be used, because the noon reference burn did not necessarily fall on any of these division lines.

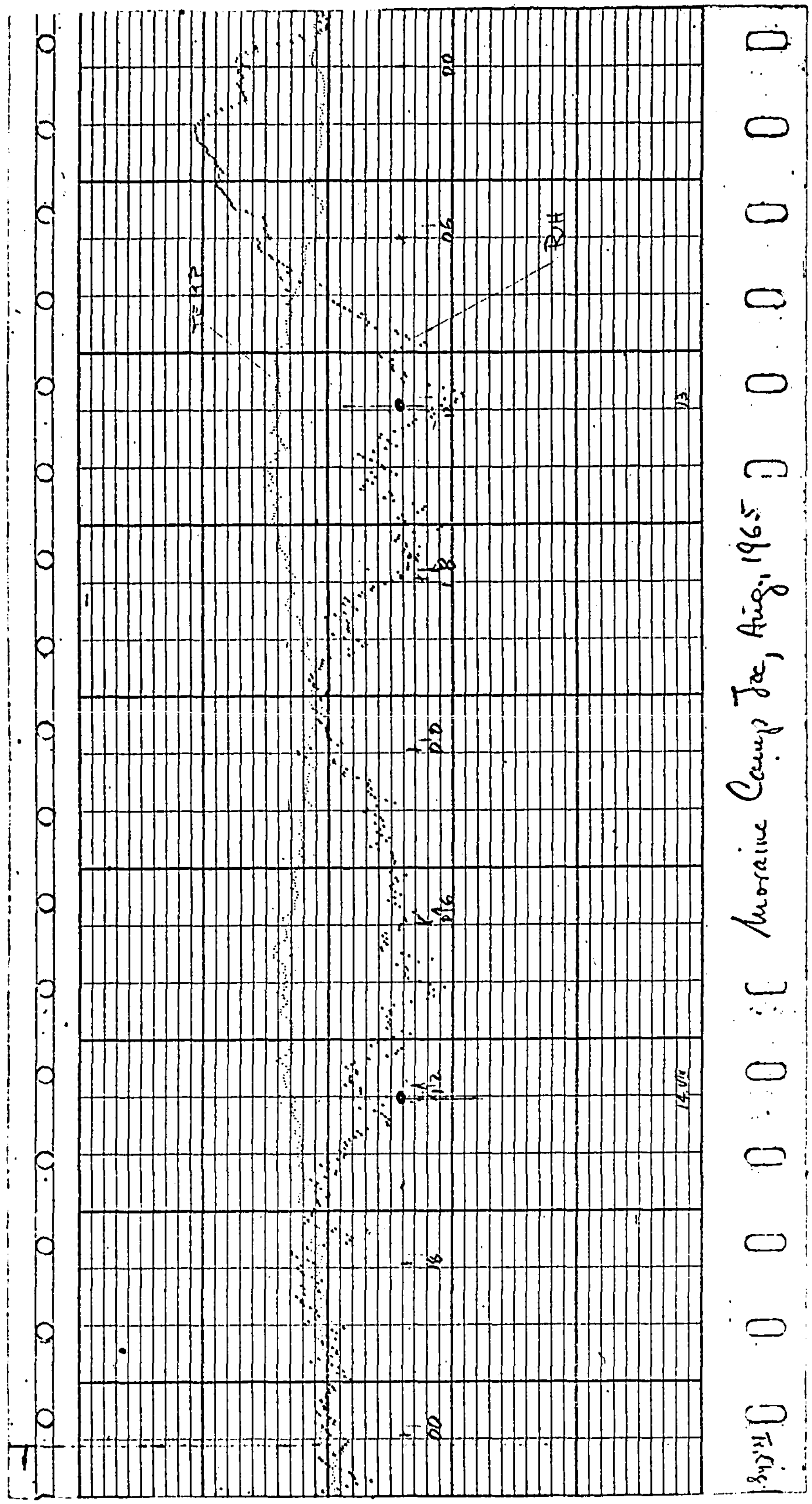


FIG. III. 1a: SECTION OF CHART, TEMP. & REL. HUMIDITY RECORD.

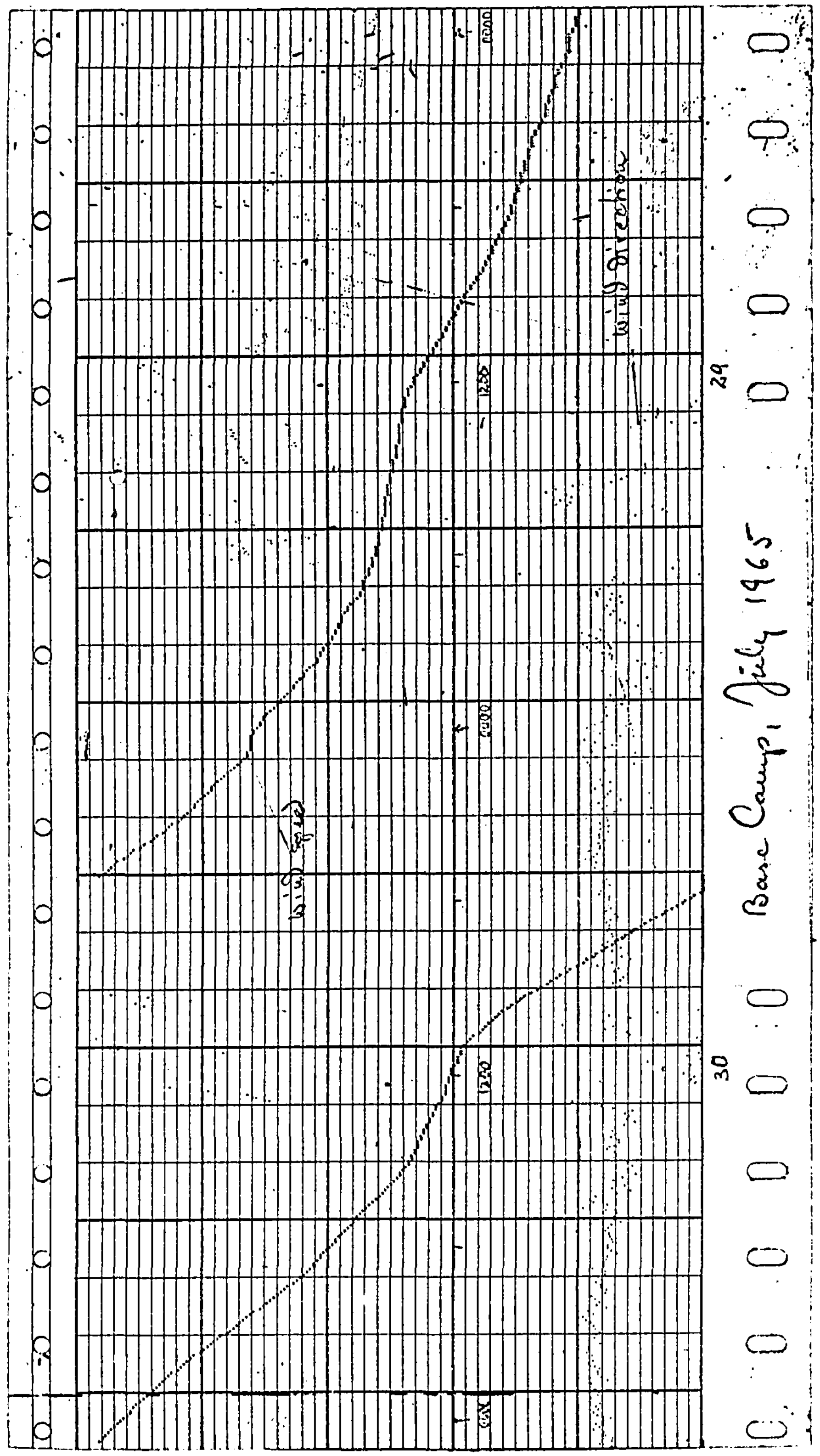


FIG III.1b: SECTION OF CHART, WINDSPEED & DIRECTION RECORD.

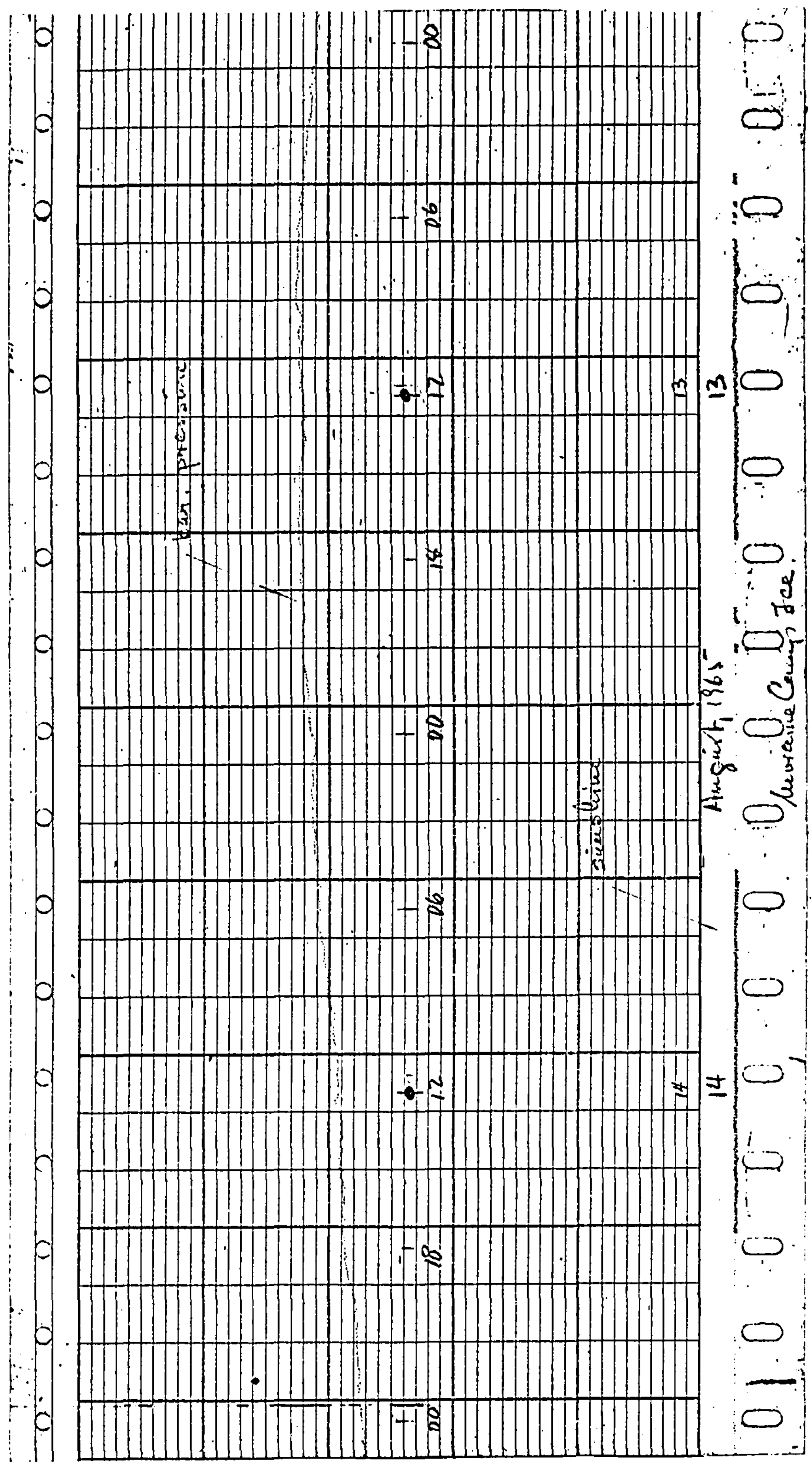


FIG III.1c: BAR.PRESSURE & SUNSHINE RECORD.

Registration of parameters is done at the same time, but due to horizontal displacement of the recording pens (characteristic of pen mechanism) registration is non-coincidental on the charts. The temperature (wind run) trace precedes the rel.humidity (wind direction) trace by the equivalent of one hour and fifteen minutes. Therefore, separate time markers have to be established for each trace on the charts. Since there are four individual, non-synchronized timers, it makes it necessary to place eight separate time reference points for every six-hourly observation, i.e. a total of 8,430 points had to be established.

Finally, it is possible to read the four six-hourly values of temperature, rel.humidity, wind run and wind speed (calculated), wind direction, bar.pressure, and sunshine (total count of all six-minute intervals) for each day from the charts. Nevertheless, these individual readings have yet to be corrected, and the following text will describe how this was done. At first, pre-calibrated cards were used to make fast extraction from the charts. These cards produced inaccurate results and the idea was abandonned to be replaced by the better method described below.

Temperature: The number of vertical divisions on the chart, coincident with time markers, are counted starting at the base of the chart. It is necessary to make an educated guess on the tenth of divisions. By using the pre-calibrated and corrected temperature graph (obtained through test and calibration of stations in the field) shown in Fig.III.2, the counted number of divisions is entered along the ordinate and the correct temperature is read along the abscissa of the graph in whole degrees. Again it is necessaby to make a guess on the tenths of degree Centigrade. The same procedure is followed for determining the maximum and minimum temperature of each day.

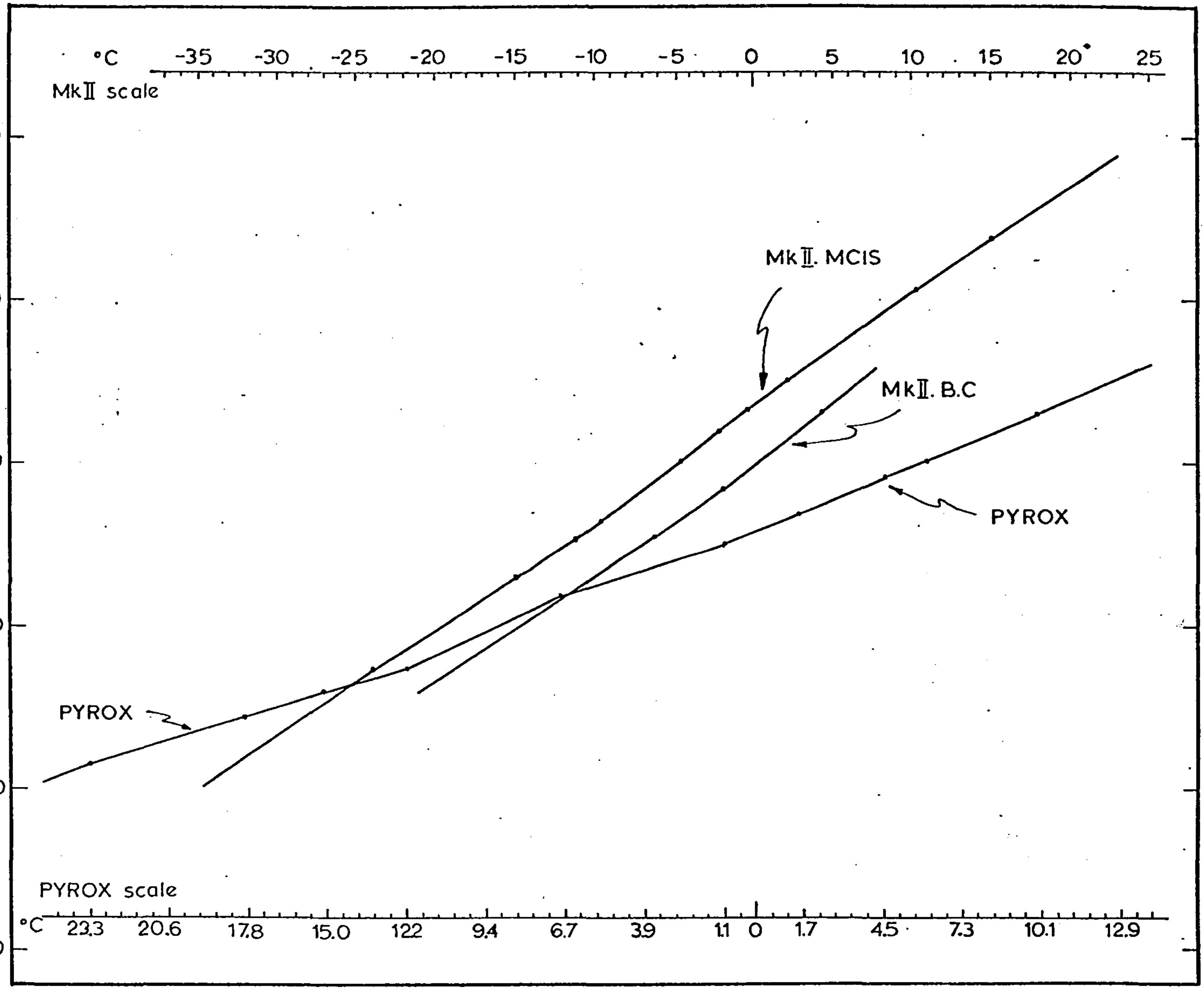


FIG III.2: TEMPERATURE CORRECTION & CALIBRATION.

Relative Humidity: This value is read directly from the chart record, whereby one vertical division represents 2 % rel.humidity; the proper read-off is to the right of the temperature trace. No calibration graph was used and it is assumed that the extracted values are within expected accuracy limits.

Barometric Pressure: This parameter is by far the easiest to extract. One vertical division equals 1 mb , and the tenths of millibars have to be interpolated. Pressure values, as presented in Appendix B, are relative to 880 $\pm$ 5 m a.s.l. Because the Mk II stations moved down-glacier and were lowered by two meters in 13 months, correction was made towards the end of the record by adding 0.1 to 0.3 mb to the read-off values. Since there are no abrupt variations in pressure, the systematic error becomes negligible.

Sunshine Duration: The number of solid dots made every six minutes, indicating that the sun was shining, are observed. Therefore, the number of solid dots minus one (n - 1) times six minutes yields in general the total amount of sunshine for a given day. These values are converted to hours and tenths.

Wind Speed and Wind Run: The slope of the wind trace indicates how strong the wind was blowing. The difference between vertical divisions fifteen minutes before and after the proper synoptic hour is representative for the wind speed per one-half hour. Using the anemometer calibration graph (Fig.III.3) and the correction and conversion chart in Table IV.56 (Appendix B), the correct wind speed in miles per hour is determined. This value is converted to meters per second. At least 10 cm of wind within one-half hour had to be registered, otherwise calm winds were listed.

Wind run is obtained by measuring the number of vertical divisions traversed by the pen in 24 hours. Each minor vertical division represents 6.4 km of wind run. The calibration graph is again used for correction of daily wind run.

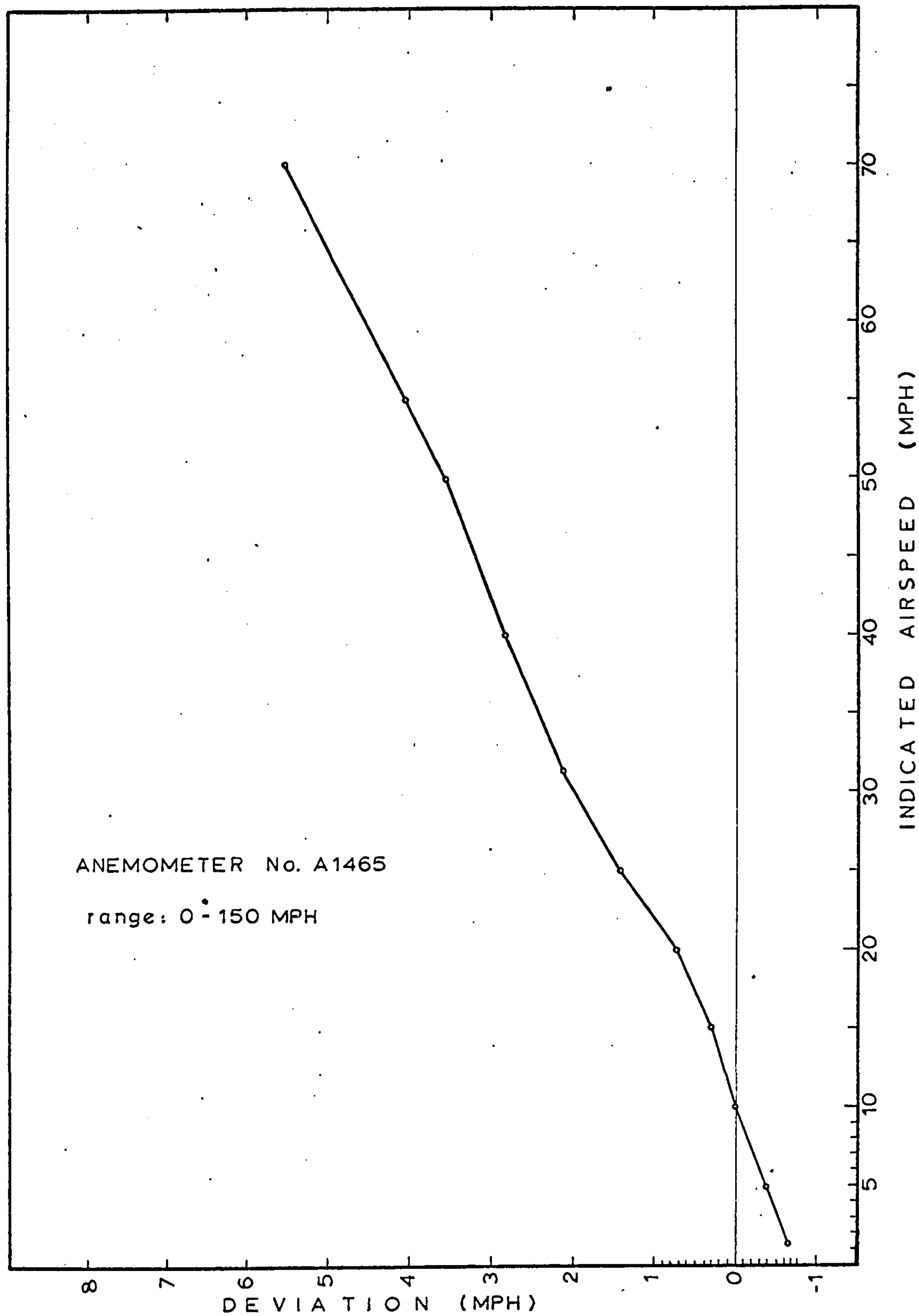


FIG III.3: ANEMOMETER CALIBRATION, Mk II RECORDER.

<u>Wind Direction:</u> An average of the number of minor vertical divisions is taken 15 minutes before and after synoptic time. Wind direction is given in Neugrad (0 - 400^g) as obtained by using Table IV.57 (Appendix B). This table also shows values of conventional wind direction.

Reading the charts and evaluation of registrations is tedious and time consuming. The values were read off the charts and recorded by use of a tape recorder. Through play-back of the tapes each registered value could be corrected. The correct values were transferred unto another tape. This retaped version was then transferred on McGill Computer Forms. To complete the cycle of extraction, the tabular values were cross-checked with the corrected tape recordings. Unfortunately, because of the unevenly distributed gaps in the data, the computer programme became almost as lengthy as the available data. It would have taken as long to make a computer programme, which is relatively simple to operate as it did to compute all the arithmetic values by hand.

III.2 Presentation of Man-Observed Weather Data

The presentation of the weather data follows the standard pattern of earlier Axel Heiberg expedition reports. In this way unity in data storage is preserved, and the results serve as a means of verification and as a reference for additional data. To discuss the weather elements in great detail would lead away from the main topic of this thesis. Weather phenomena will be treated in general and emphasis is placed only on outstanding occurrances in the weather pattern.

Mean-daily values were computed from the four six-hour observations. The daily-means were derived by the costumary formula: maximum plus minimum devided by two. This mean value was found to overemphasize the mean-daily values, which are regarded to be more representative

(Arnold and Mackay, 1964). 5-day running means were computed from the mean-daily values. In addition, monthly means were calculated for the four separate synoptic times and also for the mean-daily and daily-mean values.

III.21 Weather Elements of 1965

The synoptic records for the days of observation at Base Camp and Moraine Camp Ice are in most cases complete. In cases, where synoptic observations were not made, readings of temperature and rel.humidity were taken from the thermohygrograph records.

Figs.III.4a and b show the maximum, minimum and mean-daily air temperature and rel.humidity at Base Camp. The presentation of the temperatures and rel.humidity at Moraine Camp Ice is shown in Fig.III.5.

At first glance it may appear that in August the temperature trend between the two meteorologicla sites was common. Closer examination of the extracts of temperatures and rel.humidities demonstrates that this was not quite the case.

Extracts of Temperature (°C) and Rel.Humidity (%) data, 1965

Air temperature (°C) screen at 170 cm	Base Camp July (22-31)	Base Camp August (1-29)	Moraine Cemp Ice Station August (4-26)
Highest maximum	12.8 (24th)	15.2 (3rd)	12.0 (9th)
Mean daily maximum	7.7	6.9	5.1
Lowest maximum	3.3 (28th)	-1.3 (29th)	2.0 (20th)
Highest daily mean	9.2 (24th)	11.9 (3rd)	5.6 (4th)
Mean of daily-mean	4.7	3.9	0.7
Lowest daily-mean	1.5 (28th)	-2.0 (29th)	-2.8 (20th)

continued

Air temperature (°C) screen at 170 cm	Base Camp July (22-31)	Base Camp August (1-29)	Moraine Camp Ice Station August (4-26)
Highest mean-daily	9.3 (24th)	13.0 (3rd)	5.7 (4th)
Mean of mean-daily	4.6	3.7	0.2
Lowest mean-daily	1.6 (28th)	-2.1 (29th)	-3.6 (18th)
Highest minimum	5.6 (24th)	8.5 (3rd)	2.6 (4th)
Mean daily minimum	1.6	0.8	-3.8
Lowest minimum	-0.5 (27th)	-2.8 (29th)	-8.5 (19th)

Rel. Humidity (%) screen at 170 cm	Base Camp July (22-31)	Base Camp August (1-29)	Moraine Camp Ice Station August (4-26)
Highest maximum	100 (several)	100 (several)	
Mean daily maximum	88	96	
Lowest maximum	70 (24th)	68 (3rd)	
Highest mean-daily	97 (28th)	98 (26th)	91(19th,20th)
Mean of mean-daily	78	85	79
Lowest mean-daily	60 (30th)	54 (3rd)	62 (9th)
Highest minimum	92 (28th)	91 (28th)	
Mean daily minimum	60	69	
Lowest minimum	42 (23rd)	35 (8th)	

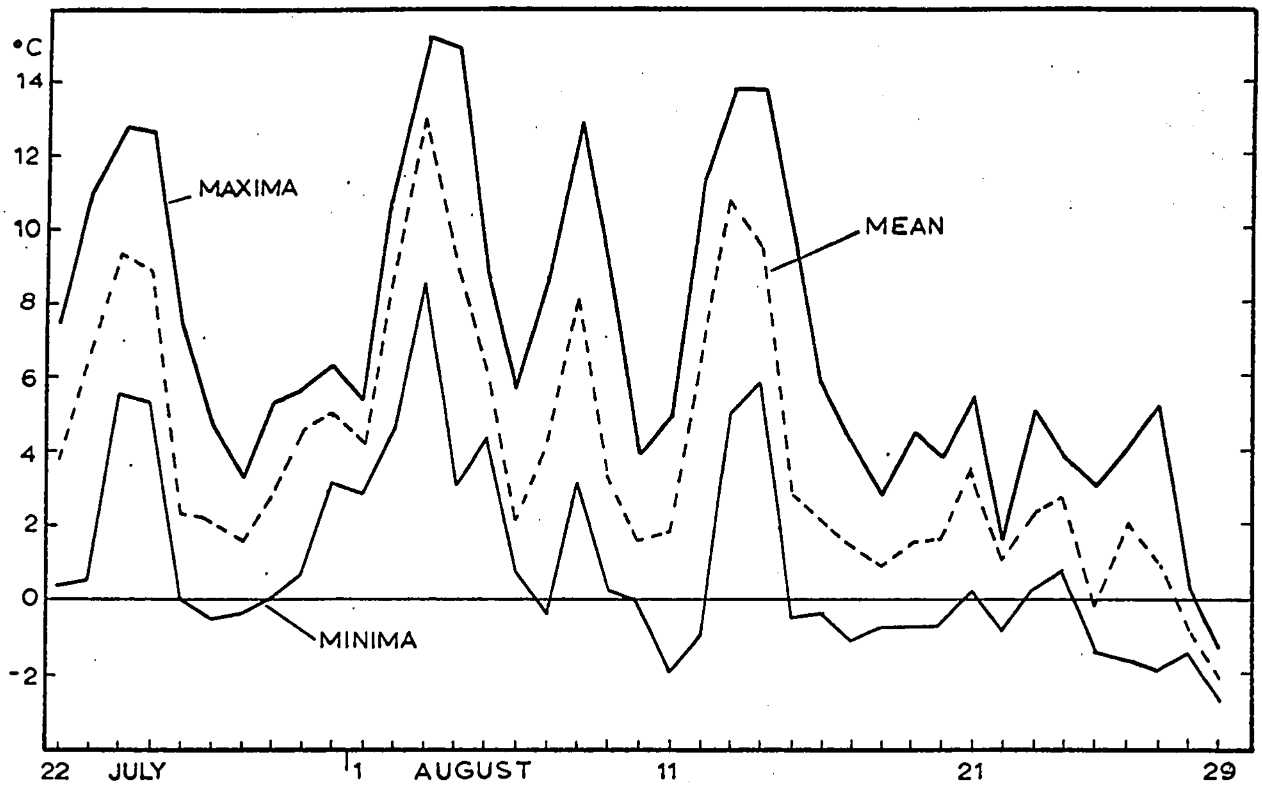


FIG III.4a: MAX., MIN., and MEAN TEMPERATURES, BASE CAMP, 1965.

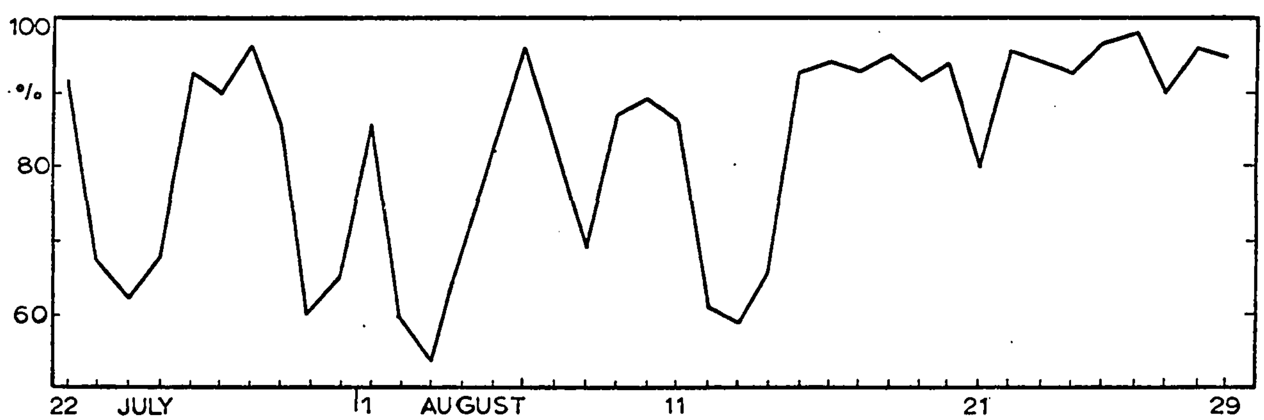


FIG III.4b: MEAN RELATIVE HUMIDITY, BASE CAMP, 1965.

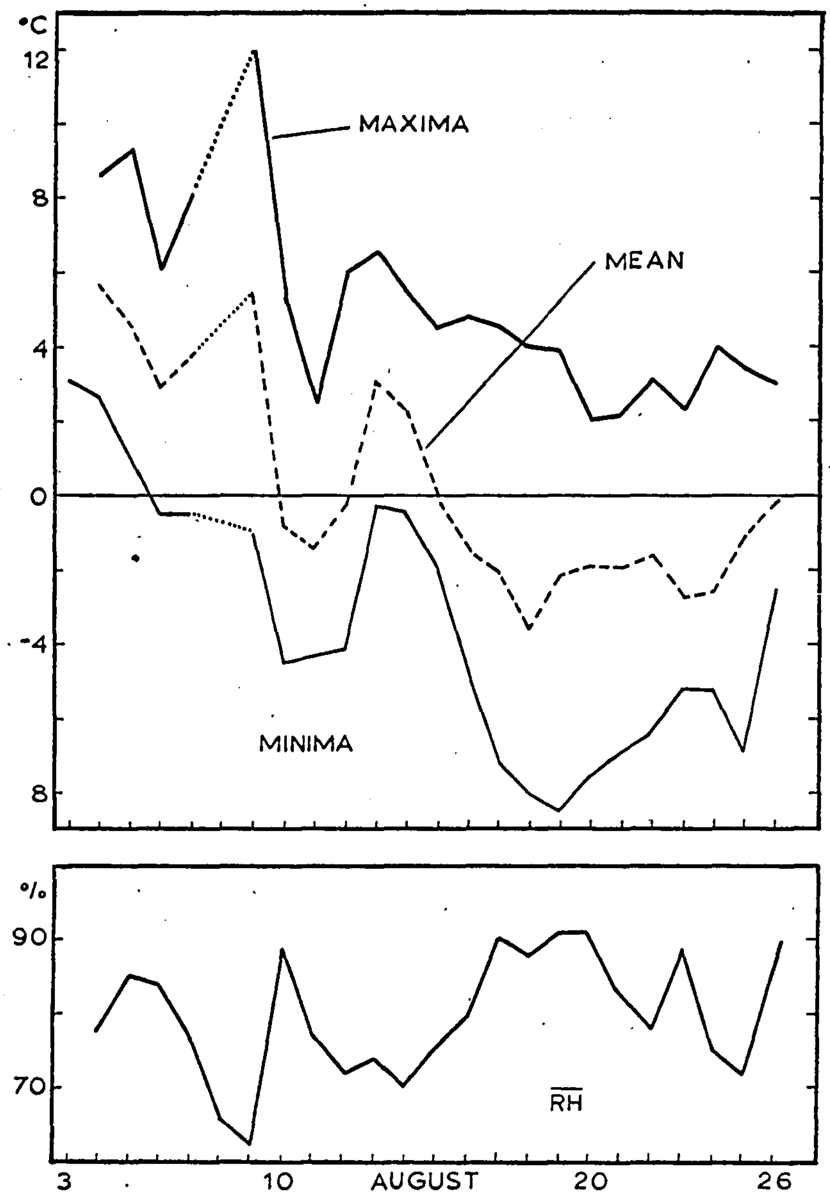


FIG III.5 MAX., MIN., MEAN TEMPERATURES and MEAN REL. HUMIDITY, MORAINE CAMP ICE, 1965.

Apart from lower temperatures and rel.humidities at Moraine Camp Ice - and this is to be expected as much as is the general decrease in temperatures towards the end of the season - it is interesting to note the one day lag in the values of highest mean-daily, daily mean and minimum temperatures at Moraine Camp Ice on August 4. Climatologically of importance, this singular occurance will not be discussed here.

The mean-daily values of bar.pressures, adjusted to sea level, and wind speed, as well as the observed hours of bright sunshine are plotted in Fig.III.6. Sparse data were collected at Base Camp during the installation of the Mk II stations and not much more synoptic information is available for Moraine Camp Ice in the period thereafter. The intervals for which no data are available at Base Camp indicate the intervals in which observations were made at Moraine Camp Ice. Synoptic data from Moraine Camp Ice are not presented graphically, but can be found in tabular form in Tables III.30 and 32 in Appendix A.

Pronounced foehn conditions occurred during the following days: July 23 to 25 (anticyclonic), August 3 to 4 (anticyclonic), August 8 to 9 (cyclonic), and August 12 to 14 (transitional). In glaciated areas, and particularly in the High Arctic, these special weather situations are of exceptional importance in the treatment of glacio-climatic relationship. The three types of foehn have unique characteristics and some of these are described by Mueller and Roskin-Sharlin (1967, p.35). All graphical presentations show the foehn conditions very well, basically as a sharp increase in temperatures and rapid decrease in rel.humidities, whereby high, gusty winds prevail. Highest mean-daily wind speeds were observed on days of anticyclonic foehn conditions, giving rise to low cloudiness (Tables III.7, 8 and 31) and much bright sunshine. The percentage of sunshine as calculated for Base Camp is given in Table III.37. August 14 was the only day within the 39-day period with 100 % sunshine at Base Camp site.

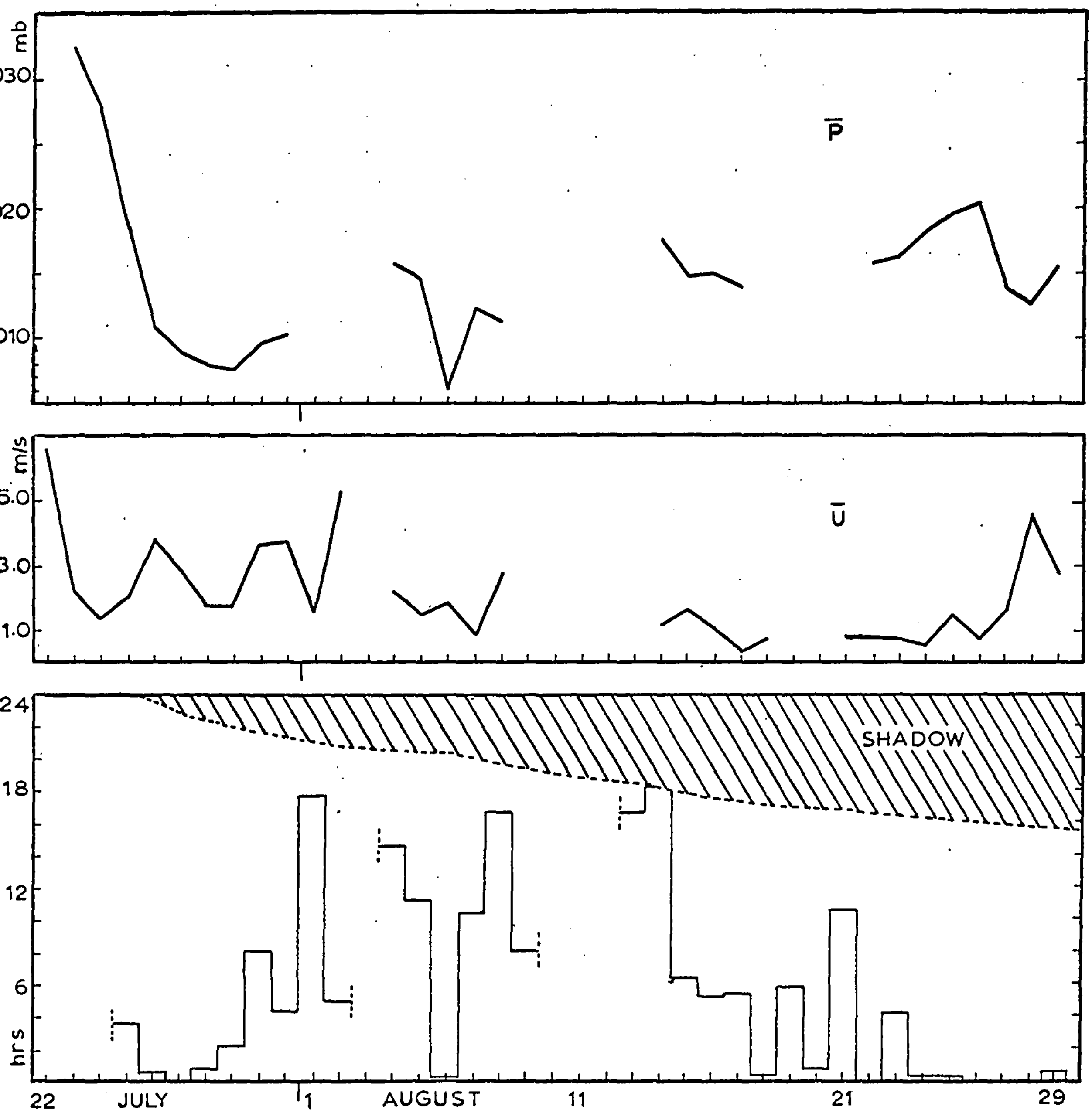


FIG. III.6: MEAN BAR. PRESSURE, MEAN WINDSPEED and BRIGHT SUNSHINE, BASE CAMP, 1965.

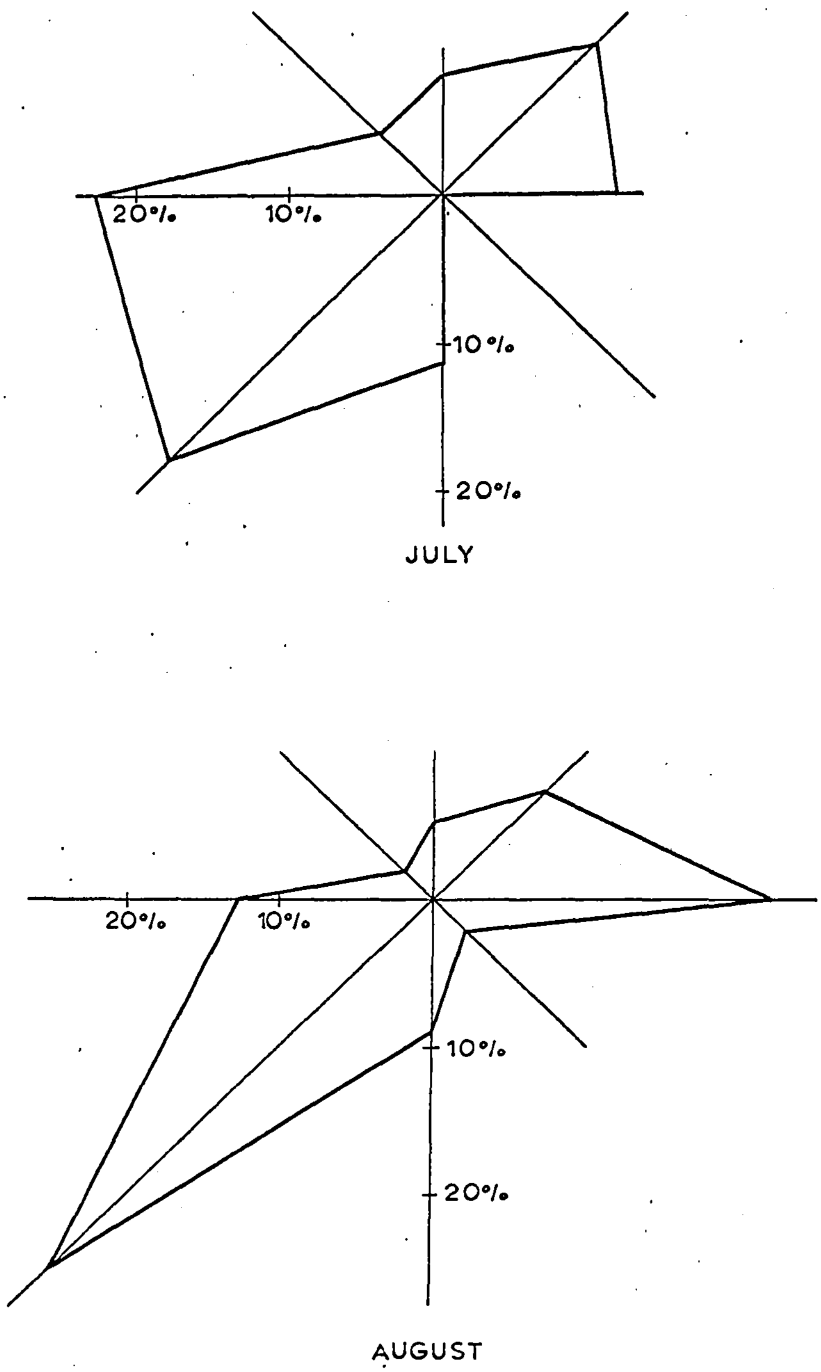


FIG III.7: WINDROSES, BASE CAMP, 1965.

Fig.III.7, representing the wind roses, shows that during August 1965 more easterly (21.7 %) and predominantly more south-westerly (35.8 %) winds were blowing at Base Camp than in the latter half of July. Wind directions at Moraine Camp Ice were most common from the northwest and north and represent, apart from the foehn influences, in most cases the "channeled" catabatic glacier wind.

III.22 Weather Elements of 1966

Complete records for Base Camp are available from April 13 to June 2. However, not enough synoptic data were collected at Moraine Camp Ice during this time to allow a similar comparison as is done for 1965. Unfortunately, the stay at Axel Heiberg Island in August 1966 was too short to collect continuous data at both sites to make a reasonable comparison and graphical presentation of the synoptic elements. But the Tables III.14, 18, 33 to 36, and 38 give spot observations carried out throughout these periods.

From the glacio-climatological stand point of view it can be said that the weather elements presented for 1965 reflect, in a conservative manner, the climatic behaviour encountered in the late stages of ablation or glacier-melt, whereas the following presentation of the weather (Fig. III.8, 9, 10) demonstrates the climatic behaviour during the period prior to the onset of melt in 1966.

During April 13 to June 2 the mean-daily temperatures progressed in a gradually increasing, steplike profile from $- 30.1^{o}C$ to $+ 1.8^{o}C$. Notably the latter half of April was three times colder than the month of May. The mean-monthly rel.humidity was less fluctuating in April. Fig.III.8 shows these behaviours in detail, and the extracts of temperatures and rel.humidities given below present an overall summary.

Extracts of Temperature (°C) and Rel.Humidity (%) data, 1966

Air temperature (°C) screen at 170 cm	Base Camp April (13-30)	May (5-31)
Highest maximum	-10.6 (21st)	3.4 (29th)
Mean daily maximum	-19.8	- 4.2
Lowest maximum	-24.7 (17th)	-13.8 (5th)
Highest daily-mean	-13.8 (21st)	1.1 (31st)
Mean of daily-mean	-24.2	- 8.1
Lowest daily-mean	-27.6 (17th)	-16.9 (5th)
Highest mean-daily	-13.2 (21st)	1.8 (29th)
Mean of mean-daily	-24.5	- 8.2
Lowest mean-daily	-30.1 (18th)	-17.3 (5th)
Highest minimum	-17.0 (21st)	- 1.0 (31st)
Mean daily minimum	-28.5	-12.1
Lowest minimum	-32.3 (19th,20th)	-20.6 (6th)

Rel. Humidity (%) screen at 170 cm		
Highest mean-daily	96 (13th)	97 (24th)
Mean of mean-daily	84	84
Lowest mean-daily	70 (21st)	66 (9th)

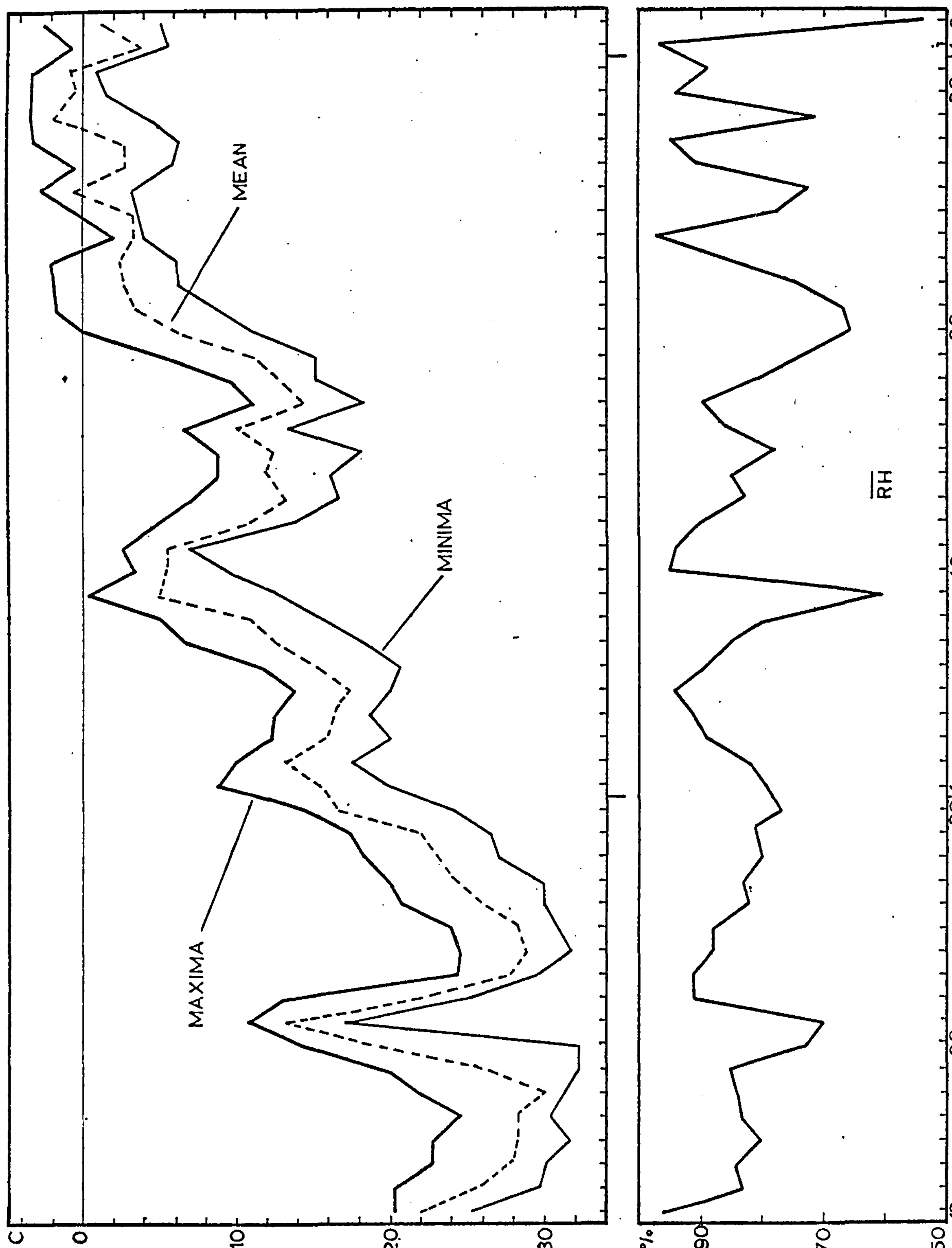


FIG III.8: MAX., MIN., MEAN TEMPERATURES and MEAN REL. HUMIDITY, BASE CAMP, 1966.

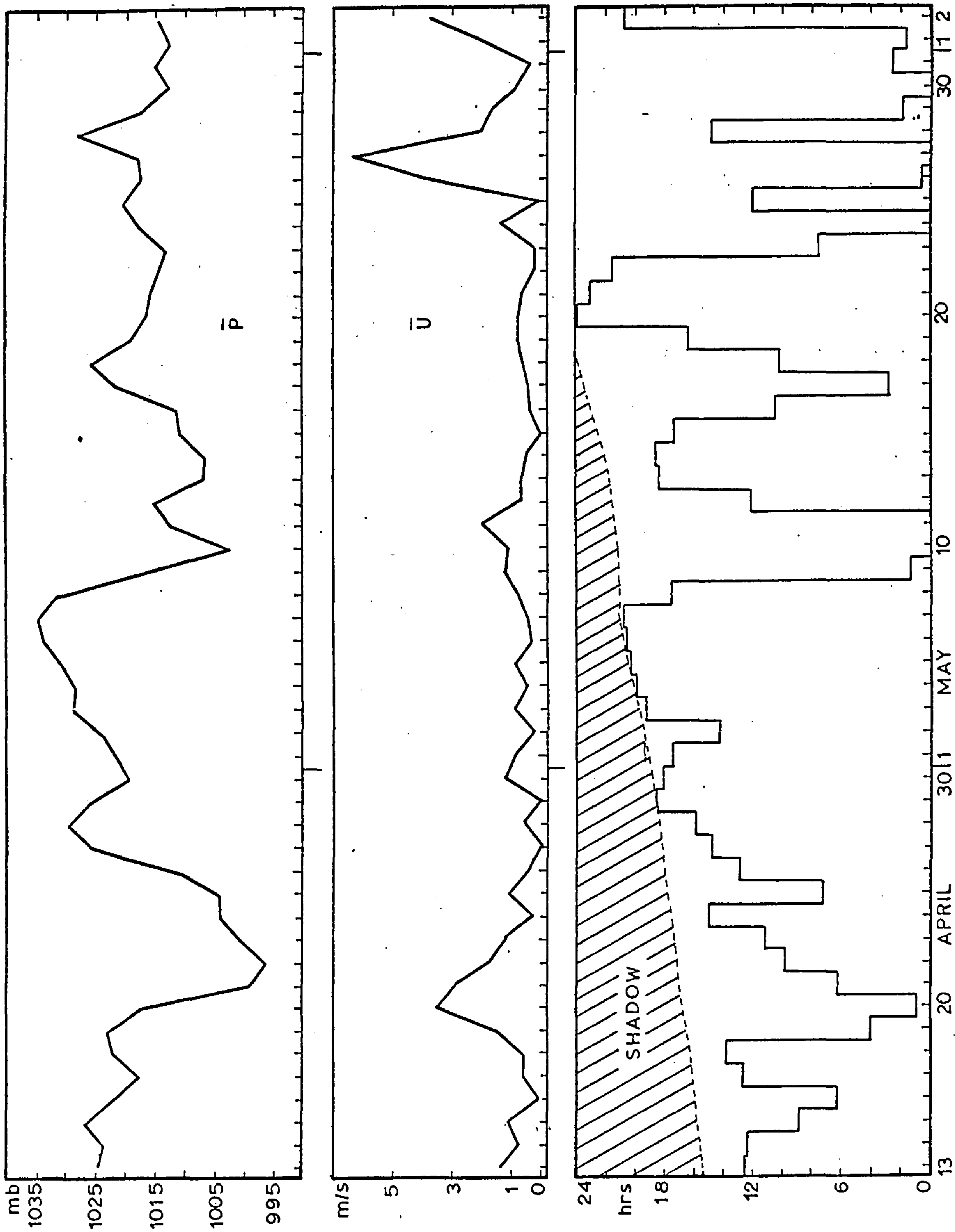


FIG III. 9: MEAN BAR. PRESSURE, MEAN WINDSPEED and BRIGHT SUNSHINE, BASE CAMP, 1966.

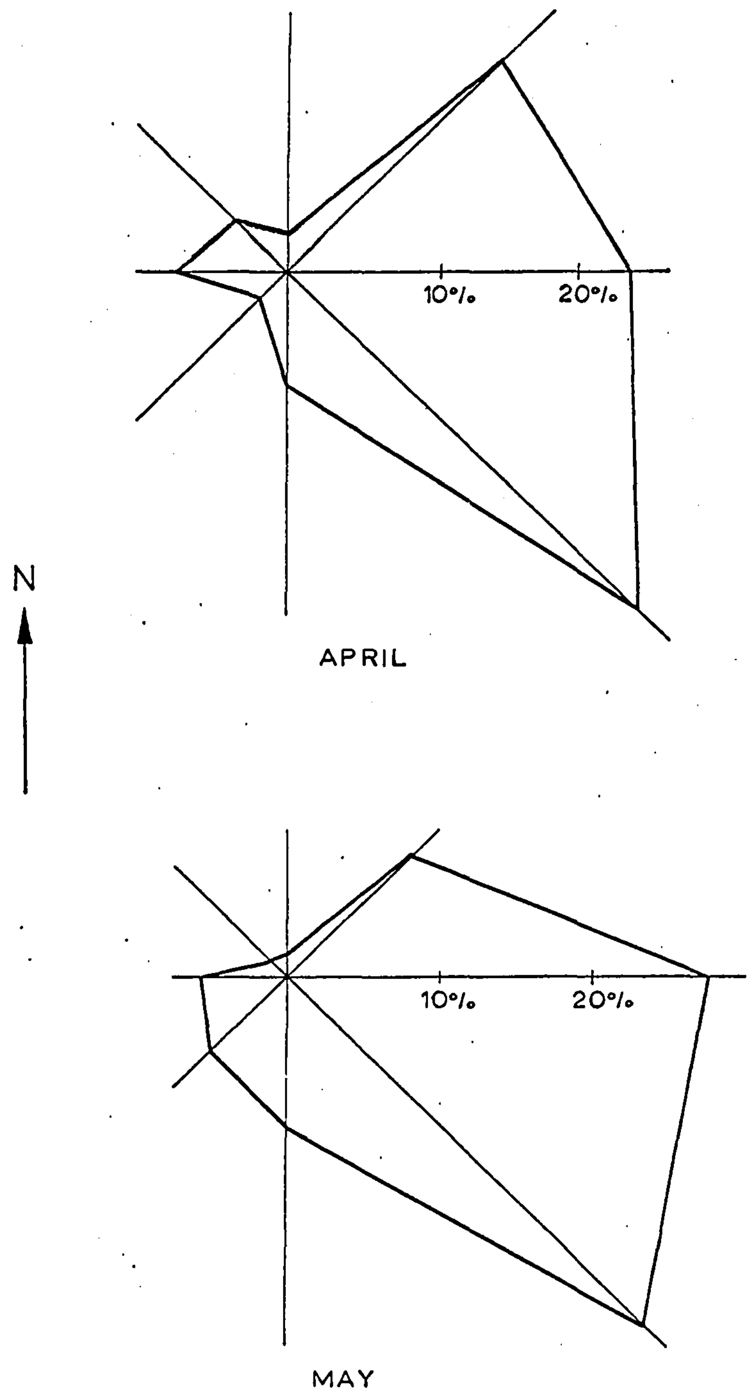


FIG III.10 WINDROSES, BASE CAMP, 1966

The plot of mean-daily pressures in Fig.III.9 shows that the general increasing trend is marked by the passing of a series of high and low pressure cells. The predominant broad high, lasting from April 27 to May 7, brought fine weather to the area with maximum possible sunshine and moderate winds. The intervals of low pressures for April 19 to 22 and May 7 to 10 are associated in both cases with high winds from north and heavy clouded skies which brought some precipitation in form of snow. In each of these three day intervals temperatures rose very rapidly (13° and 8° C respectively), as the rel.humidities dropped abruptly (15 % and 26 % respectively) to return afterwards to their former range of mean-daily values. This behaviour in parameter fluctuation suggests the influence of a cyclonic foehn.

A storm which occurred on May 26 and 27 will be discussed in a later section.

The wind roses for Base Camp, shown in Fig.III.10, indicate that most winds blew from the southeast. The cyclonic foehn period in April overemphasizes the northeast component of wind direction to some extent as this wind rose is representative for the latter half of April, only.

III.3 General Presentation of Automatically Recorded Weather Data

The Pyrox-Sumner station did not operate continuously over a longer time period. And, therefore, the recorded data by this station are not presented in this section in graphical form. Tables III.6 to 17 contain all the pertinent information.

Instead of reproducing six-hourly or daily values of the registered parameters, which are in fact available at six-minute intervals on the strip-charts, the presentation of Mk II station data is given in graphical form representing mean monthly abstracts.

Figs.III.11 and 12 merely show how the stations "observed" the weather elements. A more detailed presentation of these observations is left to a later section (see III.4). On the basis of the 5-day running mean, temperatures remained above the freezing point from June 29 until August 19, 1966. The sharp increase in temperatures was introduced by a pronounced anticyclonic foehn influence on June 18. Highest temperatures were recorded in July. The mean monthly rel.humidities increased slightly from May (77 %) to July and August (80 % in both cases).

May was the sunniest month with 419.8 hrs. of bright sunshine bathing the glacier surface at Moraine Camp Ice. June and July followed with 386.7 and 391.3 hrs. respectively, whereupon August (comparable in reality to May) brought only 135.4 hours of bright sunshine. The dotted line in the sunshine graph is an interpolation of values for the intervening 10 days in March.

Higher bar.pressures are to be expected in the High Arctic during the winter months. The low, mean monthly values recorded in September and December 1965, experienced also at the arctic stations Eureka, Isachsen and Alert (82°N, 62°W), are probably anomalous to the general pressure pattern for these times. After lowest pressures were recorded in December, they increased steadily only to be interrupted by lower pressures in June 1966.

The highest mean monthly wind speed was calculated for November 1965 at 4.1 m/sec., the highest mean-daily wind of 12.7 m/sec. was registered on January 30, 1966, whereby the highest wind speed of 19.4 m/sec. was recorded at local noon on that day. In general, winds were strong throughout the winter months. A sharp decrease in wind speeds occurred in April. In the 24 days of recording in May, 15 calms occurred at synoptic times, which represent 47 % of all calms for the entire registration period of nine months.

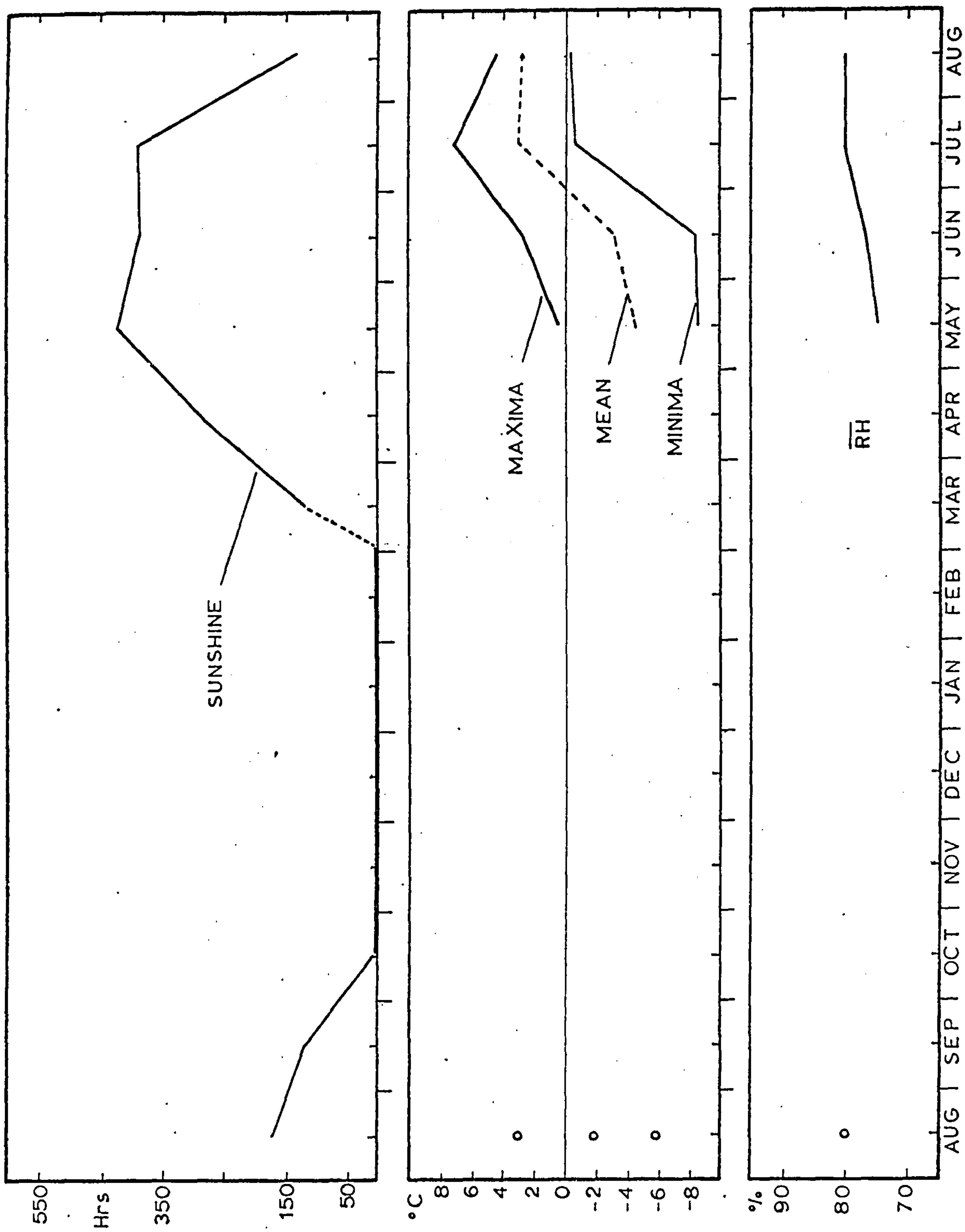
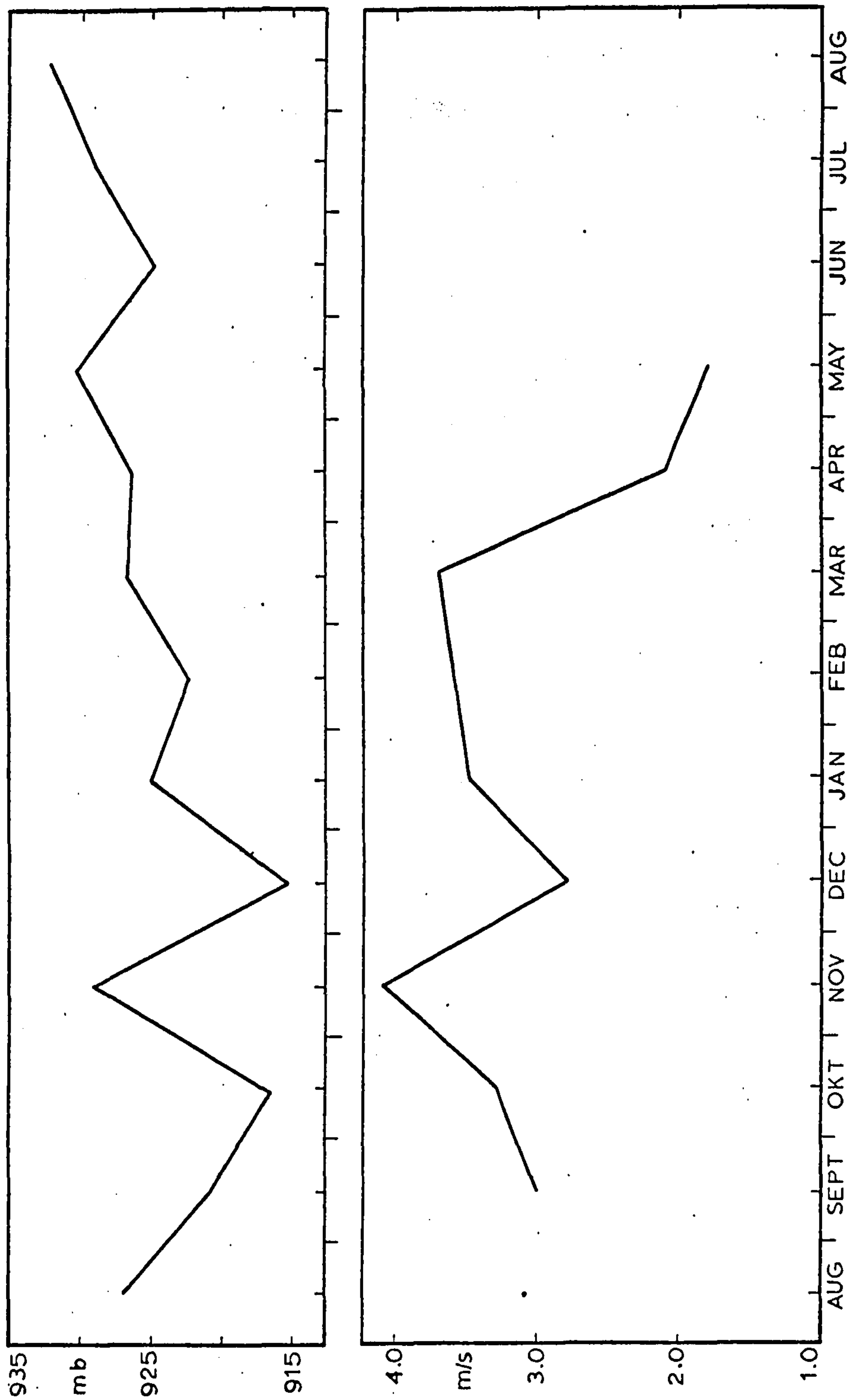


FIG III.11: TOTAL HOURS OF SUNSHINE, MAX., MIN., MEAN TEMP. and MEAN REL. HUMIDITY, MORAINE CAMP ICE, 1965 - 1966.



FIGIII.12 MONTHLY MEAN BAR.PRESSURE and MEAN WINDSPEED, MORAINE CAMP ICE, 1965 - 1966.

III.4 Operation of Stations under Different Weather Conditions

Met-parameter behaviour at Axel Heiberg Island can - only indirectly - be compared to synoptic observations made at the Joint Arctic Weather Stations.Eureka (80°N, $85^{\circ}56'$W) and 7 m.a.s.l. is situated about 100 km to the east on North Ellesmere Island. Isachsen ($78^{\circ}47'$N, $103^{\circ}32'$W) and 30 m.a.s.l. is positioned about 300 km to the west on Ellef Ringnes Island. The only purpose in using synoptic data supplied by these stations is to outline a general climatic pattern for the region, which is associated with the 500 mb and 1000 mb analysed pressure maps (Deutscher Wetterdienst, Zentralamt Offenbach, Germany: Täglicher Wetterbericht). There is, at times, parallelism in the synoptic tendencies of both Joint Weather Stations in relation to the man-observed elements at Axel Heiberg Island. But it would be premature to compare in detail at this stage the operation of the automatic stations to any information other than the man-observed data collected within the local climatic environment.

The three periods abstracted from the continuous operation pattern are chosen in such a way as to show the operation of all four automatic stations "side-by-side" in one locality (Base Camp) 1965, under a foehn condition (Period A), the operation of the Mk II stations on the glacier and the Pyrox-Sumner station at Base Camp under foehn and bad weather conditions in 1965 (Period B), and finally, the stations' behaviour at these separate locations under the influence of a storm in 1966 (Period C).

In all diagrammes the course of parameter variations representative for the compared station records are the following:

————	(heavy)	Mk II station
————	(light)	synoptic, Moraine Camp Ice
- - - - - - -	(heavy)	Pyrox-Sumner station
- - - - - - - -	(light)	synoptic, Base Camp
-·-·-·-·-		synoptic, Eureka
············		synoptic, Isachsen

Period A (July 27 to August 5, 1965)

The mean sea level pressure distribution for August 3 is presented in Fig.III.13. This pattern is representative for the better portion of the period and indicates that Axel Heiberg Island was under an easterly-northeasterly air flow. This flow pattern is particularly conducive to generation of foehn conditions. The thickness pattern 500/1000 mb (Deutscher Wetterdienst, Offenbach, no.125, p.3; 1965) shows that warm air masses were situated over the northern part of Greenland, whereas cool air was associated with the cyclones south-southwest of Axel Heiberg Island. Weatherwise the Expedition Area lies in a northeast to southwest corridor.

The course of the mean-daily temperatures is compared in Fig. III.14. The common trend is apparent, and under foehn conditions temperatures (rel.humidities) at Axel Heiberg Island are always higher (lower) than at Eureka or even Isachsen. Prior to August 2 the automatic temperature registration shows little deviation from the synoptic observed at Base Camp. During the foehn, however, Mk II-T/H station records higher temperatures - a hysteresis effect which will be discussed later. Remarkable is the small deviation in rel.humidity registration between automatic and man-observed methods. Greatest deviation (+ 3 %) took place after the foehn (August 5), when temperatures decreased rapidly and winds dropped off. This is possibly caused by the lack of ventilation of the rel.humidity sensor of the Mk II station.

The automatic pressure registration follows a close pattern with very little deviation from the synoptically observed (Fig.III.15). It is, however, apparent that pressures were registered somewhat higher (about 1.0 mb) at Axel Heiberg Island during the foehn period (see Fig.III.13). Pressure values observed at Base Camp are not subjected to pressure reduction procedures commonly carried out at the Joint Arctic Weather Stations and this inconsistancy leads to different pressure records, especially when temperatures are different.

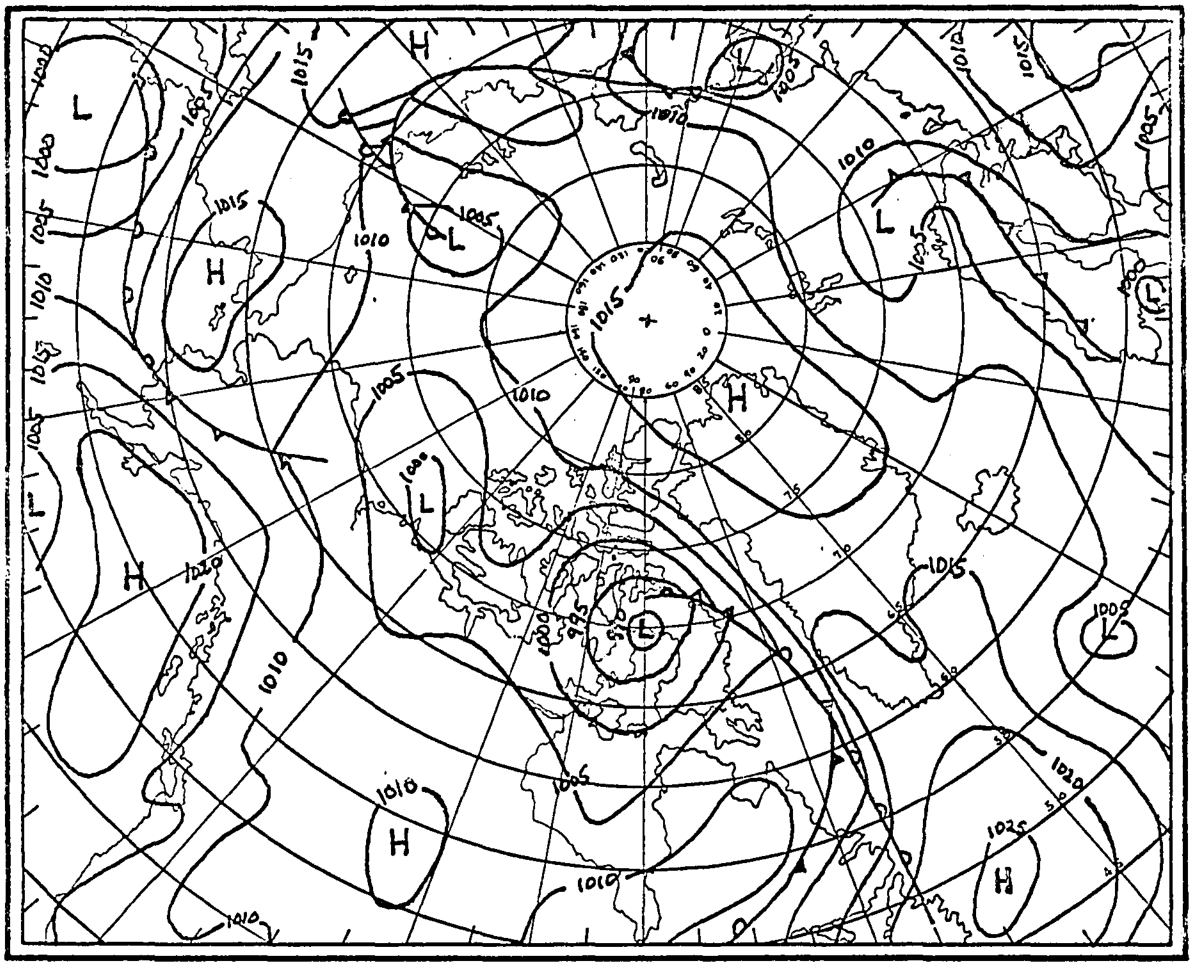


FIG. III.13: SURFACE PRESSURE PATTERN, AUGUST 3, 1965; 0000 GMT

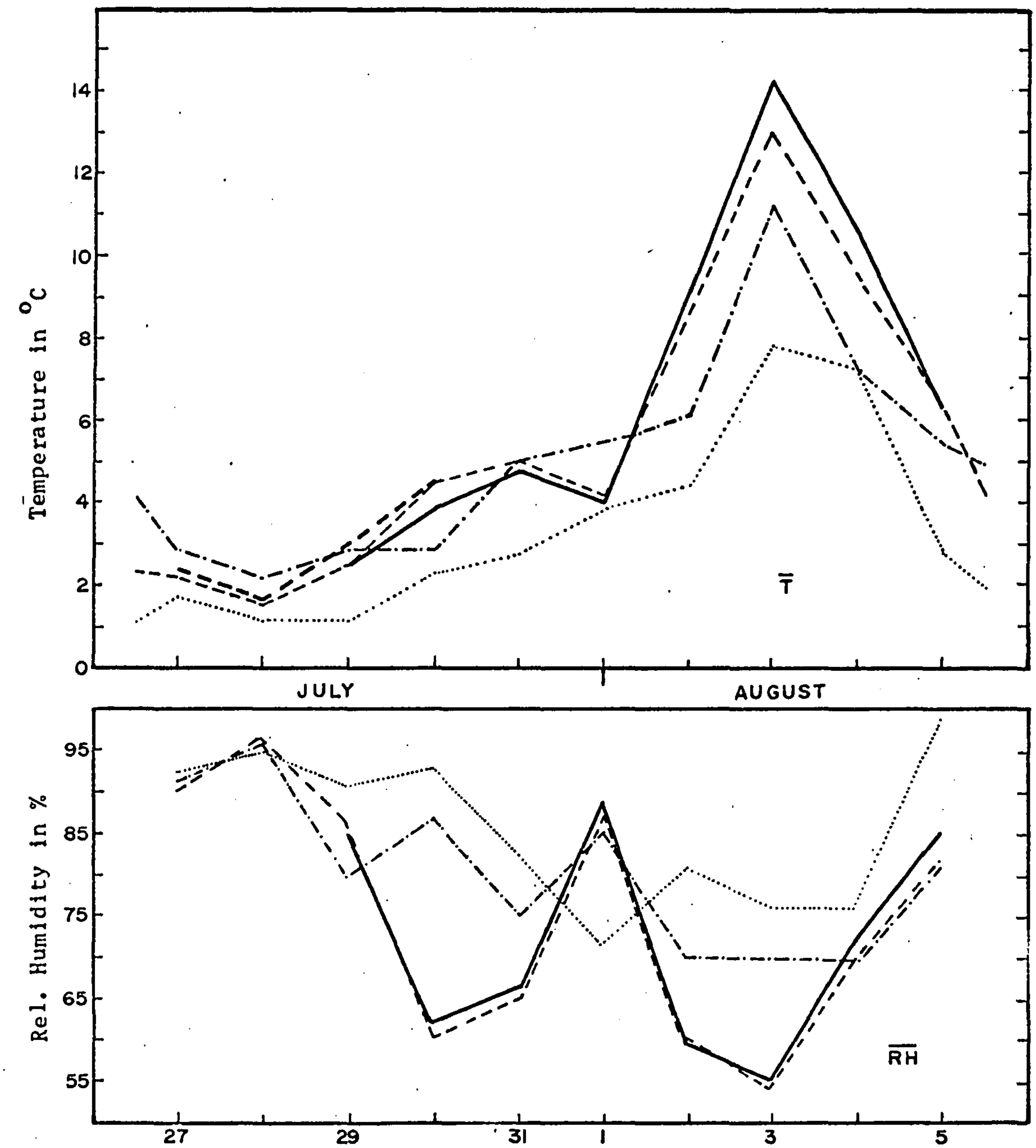


FIG. III. 14: COMPARISON, PERIOD A; MEAN DAILY TEMPERATURES AND REL. HUMIDITIES

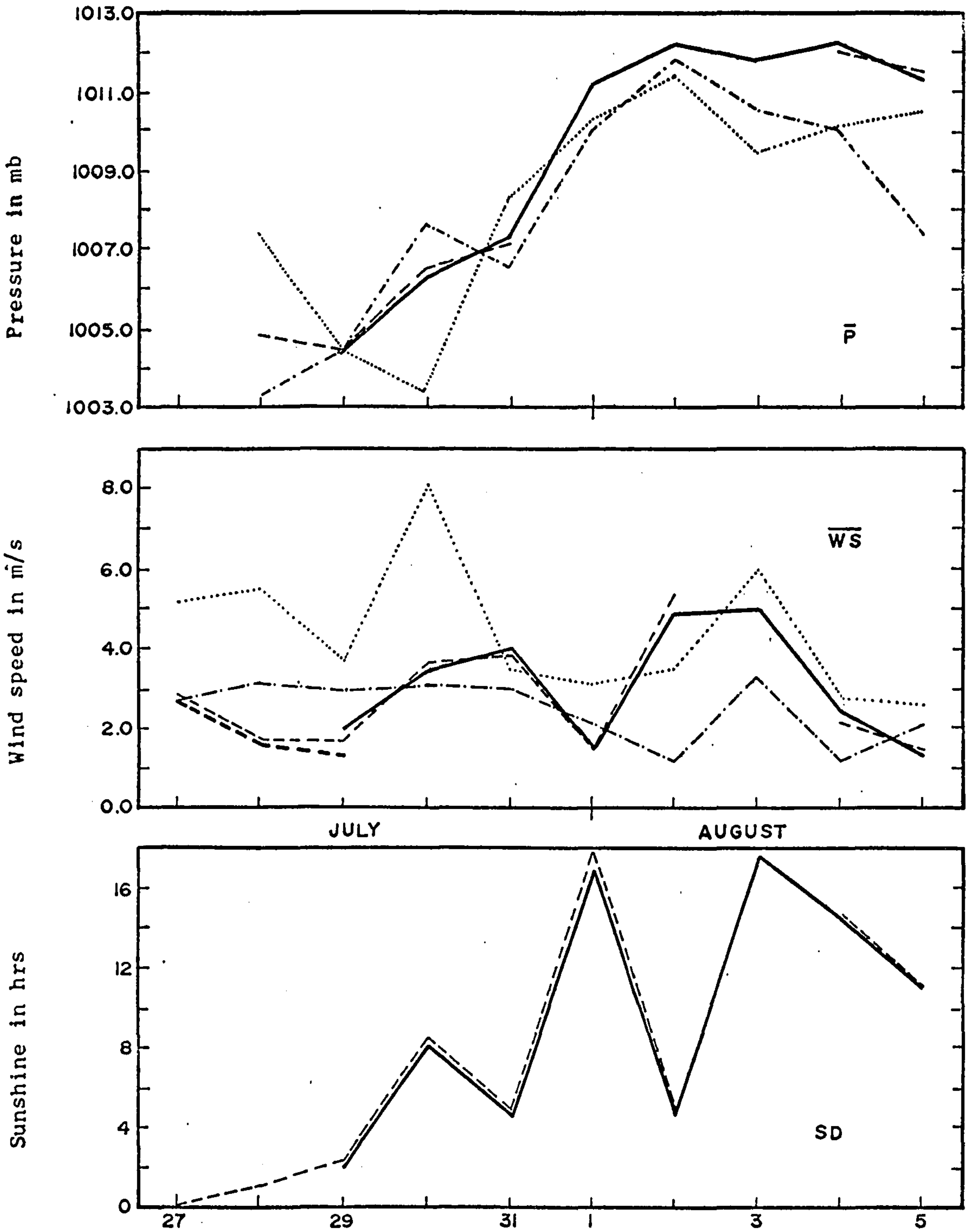


FIG. III. 15: COMPARISON, PERIOD A; MEAN DAILY PRESSURE, WIND SPEED AND DAILY SUNSHINE

On July 29, when wind speeds were low, the Mk II-WS/D station registered wind much better than the Pyrox-Sumner station. Although the mechanics of both wind speed sensors are the same, the 45 B anemometer used with the Pyrox-Sumner station is larger in dimension; the greater inertia of the wind cups will, of course, be more pronounced at lower wind speed. Otherwise the Mk II-WS/D station followed the course of the mean-daily synoptically observed wind speeds very well. At low wind speeds it recorded very well. Since there are no synoptic data for the foehn period (high winds) a comparison has to be made statistically.

Automatic registration of bright sunshine is, in general, less than is recorded by the double-Campbell Stokes instrument. The manufacturer adjusted the sensing elements of the sunshine sensor to operate at environmental temperatures below + 4.4°C. The ventilation of the housing should then maintain the instrument at the ambient temperature. It should be expected for the instrument to operate improperly when temperatures are higher than the threshold temperature at intervals of much sunshine and low wind speeds. Greatest discrepancy (deficit) is indeed shown for the day of much sunshine, lowest wind speed and somewhat high temperatures (- 54 minutes on August 1). The mean temperature for the period was + 6.7°C and the total discrepancy in automatic sunshine registration was - 1.6 hours.

<u>Period B</u> (August 10 to 29, 1965)

This period of comparison is very interesting, not only to the glaciologist but also to the climatologist involved in the study of climatic behaviour in the arctic regions. Concentrating efforts on the operation of the Automatic Climatological Stations will not allow a detailed description of the weather systems in this period. Berry, Owens and Wilson (Arctic Track Charts, 1954, pp.91-102) have made a general study of the pricipal sea level tracks of cyclones. By using the 23 analysed daily weather maps, published by the German Täglicher Wetterbericht (Offenbach, 1965; nos.221 to 243), it is possible to identify and verify the most frequent passages of cyclones over the region under study, which are described so effectively by Hare and Orvig (The Arctic Circulation, 1958; pp.107-114).

A deep low (990 mb) was centred over the Ungava Peninsula on August 10. Pressures were moderately high over Axel Heiberg Island (1010 mb). As this low moved northward along the "Baffin Bay maximum" track it began to fill in. The cooler air masses over Axel Heiberg Island were replaced by an influx of warm air from the east on August 12. By August 13 the low had become stationary over the island and had filled in completely (1010 mb), whereby at the same time a high developed northeast of North Ellesmere Island. This gave rise to a foehn condition in the Expedition Area. As the low disappeared, cooler air masses arrived and pressures increased after August 16. This describes the first stage of this period.

For August 20 to 22 the weather maps show a low in Baffin Bay and a high north of Axel Heiberg Island. Once again a moderate foehn influence is experienced in the Expedition Area.

In the following days a low over the Beaufort Sea began to move eastward along the "polar basin" track. This cold front arrived at Axel Heiberg Island on August 26, bringing low temperatures and precipitation in form of snow (about 5 cm). This weather situation is shown in Fig.III.18.

Automatically gathered information can only be compared to four parameters during this period. Constant mechanical troubles experienced with the Pyrox-Sumner station and energy supply failures of the Mk II-WS/D station called for frequent travels to both station sites. Consequently the gathering of man-observed data suffered greatly. Nonetheless, figures III.16 and 17 present the operation characteristics of the stations.

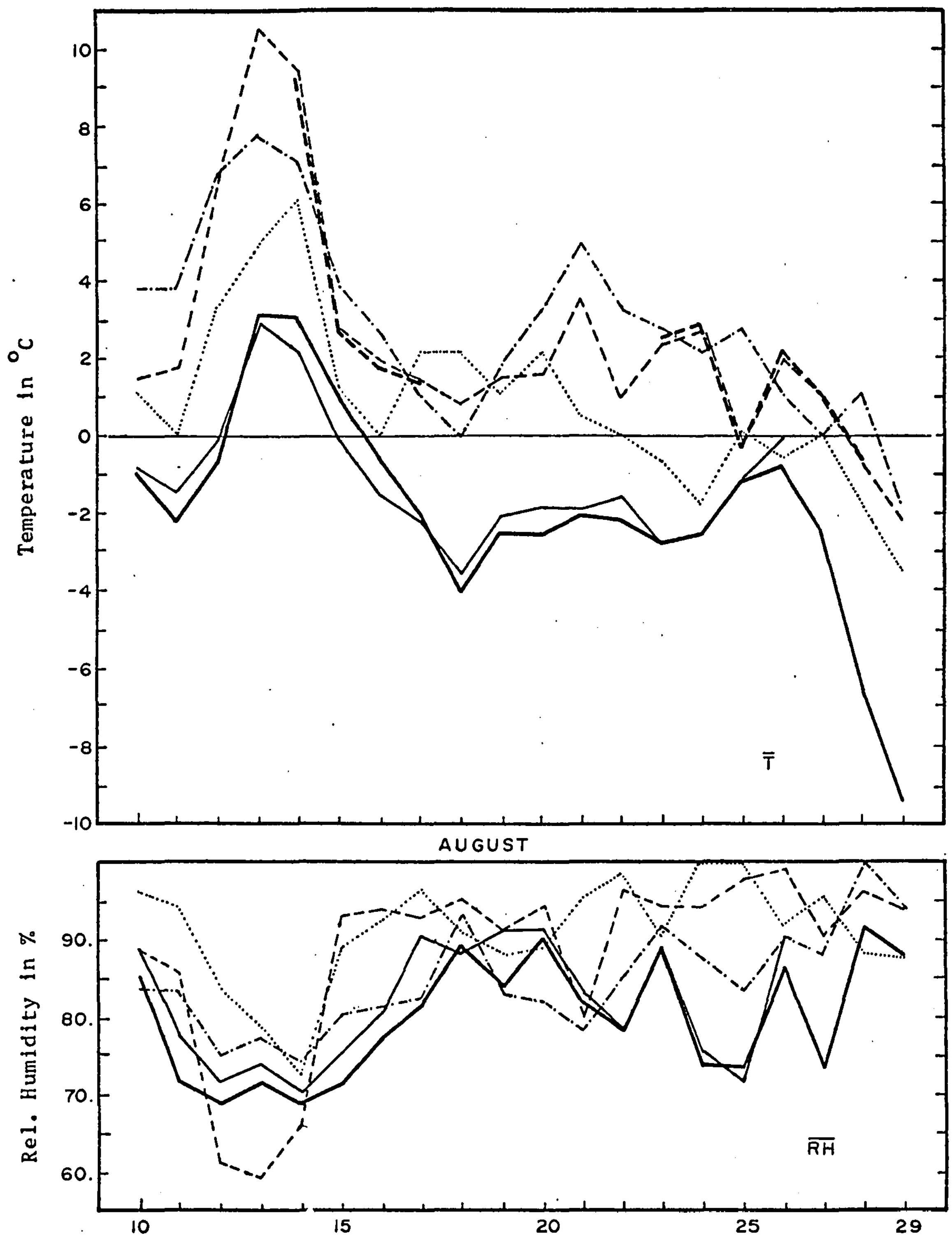


FIG.III.16: COMPARISON, PERIOD B; MEAN DAILY TEMPERATURES AND REL. HUMIDITIES

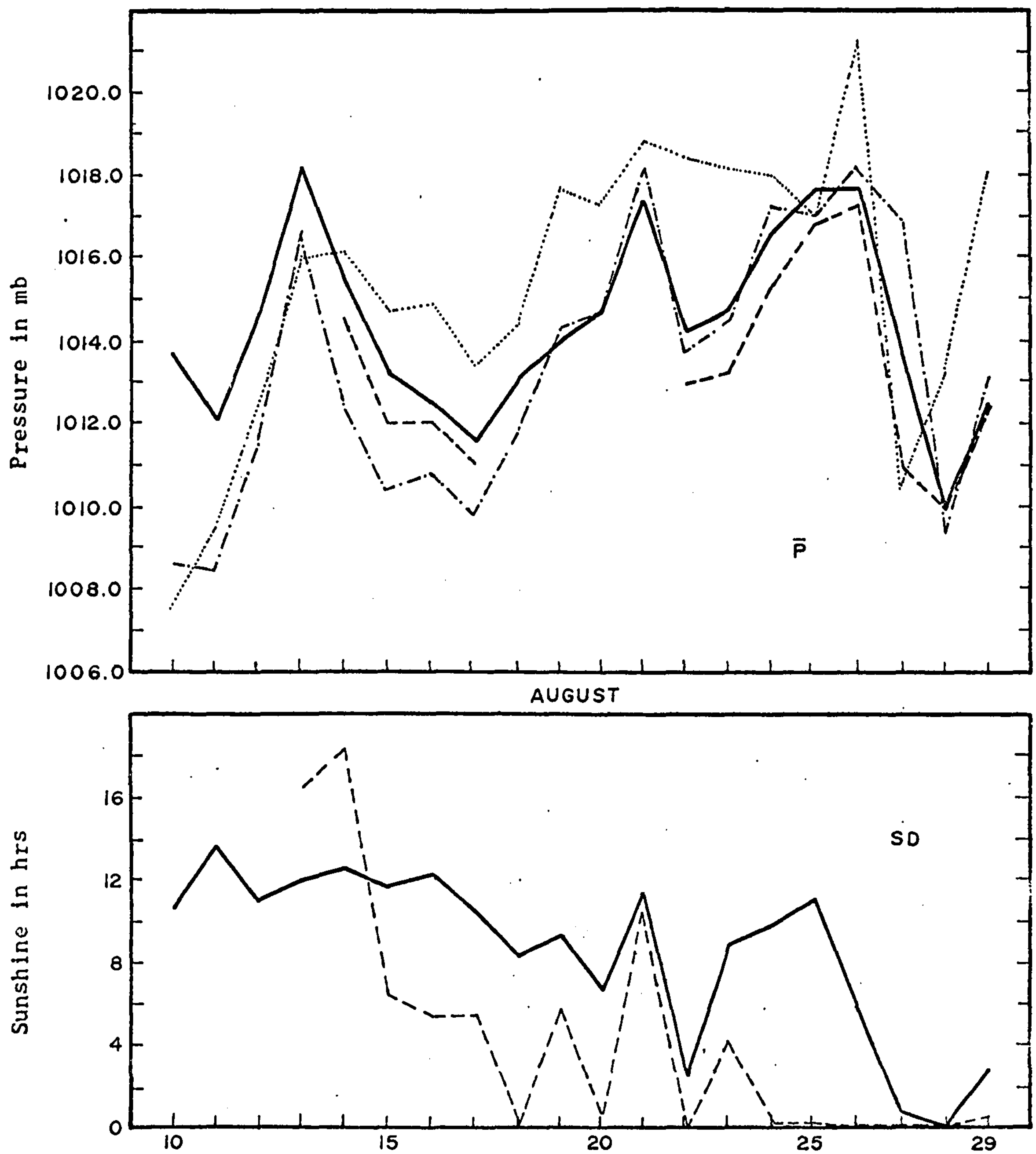


FIG.III.17: COMPARISON, PERIOD B; MEAN DAILY PRESSURE AND DAILY SUNSHINE

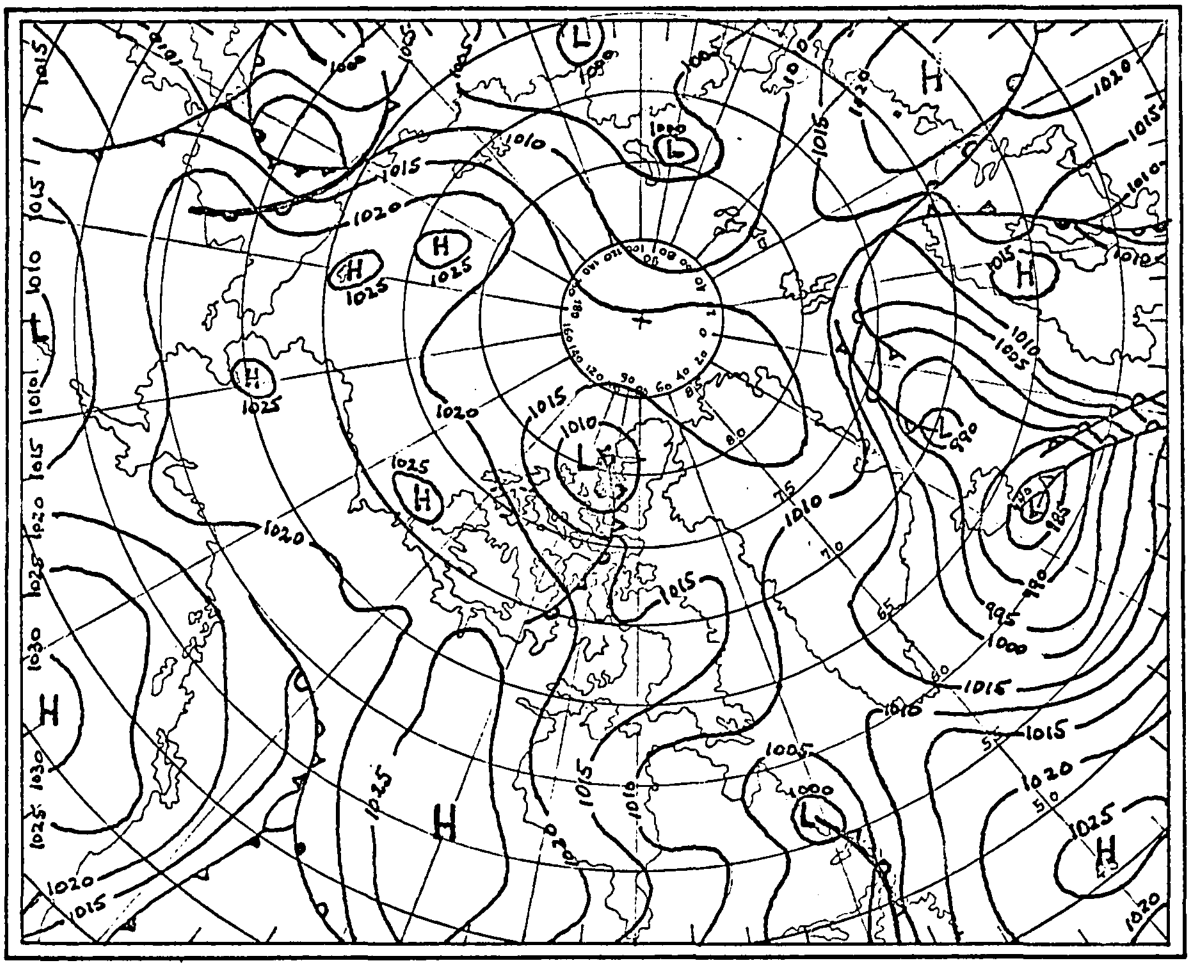


FIG.III.18: SURFACE PRESSURE PATTERN, AUGUST 27, 1965; 0000 GMT

The lag or hysteresis-effect in the temperature sensor of the Mk II-T/H station is quite predominant, but deviations observed at the glacier site were not so pronounced as during operation at Base Camp. Greatest discrepancies in both temperature and rel.humidity registrations are shown for the intervals of foehn. The Pyrox-Sumner station followed the temperature trend at Base Camp closely and maximum deviations were less pronounced. The colder temperatures on the glacier influenced rel. humidity registration to be less accurate, and on the days of greatest temperature changes (e.g.August 17, 19) the greatest deviation in rel. humidity registration occurred.

The changing temperatures seem to influence the parallelism of bar.pressure registration as well; for it was on August 17 and 27 when greatest deviations of 1.1 mb and 2.8 mb respectively, occurred. Indeed, this suggests a lag in sensor behaviour to changing environmental conditions.

<u>Period C</u> (May 14 to 31, 1966)

During this period the glacier ablation started. A high pressure cell crossed the island around May 18. Low temperatures and moderate winds marked this interval. The synoptically observed pressures at Base Camp are higher than those registered by the Mk II-BP/S station (Fig.III.19). This is to be expected and is due to its being at a higher altitude. On the other hand, however, temperature changes took place at the same time and this also causes a lag in the response of the pressure sensing instrument. Temperature registration by the Pyrox-Sumner station in itself showed this sensor hysteresis-effect (Fig.III.20). Wind speed registration by the Pyrox-Sumner station before and after the influence of the high pressures was normal and followed the trend of synoptic observations quite favourably.

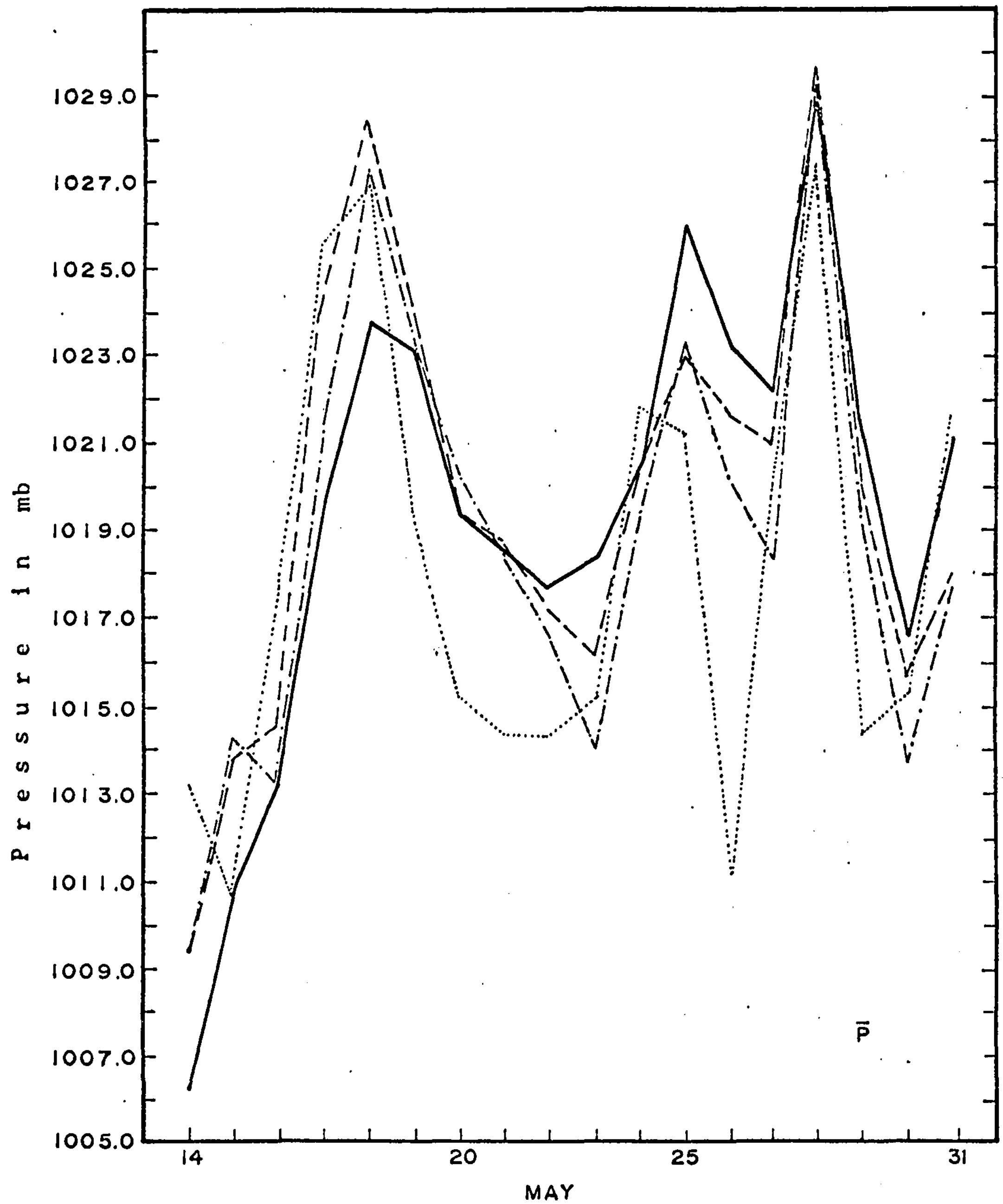


FIG. III. 19: COMPARISON, PERIOD C; MEAN DAILY PRESSURE

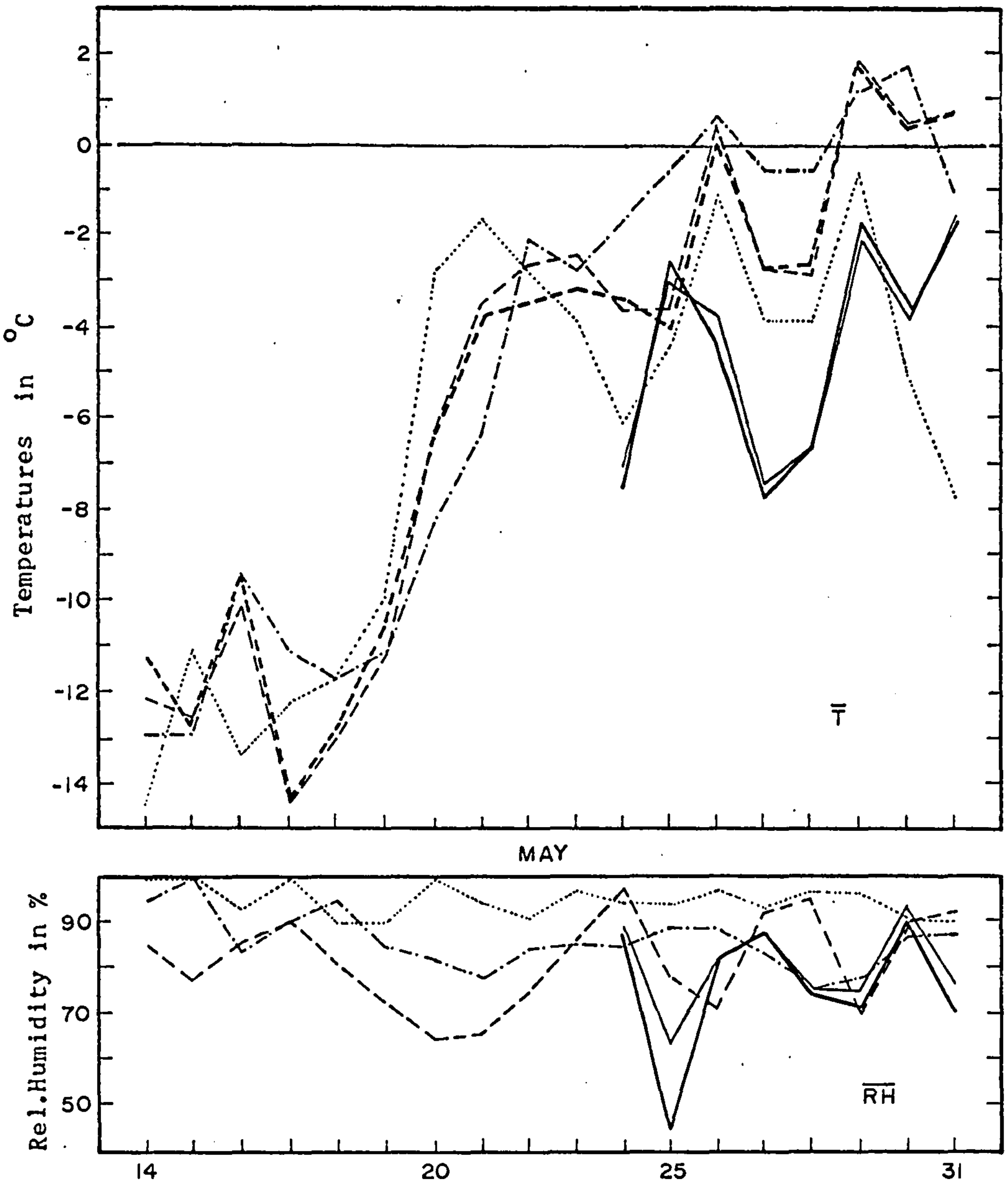


FIG.III.20: COMPARISON, PERIOD C; MEAN DAILY TEMPERATURES AND REL. HUMIDITIES

Winds were higher on the glacier and more sunshine was registered than at Base Camp (Fig.III.21). In general, it is less cloudy at the Ice Station. Base Camp was often shrouded in fog, especially in the evening hours, whereas Moraine Camp Ice would have clear weather at the same time.

A shallow low centred west of the Queen Elizabeth Islands (Fig.III.22) on May 25 to 27 introduced a southwesterly inflow of cold air along the axis of the exposed Expedition Area corridor. Winds associated with this cold front brought highest mean-daily wind speeds of 22.7 km/hr (May 27). Peak winds of 33.8 km/hr were recorded. Precipitation in form of snow amounted to 21 cm. It is fair to say that this weather condition represents a storm.

It is quite interesting how the automatic stations behaved during this occurrance. Prior to and after the storm there was a rapid temperature variation ($\pm$ 5°C). The familiar hysteresis-effect in sensor response, temperature and pressure particularly, is once again observed. Rel.humidities recorded by Mk II-T/H station showed greatest deviation ever observed (May 25, -19 %). But after the storm (May 29), when temperatures were the same as before (May 25), namely about -2°C, the rel. humidity sensor functioned quite normally (apart from the hysteresis-effect). Therefore, this occasion represents the only time within the comparative periods when the rel.humidity sensor was definitely not functioning well.

During the storm, the Mk II-WS/D station was under repair. Winds were not as high at Moraine Camp Ice as they were at Base Camp. But comparing the automatically recorded wind speeds to the man-observed at Base Camp indicates great discrepancies. The Fuess anemometer used formerly was exchanged on May 20 for another Fuess anemometer, apparently of bad operation characteristics. It was found later that this anemometer "made a scraping sound". No doubt, then, the automatically recorded wind speeds are more representative, and despite non-comparability there is a common trend of wind speeds in this period.

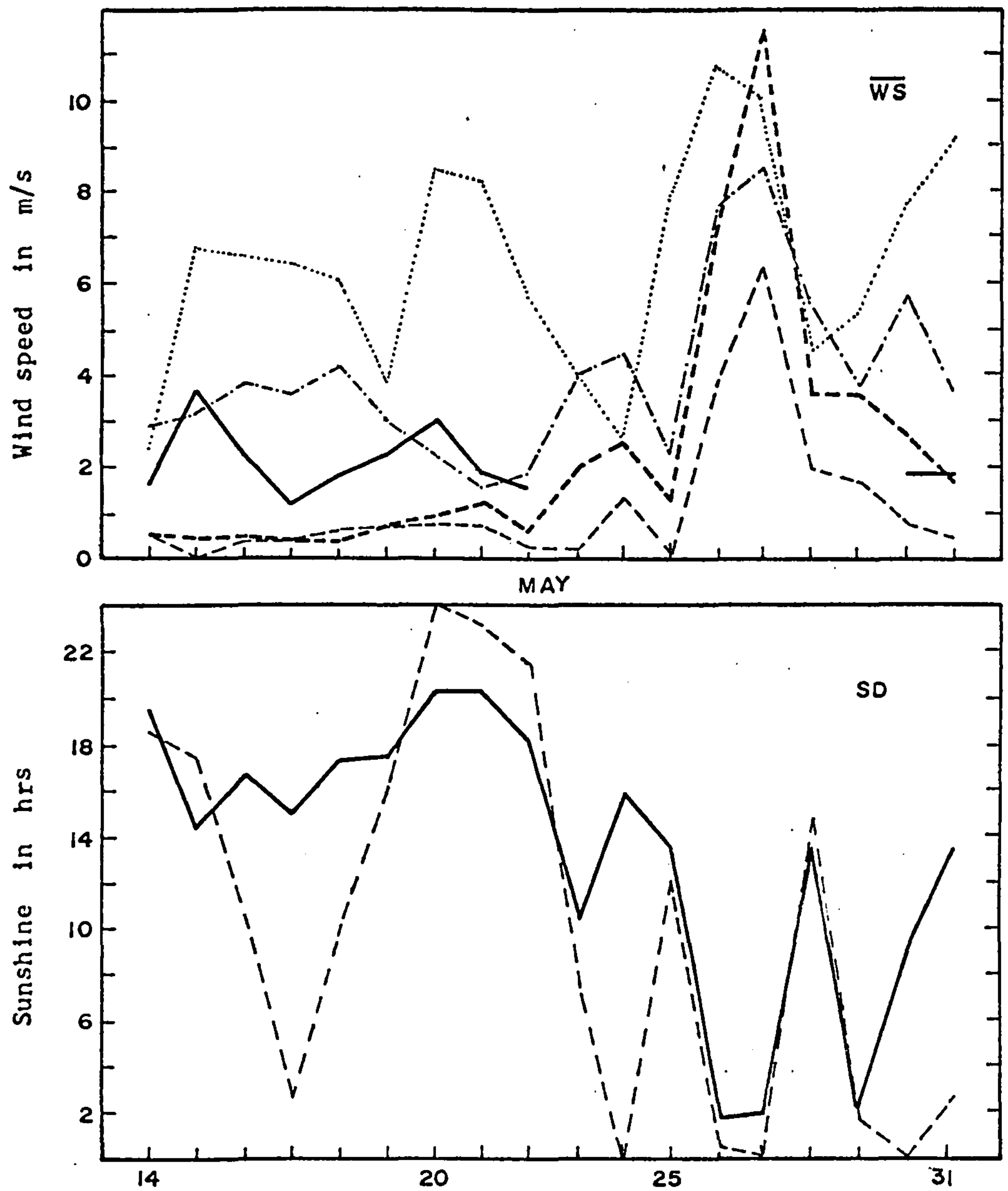


FIG. III.21: COMPARISON, PERIOD C; MEAN DAILY WIND SPEED AND DAILY SUNSHINE

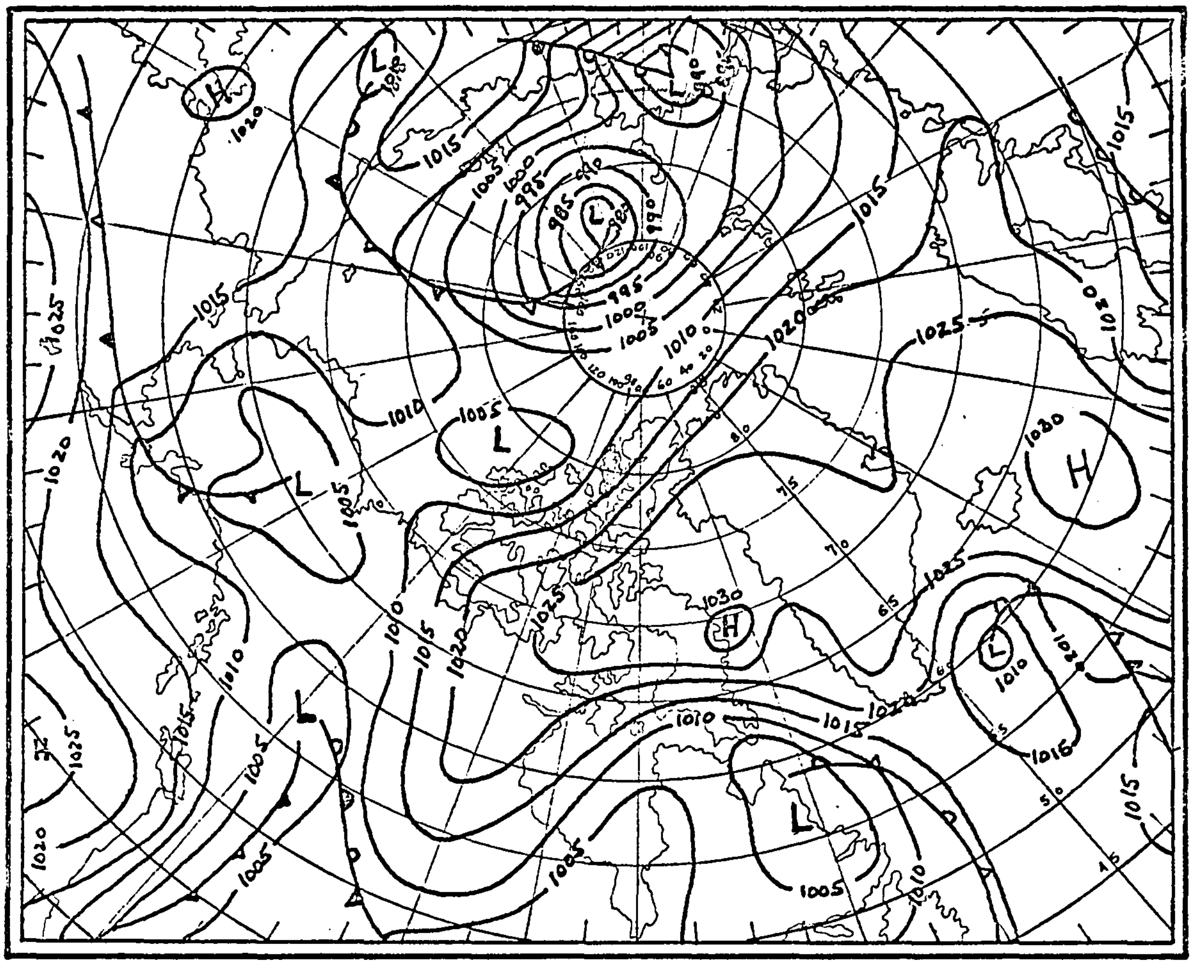


FIG. III. 22: SURFACE PRESSURE PATTERN, MAY 27, 1966; 0000 GMT

III.41 Summary

A brief but detailed summary is given in the tables below. The figures represent the mean deviation of the automatic registration from the man-observed. The values in brackets give greatest deviation observed and the day of occurance.

Period A

July 27 - August 5	Mk II against synoptic Base Camp	Pyrox-Sumner against synoptic - Base Camp
temperature	+0.2°C (+1.2; 3rd)	-0.3°C (+0.5; 29th)
rel.humidity	+ 2 % (+ 3 %;5th)	-
bar.pressure	-0.07 mb (±0.3 mb;sev.)	-
sunshine	- 16 min.(-54 min;1st)	-
wind speed	+2 cm/s (-40 cm/s;3rd)	-20 cm/s (-40 cm/s;29th)
wind run	+8.5 % (+113 km/day;31st)	-6.9 % (-40 km/day;29th)
wind direction	+4.2 deg (+8 deg;4th)	-

Period B

August 10 - 29	Mk II against synoptic Moraine Camp	Pyrox-Sumner against synoptic - Base Camp
temperature	-0.2°C (±0.8; sev.)	-0.2°C (+0.3; 23rd)
rel.humidity	- 2 % (- 9 %;17th)	-
bar.pressure	-0.4 mb(+2.8 mb;27th)	-

Period C

May 14 - 31	Mk II against synoptic Moraine Camp	Pyrox-Sumner against synoptic - Base Camp
temperature	0.0°C (+0.5; 25th)	-0.05°C (+0.9; 14th)
rel.humidity	- 4 % (-19 %;25th)	-
bar.pressure	-0.4 mb(-4.5 mb;18th)	-
wind speed	-8 cm/s(-0.6 m/s;31st)	(+1.2 m/s(+5.3 m/s;27th))
wind run	-	-2.3 %(-20 km/day;14th)

It is found that the stations followed the general climatic trends which occurred during the compared periods - indirectly also as indicated by the Joint Arctic Weather Stations. All Automatic Climatological Stations functioned well when operating "side-by-side" at Base Camp.

Apart from temperature registration the Mk II stations did not operate as well at Moraine Camp Ice as they did at Base Camp. The major causes for this are the lower environmental temperatures on the glacier and the predominant inter-period variations of the timers (Tables V.5 to 19). This pronounced influence will be discussed in the next chapter.

Temperature registration by the Pyrox-Summer station (when it works) is good, but wind speed records leave much to be desired.

Any sudden change in weather elements brought about by the rapid passing of pressure cells (highs or lows) or local environmental changes (foehn or storm) upset the general parallelism or congruency in parameter recording as compared to synoptic observations. It is before and after the disturbance that the sensors show greatest lag characteristics which bring sbout greatest discrepancies in comparison.

Whether this is effectively of importance will be seen in the next chapter in which a statistical analysis of parameter recording will be compared to specifications laid down by the World Meteorological Organisation.

CHAPTER IV

Discussion and Conclusions

The evaluation of the stations for the specific purpose of glacier-climate relationship studies is in essence the prime object of this study. There are no set rules and regulations on how well these type of stations should work on a glacier in the High Arctic. Consequently, one must compare the data registered by the Automatic Climatological Stations to identical data, recorded at the same place and at the same time, by means such as manual observations, which are of better quality. Then, on the basis that the man-observed data are more reliable, will it be possible to make a relative rather than absolute comparison. If the man-observations are carried out according to international requirements, then the operation of the stations can be judged in accordance to specifications recommended by the World Meteorological Organisation (WMO, 1966).

Immediately the question arises: Of what quality are the man-observed data? It is assumed that by having (i) used good, standard quality instrumentation, (ii) exercised great care in reducing and correcting instrumental readings, (iii) complied with the rules and specifications recommended by the Canadian Department of Transport, reasonably accurate and useful man-observed results have been obtained. Since the man-observed met-data are to serve as reference data, the automatically recorded data can at best be as good but not better than the reference data.

Surely it is not difficult to read a lot of "wanted" meanings into a series of results. In an attempt to overcome this unwanted possibility statistical methods are used; and by using these techniques the comparisons and results become objective.

Primarily, this feasibility study shows, whether the stations are as accurate as required by the problem of glacier-climate relationship studies, and as sensitive as needed to make full use of their accuracy. The stations should have and maintain a calibration, under given conditions, to within the desired precision. The errors under other conditions should be known and constant in time within required limits. In addition, the stations should be robust in design and durable enough to give the desired length of service in the Arctic. Furthermore, they must be simple, convenient, and cheap to be compatiable with the above stated requirements.

IV.1 Timer Variations

Proper timer operation assures constancy in chart transport and can be regarded as the key to reliable data extraction and evaluation. A critical analysis of the operation of the "heart of the stations" must be made.

Timer variations can be checked in different ways:

1) Measurement of the total length of strip-chart transport during a finite time interval.
2) Measuring the distance between each and every other solar time-check burn.
3) Marking the chart at certain times during operation and measuring the individual spacing between marks.
4) Counting the total number of six-minute perforations and marks made by the pen in a finite time interval.
5) Audible observation of the sequence between each six-minute clicking sound produced by the three individual recorders.

Every method was tried. The first method was used to obtain a quick check on whether the timer was working at all. When more (less) chart had been transported than would be expected during a finite time interval, it would merely indicate that during the entire operating period the timer was gaining (loosing) time. From total chart length comparisons alone it was not possible to determine how well the timer was functioning. This necessitated using methods 2, 3 and 4. The second method proved to be the most expedient and reliable approach to the problem. The modal behaviour of all timers (Mk II stations) was studied by using method five during the time the stations were manned.

Before making a statistical analysis of the burn mark spacings, it is necessary to discuss some of the major influences which lead to erroneous burn mark displacement.

a) The length of the burn mark. Under ideal conditions (no cloud cover in direction of the sun at noon, no hoar frost, rime, glaze, or snow on the lens window, proper chart transport and uniform chart paper sensitivity) the length of the burn mark is about 2.0 mm, equivalent to 28 minutes. The centre of this burn mark is the reference point for local apparent noon, and the accuracy in determining it is (on the average) $\pm$ 3 minutes. This is based on the assumption that the sun shone for at least one minute. During intermittent sunshine several or only one burn can occur. The real 12 noon burn will then be situated somewhere within $\pm$ 1 mm or $\pm$ 14 minutes of true, apparent local noon. The accuracy in chosing the proper noon reference is now $\pm$ 12.5 minutes. The limits in accuracy are, therefore, $\pm$ 3 m at best and $\pm$ 12.5 minutes under extreme conditions. The probable error in comparing two days is $\pm$ 8 minutes.

b) Solar elevation. Burn marks are not made if the sun is lower than 5° above the horizon. In latitude $79^{\circ}30'$N, the sun is at its highest zenith on June 21, when its elevation from astronomical horizon is nearly 34^{o}. According to manufacturer's specifications (Sumner,1965, p.476) the relative deviation of the centre of an ideal burn mark is 0.45 mm per degree of solar elevation. An error of ± 6.4 minutes per degree of solar elevation change is possible. The resulting central shift of 12 noon (on charts) is ± 218 minutes between March 3 and June 21 (plus) and June 21 to October 13 (minus). This erroneously suggests that timer operation was fast ot slow, respectively. To compensate for this effect a correction of ± 2 minutes for every day except June 21 is necessary.

c) Equation of time. A harmonic term is added to the solar elevation effect. The Local Mean Time (LMT) at Moraine Camp Ice is Greenwich Mean Time (GMT) minus six hours and six minutes. Noon in Apparent Solar Time (AST), as it is indicated by the burn marks, is not a uniform time, because it differs from Mean Solar Time (MST) and, therefore, from Local Mean Time by an amount known as the Equation of Time (ET). Through the combined effects of the components due to obliquity of the eclipse and the eccentricity of the earth's orbit, the equation of time reaches its maximum values in Febuary (- 14 minutes) and early November (+ 16 minutes). It has a value of zero on April 15, June 14, September 1, and December 25. True burn mark spacings would, for example, decrease between April 17 and May 7, erroneously indicating slower timer operation. Between May 7 and 21 true burn mark spacing would remain constant. From May 21 to June 12 burn mark spacing would again increase; this would indicate a faster timer operation for this period. This sort of pattern repeats itself during the summer season, and appropriate correction must be made. Non-linear in behaviour, the approximate daily error due to this harmonic component is in general ± 1.0 minute.

d) Positional change of the stations on the ice. Three kinds of station movements can cause time-check burn displacement: (i) rotation; (ii) forward or backward dip; (iii) movement not along the north to south direction. Checking the position of the ice stations 7 and 13 months after installation showed that they had moved about 38 m on the glacier's surface. During this time they were lowered by 2.0 m. Station movement was in a south-east direction and the time-lens window remained facing towards true south. This, however, indicates a slight rotation of the stations but error in burn mark spacing is negligibly small, therefore, correction for this effect is not necessary.

The daily errors in burn mark displacement due to solar elevation and the equation of time are very small; in fact, necessary correction would be less than measurement accuracy permits. However, when comparing burn mark spacings over a number of days, one can no longer neglect these errors. A general, acceptable timer error is computed by taking the rms value of the error due to burn mark length variation and the sum of errors due to the solar elevation and equation of time. And so the acceptable error that any of the four timers of the stations can make, is ± 8.5 minutes.

IV.11 Analysis of Timer Operation

Timer operation of each station is examined for two periods. These periods exclude the days when stations' testing, installation and calibration was performed.

In the period from August 10, 1965 until May 26, 1966, the energy supplies and timers of the Mk II stations were at 11 m in the glacier ice. The environmental temperature at this depth should remain constant at about $-16^{\circ}C$ (seasonal isotherme). If the nominal chart transport rate of 10.2 cm per 24 hrs. was maintained, then 29.46 m of strip-chart should have been transported by each recorder. This means 6,960 hours of operation.

Measuring of the length of chart actually used gives the following results:

Mk II stations (timers in glacier's ice)

Recorder	Total length of chart (m)	Difference in nom.length(m)	Equivalent difference in time(hrs)	Apparent total time of operation (hrs)
T/H	2.45	- 27.01	- 6,381	579
BP/S	29.27	- 0.19	- 44.8	6,915
WS/D	29.37	- 0.09	- 21.0	6,939

Operation of Mk II-T/H station ceased after September 3, 1965. The reason for stoppage was energy supply failure.

The Mk II-BP/S station stopped recording temporarely from October 24, about 1000 hrs. to October 25,1965, about 1800 hrs. The reason for intermittent operation was jamming of the solenoid armature. Vibration can free the armature, and this is what had apparently occurred.

The Mk II-WS/D station recorded without stoppage during the entire period, despite part of its energy supply being on the surface (explained in Chapter II).

Neglecting the 32 hours stoppage due to mechanical failure of the BP/S recorder it can be seen that the Mk II-BP/S station's timer lost least time(- 12.8 hrs.). But how well it kept time will be seen through the statistical analysis.

In the period from May 27 until August 29, 1966 the energy supplies and timers of the Mk II stations were on the glacier surface, at the beginning buried in snow. Environmental temperatures of the containers were probably near the freezing point at the beginning of this period. Once the containers were no longer insulated by the snow cover, temperatures of the timers must have fluctuated with daily temperature variations.

Nevertheless, 9.65 m of strip-chart should have been transported by each recorder. The nominal operation time is, therefore, 2,280 hours. Measurements of chart lengths actually transported give the following results.

Mk II stations(timers on glacier surface)

Recorder	Total length of chart (m)	Difference in nom.length(cm)	Equivalent difference in time(hrs)	Apparent total time of operation (hrs.)
T/H	9.63	- 1.8	- 4.2	2,275.8
BP/S	9.66	+ 1.3	+ 3.0	2,283.0
WS/D	9.67	+ 2.0	+ 4.7	2,284.8

All recorders functioned throughout the entire period and no stoppage of recording occurred. Operation of the timers was definitely better in the summer period than during the winter months. The timers that had lost time now gained time, but at a smaller rate. It can be decided by statistical analysis whether their operation in a different location was significant.

Operation of the Pyrox-Summer station is very erratic. Recording began on July 27 and ended on August 28, 1965. The station ceased to function until revisit on May 14, 1966. Little information about its operation from this date until August 28, 1966 is available. Within the above named periods the pattern of operation was the following (extracts from section III.13):

<u>1965:</u>	July 27 to 30	(4 days)
	August 14 to 17	(4 days)
	August 22 to 28	(7 days)
<u>1966:</u>	May 14 to 31	(18 days)
	June 2 to 17	(16 days)
	June 20 to July 8	(19 days)
	August 22 to 28	(7 days)

This indicates that the station worked only 46 % in 1965 and 56 % in 1966 of expected operation time. For the entire operation period from July 27, 1965 to August 28, 1966 it functioned for 75 days of a possible 291 days. This clearly demonstrates a very unreliable operational characteristic of 26 % of the expected operation time.

When temporary stoppage occurs once, it is relatively easy to calculate the amount of data lost. In measuring the length of used chart from each end of recording (where the time is known) towards the point of stoppage, the amount of chart length not transported can be determined. If recording was interrupted more than once, it becomes difficult to determine the proper time interval for which any data, collected during two stoppages, is representative. This happened to the Pyrox-Sumner station records from June 2 to August 22. Fortunately, during this time the Mk II T/H station was functioning at Moraine Camp Ice.

In plotting the 5-day running mean temperatures obtained by the Mk II-T/H station for this period, and the 5-day running mean temperatures of the dateless period produced by the Pyrox-Sumner station, it is possible (in this case) to locate the time interval into which this temperature (and wind) data belongs. As these stations are only about 9 km apart, it can be assumed that the temperature trend at these locations will be nearly parallel. Temperatures are, on the average, about four degrees lower at the glacier station during the summer months. Regression analysis of registrations shows best goodness of fit of the temperatures for the time interval June 20 to July 8, 1966 (r = 0.98).

Comparison of registrations from one instrument to readings obtained from another instrument demands that both recordings be made at the same time and place. In this study the special relationship is considered to remain constant.

It would be wrong to assume that the timer lost or gained time over a certain interval at a constant rate. How large the actual inter-period variations of the timer can be is indicated by measuring the spacings between the burn marks. The overall accuracy of these measurements is dictated by the formerly outlined possible accuracy limit of ± 8.5 minutes. Deviations in time less than ± 3.0 minutes were not considered. The tables presenting the inter-period variations of each timer under two distinct situations, as given in Tables V.1 to 19, Appendix C, show timer deviations greater than ± 3.0 minutes. The statistical analyses of timer behaviour are also given in Tables V.20 to 24, Appendix C. The results of the statistics are summarized below, and Fig.IV.1 presents histograms of each timer operation. The operation of the three timers of the Mk II stations are treated separately, namely when energy supplies and timers were in the ice and on the glacier surface.

Characteristics of timers (Mk II stations)

statistic	T/H (sfc)	BP/S (ice)	BP/S (sfc)	WS/D (ice)	WS/D (sfc)
days of operation	108	294	88	294	90
no.of time checks	59	89	34	93	87
arith.mean (min)	-3.6	-11.4	2.8	-4.4	2.5
median (min)	-2.7	-9.3	2.1	-4.1	2.6
mode (min)	-0.9	-9.2	0.7	-3.6	2.9
stand.deviation (min)	11.3	14.4	14.1	12.6	7.1
% of values within 1 dev.	77	69	56	66	51
equiv.difference in time	-4^h52^m	-45^h57^m	3^h5^m	-20^h5^m	3^h54^m
significance (T-test)	2.4	7.4	1.1	3.3	3.3

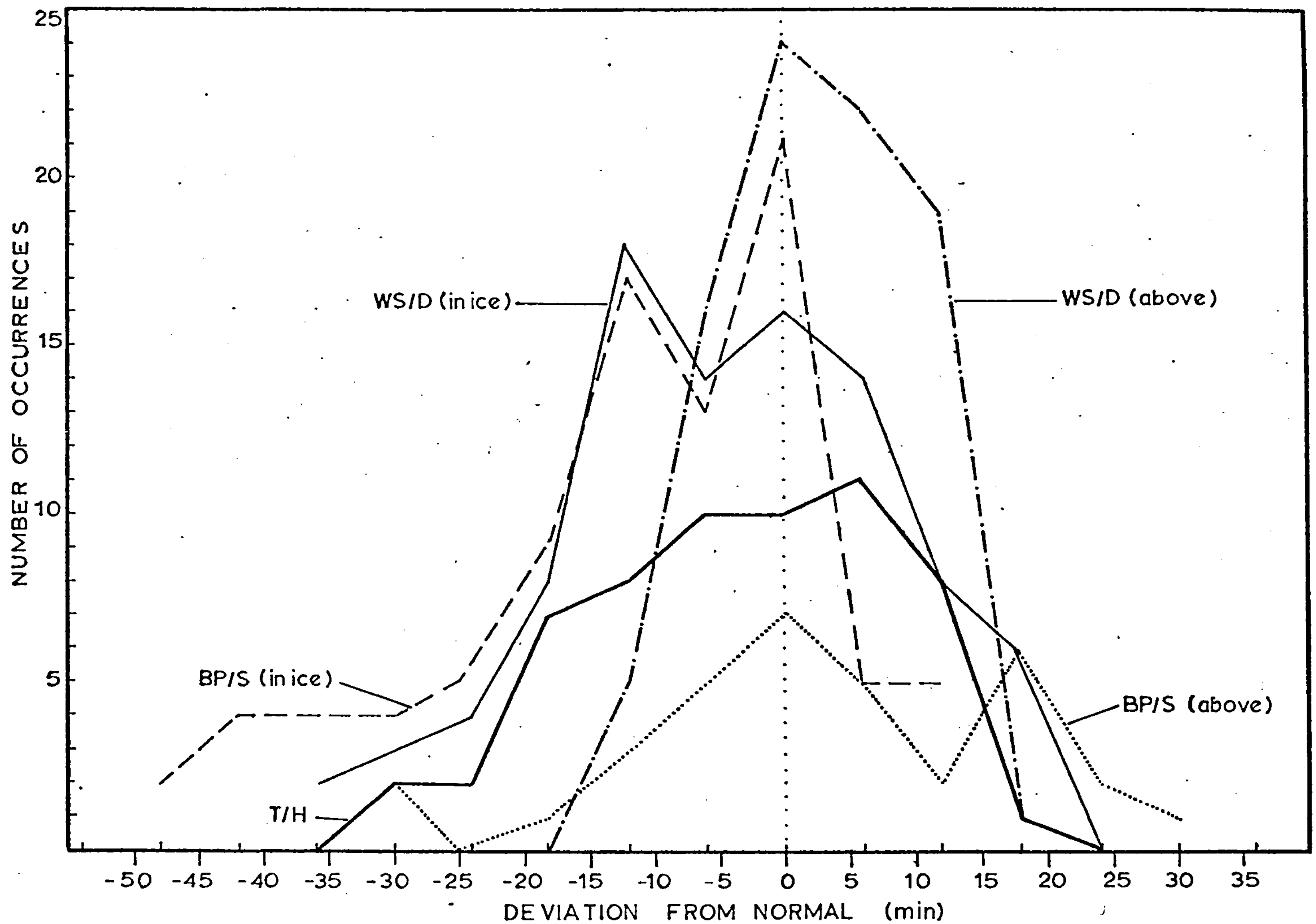


FIG IV.1 TIMER OPERATION FOR 3 UNITS ABOVE OR BELOW ICE SURFACE.

The central tendency of operation is typified by the median value of the series, because it is not distorted in value by unusual deviations. Keeping in mind that the inaccuracy of the statistic increases as the length of the period decreases, the following can be said: Each six-hourly time mark needs to be adjusted by the median value.

The standard error is in all cases greater than the best limit of accuracy of $\pm$ 3.0 minutes, and except for the WS/D (sfc) timer, deviation is greater than the possible accuracy limit of $\pm$ 8.5 minutes. All timers except BP/S (sfc) during the summer operation (skewness + 0.2), show definitely a tendency to go slow. The distribution of deviations, as can be seen from Fig.IV.1, are moderately normal. The significance test (T-test) shows that the timer variation of every station is highly significant and the results are, in 99.7 cases of 100, real and are not abtained by chances.

Comparing the standard error of the difference between the statistical means of each timer shows whether the timers are identical in operation under different environmental conditions. Tests are made on the timers when they were in ice and on the glacier surface (Arkin and Colton, 1961, p.121). Analysis indicates that the difference in operational characteristic between the BP/S and WS/D timers in ice is insignificant. Timer operation of the T/H, BP/S, and WS/D stations when their timers are kept on the glacier surface, is equally good (T-test shows no significant difference in operation).

Finally, using the same statistical techniques, it is found that timer operation of each individual station is better if the timers are kept at the surface of the glacier. The timer of the WS/D station, when placed on the glacier surface shows best operation characteristics. Therefore, there is no immediate need to place these timers and energy supplies into the ice to improve station operation.

Statistical results of inter-period variation of timers are in good agreement with results of measured actual chart transport.

The accuracy in determining the proper 12 noon burn, or in fact any six-hourly time check, is $\pm$ 11 minutes when timers are on surface and $\pm$ 13.5 minutes when the BP/S and WS/D timers are at 11 m in the ice. Notably, all deviations fall well within the spread of typical solid burn mark displacement (28 minutes). And it can be seen that it is difficult to detect any erroneous timer behaviour when observing burn marks at random or by chosing any non-solid burn within the 28 minutes.

In section IV.1 it was shown that the acceptable error is $\pm$ 8.5 minutes. Consequently 29.5 % (surface operation) and 59 % (in ice operation) of inter-period timer variations are unexplainable deviations and indicate false operational characteristics of the timers.

An insufficient number of time checks for the Pyrox-Sumner's strip-charts do not permit a proper statistical analysis of this station's timer operation.

IV.2 Characteristics of the Sensors and Validity of Registration

The primary function of a sensor is to convert the quantitative aspects of some natural phenomenon into a series of recognizable coincidences in time and/or space. Instruments which do this can be simple or complicated, depending on the number of processes which intervene between the natural phenomenon and the senses of the user. Any small changes in the quantity being measured by a responsive or sensitive senor system produces a large change in the final message to the senses. The final process leading directly to proper interpretation by the user is the observation by eye of a coincidence in space, or else the estimation of a small distance.

Very seldomly is optimum sensitivity the greatest that can be obtained. It is highly desirable at times to have a very sensitive instrument, but a sensor should be sensitive enough only to make it convenient to read to a desirable precision. Therefore, optimum sensitivity must always be determined in connection with the possible or desirable precision. The desirable precision or accuracy of any observation can be determined either theoretically or through practical experience with the phenomenon under study.

In the following text it will be shown that accuracy and validity of registration not only depand on the sensitivity of a sensor but also on the process of recording and extracting the registered values.

IV.21 Analysis of Registration Process

Temperature: Specifications by the manufacturer state temperature registration to be accurate within ± 1 % of full scale reading. This statement definitely applies to the sensor instrumentation, only. The Mk II T/H station has a temperature sensitivity range of 75 C degrees (+ 25° to - 50° C), thus an instrument accuracy of ± 0.75° C. Similarly, the Pyrox-Sumner station's instrument accuracy is ± 0.65° C. Two systematic obscurities need to be explained at this stage of the discussion. Firstly, best accuracy is obtained if pen deflection is within 0° to 45° (see sec.I13, p.8). High and low temperatures will, therefore, be recorded less accurate. Secondly, the greater the range of sensitivity and, consequently, the larger the number of temperature values to be"squeezed" on a fixed chart width, the lesser the accuracy in extracting any particular recorded value. Obviously one should expect the Pyrox-Sumner station sensor system to record temperatures with a better accuracy. This, in fact, is true.

However, parameter registration depends also on the rate of chart transport and, therefore, on the error due to inter-period timer variations. Timer error is most influential when recording trace is steep (e.g. during foehn, passing of fog patches, or high winds). Examining temperature recordings at random and at the four six-hourly synoptic times indicated that within $\pm$ 10 minutes temperatures can change by 1° C (average peak-to-peak deviation). This means a variation of $\pm 0.5^{\circ}$ C. The accuracy of temperature recording is, therefore, decreasing and now becomes the rms value of 0.75 and 0.5, namely $\pm 0.9^{\circ}$ C for the Mk II-T/H station. In reading the chart divisions, an error equivalent to $\pm 0.1^{\circ}$ C can be made. Furthermore, an error of $\pm 0.1^{\circ}$C is possible by using the calibration graph (see sec.III.14, p.41). The accuracy is decreasing by the sum of these errors, i.e. $\pm 0.2^{\circ}$ C. Thus, extracted temperatures from automatic recording have a possible accuracy of $\pm 1.1^{\circ}$ C.

The thermometers used in synoptic observations have an accuracy of $\pm 0.3^{\circ}$ C. The subjective error in reading the instrument is about $\pm 0.1^{\circ}$ C. The possible accuracy of man-observed temperature data is $\pm 0.4^{\circ}$ C.

And finally, the possible accuracy to be obtained by comparing man-observed to automatically registered temperature data is the rms value of both possible errors, i.e. 1.1° C and 0.4° C, namely $\pm 1.2^{\circ}$ C.

It now remains to be shown how well the stations actually did record. The comparisons made under different weather conditions demonstrate the particular behaviour of the stations. The following statistical approach, however, extends over the entire period of manned station observation.

A set of values representing deviations between man-observed and automatically recorded temperatures is obtained by subtracting the observed six-hourly temperature from the recorded value. The statistical analysis which done for the Pyrox-Sumner and Mk II-T/H station, is extended to include a study on the tendency of temperature variation. The slope of the registration trace indicates whether the temperature trend was increasing, remained steady or was decreasing within one-half hour before and after any six-hourly synoptic time. Figs.IV.2 and 3 show in histogram form, the temperature trend (overall, increasing, steady, and decreasing) of the Pyrox-Sumner station and the overall trend of temperature registration by the Mk II-T/H station.

Tables V.26, a, b and c and 27 in Appendix C present the statistics. An analysis of the frequency distributions gives the following results, summarized in the table below.

Characteristics of temperature registration

	Pyrox - Sumner station				Mk II-T/H station
statistic	overall trend	increas. trend	steady trend	decreas. trend	overall trend
no.of cases	132	46	37	49	212
arith.mean	- 0.25	- 0.26	- 0.21	- 0.29	- 0.08
median	- 0.23	- 0.29	- 0.19	- 0.22	- 0.06
mode	- 0.19	- 0.35	- 0.15	- 0.06	- 0.13
std.deviation	0.48	0.48	0.36	0.51	0.69
% of values in 1 dev.	66	66	49	64	69
T-test	5.8	3.6	3.5	4.0	1.2

From these results the following conclusions can be drawn:

The Pyrox-Sumner station shows a tendency to register temperatures - 0.25°C too low (skewness of the overall trend is - 0.12). Greatest influence of this effect is experienced when temperatures are decreasing or increasing, moreso on the decreasing trend (skewness - 0.41).

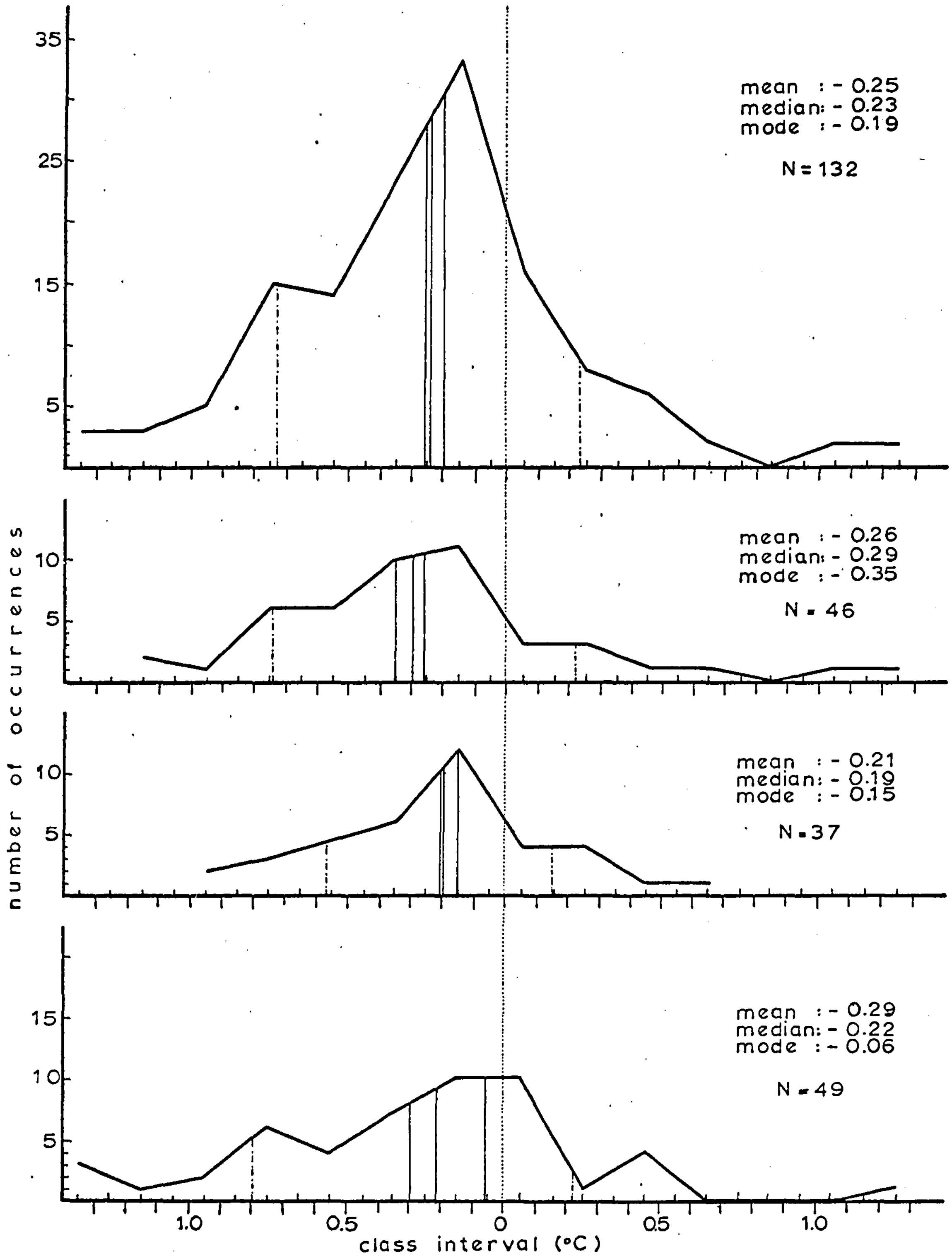
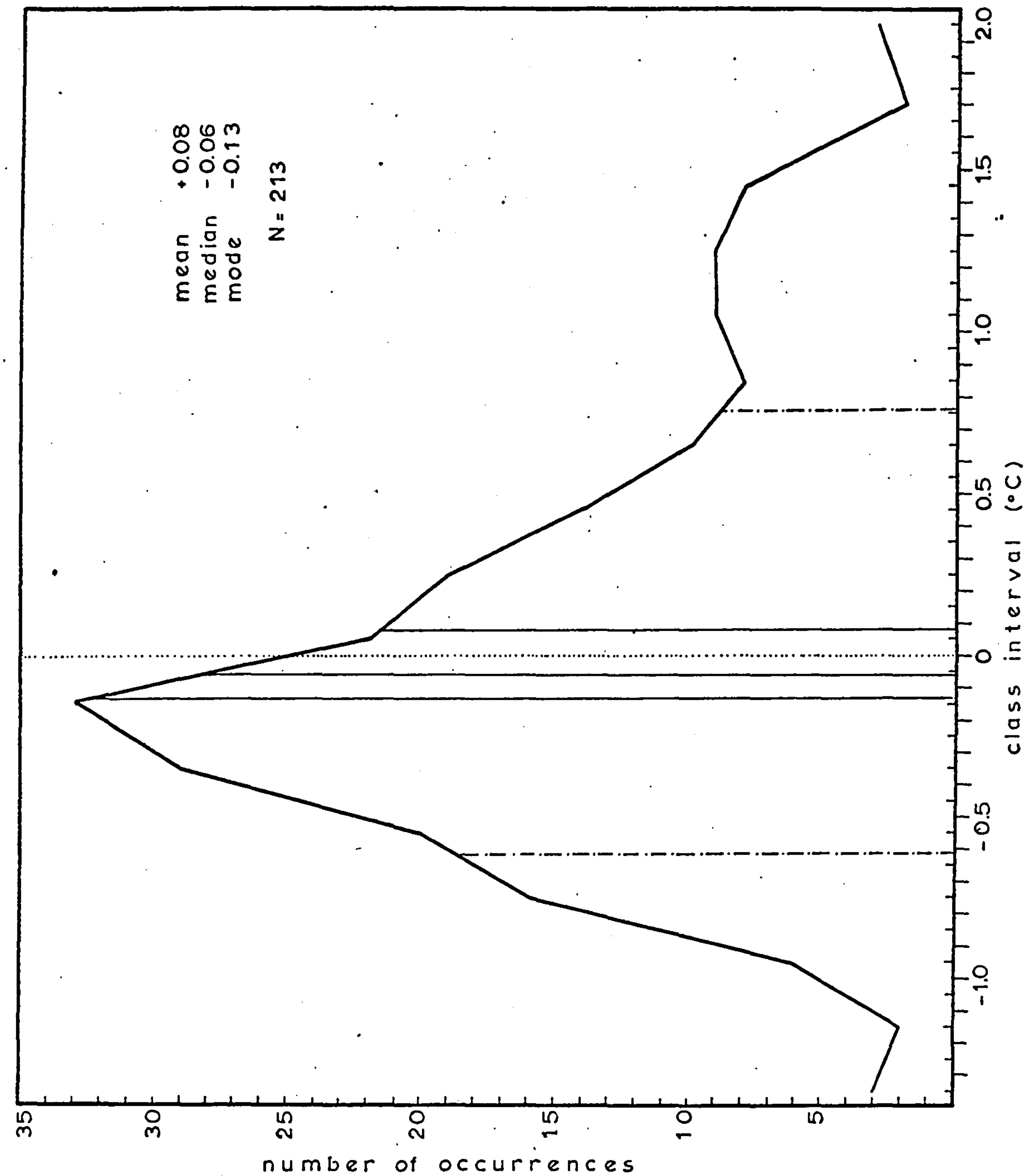


FIG IV.2: TEMPERATURE TREND & DISTRIBUTION.



FIGIV3: TEMPERATURE TREND & DISTRIBUTION, MkII.

Although it shows that the Mk II-T/H station records with a tendency very near to zero (- 0.06° C) it does not register temperature as accurate as the Pyrox-Sumner station because the Mk II station has a greater standard deviation. Nonetheless, 66 % of all compared values have an accuracy of ± 0.7° C and ± 0.5° C (Mk II-T/H and Pyrox-Sumner stations respectively). This accuracy is much better than possible accuracy discussed above. Even the largest observed deviation of temperature (+ 1.2° C, August 3, 1965) during a foehn is within expected limits. WMO specifications (WMO, 1966, p.12) suggest temperature measurement performance to be ± 1° C in 66 % of all cases. These standards are certainly met by the Mk II-T/H and Pyrox-Sumner stations.

Inspection of all differences in temperatures reveals that 99.9 % of all values fall within the expected range of minimum and maximum deviations, namely - 1.4 to 1.0° C. And it is highly probable that the median values of the overall trends are indicative of a zero-reference level drift.

Close agreement between objective and subjective analysis (see sec.III.4, p.77) is apparent.

The hysteresis-effect or lag in response to temperature fluctuations is also indicated by the statistical analysis. A physical explanation for this behaviour can be the following: Nitrogen gas is used as the transducer medium between the mercury-in-steel sensor housed in the ventilated stevenson screen and the bourdon element housed in the non-ventilated recorder. As temperatures increase, a higher temperature will prevail in the recorder housing. Consequently, a greater pressure gradient will be directed from the bourdon element towards the sensor bulb than is directed from the bulb towards the bourdon element. When temperatures decrease, the temperature in the non-ventilated recorder housing will not decrease as rapidly as the outside temperature. Hence a lagging temperature response will occur. In general, the hysteresis-effect should be most pronounced when temperatures decrease. A minimum lag should be noticible when temperatures remain steady. Examination of Fig.IV.2 and the statistics verify this physical explanation.

<u>Rel.Humidity:</u> "This is certainly the meteorological element whose measurment by automatic stations is the least satisfactory ..." (WMO, 1963; Technical Note No.52, p.2). The impossiblity of cleaning the chemically treated hair at remote locations produces the wellknown drawbacks: poor reliability on linearity, drifting of zero setting, and poor operation and response characteristics at low temperatures and low humidity values.

Comparison under different weather conditions indicated that mean-daily values did not differ very much over a given period, but rather large deviations in individual values, especially when the weather changed, occurred. To investigate how well the Mk II-T/H station recorded rel.humdities under all circumstances, including different location of the station, a statistical analysis is made. The basic information for the statistic is taken from Tables III.3, 4, 29 and 34 (Appendix A) and Tables IV.2, 19 and 39 (Appendix B). For the sake of brevity just the summary of results is given.

Mk II-T/H station at:		Base Camp July 29 - Aug.5,1965	Moraine Camp Ice Aug.10-26,1965	Moraine Camp Ice May 24-31,1965
Number of days		8	17	8
Number of comparisons		32	68	32
Mean RH % at:	0000 hrs	72 (+ 1)	77 (- 5)	79 (- 3)
(mean discre-	0600 hrs	73 (+ 2)	80 (- 3)	78 (- 2)
pancy is gi-	1200 hrs	70 (0)	71 (- 5)	71 (- 4)
ven in brkts.)	1800 hrs	71 (+ 2)	81 (+ 3)	76 (- 3)
Mean-daily RH % (period)		72 (+ 2)	79 (- 2)	75 (- 4)
Mean temperature (period)		6.6° C	-0.4° C	-4.0° C
greatest discrepancy (day)		3 % (4th)	9 % (17th)	19 % (25th)
Temp.variation at day of greatest discrepancy		10.7° C	12.0° C	16.6° C
Standard error (period)		± 1.9 %	± 3.5 %	± 7.3 %

The results indicate:

1) Mean discrepancies at synoptic hours were pronounced in the morning and evening at Base Camp, and at noon and midnight on the glacier at Moraine Camp Ice.

2) Greatest discrepancies occurred on days when temperature variations were large, and increased with increase in temperature variation.

3) Discrepancies are greater at lower temperatures and lower humidity values.

4) The station functioned better when it was located at Base Camp than it did at Moraine Camp Ice.

5) Accuracy is best when temperatures are above 0° C.

6) Aging of sensor (dessication of hair) and sub-zero ($^{\circ}$C) temperatures reduce the accuracy of the instrument to about $\pm$ 7 % after a period of 10 months. However, accuracy of rel.humidity recording (apart from the odd case) is within the WMO performance standard, namely $\pm$ 5 % above 0° C and $\pm$ 10 % below 0° C (WMO, 1966; Planning Report No. 10, page 12).

Bar.Pressure: Records of this met-parameter will be treated in two ways: a) operation of Mk II-BP/S station when unattended and b) operation of station when man-observations were carried out simultaneously.

The common trend in pressure variation of the automatic station and the weather stations at Eureka (Eu) and Isachsen (Ic) can be noticed even in the mean-daily values. It is, therefore, assumed that a common mean-monthly parallelism should also exist. A crude and simple prediction of pressure behaviour for the Axel Heiberg Island Expedition Area can be obtained by using the prototype formula:

$$\frac{3\ Eu + 1\ Ic}{4}$$

i.e., a computed mean, by taking three times the pressure value of Eureka plus the Isachsen pressure. It is derived from the distance relationship of Axel Heiberg Island to these stations along (practically) the same latitude. Pressure values used for computation are extracts from Arctic Summary, July 1965 to December 1966.

The actual automatically recorded mean-monthly pressures of the Mk II-BP/S station (reduced to mean sea level) are compared to the computed mean, and the following table shows the results and gives the mean monthly deviations.

Comparison of mean-monthly barometric pressures

		Mk II-BP/S (m.s.l.)	Predicted (m.s.l.)	Deviation (mb)
1965:	August	(1023.5)	1011.7	(+ 11.7)
	September	1017.1	1011.8	+ 5.3
	October	1013.0	1008.7	+ 4.4
	November	1025.5	1024.1	+ 1.5
	December	1011.9	1013.2	- 1.1
1966:	January	1021.5	1026.9	- 5.5
	Febuary	1018.8	1018.3	+ 0.6
	March	1023.4	1026.6	- 3.2
	April	1022.8	1023.1	- 0.3
	May	1026.7	1018.3	+ 5.4
	June	1021.4	1008.1	(+ 13.2)
	July	1025.6	1010.7	(+ 14.7)
	August	1028.8	1014.0	(+ 14.9)

In Fig.IV.4 the reduced mean monthly pressures, recorded at Moraine Camp Ice, are compared graphically to the computed mean monthly pressures for the area.

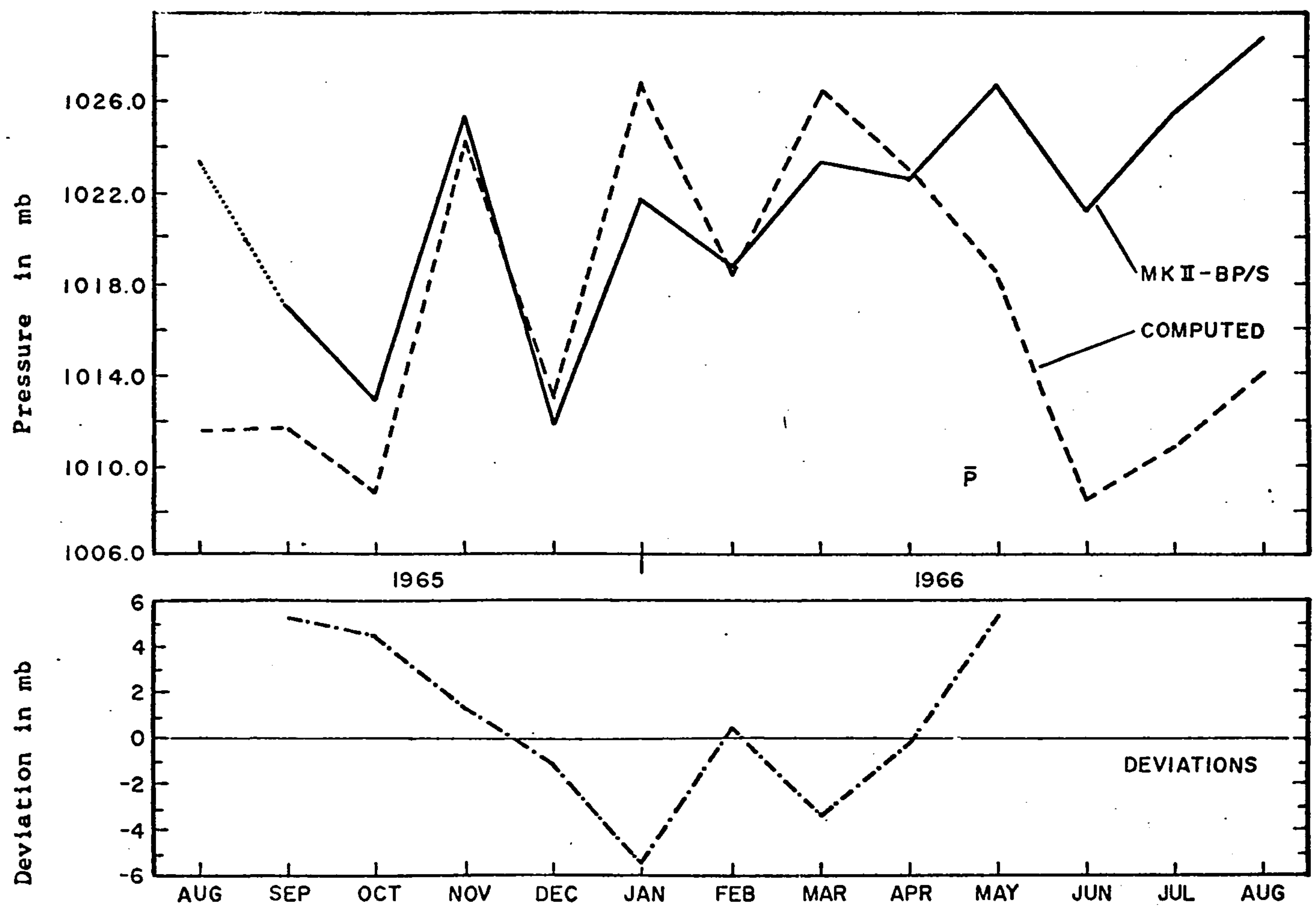


FIG. IV.4: COMPARISON OF MEAN MONTHLY BAR. PRESSURES AT MEAN SEA LEVEL.
AUTOMATIC RECORDED TO MAN-OBSERVED

It should not be expected to find "dead-on" agreement for the following reasons: The computed values can be distorted quite considerably through influences of weather patterns along the meridional axis. There may well be a pressure ridge or trough over Axel Heiberg Island, which would certainly not show up in the computed values. Examining surface pressure maps for every day of the intervening 291 days (Deutscher Wetterdienst, Zentralamt Offenbach, Germany: Täglicher Wetterbericht) it was found that in approximately 25 % of the cases pressures were about ± 3 mb different over Axel Heiberg Island. The automatically recorded pressures are not corrected for temperature. Furthermore, it is to be expected that pressures at Moraine Camp Ice may be somewhat lower because of the station being at a higher altitude (about 880 m).

Consequently, direct comparison of values is not intended. For the winter period from September to May a regression analysis shows that correlation between computed and automatically recorded values ($r = 0.828$) is significant at the 1 % probability level. It can, therefore, be assumed that the Mk II-BP/S station followed the trend of pressures during the winter months quite favourably. Deviations as well should not be regarded quantitatively. However, the course of deviations indicates the dependency of pressure registration on temperature variations. As an example: Deviation was most pronounced in January. Assuming that mean monthly temperatures at Axel Heiberg Island followed a similar trend as those observed at Eureka (100 km east), it would show that lowest mean monthly temperatures, about -40° C, prevailed in that month.

Mean monthly pressure deviations were less in Febuary than in January or March. Once again examining mean monthly temperatures indicates that Febuary was somewhat warmer (about 5° C) than either January or March 1966. The change-over from positive to negative and negative to positive deviations accurred when mean monthly temperatures were -14° C and -16°C respectively. The rather good correlation during the winter months leaves only 31.2 % of the total variation unexplained, whereby 25 % of the variations are due to meridional influences in the pressure pattern.

The regression analysis for the months of June to August 1966 shows infavourable agreement (r = -0.399) which indicates that computed values obtained by the above prototype formula are no longer applicable (84 % of the variations would remain unexplained).

Differences in reading are very small according to statistical comparison of the automatically recorded pressures to the man-observed pressure values. Table V.28 (Appendix C) presents the statistical analysis and Fig.IV.5 demonstrates the frequency distribution. The results of the statistical analysis are given below.

Statistic	Mk II-BP/S
Number of cases	44
Arith.mean	0.003
Median	0.02
Mode	0.11
Standard deviation	0.56
% of values in 1 dev.	53
Significance (T-test)	0.05

It is most typical (skewness: -0.31) of the Mk II-BP/S station to record pressures a little lower than expected. Although the number of cases observed are few the results are not obtained by chance. Comparison of operation under different weather conditions (see sec.III.4, p.77) demonstrated the disadvantageous ability of the station to record as much as 2.8 mb too high and 4.5 mb too low, when temperatures are rapidly changing. In general, however, the accuracy of pressure recording is ± 0.6 mb. This result agrees well with WMO performance standards of ± 1.0 mb (WMO, 1966; Planning Report No.10, p.12).

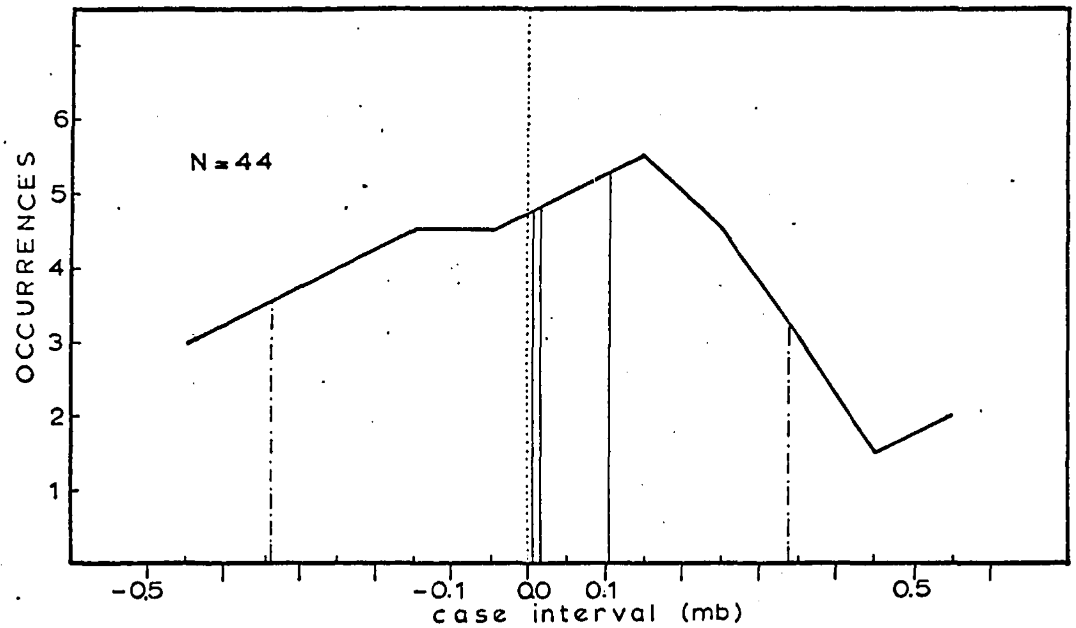


FIG IV.5: STATISTIC: BAR. PRESSURE, Mk II.

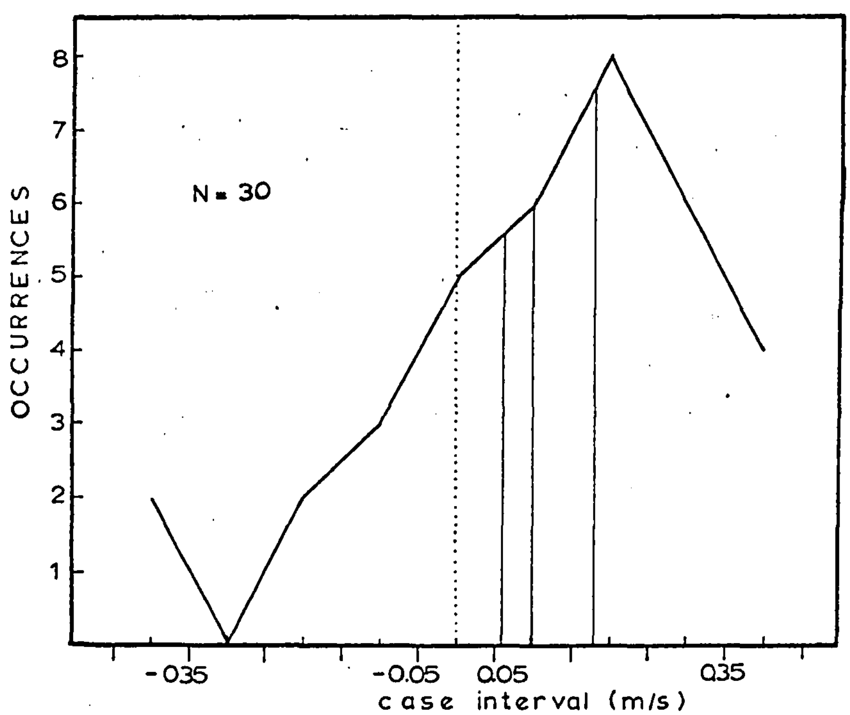


FIG IV.6: STATISTIC: WIND SPEED, Mk II.

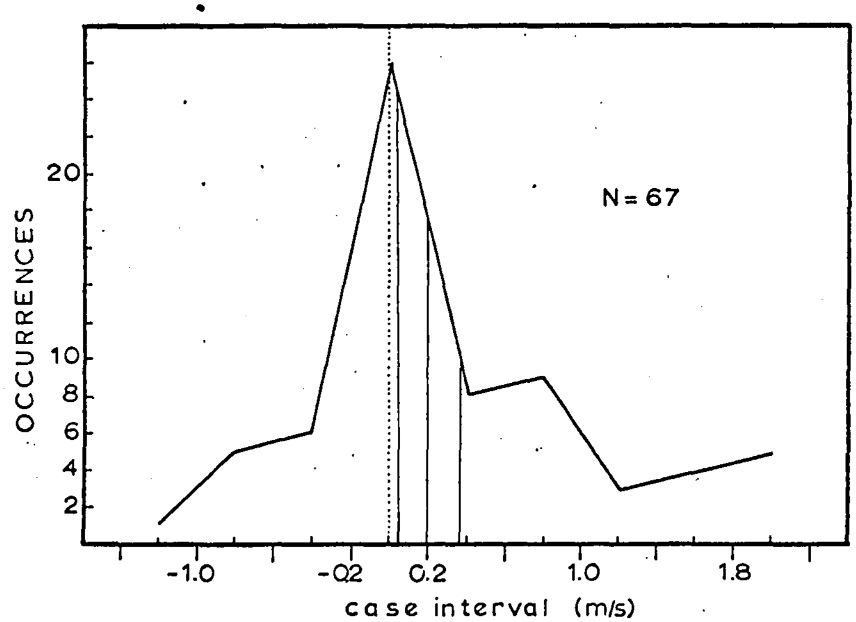


FIG IV.7: STATISTIC: WIND SPEED, PYROX SUMNER.

Wind Speed and Wind Direction: Apart from the icing problem, wind measurement does not give rise to any particular drawbacks. Comparisons made in sec.III.41 show that wind speeds recorded by Mk II-WS/D station may deviate from synotically observed values by as much as - 60 cm/s. This subjective result needs to be checked by objective, statistical analysis.

Information on wind speed registration of the Mk II-WS/D station is given in Table V.29 (Appendix C) and that for the Pyrox-Sumner station is presented in Table V.30 (Appendix C). Frequency distribution plots are shown in Fig.IV.6 and 7. The summary of the analysis is given below.

Statistic	Mk II-WS/D	Pyrox-Sumner
Number of cases	30	67
Arith. mean	0.06	0.34
Median	0.10	0.20
Mode	0.18	0.05
Standard deviation	0.19	0.71
% of values in 1 dev.	63	64
Significance (T-test)	1.7	1.9

The results for both stations are in 95 % of all cases meaningfull. The Mk II-WS/D station may not be as sensitive as the Pyrox-Sumner station, but it records with a better accuracy ($\pm$ 0.2 m/s in relation to $\pm$ 0.7 m/s for winds below 20 m/s). When comparing these results to WMO performance standards of $\pm$ 1 m/s (WMO, 1966; Planning Report No.10, p.8, Annex D) very favourable agreement is found.

For periods of unattended operation the frequency distributions are given in Table IV.54 (Appendix B). Figs.IV.8, 9 and 10 show the monthly histograms; the table below gives the sizes of the case intervals.

case interval (No)	mean wind speed (m/sec)	case interval (No)	mean wind speed (m/sec)
1	calm (0-0.1)	11	9.2 - 10.1
2	0.2 - 1.1	12	10.2 - 11.1
3	1.2 - 2.1	13	11.2 - 12.1
4	2.2 - 3.1	14	12.2 - 13.1
5	3.2 - 4.1	15	13.2 - 14.1
6	4.2 - 5.1	16	14.2 - 15.1
7	5.2 - 6.1	17	15.2 - 16.1
8	6.2 - 7.1	18	16.2 - 17.1
9	7.2 - 8.1	19	17.2 - 18.1
10	8.2 - 9.1		

(Plotted along the ordinates of the histograms are the number of occurrances. N means the number of cases which equals the number of synoptic observations in the particular month.)

The wind at Moraine Camp Ice Station was strongly influenced by the surrounding topography. There is a definite group of winds within the range of 0.2 to 3.1 m/sec (case interval 2 to 4 in the histograms) occurring every month. This particular modal distribution centers around a mean wind speed of 1.5 m/sec in 75 percent of the cases. The wind speed distribution for the entire observation period 1965 - 1966 shows the same pattern. Gletscher wind, also known as "glacier breeze", is a local, catabatic wind, that forms by air cooling and becoming more dense than the surrounding air. It "slides down" along the incline of a glacier surface in a shallow layer. This wind layer extends usually to a height of not more than about three metres above the glacier surface; shallowness depending of course on the stability of the air. Air speed is usually no more than 3 m/sec. If the wind, registered by the station at 2.0 m above the glacier surface, is the Gletscherwind, then one may deduce that the cooling effect on the lower atmosphere by the ice mass is effective also during the arctic winter. The cooling effect should be a

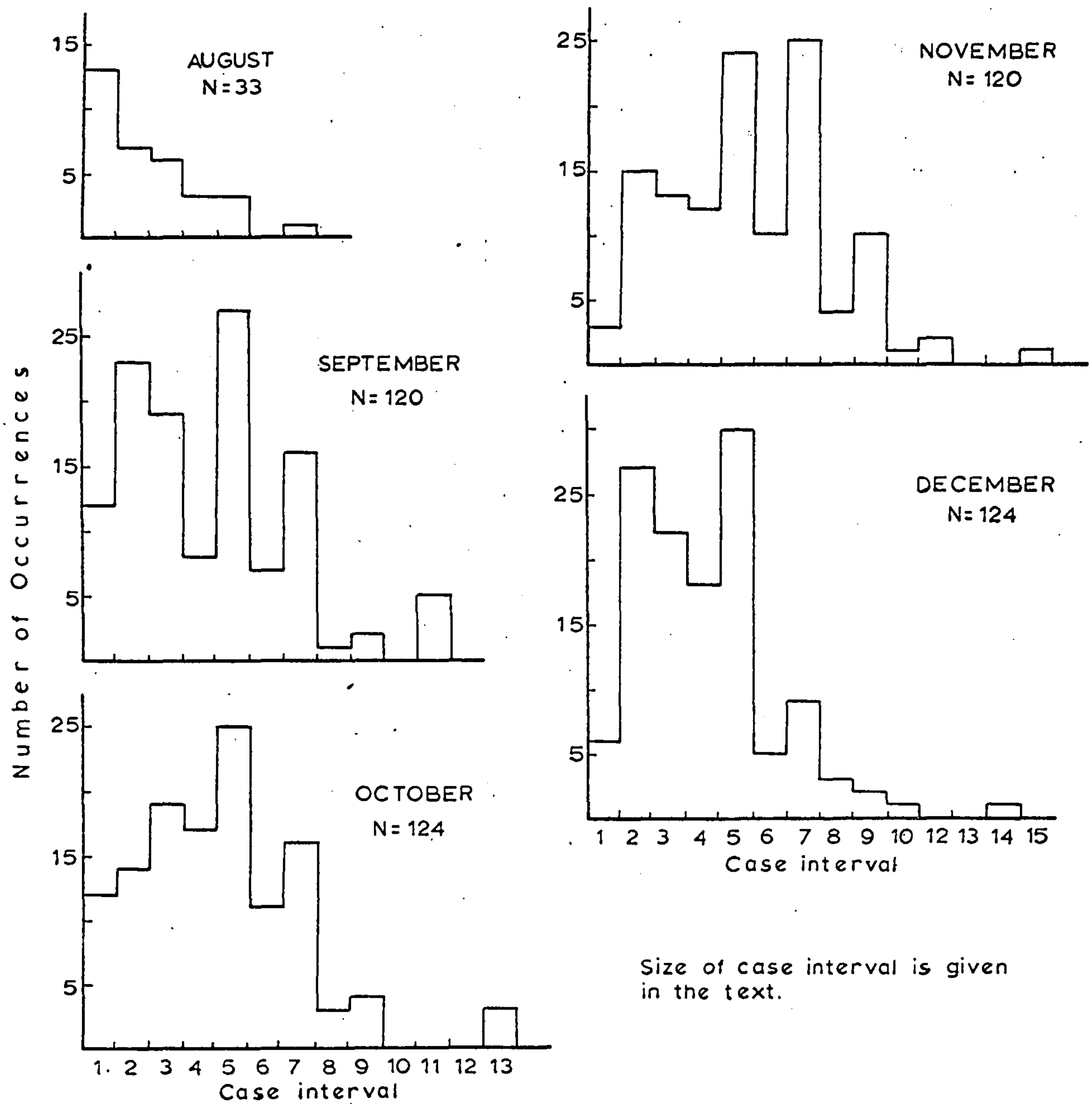


FIG IV.8: WINDSPEED DISTRIBUTION, MORAINE CAMP ICE, 1965.

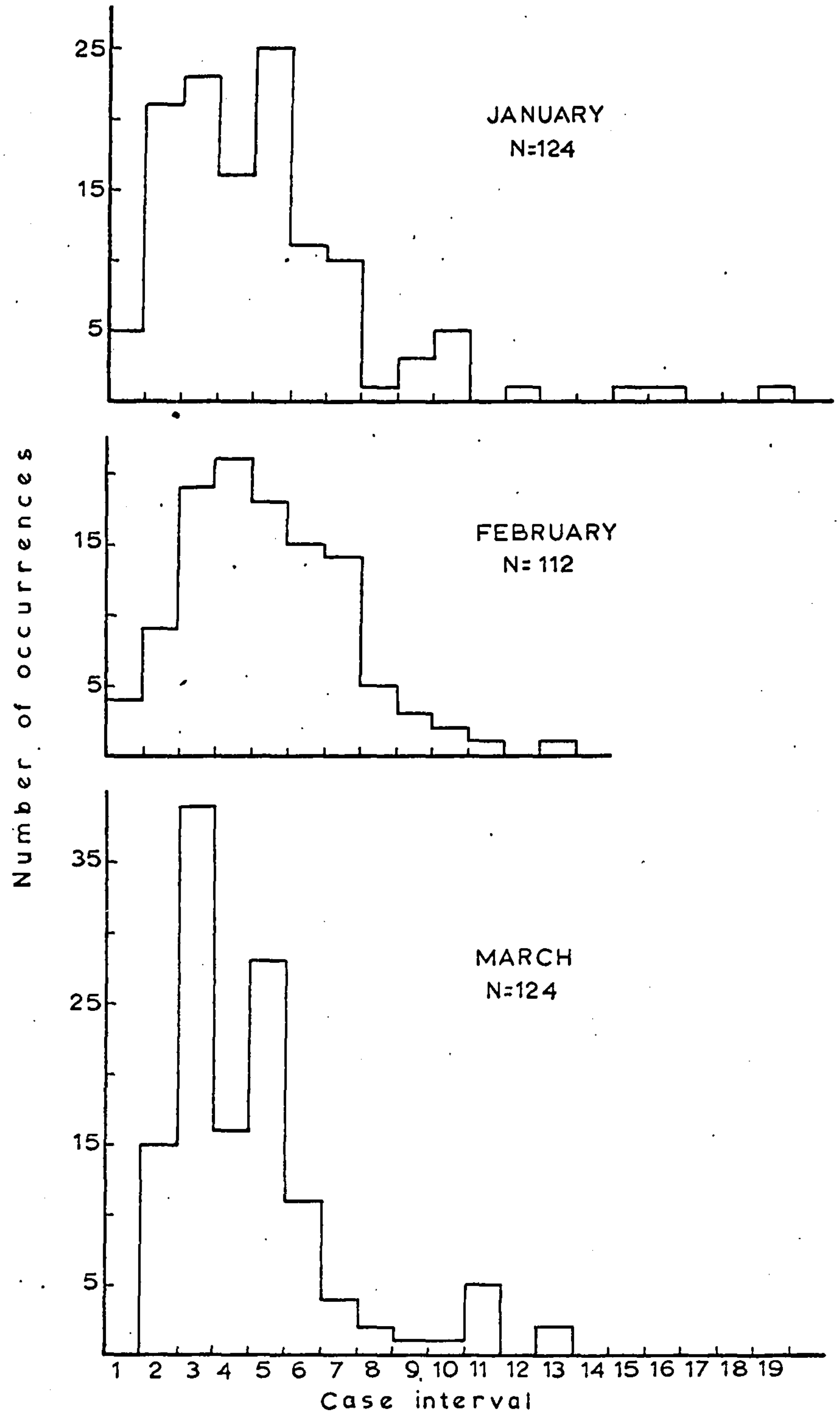


FIG IV.9: WINDSPEED DISTRIBUTION, MORAINE CAMP ICE, 1966.

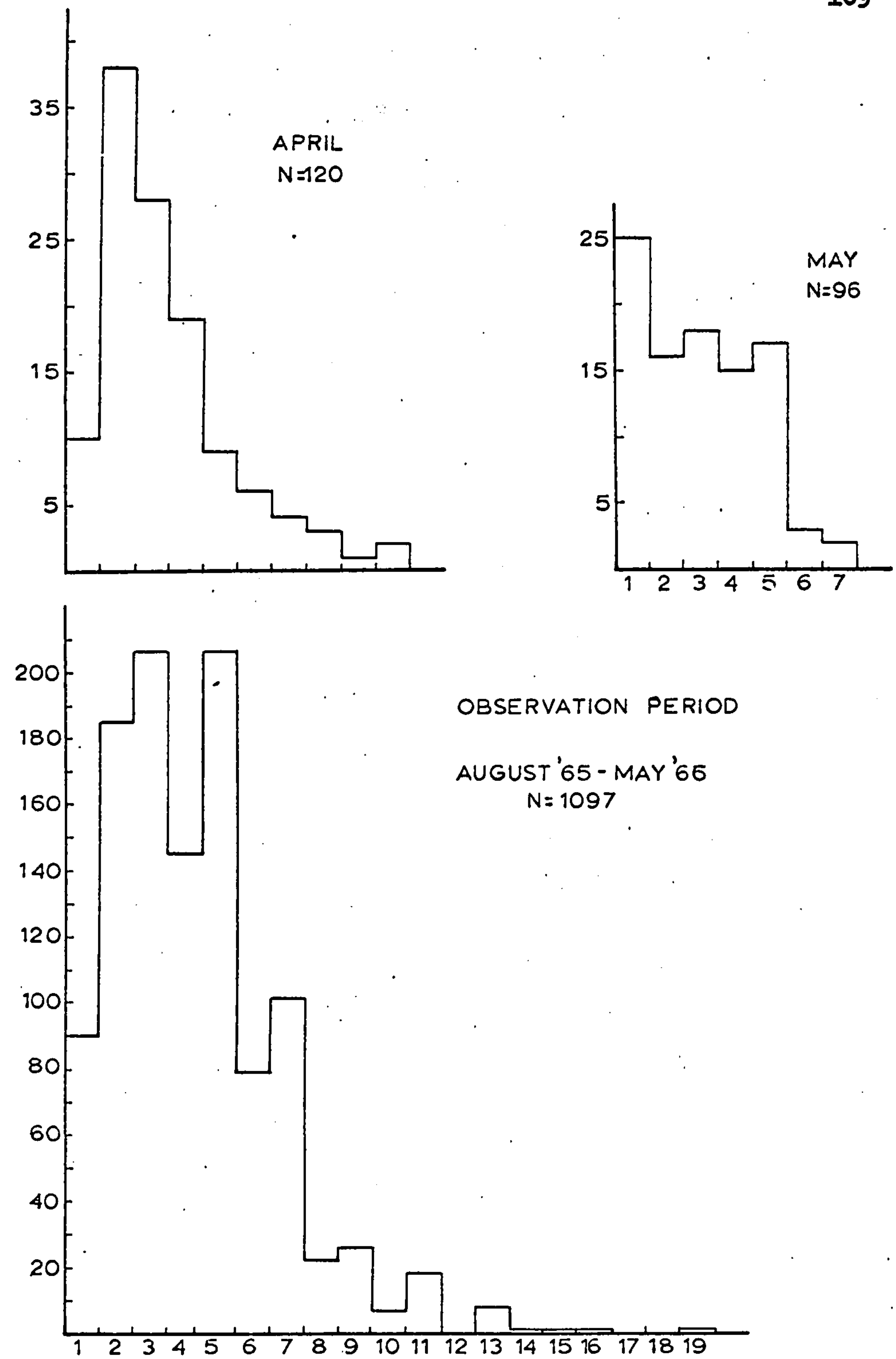


FIG IV.10: WINDSPEED DISTRIBUTION, MORAINE CAMP ICE, 1966 and OBSERVATION PERIOD 1965-66.

minimum on days with coldest air temperatures and it probably is not only dependent on insolation but also on out-going long-wave radiation.

In Febuary 1966 most influence of this particular modal wind speed distribution is evident, for it was the month of higher temperatures during the winter period of 1965 - 1966 at Moraine Camp Ice Station. The effect of Gletscherwind was well pronounced in March and April, after insolation became more effective and air temperatures increased.

Wind speed distribution is, in general, non-unimodal. Four modes of wind speed are shown for almost every month. And the histogram for the entire observation period, August 1965 to May 1966, shows this tendency as well. May is the month with most calms (47 % of the total of 32 calms recorded). No calms were recorded throughout the month of March 1966.

There seems to be no definite reason to believe that the Mk II WS/D station recorded wind speeds and wind direction incorrectly. Only 32 calms were recorded at the synoptic six-hourly intervals in the entire nine months of recording. Hoar frost, rime or glaze on the sensor was never observed during the attended period, and since no continuous period of calms shows in the automatically registered data, it may be assumed that this unwanted effect did not occur in the winter months of 1965/66.

The Figs.IV.11 and 12 show the average distribution of wind direction, expressed in percentage, at the four six-hourly synoptic times of each day as obtained for each month (see Table IV.55).

Wind directions are given to 16 points of the compass at the 200 cm level. The wind roses show what should be expected, namely winds blowing predominantly from the north at Moraine Camp Ice Station. Interesting is the creeping-effect of the main wind vector from north-northwest

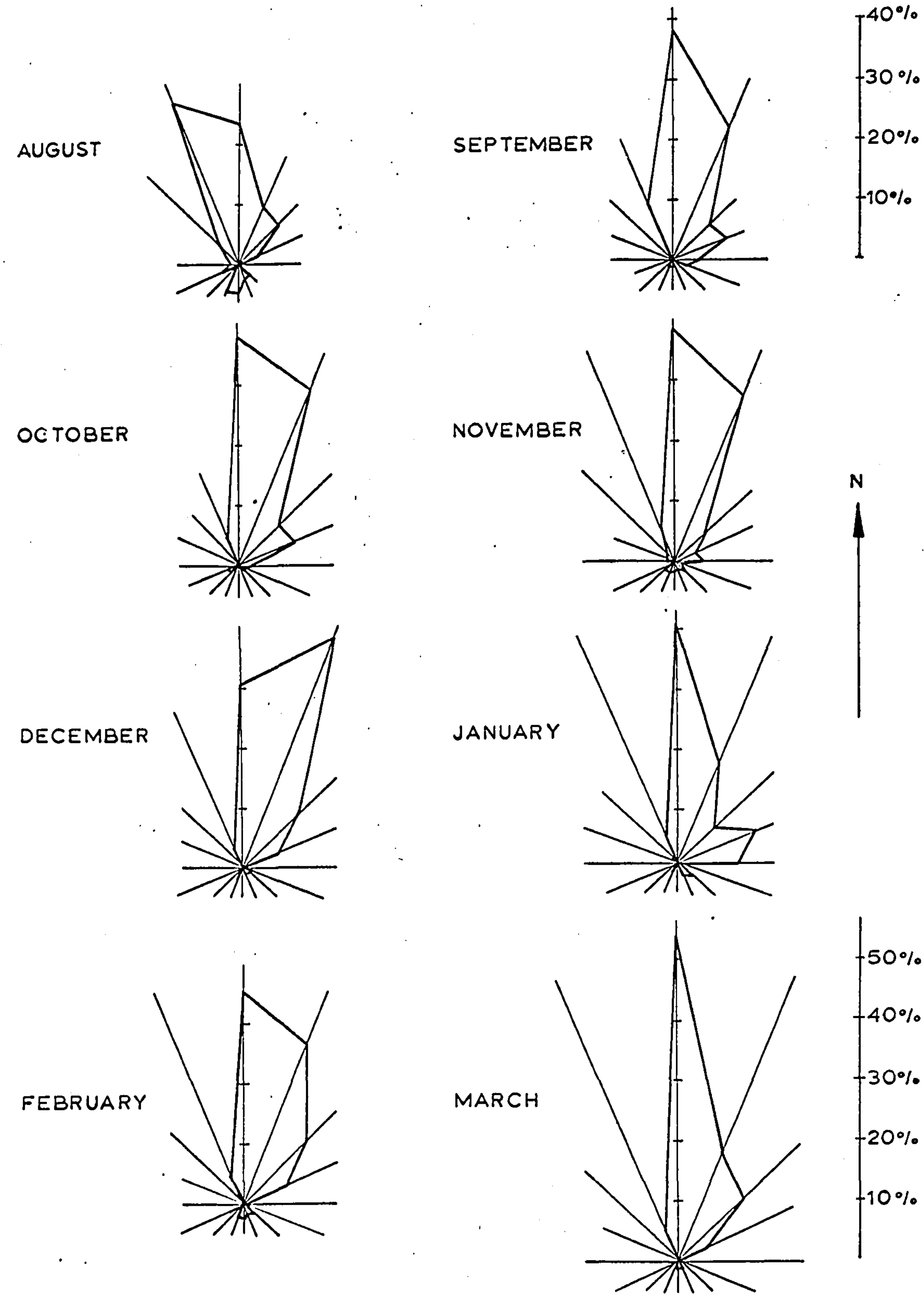


FIG IV.11: WINDROSES, MORAINE CAMP ICE, 1965-66.

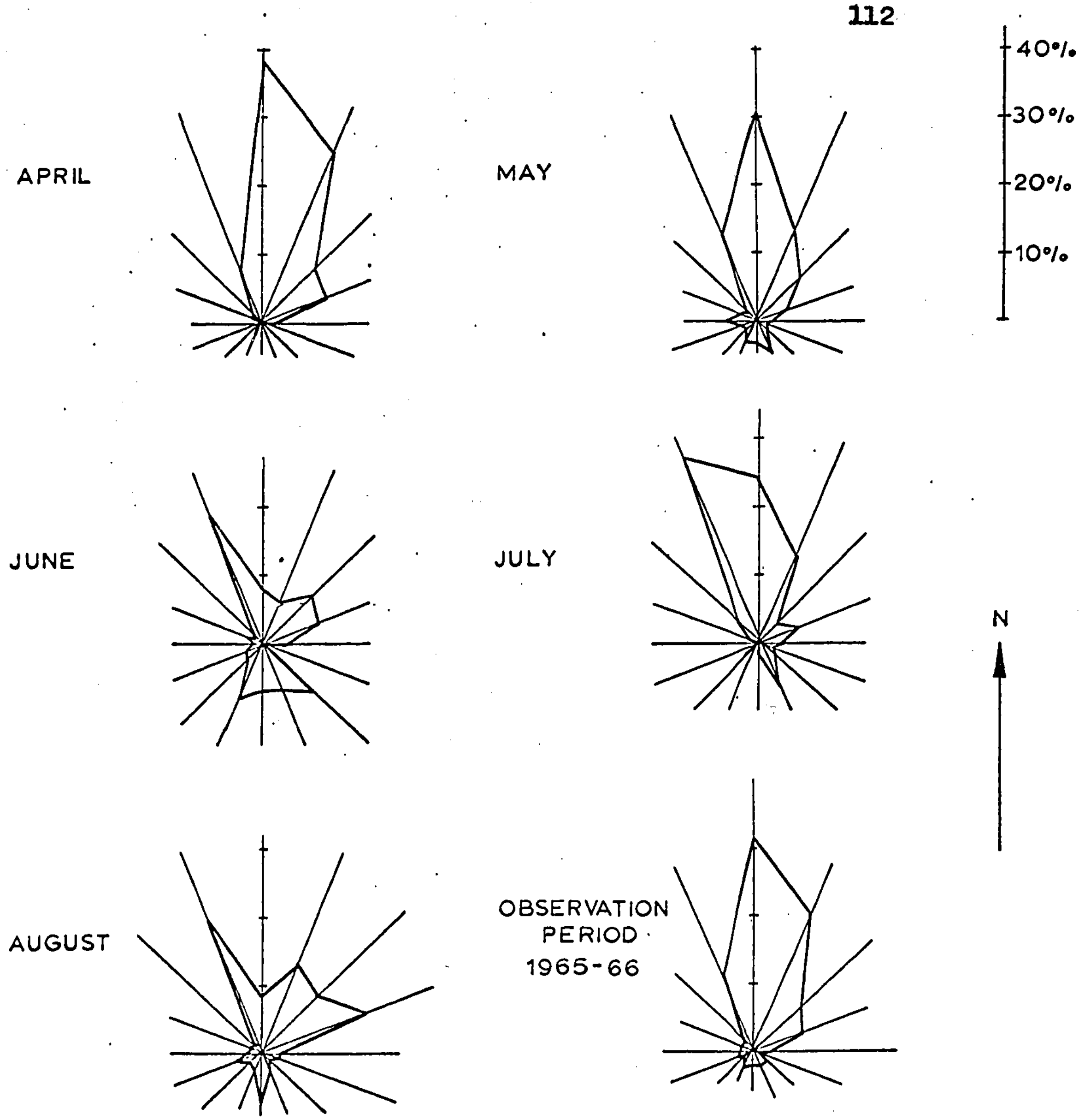


FIG IV.12: WINDROSES, MORAINE CAMP ICE, 1965-66.

through north to north-northeast during the period of August 1965 to Febuary 1966. However, highest percentage of north wind (53.3 %) occurred in March 1966. Note that during this month the Gletscherwind and the apparent cooling effect of the glacier were most pronounced.

When cyclones approach along the "polar basin" track and cross Axel Heiberg Island during the summer months, winds with a southerly component are frequent. The wind rose for the month of June 1966 shows this predominant influence, as it was the month of highest southeasterly winds (9.2 %) and moderately low pressures. High pressures north of the island in November caused winds to blow from the northeast.

The wind rose for the entire observation period from August 1965 to August 1966 (Fig.IV.12) shows that east-southeasterly, southwesterly and west-northwesterly winds were very rare. Easterly, southerly and westerly winds occurred much less frequently. Most winds blew from the northern sector (north-northwest to east-northeast) with main winds arriving from the north.

Gusty winds produce the highest wind direction deviations recorded by the Mk II-WS/D station which can be as high as $\pm 10^{\circ}$. When the station was originally installed on the glacier wind reference direction was true west. In its downward movement during the 13 months on the glacier the stations remained facing true south, therfore no appreciable distortion in the given accuracy is expected. Accuracy in wind direction registration is to be regarded as good and acceptable to WMO performance standards (WMO, 1966; Planning Report No.10, p.12).

Sunshine: The calculated astronomical possible sunshine on the 15th of each month and the calculated altitude of the sun on the 21st of each month at lat. 79° N, long. 91° W is shown in Fig.IV.13. The altitude of sun plot is useful in determining when the first and last sunshine registration can possibly be made. Twilight began on Febuary 6, 1966 and sunrise was on Febuary 21, 1966. Sunset occurred on October 28, and twilight lasted till November 12, 1965 (Air Almanac, 1965; pp.A 74,75).

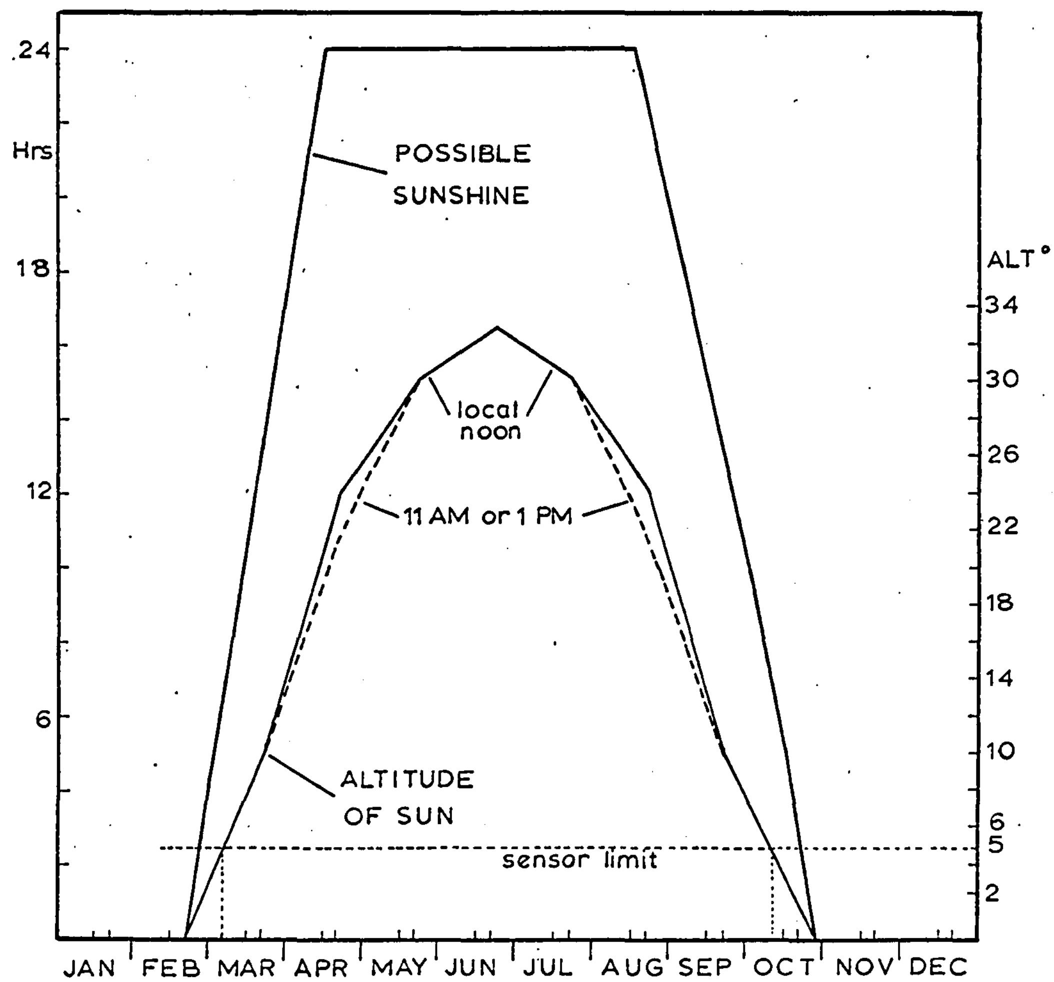


FIG IV.13: ASTRONOMICAL POSSIBLE SUNSHINE ON 15th OF EACH MONTH and ALTITUDE OF SUN ON 21st OF EACH MONTH AT LAT. 79°N, LONG. 91°W.

Sunshine registration is dependent on the sensitivity and geometry of the sensor and the registration procedure of the recording system. The sensor is not capable of registering sunshine when the sun's altitude is lower than 5^{o} above astronomical horizon in latitudes higher than 50^{o} N. This characteristic sensor threshold is shown in Fig.IV.13 as a dotted horizontal line. The intersection of this line with the calculated astronomical possible sunshine graph determines the limits of possible registration of sunshine by the equipment. No sunshine will be recorded before March 3, 1966 and after October 13, 1965 and 1966. Indeed, the sunshine records in Tables IV.5 and 32 show the first sunshine registration was made on March 13, 1966 and the last registration occurred on October 13, 1965.

Comparisons made in sec.III.4 in periods A and C showed that the sunshine sensor is perceptive to temperature and wind variations. Sumner (personal communication) states that the sensing elements will make or brake contact within 30 seconds, if sunshine is 10 milliwatts per cm^2. As the recording system does not store the number of interruptions and only prints the information, if it occurred at a six-minute interval it will, therefore, be unknown whether the sun was shining or not shining for at least four minutes of the six-minute recording interval. Chances are that there was sunshine in this time, but at the time of recording it was cloudy. This may well lead to an underestimation of sunshine duration. The yes-no principle can be applied properly, if the system's recording interval is equal to the response of the sensing equipment.

Unfortunately, the topographic horizon at Moraine Camp Ice has not been determined. Cloudiness or snow-covered sunshine sensor at the beginning of March 1966 are probable causes for the sunshine trace setting in 10 days later than expected. This is the explanation for the dotted line in Fig.III.11.

Certainly it was not expected to observe a sunshine trace during the arctic winter months. But a solid trace is shown for the following days:

a) 1730 hrs, December 12 until 0430 hrs, December 13, 1965 (very fragmentary).
b) 0930 hrs, December 15 until 1330 hrs, December 19, 1965.
c) 2130 hrs, January 1 until 1630 hrs, January 15, 1966.
d) 1030 hrs, January 22 until 1230 hrs, January 25, 1966.

The Ephemeris (Air Almanac, 1965, p.A 75) shows that there was a circumpolar full moon between January 2 and 11, 1966. Last quarter was on January 15, whereby it crossed the meridian in lat. 80° N at 1200 hrs. The semi-duration of moonlight taken for the time of meridian passage is three hours, and so moonset is at 1500 hrs L.M.T. on January 15, 1966. The timer of the Mk II-BP/S station was slow by about one hour at this time (see sec.IV.11) and it is quite evident that the sensor was registering moonshine. Furthermore, the altitude of the moon was 38°, i.e. five degrees higher in the sky than the sun could ever be at this latitude. Similar computations were made for December 12 and 15, 1965. All results were verified by the Canadian Dominion Observatory in Ottawa (Dr. D.Allis, 1967; personal communication).

There is definitely a new moon during the period of January 22 to 25, 1966.However, there was with great certainty bright auroral activity in the high arctic regions (Canadian National Research Council, Ottawa; Dr. P.Millman, personal communication). No auroral observations were made at Eureka (instrument break-down) during this time, but Isachsen and Alert report weak auroral activity, whereas Mould Bay (76°14' N, 119°20' W) observed bright aurora along the southwest to northeast hemispherical direction. It can only be concluded that, quite probably, the sunshine sensing elements are sensitive to emissive radiation originating from auroral activity.

The high sensitivity of the sensor at temperatures below + 4.4° C (must be better than 10 milliwatts per cm^2) explains, why sunshine was recorded by the station in white-out conditions (May 1966). On the other hand, the limitations imposed by the recording procedure and the perceptiveness of the instrument to temperature variation and lack of ventilation introduces doubts to whether the sunshine data are as reliable as one would want them to be. Improvement in sensor quality and recording technique is undoubtedly needed.

It is assumed that the sunshine registration accuracy is about ± 15 %.

IV.3 Over-All Reliability of Stations

A drawback in the construction of the case cover assembly is the lack of a sure-grip surface or handle. Snow collects on the time-check window, because of the raised edges around the plexiglass window. The wind direction shaft protection and guide collar is much too short in length and does not protect the wind shaft from getting bent. The mounting block fitted to the base plate of each of the recorders is too heavy and its dimensions are too small.

Causes for the stoppage or intermittance of chart transport and failure of registration were the following:

1) Jamming of solenoid armature.
2) Incorrect adjustment of eccentric stop: the ratchet arm will either not be lowered far enough to interlock the next tooth of the ratchet wheel, or the arm will overtravel and advance more than one tooth for each solenoid operation.
3) Detached ratchet arm.
4) The non-return latch (pawl) did not engage the next tooth because the spring broke.

5) The idler gear did not interlink with the gear drive.

6) The chart paper slipped off the transport sprocket pins due to dampness of paper.

7) Flattening of the tip of the recording pen points caused the pens to remain in the chart paper and, as the chart advanced, the paper was torn and the pen arms were bent slightly.

8) All micro-switches are rated for a life of one million reversals, but the unit used in the wind sensor for Mk II-WS/D recorder failed after one winter's operation.

9) Bar.pressure registration failed during the periods: October 26 to 29, 1965; January 6 to 8 and Febuary 11 to 12, 1966. The reason for failure was the low pressure values which were beyond the possible lower range setting of the instrument (900 mb).

Most electro-mechanical failures were experienced with the Pyrox-Sumner recorder at Base Camp.

The take-off drum is difficult to remove from its holding bracket and care must be taken not to damage the recording pen mechanism. Rain, snow and drizzle will cause marking of the chart paper. These marks disappear after evaporation, but accidental scratchings remain permanently. The problem of handling the charts in the field and during extraction and analysis of registrations is a serious drawback.

Expected mean time between failure of stations in polar regions should not be less than four months. And performance duration requires that all met-parameters are recorded concurrently at specified accuracy within a probability of 66 % (one standard deviation). The energy supplies and functional electronics are expected to perform at least one year, but their performance is not to be regarded as a major factor in limiting the overall reliability of the stations (WMO, 1966, Planning Report No.10, p.13).

Because every Mk II station recorded at least four months continuously, whereby the specified accuracy was maintained, it is concluded that the over-all reliability of these stations is good. The intermittent performance of the Pyrox-Summer station indicates this station to be unreliable.

IV.4 Summary

Automatic climatological stations have an extremely important role to play in recording met-parameters in uninhabited and difficult to reach locations, which holds especially true for polar regions. In this way invaluable information for over-all weather situations and occurrances at sites with specific phenomena can be provided as these stations are capable of on-site recording which avoids the loss of data as can often be the case when information is transmitted.

International standards require stations in polar areas to record as mandatory meteorological elements: air temperature, atmospheric pressure, wind speed, and wind direction. Desirable additional elements in order of priority are relative humidity and sunshine duration.

The Mk II and Pyrox-Summer stations, used for the first time in the arctic, meet the basic requirements as well as the optional. These stations were originally designed for operation at remote places in Australia. It presented an interesting challenge to investigate how the station would perform under conditions as found in the high arctic.

The stations used at Axel Heiberg Island were installed to study the glacier-climatoligical relationship. Comparisons showed that they can also be regarded as "supplementary stations" to the Joint Arctic Weather Stations Eureka and Isachsen and, therefore, prove the feasibility of these stations for arctic glacio-climatological research.

The performance of the stations under different types of weather conditions in connection with man-observations and when they were unattended, was the main purpose of this survey. In order to eliminate subjective conclusions by simply comparing the recordings of the stations with man-observed data, great care and consideration was given to the statistical analysis of the acquired data in order to demonstrate that the over-all performance meets the international requirements specified by the World Meteorological Organization. However, the pressure values for the unattended period derived by the prototype formula must, for this particular case, be regarded as fortuitous.

The minor drawbacks, such as erratic timer operation, unreliable sunshine sensing techinique and relative humidity recording, unpredictable mechanical malfunctions, and the awkward manner of storing the meteorological information leading to lengthy extraction and evaluation procedures certainly require improvement. Special attention has to be paid to most sensors which definitely show a hysteresis-effect (lag or lead) before and after rapid weather changes. Modification to the equipmant would basically be to record meteorological information by using digital methods.

ACKNOWLEDGEMENTS

To the originator of this project and supervisor of this thesis, Professor F. Müller, my sincere thanks. His stimulating discussions, critical reviews and support on the various problems which arose during my work, were a great help and were always much appreciated.

This project has been financed by generous grants from the National Research Council of Canada to Dr. F. Müller. I wish to express my great appreciation to the Council.

I am also greatly indebted to Dr. P.Andrieux, Professor S.Orvig, Dr. W.S.B.Paterson, Assoc.Dean F.R.Terroux and Dr. E.Vowinkel for their advice, encouraging comments and suggestions on many occasions.

The writer gratefully acknowledges the help of the members of the Axel Heiberg Island Expedition, 1965/66: P.Altosaar for his assistance in the field and substantial contribution to the initial working-up of the test data in the office. C.S.L.Ommanney for his invaluable technical help in establishing the stations and taking of the photographs presented on pages 7, 12 and 19. M.Kahn initially surveyed the glacier stations in 1965; A.C.D.Terroux improved the surveys in 1966 and made available the computized results of station movement.

The maps on pages 2 and 21 are taken from earlier expedition reports and due thanks go to Dr. F.Müller for permission to publish these.

Lastly, I thank N.McFarlane and B.E.Sugden who read some parts of the manuscript and made many helpful comments.

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APPENDIX A

List of scientific instruments used at Base Camp Station and Moraine Camp Ice Station, 1965 and 1966.

Base Camp: Canadian DOT Stevenson screen
Normal thermometer: # 80 T 800596
Maximum thermometer: # (X 33724)*, X 36546
Minimum thermometer: # N 53570
Thermohygrograph: Haenni
Anemometer: Fuess, # C 4938
Aspiration Psychrometer: Haenni, marked BC
Campbell-Stokes sunshine recorder
Barometer: Fuess, # C 8336
Canadian DOT 9 cm rain gauge with graduate

*) broken on August 27, 1965

Moraine Camp: Canadian DOT Stevenson screen
Normal thermometer: # S 70751
Maximum thermometer: # X 33750
Minimum thermometer: # N 51241
Thermohygrograph: Haenni, # 4049676
Anemometer: Fuess, # C 4943
Aspiration Psychrometer: Haenni, marked MC
Thommen altimeter: # 70070
Canadian DOT 9 cm rain gauge with graduate

Table III.1 - Man-observed synoptic, Base Camp,

Air temperature (°C.), July 22 - 31, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
22	2.0	1.6	3.6	7.5	3.7	-	7.5	0.4	4.0
23	2.5	6.1	9.6	7.1	6.3	-	11.1	0.6	5.9
24	6.9	7.0	10.1	13.1	9.3	6.1	12.8	5.6	9.2
25	7.4	7.6	11.3	9.2	8.9	5.8	12.7	5.3	9.0
26	6.9	0.2	1.0	1.2	2.3	4.8	7.5	0.0	3.8
27	0.9	1.4	3.8	2.3	2.1	3.5	4.7	-0.5	2.1
28	0.8	0.6	2.4	2.4	1.6	2.6	3.3	-0.4	1.5
29	1.3	1.1	2.5	5.2	2.5	3.1	5.3	0.0	2.7
30	3.4	3.7	5.2	5.4	4.4	3.5	5.7	0.7	3.2
31	4.8	5.9	5.1	4.3	5.0	5.0	6.3	3.1	4.7
mean	3.7	3.5	5.5	5.8	4.6		7.7	1.6	4.7

Table III.2 Man-observed synoptic, Base Camp,

Air temperature (°C.), August 1 - 29, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	3.1	4.2	4.6	5.0	4.2	7.8	5.4	2.8	4.1
2	6.9	9.0	9.5	9.8	8.8	8.8	11.6	4.5	8.1
3	10.6	12.5	14.5	14.3	13.0	8.4	15.2	8.5	11.9
4	12.6	7.5	9.2	8.1	9.4	8.0	15.0	3.0	9.0
5	5.3	5.3	8.1	6.9	6.4	7.0	8.8	4.4	6.6
6	3.0	1.2	2.8	1.3	2.1	7.0	5.7	0.8	3.2
7	0.4	5.2	5.6	5.1	4.1	4.7	8.7	-0.4	4.2
8	4.8	6.8	11.1	9.3	8.0	3.7	13.0	3.1	8.0
9	2.9	1.5	4.8	2.0	2.8	3.6	8.8	0.2	4.5
10	0.0	0.4	3.0	2.8	1.6	4.1	4.0	-0.1	2.0
11	-0.8	-1.1	4.2	4.8	1.8	4.7	5.0	-2.0	1.5

continued

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
12	1.2	4.1	9.2	11.0	6.4	6.0	11.5	-1.0	5.3
13	8.0	9.7	11.6	13.4	10.7	6.3	13.9	5.2	9.5
14	6.9	9.2	12.0	10.0	9.5	6.3	13.9	5.9	9.4
15	3.0	1.1	3.4	4.2	2.9	5.3	10.0	-0.5	4.8
16	1.2	1.2	2.5	3.0	2.0	3.3	5.8	-0.4	2.7
17	0.3	-0.6	3.5	2.3	1.4	1.7	4.3	-1.1	1.6
18	0.4	0.0	1.0	2.3	0.9	1.5	2.9	-0.8	1.1
19	0.2	-0.2	2.8	3.1	1.5	1.8	4.6	-0.8	1.9
20	1.7	0.9	2.2	1.7	1.6	1.7	3.9	-0.7	1.6
21	0.8	4.2	4.7	4.1	3.5	2.0	5.6	0.2	2.9
22	0.7	0.8	1.4	1.1	1.0	2.2	1.7	-0.9	0.4
23	0.9	1.1	4.0	3.3	2.3	1.9	5.2	0.2	2.7
24	3.0	2.5	2.8	2.5	2.7	1.6	3.9	0.7	2.3
25	-0.3	-0.9	-0.5	0.8	-0.2	1.6	3.1	-1.4	0.9
26	1.0	0.9	3.2	3.1	2.0	0.9	4.1	-1.6	1.3
27	0.2	-1.2	4.8	0.2	1.0	0.0	5.3	-1.9	1.7
28	0.0	-1.1	-0.9	-1.3	-0.8	-	0.4	-1.5	-0.6
29	-1.9	-2.2	-1.6	-2.8	-2.1	-	-1.3	-2.8	-2.0
mean	2.6	2.8	5.0	4.5	3.7		6.9	0.8	3.9

Table III.3 - Man-observed synoptic, Base Camp,
Relative humidity (%), July 22 - 31, 1965

Day	0000	0600	1200	1800	mean
22	95	97	95	76	91
23	70	72	60	65	67
24	67	82	53	55	64
25	69	72	61	70	69
26	78	100	97	98	93
27	98	94	79	89	90

continued

Table III.3 - continued

Day	0000	0600	1200	1800	mean
28	98	100	92	97	97
29	97	96	89	63	86
30	62	54	61	61	60
31	61	53	63	81	65
mean	80	82	75	76	78

Table III.4 - Man-observed synoptic, Base Camp,
Relative humidity (%), August 1 - 29, 1965

Day	0000	0600	1200	1800	mean
1	90	90	83	83	87
2	55	57	60	66	60
3	63	54	52	47	54
4	55	79	72	70	69
5	88	83	77	80	82
6	96	100	92	95	96
7	100	75	79	76	83
8	83	82	43	67	69
9	88	99	78	82	87
10	93	98	84	80	89
11	100	100	75	70	86
12	85	65	45	48	61
13	68	67	53	49	59
14	66	61	55	82	66
15	96	98	94	85	93
16	96	98	96	87	94
17	96	96	90	89	93
18	98	100	95	87	95
19	95	99	91	82	92
20	94	100	84	97	94

continued

Day	0000	0600	1200	1800	mean
21	78	79	83	80	80
22	89	98	98	98	96
23	98	100	88	91	94
24	88	92	96	98	94
25	99	100	99	90	97
26	100	100	96	95	98
27	94	98	69	100	90
28	96	99	95	93	96
29	97	94	91	96	94
mean	88	88	80	81	85

Table III.5 - Man-observed synoptic, Base Camp,
Bar.pressure (mb) at sea level, July 23 - 31, 1965

Day	0000	0600	1200	1800	mean
23	-	1033.0	1032.6	1031.2	1032.3
24	1029.9	1029.0	1026.7	1025.0	1027.7
25	1022.5	1020.6	1017.6	1014.2	1018.7
26	1010.3	1010.0	1011.4	1011.2	1010.7
27	1009.4	1008.4	1008.1	1009.2	1008.8
28	1009.1	1008.4	1007.0	1007.0	1007.9
29	1007.2	1007.5	1007.7	1007.8	1007.6
30	1008.3	1009.1	1010.2	1011.3	1009.7
31	1011.7	1010.2	1009.3	1009.9	1010.3
mean	1013.5	1015.1	1014.5	1014.1	1014.3

Table III.6 - Man-observed synoptic, Base Camp,

Bar.pressure (mb) at sea level, August 1 - 29, 1965

Day	0000	0600	1200	1800	mean
1	1011.4	-	-	-	-
2	1015.6	-	-	-	-
3	-	-	-	-	-
4	1014.2	1015.1	1016.0	1017.0	1015.6
5	1016.3	1014.2	1012.5	1015.0	1014.5
6	1008.6	1006.6	1004.5	1004.3	1006.0
7	1015.2	1009.6	1012.2	-	1012.3
8	1013.3	1012.3	1008.3	1007.0	1011.2
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	1020.3	-	1020.5	-
14	1018.8	1018.5	1016.8	1016.0	1017.5
15	1015.0	1014.9	1014.5	1014.6	1014.8
16	1014.5	1015.0	1014.9	1015.4	1015.0
17	1014.6	1014.0	1013.2	-	1014.1
18	-	-	-	-	-
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	-
22	-	1015.5	1015.8	1016.3	1015.9
23	1015.5	1016.1	1016.9	-	1016.2
24	1016.5	1018.7	-	1019.8	1018.3
25	1020.1	1020.4	1019.4	1018.9	1019.7
26	-	1020.1	1020.2	1020.7	1020.3
27	1019.1	1015.7	1011.4	1009.5	1013.9
28	-	1010.8	1013.2	1014.5	1012.8
29	1014.9	1015.3	1015.4	1015.5	1015.3
mean	-	-	-	-	-

Table III.7 - Man-observed synoptic, Base Camp,
Cloudiness (tenths), bright sunshine (hrs., tenths)
and percentage of possible sunshine, July 22 - 31, 1965

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
22	10	10	10	-	10.0	-	-
23	-	10	8	9	9.0	-	-
24	10	5	8	9	8.0	(12.3)	(51.3)
25	9	10	6	10	8.7	3.6	15.0
26	10	10	10	10	10.0	0.5	2.1
27	10	10	10	10	10.0	0.0	0.0
28	10	10	10	9	9.7	0.8	3.6
29	8	10	6	8	8.0	2.2	10.0
30	7	7	10	10	8.5	8.2	38.2
31	8	8	10	10	9.0	4.4	20.8
mean	9.0	8.8	8.6	9.4	9.0		
total						31.9	

Table III.8 - Man-observed synoptic, Base Camp,
Cloudiness (tenths), bright sunshine (hrs., tenths)
and percentage of possible sunshine, August 1 - 29,1965

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
1	10	10	10	1	7.8	17.8	84.8
2	6	-	-	-	-	5.2	25.0
3	-	-	-	-	-	-	-
4	5	-	3	5	4.3	14.6	70.8
5	8	9	6	2	6.2	11.2	54.7
6	10	10	10	10	10.0	0.2	1.0
7	10	3	9	-	7.3	10.4	51.3
8	9	7	1	0	4.2	16.7	85.7
9	-	-	-	-	-	8.1	42.2
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

Table III.8 - continued

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
12	-	-	-	-	-	-	-
13	-	5	-	1	-	16.6	89.7
14	0	0	0	1	0.3	18.3	100.0
15	1	9	9	1	5.0	6.3	35.4
16	10	1	9	2	5.5	5.4	30.7
17	1	8	7	2	4.5	5.6	32.2
18	10	10	-	9	9.6	0.3	1.7
19	3	10	-	-	-	5.8	34.1
20	4	10	-	10	8.0	0.7	4.2
21	-	4	5	-	-	10.5	62.6
22	10	10	10	10	10.0	0.0	0.0
23	10	10	9	-	9.7	4.2	25.7
24	10	10	-	10	10.0	0.2	1.2
25	10	10	10	10	10.0	0.2	1.2
26	10	10	10	10	10.0	0.0	0.0
27	1	10	10	10	7.7	0.0	0.0
28	-	10	10	10	10.0	0.0	0.0
29	10	10	10	-	10.0	0.5	3.2
mean	-	-	-	-	-		
total						158.6	

Table III.9 - Man-observed synoptic, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction
(neugrad, 16 points) and wind run (km), July 22 - 31,1965

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
22	3.1	275	9.9	025	6.6	350	-	-	6.5	-
23	-	-	0.0	-	2.3	200	4.4	300	2.2	159.3
24	2.1	225	0.0	-	0.0	-	3.5	250	1.4	166.6
25	2.3	100	1.3	250	2.9	100	1.4	100	2.0	82.7
26	3.0	250	5.5	250	6.4	300	0.7	250	3.9	197.6
27	4.9	300	1.3	250	0.7	200	4.6	300	2.9	156.9
28	2.1	250	1.6	250	2.4	27575	1.1	350	1.8	113.3
29	2.8	300	2.4	300	1.1	200	0.7	100	1.8	120.4
30	0.7	000	9.7	050	0.7	000	3.5	050	3.7	260.3
31	4.4	050	4.0	050	5.0	050	1.6	250	3.8	266.4
mean	2.8		2.9		2.4		2.4		2.6	1523.5

Table III.10 - Man-observed synoptic, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction(neugrad,
16 points) and wind run (km) August 1 - 29, 1965

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
1	1.4	250	1.2	100	2.6	250	1.3	250	1.6	98.5
2	6.4	050	9.5	050	-	-	0.0	-	5.3	446.7
3	-	-	-	-	-	-	-	-	-	-
4	2.5	050	-	-	2.3	300	1.8	250	2.2	165.3
5	0.7	200	0.7	000	1.8	200	2.6	250	1.5	88.0
6	1.2	100	1.7	200	2.5	250	2.0	300	1.9	101.3
7	0.8	050	1.8	100	0.0	-	-	-	0.9	71.5
8	0.0	-	2.0	050	4.5	050	4.7	250	2.8	-
9	-	-	-	-	-	-	-	-	-	-

continued

Table III.10 - continued

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
10	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
13	-	-	0.0	-	-	-	4.3	050	-	-
14	0.0	-	0.0	-	1.7	200	3.2	100	1.2	73.7
15	2.6	100	0.8	100	1.7	100	1.6	250	1.7	61.9
16	1.6	025	0.0	-	0.7	200	2.0	200	1.1	61.2
17	0.0	-	0.0	-	1.1	250	0.5	300	0.4	59.3
18	0.8	100	1.3	250	-	-	1.1	250	0.8	65.0
19	0.7	100	0.0	-	-	-	-	-	-	66.1
20	-	-	0.9	250	-	-	-	-	-	71.1
21	1.0	300	0.6	350	1.1	300	-	-	0.9	88.9
22	1.3	000	1.2	250	1.2	325	0.0	-	0.9	60.9
23	0.0	-	0.7	100	1.6	250	-	-	0.8	75.1
24	1.1	250	0.0	-	-	-	0.7	150	0.6	776.3
25	1.8	300	1.9	250	1.0	350	1.1	100	1.5	82.8
26	-	-	0.0	-	1.4	250	1.1	150	0.8	65.4
27	1.0	100	0.0	-	2.0	250	3.9	250	1.7	157.7
28	-	-	3.9	250	4.5	250	5.4	250	4.6	328.1
29	3.6	250	3.2	250	1.5	300	2.5	300	2.7	137.5
mean	-		-		-		-		-	-

Table III.11 - Man-observed synoptic, Base Camp,
Air temperatur (°C.), April 13 - 30, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
13	-22.9	-21.4	-20.8	-24.2	-22.3	-	-20.4	-25.5	-23.0
14	-27.3	-25.0	-23.0	-26.5	-25.5	-	-20.3	-29.7	-25.0
15	-28.4	-28.7	-25.8	-28.7	-27.9	-26.5	-23.1	-30.1	-26.6

continued

Table III.11 - continued

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
16	-31.6	-28.8	-26.0	-27.2	-28.4	-28.0	-23.1	-31.7	-27.4
17	-29.4	-28.1	-26.7	-28.2	-28.2	-28.1	-24.7	-30.5	-27.6
18	-30.8	-30.4	-29.9	-29.3	-30.1	-26.1	-21.8	-31.5	-26.7
19	-31.2	-28.5	-22.6	-21.6	-25.9	-23.1	-19.5	-32.3	-25.9
20	-20.9	-19.4	-15.8	-15.0	-17.8	-21.7	-14.2	-32.3	-23.2
21	-15.2	-13.5	-10.9	-13.1	-13.2	-21.3	-10.6	-17.0	-13.8
22	-18.7	-20.5	-22.3	-25.1	-21.6	-21.9	-13.2	-25.1	-19.2
23	-28.1	-28.9	-26.8	-27.3	-27.8	-23.9	-24.5	-29.7	-27.1
24	-30.1	-30.1	-27.7	-27.3	-28.9	-26.5	-24.6	-31.8	-28.2
25	-30.8	-28.8	-26.6	-26.5	-28.2	-26.9	-23.9	-30.8	-27.3
26	-29.6	-29.0	-22.5	-22.8	-25.9	-26.0	-20.8	-30.0	-25.4
27	-27.4	-26.1	-20.8	-21.1	-23.9	-24.6	-20.0	-29.8	-24.9
28	-23.5	-24.7	-21.5	-22.9	-23.1	-22.3	-18.3	-27.0	-22.7
29	-25.7	-23.9	-18.3	-20.0	-21.9	-20.2	-17.5	-26.5	-22.0
30	-16.7	-16.6	-16.7	-16.5	-16.6	-18.1	-14.3	-24.0	-19.2
mean	-27.0	-25.1	-22.5	-23.5	-24.5		-19.8	-28.5	-24.2

Table III.12 - Man-observed synoptic, Base Camp, Air temperature (°C.), May 1 - 31, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	-17.8	-16.7	-11.5	-16.4	-15.6	-16.7	- 8.8	-19.8	-14.3
2	-11.2	-15.6	-11.3	-14.7	-13.2	-15.5	- 9.9	-17.5	-13.7
3	-18.8	-17.4	-15.0	-12.5	-15.9	-15.7	-12.3	-20.1	-16.2
4	-18.0	-17.4	-15.1	-14.8	-16.3	-15.6	-12.6	-18.7	-15.7
5	-19.3	-18.0	-16.7	-15.3	-17.3	-15.6	-13.8	-20.0	-16.9
6	-20.5	-16.7	-12.0	-12.0	-15.3	-14.5	-11.6	-20.6	-16.1
7	-17.1	-13.9	- 9.3	-11.2	-12.9	-12.3	- 6.7	-18.3	-12.5
8	-15.2	-13.0	- 8.2	- 6.9	-10.8	- 9.9	- 5.1	-15.7	-10.4

continued

Table III.12 - continued

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
9	- 7.3	- 8.9	- 1.3	- 3.0	- 5.1	- 8.0	- 0.3	-12.9	- 6.6
10	- 5.8	- 5.7	- 6.3	- 4.6	- 5.6	- 7.5	- 3.4	- 9.1	- 6.3
11	- 6.5	- 5.8	- 4.5	- 5.7	- 5.6	- 8.0	- 2.7	- 6.9	- 4.8
12	-11.5	-11.8	- 7.9	-11.1	-10.6	- 9.4	- 4.9	-13.6	- 9.3
13	-15.1	-14.8	-11.2	-11.8	-13.2	-10.8	- 7.3	-16.8	-12.0
14	-14.5	-11.8	-10.5	-11.6	-12.1	-11.7	- 9.0	-16.2	-12.6
15	-11.1	-16.2	-11.5	-11.1	-12.5	-12.5	- 8.9	-18.3	-13.6
16	-11.5	-12.0	- 7.7	- 9.5	-10.2	-12.4	- 6.7	-13.5	-10.1
17	-15.9	-16.3	-12.7	-12.8	-14.4	-12.3	-11.3	-18.4	-14.8
18	-13.7	-14.5	-12.2	-11.5	-13.0	-11.0	- 9.7	-15.1	-12.4
19	-13.5	-13.7	-10.5	- 7.1	-11.2	- 9.7	- 5.3	-15.1	-10.2
20	- 9.2	- 8.2	- 4.3	- 3.7	- 6.4	- 7.4	- 0.4	-11.1	- 5.8
21	- 6.8	- 5.9	- 0.4	- 0.9	- 3.5	- 5.3	1.7	- 8.9	- 3.6
22	- 4.7	- 4.4	- 0.2	- 1.8	- 2.8	- 3.8	1.8	- 6.2	- 2.2
23	- 3.7	- 3.3	- 0.3	- 2.5	- 2.5	- 3.2	1.8	- 6.2	- 2.2
24	- 3.6	- 3.2	- 3.5	- 4.0	- 3.6	- 2.4	- 2.1	- 4.2	- 3.2
25	- 7.1	- 7.1	- 0.3	0.0	- 3.6	- 2.4	0.5	- 9.8	- 4.7
26	- 0.3	0.7	1.7	- 0.7	0.4	- 2.5	2.5	- 3.2	- 0.4
27	- 0.9	- 1.9	- 3.0	- 5.3	- 2.8	- 1.4	0.5	- 5.8	- 2.7
28	- 5.9	- 3.4	- 0.4	- 1.7	- 2.9	- 0.6	3.0	- 6.4	- 1.7
29	0.5	3.0	1.1	2.8	1.8	- 0.5	3.4	- 4.5	- 0.6
30	0.7	- 0.3	0.9	0.7	0.5	- 0.7	3.2	- 1.6	0.8
31	0.6	1.3	0.8	0.2	0.7	- 0.4	3.1	- 1.0	1.0
mean	- 9.8	- 9.5	- 6.6	- 7.1	- 8.3		- 4.2	-12.1	- 8.1

Table III.13 - Man-observed synoptic, Base Camp,
Air temperature (°C.), June 1 - 2, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	-2.1	-3.3	-4.9	-4.9	-3.8	-	0.6	-5.7	-2.6
2	-3.2	-2.3	-1.5	1.9	-1.3	-	2.7	-5.3	-1.3

Table III.14 - Man-observed synoptic, Base Camp,
Air temperature (°C.), August 22 - 28, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
22	-0.1	1.6	6.9	7.1	3.9	-	7.9	-0.3	3.8
23	5.2	5.0	6.1	6.0	5.6	-	7.1	-0.2	3.5
24	1.7	2.0	3.2	2.9	2.5	2.6	5.8	-1.3	2.3
25	-0.2	-0.4	2.6	1.1	0.8	1.7	4.7	-1.9	1.4
26	-1.1	0.2	1.1	1.9	0.5	0.6	3.0	-2.1	0.5
27	-2.1	-3.2	1.3	0.8	-0.8	-	2.1	-4.0	-1.0
28	1.7	3.2	5.0	-	3.3	-	5.0	1.5	3.3
mean	0.7	1.2	3.7	3.3	2.3		5.1	-1.2	2.0

Table III.15 - Man-observed synoptic, Base Camp,
Relative humidity (%), April 13 - 30, 1966

Day	0000	0600	1200	1800	mean
13	98	93	95	98	96
14	90	78	80	82	83
15	88	78	85	84	84
16	82	76	77	83	80
17	90	86	80	85	83
18	91	82	73	89	84

continued

Table III.15 - continued

Day	0000	0600	1200	1800	mean
19	93	93	84	72	85
20	77	73	73	70	73
21	78	70	66	66	70
22	89	92	90	93	91
23	93	93	90	89	91
24	90	88	89	83	88
25	93	86	85	89	88
26	91	88	79	71	82
27	89	90	78	76	83
28	87	81	77	76	80
29	86	85	78	76	81
30	80	78	77	74	77
mean	88	84	81	81	84

Table III.16 - Man-observed synoptic, Base Camp,
Relative humidity (%), May 1 - 31, 1966

Day	0000	0600	1200	1800	mean
1	85	76	70	85	79
2	87	85	74	81	82
3	93	96	88	77	89
4	93	95	89	85	91
5	97	98	91	92	94
6	99	93	83	80	89
7	98	85	77	78	85
8	89	81	85	59	79
9	61	71	45	68	61
10	98	91	96	93	95
11	97	96	94	89	94
12	94	90	88	89	90

continued

Table III.16 - continued

Day	0000	0600	1200	1800	mean
13	87	86	77	80	83
14	88	85	82	84	85
15	87	85	65	74	78
16	88	89	76	92	86
17	93	90	90	88	90
18	86	89	75	73	81
19	78	77	68	70	73
20	73	68	65	57	66
21	70	68	60	69	67
22	77	78	70	75	75
23	83	86	85	90	86
24	98	97	96	95	97
25	87	86	76	63	78
26	61	90	60	78	72
27	80	90	97	96	91
28	95	97	96	90	95
29	75	55	77	78	71
30	96	98	85	96	94
31	88	86	92	91	89
mean	87	86	80	81	84

Table III.17 - Man-observed synoptic, Bse Camp,
Relative humidity (%), June 1 - 2, 1966

Day	0000	0600	1200	1800	mean
1	98	97	96	96	97
2	85	41	42	48	54

Table III.18 - Man-observed synoptic, Base Camp,
Relative humidity (%), August 22 - 28, 1966

Day	0000	0600	1200	1800	mean
22	82	64	52	48	62
23	48	50	52	53	51
24	90	90	82	85	87
25	97	96	89	93	94
26	79	59	77	79	74
27	97	90	80	79	87
28	63	50	51	-	55
mean	79	71	69	73	73

Table III.19 - Man-observed synoptic, Base Camp,
Bar.pressure (mb) at sea level, April 13 - 30, 1966

Day	0000	0600	1200	1800	mean
13	1028.0	1025.4	1022.7	1022.4	1024.7
14	1021.8	1022.3	1024.4	1026.6	1023.8
15	1027.3	1027.3	1026.1	1026.1	1026.7
16	1025.1	1022.7	1020.8	1018.9	1021.9
17	1017.8	1016.8	1017.5	1018.5	1017.7
18	1019.8	1022.2	1022.9	1023.6	1022.1
19	1022.9	1022.7	1023.2	1023.5	1023.1
20	1022.2	1023.8	1014.5	1011.2	1017.9
21	1005.6	1001.8	996.7	992.9	999.2
22	992.4	994.8	997.5	999.7	996.1
23	1000.3	1000.1	1000.2	1001.3	1000.5
24	1002.0	1003.5	1004.4	1005.3	1003.8
25	1004.3	1004.0	1003.4	1004.8	1004.2
26	1005.9	1009.2	1012.5	1016.5	1011.0

continued

Table III.19 continued

Day	0000	0600	1200	1800	mean
27	1020.6	1024.6	1027.2	1029.3	1025.4
28	1029.4	1029.5	1028.7	1029.3	1029.2
29	1028.3	1029.5	1024.0	1022.6	1026.1
30	1020.0	1019.3	1018.6	1018.9	1019.2
mean	1016.3	1016.6	1015.9	1016.2	1016.3

Table III.20 - Man-observed synoptic, Base Camp,
Bar.pressure (mb) at sea level, May 1 - 31, 1966

Day	0000	0600	1200	1800	mean
1	1019.3	1021.2	1022.3	1023.5	1021.6
2	1023.0	1023.0	1023.6	1025.8	1023.9
3	1027.3	1028.6	1029.1	1029.4	1028.6
4	1028.6	1028.2	1028.1	1028.6	1028.3
5	1029.3	1030.1	1030.5	1031.6	1030.4
6	1031.8	1033.1	1034.9	1034.8	1033.7
7	1034.5	1035.1	1034.7	1035.3	1034.9
8	1033.3	1032.8	1030.5	1027.6	1031.1
9	1022.7	1018.6	1013.5	1009.4	1016.1
10	1005.4	1001.7	1001.3	1000.1	1002.1
11	1004.8	1011.4	1015.6	1017.9	1012.2
12	1017.2	1016.1	1014.5	1012.6	1015.1
13	1010.0	1007.3	1005.3	1004.2	1006.7
14	1003.7	1004.4	1007.3	1010.7	1006.5
15	1012.0	1012.3	1010.3	1008.1	1010.7
16	1009.1	1011.0	1012.3	1014.1	1011.6
17	1017.1	1020.4	1022.7	1024.7	1021.2
18	1025.6	1026.3	1025.4	1024.2	1025.4

continued

Table III.20 - continued

Day	0000	0600	1200	1800	mean
19	1022.2	1021.1	1017.5	1017.1	1019.5
20	1016.8	1017.0	1016.9	1016.6	1016.8
21	1016.3	1016.2	1015.5	1015.1	1015.8
22	1014.8	1014.6	1014.1	1013.4	1014.2
23	1012.8	1012.7	1012.6	1014.6	1013.2
24	1015.5	1016.7	1018.6	1021.5	1017.8
25	1020.4	1020.5	1019.9	1019.6	1020.1
26	1019.3	1019.3	1016.2	1014.9	1017.4
27	1014.9	1015.4	1017.4	1023.8	1017.9
28	1027.7	1029.6	1027.8	1026.0	1027.8
29	1020.7	1017.1	1015.9	1014.6	1017.1
30	1012.8	1012.3	1012.3	1013.5	1012.7
31	1014.5	1015.5	1015.4	1014.4	1015.0
mean	1018.8	1019.0	1018.8	1018.9	1018.9

Table III.21 - Man-observed synoptic, Base Camp,
Bar.pressure (mb) at sea level, June 1 - 2, 1966

Day	0000	0600	1200	1800	mean
1	1013.3	1012.2	1012.1	1011.4	1012.3
2	1012.3	1014.3	1016.2	1016.2	1014.8

Table III.22 - Man-observed synoptic, Base Camp,
Cloudiness (tenths), bright sunshine (hrs.,tenths)
and percentage of possible sunshine, April 13 - 30,1966

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
13	6	5	00	1	3.0	12.5	81.3
14	1	00	-	9	3.3	12.3	78.8
15	10	10	3	00	5.7	8.8	55.7
16	00	9	-	7	5.3	6.2	38.8
17	10	1	3	00	3.5	12.5	77.3
18	3	00	00	00	0.8	13.8	84.2
19	5	3	10	4	5.5	4.0	24.1
20	6	2	2	8	4.5	0.9	5.4
21	10	10	10	2	8.0	6.2	36.5
22	1	-	00	1	0.7	9.8	57.0
23	3	2	2	00	1.8	11.1	63.8
24	00	00	4	4	2.0	14.9	84.6
25	1	3	9	8	5.2	7.2	40.4
26	8	8	3	4	5.8	12.9	71.9
27	5	1	7	5	4.5	14.7	80.7
28	3	2	6	3	3.5	15.9	86.3
29	00	2	3	00	1.3	18.6	100.0
30	2	-	00	00	0.7	18.1	96.3
mean	4.1	3.6	3.9	3.1	3.7		
T0tal						200.4	

Table III.23 - Man-observed synoptic, Base Camp,
Cloudiness (tenths), bright sunshine (hrs.,thenths)
and percentage of possible sunshine, May 1 - 31, 1966

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
1	00	00	00	5	1.3	17.5	92.2
2	9	8	2	00	4.7	14.2	73.9
3	1	3	00	1	1.3	19.3	98.5

Table III.23 - continued

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
4	00	00	00	00	0.0	19.9	99.4
5	00	00	00	00	0.0	20.4	100.0
6	00	00	00	00	0.0	20.5	100.0
7	00	00	00	00	0.0	20.7	100.0
8	0	0	1	5	1.5	17.6	84.3
9	9	9	10	10	9.5	1.5	7.2
10	10	10	10	10	10.0	0.0	0.0
11	10	10	9	10	9.8	0.0	0.0
12	10	2	10	6	7.0	12.2	56.4
13	10	2	5	8	6.3	18.4	84.3
14	3	10	7	6	6.5	18.6	83.4
15	6	8	5	6	6.3	17.4	76.7
16	10	8	3	10	7.8	10.5	45.4
17	8	9	10	10	9.3	2.8	11.9
18	10	10	3	1	6.0	10.1	42.2
19	8	8	8	1	6.3	16.4	68.3
20	1	1	0	0	0.5	24.0	100.0
21	2	9	10	8	7.3	23.1	96.3
22	7	3	2	2	3.5	21.5	89.6
23	7	8	10	10	8.8	7.5	31.3
24	10	10	10	10	10.0	0.0	0.0
25	10	9	10	-	9.7	12.1	50.3
26	10	10	10	10	10.0	0.6	2.5
27	10	10	10	10	10.0	0.0	0.0
28	10	8	0	3	5.3	14.9	62.2
29	9	8	9	7	8.3	1.7	70.8
30	10	10	10	10	10.0	0.0	0.0
31	8	7	10	10	8.8	2.6	10.8
mean	6.4	6.1	5.6	5.6	5.9		
total						366.2	

Table III.24 - Man-observed synoptic, Base Camp,
Cloudiness (tenths), bright sunshine (hrs.,tenths) and percentage of possible sunshine, June 1 - 2,1966

Day	0000	0600	1200	1800	mean	hrs.1/10	% poss.
1	10	10	10	10	10.0	1.7	7.1
2	5	6	0	0	2.8	86.7	

Table III.25 - Man-observed synoptic, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction (neugrad 16 points) and wind run (km), April 13 - 30, 1966

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
13	1.1	100	1.3	050	1.7	200	0.9	025	1.3	72.1
14	1.6	100	0.0	-	-	-	0.8	125	0.8	47.5
15	1.0	300	1.5	100	0.8	100	1.2	125	1.1	29.7
16	0.0	-	0.0	-	-	-	0.0	-	0.0	17.8
17	0.0	-	-	-	0.8	100	1.0	250	0.6	22.3
18	0.0	-	0.0	-	1.2	100	1.7	150	0.7	29.4
19	0.0	-	0.9	000	2.9	100	2.3	200	1.5	85.7
20	2.4	125	4.3	075	2.3	075	4.9	075	3.5	344.5
21	4.7	075	3.7	050	1.9	150	1.3	325	2.9	254.8
22	0.0	-	-	-	2.5	275	2.5	275	1.7	88.3
23	1.0	125	1.2	075	1.6	125	1.0	325	1.2	42.4
24	0.0	-	0.0	-	0.0	-	1.0	125	0.3	20.1
25	0.0	-	1.8	125	1.6	125	1.0	175	1.1	33.2
26	0.0	-	0.0	-	1.6	150	0.0	-	0.4	21.3
27	0.0	-	0.0	-	0.0	-	0.0	-	0.0	14.4
28	0.0	-	0.0	-	1.2	125	1.0	100	0.6	23.5
29	0.0	-	0.0	-	0.0	-	0.0	-	0.0	52.0
30	2.3	100	-	-	1.4	125	0.0	-	1.2	78.5
mean	0.8		1.0		1.3		1.1		1.1	

Table III.26 - Man-observed synoptic, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction (neugrad 16 points) and wind run (km), May 1 - 31, 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	1.1	125	1.1	175	0.0	-	0.9	100	0.8	44.8
2	0.0	-	0.0	-	0.0	-	0.7	100	0.2	32.1
3	0.9	100	1.3	100	1.5	125	0.0	-	0.9	34.9
4	0.0	-	1.2	175	0.9	200	0.0	-	0.5	26.6
5	0.0	-	1.6	100	1.2	125	0.0	-	0.9	29.2
6	1.0	100	0.0	-	0.0	-	0.0	-	0.3	28.2
7	1.1	100	0.8	125	0.0	-	0.0	-	0.5	27.2
8	1.1	125	1.0	100	1.0	150	0.0	-	0.8	45.9
9	1.3	125	1.5	125	0.0	-	2.0	075	1.2	115.6
10	1.6	050	1.6	050	1.2	100	0.0	-	1.1	106.2
11	3.9	150	1.6	250	1.0	100	1.5	100	2.0	89.4
12	1.2	050	0.7	175	0.9	200	0.0	-	0.7	31.6
13	0.0	-	0.0	-	1.5	100	1.2	125	0.7	34.0
14	0.8	125	1.2	125	0.0	-	0.0	-	0.5	42.2
15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	29.8
16	0.0	-	0.0	-	0.0	-	1.5	300	0.4	29.5
17	0.0	-	0.0	-	0.0	-	1.5	275	0.4	39.8
18	0.0	-	1.5	025	C.8	100	0.0	-	0.6	40.5
19	0.0	-	0.0	-	1.1	100	2.0	100	0.8	44.8
20	0.0	-	2.0	125	0.0	-	1.0	100	0.8	39.8
21	0.0	-	1.0	125	1.0	150	0.8	150	0.7	35.3
22	0.9	150	0.0	-	0.0	-	0.0	-	0.2	22.7
23	0.0	-	0.0	-	0.0	-	0.9	100	0.2	55.2
24	1.0	150	2.2	150	1.1	150	1.0	200	1.3	82.1
25	0.0	-	0.0	-	0.0	-	-	-	0.0	52.9
26	2.3	075	2.4	200	5.4	225	5.1	050	3.8	280.6
27	1.1	250	8.6	075	9.4	300	5.9	350	6.3	586.6
28	3.2	225	1.0	300	2.2	150	1.5	100	2.0	93.6
29	2.6	100	1.7	125	0.0	-	2.3	150	1.7	103.4
30	0.0	-	0.0	-	1.8	000	1.5	250	0.8	82.4
31	0.0	-	0.0	-	1.7	300	0.0	-	0.4	44.4
mean	0.8		1.1		1.1		1.0		1.0	

Table III.27 - Man-observed synotpic, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction (neugrad 16 points) and wind run (km), June 1 - 2, 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	0.0	-	1.7	250	3.1	250	1.6	200	1.6	160.1
2	1.6	350	7.1	050	5.5	025	0.9	250	3.1	365.2

Table III.28 - Man-observed synoptic, Moraine Ice Camp,
Air temperature (°C), August 4 - 26, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
4	4.2	3.5	7.3	7.8	5.7	-	8.6	2.6	5.6
5	2.8	2.2	6.5	7.5	4.6	-	9.3	1.0	5.2
6	1.8	1.2	4.0	4.5	2.9	-	6.0	-0.5	2.8
7	1.8	1.8	7.5	3.7	3.7	-	8.0	-0.5	3.8
8	1.8	-	-	-	-	-	-	-	-
9	-	1.5	9.8	4.8	5.4	-	12.0	-1.0	5.5
10	-0.5	-1.0	2.4	-4.0	-0.8	-	5.4	-4.5	0.5
11	-3.5	-2.1	1.5	-1.3	-1.4	1.2	2.4	-4.3	-1.0
12	-4.0	-0.2	0.9	2.5	-0.2	0.6	6.0	-4.1	1.0
13	1.8	1.5	5.1	3.5	3.0	0.7	6.6	-0.3	3.2
14	2.5	2.3	3.3	0.7	2.2	0.7	5.5	-0.5	2.5
15	-0.8	1.8	1.7	0.2	-0.1	0.3	4.5	-2.0	1.3
16	-1.5	-0.8	-1.0	-2.5	-1.5	-1.0	4.8	-4.7	0.0
17	-4.0	-4.5	3.7	-3.5	-2.1	-1.9	4.6	-7.2	-1.3
18	-4.5	-5.6	1.5	-5.6	-3.6	-2.2	4.0	-8.1	-2.1
19	-8.3	-2.7	3.0	-0.5	-2.1	-2.3	3.9	-8.5	-2.3
20	-5.5	-1.5	0.8	-1.3	-1.9	-2.2	2.0	-7.6	-2.8
21	-4.0	-3.4	1.7	-1.8	-1.9	-2.0	2.1	-6.9	-2.4
22	-2.7	-3.2	1.5	-1.8	-1.6	-2.1	3.1	-6.4	-1.7

continued

Table III.28 - continued

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
23	-3.6	-4.1	0.8	-3.9	-2.7	-2.0	2.3	-5.2	-1.5
24	-4.5	-3.2	0.9	-3.5	-2.5	-1.6	4.0	-5.2	-0.6
25	-6.4	0.8	1.8	-0.4	-1.1	-	3.4	-6.9	-1.8
26	-1.2	-1.5	2.8	-0.6	-0.1	-	3.0	-2.5	0.3
mean	-1.7	-0.8	2.9	0.2	0.2		5.1	-3.8	0.7

Table III.29 - Man-observed synoptic, Moraine Ice Camp, Relative humidity (%), August 4 - 26, 1965

Day	0000	0600	1200	1800	mean
4	86	88	68	70	78
5	96	93	80	72	85
6	90	87	80	80	84
7	89	81	66	70	77
8	73	70	58	63	66
9	62	60	57	70	62
10	95	90	83	87	89
11	83	75	68	80	77
12	68	78	65	78	72
13	82	90	60	65	74
14	70	62	68	78	70
15	80	78	65	76	75
16	82	83	70	84	80
17	-	90	92	87	90
18	90	87	78	96	88
19	89	88	92	94	91
20	83	90	94	96	91
21	98	80	74	78	83
22	72	78	68	94	78
23	98	93	80	85	89

continued

Table III.29 - continued

Day	0000	0600	1200	1800	mean
24	70	82	78	70	75
25	74	68	66	78	72
26	85	93	92	-	90
mean	83	82	73	79	79

Table III.30 - Man-observed synoptic, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., August 9 - 21, 1965

Day	0000	0600	1200	1800	mean
9	-	928.6	929.9	929.7	-
10	927.9	-	927.5	926.3	-
11	-	925.3	-	926.8	-
12	-	928.3	928.5	-	-
13	-	-	-	932.3	-
14	930.6	-	-	-	-
15	-	-	-	-	-
16	-	-	-	-	-
17	-	-	-	-	-
18	924.8	925.3	-	930.4	-
19	-	927.1	927.2	927.0	-
20	-	927.5	-	-	-
21	-	931.5	931.7	-	-

Table III.31 - Man-observed synoptic, Moraine Ice Camp, Cloudiness (tenths), August 9 - 21, 1965

Day	0000	0600	1200	1800
9	-	1	2	1
10	10	-	2	1
11	1	1	-	0
12	0	-	1	-
13	-	-	-	6
14	10	-	-	-
15	-	-	-	-
16	-	-	-	-
17	-	-	-	-
18	3	1	-	4
19	-	1	1	9
20	-	10	10	10
21	-	1	9	-

Table III.32 - Man-observed synoptic, Moraine Ice Camp, Wind speed (m/sec) and wind direction (neugrad, 16 points), August 9 - 21, 1965

Day	0000		0600		1200		1800	
	m/sec	Dir	m/sec	Dir	m/sec	Dir	m/sec	Dir
9	-	-	1.9	000	2.3	250	0.0	-
10	3.1	000	-	-	1.5	250	2.0	350
11	-	-	4.6	350	-	-	7.0	350
12	-	-	5.9	350	3.2	050	-	-
13	-	-	-	-	-	-	5.2	050
14	2.6	000	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-
18	3.9	000	2.2	350	-	-	4.1	050
19	-	-	1.3	350	1.3	150	0.0	-
20	-	-	3.2	350	-	-	0.0	-
21	-	-	2.8	350	5.6	000	-	-

Table III.33 - Man-observed synoptic, Moraine Ice Camp, Air temperature (^{o}C), May 22 - 31, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
22	-	-	0.6	-4.3	-	-	3.4	-11.4	-4.0
23	-3.2	-	2.7	-4.2	-	-	1.8	- 8.5	-3.4
24	-8.6	-8.2	-4.4	-7.0	-7.1	-	-1.8	-10.8	-6.3
25	-10.1	-2.7	1.0	-0.8	-3.1	-	4.0	-11.0	-3.5
26	-2.0	-3.1	-3.9	-6.6	-3.9	-5.6	1.5	- 6.4	-2.5
27	-6.1	-6.4	-7.8	-9.6	-7.5	-4.7	-5.3	-12.5	-8.9
28	-10.7	-8.2	-2.3	-5.4	-6.7	-4.8	0.2	-10.9	-5.4
29	-5.5	0.0	-1.5	-1.8	-2.2	-4.4	0.3	- 5.5	-2.6
30	-3.1	-4.3	-3.7	-3.7	-3.8	-	0.7	- 4.3	-1.8
31	-2.5	-1.2	-3.0	-	-1.7	-	-	-5.3	-
mean*	-6.1	-4.3	-3.2	-4.9	-4.5		-0.1	-8.3	-4.2

* - from 24 - 31.

Table III.34 - Man-observed synoptic, Moraine Ice Camp, Relative humidity (%), May 22 - 31, 1966

Day	0000	0600	1200	1800	mean
22	-	-	60	-	-
23	76	-	85	95	-
24	96	92	82	85	89
25	60	58	55	62	64
26	75	90	70	94	82
27	83	90	83	90	87
28	90	88	68	60	76
29	67	70	78	87	75
30	98	90	90	87	91
31	85	80	72	70	77
mean*	82	80	75	79	79

* - from 24 - 31.

Table III.35 - Man-observed synoptic, Moraine Ice Camp, Cloudiness (tenths), May 22 - 31, 1966

Day	0000	0600	1200	1800
22	-	0	1	1
23	8	-	10	10
24	-	10	9	1
25	-	-	2	10
26	-	-	-	10
27	-	-	-	10
28	-	-	0	3
29	-	-	10	-
30	-	10	10	10
31	10	10	6	-

Table III.36 - Man-observed synoptic, Moraine Ice Camp, Wind speed (m/sec) and wind direction (neugrad, 16 points), May 22 - 31, 1966

Day	0000		0600		1200		1800	
	m/sec	Dir	m/sec	Dir	m/sec	Dir	m/sec	Dir
22	-	-	-	-	0.1	000	1.1	000
23	0.0	-	-	-	3.6	150	0.0	-
24	-	-	2.6	350	1.3	100	2.9	350
25	-	-	-	-	1.8	000	4.4	350
26	-	-	-	-	-	-	5.2	200
27	-	-	-	-	-	-	2.5	175
28	-	-	-	-	2.9	375	6.9	350
29	-	-	-	-	0.0	-	-	-
30	-	-	-	-	2.3	150	1.2	200
31	0.0	-	1.3	375	4.6	000	-	-

Table III.37 - Hours of possible sunshine, Base Camp, April 11 to August 31.

Month	1	2	3	4	5	6	7	8	9	10
May	19.0	19.2	19.6	20.0	20.4	20.5	20.7	20.9	21.0	21.2
August	21.4	21.2	21.0	20.9	20.7	20.5	20.4	20.0	19.6	19.2

Month	11	12	13	14	15	16	17	18	19	20
April	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6	16.8
May	21.4	21.6	21.8	22.3	22.7	23.1	23.6	24.0	24.0	24.0
August	19.0	18.8	18.6	18.4	18.2	18.0	17.8	17.6	17.4	17.2

Month	21	22	23	24	25	26	27	28	29	30	31
April	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.4	18.6	18.8	
July	24.0	24.0	24.0	24.0	24.0	23.6	23.1	22.7	22.3	21.8	21.6
August	17.0	16.8	16.6	16.4	16.2	16.0	15.8	15.6	15.4	15.2	15.0

From May 18 to July 25, 24 hours of sunshine per day are possible at the present location of the Campbell-Stokes sunshine recorder. There is no shadow on the instrument between the hours 0600 to 1800 on any of the days given above.

Table III.38 - Man-observed synoptic, Base Camp,
Wind direction frequency (%),
July 22 - 31 and August 1 - 29, 1965

Month	N	NE	E	SE	S	SW	W	NW	Total obs.	total calms
July	8.2	14.1	11.4	0.0	11.4	25.0	22.8	5.6	35	3
August	5.2	10.3	21.7	3.0	9.0	35.8	12.8	2.7	67	15

Table III.39 - Man-observed synoptic, Base Camp,
Wind direction frequency (%),
April 13 - 30 and May, 1966

Month	N	NE	E	SE	S	SW	W	NW	total obs.	total calms
April	2.5	20.0	22.5	32.5	7.5	2.5	7.5	5.0	40	27
May	1.4	11.5	27.5	33.2	10.0	7.2	5.8	1.4	69	54

APPENDIX B

Table IV.1 - Automatic recorded, Mk II, Base Camp,
Air temperatures (^{o}C), July 29 - August 5, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
29	1.5	0.5	3.0	4.5	2.4	-	5.0	-0.5	2.3
30	2.8	3.5	4.5	4.8	3.9	-	6.0	1.5	3.7
31	4.5	6.0	4.7	4.0	4.8	4.8	6.8	3.0	4.9
1	3.0	3.4	4.5	5.0	4.0	7.2	5.7	2.3	4.0
2	6.0	9.0	10.5	10.8	9.1	8.5	11.5	5.5	8.5
3	11.0	14.0	16.0	15.8	14.2	8.8	17.0	10.0	13.5
4	13.5	8.5	10.5	9.5	10.5	-	14.7	4.0	9.3
5	4.5	5.0	8.0	7.5	6.3	-	10.0	3.5	6.7
mean	5.9	6.2	7.7	7.7	6.9		9.6	3.7	6.6

Table IV.2 - Automatic recorded, Mk II, Base Camp,
Relative humidity (%), July 29 - August 5, 1965

Day	0000	0600	1200	1800	mean
29	95	99	87	60	85
30	68	55	59	66	62
31	60	55	64	86	66
1	86	92	87	85	88
2	55	58	60	62	59
3	68	55	46	50	55
4	55	85	75	74	72
5	90	87	80	82	85
mean	72	73	70	71	72

Table IV.3-Automatic recorded, Mk II, Base Camp,
Bar.pressure (mb) at 198 m a.s.l.,July 29 - August 5,1965

Day	0000	0600	1200	1800	mean
29	1007.0	1007.2	1007.3	1007.7	1007.3
30	1008.3	1008.8	1009.6	1011.4	1009.5
31	1011.6	1010.3	1009.1	1010.0	1010.6
1	1011.4	1012.9	1017.2	1016.5	1014.5
2	1016.1	1015.9	1014.9	1014.3	1015.3
3	1014.8	1015.3	1014.5	1015.1	1014.9
4	1014.3	1015.4	1016.1	1017.1	1015.7
5	1016.5	1014.6	1013.1	1012.7	1014.2
mean	1013.3	1013.3	1013.5	1013.9	1013.5
mean*	1011.5	1011.5	1012.1	1012.6	1011.9

* - without 2nd and 3rd.

Table IV.4 - Automatic recorded, Mk II, Base Camp,
Wind speed (m/sec) at 200 cm, wind direction* (neugrad, 16 points) and wind run (km) July 29 - August 5, 1965

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
29	3.0	300	2.6	300	1.4	200	1.0	100	2.0	153.0
30	0.8	000	9.6	050	0.9	000	3.1	050	3.6	242.0
31	4.6	050	4.1	050	5.2	050	1.9	250	4.0	380.0
1	1.4	250	1.3	100	2.7	250	1.3	250	1.7	104.0
2	6.0	050	9.2	050	4.2	050	0.0	-	4.9	384.0
3	5.8	050	7.2	050	5.3	050	3.8	050	5.5	521.0
4	2.7	050	2.5	200	2.3	300	1.9	250	2.4	218.0
5	0.5	200	0.5	000	2.0	200	2.7	250	1.4	98.0
mean	3.1		4.5		3.0		1.9		3.2	2100.0
mean*	2.7		4.3		2.7		1.7		2.9	1579.0

* - without 3rd.

Table IV.5 - Automatic recorded, Mk II, Base Camp,
Bright sunshine (hrs.,tenths), daily total (hrs.,tenths)
and percentage of possible sunshine, July 29 - August 5, 1965

Day	0000 0600	0600 1200	1200 1800	1800 0000	daily total	% poss.
29	-	-	0.5	1.0	-	-
30	2.8	1.6	0.6	3.0	8.0	37.2
31	3.0	1.5	0.0	0.0	4.5	21.2
1	1.4	6.0	6.0	3.5	16.9	80.4
2	2.1	2.6	0.0	0.0	4.7	22.6
3	1.1	5.8	6.0	4.6	17.5	84.6
4	1.1	5.1	6.0	2.3	14.5	70.3
5	1.8	2.3	5.0	2.1	11.2	54.7
total*	12.2	19.1	17.6	10.9	59.8	(35.6)

* - without 29th and 3rd.

Table IV.6 - Automatic recorded, Pyrox-Sumner, Base Camp,
Air temperature (°C), July 27 - 30, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
27	1.3	1.5	4.0	2.3	2.3	-	4.9	-0.1	2.4
28	1.0	0.6	2.5	2.6	1.7	-	3.3	0.1	1.7
29	2.3	1.4	2.7	5.5	3.0	-	5.7	0.8	3.2
30	3.5	3.8	5.1	5.9	4.6	-	6.1	1.3	3.7
mean	2.0	1.8	3.6	4.1	2.9		5.0	0.5	2.8

Table IV.7 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (^{o}C), August 14 - 17, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
14	7.1	8.8	12.1	9.8	9.4	-	14.4	6.0	10.2
15	2.5	1.1	3.3	3.8	2.7	-	11.3	-0.7	5.3
16	1.1	1.1	2.4	3.1	1.9	-	5.8	0.0	2.9
17	-0.2	-0.7	3.5	2.8	1.4	-	5.1	-1.4	1.8
mean	2.6	2.6	5.3	4.9	3.8		9.1	1.0	5.1

Table IV.8 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (^{o}C), August 22 - 28, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
22	-	-	1.3	1.1	-	-	1.7	-0.7	0.5
23	1.5	1.2	3.9	4.0	2.6	-	5.3	0.3	2.8
24	3.4	2.3	2.6	3.2	2.9	-	3.8	0.5	2.2
25	-0.3	-0.9	-0.5	0.6	-0.3	1.5	3.3	-1.0	1.1
26	1.5	1.0	3.3	3.2	2.2	1.0	4.2	-0.8	1.7
27	0.3	-0.9	4.4	0.3	1.0	-	4.9	-1.7	1.6
28	0.1	-1.0	-0.7	-1.2	-0.7	-	0.8	-1.4	-0.3
mean	1.1	0.2	2.1	1.6	1.3		3.4	-0.7	1.4

Table IV.9 - Automatic recorded, Pyrox-Sumner, Base Camp, Wind speed (m/sec) and wind run (km) at 200 cm, July 27-29,1965

Day	0000	0600	1200	1800	mean	total km
27	5.0	1.2	0.6	4.5	2.8	162.0
28	2.2	1.4	2.4	0.6	1.7	121.0
29	2.2	2.0	1.0	0.5	1.4	80.5
mean	3.1	1.5	1.3	1.9	2.0	363.5

Table IV.10 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (°C), May 14 - 31, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
14	-12.9	-11.3	- 9.1	-11.5	-11.2	-	-8.4	-17.5	-13.0
15	-15.6	-14.9	- 9.9	-10.7	-12.8	-	-8.0	-18.5	-13.3
16	-10.8	-11.5	- 6.7	- 8.7	- 9.4	-12.1	-6.0	-13.7	- 9.9
17	-15.6	-16.6	-12.4	-12.9	-14.4	-12.0	-8.7	-18.5	-13.6
18	-13.3	-14.6	-12.1	-11.5	-12.9	-10.7	-8.8	-15.6	-12.2
19	-13.8	-13.0	- 7.1	- 7.5	-10.4	- 9.6	-6.4	-14.7	-10.6
20	- 9.4	- 8.6	- 4.1	- 3.3	- 6.4	- 7.4	-1.0	-12.7	- 6.9
21	- 7.5	- 6.7	- 0.3	- 0.8	- 3.8	- 5.5	1.3	- 8.8	- 3.8
22	- 5.7	- 5.5	- 1.0	- 1.6	- 3.5	- 4.1	1.3	- 6.9	- 2.8
23	- 4.3	- 4.3	- 1.1	- 3.1	- 3.2	- 3.6	- 0.3	- 6.3	- 3.5
24	- 4.0	- 2.9	- 3.1	- 4.0	- 3.5	- 2.8	- 2.7	- 5.7	- 4.2
25	- 7.5	- 7.0	- 0.9	- 0.4	- 4.0	- 2.7	1.7	- 9.5	- 3.8
26	- 0.2	0.0	1.4	- 0.9	0.0	- 2.6	2.0	- 7.3	- 2.7
27	- 0.8	- 2.3	- 2.7	- 5.7	- 2.9	- 1.6	- 0.3	- 2.5	- 1.4
28	- 5.7	- 2.9	0.1	- 2.8	- 2.8	- 0.7	2.5	- 6.7	- 2.1
29	0.2	3.1	1.2	2.5	1.8	- 0.6	3.2	- 4.1	- 0.5
30	0.0	- 0.5	1.2	0.7	0.4	-	2.7	- 1.6	0.5
31	0.2	0.9	1.2	0.1	0.7	-	3.4	- 0.5	1.5
mean	- 7.0	- 6.6	- 3.6	- 4.6	- 5.4		- 1.8	- 9.5	- 5.6

Table IV.11 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (°C), June 2 - 17, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
2	-2.5	-2.3	-1.7	-0.1	-1.7	-	2.5	-4.5	-1.0
3	-5.1	-7.6	-6.5	-3.9	-5.8	-	-3.5	-8.3	-6.1
4	-5.9	-3.8	-1.8	-1.7	-3.3	-4.4	0.1	-6.5	-3.2
5	-6.5	-4.7	-4.8	-4.3	-5.1	-5.3	-2.8	-6.8	-4.8
6	-8.5	-6.9	-4.2	-4.5	-6.0	-5.5	-1.7	-8.6	-5.2
7	-3.5	-3.9	-8.4	-8.8	-6.2	-6.0	-3.6	-8.6	-6.1
8	-9.5	-8.9	-3.9	-5.9	-7.1	-5.8	-1.5	-11.0	-6.2
9	-9.4	-4.8	-4.0	-3.5	-5.4	-5.8	-0.8	-9.7	-5.3
10	-6.5	-3.9	-2.1	-3.7	-4.1	-5.4	0.2	-6.6	-3.2
11	-6.4	-6.5	-4.7	-7.0	-6.2	-4.1	-2.9	-7.8	-5.3
12	-7.5	-4.7	-1.5	-3.5	-4.3	-3.2	0.5	-7.5	-3.5
13	-2.8	-0.9	1.3	-0.5	-0.7	-2.3	3.8	-3.7	0.0
14	-1.7	-1.5	2.4	-1.5	-0.6	-1.3	2.9	-2.7	0.1
15	-2.5	-1.5	2.9	2.1	0.2	-0.4	4.9	-3.9	0.5
16	-0.9	-2.7	-0.6	-0.7	-1.2	-	2.8	-3.9	-0.6
17	-2.7	0.3	2.3	1.1	0.2	-	3.3	-3.8	-0.3
mean	-5.1	-4.0	-2.3	-2.9	-3.5		0.3	-6.5	-3.1

Table IV.12 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (°C), dateless, Summer 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
X 1	-	2.6	4.2	5.5	3.8	-	6.4	0.5	3.5
x 2	0.1	2.4	6.6	7.1	4.1	-	8.0	0.2	3.9
x 3	3.3	4.1	3.8	4.2	3.9	3.7	5.1	1.4	3.3
x 4	1.6	4.0	5.3	4.5	3.9	3.2	5.5	0.2	2.9
x 5	4.4	3.3	0.3	0.8	2.2	3.0	5.2	-0.1	2.6

continued

Table IV.12 - continued

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
x 6	0.6	1.3	3.3	3.1	2.1	2.4	4.6	0.4	2.5
x 7	2.4	3.7	3.3	1.5	2.7	2.1	4.4	0.3	2.4
x 8	0.4	-0.3	1.5	2.0	0.9	2.0	3.3	-0.4	1.5
x 9	1.5	0.3	3.4	4.8	2.5	2.0	6.4	-0.7	2.9
x10	2.5	2.1	2.22	0.3	1.8	2.2	2.5	-0.3	1.1
x11	0.3	2.5	3.3	3.0	2.3	3.1	3.9	0.0	2.0
x12	2.1	2.0	4.3	5.7	3.5	3.6	6.4	1.2	3.8
x13	4.3	2.6	7.4	7.2	5.4	3.7	9.3	2.3	5.8
x14	3.3	4.1	6.0	7.0	5.1	3.8	7.1	2.2	4.8
x15	2.3	0.6	2.4	2.6	2.0	4.5	3.4	0.3	1.9
x16	1.2	1.2	2.5	6.9	3.0	4.9	7.4	0.5	4.0
x17	6.5	5.3	7.4	9.3	7.1	5.6	9.9	4.3	7.1
x18	8.3	6.4	7.5	7.7	7.5	-	9.0	5.2	7.1
x19	8.3	8.0	9.3	-	8.5	-	-	5.4	-
mean	3.0	3.0	4.4	4.6	3.8		6.0	1.2	3.6

Table IV.13 - Automatic recorded, Pyrox-Sumner, Base Camp, Air temperature (°C), August 22 - 28, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
222	0.2	1.5	7.0	7.7	4.1	-	8.4	-0.5	4.0
23	6.0	5.8	6.3	6.7	6.2	-	7.7	-0.5	3.6
24	1.8	2.6	4.0	3.5	3.0	3.1	5.9	-0.8	2.6
25	0.2	-0.3	3.5	1.4	1.2	2.2	5.6	-0.8	2.4
26	-0.8	1.2	1.5	2.2	1.0	1.6	3.7	-1.7	1.0
27	-2.3	-3.3	1.8	2.3	-0.4	-	2.7	-4.1	-0.8
28	1.8	3.2	4.9	-	3.3	-	4.9	1.8	3.3
mean	1.0	1.5	4.1	4.0	2.6		5.5	-0.9	2.5

Table IV.14 - Automatic recorded, Pyrox-Sumner, Base Camp, Wind speed (m/sec) and wind run (km) at 200 cm, May 14 - 31, 1966

Day	0000	0600	1200	1800	mean	total km
14	0.5	1.3	0.0	0.0	0.5	22.2
15	0.0	0.5	0.0	0.9	0.4	27.4
16	0.5	0.5	0.0	0.9	0.5	29.8
17	0.5	0.0	0.9	0.5	0.5	38.6
18	0.5	0.5	0.5	0.0	0.4	33.8
19	0.0	0.0	1.8	0.9	0.7	42.6
20	0.5	1.3	1.8	0.0	0.9	38.6
21	0.0	2.2	1.3	1.3	1.2	36.2
22	0.0	0.0	0.9	1.3	0.6	21.6
23	0.9	3.6	2.7	0.9	2.0	54.7
24	4.0	3.1	1.3	1.8	2.6	80.0
25	1.3	0.0	2.2	1.8	1.3	52.2
26	3.1	2.2	10.8	12.6	7.2	277.0
27	6.3	14.4	13.0	12.6	11.6	583.4
28	7.2	0.0	4.3	2.9	3.6	94.2
29	5.4	3.6	1.8	3.4	3.6	103.0
30	2.2	3.1	3.1	2.5	2.7	82.6
31	2.3	1.8	1.8	1.3	1.8	48.0
mean	2.0	2.1	2.7	2.5	2.3	

Table IV.15 - Automatic recorded, Pyrox-Sumner, Base Camp, Wind speed (m/sec) and wind run (km) at 200 cm, June 2 - 17, 1966

Day	0000	0600	1200	1800	mean	total km
2	8.1	8.0	3.1	0.5	4.9	322.0
3	0.5	0.5	1.3	0.9	0.8	45.0
4	0.0	1.3	2.5	1.3	1.3	83.7
5	2.0	0.0	3.6	4.9	2.6	276.8
6	3.6	1.8	0.5	1.8	1.9	200.0
7	5.8	7.2	4.5	3.6	5.3	334.5
8	0.5	0.9	0.0	0.0	0.3	12.8
9	0.0	0.7	0.9	1.0	0.7	24.2
10	0.0	0.5	0.0	0.0	0.1	14.5
11	0.5	0.7	1.8	4.5	1.9	140.0
12	0.0	0.0	0.5	1.3	0.5	58.0
13	1.5	1.3	0.9	1.3	1.3	90.2
14	0.0	2.2	0.0	1.3	0.9	136.0
15	1.0	0.9	0.0	0.0	0.5	38.1
16	0.0	0.5	1.3	0.7	0.6	51.5
17	0.0	0.9	0.5	0.0	0.4	38.8
mean	1.5	1.7	1.3	1.4	1.5	

Table IV.16 - Automatic recorded, Pyrox-Sumner, Base Camp, Wind speed (m/sec) and wind run (km) at 200 cm, dateless, Summer 1966

Day	0000	0600	1200	1800	mean	total km
x 1	-	1.3	1.3	1.3	1.3	-
x 2	2.0	0.0	0.9	1.5	1.1	99.8
x 3	3.6	3.8	5.6	4.5	4.4	244.5
x 4	1.3	1.8	0.9	1.8	1.5	114.1
x 5	1.3	0.5	0.9	0.0	0.7	77.4
x 6	0.0	0.7	0.0	5.4	1.5	152.0

continued

Table IV.16 - continued

Day	0000	0600	1200	1800	mean	total km
x 7	3.6	1.5	1.8	3.6	2.6	155.0
x 8	3.6	2.7	3.6	9.0	4.7	400.0
x 9	7.5	0.5	1.3	2.2	2.9	209.8
x10	3.6	0.0	0.0	4.0	1.9	226.0
x11	1.3	0.9	1.0	2.2	1.4	93.5
x12	1.8	0.0	0.0	1.3	0.8	109.6
x13	0.0	0.5	1.3	1.0	0.7	95.5
x14	1.3	0.7	0.5	1.0	0.9	78.5
x15	1.2	0.5	0.5	3.5	1.4	129.0
x16	1.8	0.0	0.0	2.2	1.0	97.7
x17	2.2	0.7	1.8	2.0	1.7	119.3
x18	2.7	1.3	1.0	4.0	2.3	125.8
x19	0.0	0.5	1.3	-	0.5	-
mean	2.0	0.9	1.2	2.8	1.7	

Table IV.17 - Automatic recorded, Pyrox-Sumner, Base Camp, Wind speed (m/sec) and wind run (km) at 200 cm, August 22 - 28, 1966

Day	0000	0600	1200	1800	mean	total km
22	1.0	0.5	6.2	10.0	4.4	425.1
23	6.7	9.2	6.3	5.4	6.9	445.0
24	0.9	0.5	1.8	1.3	1.1	69.6
25	0.5	0.0	1.3	0.0	0.5	41.8
26	0.9	0.9	1.3	0.0	0.8	83.5
27	0.0	1.3	1.8	0.5	0.9	65.0
28	3.2	3.6	-	-	-	-
mean	1.7	2.3	3.1	2.9	2.5	

Table IV.18 - Automatic recorded, Mk II, Moraine Camp Ice,
Air temperature (^{o}C), August 10 - 30, 1965

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
10	-0.8	-1.8	3.0	-4.0	-0.9	-	5.0	-4.5	0.3
11	-4.0	-2.8	1.1	-2.8	-2.1	-	2.2	-4.5	-1.2
12	-4.0	-0.8	0.9	2.8	-0.5	0.5	6.1	-4.2	1.0
13	1.5	1.5	5.7	4.2	3.2	0.7	6.7	0.3	3.5
14	2.8	4.3	4.3	1.1	3.1	1.2	6.3	0.0	3.2
15	0.5	2.1	1.4	0.0	1.0	0.9	5.6	-1.2	2.2
16	-2.0	0.2	1.4	-2.1	-0.6	-1.1	5.0	-4.1	0.5
17	-4.2	-3.8	4.2	-4.0	-2.0	-1.6	4.5	-7.5	-1.5
18	-5.4	-6.1	0.8	-5.4	-4.0	-2.3	4.1	-9.7	-2.8
19	-8.5	-3.6	3.0	-0.5	-2.4	-2.6	4.6	-9.1	-2.3
20	-6.4	-1.9	0.2	-1.4	-2.4	-2.6	1.8	-8.5	-3.4
21	-3.8	-3.1	1.3	-2.5	-2.0	-2.1	1.8	-7.0	-2.6
22	-2.9	-3.6	0.7	-2.5	-2.1	-2.3	3.3	-6.4	-1.5
23	-4.0	-3.8	0.7	-3.7	-2.7	-2.1	2.8	-5.4	-1.3
24	-4.1	-3.3	1.1	-3.6	-2.5	-1.9	4.1	-5.2	-0.7
25	-6.6	0.3	1.4	0.0	-1.2	-1.9	3.3	-7.0	-1.4
26	-0.8	-1.6	2.9	-4.2	-0.9	-2.7	3.9	-2.6	0.7
27	-3.9	-2.6	0.3	-3.3	-2.4	-4.1	0.6	-6.5	-2.5
28	-6.2	-5.2	-6.4	-8.2	-6.5	-	-3.3	-8.2	-5.8
29	-10.0	-9.3	-3.7	-14.8	-9.5	-	-3.3	-17.0	-9.1
30	-14.2	-	-	-	-	-	-	-	-
mean	-3.6	-2.3	1.1	-2.7	-1.9		3.3	-5.9	-1.3

Table IV.19 - Automatic recorded, Mk II, Moraine Camp Ice, Relative humidity (%), August 10 - 30, 1965

Day	0000	0600	1200	1800	mean
10	92	90	75	84	85
11	80	70	63	74	72
12	67	74	57	78	69
13	87	85	53	63	72
14	74	63	65	75	69
15	73	70	65	75	71
16	77	81	68	80	77
17	86	80	66	92	81
18	88	86	90	90	89
19	88	85	70	92	84
20	89	85	90	96	90
21	100	78	70	76	81
22	75	76	67	92	78
23	98	95	80	83	89
24	69	80	76	72	74
25	75	70	69	76	73
26	87	95	88	73	86
27	63	66	65	96	73
28	95	94	87	90	92
29	94	91	74	88	87
30	88	-	-	-	-
mean	83	81	72	82	80

Table IV.20 - Automatic recorded, Mk II, Moraine Camp Ice, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs., tenths), August 10 - 31, 1965

Day	0000	0600	1200	1800	mean	hrs.1/10
10	927.7	927.8	927.8	926.3	927.4	10.9
11	925.2	925.6	924.8	926.3	925.5	13.9
12	926.8	928.2	928.7	928.5	928.1	11.2
13	930.9	932.2	932.1	932.0	931.8	12.0
14	930.7	929.6	928.2	928.0	929.1	12.5
15	927.0	926.8	926.3	926.5	926.7	11.8
16	925.6	926.3	926.0	926.3	926.0	12.3
17	925.2	925.1	924.8	924.3	924.9	10.5
18	924.5	925.8	926.8	929.0	926.5	8.4
19	927.3	927.8	927.7	927.2	927.5	9.4
20	926.3	927.4	929.0	930.0	928.2	6.7
21	930.3	931.2	931.6	930.8	931.0	11.5
22	928.6	928.0	926.9	927.0	927.6	2.5
23	926.7	927.7	928.8	929.0	928.1	8.9
24	929.3	929.6	930.8	931.3	930.1	9.9
25	930.8	931.2	931.5	930.7	931.1	11.2
26	929.2	930.0	931.9	932.8	931.0	5.8
27	931.2	929.0	925.6	922.8	927.2	0.7
28	921.7	922.8	924.2	925.6	923.6	0.0
29	925.8	926.0	926.8	925.4	926.0	2.9
30	924.7	923.5	922.2	919.6	922.5	0.0
31	916.7	915.0	913.7	913.8	914.8	0.0
mean	926.9	927.1	927.1	927.0	927.0	173.0

Table IV.21 - Automatic recorded, Mk II, Moraine Camp Ice,
Bar.pressure (mb) at 880 m a.s.l.,bright sunshine (hrs., tenths)
September 1965

Day	0000	0600	1200	1800	mean	hrs.1/10
1	913.7	913.8	914.8	914.0	914.1	7.6
2	912.8	912.7	914.6	915.7	914.0	3.7
3	919.6	922.8	925.5	926.4	923.6	6.8
4	927.1	927.8	929.0	931.3	928.8	4.4
5	934.9	936.3	936.1	935.6	935.7	3.4
6	933.1	934.5	935.2	936.8	934.9	9.3
7	937.1	936.8	934.2	929.8	934.5	6.5
8	931.0	929.0	929.8	932.6	930.6	9.0
9	933.6	935.1	934.8	933.4	934.2	8.7
10	930.4	927.6	925.1	923.8	926.7	8.5
11	922.7	923.0	924.2	926.7	924.2	8.4
12	928.9	929.6	932.0	932.6	930.7	2.9
13	932.0	931.0	930.4	928.3	930.4	5.5
14	926.5	923.8	920.6	921.2	923.0	0.5
15	922.9	923.7	923.8	923.5	923.5	1.4
16	920.8	917.7	915.4	913.3	916.8	2.7
17	912.3	912.8	911.8	911.6	912.1	0.4
18	911.0	912.3	913.7	913.8	912.7	1.1
19	912.6	911.0	909.8	907.2	910.2	4.3
20	905.6	903.8	903.9	905.0	904.6	0.0
21	904.9	907.2	909.5	912.0	908.4	4.1
22	914.1	917.2	920.0	920.8	918.0	3.5
23	922.6	923.8	925.5	925.7	924.4	6.9
24	926.0	925.5	925.0	924.8	925.3	4.2
25	923.7	923.6	923.9	925.0	924.1	0.0
26	924.0	923.6	921.3	918.8	921.9	3.2
27	915.3	913.3	913.5	913.6	913.9	3.4
28	913.6	913.8	914.1	915.1	913.9	1.0
29	916.4	918.2	920.3	920.8	918.9	0.0
30	919.1	916.8	914.0	913.3	915.8	0.6
Mean	921.6	921.6	917.3	921.8	920.6	122.0

Table IV.22 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs., tenths) October 1965

Day	0000	0600	1200	1800	mean	hrs.1/10
1	912.7	913.0	913.8	914.7	913.6	3.4
2	915.0	915.7	915.3	913.8	915.0	0.0
3	912.8	913.7	913.8	912.8	913.2	1.0
4	910.0	909.7	909.8	911.1	910.2	0.0
5	913.5	916.8	921.0	925.3	919.2	0.0
6	927.2	929.0	930.1	931.8	929.5	0.0
7	931.8	932.9	933.3	933.9	932.9	3.2
8	934.1	934.8	934.0	933.0	933.9	2.0
9	929.8	927.7	925.6	926.7	927.5	0.0
10	926.7	927.4	928.4	929.8	928.1	0.0
11	928.8	929.0	927.9	927.5	928.3	0.0
12	926.8	927.0	926.9	926.5	926.8	0.7
13	925.6	925.7	925.2	925.1	925.4	0.8
14	924.5	924.0	923.3	923.7	923.9	0.0
15	923.5	923.8	923.8	923.6	923.7	0.0
16	922.7	922.3	921.6	920.3	921.7	0.0
17	917.6	914.9	913.1	912.3	914.5	0.0
18	910.7	909.6	908.0	907.8	909.0	0.0
19	907.8	907.7	907.3	907.4	907.6	0.0
20	907.5	907.8	909.7	912.6	909.4	0.0
21	913.8	914.5	914.9	916.0	914.8	0.0
22	918.0	919.8	920.7	921.6	920.0	0.0
23	920.4	919.6	917.7	915.8	918.4	0.0
24	914.6	913.9	-	912.3	913.6	0.0
25	913.6	914.0	913.7	911.0	913.1	0.0
26	906.8	902.0	- beyond -		-	0.0
27		- range of -			-	0.0
28		- recording instrument -			-	0.0
29	-	900.5	902.0	903.8	901.6	0.0
30	905.7	907.5	908.3	908.8	907.6	0.0
31.	909.2	909.6	911.8	912.3	910.7	0.0
mean	916.5	916.6	916.2	916.8	916.5	11.1

Table IV.23 - Automatic recorded, Mk II, Moraine Ice Camp,

Bar.pressure (mb) **at 880 m a.s.l.,bright sunshine (hrs., tenths)**
November 1965

Day	0000	0600	1200	1800	mean	hrs.1/10
1	912.8	912.8	913.0	913.9	913.1	0.0
2	915.0	917.0	918.8	918.3	917.3	0.0
3	914.2	907.9	904.4	903.6	907.5	0.0
4	903.8	904.7	904.7	904.9	904.5	0.0
5	907.0	909.6	913.0	914.4	911.0	0.0
6	917.8	919.6	919.6	917.1	918.5	0.0
7	915.3	915.1	916.0	919.1	916.4	0.0
8	922.7	924.3	925.6	925.0	924.4	0.0
9	925.9	925.6	924.8	923.6	925.0	0.0
10	922.8	922.7	924.1	926.1	923.9	0.0
11	927.8	927.0	927.5	927.5	927.5	0.0
12	927.8	927.2	926.4	925.3	926.7	0.0
13	925.4	925.8	924.9	924.9	925.3	0.0
14	925.8	924.7	928.6	930.8	927.5	0.0
15	932.8	932.1	931.9	932.4	932.3	0.0
16	936.8	938.2	940.0	941.0	939.0	0.0
17	941.9	942.3	943.9	945.7	943.5	0.0
18	946.9	947.7	948.0	947.8	947.6	0.0
19	947.8	947.9	947.9	947.9	947.9	0.0
20	946.4	945.3	944.4	944.0	945.1	0.0
21	945.2	945.9	946.3	947.0	946.1	0.0
22	947.0	946.0	945.7	945.1	946.0	0.0
23	945.2	945.3	945.2	944.4	945.0	0.0
24	943.1	941.2	940.2	938.8	940.8	0.0
25	938.4	935.8	933.8	932.4	935.1	0.0
26	931.1	929.7	929.7	929.3	930.0	0.0
27	927.9	926.3	925.4	926.1	926.4	0.0
28	927.9	928.3	929.2	928.9	928.6	0.0
29	928.5	928.0	927.2	927.5	927.8	0.0
30	927.7	927.8	928.2	926.7	927.6	0.0
mean	929.3	928.2	929.3	929.3	929.0	0.0

Table IV.24 - Automatic recorded, Mk II, Moraine Ice Camp,
Bar.pressure (mb) at 880 m a.s.l.,bright sunshine (hrs., tenths)
December 1965

Day	0000	0600	1200	1800	mean	hrs.1/10
1	925.9	921.2	918.0	914.2	919.8	0.0
2	911.8	913.0	911.8	913.6	912.6	0.0
3	914.7	915.8	915.7	914.8	915.3	0.0
4	913.7	913.7	913.8	914.6	914.0	0.0
5	913.8	914.3	915.7	917.6	915.4	0.0
6	920.2	922.0	922.7	921.9	921.7	0.0
7	918.6	915.2	911.4	908.2	913.4	0.0
8	908.4	908.6	909.0	909.7	908.9	0.0
9	910.0	911.3	913.7	914.2	912.3	0.0
10	913.6	912.0	911.1	910.0	911.7	0.0
11	911.0	911.4	911.1	912.3	912.3	0.0
12	912.6	913.8	915.8	917.5	914.9	0.0
13	918.8	918.8	918.7	917.3	918.4	0.0
14	915.3	911.9	908.9	907.1	910.8	0.0
15	906.8	907.8	911.3	912.9	909.7	0.0
16	913.9	913.1	911.8	909.5	912.1	0.0
17	908.9	907.6	907.0	907.2	907.7	0.0
18	904.2	902.7	901.4	901.0	902.3	0.0
19	901.1	902.9	905.2	909.8	904.8	0.0
20	912.1	914.0	916.1	917.2	914.9	0.0
21	917.7	917.8	917.7	916.4	917.4	0.0
22	915.7	915.8	916.7	908.3	914.1	0.0
23	919.0	918.2	918.6	920.0	919.0	0.0
24	922.1	924.9	927.1	928.6	925.7	0.0
25	928.9	929.2	929.3	929.4	929.2	0.0
26	929.3	928.1	925.6	924.1	926.8	0.0
27	924.2	924.6	923.7	921.2	923.4	0.0
28	917.8	914.5	913.7	913.9	919.1	0.0
29	914.6	915.8	917.7	919.6	916.9	0.0
30	919.7	919.8	919.6	918.8	919.5	0.0
31	918.1	917.0	916.8	917.7	917.4	0.0
MEAN	915.6	915.4	915.4	915.1	915.4	0.0

Table IV.25 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad 16 points), August 11 - 31, 1965

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
11	-	375	-	375	-	375	-	375	-	-
12	-	375	-	375	-	350	0.0	375	-	-
13	-	000	-	375	-	025	-	050	-	-
14	-	375	-	000	-	375	-	375	-	-
15	-	000	-	375	-	000	-	375	-	-
16	-	375	-	000	-	375	-	375	-	-
17	-	375	-	375	0.0	000	-	375	-	-
18	-	375	-	000	-	075	-	375	-	-
19	-	375	-	000	-	375	-	350	-	-
20	-	025	-	000	-	050	0.0	275	-	-
21	-	000	-	025	-	075	-	000	-	-
22	-	000	-	000	-	375	-	300	-	-
23	0.0	275	-	000	-	025	-	000	-	-
24	1.6	025	3.0	050	1.1	025	2.5	050	2.1	222.3
25	3.0	025	1.1	050	1.6	075	1.1	050	1.9	154.8
26	0.1	350	1.6	050	0.0	050	4.0	000	1.4	193.5
27	5.9	000	4.0	025	0.1	025	1.1	175	2.8	194.0
28	0.1	200	0.0	200	1.1	225	0.7	200	0.5	58.1
29	0.1	225	0.0	225	0.0	225	1.6	375	0.4	64.5
30	2.1	000	2.1	000	0.1	125	0.0	175	0.6	100.2
31	0.1	150	3.4	150	0.1	200	0.7	000	1.1	135.6
mean	1.6		1.9		0.5		1.5		1.4	1123.0

Table IV.26 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), September 1965

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	3.4	000	0.7	025	1.1	000	4.9	075	2.5	232.0
2	4.0	075	4.5	025	2.1	000	3.4	025	3.5	290.2
3	0.1	025	0.1	250	2.1	000	4.0	000	1.6	206.4
4	4.0	100	5.4	100	2.5	100	4.5	125	4.1	334.8
5	0.7	025	1.6	025	5.4	075	10.3	075	4.5	452.0
6	9.3	075	5.9	075	3.4	000	3.0	375	5.4	432.5
7	3.4	000	3.4	075	3.4	050	3.4	000	4.4	445.0
8	4.0	000	4.9	025	1.6	000	3.4	000	3.5	342.0
9	5.4	000	2.5	000	1.1	375	3.4	000	3.1	238.5
10	3.4	000	1.6	025	1.1	050	1.6	375	1.9	206.5
11	3.4	025	2.5	025	5.4	050	6.3	000	4.4	376.0
12	5.4	000	1.6	375	0.7	000	3.4	000	2.8	154.7
13	1.1	000	3.4	025	0.1	075	1.1	000	1.4	219.0
14	1.1	050	0.1	025	0.7	025	9.8	050	2.9	281.0
15	7.8	100	3.4	375	1.1	025	0.1	075	3.1	226.0
16	0.0	-	3.4	000	0.1	025	4.5	000	2.0	208.0
17	1.6	375	3.4	000	3.4	000	0.0	100	2.1	264.5
18	2.1	025	1.6	000	0.1	000	1.1	375	1.2	148.4
19	3.0	025	4.0	000	3.4	000	5.4	000	4.0	338.5
20	5.4	000	4.0	000	0.7	175	1.6	125	2.9	265.0
21	1.6	000	4.0	125	3.4	000	5.4	375	3.6	323.0
22	5.4	375	1.1	025	3.0	[illegible]	1.1	050	2.7	148.5
23	3.0	050	1.1	025	0.7	025	1.1	375	1.5	251.5
24	9.3	050	5.4	075	10.8	050	3.4	025	7.2	497.0
25	1.1	000	1.6	025	2.5	000	0.1	000	1.3	161.5
26	1.6	025	0.7	025	1.1	025	1.6	225	1.2	193.6
27	1.6	375	5.4	000	4.5	000	5.9	000	4.4	432.0
28	4.5	000	5.4	000	1.6	375	0.0	025	2.9	203.5
29	0.1	000	1.1	000	3.4	050	1.6	025	1.6	144.0
30	5.9	375	5.9	000	1.1	000	1.6	025	3.6	364.2
mean	3.4		3.0		2.2		3.2		3.0	8379.3

Table IV.27 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), October 1965

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	3.4	375	4.0	000	3.4	025	2.5	000	3.3	287.5
2	1.6	000	0.1	050	3.4	000	2.0	025	1.8	232.1
3	7.4	000	11.2	000	5.4	000	1.6	025	6.4	445.0
4	1.1	000	1.6	025	2.0	025	1.1	025	1.5	191.0
5	0.1	325	0.0	100	4.0	000	1.1	025	1.4	127.0
6	0.1	025	0.1	375	0.1	025	0.1	025	0.1	109.5
7	4.9	075	4.5	075	1.6	050	1.1	075	3.0	300.0
8	5.4	350	7.0	000	5.5	000	7.4	000	6.3	549.0
9	5.9	000	4.5	025	2.5	025	1.6	025	3.6	255.0
10	0.0	050	0.7	025	0.1	000	0.1	375	0.2	100.0
11	3.4	000	2.1	000	4.0	000	4.9	000	3.6	345.5
12	2.5	000	2.5	375	3.4	000	4.5	000	3.2	335.5
13	3.4	000	4.5	025	1.6	075	0.7	050	2.6	316.0
14	1.6	250	5.4	025	5.4	000	1.1	375	3.4	348.0
15	6.9	000	5.4	000	3.4	025	2.5	025	4.6	335.8
16	4.0	000	2.5	000	1.1	075	3.4	025	2.8	387.0
17	5.4	025	4.5	000	4.0	000	5.4	000	4.8	455.0
18	5.4	375	3.4	000	3.4	000	6.3	000	4.6	371.0
19	3.0	025	5.9	025	4.9	000	3.4	000	4.3	400.0
20	3.4	025	3.4	000	2.5	275	2.5	275	3.0	213.0
21	0.7	125	2.1	025	3.0	000	2.1	025	2.0	206.5
22	1.6	025	1.6	000	2.5	000	2.5	000	2.1	229.0
23	2.5	000	1.6	075	3.4	050	5.4	050	3.4	335.0
24	5.4	075	11.2	075	11.2	075	1.6	075	7.4	847.5
25	5.4	025	1.1	050	0.1	050	0.1	025	1.7	142.0
26	0.7	000	2.5	025	5.4	025	3.4	000	3.0	274.0
27	3.0	000	3.0	000	1.6	025	1.6	025	2.3	181.5
28	1.1	025	0.7	050	1.1	075	2.1	025	1.3	164.3
29	3.4	375	4.0	100	3.4	025	4.9	000	3.9	400.0
30	5.0	050	7.4	075	3.4	025	7.8	000	5.9	480.0
31	3.4	050	3.0	025	4.9	025	5.9	025	4.3	407.0
mean	3.3		3.6		3.3		2.9		3.3	9769.6

Table IV.28 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), November 1965

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	5.4	025	5.4	025	7.4	025	5.4	025	5.9	509.5
2	5.4	025	5.4	025	1.6	000	1.6	100	3.5	287.5
3	1.1	050	5.4	000	3.4	000	3.4	000	3.3	319.0
4	3.4	000	3.0	000	2.1	000	2.5	000	2.8	268.0
5	1.6	000	3.4	000	4.5	025	4.0	000	3.4	361.5
6	4.5	000	3.4	000	5.4	100	7.4	050	5.2	438.5
7	7.4	050	6.9	100	0.7	225	5.4	000	5.1	358.0
8	5.0	125	2.1	100	9.3	075	5.4	025	5.5	497.0
9	5.4	375	8.3	000	5.4	000	5.4	025	6.1	487.0
10	3.4	025	3.0	000	3.4	025	3.4	000	3.3	337.5
11	3.0	000	3.4	000	4.0	025	3.4	000	3.5	284.0
12	1.1	025	4.5	025	2.5	050	4.0	000	3.0	251.5
13	3.4	350	7.4	100	7.4	175	0.7	225	4.7	387.0
14	2.1	200	1.1	150	1.1	150	1.6	000	1.5	245.5
15	5.9	000	4.9	025	4.0	025	1.6	250	4.1	310.0
16	0.7	150	1.6	025	1.1	250	1.1	000	1.1	164.5
17	2.1	025	2.5	025	3.0	025	7.2	000	3.7	300.0
18	5.4	025	5.4	050	4.0	000	6.9	025	5.4	503.0
19	7.4	025	5.3	000	4.0	375	1.1	000	4.5	423.0
20	6.9	025	3.0	300	3.0	025	0.7	200	3.4	251.5
21	3.4	025	3.0	025	4.0	025	5.2	000	3.9	387.5
22	3.4	000	5.9	000	5.0	000	3.4	000	4.4	461.5
23	4.0	000	5.4	025	5.2	000	1.1	000	3.9	374.0
24	2.5	375	5.0	000	5.0	000	7.4	025	5.0	474.0
25	3.4	050	6.0	025	5.4	000	5.4	000	5.0	438.5
26	4.9	025	4.9	025	1.6	000	1.1	350	3.1	235.5
27	0.7	325	0.1	375	1.6	000	0.0	375	0.6	78.0
28	0.0	375	1.1	000	4.0	000	3.0	075	2.0	164.5
29	2.0	050	7.4	050	7.3	375	6.3	000	5.8	442.0
30	5.4	025	9.3	075	12.3	075	5.4	025	8.1	635.0
mean	3.7		4.5		4.3		3.7		4.1	10674.0

Table IV.29 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), December 1965

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
1	4.5	050	6.3	075	7.4	025	11.2	050	7.4	758.0
2	8.3	050	8.0	075	4.0	025	5.4	025	6.4	541.5
3	4.0	025	3.4	000	3.0	025	6.0	000	4.1	397.0
4	5.4	025	4.5	025	6.3	025	5.4	050	5.4	396.5
5	1.1	050	3.0	375	1.6	025	5.4	000	2.8	345.0
6	6.3	000	5.4	025	5.0	025	5.4	025	5.5	413.0
7	3.4	025	3.0	000	1.6	000	4.0	000	3.0	287.0
8	4.0	000	3.4	025	2.1	000	1.6	025	2.8	254.5
9	2.5	000	4.0	000	5.4	025	5.4	025	4.3	441.5
10	3.4	025	0.1	050	2.5	200	1.3	050	1.8	203.0
11	1.6	050	0.7	075	3.4	025	3.4	000	2.3	222.5
12	1.6	000	3.0	000	2.5	025	1.6	025	2.2	231.5
13	1.6	025	0.7	025	3.4	025	3.4	025	2.3	277.0
14	4.0	025	4.0	000	3.0	375	4.0	025	3.8	354.5
15	2.5	000	3.4	000	3.4	000	1.1	375	2.6	245.0
16	1.1	000	0.7	375	1.6	000	1.1	000	1.1	141.8
17	2.1	000	4.0	000	3.2	000	3.4	025	3.2	322.0
18	0.7	025	3.0	025	0.7	050	0.1	025	1.1	93.5
19	1.1	050	1.1	225	0.1	050	1.6	050	1.0	167.8
20	2.1	075	1.8	125	3.4	025	4.0	025	2.8	271.0
21	3.4	025	3.4	025	4.5	025	4.0	025	3.8	348.5
22	4.0	000	4.0	025	2.1	025	2.5	000	3.2	328.5
23	2.1	025	2.5	025	2.3	000	4.5	025	2.9	268.0
24	4.0	025	3.4	025	2.5	000	2.5	000	3.1	277.5
25	1.6	000	1.1	375	1.1	050	1.1	000	1.2	190.0
26	2.5	000	1.1	000	3.0	025	0.7	000	1.8	171.0
27	1.1	025	0.1	000	0.7	025	1.3	075	0.8	200.0
28	2.1	225	1.1	150	1.6	225	2.1	025	1.7	216.0
29	1.1	050	1.1	000	2.5	075	1.0	000	1.4	175.0
30	0.7	025	0.7	075	0.7	050	0.0	075	0.5	87.1
31	0.1	050	0.7	025	1.1	025	1.6	000	0.9	151.5
mean	2.7		2.7		2.8		3.1		2.8	8774.1

Table IV.30 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l.,bright sunshsine (hrs., tenths) January 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	917.8	917.9	918.6	919.9	918.6	0.0
2	921.8	922.1	922.1	921.8	922.0	0.0
3	922.8	924.0	924.6	923.0	923.6	0.0
4	920.0	915.8	913.9	913.9	915.9	0.0
5	914.2	912.7	911.8	909.6	912.1	0.0
6	904.2	900.3	- beyond -		-	0.0
7		- range of -			-	0.0
8		- recording instrument -			-	0.0
9	-	900.4	901.1	903.0	901.1	0.0
10	903.7	900.8	903.1	909.8	904.4	0.0
11	913.0	914.2	914.0	912.6	913.5	0.0
12	908.3	907.0	909.7	915.0	910.0	0.0
13	917.8	919.3	919.9	922.9	919.9	0.0
14	925.4	928.2	934.0	938.8	931.6	0.0
15	942.5	945.7	946.0	946.0	945.1	0.0
16	945.9	945.0	944.3	942.0	944.3	0.0
17	939.6	937.2	935.4	934.1	936.6	0.0
18	932.7	932.0	930.6	928.7	931.0	0.0
19	925.7	922.9	921.7	922.9	923.3	0.0
20	923.6	923.8	923.6	922.8	923.5	0.0
21	920.8	918.1	916.0	912.9	917.0	0.0
22	911.6	911.0	914.3	918.7	913.9	0.0
23	922.0	923.9	925.8	927.7	924.9	0.0
24	929.6	932.9	936.7	939.7	934.7	0.0
25	942.3	943.0	942.9	942.2	942.6	0.0
26	941.7	941.1	941.3	942.0	941.5	0.0
27	944.0	945.3	946.8	947.2	945.8	0.0
28	947.6	947.8	948.6	949.0	948.3	0.0
29	948.6	948.1	947.6	947.2	947.9	0.0
30	947.0	945.7	942.3	939.7	943.7	0.0
31	938.2	936.8	936.2	935.7	936.7	0.0
mean	924.9	924.6	924.9	925.4	925.0	0.0

Table IV.31 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l.,bright sunshine (hrs., tenths) Febuary 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	934.3	933.7	942.7	942.8	938.4	0.0
2	931.2	928.6	925.7	923.7	927.3	0.0
3	921.0	918.6	915.3	915.4	917.6	0.0
4	914.6	913.7	912.3	911.1	912.9	0.0
5	912.8	915.0	916.6	917.4	915.5	0.0
6	920.0	921.8	921.8	921.4	921.4	0.0
7	919.2	920.2	919.6	917.9	919.2	0.0
8	916.7	914.2	911.6	911.9	913.6	0.0
9	912.7	913.0	913.0	913.7	913.1	0.0
10	913.8	912.4	910.8	907.1	911.0	0.0
11	901.9	- beyond range of -			-	0.0
12		- recording instrument -			-	0.0
13	-	900.2	904.0	912.1	904.1	0.0
14	914.3	915.6	916.1	916.1	915.5	0.0
15	915.4	913.6	915.7	919.8	916.1	0.0
16	923.7	927.0	929.9	933.1	928.4	0.0
17	934.0	935.0	934.6	935.8	934.9	0.0
18	936.0	036.7	938.6	940.8	938.0	0.0
19	941.9	942.6	943.1	942.9	942.6	0.0
20	942.3	941.7	940.6	940.1	941.2	0.0
21	939.7	939.0	937.8	936.5	938.3	0.0
22	935.7	934.7	931.7	929.4	932.9	0.0
23	927.2	925.8	925.4	925.0	925.9	0.0
24	923.8	923.6	922.0	921.5	922.7	0.0
25	919.4	919.5	920.0	921.8	920.2	0.0
26	922.0	922.2	922.5	923.3	922.5	0.0
27	923.7	923.8	924.4	925.2	924.3	0.0
28	925.7	926.5	926.0	926.7	926.2	0.0
mean	922.3	922.1	922.2	922.6	922.3	0.0

Table IV.32 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs., tenths) March 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	926.2	926.6	925.8	925.4	926.0	0.0
2	924.2	923.1	922.3	921.3	922.7	0.0
3	922.6	923.1	923.8	924.2	923.4	0.0
4	924.0	922.2	920.1	920.2	921.6	0.0
5	921.1	921.2	923.3	925.0	922.7	0.0
6	925.1	926.8	926.8	927.5	926.6	0.0
7	927.0	925.4	922.9	920.9	924.1	0.0
8	918.8	917.8	915.7	915.3	916.9	0.0
9	916.3	918.6	921.0	923.0	919.7	0.0
10	923.8	924.0	925.3	926.4	924.9	0.0
11	927.0	927.8	926.9	925.8	926.9	0.0
12	925.7	925.6	924.7	925.6	925.4	0.0
13	924.8	923.8	923.8	926.1	924.6	3.4
14	927.9	929.3	931.6	931.7	930.1	5.1
15	931.4	931.2	932.0	932.3	931.7	5.7
16	933.8	934.2	932.6	932.0	933.2	0.0
17	931.8	930.8	928.9	927.3	929.7	4.9
18	925.7	923.9	922.2	920.7	923.1	4.8
19	918.8	918.9	920.0	921.2	919.7	6.8
20	921.3	920.7	922.8	925.0	922.5	5.4
21	924.7	924.6	927.2	932.8	927.3	5.3
22	936.7	940.0	942.1	942.5	940.3	5.0
23	941.7	939.9	936.9	933.9	938.1	7.6
24	930.4	927.8	924.8	922.4	926.4	7.7
25	920.6	920.5	920.7	921.0	920.7	5.9
26	922.4	924.2	926.0	927.8	925.1	7.7
27	928.3	929.2	929.0	928.9	928.9	7.8
28	928.7	928.6	928.5	929.7	928.9	8.5
29	931.7	933.2	934.8	935.7	933.9	8.1
30	935.2	935.0	934.0	933.1	934.3	8.3
31	933.7	934.0	935.7	936.2	934.9	8.3
mean	926.8	926.9	926.8	927.1	926.9	116.3

Table IV.33 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs., tenths), April 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	936.8	936.8	936.6	936.8	936.8	8.4
2	937.4	938.0	939.0	939.7	938.5	8.6
3	939.2	938.8	937.6	936.8	938.1	8.7
4	935.2	935.4	936.1	935.7	935.6	9.0
5	934.8	934.0	933.2	932.8	933.7	9.3
6	931.7	931.2	930.1	929.0	930.5	9.6
7	927.6	925.8	924.0	924.6	925.5	9.4
8	922.7	921.8	921.3	923.2	922.2	9.1
9	923.8	925.7	929.3	932.0	927.7	4.1
10	934.1	935.3	936.8	937.9	936.0	10.4
11	938.6	938.7	938.8	938.7	938.7	10.6
12	937.9	937.3	937.0	936.7	937.2	10.7
13	934.7	933.8	931.1	931.0	932.6	10.9
14	929.7	929.3	929.5	930.4	929.7	10.8
15	931.2	931.1	931.0	930.1	930.8	5.8
16	928.6	927.0	925.6	923.6	926.2	6.8
17	922.0	920.1	921.0	921.7	921.2	11.0
18	923.0	925.2	926.6	927.0	925.4	11.4
19	927.1	928.0	928.3	928.2	927.9	3.9
20	928.5	927.1	923.2	919.1	924.5	5.8
21	914.2	911.7	907.0	902.0	908.7	6.3
22	900.0	901.0	902.0	903.2	901.5	10.9
23	903.8	903.5	903.7	904.3	903.8	11.3
24	904.8	906.2	908.0	908.3	906.8	11.9
25	908.0	907.0	906.9	906.8	907.2	10.0
26	907.3	912.2	916.5	921.0	914.2	9.9
27	925.5	928.2	931.5	933.1	929.6	10.9
28	933.4	934.2	935.0	934.4	934.2	12.0
29	934.0	934.0	933.0	932.6	933.4	13.8
30	930.5	930.7	930.0	930.1	930.3	14.0
mean	926.2	926.3	926.3	926.3	926.3	285.3

Table IV.34 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points), wind run (km), January 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	4.0	025	1.1	000	1.1	000	21.	000	2.1	174.2
2	1.6	000	0.7	025	1.6	375	1.1	000	1.3	198.0
3	1.1	000	1.1	000	0.0	075	1.1	150	0.8	138.0
4	2.5	175	3.4	025	4.5	000	3.4	025	3.5	316.0
5	4.5	025	2.1	000	4.0	025	2.5	000	3.3	248.0
6	1.6	000	3.4	025	2.1	000	3.0	025	2.5	237.5
7	5.4	050	3.4	050	1.6	025	4.0	000	3.6	358.0
8	4.0	025	7.4	025	3.4	375	7.8	075	5.7	496.0
9	4.5	100	4.3	075	5.0	075	5.9	100	4.9	381.0
10	7.0	100	4.0	150	5.4	150	3.4	175	5.0	342.0
11	1.6	225	1.1	000	3.0	100	0.1	025	1.5	116.0
12	0.0	075	1.3		1.1		1.6		1.0	180.8
13	5.4		5.4		2.5		4.9	100	4.6	467.0
14	5.4	100	5.9	100	5.4	100	1.6	100	4.6	420.0
15	0.0		1.1		0.7		1.6		0.9	129.0
16	1.6		3.4		1.1	050	5.4	375	2.9	300.0
17	3.4	025	3.4	050	0.5	075	1.0	350	2.1	174.0
18	0.2	375	1.6	050	1.1	050	1.0	075	1.0	161.5
19	0.7	075	0.0	025	1.1	025	1.1	000	0.7	138.7
20	1.6	000	2.0	000	3.4	000	2.0	000	2.3	232.0
21	2.5	000	3.0	000	2.5	000	3.0	000	2.8	258.0
22	3.4	000	3.4	375	4.0	000	3.4	000	3.6	303.0
23	1.6	000	2.1	025	3.4	000	2.5	000	2.4	229.0
24	3.0	000	3.0	000	1.2	000	1.6	000	2.2	209.5
25	1.6	000	3.4	000	4.5	000	1.6	000	2.8	248.0
26	3.4	000	2.5	000	1.1	000	2.5	000	2.4	232.0
27	2.5	000	3.2	000	3.4	025	5.4	050	3.6	295.0
28	4.5	025	4.0	375	4.5	000	4.9	025	4.5	433.0
29	9.3	075	13.4	100	9.8	075	9.3	100	10.5	890.0
30	7.8	050	14.4	075	19.4	075	9.3	075	12.7	1245.0
31	11.2	075	9.3	075	4.5	050	3.0	025	7.0	548.0
mean	3.3		3.8		3.4		3.3		3.5	10098.2

Table IV.35 - Automatic recorded, Mk II, Moraine Ice Camp, wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), Febuary 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	1.2	025	1.6	300	1.1	025	1.1	025	1.3	180.5
2	1.6	050	0.7	025	3.0	025	3.0	000	2.1	226.0
3	0.7	025	4.0	000	4.9	025	4.7	025	3.6	309.5
4	9.8	050	7.8	075	2.1	375	2.5	025	5.6	371.0
5	5.4	025	2.1	050	2.5	050	5.4	000	3.9	309.0
6	3.0	000	2.2	025	1.1	000	4.0	025	2.6	248.0
7	1.2	375	5.4	025	6.3	025	2.1	175	3.8	374.0
8	3.4	150	4.5	150	0.1	200	3.4	025	2.9	309.5
9	4.0	025	3.4	000	3.0	025	2.5	000	3.2	261.5
10	4.5	000	3.4	025	6.0	025	5.4	000	4.8	335.5
11	1.5	375	1.6	075	0.0	075	0.5	050	0.9	116.0
12	0.1	050	0.0	025	3.0	025	4.9	000	2.0	209.5
13	3.0	000	5.4	000	4.5	025	3.0	050	4.0	361.5
14	2.5	075	1.6	050	11.2	075	5.0	075	2.6	596.0
15	8.3	050	3.4	050	4.5	025	6.3	000	5.6	371.0
16	4.5	000	4.0	000	4.5	000	2.5	000	3.9	338.5
17	1.8	025	2.1	000	1.1	050	1.2	050	1.6	200.0
18	3.0	075	7.4	000	3.4	000	1.1	000	3.7	219.5
19	1.1	050	2.0	050	3.4	025	5.4	375	2.7	338.5
20	6.3	000	4.5	000	2.5	375	3.0	000	4.1	374.0
21	3.4	000	1.6	025	2.5	000	7.4	225	3.7	322.5
22	5.4	050	6.3	025	3.0	050	3.4	000	4.5	354.0
23	5.0	000	6.0	000	4.0	025	5.4	025	5.1	415.5
24	4.9	000	5.0	025	2.0	200	8.3	275	5.1	425.0
25	2.0	225	3.0	200	3.0	225	1.6	025	2.4	242.0
26	5.4	000	5.4	000	6.0	000	5.8	000	6.2	506.0
27	4.0	000	3.0	025	1.6	000	3.2	000	3.0	284.0
28	3.4	000	4.5	000	4.0	000	6.3	075	4.6	445.0
mean	3.6		3.6		3.4		3.9		3.6	9043.0

Table IV.35 - Automatic recorded, Mk II, Moraine Ice Camp, wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), Febuary 1966

Day	0000 m/sec	0000 Dir	0600 m/sec	0600 Dir	1200 m/sec	1200 Dir	1800 m/sec	1800 Dir	mean m/sec	total km
1	1.2	025	1.6	300	1.1	025	1.1	025	1.3	180.5
2	1.6	050	0.7	025	3.0	025	3.0	000	2.1	226.0
3	0.7	025	4.0	000	4.9	025	4.7	025	3.6	309.5
4	9.8	050	7.8	075	2.1	375	2.5	025	5.6	371.0
5	5.4	025	2.1	050	2.5	050	5.4	000	3.9	309.0
6	3.0	000	2.2	025	1.1	000	4.0	025	2.6	248.0
7	1.2	375	5.4	025	6.3	025	2.1	175	3.8	374.0
8	3.4	150	4.5	150	0.1	200	3.4	025	2.9	309.5
9	4.0	025	3.4	000	3.0	025	2.5	000	3.2	261.5
10	4.5	000	3.4	025	6.0	025	5.4	000	4.8	335.5
11	1.5	375	1.6	075	0.0	075	0.5	050	0.9	116.0
12	0.1	050	0.0	025	3.0	025	4.9	000	2.0	209.5
13	3.0	000	5.4	000	4.5	025	3.0	050	4.0	361.5
14	2.5	075	1.6	050	11.2	075	5.0	075	2.6	596.0
15	8.3	050	3.4	050	4.5	025	6.3	000	5.6	371.0
16	4.5	000	4.0	000	4.5	000	2.5	000	3.9	338.5
17	1.8	025	2.1	000	1.1	050	1.2	050	1.6	200.0
18	3.0	075	7.4	000	3.4	000	1.1	000	3.7	219.5
19	1.1	050	2.0	050	3.4	025	5.4	375	2.7	338.5
20	6.3	000	4.5	000	2.5	375	3.0	000	4.1	374.0
21	3.4	000	1.6	025	2.5	000	7.4	225	3.7	322.5
22	5.4	050	6.3	025	3.0	050	3.4	000	4.5	354.0
23	5.0	000	6.0	000	4.0	025	5.4	025	5.1	415.5
24	4.9	000	5.0	025	2.0	200	8.3	275	5.1	425.0
25	2.0	225	3.0	200	3.0	225	1.6	025	2.4	242.0
26	5.4	000	5.4	000	6.0	000	5.8	000	6.2	506.0
27	4.0	000	3.0	025	1.6	000	3.2	000	3.0	284.0
28	3.4	000	4.5	000	4.0	000	6.3	075	4.6	445.0
mean	3.6		3.6		3.4		3.9		3.6	9043.0

Table IV.36 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), March 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	2.1	050	2.1	275	6.3	050	3.4	375	3.5	367.5
2	2.1	000	2.5	000	4.5	000	4.5	000	3.4	380.0
3	4.0	000	1.6	000	3.4	000	3.4	000	3.1	309.5
4	3.0	000	3.0	000	2.1	000	1.2	025	2.3	187.0
5	1.2	050	1.1	050	1.1	050	1.0	025	1.1	112.8
6	2.0	025	1.1	000	1.5	025	0.7	000	1.3	154.5
7	1.1	025	3.4	000	2.5	000	2.1	000	2.3	219.0
8	1.6	000	1.6	000	2.5	000	3.0	000	2.2	245.0
9	2.5	000	2.5	000	4.0	000	6.0	000	3.8	332.0
10	4.0	000	3.4	025	1.2	375	4.3	025	3.2	303.0
11	4.0	025	1.6	025	1.1	200	1.1	000	2.2	148.5
12	1.6	025	1.6	000	5.0	000	3.4	000	2.9	341.5
13	3.4	000	5.4	000	4.0	000	3.5	000	4.1	325.5
14	2.2	000	1.6	000	1.6	000	2.5	050	1.7	238.5
15	4.5	025	1.8	050	1.6	000	1.6	375	2.4	271.0
16	1.6	000	1.2	025	0.3	000	9.3	075	3.1	377.0
17	11.2	075	6.3	050	9.3	050	5.4	075	8.1	774.5
18	11.9	050	5.4	050	9.3	050	9.3	025	9.0	823.0
19	8.3	050	7.4	050	4.5	025	4.0	025	6.1	552.0
20	4.0	050	9.3	075	1.2	025	3.4	025	4.5	426.0
21	0.7	000	1.6	175	2.5	000	4.9	000	2.4	251.5
22	3.4	000	2.0	000	3.4	000	2.1	000	2.7	232.3
23	2.1	000	0.7	025	3.4	375	4.0	000	2.6	241.5
24	1.2	000	2.1	000	3.0	000	4.0	025	2.5	281.0
25	3.4	000	4.0	000	0.8	375	1.6	000	2.5	226.0
26	3.0	000	1.2	025	2.5	000	5.0	000	2.9	316.0
27	4.0	000	1.6	025	2.5	000	5.0	000	3.3	323.0
28	5.0	000	3.0	000	3.4	000	4.0	000	3.9	377.5
29	4.5	000	1.3	025	1.6	000	1.6	375	2.3	261.5
30	1.6	050	1.2	050	1.1	075	3.4	075	1.8	200.0
31	2.1	025	0.8	375	1.1	025	3.4	050	1.9	210.0
mean	3.5		2.7		3.0		3.6		3.2	9807.6

Table IV.37 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), April 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	3.4	025	3.0	050	1.6	000	1.1	025	2.3	216.0
2	2.5	025	1.2	075	1.1	050	1.2	050	1.5	194.0
3	3.0	325	3.0	375	1.2	075	1.6	025	2.2	200.0
4	1.2	050	2.1	025	1.1	025	1.6	000	1.5	158.0
5	1.2	025	1.1	050	0.7	025	3.4	000	1.6	165.0
6	3.0	000	4.0	000	1.0	025	1.1	000	2.3	194.5
7	6.3	025	2.5	025	6.0	000	1.1	050	4.0	283.0
8	0.7	100	3.0	025	0.2	025	0.7	000	1.1	132.5
9	1.6	000	3.0	000	0.7	000	0.1	000	1.4	142.0
10	0.7	025	0.7	050	0.7	025	1.6	000	0.9	155.0
11	1.2	000	1.1	025	1.1	025	3.4	000	1.7	228.5
12	5.0	000	4.8	000	1.6	025	1.1	000	3.1	238.5
13	2.0	350	6.3	075	6.0	025	5.4	075	4.9	158.0
14	2.5	375	2.1	000	0.3	025	1.6	000	1.7	129.0
15	0.7	000	0.7	000	1.0	000	1.1	000	0.9	119.5
16	3.0	000	2.5	000	0.0	000	0.7	050	1.6	151.5
17	1.0	000	2.5	000	0.0	025	2.1	000	1.4	161.5
18	3.0	000	3.4	000	0.0	025	2.1	375	2.1	219.5
19	2.5	000	1.6	375	0.2	050	1.0	075	1.3	142.0
20	4.0	000	5.4	025	2.5	025	1.6	375	3.4	258.0
21	1.6	000	2.1	000	2.1	225	5.0	075	2.7	232.0
22	4.5	025	2.5	025	0.7	050	0.7	375	2.1	161.5
23	1.6	000	1.1	375	0.2	075	1.1	025	1.0	103.5
24	1.6	000	3.4	000	0.0	025	1.1	000	1.5	129.0
25	1.6	000	1.0	000	0.0	100	0.0	100	0.7	80.7
26	1.1	025	3.0	000	0.0	025	0.7	000	1.2	132.0
27	1.0	375	3.4	025	0.0	000	2.5	075	1.7	174.0
28	3.4	000	1.6	000	0.1	050	1.1	375	1.6	164.5
29	2.5	025	4.5	050	8.3	075	1.6	075	4.2	471.0
30	8.3	050	6.3	050	7.2	075	4.9	075	6.6	600.0
mean	2.5		2.8		1.5		1.7		2.1	5893.7

Table IV.38 - Automatic recorded, Mk II, Moraine Ice Camp, Air temperature (^{o}C), May 23 - 31, 1966

Day	0000	0600	1200	1800	mean	5-dya running mean	Tmax	Tmin	mean
23	-	-	-	-4.5	-	-	-	-	-
24	-9.0	-9.0	-3.2	-9.0	-7.5	-	-1.5	-10.4	-6.0
25	-10.8	-2.8	2.5	0.1	-2.6	-	5.3	-11.3	-3.0
26	-2.3	-3.5	-4.3	-7.2	-4.3	-5.8	1.0	-7.2	-3.1
27	-6.0	-7.2	-8.2	-10.0	-7.9	-4.7	-5.9	-11.6	-8.8
28	-10.6	-8.7	-1.8	-5.6	-6.7	-4.9	2.0	-11.6	-4.8
29	-5.7	-0.3	-0.6	-0.6	-1.8	-4.4	0.6	-6.0	-2.7
30	-3.6	-4.6	-3.1	-3.3	-3.7	-3.5	0.8	-5.0	-2.1
31	-2.8	-0.6	-2.3	-1.5	-1.8	-3.7	2.0	-4.8	-1.4
mean	-6.4	-4.6	-2.6	-4.6	-4.5		0.5	-8.5	-4.0

Table IV.39 - Automatic recorded, Mk II, Moraine Ice Camp, Relative humidity (%), May 23 - 31, 1966

Day	0000	0600	1200	1800	mean
23	-	-	-	90	-
24	98	93	75	84	88
25	53	50	32	46	45
26	70	90	76	91	82
27	86	91	87	88	88
28	89	86	70	56	75
29	60	66	74	84	71
30	94	90	85	90	90
31	79	67	69	66	70
mean	79	78	71	76	75

Table IV.40 - Automatic Recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs.,tenths), May 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	930.2	931.5	932.8	933.0	931.9	12.6
2	932.3	932.4	934.0	934.8	930.9	12.5
3	935.3	936.4	937.2	936.8	936.4	15.5
4	936.0	936.0	936.3	936.8	936.3	15.8
5	937.0	937.3	938.1	938.5	937.7	16.1
6	938.8	939.5	941.0	941.2	940.1	16.4
7	941.3	942.0	942.4	942.0	941.9	16.9
8	941.0	940.8	939.7	937.8	939.8	13.8
9	935.0	931.2	927.1	922.2	928.9	4.3
10	917.3	914.0	913.2	913.0	914.4	1.7
11	917.2	923.1	928.1	929.6	924.5	16.6
12	929.0	927.8	925.8	923.2	926.5	18.9
13	919.8	919.0	917.3	916.0	918.0	16.8
14	913.7	915.2	917.8	920.0	916.7	19.6
15	922.0	922.3	921.2	920.2	921.4	14.6
16	919.6	922.0	924.3	925.0	922.7	16.7
17	926.3	929.0	931.7	933.8	930.2	15.1
18	934.0	934.2	934.6	934.5	934.3	17.3
19	933.1	932.0	931.2	930.2	931.6	17.5
20	929.3	929.5	930.2	930.0	922.3	20.3
21	929.1	929.1	929.2	928.9	929.1	20.3
22	928.7	928.5	928.1	927.6	928.2	18.1
23	926.6	926.8	926.1	927.8	926.8	10.6
24	928.4	930.1	932.8	933.5	931.2	15.9
25	934.1	934.7	935.0	934.5	934.6	13.5
26	934.1	932.7	931.0	928.8	931.7	1.7
27	928.7	929.0	930.0	935.5	930.8	1.9
28	938.7	940.7	940.0	938.2	939.4	13.9
29	935.3	932.0	930.8	930.0	932.0	2.1
30	927.0	926.2	927.0	928.7	927.2	9.3
31	929.2	930.0	929.7	929.9	929.7	13.5
mean	929.9	930.2	930.4	930.4	930.2	419.8

Table IV.41 - Automatic recorded, Mk II, Moraine Ice Camp, Wind speed (m/sec) at 200 cm, wind direction (neugrad, 16 points) and wind run (km), May 1966

Day	0000 m/sec	Dir	0600 m/sec	Dir	1200 m/sec	Dir	1800 m/sec	Dir	mean m/sec	total km
1	4.5	050	3.0	050	0.0	025	0.7	375	2.1	135.5
2	1.1	025	0.1	000	0.0	050	2.5	375	0.9	122.5
3	1.6	000	3.4	000	0.0	025	1.1	375	1.5	177.0
4	3.4	000	2.5	000	0.2	025	1.4	000	1.9	148.5
5	3.0	000	3.4	000	0.0	025	1.1	000	1.9	174.0
6	2.5	375	2.5	000	0.0	025	1.1	000	1.5	142.0
7	1.6	375	2.5	000	0.0	025	1.6	375	1.4	177.2
8	4.0	000	3.0	025	0.0	075	2.1	375	2.3	174.5
9	1.1	000	2.1	150	1.6	175	0.0	125	1.2	140.0
10	0.1	100	0.1	175	0.7	200	0.7	225	0.4	117.5
11	0.7	050	0.1	050	0.0	200	2.5	375	0.8	135.5
12	3.4	000	4.0	000	0.1	025	1.6	375	2.3	248.0
13	2.1	375	3.4	025	0.0	025	0.0	375	1.4	129.0
14	3.4	000	2.5	000	0.0	050	0.7	375	1.7	203.5
15	5.4	000	4.5	000	3.4	175	1.6	300	3.7	316.0
16	3.4	275	4.0	000	1.1	025	0.1	250	2.2	161.5
17	3.0	000	1.6	000	0.0	375	0.1	100	1.2	138.5
18	4.0	000	2.5	000	0.0	075	1.1	375	1.9	213.5
19	3.4	000	1.6	000	0.2	025	4.0	000	2.3	206.5
20	5.4	000	4.0	000	0.0	025	2.5	375	3.0	238.5
21	3.0	000	3.4	000	0.0	075	1.1	000	1.9	171.0
22	3.4	000	1.6	000	0.0	050	1.2	375	1.6	96.8
mean	2.9		2.5		0.3		1.3		1.8	3766.8
23		000		000		300		250		
24		200		075		100		025		
25		025		050		050		025		
26		075		275		300		300		
27		300		325		325		225		
28		225		unit		under				
29		repair					2.1	175		
30	2.1	200	3.0	175	1.6	150	1.6	175	1.9	193.5
31	0.1	325	0.7	350	4.5	050		225		

Table IV.42 - Automatic recorded, Mk II, Moraine Ice Camp, Air temperature (°C), June 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	-3.3	-6.8	0.7	-3.8	-3.3	-5.3	1.0	-9.8	-4.4
2	-7.8	-8.9	-4.7	-9.5	-7.7	-6.1	-2.9	-10.2	-6.5
3	-14.5	-10.6	-7.8	-8.0	-10.2	-7.1	-2.3	-16.5	-9.4
4	-14.1	-10.5	0.6	-6.3	-7.6	-8.2	3.2	-16.0	-6.4
5	-8.7	-10.0	0.0	-7.2	-6.5	-8.7	2.8	-12.3	-4.8
6	-13.8	-10.0	-5.6	-6.7	-9.0	-9.1	-5.3	-14.6	-10.0
7	-7.0	-9.8	-10.2	-13.8	-10.2	-8.8	-6.2	-14.7	-10.5
8	-17.2	-13.0	-9.3	-9.0	-12.1	-8.8	-5.2	-18.0	-11.6
9	-12.5	-8.2	-0.5	-4.5	-6.4	-8.5	2.3	-13.0	-5.4
10	-12.5	-11.6	3.0	-4.5	-6.4	-7.9	3.1	-13.2	-5.1
11	-9.7	-11.0	-2.5	-5.4	-7.2	-6.0	-1.5	-12.0	-8.5
12	-11.3	-9.2	-4.5	-4.8	-7.5	-5.6	-2.0	-13.2	-7.6
13	-5.0	-3.8	2.8	-4.0	-2.5	-4.9	4.0	-6.2	-1.1
14	-6.8	-6.0	-2.8	-2.4	-4.5	-4.2	2.4	-6.7	-2.2
15	-5.3	-4.7	3.5	-4.5	-2.8	-3.1	5.0	-9.6	-2.3
16	-8.0	-6.2	4.0	-4.5	-3.7	-2.8	7.3	-12.1	-2.4
17	-8.0	-1.0	0.8	-0.2	-2.1	-0.8	5.0	-11.0	-3.0
18	-6.1	-4.2	6.0	1.0	-0.8	0.6	8.8	-11.0	-1.6
19	-0.3	6.5	7.0	7.8	5.3	1.7	1.0	-2.8	-0.9
20	3.3	2.4	8.2	2.5	4.1	2.7	11.0	-1.9	4.6
21	1.2	-0.7	3.8	2.8	1.8	3.1	7.2	-1.3	3.0
22	0.0	3.9	6.8	2.6	3.3	1.9	12.6	-1.8	5.4
23	-1.0	0.2	2.8	1.6	0.9	1.2	6.0	-0.8	2.6
24	-2.2	-1.1	0.8	-0.2	-0.7	0.4	0.7	-2.8	-1.1
25	-1.8	-2.2	6.5	0.0	0.6	-0.2	9.3	-3.0	3.2
26	-2.6	-1.6	-2.0	-1.2	-1.9	-0.4	-1.0	-2.8	-1.9
27	-2.2	0.6	2.9	-0.8	0.1	-0.3	4.9	-2.4	1.3
28	-0.5	-1.0	0.0	0.7	-0.2	-0.2	1.0	-2.0	-0.5
29	-1.7	0.8	4.3	1.2	1.2	0.2	5.9	-1.8	2.1
30	-1.0	2.0	-0.5	2.7	0.8	0.2	5.6	-4.0	0.8
mean	-6.0	-4.5	0.5	-2.6	-3.1		2.8	-8.3	-2.8

Table IV.43 - Automatic recorded Mk II, Moraine Ice Camp, Relative humidity (%), June 1966

Day	0000	0600	1200	1800	mean
1	64	66	76	85	73
2	69	45	25	60	50
3	63	76	77	65	70
4	80	70	40	65	64
5	90	83	49	87	77
6	91	76	76	75	80
7	86	83	87	84	85
8	84	72	65	64	71
9	66	77	58	73	69
10	82	77	57	70	72
11	84	89	74	78	81
12	87	80	66	70	76
13	78	75	74	89	79
14	92	91	75	71	82
15	91	80	58	77	77
16	82	69	50	67	67
17	81	71	75	85	78
18	88	79	60	74	75
19	68	59	61	51	60
20	62	75	70	75	71
21	79	87	72	66	76
22	76	72	65	82	74
23	85	94	88	82	87
24	99	86	84	98	92
25	94	94	61	77	81
26	89	95	89	90	91
27	93	92	82	93	88
28	94	95	97	93	95
29	94	91	70	87	85
30	83	81	86	81	83
mean	83	79	69	77	77

Table IV.44 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs.,tenths), June 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	928.9	927.2	926.8	925.5	927.1	14.8
2	926.2	928.9	930.0	930.7	929.2	21.5
3	929.6	927.8	924.4	924.2	926.5	8.8
4	925.0	926.8	927.9	928.1	927.0	17.1
5	926.5	926.9	927.0	927.8	927.1	10.2
6	925.1	920.6	917.8	914.2	919.4	5.3
7	910.0	909.2	907.0	909.1	908.8	9.3
8	911.0	912.7	913.8	916.5	913.5	17.1
9	917.4	919.0	919.6	920.3	919.1	12.8
10	920.9	921.3	922.3	924.0	922.1	13.0
11	925.1	926.2	927.3	927.8	926.6	11.3
12	927.2	926.0	924.0	923.2	925.1	9.6
13	921.2	919.0	916.1	912.7	917.3	11.3
14	908.5	907.8	909.0	913.0	909.6	12.0
15	917.6	923.0	927.0	928.8	924.1	20.6
16	928.8	928.7	928.5	928.0	928.5	18.7
17	927.6	927.8	926.6	928.2	927.6	13.8
18	929.3	932.2	934.2	935.3	932.8	21.2
19	935.0	935.2	933.7	932.6	934.1	20.8
20	931.2	932.3	932.0	931.4	931.7	15.1
21	930.6	931.2	932.0	931.0	931.2	16.2
22	930.9	930.5	931.0	931.0	930.9	19.9
23	929.8	930.5	931.9	932.2	931.1	10.4
24	931.7	930.6	929.2	928.8	930.1	9.5
25	929.0	928.3	927.2	926.1	927.7	13.0
26	925.3	923.8	922.7	923.2	923.8	0.3
27	923.1	923.6	922.9	921.4	922.8	6.4
28	920.7	921.2	921.3	923.0	921.6	1.4
29	924.1	925.7	926.2	927.1	925.8	13.8
30	926.8	925.5	924.2	924.0	925.1	11.5
mean	924.8	925.0	924.8	925.0	924.9	386.7

Table IV.45 - Automatic recorded, Mk II, Moraine Ice Camp, Wind direction (neugrad, 16 points), June 1966

Day	0000	0600	1200	1800
1	050	100	025	075
2	050	025	375	375
3	375	375	175	000
4	375	000	375	375
5	375	025	075	150
6	150	325	275	300
7	275	250	200	200
8	050	075	075	325
9	025	025	075	350
10	375	375	050	100
11	375	375	100	150
12	150	075	050	075
13	050	375	225	250
14	175	175	225	225
15	000	050	300	375
16	375	050	150	375
17	000	025	375	050
18	025	000	050	375
19	375	000	025	325
20	375	200	175	325
21	250	225	175	275
22	000	075	050	375
23	375	275	150	225
24	200	225	150	224
25	150	150	200	200
26	175	175	150	000
27	275	050	100	175
28	225	075	200	225
29	375	375	075	225
30	150	250	175	000

Table IV.46 - Automatic recorded, Mk II, Moraine Ice Camp, Air temperature (^{o}C), July 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	-1.5	-1.2	-0.8	0.3	-0.8	0.5	3.3	-3.8	-0.3
2	-4.1	-4.8	8.0	0.8	0.0	0.7	8.2	-8.2	0.0
3	-2.1	0.3	4.8	1.8	1.2	1.1	7.7	-2.1	2.8
4	2.8	3.0	3.2	0.9	2.5	2.3	4.0	-0.9	1.6
5	0.0	0.7	6.3	3.0	2.5	3.2	9.2	-2.0	3.6
6	3.7	2.0	9.0	7.0	5.4	3.8	10.5	0.3	5.4
7	3.8	4.2	4.3	4.8	4.3	3.9	7.0	2.0	4.5
8	2.0	2.1	7.0	5.2	4.1	4.1	8.0	1.0	4.5
9	2.8	2.9	6.7	0.3	3.2	3.7	9.8	-0.8	4.5
10	0.2	1.2	8.6	3.2	3.3	3.3	11.3	-2.9	4.2
11	1.8	0.8	6.4	5.8	3.7	2.9	8.7	-2.8	3.0
12	0.3	1.0	4.2	2.4	2.0	3.0	9.0	-1.5	3.3
13	1.2	2.3	5.0	1.6	2.5	3.6	7.8	0.7	3.5
14	1.0	3.7	4.0	4.7	3.4	3.0	8.9	-1.0	4.0
15	2.7	1.2	5.6	3.7	3.3	3.1	8.2	-0.9	3.7
16	1.4	2.2	8.1	2.6	3.6	3.1	9.0	-0.3	4.4
17	3.3	2.0	3.3	3.0	2.9	2.5	4.8	0.8	2.8
18	0.3	0.0	7.1	2.2	2.4	.23	8.3	-2.0	3.2
19	-1.2	0.0	0.8	1.3	0.2	2.1	3.1	-2.0	0.6
20	-0.1	-0.6	6.0	4.5	2.5	1.7	7.8	-2.0	2.9
21	1.1	1.7	5.8	1.7	2.6	1.9	8.0	-0.9	3.5
22	-1.3	-1.8	2.0	3.5	0.9	2.4	6.2	-2.2	2.0
23	0.5	3.0	5.0	3.8	3.1	2.8	6.0	-1.2	2.4
24	1.0	0.0	6.0	5.0	3.0	2.8	9.8	-1.0	4.4
25	3.2	4.7	5.7	3.4	4.2	3.3	7.0	0.5	3.8
26	1.0	3.3	4.8	1.2	2.6	3.4	8.8	-0.8	4.0
27	2.3	3.6	5.0	4.1	3.6	3.7	6.8	1.0	3.9
28	3.7	1.5	4.2	5.0	3.6	3.8	6.0	0.8	3.4
29	3.0	5.1	5.6	3.9	4.4	4.4	8.3	2.0	5.2
30	4.0	5.0	6.0	3.8	4.7	4.8	7.2	3.7	5.5
31	6.8	6.0	4.5	6.3	5.9	4.9	8.1	4.9	6.5
mean	1.4	1.8	5.2	3.3	3.0		7.6	-0.6	3.4

Table IV.47 - Automatic recorded, Mk II, Moraine Ice Camp, Realtive humidity (%), July 1966

Day	0000	0600	1200	1800	mean
1	95	86	86	80	87
2	82	87	56	78	76
3	97	95	92	81	89
4	74	75	83	93	81
5	96	93	74	87	88
6	73	77	60	78	72
7	79	84	80	92	84
8	96	89	75	79	85
9	91	92	72	88	86
10	81	74	50	71	69
11	78	82	78	82	80
12	79	71	81	96	82
13	97	91	77	91	89
14	88	79	73	84	81
15	79	82	75	81	79
16	76	73	45	77	68
17	59	71	52	74	64
18	74	78	70	91	78
19	100	94	87	82	91
20	89	84	67	61	75
21	86	88	74	89	84
22	99	97	88	81	91
23	75	76	76	78	76
24	79	82	74	68	76
25	70	61	62	63	64
26	66	59	59	73	64
27	72	79	69	75	74
28	73	87	73	78	78
29	87	92	87	90	89
30	93	94	90	92	92
31	78	72	81	76	78
mean	83	83	73	81	80

Table IV.48 - Automatic recorded, Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs.,tenths), July 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	923.8	923.6	925.3	927.2	925.0	16.7
2	929.1	930.4	930.1	928.7	929.6	14.4
3	927.3	925.0	923.2	922.8	924.6	7.9
4	924.7	926.3	927.0	928.2	926.6	5.7
5	929.0	930.1	931.0	930.7	930.2	17.2
6	930.0	928.3	926.4	925.5	927.6	14.4
7	924.7	922.5	920.2	920.0	921.9	7.3
8	920.3	922.0	923.6	925.2	922.8	8.5
9	926.9	928.3	929.2	930.0	928.6	14.8
10	930.0	930.2	929.4	930.0	929.9	20.1
11	929.9	930.0	930.2	931.1	930.3	21.0
12	931.2	931.5	931.4	931.7	931.5	7.6
13	930.9	929.7	926.8	926.7	928.5	6.1
14	926.2	927.8	928.8	930.4	928.3	16.8
15	931.2	932.0	931.2	931.1	931.4	20.2
16	929.8	928.7	927.2	925.7	927.9	20.4
17	923.8	923.3	923.1	920.6	922.7	18.1
18	919.8	919.0	919.1	919.2	919.3	8.8
19	919.2	919.2	920.0	919.8	919.6	4.1
20	919.6	919.3	919.8	921.7	920.1	8.9
21	925.0	925.0	927.3	931.3	927.2	7.9
22	934.5	938.0	940.1	942.8	938.9	10.9
23	943.2	943.5	943.0	941.3	942.8	19.6
24	940.2	938.6	936.3	935.3	930.1	16.5
25	933.0	931.8	930.7	929.9	931.1	20.0
26	929.3	929.7	930.0	931.0	930.0	18.5
27	931.3	932.0	931.1	931.4	931.5	10.2
28	931.2	930.8	933.0	934.8	932.5	5.7
29	935.2	935.0	934.8	934.9	935.0	12.6
30	934.5	934.3	934.5	935.5	934.7	7.5
31	935.3	935.9	936.3	936.0	935.9	2.9
mean	929.0	929.1	929.0	929.4	929.1	391.3

Table IV.49 - Automatic recorded, Mk II, Moraine Ice Camp, Wind direction (neugrad, 16 points), July 1966

Day	0000	0600	1200	1800
1	025	025	-	-
2		instrument		
3		off		
4		range		
5	-	-	075	000
6	000	000	375	000
7	375	035	075	100
8	000	275	200	175
9	175	275	375	375
10	375	000	000	375
11	375	000	375	075
12	375	000	000	175
13	150	125	075	100
14	375	025	375	375
15	000	000	025	000
16	375	375	375	000
17	375	000	000	375
18	025	025	025	025
19	325	000	100	100
20	050	075	150	175
21	050	025	175	075
22	350	000	000	150
23	125	175	175	375
24	375	000	375	375
25	375	375	025	000
26	375	000	000	025
27	050	350	350	350
28	000	375	025	025
29	075	050	025	375
30	375	375	375	375
31	375	375	000	000

Table IV.50 - Automatic recorded, Mk II, Moraine Ice Camp,
Air temperature (°C), August 1 - 24, 1966

Day	0000	0600	1200	1800	mean	5-day running mean	Tmax	Tmin	mean
1	5.8	6.7	6.0	3.2	5.4	5.7	7.3	3.5	5.4
2	2.9	2.5	4.7	6.5	4.2	5.9	8.9	2.0	5.5
3	7.3	8.0	8.8	8.5	8.2	5.6	9.2	6.0	7.6
4	6.6	6.0	3.8	7.1	5.9	5.1	7.5	3.4	5.5
5	6.5	3.7	4.0	2.8	4.3	5.5	8.0	1.8	4.9
6	0.6	0.1	4.7	6.3	2.9	5.4	8.2	-1.9	3.2
7	5.5	5.3	7.2	6.1	6.0	5.5	8.2	4.7	6.5
8	6.0	8.9	8.1	8.2	7.8	5.5	9.8	5.0	7.4
9	6.6	7.6	6.0	5.6	6.5	5.6	8.7	4.0	6.4
10	5.6	4.0	3.8	4.7	4.5	4.9	5.9	3.4	4.7
11	2.8	4.1	5.0	1.6	3.4	2.8	5.7	1.0	3.4
12	0.7	0.6	5.1	3.5	2.5	0.7	6.8	-0.1	3.4
13	-1.8	-3.3	-3.1	-4.2	-3.1	0.9	-1.2	-4.8	-3.0
14	-5.0	-6.0	-1.2	-3.0	-3.8	1.1	0.8	-9.1	-4.1
15	1.9	5.2	6.4	9.0	5.6	1.3	10.5	0.6	5.5
16	4.2	3.1	5.7	4.8	4.5	2.7	6.5	1.4	4.0
17	3.2	3.0	3.9	3.5	3.4	3.5	5.7	2.0	3.8
18	2.3	3.4	4.9	3.9	3.6	1.9	5.6	0.8	3.2
19	0.7	0.5	1.6	-1.8	0.3	0.4	2.8	-4.8	-1.0
20	-4.9	-3.1	1.0	-1.2	-2.1	-0.6	2.5	-6.0	-1.7
21	-3.1	-3.9	-3.2	-3.0	-3.3	-1.6	-1.2	-7.0	-4.1
22	-5.8	-5.5	2.8	1.8	-1.7	-1.5	3.2	-8.8	-2.8
23	0.0	0.5	3.2	1.0	-1.2	-	4.2	-1.4	1.4
24	-0.8	-0.8	3.8	0.9	0.8	-	5.0	-1.3	1.4
mean	2.0	2.1	3.9	3.2	2.8		4.5	-0.2	2.1

Table IV.51 - Automatic recorded, Mk II, Moraine Ice Camp, Relative humidity (%), August 1 - 24, 1966

Day	0000	0600	1200	1800	mean
1	79	79	80	90	82
2	98	89	78	72	84
3	67	79	61	64	68
4	75	84	90	78	82
5	77	84	85	94	85
6	98	75	74	72	80
7	74	71	69	69	71
8	55	42	53	59	52
9	67	68	72	82	72
10	79	87	84	78	81
11	92	87	90	98	92
12	97	93	74	82	86
13	98	96	89	81	91
14	95	90	58	61	76
15	68	57	80	65	68
16	59	80	81	89	77
17	92	94	89	87	91
18	97	79	78	85	85
19	96	97	83	92	92
20	89	89	69	91	85
21	90	97	92	95	94
22	91	76	72	61	75
23	57	59	55	74	61
24	77	79	69	79	76
mean	82	81	76	79	80

Table IV.52 - Automatic recorded Mk II, Moraine Ice Camp, Bar.pressure (mb) at 880 m a.s.l., bright sunshine (hrs., tenths), August 1 - 24, 1966

Day	0000	0600	1200	1800	mean	hrs.1/10
1	935.2	935.7	935.8	937.8	936.7	2.5
2	939.1	940.2	940.3	940.1	939.9	14.3
3	939.2	936.9	935.8	935.8	936.9	6.2
4	935.5	935.3	935.7	935.7	935.6	0.7
5	935.2	935.1	935.2	935.4	935.2	3.5
6	936.3	937.8	937.6	937.3	937.3	9.7
7	937.9	938.6	939.0	939.0	938.6	10.7
8	938.8	938.5	938.9	938.6	938.7	15.4
9	938.7	938.9	938.2	937.3	938.3	8.5
10	935.8	934.1	932.6	930.0	933.1	1.0
11	927.7	925.7	925.3	927.1	926.5	0.0
12	927.2	927.4	926.3	925.0	926.5	7.6
13	924.1	923.3	922.2	924.7	923.6	0.1
14	927.8	929.7	930.0	929.1	929.2	12.2
15	928.3	928.1	926.6	925.2	927.1	7.7
16	925.0	925.9	926.8	928.3	926.5	3.7
17	929.7	931.0	932.0	932.6	931.3	0.0
18	933.4	933.6	932.8	932.0	933.0	0.9
19	932.1	932.3	933.2	934.2	933.0	1.2
20	935.0	935.8	935.7	935.4	935.5	3.7
21	935.8	936.3	936.9	936.4	936.4	3.6
22	935.7	933.9	930.7	926.5	931.7	8.2
23	924.2	922.1	921.3	921.9	922.4	11.7
24	921.2	921.8	921.9	923.2	922.0	2.3
mean	932.5	932.4	932.1	932.0	932.3	135.4

Table IV.53 - Automatic recorded, Mk II, Moraine Ice Camp, Wind direction (neugrad, 16 points), August 1 - 24, 1966

Day	0000	0600	1200	1800
1	050	075	375	375
2	000	025	375	000
3	050	075	075	075
4	075	075	375	000
5	100	050	375	000
6	175	375	375	075
7	075	025	025	025
8	025	050	050	100
9	075	050	275	025
10	050	075	075	075
11	075	075	250	200
12	050	025	025	125
13	200	225	275	275
14	225	000	300	350
15	375	375	375	275
16	200	125	375	375
17	375	025	000	000
18	000	050	325	375
19	375	375	075	150
20	025	025	375	200
21	200	200	225	175
22	375	375	050	025
23	025	050	300	025
24	375	375	325	250

Table IV.54 - Automatic recorded, Moraine Ice Camp, wind speed distribution, number of occurrances for given intervals, August 1965 - May 1966

mean wind speed(m/s)	Aug. N	Sept. N	Oct. N	Nov. N	Dec. N	Jan. N	Feb. N	Mar. N	Apr. N	May N	total N	case interval
calm 0-0.1	13	12	12	3	6	5	4	0	10	25	90	1
0.2-1.1	7	23	14	15	27	21	9	15	38	16	185	2
1.2-2.1	6	19	19	13	22	23	19	39	28	18	206	3
2.2-3.1	3	8	17	12	18	16	21	16	19	15	145	4
3.2-4.1	3	27	25	24	30	25	18	28	9	17	206	5
4.2-5.1	0	7	11	10	5	11	15	11	6	3	79	6
5.2-6.1	1	16	16	25	9	10	14	4	4	2	101	7
6.2-7.1	0	1	3	4	3	1	5	2	3	0	22	8
7.2-8.1	0	2	4	10	2	3	3	1	1	0	26	9
8.2-9.1	0	0	0	1	1	0	2	1	2	0	7	10
9.2-10.1	0	5	0	2	0	5	1	5	0	0	18	11
10.2-11.1	0	0	0	0	0	0	0	0	0	0	0	12
11.2-12.1	0	0	3	0	1	1	1	2	0	0	8	13
12.2-13.1	0	0	0	1	0	0	0	0	0	0	1	14
13.2-14.1	0	0	0	0	0	1	0	0	0	0	1	15
14.2-15.1	0	0	0	0	0	1	0	0	0	0	1	16
total	33	120	124	120	124	124	112	124	120	96	1097	

Table IV.55 - Automatic recorded, Moraine Ice Camp, wind direction frquency (%), 1965 - 1966

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total obs.	Frequ. %
N	23.6	39.1	38.0	38.3	30.6	39.3	35.7	53.3	38.5	31.4	7.5	24.1	8.3	473	31.9
NNE	10.6	24.0	31.4	29.2	41.2	17.7	28.6	19.3	26.7	14.4	6.7	13.9	14.6	325	21.9
NE	9.4	8.3	8.9	6.7	12.9	8.0	14.3	14.5	11.7	8.5	10.0	3.7	11.5	147	9.9
ENE	3.5	9.2	9.7	3.3	6.5	13.4	7.2	4.8	10.0	4.2	8.3	6.5	15.6	116	7.8
E	0.0	4.2	1.6	4.2	0.0	9.8	0.0	0.0	2.5	2.5	3.3	3.7	2.1	39	2.6
ESE	1.2	2.5	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.9	0.0	1.9	2.1	12	0.8
SE	2.4	0.0	0.0	2.5	0.8	2.7	1.8	0.0	0.0	1.7	9.2	2.8	1.0	28	1.9
SSE	2.4	0.8	0.0	0.8	0.0	1.8	0.9	0.8	0.0	5.1	7.5	6.5	2.1	32	2.2
S	4.7	0.0	0.0	1.7	0.8	0.0	2.7	0.8	0.0	3.4	5.8	0.9	6.3	29	2.0
SSW	4.7	0.8	0.0	1.7	2.4	0.9	2.7	0.0	0.8	3.4	8.3	0.0	3.1	32	2.2
SW	0.0	0.0	0.8	1.7	0.0	0.0	0.0	0.0	0.0	1.7	3.3	0.0	2.1	11	0.7
WSW	2.4	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	1.7	3.3	1.9	4.2	17	1.1
W	1.2	0.0	1.6	0.8	0.0	0.0	0.0	0.8	0.0	4.2	1.6	0.0	2.1	14	1.0
WNW	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.8	2.5	3.3	0.9	2.1	13	0.9
NW	4.7	0.0	0.8	1.7	0.0	0.9	0.0	0.0	0.8	0.9	0.8	3.7	1.0	16	1.1
NNW	29.5	10.8	5.6	5.8	4.0	5.4	4.5	5.6	8.3	13.5	20.8	29.6	21.9	179	12.0
Total obs.	85	120	124	120	124	112	112	124	120	118	120	108	96	1483	100.0

Table IV.56 - Correction and conversion chart for wind speed evaluation, Mk II and Pyrox-Sumner recorders

Div.	read MPH	correct MPH	true m/s	Div.	read MPH	correct MPH	true m/s
0.25	1	0.3	0.1	4.00	16	16.3	7.4
0.50	2	1.4	0.7	4.25	17	17.4	7.8
0.75	3	2.5	1.1	4.50	18	18.5	8.3
1.00	4	3.5	1.6	4.75	19	19.6	8.8
1.25	5	4.6	2.1	5.00	20	20.7	9.3
1.50	6	5.7	2.5	5.25	21	21.8	9.8
1.75	7	6.8	3.0	5.50	22	22.9	10.3
2.00	8	7.8	3.4	5.75	23	24.0	10.8
2.25	9	8.9	4.0	6.00	24	25.2	11.2
2.50	10	10.0	4.5	6.25	25	26.4	11.9
2.75	11.	11.1	4.9	6.50	26	27.5	12.3
3.00	12	12.1	5.4	6.75	27	28.6	12.8
3.25	13	13.2	5.9	7.00	28	29.8	13.4
3.50	14	14.2	6.3	7.25	29	30.9	13.9
3.75	15	15.3	6.9	7.50	30	32.0	14.4

Dir $\cong$ difference in minor vertical divisions of $\pm$ 1/2 hr at synoptic time.

Table IV.57 - Wind direction evaluation chart (wind rose)

Vertical Division	Neugrad 0-400^g	Direction	Vertical Division	Neugrad 0-400^g	Direction
0.0	100	E	28.1	275	WSW
3.1	075	ENE	31.2	250	SW
6.3	050	NE	34.3	225	SSW
9.4	025	NNE	37.5	200	S
12.5	000	N	40.6	175	SSE
15.3	375	NNW	43.7	150	SE
19.2	350	NW	46.9	125	ESE
22.2	325	WNW	50.0	100	E
25.0	300	W			

Note: vertical division means counting divisions from bottom to top of chart.

APPENDIX C

Table V.1 - Inter-period variation of timer (T/H) Min., power supply in ice, August 1965

Date	13	14	15	16	18	19
12	s -12	n 0	s -33	s -22	s -22	s -18
13		f +12	s -18	n -10	n - 8	n - 6
14			s -30	s -20	s -20	s -18
15				n +10	n +10	f +12
16					n 0	n + 3
18						n + 3

Table V.2 - Inter-period variation of timer (T/H) Min., power supply above ice, May 1966

Date	28	30
25	n + 6	n +10
28		n + 3

Table V.3 - Inter-period variation of timer (T/H) Min., power supply above ice, June 1966

Date	18	20	21	22	23	24
17	n 0	n - 6	n -10	n - 6	n - 3	n + 6
18		n - 6	n -10	n - 6	n - 3	n + 6
20			n - 3	n 0	n 0	f +12
21				n + 3	n + 6	f +15
22					n + 3	n +10
23						n + 9

Table V.4 - Inter-period variation of timer (T/H) Min., power supply above ice, July 1966

Date	26	28	31
25	n + 6	n - 6	n -10
26		s -12	s -18
28			n - 6

Table V.5 - Inter-period variation of timer (T/H) Min., power supply above ice, August 1966

Date	9	10	12	16
8	n - 3	n - 6	n 0	s -20
9		n - 3	n 0	s -15
10			n + 3	s -15
12				s -18

Table V.6 - Inter-period variation of timer (BP/S) Min., power supply in ice, August 1965

Date	13	14	15	16	18	19
12	s -10	n - 6	s -34	s -28	s -43	s -54
13		n + 4	s -24	s -18	s -32	s -42
14			s -28	s -22	s -36	s -48
15				n + 6	n - 8	s -12
16					s -14	s -16
18						n - 8

Table V.7 - Inter-period variation of timer (BP/S) Min., power supply in ice, September 1965

Date	9	10	11	12	13	15
8	s -12	n -10	s -20	s -18	s -33	s -40
9		n + 3	n -10	n - 6	s -22	s -30
10			s -12	n -10	s -24	s -36
11				n + 3	n -10	s -22
12					s -15	s -25
13						n -10

Table V.8 - Inter-period variation of timer (BP/S) Min., power supply in ice, April 1966

Date	15	16	20	24
13	n + 3	n 0	n + 6	s -12
15		s -12	n 0	s -12
16			f +12	n - 6
20				s -15

Table V.9 - Inter-period variation of timer (BP/S) Min., power supply in ice, May 1966

Date	8	9	10	14	15	17	19	20
7	s -12	n - 6	n - 9	s -16	s -18	s -12	s -12	s -12
8		n - 6	n + 3	n - 6	n 0	n 0	n 0	n 0
9			n - 6	n -10	n - 6	n 0	n - 3	n 0
10				n - 6	n - 3	n 0	n 0	n 0
14					n + 3	n + 6	n + 6	n + 6
15						n + 8	n 0	n 0
17							n 0	n 0
19								n 0

Table V.10 - Inter-period variation of timer (BP/S)Min., power supply above ice, May 1966

Date	23	24	30
22	n 0	s -12	s -28
23		s -12	s -28
24			s -18

Table V.11 - Inter-period variation of timer (BP/S)Min., power supply above ice, June 1966

Date	18	20	21	22	23	24
17	n 0	f +20	f +18	f +26	f +14	f +22
18		f +20	f +20	f +26	f +15	f +20
20			n - 3	n + 4	n - 6	n 0
21				n + 6	n - 4	n + 4
22					n -10	n - 3
23						n + 8

Table V.12 - Inter-period variation of timer (BP/S)Min., power supply above ice, July 1966

Date	13	17	18
12	n + 3	n 0	n - 3
13		n - 3	n - 6
17			n - 3

Table V.13 - Inter-period variation of timer (WS/D)Min., power supply in ice, August 1965

Date	14	15	16	18	19	21
13	f +12	n -10	s -12	s -20	s -15	s -18
14		s -20	s -25	s -30	s -25	s -28
15			n - 3	n -10	n - 9	n - 9
16				n - 6	n - 4	n - 3
18					n + 3	n + 3
19						n 0

Table V.14 - Inter-period variation of timer (WS/D)Min., power supply in ice, September 1965

Date	9	10	11	12	13	15
8	n 0	n + 6	n - 8	s -15	s -18	s -30
9		n + 6	n - 6	s -10	s -15	s -28
10			s -12	s -18	s -20	s -36
11				n - 6	n - 9	s -22
12					n - 3	s -18
13						s -15

Table V.15 - Inter-period variation of timer (WS/D)Min., power supply in ice, April 1966

Date	2	3	4	5	6	7	8	9
1	s -15	n - 3	n + 3	n -10	n - 9	n -10	s -15	n + 3
2		f +12	f +18	n + 6	n + 6	n + 6	n + 3	f +20
3			n + 6	n - 9	n - 3	n - 3	n -10	n +10
4				s -12	n -10	n -10	s -15	n + 3
5					n + 3	n + 3	n - 3	f +15
6						n 0	n - 6	f +12
7							n - 6	f +12
8								f +18

Table V.16 - Inter-period variation of timer (WS/D)Min., power supply in ice, April 1966

Date	14	15	16	24	26
13	s -12	n + 6	f +18	n 0	n + 3
14		f +15	f +20	f +12	f +18
15			n + 9	n - 3	n 0
16				s -12	n - 9
24					n + 3

Table V.17 - Inter-period variation of timer (WS/D)Min., power supply above ice, May 1966

Date	2	3	4	5	6	7	8	9	10	14	15	16	17	18	19	20	22
1	n -6	n +9	n +2	n 0	n +2												
2		f +15	n +10	n +10	n +9												
3			n -6	n -3	n +3												
4				n 0	n 0												
5					n 0												
6						n 0	n +6	n +3	n +9	n -6	n +9						
7							n +6	n +6	n +10	n -6	n +10						
8								n -2	n +6	s -12	n +2						
9									n +6	n -9	n +3						
10										s -15	n -3						
14											f +12						

continued

Table V.17 - continued

Date	16	17	18	19	20	22
15	n -3	n -3	n +6	n -3	n +9	n +10
16		n 0	n +10	n +3	n +10	f +15
17			n +9	n 0	f +12	f +12
18				n -9	n +3	n +2
19					f +12	f +12
20						n 0

Table V.18 - Inter-period variation of timer (WS/D)Min., power supply above ice, June 1966

Date	18	20	21	22	23	24
17	n - 6	n 0	n - 3	n -10	n + 3	n - 3
18		n + 6	n + 3	n - 3	n +10	n + 3
20			n - 3	n -10	n + 6	n 0
21				n - 6	n + 6	n 0
22					f +12	n + 9
23						n - 6

Table V.19 - Inter-period variation of timer (WS/D)Min., power supply above ice, July 1966

Date	13	17	18
12	n + 3	n - 6	n - 6
13		n - 9	n - 6
17			n + 3

Table V.20 - Statistic: T/H recorder's timer operation

class boundaries	class mid mark	f	t	f·t	$f \cdot t^2$
-39 to -33	-36	0	-5	0	0
-33 to -27	-30	2	-4	-8	32
-27 to -21	-24	2	-3	-6	18
-21 to -15	-18	7	-2	-14	28
-15 to - 9	-12	8	-1	-8	8
- 9 to - 3	- 6	10	0	0	0
- 3 to 3	0	10	1	10	10
3 to 9	6	11	2	22	44
9 to 15	12	8	3	24	72
15 to 21	18	1	4	4	16
21 to 27	24	0	5	0	0
	$x_o = -6$	59		24	228
	$c = 6$				

Table V.21 - Statistic: BP/S recorder's timer operation with energy supply in the ice

class boundaries	class mid mark	f	t	f·t	$f \cdot t^2$
-51 to -45	-48	2	-6	-12	72
-45 to -39	-42	4	-5	-20	100
-39 to -33	-36	4	-4	-16	64
-33 to -27	-30	4	-3	-12	36
-27 to -21	-24	5	-2	-10	20
-21 to -15	-18	9	-1	- 9	9
-15 to - 9	-12	17	0	0	0
- 9 to - 3	- 6	13	1	13	13
- 3 to 3	0	21	2	42	84
3 to 9	6	5	3	15	45
9 to 15	12	5	4	20	80
	x_o = 12 c = 6	89		11	523

Table V.22 - Statistic: BP/S recorder's timer operation with energy supply on the ice surface

class boundaries	class mid mark	f	t	f·t	$f \cdot t^2$
-39 to -33	-36	0	-6	0	0
-33 to -27	-30	2	-5	-10	50
-27 to -21	-24	0	-4	0	0
-21 to -15	-18	1	-3	-3	9
-15 to - 9	-12	3	-2	-6	12
- 9 to - 3	- 6	5	-1	-5	5
- 3 to 3	0	7	0	0	0
3 to 9	6	5	1	5	5
9 to 15	12	2	2	4	8
15 to 21	18	6	3	18	54
21 to 27	24	2	4	8	32
27 to 33	30	1	5	5	25
	$x_o = 0$	34		16	200
	$c = 6$				

Table V.23 - Statistic: WS/D recorder's timer operation with energy supply in the ice

class boundaries	class mid mark	f	t	f•t	$f \cdot t^2$
-39 to -33	-36	2	-5	-10	50
-33 to -27	-30	3	-4	-12	48
-27 to -21	-24	4	-3	-12	36
-21 to -15	-18	8	-2	-16	32
-15 to - 9	-12	18	-1	-18	18
- 9 to - 3	- 6	14	0	0	0
- 3 to 3	0	16	1	16	16
3 to 9	6	14	2	28	56
9 to 15	12	8	3	24	72
15 to 21	18	6	4	24	96
21 to 27	24	0	5	0	0
	$x_o = -6$	93		24	424
	$c = 6$				

Table V.24 - Statistic: WS/D recorder's timer operation with energy supply on the ice surface

class boundaries	class mid mark	f	t	f•t	f•t^2
-21 to -15	-18	0	-3	0	0
-15 to - 9	-12	5	-2	-10	20
- 9 to - 3	- 6	16	-1	-16	16
- 3 to + 3	0	24	0	0	0
3 to 9	6	22	1	22	22
9 to 15	12	19	2	38	76
15 to 21	18	1	3	3	9
21 to 27	24	0	4	0	0
	x_o = 0	87		37	143
	c = 6				

Table V.25 - Statistic: Temperature registration, overall trend; Pyrox Sumner recorder, Base Camp

class boundaries	class mid mark	f	t	f•t	f•t^2
-1.45 to -1.25	-1.35	3	-6	-18	108
-1.25 to -1.05	-1.15	3	-5	-15	75
-1.05 to -0.85	-0.95	5	-4	-20	80
-0.85 to -0.65	-0.75	15	-3	-45	135
-0.65 to -0.45	-0.55	14	-2	-28	56
-0.45 to -0.25	-0.35	23	-1	-23	23
-0.25 to -0.05	-0.15	33	0	0	0
-0.05 to 0.15	0.05	16	1	16	16
0.15 to 0.35	0.25	8	2	16	32
0.35 to 0.55	0.45	6	3	18	54
0.55 to 0.75	0.65	2	4	8	32

continued

Table V.25 - continued

class boundaries	class mid mark	f	t	f•t	$f \cdot t^2$
0.75 to 0.95	0.85	0	5	0	0
0.95 to 1.15	1.05	2	6	12	72
1.15 to 1.35	1.25	2	7	14	98
	x_o = -0.15	132		-65	781
	c = o.2				

Table V.25a - Statistic: Temperature registration, increasing trend; Pyrox-Sumner recorder, Base Camp

class mid mark x	f	t	f•t	$f \cdot t^2$
-1.15	2	-4	-8	32
-0.95	1	-3	-3	9
-0.75	6	-2	-12	24
-0.55	6	-1	-6	6
-0.35	10	0	0	0
-0.15	11	1	11	11
0.05	3	2	6	12
0.25	3	3	9	27
0.45	1	4	4	16
0.65	1	5	5	25
0.85	0	6	0	0
1.05	1	7	7	49
1.25	1	8	8	64
x_o =-0.35	46		21	275

Table 25b - Statistic: Temperature registration, steady trend; Pyrox-Sumner recorder, Base Camp

class mid mark x	f	t	f·t	$f \cdot t^2$
-0.95	2	-3	-6	18
-0.75	3	-2	-6	12
-0.55	4	-1	-4	4
-0.35	6	0	0	0
-0.15	12	1	12	12
+0.05	4	2	8	16
0.25	4	3	12	36
0.45	1	4	4	16
0.65	1	5	5	25
x_o = -0.35	37		25	139

c = 0.2

Table V.25c - Statistic: Temperature registration, decreasing trend; Pyrox-Sumner recorder, Base Camp

class mid mark x	f	t	f•t	$f \cdot t^2$
-1.35	3	-5	-15	75
-1.15	1	-4	- 4	16
-0.95	2	-3	- 6	18
-0.75	6	-2	-12	24
-0.55	4	-1	- 4	4
-0.35	7	0	0	0
-0.15	10	1	10	10
0.05	10	2	20	40
0.25	1	3	3	9
0.45	4	4	16	64
0.65	0	5	0	0
0.85	0	6	0	0
1.05	0	7	0	0
1.25	1	8	8	64
x_o = -0.35	49		16	324

c = 0.2

Table V.26 - Statistic: Temperature registration, overall trend, Mk II recorder, Moraine Ice Camp

class boundaries	class mid mark	f	t	f•t	$f \cdot t^2$
-1.45 to -1.25	-1.35	3	-6	-18	108
-1.25 to -1.05	-1.15	2	-5	-10	50
-1.05 to -0.85	-0.95	6	-4	-24	96
-0.85 to -0.65	-0.75	16	-3	-48	144
-0.65 to -0.45	-0.55	20	-2	-40	80
-0.45 to -0.25	-0.35	29	-1	-29	29
-0.25 to -0.05	-0.15	33	0	0	0
-0.05 to 0.15	0.05	22	1	22	22
0.15 to 0.35	0.25	19	2	38	76
0.35 to 0.55	0.45	14	3	42	126
0.55 to 0.75	0.65	10	4	40	160
0.75 to 0.95	0.85	8	5	40	200
0.95 to 1.15	1.05	9	6	54	324
1.15 to 1.35	1.25	9	7	63	441
1.35 to 1.55	1.45	8	8	64	512
1.55 to 1.75	1.70	2	9	18	162
1.75 to 1.95	1.95	3	10	30	300
	x_o = -0.15	213		242	2830
	c = 0.2				

Table V.27 - Statistic: Bar.pressure registration, Mk II recorder, Moraine Ice Camp

class boundaries	class mid mark	f	t	f·t	$f \cdot t^2$
-0.55 to -0.45	-0.5	4	-6	-24	144
-0.45 to -0.35	-0.4	2	-5	-10	50
-0.35 to -0.25	-0.3	5	-4	-20	80
-0.25 to -0.15	-0.2	3	-3	- 9	27
-0.15 to -0.05	-0.1	6	-2	-12	24
-0.05 to 0.05	0.0	3	-1	- 3	3
0.05 to 0.15	0.1	7	0	0	0
0.15 to 0.25	0.2	4	1	4	4
0.25 to 0.35	0.3	5	2	10	20
0.35 to 0.45	0.4	1	3	3	9
0.45 to 0.55	0.5	2	4	8	32
0.55 to 0.65	0.6	2	5	10	50
	x_o = 0.1	44		-43	443
	c = 0.1				

Table V.28 - Statistic: Wind speed registtation, Mk II recorder; Moraine Ice Camp

class boundaries	class mid mark	f	t	f·t	f·t^2
-0.45 to -0.35	-0.4	2	-5	-10	50
-0.35 to -0.25	-0.3	0	-4	0	0
-0.25 to -0.15	-0.2	2	-3	- 6	18
-0.15 to -0.05	-0.1	3	-2	- 6	12
-0.05 to 0.05	0.0	5	-1	- 5	5
0.05 to 0.15	0.1	6	0	0	0
0.15 to 0.25	0.2	8	1	8	8
0.25 to 0.35	0.3	4	2	8	16
	x_o = 0.1 c = 0.1	30		-11	109

Table V.29 - Statistic: Wind speed registration, Pyrox-Sumner, Base Camp

class boundaries	class mid mark	f	t	f·t	f·t^2
-1.4 to -1.0	-1.2	1	-3	- 3	9
-1.0 to -0.6	-0.8	5	-2	-10	20
-0.6 to -0.2	-0.4	6	-1	- 6	6
-0.2 to 0.2	0.0	26	0	0	0
0.2 to 0.6	0.4	8	1	8	8
0.6 to 1.0	0.8	9	2	18	36
1.0 to 1.4	1.2	3	3	9	27
1.4 to 1.8	1.6	4	4	16	64
1.8 to 2.2	2.0	5	5	25	125
	x_o = 0 c = 0.4	67		57	295