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MICROCLIMATOLOGY OF OGOTORUK VALLEY

Preliminary Report No. 1

December 15,

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E. D. Campbell (2)

ERRATA AND ADDENDUM

Insert on Page 10:

ACKNOWLEDGMENTS

The data for this study were collected through the hard work and personal sacrifice of several men, whose efforts are worthy of special acknowledgment:

Mr. Donald L. Willson, USWB meteorological technician, who planned and carried out the details of assembling, shipping and installing much of the observing equipment, initiated the detailed observation program and bore the brunt of nasty weather and hazardous travel to make the rounds of the stations for five months.

Mr. Harry Spencer, former H & N employee who contributed a valuable set of weather observations for the fall and winter of 1959-60.

Mr. Robert Nickerson and Mr. Dale Clay, USWB meteorological technicians who assisted with observations during the summer and fall of 1960.

Mr. Ed Watt, Mr. Harry Dunham, and Mr. Bill Lyons, H & N employees who are continuing the base camp observing program through the winter of 1960-61.

Corrections:

1. Page 2, para. 4, line 5, change $.05 \text{ gm/cal/cm}^2/\text{sec}$ to $.05 \text{ gm cal/cm}^2/\text{min}$.
2. Figure 1: Change mph to knots.
3. Figures 2, 7, 9-12C, 25-41: Four small areas having elevations above 750 feet, MSL, surround stations 13 and 14 and include other hilltops on the same ridge a short distance northwest of station 14 (Crowbill). Another small area is $2\frac{1}{4}$ mi E of base camp near the center of stippled area. These maps will be corrected in subsequent reports.
4. The phrases "Kotzebue's 18-year mean" and "18-year average" should be changed to read "Kotzebue's Normal" in the places listed below. Although the station at Kotzebue had been in its present location for 18 years at the time of this report, these figures include adjusted readings from older nearby locations in Kotzebue, and thus qualify as "normals" in the true sense of the U. S. Weather Bureau definition, which requires a continuous 30-year record.
 - Page 4. PRECIPITATION: 1st para., 3rd line; 2nd para., 7th line.
 - " 5. 2nd para., 6th line.
 - " 6. TEMPERATURE: 5th line.
 - Fig. 8. OTZ open bar.
 - Tbl. 7. Under "Normal" Precipitation, 3rd line.
 - " 8. Under "Normal" Snowfall, 1st line.
 - " 12. Under Mean Maximum Temp., 2nd line.
 - " 12. Under Mean Temperatures, 2nd line.
5. Page 5, 1st para., 3rd line and 3rd para., last line: Change "18-year" to "30-year".
6. Page 8, CLOUDINESS: 1st para., last line, and 3rd para., 2nd line: Change "18-year" to "15-year".

UNITED STATES DEPARTMENT OF COMMERCE

WEATHER BUREAU

MICROCLIMATOLOGY OF OGOTORUK VALLEY

Preliminary Report No. 1

December 15, 1960

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Prepared for the U. S. Atomic Energy Commission as
part of Project Chariot Environmental Study Program

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INTRODUCTION

This study of the microclimate of the Ogotoruk Valley near Cape Thompson, Alaska, was undertaken by the Weather Bureau at the request of the Atomic Energy Commission. Its two main purposes are to provide information to assist in the interpretation of other environmental study results and to provide a background of data that will help in recognizing annual and seasonal variations of climatological elements.

The climatological record of the Chariot Site (Ogotoruk Valley) began in August 1959 and continues to the present with an intensification of the collection of climatological data between March and October of 1960. The shortness of the data record makes it necessary to compare the monthly, seasonal, and annual averages of the Chariot Site with the averages covering the same period for nearby locations having much longer records. In this manner it is possible to infer the long term average of the Chariot Site and the amount of deviation from the average which can be anticipated. Most of the weather data collected since August 1959 has been tabulated at the end of this report. Tables 1 and 2 give a geographical description of the micrometeorological stations and their instrumentation.

OPERATIONAL PROCEDURE

The weather observing program for Chariot falls into two parts, separated by the scale of phenomena being considered. The observing program started at the base camp in August 1959 was designed to produce information of the large scale variations of temperature, pressure, wind and weather phenomena. That information is useful in the other part, the microclimatological program which is producing much more detailed information of the variation of some of these same elements within the Ogotoruk valley.

The base camp observations are being carried on throughout the year by the Holmes and Narver caretakers during the winter and by USWB observers during the spring, summer, and early autumn. Three observations are made each day at international observing times and are radioed to Kotzebue for general distribution.

The microclimatological observations involve visits to each station and these are made once daily during the period when a USWB observer is at the site, except when transportation difficulties or inclement weather make the trip impossible.

INSTRUMENTATION

Air temperature is being measured at standard height at three stations using USWB glass maximum and minimum thermometers, mounted in white louvered instrument shelters. Hygrothermographs with bourdon tube temperature sensors and hair hygrometers, recording on 7-day clock-driven charts are installed in two of the shelters.

Soil temperatures were to have been measured at 12 stations by hydrocarbon-in-steel max-min thermometers manufactured by the Palmer Thermometer Co., but calibration difficulties delayed delivery of most of these thermometers until late summer. Thermocouples were tried but were abandoned in favor of ordinary glass max-min thermometers inserted 5 cm. in the ground so that maximum and minimum temperatures might be obtained by having an observer read them once daily. For comparison with air temperatures, thermometers were also placed at 5 cm above the surface and shielded, above and below, from terrestrial and solar radiation. Thermometers were in place at all 12 stations at the +5 and -5 cm levels and five stations had Palmer thermometers at 10, 20, and 50 cm below the surface by August 7, 1960. Most of the rest of the Palmer thermometers were received and placed in the ground by late October so they may be used next year.

Precipitation is measured at 13 stations using 8-inch cylindrical gages, equipped with wind shields. Being visited daily in summer, these are adequate for measuring all liquid forms of precipitation. They are useful for measuring snowfall in the absence of drifting winds, the liquid equivalent being found simply by melting the accumulated snow. Such winds are rarely absent from the Chariot Site, however, so snow depth and density measurements are made at each station using a core sampler and weighing gage.

Wind speed and direction are measured three or more times daily at the base camp by means of a contacting anemometer and nine-light indicator. The vane and cups are mounted on the roof of one of the buildings, roughly 22 ft above the ground. Wind speed and direction were recorded during the summer at a height of 2 feet at the station near the ponds and on Crowbill. Speed only was measured at two other stations at the same height. Contacting anemometers and vanes at the 2-foot installations were wired, using battery power, to 9-pen Esterline-Angus recorders.

Sunshine intensity was measured by four Instruments Corp. recording pyrheliometers. These instruments use the temperature difference between a polished reflector and a blackened surface as an indicator of radiation intensity. The intensity is mechanically traced on a clock-driven chart. They are reliable and measure radiation levels down to as low as $.05 \text{ gm}^3\text{cal/cm}^2\text{/sec}$. This level is above the amount of radiation received at this latitude from late November to late January, but during most of the remainder of the year the instruments adequately record the variations due to cloudiness, dust, and other factors.

The only atmospheric pressure measurements at the site are made at the base camp, using a sensitive Kollsman altimeter setting indicator and a small Friez barograph.

Upper winds are measured once or twice daily, clouds permitting, by optically tracking helium-filled pilot balloons. These data are not included in this report.

WIND

The seasonal and annual wind roses for the Chariot Site are shown in Figure 1 for one year of data. The predominant feature is the large percentage of strong northerly winds during all seasons. Since air at the surface will flow spirally from an area of high pressure to one of lower pressure, a reason for the predominantly northerly flow is that most of the major storms or low pressure areas pass to the south of the Chariot Site and higher pressure usually dominates the Arctic Ocean ice pack. These pressure centers have their greatest development in winter and, in part, account for the strong winds from the north. Furthermore, the strong temperature inversion which exists in the Arctic most of the year and which often extends up to 3000 feet acts as a lid and prevents flow over the mountains. Any topographical barrier such as the Brooks Mountain Range would thus tend to channel the flow through the passes and valleys at increased speeds. The intensity of the inversion is greatest in the colder months when there is most surface radiational cooling. Thus, in the winter when the inversion is intense and the pressure gradient is strong and effectively orientated with respect to the local topography, strong winds may be expected to blow down the lower Ogotoruk Creek valley.

As can be seen from Figure 2 the Chariot Site is centered in the lower Ogotoruk Creek valley which extends along a north-northeast line. Figure 3 shows the valley as the mouth of a low topographic channel which extends inland across the west end of the Brooks Range. This low channel is the first one through the western end of the Brooks range.

A tabulation of the Chariot Site winds in Table 3 shows that the wind has blown from the north and north-northeast 62% of the daily observations since September 1959. From September 1959 to April 1960 the monthly percentages are even higher, the percentage from these two directions being 75.3 for the month of December 1959 alone. It is rather difficult to delineate the areal extent of these strong northerly winds, hereafter referred to as "Ogotoruk Winds", which seem to be due to a funneling effect through the valley. It is likely that some variation exists in its location, depending on the orientation and strength of the pressure gradient and also the depth and strength of the surface inversion. Table 5 compares days with the Ogotoruk wind (average wind above 30 knots or peak gust above 40 knots) with peak gusts at Kotzebue and Cape Lisburne. In general, Kotzebue had a more easterly wind and Cape Lisburne either northeast or southeast wind at those times. In almost all cases the Ogotoruk peak wind speed was at least twice that of the other two stations. Mr. Porter Lockhard, who flew this general area this past summer, stated that when the Ogotoruk wind was blowing, the speed would be high at the Chariot Site and much less at Point Hope on the north and Cape Seppings on the south. One observation from aircraft near the end of August showed whitecaps out to at least 5 miles and extending almost as far south as Kivalina. One of the few observations received from Noatak was taken August 15, 1960 which showed a northerly wind of 20 knots with gusts to 35 and blowing dust from 0600-1400 hours. This was the day the Ogotoruk wind averaged 33 knots with gusts to 62 knots. It is difficult to say whether the strong northerly wind at Noatak was due to channeling but the difference in speed between the two locations seems to confirm that channeling effect is centered near the Chariot Site.

An examination of the mean monthly surface maps shows that over 10 years the average pressure gradient from November through March would have caused a geostrophic wind of 15 mph from the northeast over Northwestern Alaska, while the average for October 1959 through March 1960 would have caused a geostrophic wind of 29 mph from the north-northeast, almost double the ten year average. This indicates that the stronger-than-usual northerly winds at the Chariot Site observed during the winter of 1959-1960 were in large part due to an increase in the overall pressure gradient. During this winter, open water intermittently extended from just south of Point Hope to as far south as Cape Seppings as late as February 1960. This unusual condition was attributed to and attested to the force of this off-shore wind. Table 6 relates the Ogotoruk wind with days of open water along the coast of the Chariot Site.

The second most frequent surface wind direction has been from the southeast along the coast and parallel with the general direction of the edge of terrain above 1000 feet. Little tendency has been shown by the surface wind to be channeled up the Ogotoruk Valley. Table 3 shows that the total percentage of wind from the southeast has only been 5% and from the south-southeast, east-southeast, and south only 4% each. Thus the flow from a general southeast direction totals 17%. However, the summer monthly figures show much higher frequencies, with the totals for June 1960 showing 40% from the southeast quadrant (ESE to S) and 27% from the southwest quadrant (SSW to WSW). Thus the total for southerly wind components for June 1960 was 67%.

PRECIPITATION

On an annual basis it seems logical to assume that the Chariot Site mean precipitation amount will be close to Point Hope's 8-year mean of 10.21 inches and Kotzebue's 18-year mean of 8.02 inches (see Table 7). All three locations are coastal stations, Point Hope being about 30 miles to the northwest and Kotzebue about 120 miles to the southeast of the Chariot Site. The mean annual precipitation map for Alaska shows the 8-inch line passing through Kotzebue and going inland near the Chariot Site. Kotzebue's mean is 9.77 inches for the same 8-year period as Point Hope's data.

The precipitation from September 1959 through August 1960 at Chariot Site base camp totaled 7.55 inches, and 8.09 inches if September 1959 and 1960 are averaged. Similar data for Kotzebue totaled 8.39 and 9.49, respectively. Considering only summer rainfall, Figure 8 shows Kotzebue's total this summer to be 7.57 as compared to 7.68 for Cape Lisburne and 7.63 for the average of 13 locations in the Chariot Site. The Kotzebue summer average for 1960 is much higher than the 18-year average of 4.91 and the 8-year average (1945-52) of 6.33. The same 8-year summer average for Point Hope was 4.54. Chariot Site undoubtedly had its share of excess rain this summer and the total annual precipitation would be higher than should normally be expected. It would seem from these assumptions that a yearly figure of 8 inches of precipitation might be considered about "normal" for the Chariot Site. Continuing measurements will refine this figure.

Precipitation amounts include both rain and the liquid equivalent of snow. Using the ratio of the summer rainfall (June through September) to the total precipitation amount, Kotzebue shows a value of 60% for the 18-year period. Since average temperatures for Kotzebue are well below freezing during the months October through May, it would be safe to assume that on the average, 40% of the precipitation is due to the liquid equivalent of snowfall. Snowfall measurements are, at best, difficult to make. The tendency for snow either to blow away or to drift during windy periods makes measurements at the windy Chariot Site very questionable. Further accuracy is lost in the conversion of snowfall to liquid equivalent by using approximation methods.

Table 8 shows a comparison of the snowfall and greatest snow depth on the ground for Chariot Site, Kotzebue, and Cape Lisburne for the winter 1959-1960. It can be seen that the snow cover gradually increases throughout the winter from successive falls until melting occurs in May and June. Snowfall at the Chariot Site was measured at 23 inches for the 1959-1960 winter as compared to 29 inches for Kotzebue and 41 inches for the Kotzebue 18-year mean. Thus it seems that there was probably less snowfall than usual and less snow accumulation on the ground at the Chariot Site this past winter. The persistent strong northerly winds during the winter could explain the decrease in accumulation with the tendency to blow the snow out over the sea. Also, the snowfall may have been below normal because of abnormal atmospheric pressure patterns, but this type of abnormality is not readily apparent from the study so far.

The variability of monthly precipitation totals is quite evident in the Kotzebue data and also appears in the Chariot Site data. In general, the variability can be attributed to two factors. First, the local nature of the convective storms in summer which may produce considerable precipitation at one spot and none a few miles away, depending on the path of the convective cells and on the underlying topography. Second, the variability of the major storm centers from month to month has a great effect on precipitation. As an example, the precipitation total for September 1949 was .50 inches and for September 1960, 1.58 inches at the Chariot base camp. An intense storm moved northward through the Bering Straits and almost directly over the Chariot Site on September 26, 1960 giving .83 inch of rain. Two other storms followed the same path, giving an additional .18 inch on September 30 and .81 inch the first three days of October, the latter already being double the October 1959 total. Further, Cape Lisburne's June 1960 total of 2.22 inches, the July total of .12 inch, and the August total of 3.51 inches shows how variable the month to month precipitation can be. Consequently, the precipitation from month to month or from a month in one year to the same month in the next year can be expected to vary from tenths of inches to several inches at the Chariot Site as it will most other places on the earth. The yearly total, using Kotzebue's 18-year record as a basis, can be expected to vary from 6 inches to 13 inches.

The microclimatic differences in precipitation totals in the Ogotoruk Valley can be analyzed from the 13 rain gages on the Chariot Site. June 1960 was the first month in which daily totals were taken at all stations except A34.5. The total precipitation for June through September 1960 is illustrated in Figure 8 while the monthly totals have been plotted on maps (Figures 9-12) and isohyets (lines of equal precipitation) drawn. Monthly totals for October 1960, for September 26 to October 3, 1960, and for the entire period June through October 1960 are shown in Figures 12A, 12B and 12C along with the isohyet analyses. The validity of any isohyet analysis for so few stations is open to question, especially along the boundaries of the rain gage network. For instance, the maximum centered at the mouth of the valley in Figure 9 may actually extend over the hills along the coast in both directions. Similarly, the maximum depicted at Station 6 in Figure 11 may extend southeastward over the hill and beyond. It is interesting to note that the higher precipitation amounts were located at the mouth of the valley during June and July and moved inland during August and September. This coincides with rather weak east-southeast winds during June and July and strong south-southeast winds in August and September (Table 9). Geiger (2) points out that the distribution of precipitation in a hilly area is exactly the reverse of that in high mountainous country with the slope of the hill away from the wind receiving the most precipitation. On the windward side the precipitation is carried up over or around the hill. On the lee side of the hill a quiet area with irregular weak air-movement forms in the wind shadow and this is where the heavier precipitation occurs. Presumably, the greater the wind speed the farther down the lee slope the precipitation will be carried. Geiger warns that this wind effect is, to a certain extent, annulled by another factor called the ground slope effect: a rain gage whose mouth is parallel to the slope of the hill will collect less precipitation (depending on wind velocity) when on the leeward side than the normally positioned rain gage, whose mouth is horizontal. The rain gages in the Chariot Site are positioned horizontally, although the slopes of the various stations are very gentle as can be seen from Figure 7. Tentatively then, an explanation to the movement of the higher precipitation amounts inland to the upper part of the valley may be Geiger's wind shadow effect such that the light easterly winds in the earlier part of the summer caused higher amounts at the mouth of the valley immediately behind the coastal hills in the southeast corner of the site. With the stronger south-southeasterly winds later in the summer the wind shadow was oriented upvalley behind the same hills. Data over a longer period are needed before any definite explanation can be made for the microclimate of the precipitation in the valley of the Ogotoruk Creek.

TEMPERATURE

A comparison of mean monthly temperatures and extremes between Chariot Site and Kotzebue for 1959-1960 (Tables 12 and 13) shows a difference varying from 0.7 deg F to 6.3 deg F, with Chariot Site always having the lower temperature. The mean maximum temperatures show the same relationship. Applying a -3.5 degree correction to the 18-year means of Kotzebue, a mean annual temperature of 17 deg F is obtained for Chariot Site with the lowest monthly mean of -10 for January and the highest of 49 for July.

Considerable deviation from the mean of a particular monthly temperature can be expected from year to year. For instance, the mean of -15.6 for December 1959 at Chariot Site seems well below the anticipated "normal" of about -7, whereas the February 1960 mean of 4.0 is well above the anticipated "normal" of about -8. The change from predominantly northerly flow in December to predominantly southerly flow in late February is apparently the explanation for the deviation. April 1960 also was a month with predominantly northerly flow and the mean temperature of 1.2 is well below the expected "normal" of about 9. In general then, northerly flow can be expected to bring colder temperatures while southerly flow from sea to land will bring warmer temperatures, except for the early summer months of May, June and July when the water is still cold.

As mentioned in the Interim Report No. 1 in the section on Climate of Northwest Alaska (1), the cold Chukchi Sea has a modifying effect on early summer temperatures along the coast. During this period air moving from the south will often be cold and foggy, but will begin to warm as it moves inland. This cooling sea-breeze effect decreases as the sea surface temperatures rise to the mid-fifties (Tables 15-19) in late July. There are several instances of marked falls in the sea-surface temperatures occasioned by several days of strong northerly wind during latter part of July 1960. On July 29 the sea-surface temperature was 55 deg F, on the 30th it was 48 deg F, and by August 1 it had dropped to 40 deg F.

A comparison of the mean temperature for the station at base camp, at a point 3 miles inland, and at a point $6\frac{1}{2}$ miles inland is shown in Table 14 for the entire month and for the cases with onshore winds. The microclimatic effect of onshore winds is quite evident in both the mean temperatures and the mean maximum temperatures such that the temperatures of the coastal station is several degrees colder than the inland stations in May, June, and July while the reverse in August and September. This seems to confirm that the land is warmer than the sea during the early summer and colder the remainder of the year, indicating the sea's warming effect with onshore winds.

Starting August 13, 1960 fairly reliable and accurate temperature data were recorded daily at the 12 micrometeorological locations. The compilation and analysis of these data are shown in Figures 13 through 45 and in Tables 20 through 31. Again, the validity of any isotherm analysis for so few stations, especially along the boundary of the network is open to question. In general, however, the pattern as depicted in Figures 25-28 and 31-34 show that at 5 cm above the ground the center of the valley is warmest in the daytime and coldest at night during mid-August to mid-October. This is not unexpected, since according to Geiger (2) the lower the station in the valley the greater the daytime heating and nighttime cooling.

An explanation of the soil temperature patterns is very difficult. An Arctic valley such as the Ogotoruk Creek Valley can hardly be considered a "textbook example" as far as uniformity of soil, vegetation and drainage is concerned, and in addition is complicated by the permafrost which exists in summer from a depth of several feet to possibly a thousand feet. For instance, in August when some of the soil thermometers were installed, frost was noticed at a depth of 38 cm at station A34.5 and 25 cm at A34.7 while no frost was encountered at similar depths at other stations. A possible explanation is the insulation provided by the vegetation at these two stations. An examination of

Figures 13-18 show that there is little day-to-day variation of the mean temperature of the soil at -50 cm and that there is a 12-to-36 hour lag in temperature penetration into the soil, the lag increasing with depth.

The latest USAF Handbook of Geophysics (3) lists what now appears to be the more important factors which influence the pattern of soil temperature variations at any locality. The following factors are listed: (1) type of soil, (2) states of compaction of the soil, (3) moisture content of the soil, (4) position of water table, (5) type of surface cover including color, (6) amount and nature of traffic over site, and (7) local climatic conditions. It may be possible to use the Chariot Site soil survey when available to help explain some soil temperature variations, but at best, the factors influencing Arctic soil temperatures are very complicated.

CLOUDINESS AND RELATIVE HUMIDITY

Average cloudiness for the year at Chariot Site is shown in Table 4. In general, the months November through April show the least amount of clouds with the average amount being below 50% in all these months. The summer half of the year, May through October, show percentages well above 50. These winter and summer averages are in agreement with the 18-year record at Kotzebue.

It seems from Table 3 that northerly winds in winter and to a lesser degree in summer have a tendency to bring clearer skies. The cloudiness for winter includes observations when the sky was obscured by blowing snow. Summer cloudiness, in large part, occurred when winds had a southerly component.

Relative humidity, as is the case with cloudiness, is somewhat higher in the summer half of the year than the winter half according to the 18-year record at Kotzebue. The same is assumed to hold true for Chariot Site. Continuous records of relative humidity have been taken since May 1960 at the base camp along the coast and at the head of the valley, $6\frac{1}{2}$ miles inland. The data are summarized in Table 10 and show that the average mean daily minimum relative humidity is about 10% higher along the coast than at the inland location. Since the daily maximum relative humidity was almost always 100%, as can be seen from the monthly means in Table 10, it was felt that the minimum values would be more of an indicator in showing the high relative humidity which prevails in the Chariot Site area. The high humidity is probably caused by air trajectories over the sea rather than any significant contribution from the wet meadows and the standing pools of water found just inland from the coast.

SOLAR RADIATION

Four pyrliometers were installed at locations along the valley in August 1960. The daily integrated readings are tabulated in Table 11 for August and September. The readings in September are lower than those in August because of the rapidly declining angle of the sun. However, successive daily variations are due to varying amounts of cloud cover or moisture concentrations. It is hoped that with more complete data, meaningful monthly averages can be obtained.

According to Geiger (2) "the amount of radiation received from the sun depends on the time of day, the season, the degree of cloudiness, the direction of the slope, and the angle of the slope". From the sunshine tables distributed with the Interim Report (1) it is seen that the potential maximum radiation is on June 21 when the sun is at its zenith. Figure 7 is a map showing the angle of slope and the direction downward, where significant, of the various stations in the Chariot Site. Geiger further adds that "the amount of heat which a slope receives is made up of two parts, direct insolation and diffuse sky radiation. The former varies with the direction and angle of slope; the latter with angle only". The graphs in Figures 4, 5, and 6 show the various skylines for the microclimatic stations. On clear days it can be seen that some direct insolation would not be received at some stations because of the surrounding hills, especially in the summer months when the sun is above the horizon all or most of the day.

The amount of insolation received from diffuse sky radiation is not so greatly affected by exposure. Thus, large differences in exposure will be encountered in clear weather, small differences in overcast weather. In the far north, although the low position of the sun occasions the greatest differences in exposure to direct solar radiation, the ratio of the total direct to the total diffuse radiation is relatively small, because of greater cloudiness. The consequence is that in polar regions the matter of exposure is not as significant for plants, man, or beast as in middle latitudes. Also, any differences in sub-soil or near surface temperature measurements would be due more to other factors such as types of vegetation and soil than to solar radiation.

REFERENCES

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Fig. 1. Wind Roses for Chariot Site for Various Periods 1959-60.

Sept, Oct, Nov. 59

Annual

Dec. 59, Jan, Feb. 60

Mar, Apr, May 60

Jun, Jul, Aug. 60

Fig. 2. Chariot Site Area. 2 indicates Station A34.2, etc.
Stipled areas are elevations above 500 feet. Solid areas
are above 750 feet.

Fig. 3. Section of Northwest Alaska. Shaded areas are elevations above 1000 feet.

360° 30° 60° 90° 120° 150° 180° 210° 240° 270° 300° 330° 360°

Fig. 4. Skyline at Base Camp, A34.0 (360° is North, 90° is East, etc.)

Fig. 5. Skylines at 6 Micrometeorological Stations. (360° is North, 90° is East, etc.).

Fig. 6. Skylines at balance of Micrometeorological Stations.

Fig. 7. Significant Angles of Slope and Direction Downward.

Note the large angles on the eastward-facing slopes of A34.5, with 9° and A34.10, with 21°. On clear mornings this could result in much additional heating. Table 37 shows A34.5 to have the highest recorded temperature of 86 F. A34.1, with a 7° slope, benefits from the afternoon sun, and stands out as a secondary warm spot in Figures 25, 26, and 27.

Fig. 9. Chariot Site Precipitation Totals in Inches for June, 1960.

Fig. 10. Chariot Site Precipitation July 1960.

Fig. 11. Chariot Site Precipitation August 1960.

Fig. 12. Chariot Site Precipitation September 1960.

Fig. 12A. Chariot Site Precipitation October 1960.

Fig. 12 B. Chariot Site Precipitation Sept. 26 - Oct. 3, 1960.

This heavy precipitation occurred from a series of storms which moved northward through the Bering Straits.

Fig. 12 C. Chariot Site Precipitation June - October 1960.

Fig. 13. Daily Mean Temperatures at Stations A34.1 and 2.

Fig. 14. Daily Mean Temperatures at Stations A34.3 and 5.

Fig. 15. Daily Mean Temperatures at Stations A34.4 and 6.

Fig. 16. Daily Mean Temperatures at Stations A34.7 and 9.

Fig. 17. Daily Mean Temperatures at Stations A34.8 and 10.

Fig. 18. Daily Mean Temperatures at Stations A34.11 and 12.

Fig. 19. Daily March of Mean Temperatures at A34.2

Fig. 20. Daily March of Mean Temperatures at A34.3.

Fig. 21. Daily March of Mean Temperatures at A34.5.

Fig. 22. Daily March of Mean Temperatures at A34.7.

Fig. 23. Daily March of Mean Temperatures at A34.11.

Fig. 25. Distribution of Mean Maximum Temperature at 5 cm.
August 13-31, 1960.

The warmest temperatures are generally at the lowest elevations, as above and following Figures 26-30 show. A34.1 shows a secondary warm spot, possibly due to its 7° slope toward the afternoon sun and its drier soil. The consistent cold spot at A34.6 on Figures 25-28 is due to its frost scar type of soil having a large percentage of rock in it, which conducts heat to the lower levels more rapidly.

Fig. 26. Distribution of Mean Maximum Temperature at 5 cm.
September 1-15, 1960

The warmer temperatures generally continue at the lower elevations, as in Figure 25. Note: thermometers were removed from the center of tussocks on Aug. 30 at A34.4, 9, and 12 to more level soil between the tussocks. A34.10 shows warmer than 9 possibly because of increased dryness, in spite of its higher altitude. A34.8 is warmest because its sandy soil is drier than further down-creek.

Fig. 27. Distribution of Mean Maximum Temperature at 5 cm.
September 16-30, 1960.

The warmest temperatures continue in the lower parts of the valley. With the declining sun, the 7° slope at A34.1 is less of a factor and this secondary warm spot is fading.

Fig. 28. Distribution of Mean Maximum Temperature at 5 cm.
October 1-14, 1960 (9 days of data).

The lower parts of the valley are still warmest. Another factor in this period is warming from the sea surface, whose temperatures during this period ranged from 40°F. down to 34°F. on October 14. Thus A34.12, 6½ miles inland, is almost the coldest spot.

Fig. 29. Distribution of Mean Maximum Temperature at -5 cm.
August 13-31, 1960.

Warmer temperatures even below the soil are in the lower parts of valley. Warm spot at A34.10 probably due to drier soil, as the looser packing around the glass thermometer at this station allowed greater exposure to warmer air temperature. Thermometers at A34.4, 9 and 12 are from the center of tussocks, and were moved Aug. 30. The cold spot at this level is now at A34.7 and is probably due to the greater insulating properties of its thick stand of wet meadow and tussocks.

Fig. 30. Distribution of Mean Maximum Temperature at -5 cm.
September 1-15, 1960.

Little change is seen from Figure 29. No subsequent maps were drawn for this level, as the glass thermometers in use at 6 of the stations became frozen in the ground about Sept. 19, and several were broken on being replanted. The readings from the other 6 stations were not enough to logically analyse a map.

Fig. 31. Distribution of Mean Minimum Temperature at 5 cm.
August 13-31, 1960.

The coldest temperatures are generally at the lowest elevations in a valley. This is illustrated nicely for the up-creek stations but the stations near the coast show the effect of the warmer sea-surface temperatures, which were mostly 50°F. during this period.

Fig. 32. Distribution of Mean Minimum Temperature at 5 cm.
September 1-15, 1960.

Little change is seen from previous period, Figure 31.

Fig. 33. Distribution of Mean Minimum Temperature at 5 cm.
September 16-30, 1960.

The effects of the warmer sea-surface temperatures show up very definitely in the lower coastal stations. The displacement of the cold spots up-valley were probably due to the heavy rains from September 26 to the end of the month, which raised all minimum temperatures 10°F . generally.

Fig. 34. Distribution of Mean Minimum Temperature at 5 cm.

October 1-14, 1960.

The colder spots again appear in the lower parts of the valley, away from the coastal area.

Fig. 36. Distribution of Mean Minimum Temperature at -5 cm.
September 1-15, 1960.

Same pattern appears as in previous period, Figure 35. Maps for the colder two periods were not drawn as only readings from 6 stations were available.

Fig. 37. Highest Reported Temperatures August 13-31, 1960 at 5 cm.

These extreme temperatures all occurred on relatively clear days. It is believed that the highest, 86°F. at A34.5 was because of the better reflective properties of its vegetation and soil. Its 9° slope toward the morning sun undoubtedly helped also.

Fig. 38. Highest Reported Temperatures September 1-15, 1960 at 5 cm.

The warmest spots again appear, as on the mean maximum maps, in the center of the valley.

Fig. 39. Highest Reported Temperatures September 16-30, 1960 at 5 cm.

Little change is seen from previous period, Figure 38.

Fig. 40. Highest Reported Temperatures October 1-14, 1960 at 5 cm.

Again, little change is noted from 2 previous periods, Figures 38 and 39.

Fig. 41. Highest Reported Temperatures August 13-31, 1960 at -5 cm.

The following stations were equipped with glass thermometers: A34.1, 2, 4, 6, 8, 9 and 10. Because these thermometers had to be pulled out of the ground and then re-imbedded daily, the resulting looser packing around them would expose them more to the warmer air temperatures, and thus their readings would tend to be higher than what a Palmer thermometer would have shown. This accounts for some of the higher readings shown above and also for the lack of any definite or familiar pattern. No further comparisons at this level were drawn.

Fig. 42. Altitude vs. 5 cm. Mean Maximum Temperatures for Coastal Stations A34.1, 2, 3, 4 and 5.

No linear decrease of temperature with altitude is evident, except in October period, which suggests that in periods of greater heating, other factors than altitude are more important.

Fig. 43. Altitude vs. 5 cm. Mean Maximum Temperatures for Inland Stations A34.6, 7, 8, 9, 10, 11 and 12.

Fairly good correlation with altitude is evident.

Fig. 45. Altitude vs. 5 cm. Mean Maximum Temperatures for Creek Stations with Willow-type Vegetation.

Good correlation would exist except for the higher temperatures at A34.8, which, as noted in a previous figure is probably due to the sand and gravel being drier at this station.

Station	Plot	Latitude (N)	Longitude (W)	Angle and Dir. of Slope	Altitude (feet)	Type of Instrumentation
A34.0	100	68°05'58"	165°45'42"	Level	25	HPRWY
A34.1	101	68°06'42"	165°41'30"	7.0° toward 250°	380	AR
A34.2	31	68°06'30"	165°43'30"	0.2° toward 280°	110	BR
A34.3	6	68°06'38"	165°44'48"	0.6° toward 255°	20	CR
A34.4	4	68°06'46"	165°46'08"	1.3° toward 50° also 3.0° " 85°	95	AR
A34.5	7	68°06'33"	165°47'24"	9.0° toward 110°	330	CR
A34.6	51	68°08'40"	165°39'06"	4.0° toward 280°	375	AR
A34.7	45	68°08'30"	165°41'30"	2.5° toward 245° also 2.0° " 310°	160	CEPRV
A34.8	47	68°08'11"	165°43'12"	1.5° toward 197°	75	AR
A34.9	49	68°08'44"	165°44'21"	3.6° toward 211°	160	ARV
A34.10	50	68°09'28"	165°45'33"	21.0° toward 113°	300	AR
A34.11	19	68°09'06"	165°38'38"	0.5° toward 285°	190	CR
A34.12	37	68°11'35"	165°42'24"	3.9° toward 350°	295	CDEHPRU
A34.13	102	68°07'50"	165°46'25"		805	
A34.14	103	68°06'18"	165°48'08"		847	PU

A - Glass Max-Min Thermometers at 5 and -5 cm levels.

B - Same as A but with Palmer thermometers at -10, -20, and -50 cm.

C - Palmer Thermometers at -5, -10, -20, and -50 cm, glass at 5 cm.

D - Palmer Thermometer at 50 cm above surface.

E - Glass Max-Min Thermometer in shelter at 122 cm.

H - Hygrothermograph in shelter at 122 cm.

P - Pyrheliometer.

R - Rain Gauge.

U - Esterline Angus wind recorder with vane and cups at 2 ft height.

V - Wind recorder with cups only at 2 ft height.

W - Aerovane Wind Instrument at 20 ft height.

Y - Barograph.

Note: A34.9 had Palmer Thermometers installed 9/15/60 at -5, -10, -20, and -50 cm.

Table 1. Geographical Description and Instrumentation of the Microclimatological Stations in the Chariot Site area during the period from August 13 through October 14, 1960.

<u>Station</u>	<u>Percent Tussock</u>	<u>Type of Vegetation</u>
A34.0	0	Base Camp. Formerly wet meadow area.
A34.1	0	Dryas fellfield, soil very rocky, and covered with mosses and lichens.
A34.2	80	Eriophorum Tussocks, depressions remain fairly damp. Wet meadow to the west.
A34.3	0	Willows, on a shelf or bench about 4 feet above gravel bar.
A34.4	100	Eriophorum Tussock, depressions remain fairly damp.
A34.5	60	Eriophorum-Carex solifluction slope. More of a wet meadow on a slope. Soil very moist and consists mainly of sedges, mosses, and lichens.
A34.6	0	Eriophorum-Carex. Carex Bigelowii. Wet meadows and frost scars.
A34.7	50	Eriophorum-Carex. Eriophorum Tussock. Wet meadows and tussocks.
A34.8	0	Willows growing on shelf or bench about 4 feet above gravel bar.
A34.9	100	Carex Bigelowii, high centered polygons. Big tussocks.
A34.10	0	Ericaceous polygon. Vegetation similar to mosses and lichens, but dry.
A34.11	6	Same as A34.3 and A34.8.
A34.12	80	Eriophorum Tussock. Mainly tussocks, quite damp in depressions.
A34.13	0	Dryas fellfield, on limestone. Predominately limestone.
A34.14	0	Same as A34.13.

Table 2. Type of Vegetation at each Microclimatological Station.

Percent of Cloudiness Occurring with Observed Wind Directions

	<u>CALM</u>	<u>W</u>	<u>WNW</u>	<u>NW</u>	<u>NNW</u>	<u>N</u>	<u>NNE</u>	<u>NE</u>	<u>ENE</u>	<u>E</u>	<u>ESE</u>	<u>SE</u>	<u>SSE</u>	<u>S</u>	<u>SSW</u>	<u>SW</u>	<u>WSW</u>
Sep 59		60			60	43	33			84			52	77			
Oct		94				46	35		20	100	100	100	100	93	100		100
Nov						34	19	30		71	100	100			100		100
Dec				50	10	10	20									100	
Jan 60					70	30	40			100	100	80					
Feb						30	20		30	80	70	90					
Mar		100		50	10	10	20				100	60	40	100			
Apr				40	50	50	50	100		80	100		90		20		
May		50	70	80	100	50	50	90		40	80	50	100	90	70	80	100
June		100	60	100		80				100	100	90	90	90	60	70	60
July		90	100	80		40	70			100	90	60	100	70	90	30	70
Aug	100	40		40	20	60	70	100		90	60	100	100	100	100	70	70
Sep	90	90	100	90	70	60	50	100	100	100	100	100	80	90	100	100	

Wind Direction Percentages

Sep 59	0	3	0	1	1	17	49	1	0	11	0	0	7	10	0	0	0
Oct	0	5	0	0	0	23	48	0	2	4	1	1	5	3	2	0	4
Nov	0	0	0	0	1	36	39	7	0	10	2	2	0	2	0	0	1
Dec	0	0	0	7	14	48	27	2	1	0	0	0	0	0	0	1	0
Jan 60	0	0	0	1	3	62	19	3	0	4	1	5	0	0	0	0	0
Feb	0	0	0	0	1	40	10	1	1	5	22	10	8	1	0	0	0
Mar	0	2	0	3	11	53	13	1	0	0	1	13	1	1	0	0	1
Apr	0	0	0	7	6	58	17	1	0	1	6	0	3	1	1	0	0
May	0	2	3	8	2	30	8	3	0	1	7	5	3	8	3	12	5
June	0	1	6	1	0	23	0	0	0	2	4	11	17	8	2	17	8
July	0	1	2	5	0	41	9	0	0	1	11	9	7	7	2	3	3
Aug	1	1	0	10	2	33	14	1	0	2	2	10	10	4	1	5	3
Sep	3	3	1	2	4	52	4	1	1	10	2	4	3	3	2	1	0
Total %	0	1.1	1.0	3.6	3.7	41.4	20.6	1.8	0	1.4	4.4	5.4	4.1	3.9	1.1	3.2	2.1
Total #	4	18	11	41	42	472	235	20	5	16	50	62	47	44	13	36	24

Table 3. Top table shows less cloudiness with northerly winds. Bottom table shows the high frequency of north and north-northeasterly winds.

	<u>0700 B.S.T.</u>	<u>1300 B.S.T.</u>	<u>1900 B.S.T.</u>	<u>Average</u>
Sept. 59	50	48	40	46
Oct.	48	58	49	52
Nov.	36	30	25	30
Dec.	16	16	9	14
Jan. 60	28	35	29	31
Feb.	49	39	23	37
Mar.	14	17	15	15
Apr.	39	40	44	41
May	68	61	60	63
June	87	74	71	77
July	57	52	48	52
Aug.	66	63	59	63
Sept.	76	66	69	70

Table 4 . Percent of Cloudiness below 20,000 Feet
at Chariot Site.

<u>Date</u>	<u>Chariot Site</u> <u>Average-Gusts</u>		<u>Kotzebue</u> <u>Peak Gust</u>	<u>Cape Lisburne</u> <u>Peak Gust</u>	<u>Date</u>	<u>Chariot Site</u> <u>Average-Gusts</u>		<u>Kotzebue</u> <u>Peak Gust</u>	<u>Cape Lisburne</u> <u>Peak Gust</u>
9/4/59	NNE	48.5	50	N 29	1/20/60	N	44	60	WNW 6 ESE 13
9/22	NNE	29	40	ENE 15	1/21	N	46	60	N 14 ESE 14
9/23	NNE	38	55	N 17	1/22	N	37	50	NNE 13 ESE 17
10/26	NNE	26	42	NNE 12	1/29	N	32	50	ENE 10 ESE 27
10/27	NNE	32	48	NE 23	1/30	N	43	60	N 15 E 35
10/28	NNE	33	54	NE 23	1/31	N	53	70	NNW 23 E 42
10/29	NNE	36	60	NNW 17	2/9	N	34	53	WNW 7 ESE 24
11/5	NNE	30	45	ENE 8	2/10	N	36	53	N 13 ESE 20
11/16	N	33	60	ENE 23	2/11	NNE	30	46	N 17 SE 5
11/17	NNE	32	60	ENE 26	2/12	NNE	30	46	NNW 16 ESE 14
11/18	N	30	45	ENE 23	2/13	N	38	46	W 6 ESE 21
11/19	NNE	37	50	ENE 16	2/14	N	27	42	SSW 17 ESE 24
11/21	N	31	45	NNE 12	3/10	NNE	30	39	N 17 ENE 17
11/22	N	47	73	NNW 15	4/4	N	35	58	E 23 ENE 32
11/25	NNE	28	45	E 20	4/11	N	30	48	NNE 9 ENE 19
11/26	NNE	43	60	ENE 23	4/12	N	36	68	ENE 18 ENE 28
11/27	N	31	55	ESE 28	4/13	N	36	54	ENE 16 ENE 37
12/4	NNE	28	56	NE 7	4/14	N	34	52	NE 18 ENE 28
12/8	N	31	40	NE 8	5/26	N	33		E 16 ENE 19
12/18	NNE	31	54	NNW 10	5/27	N	32		E 14 ENE 13
12/28	NNE	38	56	NNE 13	8/15	N	33	62	ENE 24 ENE 40
12/31	N	35	54	NNW 20	9/2	N	30	55	N 30 ENE 31
1/8/60	N	35	46	E 30	9/10	N	30		NNE 12 ENE 26
1/9	N	44	64	SW 25	9/22	NNE	31	46	N 24 ENE 28
1/17	N	33	42	WSW 16	9/24	N	28	40	E 8 NE 25

Table 5. "Ogotoruk Wind" Compared to Peak Gusts at Kotzebue and Cape Lisburne.

"Ogotoruk Wind" in this table is considered when average is above 30 knots or gusts are above 40 knots. Peak gusts for Chariot Site and Cape Lisburne are shown where available. Many other days when the "Ogotoruk Wind" averaged between 20 and 30 knots have been omitted.

<u>Date</u>	<u>Mean Temp.</u>	<u>Observed Wind Dir.</u>	<u>Speed</u>	<u>Comments on State of Sea</u>
11/2/59	6	NNE	15	Ice floes blown out to sea.
11/21	-12	NNE	40	Sea ice-free; "steaming".
12/10	-15	N	24	Very thin ice over calm sea.
12/11	-14	N	22	Sea open except for thin ice patches. Pilot reports Point Hope and Kivalina frozen solid.
12/25	-25	N	16	Sea frozen solid.
12/27	-10	NNW	26	Sea frozen to SE, open to west.
12/28	-16	NNE	47	Sea open near camp, frozen in distance.
12/30	-26	NW	10	Sea frozen.
12/31	-29	N	37	Sea obscured by Blowing Snow.
1/1/60	-19	N	23	Sea wide open; steaming.
1/7	-3	NNE	15	Sea frozen. Ice in piles.
1/8	-4	N	42	Sea obscured by Blowing Snow.
1/9	-20	N	54	" " " " "
1/10	-13	N	24	Sea open; steaming.
1/11-16				Sea frozen.
1/17	-23	N	38	Sea obscured by Blowing Snow.
1/18	-23	N	23	Sea open; steaming.
1/24-29				Sea frozen.
1/30	-24	N	48	Sea obscured by Blowing Snow.
1/31	-24	N	64	Sea obscured. Sand and gravel blowing with snow.
2/1	-8	N	15	Sea open; steaming.
2/4	-8	N	20	Sea covered with thin ice.
2/5	-3	N	30	Sea open; steaming.
2/6-8				Sea frozen, with a few open spots.
2/9-10	-15	N	42	Sea obscured by Blowing Snow.
2/11	-23	NNE	32	Sea open.
2/12-13				Sea obscured by Blowing Snow.
2/14	-15	N	35	Sea open; steaming.
2/15-6/10				Sea frozen.

Table 6 . Relation between "Ogotoruk Wind" and Open Sea,
showing how the ice departed with the onset of a north wind.

<u>"Normal" Precipitation</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Annual</u>
Point Hope (8 yr. mean) 1945-52	.99	1.14	1.11	.77	.40	.61	.43	.75	.46	.52	.98	2.05	-	10.21
Kotzebue (8 yr. mean) 1945-52	1.07	.61	.62	.41	.36	.36	.33	.40	.35	.56	1.81	2.89	-	9.77
Kotzebue (18 yr. mean)	.94	.58	.43	.35	.47	.32	.27	.36	.33	.49	1.53	1.95	-	8.02
Cape Lisburne	-	-	-	-	-	-	-	-	-	-	-	-	-	16.00

Precipitation 1959-60

Cape Lisburne	-	-	-	-	.50	.71	.21	.37	.59	2.22	.12	3.51	1.83
Kotzebue	.65	.53	.24	.33	.58	.46	T	.31	.57	.75	2.31	1.66	2.85
Chariot Site A34.0	.50	.46	.57	T	.10	.12	.04	.27	.73	1.22	1.13	2.41	1.58
A34.1										1.38	1.27	3.14	1.37
A34.2										1.46	1.39	3.14	1.96
A34.3										1.39	1.32	3.06	1.95
A34.4										1.41	1.35	3.47	1.82
A34.5										(1.30)	1.37	3.17	1.47
A34.6										1.02	1.03	4.11	2.66
A34.7										.99	.95	3.21	2.03
A34.8										1.07	1.22	3.34	2.15
A34.9										1.35	.80	3.35	2.13
A34.10										1.33	1.13	3.51	2.09
A34.11										.95	.92	3.36	3.06
A34.12										1.01	.68	3.06	2.18

T - Trace (less than .01 inch)

Table 7. Chariot Site Precipitation (inches of water) Compared to Nearby Locations.

<u>"Normal" Snowfall</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Annual</u>
Kotzebue (18 yr. mean)	1.0	5.6	7.8	6.1	5.5	4.9	6.0	3.4	1.0	0.1	0.0	T	41.4
Point Hope (5 yr. mean)	1.2	6.3	4.1	3.2	4.0	2.6	1.9	2.3	3.2	0.6	0.1	T	29.5
Point Hope (1924 only)	0.4	2.0	16.0	16.4	0.5	0.4	5.0	2.8	1.7	0.6	0.0	0.0	45.8
Cape Lisburne	-	-	-	-	-	-	-	-	-	-	-	-	65.0

Snowfall 1959-60

Chariot Site A34.0	T	5.0	7.5	T	2.8	1.9	0.5	2.9	2.0	T	T	0.0	22.6
Kotzebue	0.0	1.9	2.7	3.9	6.7	5.7	T	5.5	2.2	0.7	0.0	0.0	29.3
Cape Lisburne	-	-	-	-	5.0	7.1	2.1	3.7	3.0	1.0	T	0.0	

Greatest Snow Depth on
Ground (inches) 1959-60

Chariot Site A34.0	0	2.5	5	5	5	6	6	8	2	T	0	0	
Kotzebue	0	1	4	6	11	17	18	22	15	1	0	0	
Cape Lisburne	-	-	-	-	19	28	30	34	34	1	0	0	

T - Trace (less than .01 inch)

Table 8 . Chariot Site Snowfall and Snow Depth Compared to Nearby Locations.

Station	A34.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12	Wind(knots)
6/1/60	.03	0	0	0	0	M	0	.01	0	.01	0	0	.01	W 10
6/14-15	.23	.20	.18	.18	.20	M	.03	.10	.16	.16	.19	.03	.11	N 17
6/19	.03	.02	.02	.02	.03	M	.03	.02	.02	.03	.03	.02	.02	SE 9
6/21	.03	.09	.08	.05	.03	M	.03	.02	.02	.04	.03	.03	.01	S 9
6/23-27	.90	1.07	1.18	1.14	1.15	M	.93	.84	.87	1.11	1.08	.87	.86	Variable, mostly SW 8
7/11-12	.27	.42	.44	.42	.45	.51	.51	.36	.60	.38	.46	.39	.41	ESE 10
7/19	.01	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	T	.03	SSE 10
7/20	0	0	0	0	0	0	T	.01	.01	0	0	T	0	S 5
7/27-30	.85	.83	.93	.88	.88	.84	.50	.56	.59	.40	.65	.53	.24	ESE 11
8/5-8	.02	.05	.02	.02	.02	.03	.18	.13	.12	.13	.16	.09	.06	S 10
8/9-10	1.48	2.05	2.09	2.02	2.41	2.06	2.70	2.05	2.27	2.39	2.43	2.16	2.19	SSE 19
8/13	T	.02	T	T	T	T	T	T	T	T	T	T	T	N 14
8/24-26	.79	.83	.82	.82	.83	.84	1.05	.88	.76	.66	.73	.95	.58	SE 20
8/27-28	.12	.19	.21	.20	.21	.24	.18	.15	.19	.17	.19	.16	.13	WNW 10
9/2	T	.01	.01	.01	.01	.01	T	T	T	T	T	T	T	N 30
9/8-9	.21	.28	.28	.32	.32	.24	.25	.24	.25	.30	.28	.28	.20	N 15
9/16-17	.18	T	T	T	T	0	.15	.13	.16	.18	.26	.15	.15	W 12
9/18-19	.17	.14	.20	.20	.18	.30	.26	.03	.16	.17	.15	.22	.19	E 14
9/26	.83	.80	1.32	1.20	1.16	.78	1.36	1.27	1.40	1.25	1.20	2.05	1.35	SE 30
9/28-30	.19	.14	.15	.22	.15	.14	.64	.36	.18	.23	.20	.36	.29	E 22

T - Trace (less than .01 inch)

M - Missing

Table 9. Days with Measurable Rainfall at the Microclimatological Stations.

The days with the larger totals seem to be related to southerly or southeasterly winds. Many days have been grouped together, since readings were not taken simultaneously but were read only once a day on the observer's daily rounds (except at A34.0, where 3 readings a day were taken).

	May			June			July			August			September 1960		
	C	I		C	I		C	I		C	I		C	I	
1	57	M		83	80		41	36		67	66		87	100	
2	60	M		90	62		69	62		64	60		68	82	
3	48	M		78	32		68	62		56	46		56	48	
4	58	M		92	60		70	70		46	35		64	60	
5	52	M		78	46		69	60		72	66		56	38	
6	68	M		45	44		78	72		86	72		70	58	
7	83	M		51	56		70	51		79	85		54	48	
8	84	80		58	72		98	73		85	75		76	54	
9	86	90		60	66		60	51		97	M		73	74	
10	64	68		83	56		65	64		84	75		66	66	
11	55	62		90	60		100	100		50	46		71	72	
12	60	52		91	72		100	100		72	68		76	76	
13	67	60		56	54		81	62		62	60		76	70	
14	42	54		65	74		60	55		47	47		58	54	
15	64	74		66	65		88	34		65	63		84	82	
16	65	55		52	48		49	49		62	58		67	71	
17	60	51		84	65		63	39		60	62		72	70	
18	98	70		100	100		68	64		52	54		77	74	
19	78	69		100	95		94	77		50	46		96	M	
20	74	62		71	62		87	55		48	30		86	84	
21	62	58		68	58		58	54		40	M		71	77	
22	92	89		100	93		57	51		56	42		66	72	
23	82	74		96	88		35	44		84	60		75	80	
24	77	82		93	72		57	52		93	M		78	80	
25	72	79		80	71		41	42		82	64		82	89	
26	60	M		96	87		43	43		82	64		86	M	
27	51	M		96	78		60	52		80	M		82	M	
28	42	M		86	60		75	58		62	M		68	72	
29	62	M		100	62		48	42		64	55		84	90	
30	68	M		74	54		48	50		62	M		90	84	
31	64	M					62	65		77	87				
Mean															
Min	66	68		79	66		67	58		67	59		74	71	
Mean															
Max	95	100		100	99		100	99		100	100		99	98	

Table 10. Daily Minimum Relative Humidity Comparison between an inland and a coastal station.

C: Coastal station A34.0

I: Inland station A34.12

Station	August 1960				September 1960			
	<u>A34.0</u>	<u>A34.7</u>	<u>A34.12</u>	<u>A34.14</u>	<u>A34.0</u>	<u>A34.7</u>	<u>A34.12</u>	<u>A34.14</u>
1		440	304		184	136	128	120
2		456	416		480	368	320	360
3		336	312		320	328	248	328
4		520	480		400	384	368	376
5	304	280	216		352	336	280	336
6	360	400	320		224	232	240	208
7		200	144		208	208	176	200
8	192	280	224	208	176	184	176	168
9	96	88	104	80	336	320	296	368
10	96	96	104	64	360	320	296	352
11	384	392	360	392	320	320	336	368
12		504	464	456	344	296	320	264
13	384	360	376	368	184	184	176	168
14		368	336	264	216	200	192	240
15	560	480	448	496	160	168	128	160
16		320	296	280	208	248	216	256
17	320	368	328	344	200	200	216	248
18	480	464	480	464	152	144	144	168
19	464	472	456	488	96	112	128	96
20	488	456	424	456	256	248	248	304
21		464	424	416	312	280	248	320
22		432	432		264	216	232	
23	160	200	192		240	232		
24	88	104	88		248	240	232	
25	192	160	144		152	120	160	
26	208	168	136		32	48	48	
27	200	184	160	152	80	96		
28	320	304	320	286	136	128	80	144
29	400	400	360	392	48	64	64	32
30	352	344	328	352	64	64	48	48
31	216	184	184	216				

Table 11. Pyrheliometer Comparisons. Above readings are gram calories/sq.cm./day, as measured by a planimeter from the recording charts of the Belfort Pyrheliograph.

<u>Mean Maximum Temp.</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Annual</u>
Point Hope(8 yr.mean)*	43.4	33.4	21.4	7.8	5.2	2.9	4.3	17.2	31.7	41.6	48.9	48.9	-	25.6
Kotzebue (18 yr. mean)	45.6	30.2	12.9	3.3	0.6	2.5	6.6	22.3	36.3	49.2	58.5	55.8	-	27.0

Chariot 1959-60	45.8	26.9	11.2	-11.1	-4.4	9.7	9.2	9.4	38.9	42.3	56.3	55.0	37.6	25.1
Kotzebue 1959-60	47.2	27.7	14.6	-8.7	2.4	9.1	13.6	18.0	40.2	45.0	59.4	58.0	43.4	28.5
Cape Lisburne 1960	-	-	-	-	-8.8	8.2	8.5	6.0	33.2	39.2	49.1	47.9	35.1	

Mean Temperatures

Point Hope(8 yr.mean)*	38.6	27.9	15.7	0.9	-3.9	-5.6	-5.1	7.0	24.6	36.1	43.9	44.0	38.6	18.7
Kotzebue (18 yr. mean)	40.9	25.5	7.5	-3.7	-6.6	-4.7	-1.6	13.8	29.6	43.3	52.6	50.7	-	20.6

Chariot 1959-60	37.4	21.3	5.8	-15.6	-11.2	4.0	2.0	1.2	32.5	36.5	48.3	47.5	32.4	18.6
Kotzebue 1959-60	39.8	22.0	9.1	-14.8	-4.9	7.3	5.4	6.3	34.5	39.8	53.5	52.6	37.6	22.2
Cape Lisburne 1960	-	-	-	-	-12.9	3.3	2.7	1.5	29.1	35.5	44.4	44.5	32.9	

* 1945-52.

Table 12. Chariot Site Mean Maximum and Mean Temperatures Compared to Nearby Locations.

	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>
<u>Highest Recorded Temperatures</u>													
Kotzebue - Record High	63	51	38	34	36	35	34	46	74	81	82	78	
Kotzebue - 1959-60	55	46	27	22	29	33	31	46	60	56	72	78	55
Chariot Site 1959-60	56	45	33	9	32	34	29	44	53	57	72	68	47
Cape Lisburne 1960	-	-	-	-	18	35	33	29	46	50	70	59	43
<u>Lowest Recorded Temperatures</u>													
Kotzebue - Record Low	17	-8	-36	-47	-43	-48	-48	-44	-18	20	34	31	
Kotzebue - 1959-60	21	-6	-17	-34	-40	-33	-17	-23	22	27	35	40	23
Chariot Site 1959-60	14	-4	-15	-37	-38	-19	-28	-21	15	24	28	32	16
Cape Lisburne 1960	-	-	-	-	-30	-26	-30	-19	16	24	32	34	20

Table 13. Highest and Lowest Temperatures Recorded at Chariot Site and Nearby Locations.

Mean Temperature Comparisons with Onshore Winds

<u>Station</u>	<u>A34.0</u>			<u>A34.12</u>			<u>A34.7</u>		
	<u>Max</u>	<u>Min</u>	<u>Mean</u>	<u>Max</u>	<u>Min</u>	<u>Mean</u>	<u>Max</u>	<u>Min</u>	<u>Mean</u>
May	35.2	27.3	31.3	37.5	26.6	32.1	37.8	26.7	32.3
June	39.8	30.1	35.0	46.6	30.4	38.5	46.1	30.5	38.3
July	50.8	39.7	45.3	56.9	39.4	48.2	57.6	39.7	48.7
August	54.7	42.7	48.7	55.9	41.6	48.7	56.4	39.9	48.2
Sept.	39.9	28.9	34.4	39.1	27.6	33.4	39.2	24.7	31.9

Mean Temperature Comparisons for Entire Month

May	38.9	26.0	32.5						
June	42.3	30.7	36.5	46.2	30.7	38.5	46.4	30.9	38.7
July	56.0	40.2	48.3	57.9	39.3	48.6	58.5	39.4	49.0
August	55.0	40.0	47.5	54.8	38.4	46.6	55.7	37.7	46.7
Sept.	37.6	27.1	32.4	36.7	26.6	31.7	37.3	25.3	31.3

Highest and Lowest Recorded Temperatures

June	57	24		59	25		57	25
July	72	28		70	29		70	26
August	68	32		68	30		69	28
Sept.	47	16		47	13		48	12

Table 14. Mean and Extreme Temperature Comparisons at 3 Stations in Chariot Site 1960 at height of approximately 122 cm., recorded in standard Weather Bureau shelters.

<u>Station</u>	<u>A34.0</u>			<u>A34.12</u>			<u>A34.7</u>		<u>Wind</u>	
<u>Day</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>Dir.</u>	<u>Speed</u>
1	41	22	57						N	24.7
2	45	22	83						E	10.0
3	43	22	58						N	22.7
4	38	15	72						N	24.3
5	47	24	59						N	14.3
6	34	24	86						SSW	12.0
7	25	22	84				24	23	SW	8.0
8	26	21	87	24	19	90	32	19	*SW	8.0
9	33	25	98	33	24	100	35	23	*SSE	11.0
10	31	24	74	29	22	72	44	23	NW	11.3
11	44	24	56	38	22	66	41	23	NE	11.3
12	38	34	72	40	32	60	40	31	*ESE	10.3
13	40	32	80	44	33	68	44	34	*SE	6.0
14	53	29	50	48	27	64	52	30	NNE	11.3
15	44	28	71	44	26	84	46	28	WNW	9.7
16	43	27	80	44	26	64	46	26	W	7.7
17	41	23	98	44	26	59	42	26	*SE	8.3
18	30	21	98	37	21	75	36	22	*S	5.7
19	35	26	86	38	24	84	37	22	*WSW	11.0
20	34	27	90	34	26	84	34	26	*SW	7.7
21	45	30	62	42	29	60	44	M	N	13.7
22	43	36	98	46	37	90	47	34	*ESE	9.0
23	38	30	94	40	27	100	37	33	*S	8.0
24	40	29	93	37	27	94	37	28	N	9.0
25	41	28	78	39	26	84	M	M	NNW	14.3
26	42	26	69	39	26	77	41	21	N	32.7
27	45	30	53	M	M	M	43	M	N	31.7
28	45	29	48	44	M	M	45	M	NNW	17.7
29	37	25	66	34	25	M	36	22	NW	11.0
30	36	26	91	34	M	M	35	25	W	15.0
31m	29	25	84	33	23	80	32	24	*SW	8.0

* - 11 days with Onshore Winds.

R.H. - Relative Humidity at 1300 B.S.T.

Table 15. May 1960 Air Temperature Comparison at 122 cm. Height.
Also listed are average wind directions and speeds at A34.0.

<u>Station</u>	<u>A34.0</u>			<u>A34.12</u>			<u>A34.7</u>		<u>Wind</u>	
<u>Day</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>Dir.</u>	<u>Speed</u>
1	37	28	97	36	28	83	42	26	WNW	11.3
2	35	26	100	44	28	62	45	26	*SW	10.0
3	38	24	90	48	28	61	48	25	*SW	9.3
4	37	26	94	46	26	60	43	27	*SSE	6.3
5	35	26	100	51	25	65	49	26	*S	7.3
6	57	30	46	56	30	54	57	28	WNW	12.7
7	54	30	86	54	32	62	55	30	N	13.7
8	50	33	60	47	33	72	49	33	N	23.7
9	52	33	60	49	33	67	52	33	N	17.0
10	42	33	100	55	31	66	55	35	*WSW	13.3
11	34	31	95	41	30	66	41	31	*SE	6.3
12	34	28	99	42	29	85	43	29	*SSE	7.0
13	49	30	78	48	29	57	52	27	*SW	13.0
14	45	34	67	39	31	74	43	30	N	17.3
15	42	33	74	40	29	69	43	35	N	16.7
16	43	27	67	42	27	56	44	31	WNW	12.0
17	37	26	88	45	27	72	43	25	*ESE	9.0
18	34	31	100	36	31	100	37	31	*SSE	9.3
19	34	31	100	36	29	98	38	33	*SE	9.0
20	47	30	90	59	28	67	56	29	*S	5.3
21	50	33	98	55	35	93	54	32	*S	9.3
22	37	33	100	39	36	93	39	34	*SE	11.7
23	37	34	100	38	34	92	38	34	*SSE	14.3
24	43	33	100	44	34	98	46	35	*SW	6.0
25	46	37	99	45	35	83	46	37	N	17.0
26	45	35	100	45	34	93	46	34	ENE	9.3
27	40	32	100	45	34	96	47	34	*WSW	7.7
28	44	33	86	51	32	64	49	36	*SW	6.3
29	38	28	100	50	28	87	45	28	*S	4.3
30	52	34	100	59	34	54	53	33	*SW	5.3

* - 20 days with Onshore Winds.

R.H. - Relative Humidity at 1300 B.S.T.

Table 16. June 1960 Air Temperature Comparison at 122 cm. Height.

Station	A34.0			A34.12			A34.7		Wind		Sea Temp.
Day	Max	Min	R.H.	Max	Min	R.H.	Max	Min	Dir.	Speed	1900 BST
1	67	36	54	66	43	53	63	40	N	19.0	
2	57	38	71	56	38	64	56	38	N	28.3	
3	52	37	68	54	35	66	50	35	N	20.0	
4	48	36	84	49	33	85	48	33	NNW	14.3	
5	45	33	73	44	33	60	45	32	NW	11.7	34
6	45	35	81	44	34	74	48	34	NW	14.3	34
7	50	34	76	57	32	59	61	33	*WSW	16.3	36
8	38	30	100	44	29	100	54	29	*SE	6.7	35
9	55	28	75	59	29	54	58	26	*S	4.3	39
10	51	44	100	57	47	97	58	45	*ESE	13.0	38
11	46	40	100	50	45	100	51	44	*ESE	11.7	40
12	46	43	100	48	43	100	49	44	*ESE	9.3	41
13	54	36	100	59	42	80	59	43	*S	6.7	43
14	60	42	67	60	40	59	62	40	WNW	14.7	44
15	48	42	100	61	40	50	60	39	*SW	12.0	42
16	59	38	53	57	35	49	58	35	N	16.7	42
17	54	37	75	63	35	47	60	32	*ESE	6.3	46
18	53	47	95	60	43	76	62	46	*SE	6.7	45
19	50	46	100	54	43	100	52	45	*SSE	10.7	44
20	52	44	94	61	42	82	58	44	*S	5.0	47
21	68	44	60	65	42	61	66	39	N	18.3	47
22	65	48	57	63	45	55	64	46	N	23.7	49
23	68	44	51	62	42	49	66	43	N	25.7	50
24	60	41	59	58	40	56	59	41	N	28.7	46
25	67	40	42	65	38	44	66	38	N	20.7	45
26	72	44	57	70	43	52	70	41	NE	13.0	49
27	63	45	86	67	42	78	67	46	*SSE	6.0	56
28	62	52	90	64	50	84	65	52	NE	9.0	56
29	65	42	75	65	42	73	65	42	N	12.3	55
30	60	40	55	59	37	63	59	38	N	24.0	48
31	54	40	63	53	36	66	54	38	N	24.7	50

* - 13 days with Onshore Winds.

R.H.- Relative Humidity at 1300 B.S.T.

Table 17. July 1960 Air Temperatures at 122 cm. Height.

Station	A34.0			A34.12			A34.7		Wind		Sea-Surface
Day	Max	Min	R.H.	Max	Min	R.H.	Max	Min	Dir.	Speed	Temps. 1900 BST
1	51	38	67	50	36	66	50	36	N	19.0	40
2	50	36	67	49	32	65	51	36	NW	10.3	40
3	58	32	79	58	30	48	59	28	NW	13.0	46
4	68	40	62	67	37	37	69	34	NNW	12.7	48
5	57	49	81	58	45	80	59	43	*E	8.3	50
6	55	49	92	57	44	77	58	46	*SE	9.0	51
7	52	42	97	51	45	100	56	45	*SW	11.0	52
8	49	41	97	49	40	90	51	40	*SSE	11.7	52
9	51	47	100	50	44	M	51	45	*S	18.7	52
10	56	49	100	54	48	100	54	46	*SSE	19.3	53
11	64	49	76	68	46	50	68	46	*E	7.7	51
12	62	46	75	62	46	75	63	45	N	17.0	54
13	66	47	74	63	45	70	65	43	N	14.7	53
14	58	35	49	55	34	49	58	45	NNE	27.7	-
15	42	32	72	42	31	72	43	30	N	33.3	48
16	46	33	70	43	32	68	44	31	N	28.3	48
17	58	34	66	56	33	65	59	33	N	17.3	48
18	58	39	55	57	36	55	59	33	N	11.7	48
19	60	38	54	58	35	54	59	37	N	14.0	48
20	57	34	67	62	34	46	64	28	*NW	9.7	50
21	64	33	77	65	34	M	67	30	*NW	13.3	50
22	55	32	82	63	34	54	59	29	*NW	7.7	50
23	52	32	96	52	32	82	52	31	*S	6.3	51
24	51	42	100	51	44	M	49	42	*SSE	19.7	51
25	53	49	93	53	44	80	54	45	*SE	20.0	52
26	53	48	92	52	48	77	53	40	*SE	7.7	-
27	52	44	94	53	42	M	51	43	*WSW	9.7	-
28	55	42	65	52	41	M	54	40	N	20.7	44
29	51	34	66	52	33	57	50	32	N	22.7	44
30	53	34	76	51	32	M	51	32	N	11.7	-
31	48	39	80	45	33	90	47	34	NNE	9.0	38

* - 15 days with Onshore Winds.

R.H. - Relative Humidity at 1300 B.S.T.

Table 18. August 1960 Air Temperature Comparison at 122 cm. Height.

<u>Station</u>	<u>A34.0</u>			<u>A34.12</u>			<u>A34.7</u>		<u>Wind</u>		<u>Sea-Surface</u>
<u>Day</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>R.H.</u>	<u>Max</u>	<u>Min</u>	<u>Dir.</u>	<u>Speed</u>	<u>Temps.</u> <u>1900 BST</u>
1	41	33	90	40	36	100	41	37	N	28.3	48
2	39	32	74	37	30	90	39	29	N	30.3	46
3	47	30	77	45	29	65	48	30	NNW	15.7	45
4	39	26	64	37	26	63	38	26	N	21.3	45
5	43	26	57	47	26	40	45	24	*NNW	12.7	44
6	40	23	83	40	23	74	38	20	*SSE	10.7	44
7	47	34	70	47	30	M	48	29	*N	13.3	44
8	43	32	88	42	31	90	42	30	N	16.0	45
9	36	26	75	36	28	76	36	30	N	22.7	45
10	35	25	68	35	26	70	35	24	N	30.0	44
11	38	26	72	37	26	72	38	25	N	26.0	44
12	38	28	80	36	31	82	38	26	N	29.0	43
13	38	27	78	40	30	70	38	30	N	11.3	43
14	40	24	74	41	24	62	39	24	N	2.7	40
15	37	21	100	38	23	97	37	17	*SSE	8.3	44
16	37	31	92	39	30	92	39	28	*W	10.7	43
17	36	30	84	37	29	90	40	29	NW	10.0	40
18	35	30	91	36	31	84	34	23	*E	10.0	40
19	34	30	100	32	29	100	32	29	E	14.3	39
20	32	20	90	30	19	94	34	22	N	19.3	42
21	28	19	72	26	18	80	28	17	N	28.3	40
22	29	16	67	26	16	73	28	16	NNE	31.0	40
23	29	16	76	27	16	82	22	16	N	23.3	40
24	29	19	81	28	18	87	33	14	N	28.3	40
25	39	16	95	35	13	97	42	12	*SE	17.3	41
26	44	34	100	37	33	100	38	34	*SE	30.0	40
27	40	37	96	37	32	100	38	28	*SW	13.0	40
28	40	32	70	37	29	77	35	27	*S	5.0	42
29	37	34	98	37	34	100	37	30	*E	22.7	40
30	38	36	95	40	32	M	38	33	ENE	35.7	40

* - 11 days with Onshore Winds.

R.H. - Relative Humidity at 1300 B.S.T.

Table 19. September 1960 Air Temperature Comparison at 122 cm. Height.

Station	A34.1	A34.2	A34.3	A34.4	A34.5	A34.6	A34.7	A34.8	A34.9	A34.10	A34.11	A34.12
<u>Mean Temperatures</u>												
50 cm.												46.7
5 cm.	49.0	47.5	49.1	50.1	49.5	47.0	46.8	48.1	47.3	48.1	48.0	47.1
-5 cm.	44.7	42.6	42.7	44.8	40.6	42.3	38.8	40.2	41.8	44.5	40.0	41.8
-10 cm.		41.2	41.1		41.1		37.6				39.4	41.0
-20 cm.		39.1	38.3		35.5		35.3				38.0	37.8
-50 cm.		37.6	37.0		32.4		30.9				35.1	32.8
<u>Mean Maximum Temperatures</u>												
50 cm.												57.2
5 cm.	61.4	58.9	61.7	63.1	60.4	57.6	59.8	63.0	60.0	58.8	61.1	59.2
-5 cm.	48.8	45.9	45.5	50.5	41.4	45.8	39.3	42.4	44.4	47.3	40.5	43.2
-10 cm.		42.6	42.1		41.8		37.8				39.8	41.5
-20 cm.		39.3	38.4		36.1		35.5				38.6	38.4
-50 cm.		38.5	37.4		33.1		31.1				35.9	32.8
<u>Mean Minimum Temperatures</u>												
50 cm.												36.1
5 cm.	36.6	36.1	36.4	37.1	38.1	36.4	33.8	33.1	34.6	37.4	34.9	34.9
-5 cm.	40.6	39.2	39.9	39.7	39.7	38.6	38.2	37.9	39.1	41.6	39.4	40.4
-10 cm.		39.8	40.1		40.3		37.3				38.9	40.5
-20 cm.		38.9	38.1		34.9		34.8				37.8	37.3
-50 cm.		36.6	36.5		31.7		30.7				34.3	32.7
<u>Mean Temperature Fluctuations (Max minus Min)</u>												
50 cm.												21.1
5 cm.	24.8	22.8	25.3	26.0	22.3	21.2	26.0	29.9	25.4	21.3	26.2	24.3
-5 cm.	8.2	6.8	5.6	10.1	1.7	7.3	1.1	4.5	5.4	5.7	1.1	2.8
-10 cm.		2.8	2.0		1.5		0.5				0.9	1.0
-20 cm.		0.4	0.3		1.2		0.7				0.8	1.1
-50 cm.		1.9	0.9		1.4		0.4				1.6	0.1

Table 20. Mean Temperature Data, August 13-31, 1960.

Station	A34.1	A34.2	A34.3	A34.4	A34.5	A34.6	A34.7	A34.8	A34.9	A34.10	A34.11	A34.12
<u>Mean Temperatures</u>												
50 cm.												34.6
5 cm.	36.5	36.3	38.1	37.6	36.6	34.8	34.8	38.0	35.3	36.2	36.3	36.5
-5 cm.	33.5	33.6	35.3	33.9	33.5	33.6	33.5	34.8	33.5	35.3	33.7	33.3
-10 cm.		32.8	33.5		33.8		33.2				33.8	35.0
-20 cm.		32.6	32.9		32.3		32.5				33.2	32.6
-50 cm.		33.7	34.0		31.5		30.1				32.5	32.6
<u>Mean Maximum Temperatures</u>												
50 cm.												42.7
5 cm.	48.0	46.2	49.2	47.3	47.2	43.3	45.0	51.1	45.3	46.8	47.1	47.2
-5 cm.	36.3	35.4	37.3	36.8	33.8	35.6	33.7	36.4	36.0	37.8	34.7	33.8
-10 cm.		33.5	34.0		34.3		33.4				33.9	35.2
-20 cm.		32.7	33.0		32.3		32.5				33.5	32.7
-50 cm.		34.2	34.1		32.2		30.2				32.9	32.6
<u>Mean Minimum Temperatures</u>												
50 cm.												26.4
5 cm.	25.0	26.3	27.0	27.8	25.9	26.2	24.6	24.8	25.3	25.6	25.4	25.7
-5 cm.	30.6	31.7	33.3	31.0	33.1	31.5	33.2	31.6	30.9	32.8	32.6	32.7
-10 cm.		32.1	33.0		33.4		33.0				33.6	34.8
-20 cm.		32.5	32.8		32.3		32.5				32.9	32.4
-50 cm.		33.2	33.8		30.8		30.0				32.1	32.5
<u>Mean Temperature Fluctuations (Max minus Min)</u>												
50 cm.												16.3
5 cm.	23.0	19.9	22.2	19.5	21.3	17.1	20.4	26.3	20.0	21.2	21.7	21.5
-5 cm.	5.7	3.7	4.0	5.8	0.7	4.1	0.5	4.8	5.1	5.0	2.1	1.1
-10 cm.		1.4	1.0		0.9		0.4				0.3	0.4
-20 cm.		0.2	0.2		0.0		0.0				0.6	0.3
-50 cm.		1.0	0.3		1.4		0.2				0.8	0.1

Table 21. Mean Temperature Data, September 1-15, 1960.

Station	<u>A34.1</u>	<u>A34.2</u>	<u>A34.3</u>	<u>A34.4</u>	<u>A34.5</u>	<u>A34.6</u>	<u>A34.7</u>	<u>A34.8</u>	<u>A34.9</u>	<u>A34.10</u>	<u>A34.11</u>	<u>A34.12</u>
<u>Mean Temperatures</u>												
50 cm.												26.8
5 cm.	28.0	28.8	31.0	30.2	29.4	27.2	28.3	(30.2)	(29.6)	(28.4)	27.4	28.7
-5 cm.			30.3		30.9		31.0		29.3		31.1	31.6
-10 cm.		29.8	30.2		31.6		31.1		30.2		31.0	32.2
-20 cm.		30.0	29.8		31.2		31.3		27.1		30.5	30.3
-50 cm.		31.7	32.1		30.5		29.6		29.3		30.2	31.7
<u>Mean Maximum Temperatures</u>												
50 cm.												33.8
5 cm.	35.0	34.8	38.2	38.1	37.8	33.9	36.0	(38.5)	37.4	(35.3)	34.8	35.9
-5 cm.			31.0		30.9		31.1		29.5		31.4	31.6
-10 cm.		29.8	30.2		31.6		31.1		30.2		31.0	32.2
-20 cm.		30.0	29.8		31.4		31.3		27.1		30.7	30.3
-50 cm.		31.7	32.1		30.5		29.6		29.3		30.3	31.7
<u>Mean Minimum Temperatures</u>												
50 cm.												19.9
5 cm.	21.0	22.7	23.7	22.2	21.0	20.5	20.6	21.8	(21.8)	21.5	20.0	21.5
-5 cm.			29.5		30.9		30.9		29.0		30.8	31.6
-10 cm.		29.8	30.1		31.6		31.1		30.2		30.9	32.2
-20 cm.		30.0	29.8		31.0		31.3		27.1		30.3	30.3
-50 cm.		31.6	32.0		30.5		29.6		29.3		30.0	31.7
<u>Mean Temperature Fluctuations (Max minus Min)</u>												
50 cm.												13.9
5 cm.	14.0	12.1	14.5	15.9	16.8	13.4	15.4	16.7	15.6	13.8	14.8	13.9
-5 cm.			1.5		0.0		0.2		0.5		0.6	0.0
-10 cm.		0.0	0.1		0.0		0.0		0.0		0.1	0.0
-20 cm.		0.0	0.0		0.4		0.0		0.0		0.4	0.0
-50 cm.		0.1	0.1		0.0		0.0		0.0		0.3	0.0

() indicates estimate.

Table 22. Mean Temperature Data, September 16-30, 1960.

Station	A34.1	A34.2	A34.3	A34.4	A34.5	A34.6	A34.7	A34.8	A34.9	A34.10	A34.11	A34.12
<u>Mean Temperatures</u>												
50 cm.												19.7
5 cm.	20.4	22.1	21.0	20.7	20.5	19.6	20.7	20.3	19.8	19.7	20.6	19.5
-5 cm.			26.8		25.6		27.4		25.1		28.8	27.1
-10 cm.		26.5	27.1		26.8		28.2		27.3		28.9	29.0
-20 cm.		29.0	28.4		30.5		30.3		26.7		29.7	29.1
-50 cm.		30.8	31.3		30.4		29.0		29.1		29.3	30.9
<u>Mean Maximum Temperatures</u>												
50 cm.												26.7
5 cm.	28.3	30.0	30.2	29.3	29.1	26.7	27.3	29.8	29.3	28.1	28.5	27.1
-5 cm.			27.8		26.6		27.9		26.2		29.3	28.6
-10 cm.		27.0	27.6		27.6		28.6		27.8		29.3	29.2
-20 cm.		29.2	28.8		31.0		30.6		26.7		30.0	29.4
-50 cm.		31.1	31.4		30.4		29.2		29.1		29.3	30.9
<u>Mean Minimum Temperatures</u>												
50 cm.												12.6
5 cm.	12.5	14.2	11.8	12.0	(11.8)	12.5	14.0	10.8	10.2	11.2	12.6	11.9
-5 cm.			25.7		24.6		26.8		23.9		28.2	25.6
-10 cm.		26.0	26.6		26.0		27.7		26.8		28.5	28.7
-20 cm.		28.8	28.0		29.9		29.9		26.7		29.3	28.7
-50 cm.		30.4	31.2		30.3		28.8		29.0		29.3	30.9
<u>Mean Temperature Fluctuations (Max minus Min)</u>												
50 cm.												14.1
5 cm.	15.8	15.8	18.4	17.3	17.3	14.2	13.3	19.0	19.1	16.9	15.9	15.2
-5 cm.			2.1		2.0		1.1		2.3		1.1	3.0
-10 cm.		1.0	1.0		1.6		0.9		1.0		0.8	0.5
-20 cm.		0.4	0.8		1.1		0.7		0.0		0.7	0.7
-50 cm.		0.7	0.2		0.1		0.4		0.1		0.0	0.0

Table 23. Mean Temperature Data, October 1-14, 1960.

<u>Station No.</u>		<u>A34.1</u>	<u>A34.2</u>	<u>A34.3</u>	<u>A34.4</u>	<u>A34.5</u>	<u>A34.6</u>	<u>A34.7</u>	<u>A34.8</u>	<u>A34.9</u>	<u>A34.10</u>	<u>A34.11</u>	<u>A34.12</u>
8/13-31	5 cm.	79/29	76/29	83/28	79/30 $\frac{1}{2}$	86/30	71/28 $\frac{1}{2}$	75/23	81/17	73/25	77/30	80/19	71/27
	-5 cm.	54/36	52/35	51/36	60/34	46 $\frac{1}{2}$ /35	62/28 $\frac{1}{2}$	46/33	47/35	49/32	54 $\frac{1}{2}$ /37	45/35	51/34 $\frac{1}{2}$
9/1-15	5 cm.	55/17	52/17	60/21	56/22	57/20	52/20	54/12	63/15	56/16	52/18	54/18	57 $\frac{1}{2}$ /15
	-5 cm.	44/28	42/29	47/31	42/29	38 $\frac{1}{2}$ /31	42/27	38/30	42/28 $\frac{1}{2}$	46/26	46/31	37 $\frac{1}{2}$ /28	38/27
9/16-30	5 cm.	45/12	42/12	46/15	43/12	53/12	44/11	42/9	50/12 $\frac{1}{2}$	47/11	41/12	42/5	44/10
	-5 cm.	32 $\frac{1}{2}$ /R	33/R	33/27	35/R	32/20	33/R	31 $\frac{1}{2}$ /30	33/R	30/27	33/R	35/30	32/31
10/1-14	5 cm.	40/-1	40/1	39/ $\frac{1}{2}$	41/0	39/0	39/-2	40/0	42/-6 $\frac{1}{2}$	40/-3	39/-1 $\frac{1}{2}$	40/-2 $\frac{1}{2}$	40/-6
	-5 cm.			32/22		31/20		31 $\frac{1}{2}$ /23		32/20		32/21 $\frac{1}{2}$	32/18

R - Removed approximately 9/22/60 because of frozen ground.

Table 24. Highest Maximum and Lowest Minimum Temperatures Recorded at 5 and -5 cm.

Station	A34.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12
August												
13	(70)	70	68 $\frac{1}{2}$	77	66	64	65	69	67	61 $\frac{1}{2}$	67	66
14	61	60	60	58	58	65	69	75	67	62	71	67
15	62	57	60	61 $\frac{1}{2}$	58	57	59	63	59	57	60	58
16	48	45	46	47	47	44	46 $\frac{1}{2}$	47	47	45	48	45
17	63	61	62	63 $\frac{1}{2}$	61	53	50	52	55	54	54	51
18	67	60	66	70	68	62	65	66	62	63	62 $\frac{1}{2}$	61 $\frac{1}{2}$
19	65	60	63	66	60	61	64	66	61	63	61 $\frac{1}{2}$	61
20	69	70	83	75	86	62	62	65	64	65	67	65
21	79	76	74	79	82	69	75	81	71	67	70 $\frac{1}{2}$	70
22	74	69	74	78	75 $\frac{1}{2}$	70	74	80	73	77	78	71
23	63	58	61	74	60	71	71	80	70	70	80	71
24	55	52	55	55	52	56	55	60	54	53	58	54
25	51	53	55	55	54	49	50	51	48	49	51	49
26	57	57	58	55	53	55	58	51	55	54	56	55
27	57	57	59	58	58	55	56	60	55	56	56	57
28	55	51 $\frac{1}{2}$	54	54	53	52	53	56	62	51	54	57
29	(57)	56	56	53	51 $\frac{1}{2}$	51	55	56	54	56	58	55
30	(59)	54	59	59	54	49	52	54	58	54	52	55
31	57	52	59	61	51	50	56	61 $\frac{1}{2}$	58	56	56	54
Sept 1960												
1	53	50	48	51	44	48	52	55	50	50	54	52
2	42	40	41 $\frac{1}{2}$	41 $\frac{1}{2}$	43	41	43	38	41	43	43	46
3	50	50	48 $\frac{1}{2}$	50	57	46	41	45	51	50	53	52
4	55	50	52	56	47	50	54	57	48	52	53	53
5	50	50	58	52	48	41	42	51	50	52	48	43 $\frac{1}{2}$
6	55	50	60	51	54	53	53	58	56	52	52	57 $\frac{1}{2}$
7	52	52	57	54	55							
8	54	47	52	46	55	52	52 $\frac{1}{2}$	63	55	50	54	52
9	45	45	45	44	43	43	44	52	43	46	46	43
10	41	42	43	38	41	37	38	43	36	38	40	39
11	45	42	44	40	42	35	37	41	37	38	39	37
12	46	43	43	42	41	39 $\frac{1}{2}$	39	46	40	42	43	43
13	41	41	45	43	40	39	42	47	40	43	40	43
14	39	40	46	48	50	(43)	47	61	39	48	52	48
15	52	51	55	50	48	(38)	46	58	48	51	43	52

() indicates estimate.

Table 25. Maximum Temperatures at 5 cm. August 13-September 15, 1960.

Station	A34.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12
Sept.												
16	30	34	42	43	53	44	40	(50)	47	41	42	41
17												
18	42	42	46	42	43	44	42	(47)	42	40	41	43
19	43	41	45	43	51	35	40	(45)	39	36	39	36
20	33	34	34	35	32	32	33	(33)	36	34	38	33
21	25	25 $\frac{1}{2}$	33	36	32	27	27	(32)	28	28	24	32
22	24 $\frac{1}{2}$	24 $\frac{1}{2}$	32	35	28	26	32	(31)	31	(31)	26	28
23	33	32	39	35	28	27	32	(30)	30 $\frac{1}{2}$	(30)	26	27
24	31	34	30	34	34	29	32	34	34	(29)	30	31
25	34	34	36	32	33	33	33	36	39	(33)	33	35
26												
27	39	38	39	42	41	37	40	42	41	(38)	38	40
28	41	(39)	42	39	39	36	42	40	40	(40)	39	40
29	45	40	43	43	42	37	40	45	42	(42)	40 $\frac{1}{2}$	44
30	34	35	36	36	35	34	35	36	37	(37)	36	37
October												
1	39	38	39	39	39	37	38	40	38	39	39 $\frac{1}{2}$	32 $\frac{1}{2}$
2	38	39	38 $\frac{1}{2}$	38	38	35	37 $\frac{1}{2}$	37	38	38	38	39
3	40	40	37	41	39	39	40	42	39	38	40	40
4												
5	37	37	39	39	39	36	37	38	40	37	37 $\frac{1}{2}$	36
8	23	31	21	21	21	2	23	27	21	21	24	21
9	24	24	21	21 $\frac{1}{2}$	21	16	14	21	20 $\frac{1}{2}$	20	15	18
10	16	17	23	22	24	20	19	21	21	21	21	20
11	21	22	23	21	20	21	22	22	21	21	23	20
14	17	22	30	22	21	16	16	21	25	18 $\frac{1}{2}$	19	18
21	35	30	32	32	30	32	31	35	31 $\frac{1}{2}$	31	32 $\frac{1}{2}$	28
28	30	28				31	28	31	31		31	30

() indicates estimate.

Table 26. Maximum Temperatures at 5 cm. Sept. 16-October 1960.

Station	A34.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12
August												
13	(52)	51	51	60	46 $\frac{1}{2}$	62	46	47	(49)	54 $\frac{1}{2}$	45	51
14	53	52	51	54	46 $\frac{1}{2}$	48	45 $\frac{1}{2}$	46	49	52	44	49 $\frac{1}{2}$
15	48	47	46 $\frac{1}{2}$	50 $\frac{1}{2}$	45	46	43	44	46	50	41	46
16	42	40	38	41	36 $\frac{1}{2}$	41 $\frac{1}{2}$	37 $\frac{1}{2}$	41	40 $\frac{1}{2}$	44 $\frac{1}{2}$	37 $\frac{1}{2}$	35 $\frac{1}{2}$
17	45	41	43	47	37	39 $\frac{1}{2}$	37 $\frac{1}{2}$	39	38 $\frac{1}{2}$	41 $\frac{1}{2}$	36 $\frac{1}{2}$	36
18	50	44	45 $\frac{1}{2}$	50	40	43	36	41	42	44	38 $\frac{1}{2}$	41
19	53	45	46	50	41	45	37	37 $\frac{1}{2}$	45	47	39	43
20	51	45	48	52	42	45	37	43	45	47 $\frac{1}{2}$	40	43
21	54	46 $\frac{1}{2}$	47	56	42 $\frac{1}{2}$	47	37	43 $\frac{1}{2}$	48	50	40	43 $\frac{1}{2}$
22	54	46 $\frac{1}{2}$	48	54	42 $\frac{1}{2}$	47	37	43	47	50	41	44
23	54	46	46	50	42 $\frac{1}{2}$	48	37 $\frac{1}{2}$	43	(47)	50	41	45
24	47	45	45	50	41	46	38	41	(44)	46	41 $\frac{1}{2}$	42 $\frac{1}{2}$
25	46	45	43 $\frac{1}{2}$	50	41 $\frac{1}{2}$	45	37 $\frac{1}{2}$	42	43	45	41 $\frac{1}{2}$	42 $\frac{1}{2}$
26	47	49	46	50	41	46	39 $\frac{1}{2}$	44	46	48	42	44 $\frac{1}{2}$
27	49	49	46	54	41	46	41 $\frac{1}{2}$	44	45	47	43	45 $\frac{1}{2}$
28	49	48	46	(51)	41	45	41	41	44	46	42 $\frac{1}{2}$	45
29	46	46	44	(50)	41 $\frac{1}{2}$	45	40 $\frac{1}{2}$	43	43	46	40	42
30	43	42	42	(45)	39	43	38 $\frac{1}{2}$	41	41	45	37 $\frac{1}{2}$	43
31	44	45	42	45	39	43	38 $\frac{1}{2}$	42	41	45 $\frac{1}{2}$	38	38 $\frac{1}{2}$
September												
1	44	42	42	39	38	42	38	42	40	43	37 $\frac{1}{2}$	36 $\frac{1}{2}$
2	40	39	38 $\frac{1}{2}$	40	38 $\frac{1}{2}$	39	38	39	39	41	37	38
3	40	36	36 $\frac{1}{2}$	38	35	38	35	38	41	39	35	34
4	39	39	42	39	37	40	36	41	46	46	37	34
5	36	33 $\frac{1}{2}$	37 $\frac{1}{2}$	35	33 $\frac{1}{2}$	36	33 $\frac{1}{2}$	37	35	41	33 $\frac{1}{2}$	34 $\frac{1}{2}$
6	36	35	39	35 $\frac{1}{2}$	33	35	33	36	35	41	33	36
7	38	35	39 $\frac{1}{2}$	42	34							
8	39	36	39 $\frac{1}{2}$	40	34	36	33	36	36	39	36	33 $\frac{1}{2}$
9	37	37	36	40	34	35	33	37	36	38	35	33 $\frac{1}{2}$
10	36	34	47	34	32 $\frac{1}{2}$	34	33	35	34	36	37	33
11	32	32	32	33	31	33	32 $\frac{1}{2}$	34	33	33	32 $\frac{1}{2}$	32 $\frac{1}{2}$
12	32	33	32 $\frac{1}{2}$	34	31 $\frac{1}{2}$	32	32	33	33	33	32	32
13	32	33	32	34	31	32	32	33	33	33	32	32
14	32	33	32	35	31 $\frac{1}{2}$	33	32	34	33	33	33 $\frac{1}{2}$	32 $\frac{1}{2}$
15	32	33	34	34	32	33	31	34	30	33	35	31 $\frac{1}{2}$
16	32	32	31	33	31 $\frac{1}{2}$	33	31 $\frac{1}{2}$	33	30	33	35	32
17												
18	33	33	31	33 $\frac{1}{2}$	32	33	31 $\frac{1}{2}$	33	30	32	32 $\frac{1}{2}$	32
19	32 $\frac{1}{2}$	32 $\frac{1}{2}$	33	35	31 $\frac{1}{2}$	32	31	32	30	33	32	32
20	32	32	32	33	31 $\frac{1}{2}$	32	31	32	30	32	31	31 $\frac{1}{2}$

() indicates estimate.

Table 27. Maximum Temperatures at -5 cm. Aug. 13-Sept. 20, 1960.

Station	A34.1	.2	.3	.4	.5	.6	.7	.8	.9	.10	.11	.12
Sept.												
21	32		31		31	32	31	33	29½	32	31	31
22			30½		31	32	31	32	29	32	31	31
23			30		30	32	31	32	28		31	31
24			30		30	32	31		28½		30½	31
25			30		30	33	31		28½		30½	31
26												
27			30		31		31		30		30	32
28			31		31		31		30		31½	32
29			32		31		31		30		31½	32
30			32		30½		31		30		31	32
October												
1			32		30½		31		30		32	32
2			32		31		31½		30½		31½	32
3			32		31		31		32		31	32
4												
5			32		30		31		32		31	31
8			24		24		30½		22		30½	32
9			24		24		23½		22		28½	26
10			24		23		24		23		26	24
11			25		23		24		23		27	24
14			25		23		25		23½		27	24
21	27	27	29	28	30		28	31	27		29	30
28	28	26				27	27	25			28	24

Table 28. Maximum Temperatures at -5 cm. Sept.16-October 1960.

A34.2	A u g u s t						S e p t e m b e r						O c t o b e r						1960	
	.3	.5	.7	.11	.12	.2	.3	.5	.7	.9	.11	.12	.2	.3	.5	.7	.9	.11	.12	
1						38	38	39	36½		37	37	30	30	31	31	30	31	32	
2						36½	35½	38½	36		36	38	30	30	31	31	30	31	31½	
3						34	34½	36	35		35	37½	30	30	32	31	30	31	32	
4						36½	38½	37	37½		35½	35½								
5						33½	34	34½	33		34	35½	29½	30	31	31	30	31	30	
6						33½	35	33	33		34	35								
7						34½	35½	34												
8						35	36	33½	32½		34½	35	30	26	24	31	26	30	32	
9						33	33	35	32½		34	35	24	25	24	25	26	29	28	
10						33	34	34	32		34	36	24	25	25	25	26	27	26	
11						31	31½	32	32		32½	34	23	26	25½	25	26	27	26	
12						31	31½	32	32		32	33½								
13	48	47½	46½	42½	44	48½	31	31	31½	32	32	33½								
14	48	48	48	42	43	47½	30½	31½	32	32	32	34	23	26	25	27	26	27	25	
15	44	42½	46	40½	41	45½	32	31	32	31½	31	33								
16	37½	37	40	37	37½	37	30	30	32	31½	30½	32								
17	39	39	37	37	36	36														
18	42	41	40	35	38	38½	30	30	32	31½	32	31	32½							
19	42	42	40½	36	39	40	30	30½	32	31½	30½	32	33							
20	43	42	41	36	39½	40	30	31	31½	31½	30	31	32½							
21	43	40½	41½	36½	40	40	30	31½	31½	31	30	30	32	30	28	30	28½	27	30	29
22	43½	42	42	36½	40	40½	29½	29	31½	30½	30	30½	32½							
23	43	42½	42	36½	40	41	29	30	31	30½	30	30½	32							
24	41½	42	41½	36½	40	41	29½	30	31	31	30	31	32							
25	42½	41½	41	37	40	41	29½	30	31½	31	30	31	32							
26	44	43	41	37	41	42														
27	44½	43½	42	38½	42	43	30	30	32	31	30	31	32							
28	44	45	42	40	42	43½	30	30	31½	31	30	31	32	26		28		30	28	
29	42	42	43	39	39½	43	30	30	31½	31	30	31	32							
30	39	39½	39½	39	37½	42	30	30	31½	31	30	31	32							
31	39	39	39½	36½	37	38														

Table 29. Maximum Temperatures at -10 cm.

A34.2	A u g u s t						S e p t e m b e r						O c t o b e r						1960	
	.3	.5	.7	.11	.12	.2	.3	.5	.7	.9	.11	.12	.2	.3	.5	.7	.9	.11	.12	
1						36	37½	34½	34½		36	35½	30	30	31	31	27	31	30	
2						35½	36	33½	34		35½	35	30	30	31	31	27	31	30	
3						34	34½	33	33½		36	35		30	32	31	27	31	30	
4						33½	34	33	33½		35½	33								
5						33	33½	30½	32½		33	32½	30	30	32	32	27	30	30	
6						33	33	32	32		33½	33								
7						32½	32½	32½												
8						32½	33	32½	32		34	32½	30	26	30	32	27	30	30	
9						32	33	32½	32		33	32	28	26	30	29	27	27	29	
10						32½	32	32	31½		33	32	28	29	31	29	26	30	29	
11						31½	32	32	32		32	31½	29	29	31	30	26	30	29	
12						31½	32	32	32		31½	31½								
13	43	42	38	36½	41	44	31	30½	31½	32	31½	31½								
14	43	41½	37	36½	40½	43	31	30½	31½	32	32½	31½	28	29	31	30	26	30	28	
15	42	41	37	35	39½	40½	30½	31	31½	31½	28½	32								
16	38½	37½	35	34	37	37	30½	30½	32	32	28	31½	31							
17	37	36½	34½	33½	35½	35														
18	37½	36½	35	34	36½	35½	30½	30½	31½	32	27½	32	31							
19	38½	37	35½	35	37	36½	30½	29	32	32	27½	31	31							
20	38½	37½	36	35½	37½	37½	30	29	31	31½	27	30	30½							
21	39	38	36	36	40	38	30	29	31	31	27	30	30	30	30	29½	25	28	29	
22	39	38	36½	36	40	37½	30	29	31	30½	26½	30	30							
23	38½	38	37	36	40	38	29½	30	31	30½	26½	30	30							
24	39	37½	36	35	39	37	30	30	31	31	27	30	30							
25	38½	38½	36	35½	40	37	29½	30	31	31	27	31	30							
26	40	39	36	36	39½	37½														
27	40	39	36	36½	40	40	29½	30	32	31	27	30	30							
28	40	39	36	37½	39½	40	29½	30	32	31½	27	31	30	30						
29	40	39	36	36	37½	40	30	30	32	31½	27	31	30							
30	37½	37½	37	36	36½	40	30	30	31	31	27	31	30							
31	36½	37½	35	34½	37	36½														

Table 30. Maximum Temperatures at -20 cm.

	A u g u s t						S e p t e m b e r						O c t o b e r					1960		
	<u>A34.2</u>	<u>.3</u>	<u>.5</u>	<u>.7</u>	<u>.11</u>	<u>.12</u>	<u>.2</u>	<u>.3</u>	<u>.5</u>	<u>.7</u>	<u>.9</u>	<u>.11</u>	<u>.12</u>	<u>.2</u>	<u>.3</u>	<u>.5</u>	<u>.7</u>	<u>.9</u>	<u>.11</u>	<u>.12</u>
1							36	36	32	30½		34	32	32	32	31	30	29	30	31
2							35½	35½	32½	30		34	32	32	32	31	30	29	30	31
3							35	35½	32½	30		34	32½		32	31	30	30	30	31
4							36	35	36	32		35	33½							
5							35	34½	33	30		33	33	32	32	31	31	29	30	31
6							36	34½	32	30		33	33							
7							34½	34	33											
8							35	34	32½	30½		34	33	32	31	30	30	29	30	31
9							33½	33½	32	30		32½	33	30	31	30	28	29	26	31
10							34	34	32½	30		33	32½	30	31	30	28	29	29	31
11							33	33½	31	30		32	33	30	31	30	28	29	30	31
12							32½	34	31	30		31½	32½							
13	41	39	33½	32	36	33	32½	33	31	30		31½	32							
14	40	39	34½	32	36½	33	32	32½	31	30		31	32½	30	31	30	28	29	29	30
15	39	37	34	30½	35½	32½	33	32½	31	30	30	31½	32							
16	37	36½	33	30	35½	32	31½	32½	30	30	30	31	32½							
17	37	36	32	30	35½	32														
18	37½	36½	36	30½	34½	32½	32	32	31	30	29	32	31½							
19	38	37	34½	31½	35½	32½	32	32½	31	30	29	31	32½							
20	39	37½	33½	31	36	32½	32	32	31	29	29	30	32							
21	39½	37½	33½	31½	36½	32½	31½	32	30	30	29	30	31½	31	31½	30	28½	29	28	31
22	40½	37½	33½	31½	36½	33	31	32	30	29	29	30	31½							
23	38½	37½	33½	31½	37½	33	31	32	30	29	29	30	31½							
24	38	37	32	31	37	33	31½	32	30	29	29	30	31½							
25	37	37	32	31½	37	33	32	31½	30	30	29½	30	32							
26	38	37½	32	31	36½	33														
27	38½	37½	32	31½	37½	33	31½	31½	30	29	30	30	31							
28	38	37½	32	31½	35	33	31½	33	31	30	30	30	31½	31			27		28	30
29	38	37½	33	31	34½	33	32	32	31	30	29	30	31½							
30	38	38	32	31	34½	33	32	32	31	30	29	30	31							
31	38½	37	32	30½	35	33½														

Table 31. Maximum Temperatures at -50 cm.