AIR TEMPERATURE AND PRECIPITATION DATA, 1967-88 WOLVERINE GLACIER BASIN, ALASKA

by Lawrence R. Mayo, Rod S. March, and Dennis C. Trabant

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square meter (m^2)	10.76	square foot
square kilometer (km^2)	0.3861	square mile
liter (L)	0.2642	gallon
kilogram (kg)	2.205	pound, avoirdupois
degree Celsius (°C)	°F = (°C x 1.8) + 32	degree Fahrenheit (°F)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 -- a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Mean Sea Level Datum of 1929.

SYMBOLS AND ABBREVIATIONS IN TEXT

Symbol	Description
b_a	Annual glacier mass balance, in meters water equivalent, averaged over the glacier surface.
$d\rho_s/dT$	Change in antifreeze density with change in temperature; in our case, a constant of -6.67×10^{-4} (kg/L)/°C.
$d\rho_s/dW$	Change in antifreeze density with water concentration, in kilograms per liter.
D_c	Distance, in millimeters, measured on chart record between the lower fixed pen trace and the upper fixed pen trace.
°C	Degrees Celsius.
f_g	Fraction of basin occupied by glacier.
g_a	Average annual gage catch of precipitation, in meters.
G_1	An interim component of gage height used in calculating gage height and defined by equation 5.
G_c	Distance, in millimeters, measured on chart record between the lower pen trace and the gage height pen trace.
G_t	Distance, in millimeters, between the instrument reference point and the gage height pen, measured with a steel tape during servicing visits.
H	Gage height, in millimeters, uncorrected for density variations; equal to 5 times the actual fluid depth in the storage tank, due to the 5:1 ratio of area of the tank to the orifice.
H_0	Initial gage height of antifreeze, in millimeters.
kg	Kilogram.
km	Kilometer.
L	Liter.
lap#	Lap number; an integer variable for each of the series of gage height pen traverses of the chart. It changes by one as the gage height pen direction reverses at the chart edge. Lap#1 contains the gage value of zero.
L_t	Average distance, in millimeters, between the instrument reference point and the lower fixed pen determined from measurements with a steel tape during servicing visits.
m	Meter.
mm	Millimeter.

Symbol	Description
n	Integer variable used with *lap#* to describe whether the pen is traversing the chart up or down. It is the same as the lap# if the lap# is an even integer and it is one less than the *lap#* if the lap# is an odd integer. Also used for the sample size.
p_b	Fraction of annual precipitation stored by glacier.
p_e	Precipitation gage catch efficiency compared with basin.
ρ_s	Antifreeze mixture density, in kilograms per liter.
ρ_w	Density of water, in kilograms per liter.
r_a	Annual basin runoff, in meters water equivalent.
r^2	Coefficient of determination.
R_i	Distance, in millimeters, between the instrument reference point and the gage height pen at lower reversal determined from measurements with a steel tape during servicing visits when the gage is pumped out and recharged.
S_e	Standard error of the estimate.
T	Air temperature, in degrees Celsius, measured with a calibration-grade thermometer.
T_s	Air temperature, in degrees Celsius, at Seward, Alaska.
T_w	Air temperature, in degrees Celsius, at Wolverine Glacier.
T_0	Temperature, in degrees Celsius, producing a density of 1.00 kg/L of antifreeze with any given water concentration.
U_i	Average distance, in millimeters, between the instrument reference point and the upper fixed pen; determined from measurements with a steel tape during servicing visits.
V_g	Gage height, in millimeters, at calibration point in lap#1.
W	Water concentration by volume, a ratio from 0 to 1.
W_0	Water concentration, W, rounded to one decimal place.
Y_c	Distance, in millimeters, measured from the chart between the lower fixed pen trace and the temperature pen trace.
Y_i	Distance, in millimeters, between the instrument reference point and the temperature pen at the time the trace was recorded.
yr	Year.

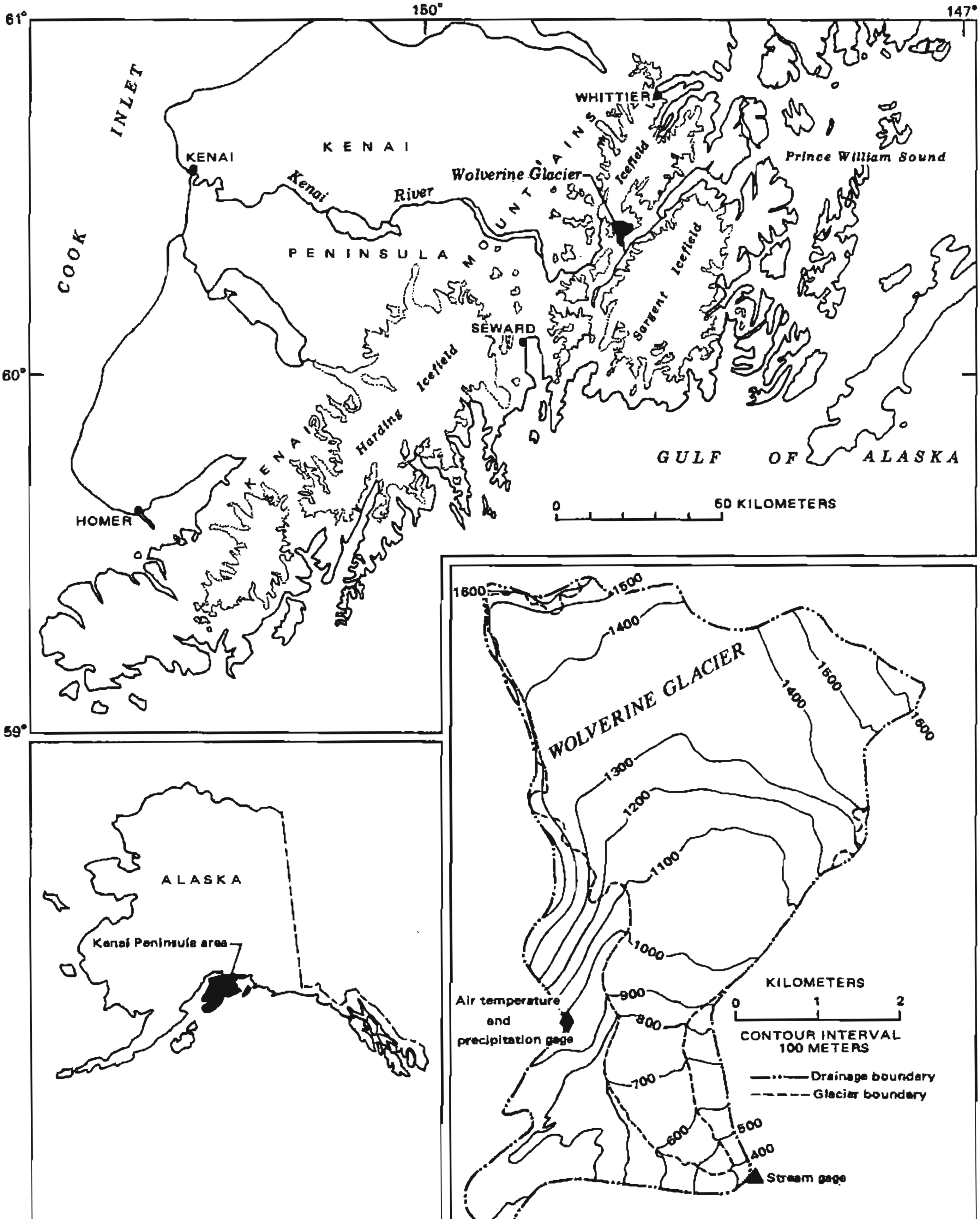

Figure 1.--Location of Wolverine Glacier and instrument sites in the drainage basin.

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ABSTRACT

An air temperature and storage precipitation gage, operated at a windy site at an altitude of 990 meters in the Wolverine Glacier basin from May 1967 to the present, provides long-term climate data near the average annual snowline in the glacierized mountains of south-central Alaska. To assure high quality information, data reduction techniques include corrections for changes in recorder paper size, instrument response to temperature, and density of self-mixing antifreeze. Daily precipitation catches and mean temperatures from the gage through September 1988 are presented in appendixes. To provide a continuous time series of data at monthly resolution, gaps in the record were estimated using climatological records from Seward, Alaska.

The precipitation catch was significantly less than the actual precipitation because of adverse effects of wind, despite orifice shielding. This and some sticking of snow in the gage orifice indicate that the relation between the precipitation catch and the true precipitation in the basin is complex. An analysis of published streamflow observations during a 10-year period indicates that precipitation averaged over the basin is about three times greater than the gage catch. Characteristics of the precipitation record, such as splash events, which are easily discernible on the analog chart and which could lead to errors if not identified, are discussed.

Mean annual air temperature at the Wolverine Glacier climatological station was -1.5°C (degree Celsius), and monthly mean temperatures were below 0°C about 60 percent of the time. Mean monthly temperatures ranged from -7.7°C in January to +7.2°C in July and August. Mean annual precipitation for the basin was 3.3 meters, but the average annual gage catch was 1.10 meters. Monthly average precipitation gage catch ranged from 39 millimeters in June to 154 millimeters in September. Monthly precipitation correlates positively with air temperature in winter, but negatively in summer.

INTRODUCTION

Glaciologic and hydrologic research began at Wolverine Glacier in April 1966 as part of the International Hydrological Decade program. The site is one link in a "chain of glaciers" from arctic Alaska to the Antarctic Peninsula to investigate processes of glacier mass balance (Anonymous, 1970). The glacier is located in the Kenai Peninsula in southern Alaska near the Gulf of Alaska (fig. 1), where the climate is subpolar-maritime. The glacier occupies 71 percent of a 24.6-km^2 drainage basin and is the southern member of a relatively small icefield, which is about 44 km in length.

An air temperature and precipitation gage (cover photo) at an altitude of 990 m in the basin provides climate information from May 1967. Data from the beginning of this record in 1967 to September 1988 are presented in this report. These observations are the only known long-term climate data in the highly glacierized mountains of south-central Alaska and at a height that is significantly above sea level and near the altitude of the average annual highest snowline (the equilibrium line) on glaciers in the region.

Purpose and Scope

The air temperature and precipitation measurements at Wolverine Glacier described in this report were made for the purpose of (1) studying climate variations at a glacier in southern Alaska, (2) determining dates of important glacier mass balance events and the values of important parameters such as snow balance at the end of a hydrologic year, and (3) investigating the effects of climatic variation on glacier behavior. Meier and others (1971), Fahl (1973), Tangborn and others (1977), Mayo and Trabant (1984), Mayo and others (1985), Trabant and Mayo (1985), Mayo and others (1988), and Mayo and March (1990) have analyzed some of the glaciologic processes at Wolverine Glacier.

Daily, monthly, and yearly values of air temperature and precipitation catch are given in this report as appendix 1 and appendix 2. Additional air temperature and precipitation information is available from the original analog charts which are archived at the U.S. Geological Survey's Water Resources Division Office in Fairbanks, Alaska. Meteorological events such as atmospheric waves and temperature inversions (fig. 2) and the passage of cold fronts (fig. 3) are not analyzed here but are recognizable on the analog charts. Although maximum and minimum temperatures recorded on the charts could be obtained, these values may not be reliable measures of true maximum and minimum air temperatures because the sensor's thermal lag is large compared with that of standard thermometers used for that purpose.

Acknowledgments

The air temperature and precipitation gage at Wolverine Glacier was modeled after a similar gage located at South Cascade Glacier, Washington, which was designed by W.V. Tangborn. Tangborn reviewed the Alaskan design. A.E. Helmers, U.S.D.A. Forest Service, shared his ideas about developing a successful windshield device at Lemon Creek Glacier near Juneau, Alaska, and this contributed to the design of the windshield at Wolverine Glacier. The gage was fabricated by Greer Tank and Welding[1] of Fairbanks and has repeatedly withstood hurricane-force winds for more than two decades. S.H. Jones helped install the gage. Chester Zenone and D.R. Scully assisted for years in operating the gage, which sometimes required exposure to unusually fierce weather. Several programs for data reduction were written by E.P. Weeks and Denvy Saxowsky. G.C. Hopkins extracted a large part of the data from the charts.

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[1] The use of brand, firm, or product names in this report is for identification purposes only, and does not constitute endorsement by the U.S. Geological Survey.

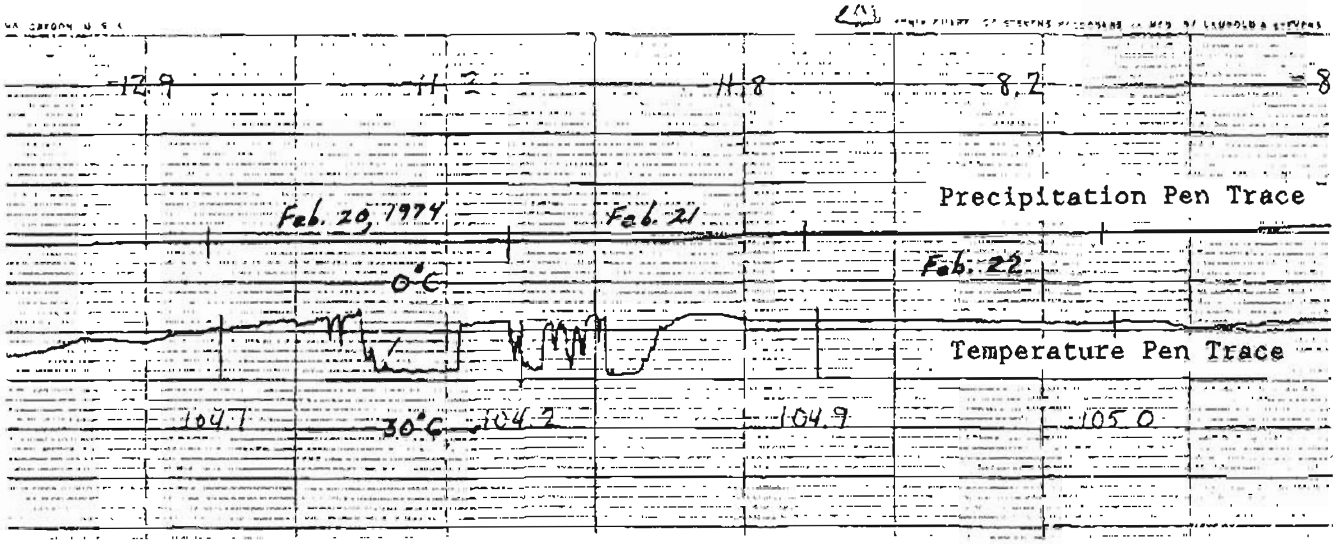

Figure 2.--Copy of gage chart February 19-22, 1974, showing an unusual temperature regime caused by a sharp temperature inversion between two air masses that moved up and down past the gage. Vertical marks are local midnight. Vertical scale is 10 mm of precipitation catch or 2°C per chart division. Numbers written on chart are chart readings.

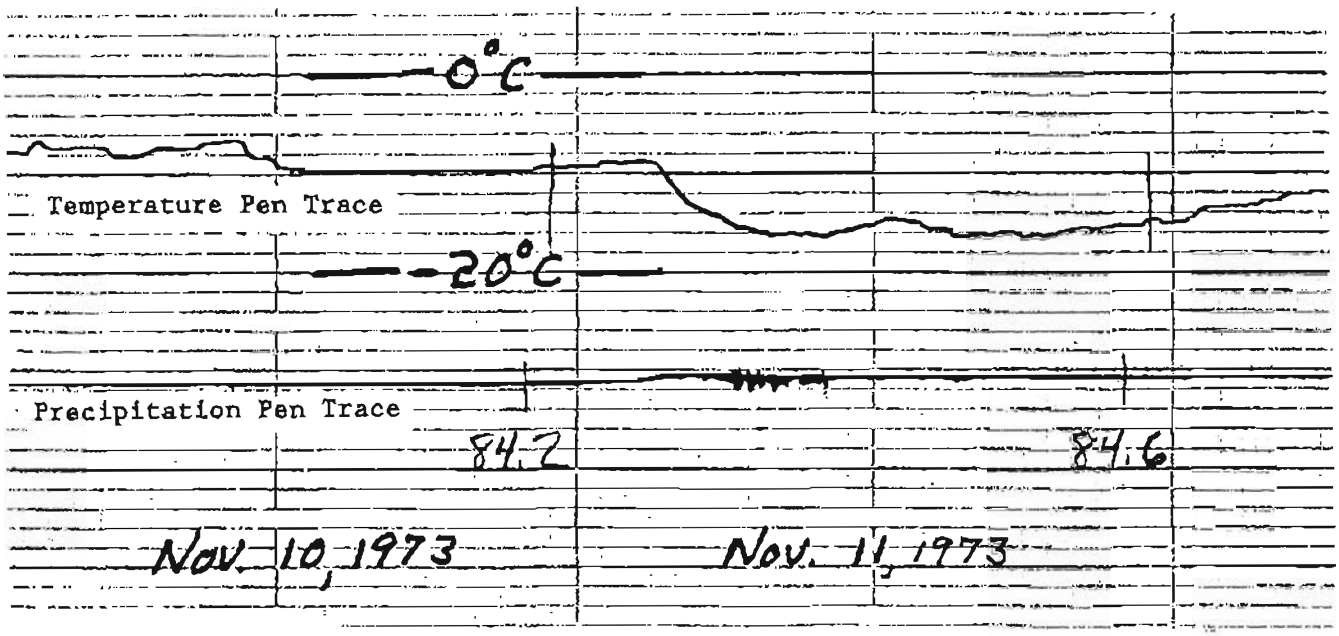

Figure 3.--Copy of gage chart November 10-12, 1973, showing the passage of a cold front. An abrupt temperature decrease happened at the same time as the arrival of precipitation, indicated by the rising precipitation pen trace. High frequency variations of the precipitation pen trace indicate strong shaking of the gage in very high wind.

GAGE LOCATION AND DESIGN

The measurement site is on the relatively large, smooth, and flat crest of a tundra-vegetated glacial moraine at the western boundary of the drainage basin (fig. 1). The precipitation catch orifice is at 991.1 m altitude, the air temperature sensor is at 989.6 m, and the land surface is at 988.1 m. Altitudes were determined by optical surveying and referenced to post-1964 earthquake geodetic datum. For convenience, the gage can be considered to be at 990 m altitude, which is about 100 m lower than the average equilibrium line altitude of Wolverine Glacier.

Wind keeps the site nearly clear of snow during the winter. Although the lack of significant snow accumulation makes this site non-representative (3 to 8 m of snow is common at Wolverine Glacier), the gage would have been buried by snow each winter had it been installed at a more "representative" site. However, wind tends to improve the response of the gage to variations in temperature. Thus, the gage produces high quality air temperature data, but poor quality precipitation data, especially in winter. This compromise was accepted for the gage site because precipitation gages are notoriously unreliable for intercepting windblown snow (Brown and Peck, 1962; Goodison, 1978, 1981), no non-windy site could be found, and snow accumulation in the basin can be measured by other methods.

Intense storms with high winds and abundant precipitation pass through the area frequently. These storms are usually associated with a persistent atmospheric low pressure area in the northwest Pacific region known as the Aleutian Low. Snowfall is the dominant form of precipitation at Wolverine Glacier and usually accumulates from September through mid-June. The weather at Wolverine Glacier is usually windier, wetter, and colder than at other nearby climatological stations, all of which are located near sea level. The gage at Wolverine Glacier is designed for this weather.

The gage at Wolverine Glacier consists of a conical precipitation catch orifice with a windshield device, a steel precipitation collection tank, a nearby ventilated shelter for the air temperature sensor, and an analog recorder inside a double-walled metal and wooden shelter mounted on the gage tank. The entire gage stands about 3 m tall and is guyed by three cables. It was designed using concepts developed for recording storage precipitation gages in mountainous areas that were developed by W.V. Tangborn (1963), and was installed on May 27, 1967, by L.R. Mayo and S.H. Jones.

Various windshield devices have been used to improve the accuracy of the Wolverine Glacier precipitation gage. A free-swinging Alter-type windshield (fig. 4) initially installed on the gage was ineffective and self-destructed in short order. Shield sections, spun by the wind, cut through their supporting steel rods, and reduced them to something resembling strings of sausages. A redesigned windshield (fig. 5), approximating the shape of a Nipher Shield (Warnick, 1953) and made of 3-mm thick aluminum plates with restricted swinging arcs, was installed June 5, 1968. This shield wore out and was replaced by one with 6-mm thick aluminum plates on June 4, 1980.

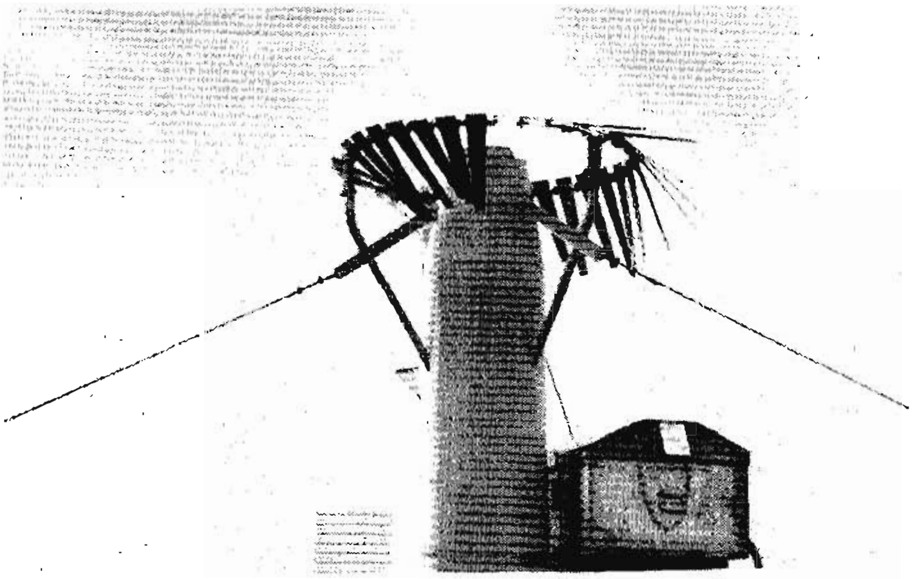

Figure 4.--Alter-type windshield device first used at the gage. Slats were lightweight and free to swing, so their effect was minimal in strong winds. The slats spun freely in the wind, causing them eventually to cut through the supporting steel hoop. Faint horizontal white stripes on the gage are snowflakes blowing horizontally.

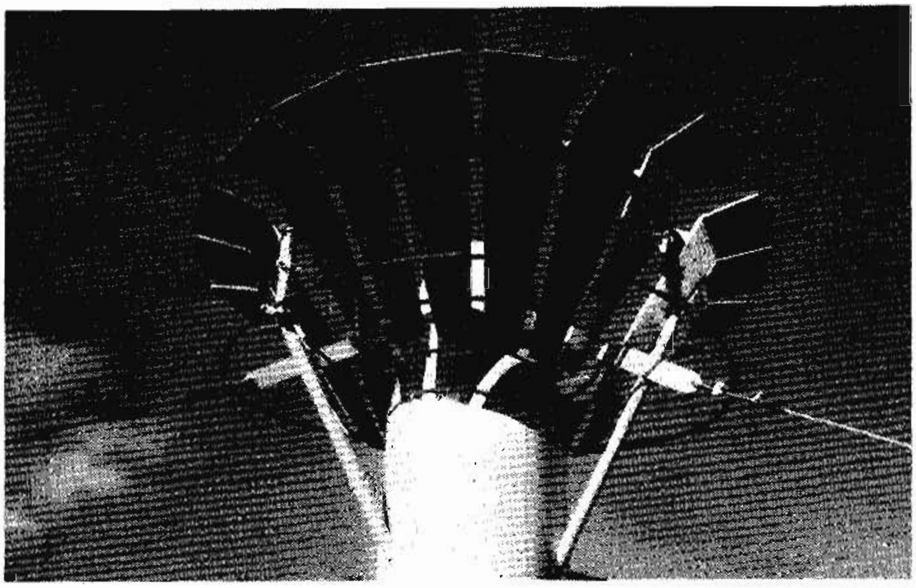

Figure 5.-- Windshield installed June 1966. Movable aluminum slats surrounding the precipitation gage orifice cause air to flow around the gage and reduce wind effects on gage catch. The shape is similar to that of a Nipher shield, but has movable slats to prevent snow capping of the gage. Steel hoops limit the swing of the slats.

The Nipher shield has improved efficiency when tested in a wind tunnel (Goodison, 1978), but can cause capping of the gage by snow. To solve this problem, A.E. Helmers (U.S.D.A. Forest Service, written commun., 1968) began experimental development of a movable, slatted Nipher-type of windshield at Lemon Creek Glacier near Juneau, Alaska. The windshield at the Wolverine Glacier gage is a modification of Helmers' design. Each panel of the shield moves with the wind, which helps avoid accumulations of snow. The shield has never been observed to have significant amounts of snow on it, and the orifice has never been known to be capped by snow. The improvement in gage catch efficiency provided by this shield has not been tested, but is probably similar to that of the Nipher shield.

The gage orifice is 0.305 m in diameter (0.0731 m^2) at the top of a conical pipe section. The large orifice and conical shape design was made in an attempt to minimize the amount of snow that sticks to the inside of the standpipe above the precipitation storage tank. The precipitation collection orifice is painted dark green to absorb sunlight and help shed any accumulations of ice on it. However, the gage record shows numerous abrupt rises in winter (fig. 6), which indicate that some snow does stick to the inside of the standpipe.

Precipitation intercepted by the gage is sensed by a float in a storage tank with antifreeze. The storage tank has an area that is five times greater than that of the orifice. Changes in depth of the stored liquid are sensed by a 0.3-m diameter float which drives a movable pen in the recorder.

The precipitation storage tank contains a self-stirring antifreeze mixture designed for trouble-free operation in cold climates (Mayo, 1972). The antifreeze consists of 2 parts glycol and 3 parts methanol by volume. This mixture has a density between that of ice and water. The methanol component is protected from evaporation by an oil layer and the tank is painted white to reduce solar warming of the liquid. Snow floats on this liquid and melts readily in the antifreeze even at very cold temperatures. The new melt solution (antifreeze with additional water) is a denser liquid that settles and causes circulation in the storage tank. The diluted mixture in the gage is replaced with fresh antifreeze each fall.

Air temperature is sensed by a copper-finned, liquid-filled bulb in a well-ventilated white wooden shelter located at a height of 1.5 m above the land surface. Temperature-induced liquid volume change in the bulb expands a bellows in the recorder which is geared to the pen mechanism that is designed for a temperature range from -40 to +50°C. The temperature-sensing bulb is relatively bulky (20x300 mm) and is about 30 percent enclosed in solid wood for support; thus the system responds slowly and smooths (averages) short-period temperature variations. A high quality alcohol thermometer, which the manufacturer claims to be accurate to ±0.1°C, and which reads 0.0°C when packed in wet snow, is taped to the sensor bulb and provides calibration data.

The south wall of the temperature sensor shelter has a narrow slot (fig. 7) which allows sunshine to warm the sensor for about 15 minutes each day, producing periodic time marks on the chart (fig. 8). The bottom of the shelter is open to allow windblown snow, which enters the ventilation slots in the shelter, to fall out and not become packed around the sensor.

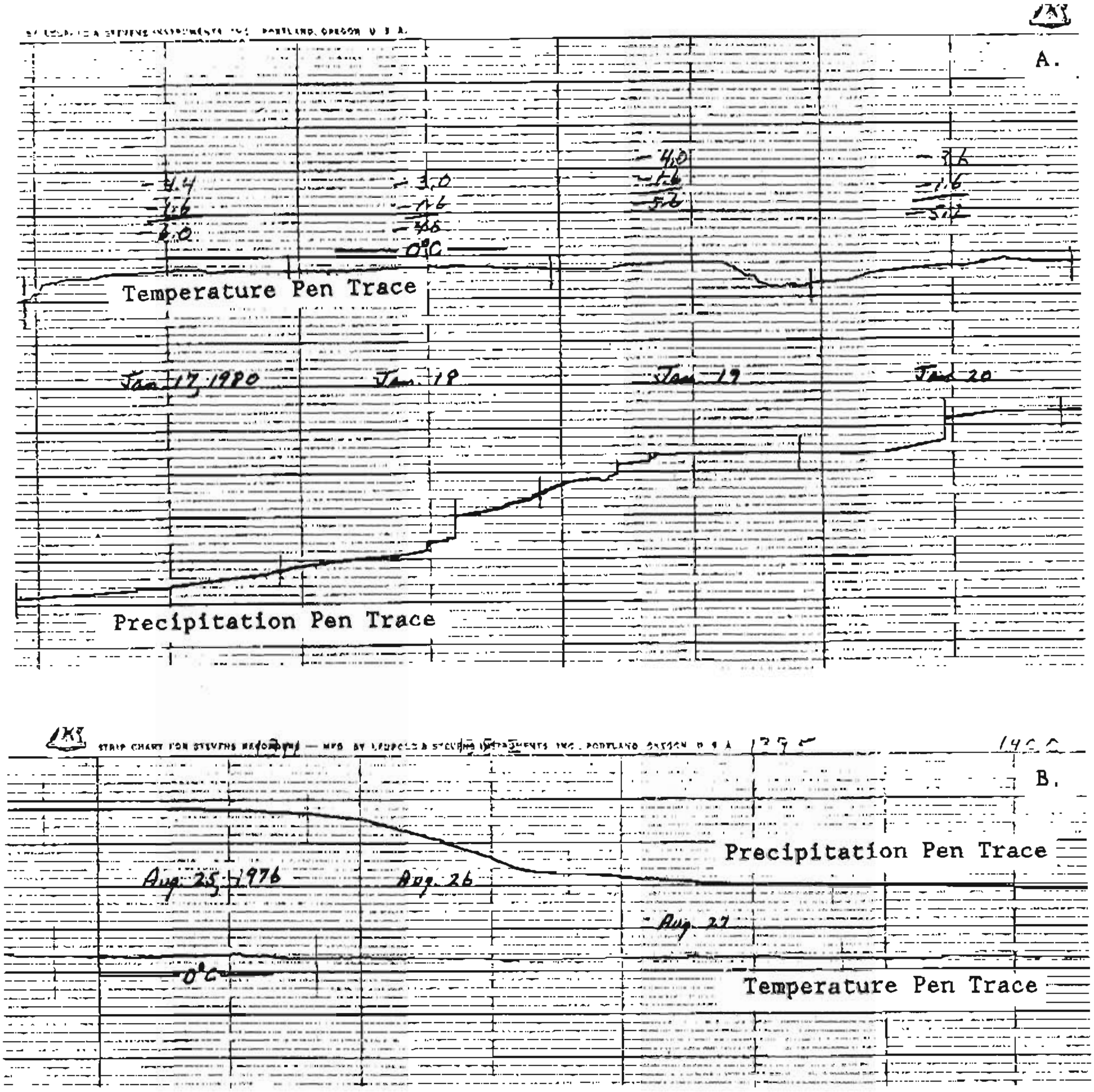

Figure 6.--Copies of gage charts: **A**, January 17-20, 1980, showing partly unreliable precipitation record. This was caused by snow accumulating inside the gage orifice and periodically dropping into the storage tank. The storm at that time was a blizzard lasting for about 7 days in which about 0.8 m water equivalent of snow accumulated in the basin. **B**, August 25-28, 1976, showing a reliable record. Chart shows 98 mm of rainfall catch (precipitation gage pen trace is in lap#2, reversed). Air temperature was almost constant, probably due to clouds and wind.

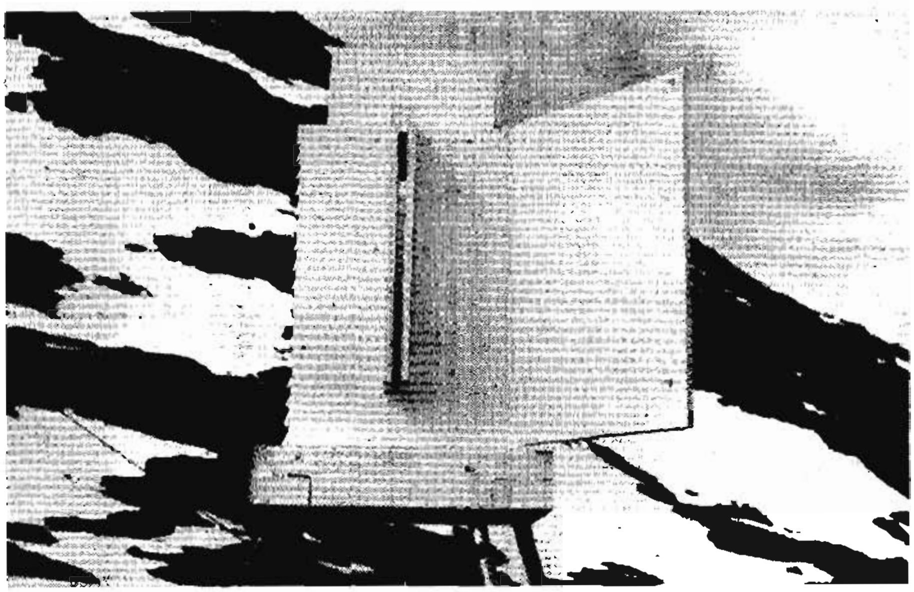

Figure 7.--Shelter for the air temperature sensor. Slot in the near (south) side is to admit sunlight for a short time each day, causing a time mark on the record (see figure 8). Access door (right side of photograph) is open for reading the calibration thermometer.

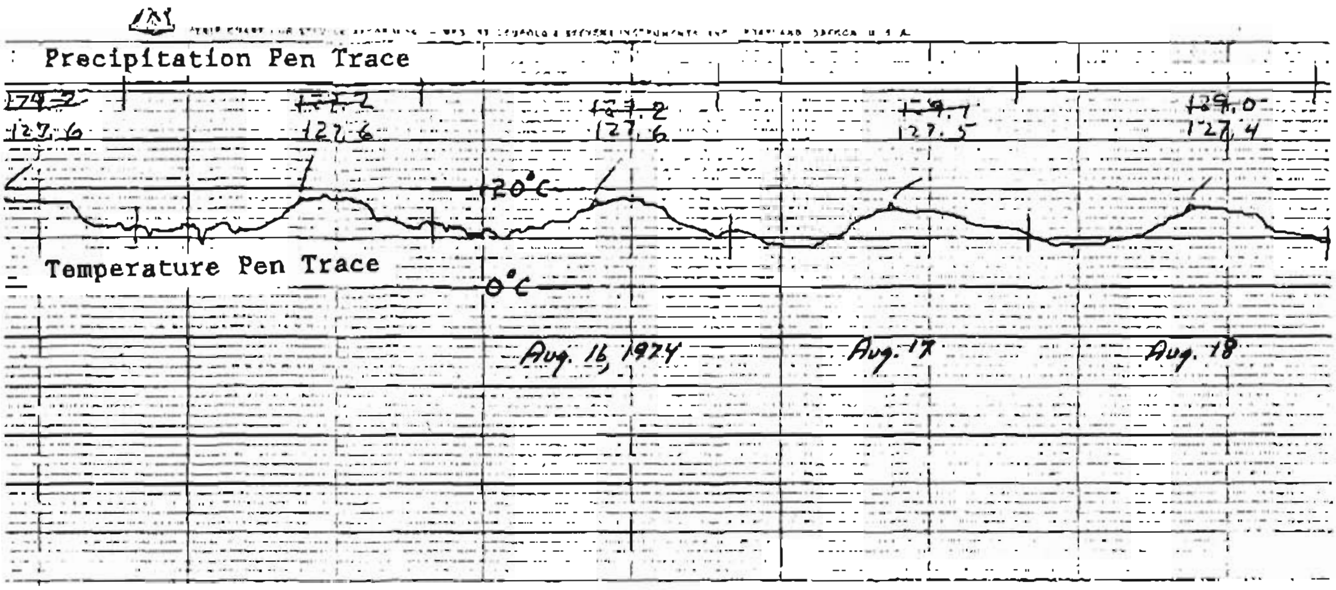

Figure 8.--Copy of gage chart August 15-18, 1974, showing small time marks on air temperature record produced by sunshine passing through a south-facing slot in the shelter. Sinusoidal temperature fluctuations also indicate clear weather.

The precipitation catch and the ambient air temperature are recorded by a spring-driven, multi-pen strip-chart instrument (Leupold & Stevens, Type A35). The recorder operates for up to 162 days between servicing visits. The recorder is protected by an outer box made of galvanized steel and an inner box made of wood. The outer box shields against animal damage and "sand blasting" by cold snow particles. The inner box is tightly sealed and prevents windblown snow powder and rain water from reaching the instrument.

DATA REDUCTION

Errors and Their Corrections

Instrument recording errors can result from differences between the actual response rate and that claimed by the manufacturer, as well as those caused by other problems. Snow can stick on the inside of the orifice and fall into the gage at some later time. Antifreeze density can change with composition and temperature. The user sets the position of the pen in the recorder and can move it purposefully to a calibration position, or accidentally when replacing the pen or by bumping it. Paper moving in a strip-chart recorder can expand and contract from humidity changes, and can wander, necessitating a procedure to recover the real pen position from the chart record.

A number of steps are taken, therefore, to derive accurate air temperature and precipitation gage catch data from the strip-chart records: (1) a time base is established for each record to correct for errors in the chart speed; (2) adjustments are made to correct for chart paper expansion, contraction, and wandering; (3) average temperature pen position for each day and the midnight position for the gage height pen are measured; (4) instrument calibration constants are determined for converting the temperature pen position to air temperature and the gage height pen position to gage height; and (5) antifreeze densities as a function of temperature and dilution are calculated and then multiplied by the recorded gage height data to yield the daily gage catch in water equivalent units.

These methods were developed through an evolutionary process in an attempt to reduce errors. From 1967 to 1980, periodic observations of the reference thermometer and recorded temperatures were analyzed to produce a series of calibration graphs. After 1980, fixed pens that were installed in the instrument simultaneously record changes in paper position, caused by wandering, and changes in size, caused by variations in humidity. These measurements of variations of the paper, combined with thermometer readings, were used in a somewhat more elaborate system to obtain instrument calibration. The changes made in instrument calibration and data reduction procedures improve the precision of daily values, but do not introduce any artificial trends.

Precision is limited by the width of the recorded ink lines. The chart cannot be measured more accurately than about ±0.2 mm, which translates to ±0.2°C temperature and ±1.0 mm of precipitation. Actual chart readings are estimated to have an uncertainty of approximately ±0.3°C air temperature and ±1.5 mm precipitation.

Time Base

Daily mean temperatures (appendix 1) and daily precipitation catches (appendix 2) are reported for each day starting at midnight, local Alaska Standard Time or Alaska Daylight Savings Time. In October 1983, Alaska Standard Time was redefined to be one hour later, and merged with the time zone to the east.

The recorder clock sometimes runs slow or fast, and the paper can expand or contract, so corrections are applied to ensure an accurate time base for the record. Time marks are made on the chart during servicing visits to the gage. Additional, but less accurate, time marks are produced by direct sunlight shining, if present, through a south-facing slot in the temperature sensor shelter, and falling on the temperature sensor for 15 to 20 minutes at the same time each day. This creates an artificial peak in the temperature record. The sun at noon does not go below the actual horizon at the gage site during winter. With these two types of information, a corrected time base for the record is obtained and applied in 1-hour increments. Thus, it is generally possible to establish times on the record that are accurate within 0.5 hours. On several occasions, the recorder stopped between servicing visits. In these instances, the sun peaks are essential to establish the time base for the record prior to the stoppage, and after the stoppage if the clock happens to restart.

AIR TEMPERATURE OBSERVATIONS

Calibration

Calibration of climatological instrumentation is essential if the data are to be reliable for analyses of climatic trends and development of hydrologic models. For this reason, a record of instrument calibration is maintained and analyzed for indications of stability or changes in the operation of the recorder. To do this, observations of a high quality calibration thermometer physically taped to the air temperature sensor and observations of the true position of the temperature pen were made on all servicing visits.

From May 1967 to June 1980, calibration of the temperature sensor was based on simultaneous observations of the thermometer and the ink trace of temperature indicated on the lined paper in the recorder. The average of a number of thermometer readings during a 5- to 10-minute period was compared with the pen trace for each calibration measurement. Calibration data obtained during rapid temperature excursions were disregarded. In June 1978, a fixed pen was installed on one side of the instrument to record any paper wandering. In June 1980, a second fixed pen was installed at the other side of the recorder to document any expansion or contraction in paper size.

The temperature calibration observations (table 1) from June 1967 to November 1969 are discussed here to provide examples of the correction procedures used from May 1967 to June 1980. Calibration can change over time as a result of many factors, and all possibilities are considered. The calibration data (fig. 9 and table 1) show that changes in calibration with time did happen. The rapid rises of calibration correction from June to September 1967 and from April to June 1968 occurred during the first few months after factory-new paper was installed in the recorder. Paper expansion due to humidity, which would produce such a change and in the direction indicated, is suspected to be the cause. A recurrence of that type of calibration change has been observed infrequently since 1968, because chart paper has usually been stored at a shelter in the basin, and it apparently adjusts to high humidity conditions before being put on the recorder.

Table 1.--Temperature calibration observations, June 1967 to November 1969

[Data values in degrees Celsius]

Date mm/dd/yy	Notebook entry	Thermometer reading	Recorder reading	Correction
06/01/67	Chart	3.1	3.8	-0.7
06/03/67	67M90A	3.1	4.0	-.9
06/05/67	67M91A	3.1	4.2	-1.1
06/06/67	67M92A	4.2	5.4	-1.2
06/07/67	67M93A	3.9	4.8	-.9
08/03/67	Chart	6.1	6.0	.1
09/18/67	67M135B	1.6	0.0	1.6
01/26/68	68M1B	-6.1	-7.2	1.1
01/30/68	68M4C	-11.4	-12.6	1.2
04/03/68	68M11A	-3.2	-4.2	1.0
04/03/68	68M11A	-3.2	-3.2	0
06/05/68	68M63A	5.2	3.8	1.4
07/17/68	68M78C	6.3	5.2	1.1
07/17/68	68M78C	6.3	5.6	.7
07/20/68	68M82C	10.1	9.2	.9
08/19/68	68M86A	11.3	10.4	.9
08/21/68	68M88G	5.5	5.0	.5
08/23/68	68M90A	6.5	5.4	1.1
10/06/68	68M107D	1.3	1.4	-.1
10/15/68	68M116F	-6.7	-6.0	-.7
01/25/69	69M1B	-4.3	-4.4	.1
04/11/69	69M7A	-3.9	-3.2	-.7
06/05/69	69M66A	0	-.2	.2
09/14/69	69M102F	3.1	3.0	.1
11/20/69	69M111A	-1.4	-1.1	-.3

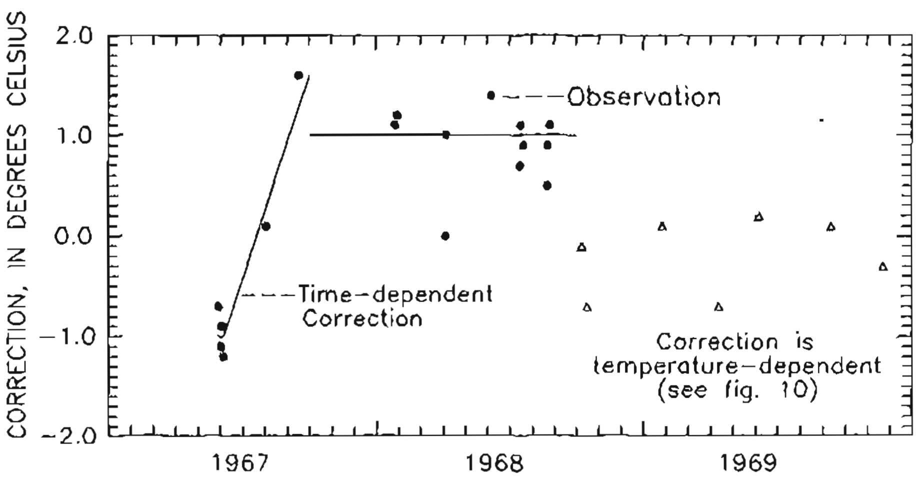

Figure 9.--Time-dependent calibration corrections to the air temperature record during first 2 years of gage operation. Data after September 1968 (triangles) indicate that the correction varied as a function of temperature (see figure 10) rather than with time.

Initially, from June 1967 to October 1968, the instrument responded to temperature changes at the rate designed by the manufacturer, 1.0 mm/°C (fig. 10) and the temperature datum on the chart changed solely from pen position adjustments. From June to September 1967, the correction to the recorded temperature changed 2.6°C as the recorder operated, and the change is judged to be caused by paper expansion. From September 1967 to September 1968, a relatively steady correction of 1.0°C prevailed (fig. 10).

Beginning in October 1968 and continuing through 1988, calibration data show that the instrument responded with slightly less sensitivity to temperature fluctuations than designed (triangles on fig. 10). The best set of calibration data over a large range of temperatures and a short period of time was obtained in 1972 (fig. 11). The general shape of this calibration curve is typical of other calibration curves from 1968 to 1980. The change in response near 0°C may be caused either by shrinkage of moist paper fiber as ice forms and re-expansion of the fibers as ice melts, or by a mechanical problem. The 1972 correction curve, (fig. 11) was used as the pattern for other correction curves (not shown in this report) from October 1968 to September 1980.

To improve the quality of the data, a fixed pen was installed near the lower edge of the chart paper on June 2, 1978, to detect paper wander. After that date, chart measurements are made from the trace of this fixed pen rather than from the paper edge (fig. 12). Paper wandering was typically 0.5 mm or less, which could result in temperature errors of 0.5°C if uncorrected.

A second fixed pen was installed near the upper edge of the chart paper on June 4, 1980 (fig. 12). The second trace additionally allows for the detection of paper expansion and contraction. The distance between these two fixed pens, and hence their traces on the chart paper, is constant at the time the pen traces are made. After the pen traces have been made, any expansion, contraction, or wandering of the paper can be measured. After September 1980, the potential for uncertainties due to these problems has been reduced.

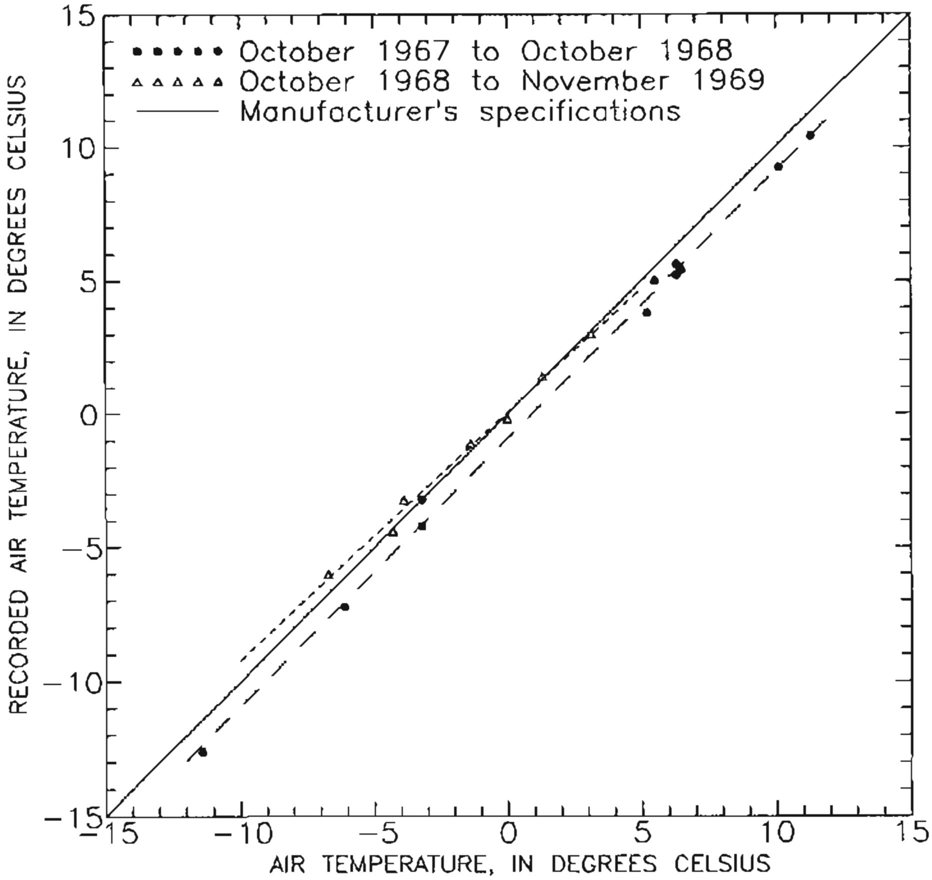

Figure 10.--Comparison of air temperatures measured with the calibration thermometer and recorded by the instrument from October 1967 to November 1969. Instrument response that was expected for the recorder is shown with a solid line. Dashed lines are least-squares regressions of the data and are the calibrations used. Slopes of the lines are the instrument responses to temperature variations. The lines can be offset vertically on this graph simply because of variations in the placement of the recording pen in its holder.

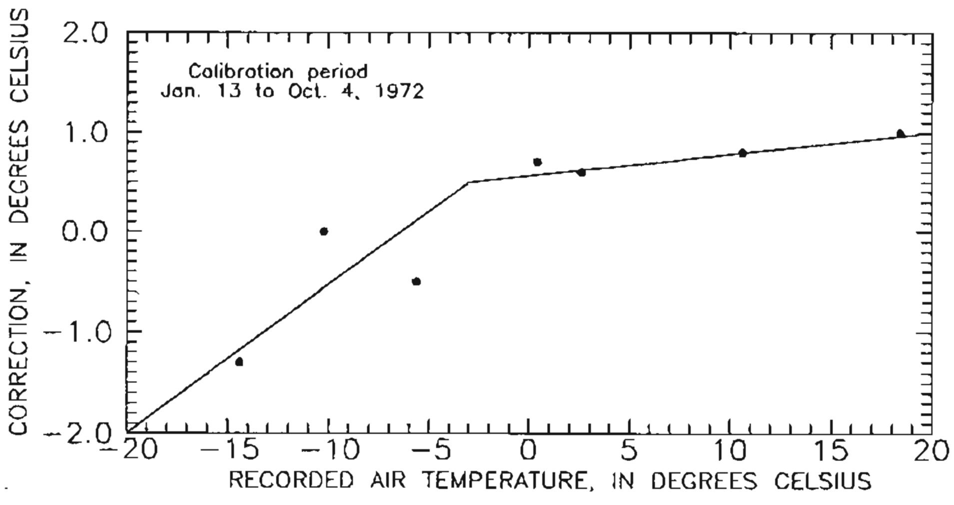

Figure 11.--Air temperature correction from January to October 1972. This calibration period had a wide range of temperatures and serves as a model for other periods with fewer data.

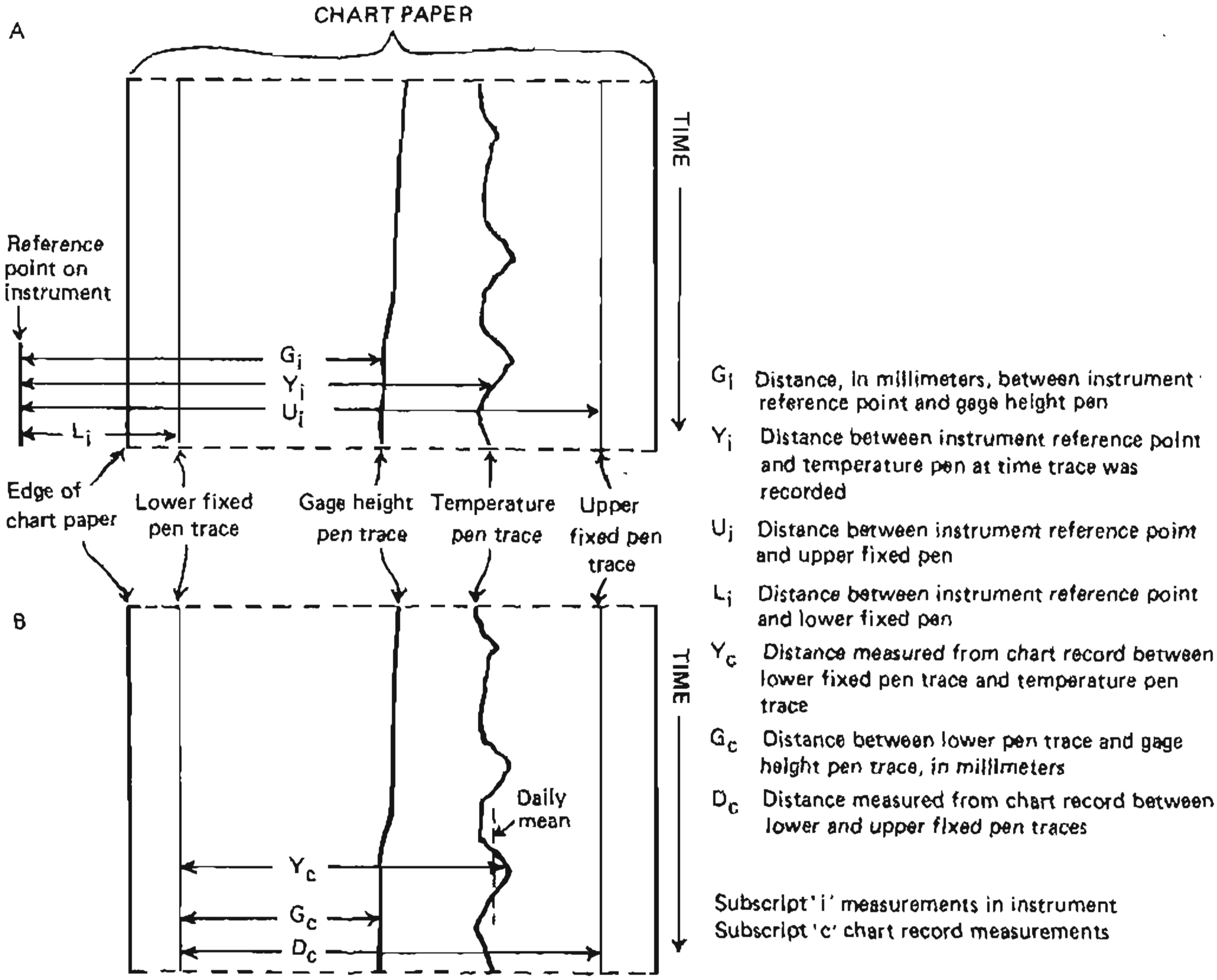

Figure 12.–**A,** Simulated chart record showing variables measured at the instrument relative to a fixed reference point. Fixed pens record paper position and size. **B,** Same record showing variables on the chart measured later relative to the position of the lower fixed pen trace.

At all service visits to the instrument, the distances of the fixed pens relative to a fixed reference in the instrument are measured with a steel tape. As the servicing of the instrument requires some disturbance of the pens--such as lifting them off the chart paper so the chart can be changed, and adding ink to the pens--the pen position measurements are done twice during each service visit: once, when the instrument is first opened prior to any pen disturbance, and again, after the servicing is done just prior to closing the instrument. This gives two calibration points applicable to each period of chart record during which there have been no external pen disturbances. These two values are averaged and are used to determine the placement of the pens for the measurement period. These readings are then used with the following equation to obtain the position of the temperature pen at the time data were recorded:

$$Y_i = Y_c(U_i - L_i)/D_c + L_i, \tag{1}$$

where Y_i is the distance between the instrument reference point and the temperature pen at the time the trace was recorded,

Y_c is the distance measured from the chart record between the lower fixed pen trace and the temperature pen trace,

U_i is the average distance between the instrument reference point and the upper fixed pen as determined from measurements with a steel tape during servicing visits,

L_i is the average distance between the instrument reference point and the lower fixed pen as determined from measurements with a steel tape during servicing visits, and

D_c is the distance measured from the chart record between the lower fixed pen trace and the upper fixed pen trace (fig. 12).

[Note: Subscript *i* is used to indicate measurements made on the *instrument* in the field. Subscript *c* is used to indicate measurements made from the *chart* record.]

The response of the mechanism to variations in temperature was determined slightly differently after 1980. Thirty calibration data sets were obtained from 1980 to 1985, each involving several simultaneous readings of the calibration thermometer and the instrument temperature pen positions, and spanning the temperature range from -21.6°C to +13.6°C. A linear regression carried out on these data (fig. 13) yields the following relation:

$$Y_i = 0.924T + 225.6, \tag{2}$$

where Y_i is temperature pen position, in millimeters; and

T is the temperature, in degrees Celsius.

The r^2 value for the regression is 0.997 and the standard error of the estimated pen position is 0.6 mm.

To interpret a gage record and solve for temperature, T, from its resulting pen position, Y_i, the regression must be carried out using the same data, but with T as the dependent variable. In this case, the slope obtained was 0.931 mm/°C (fig. 13). This slight change in slope results in differences in temperature of only 0.1 to 0.2°C, which are not significant. The temperature scale after 1980 is approximately the same as before 1980, and consistency of the data was preserved during the change in calibration methods. The manufacturer specifies a temperature scale of 1.0 mm/°C.

Finally in the analysis, the slope (scale) component of this regression (fig. 13) is used as the best approximation of the temperature response of the instrument, and the intercept value is determined uniquely for each measurement period. This calibration method is based on the assumption that disturbances to the temperature pen, such as can happen during routine

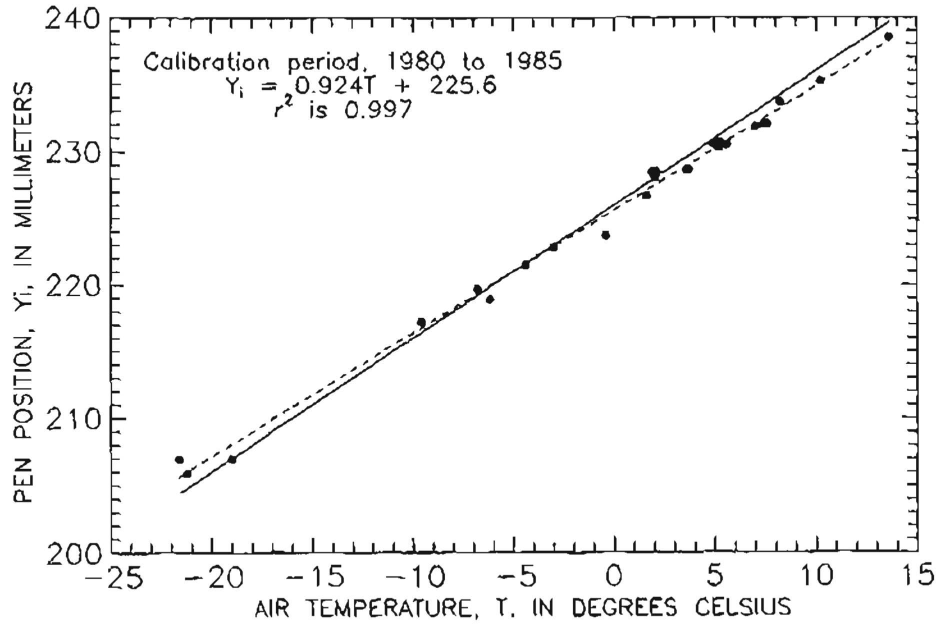

Figure 13.--Temperature pen position, Y_i, and air temperature observations using calibration thermometer, *T*, from 1980 to 1985. Manufacturer's specification (solid line) is for a response rate of 1.0 mm/°C; linear regression of the data (dashed line) indicates a smaller value, 0.924 mm/°C.

servicing of the gage, are randomly distributed with respect to temperature at the time of calibrations. Other errors can result from response time differences between the reference thermometer and the instrument or from any imperfection in the pen drive mechanism. These are also assumed to be randomly distributed with respect to the temperature at the time of calibration observations.

The final step is determination of the regression constant. This constant (y-axis intercept) in the linear regression is not assumed to be constant; rather, the regression line is shifted up and down for each period of record between servicing visits to accommodate for any disturbances to the temperature pen such as replacing the pen or bending the pen slightly, changes that are likely to happen occasionally during routine servicing.

Method of Obtaining Daily Averages

Three types of erroneous air temperature information in the record were detected by inspection of the analog chart and omitted prior to determining daily averages. First, time marks made by sun shining in the south-facing slot (fig. 8) were not used. Second, the access door blew off the temperature sensor shelter once, allowing the sun to shine directly on the sensor for a few hours in the morning each day until it was repaired. The temperature during those periods was estimated by drawing simple curves connecting the unaffected record. And third, the temperature pen carriage once was adjusted too tightly on its rails, so that it tended to stick and therefore not record the average temperature. Accordingly, that record was not used.

From reliable record, an average temperature was picked for each day from the continuous temperature pen trace. A clear template with a straight line was placed on top of the strip-chart record of the day to be averaged. The template line was shifted over the recorded line until the two areas enclosed by the two lines above and below the template line were equal. When this condition was met, the center of the template line was then on the average temperature for the day. Experiments were conducted to determine how well different observers agree using the template method. Different observers can usually agree to an average position within ±0.4 mm (0.4°C), and frequently agree exactly or within ±0.2 mm (0.2°C). Most of the chart observations were checked and when differences greater than ±0.4 mm were found, readings were judged to be unreliable, so were redone.

Accuracy

Uncertainties in determining the actual air temperature with this recorder system may arise from several causes: (1) the sensor responds slowly to rapid variations of temperature; (2) a small hysteresis lag error may exist in the mechanical parts of the recorder, but is not detectable as flat spots in the record, so is less than 0.2°C; (3) the thermometer cannot be read closer than 0.1°C; (4) chart paper can wander slightly in the recorder; (5) the paper can expand and contract; (6) daily average values obtained by visually estimating areas above and below a transparent template probably vary less than ±0.4°C from true means; and (7) calibration measurements can vary from the correction curves by as much as ±1.0°C.

Chart width when measured in the office, D_c, is typically 2-3 mm smaller than what it (U_i-L_i) was when the fixed pen marks were made in the recorder. This change is assumed to be uniform over the width of the paper. In the worst case, this problem could result in temperature errors of about 2 to 3°C if uncorrected. The full magnitude of this error does not apply to the period before 1980 because the pen was referenced both at the gage and in the office to grid lines printed on the paper and the temperature pen traverses only part of the total chart width.

Because all calibration data were used for the purpose of making corrections to the recorded temperature data, the standard error of the resulting product cannot be independently tested, but can be estimated. Known errors in the record are generally less than ±1.0°C because the known sources of large error (paper wander, size change, pen placement, and instrument response) have been removed. Residual errors on calibration diagrams (such as fig. 11) have a standard error of about ±0.3°C, are always less than ±1.0°C, and are distributed randomly. Undetected errors for short periods of record could be larger. The daily average temperatures reported here (appendix 1) are thus estimated to be within ±1.0°C for 67 percent of the time, and almost always within ±2.0°C of their true value. These errors are randomly distributed.

PRECIPITATION OBSERVATIONS

Gage Height Calculations

To calculate precipitation catch, the density of the antifreeze solution in the gage's storage tank must be estimated and multiplied by the liquid depth to obtain the water equivalent in the gage at midnight of each day. Errors of daily precipitation values caused by solution density variations in a storage precipitation gage may be small if not corrected, but are cumulative rather than random. Thus, it is important that corrections for antifreeze density changes caused by variations in temperature and composition are made daily in the Wolverine Glacier data set because seasonal errors of total precipitation of 5 to 10 percent are possible (Mayo, 1972). Even though such errors may be relatively small compared with the errors of catch caused by wind, these corrections are made to the data so that accuracy is limited only by factors affecting the gage's catch efficiency.

The first step in interpreting the precipitation storage tank gage height data, after the time base has been properly established, is to measure the float pen position at the end of each day from the chart record. Prior to installation of two fixed pens in 1980, it was assumed that the printed chart scale markings were correct.

The analysis of record after 1980 includes correction for paper wander and size changes detected by fixed pens located at each edge of the chart paper in a similar manner to that used for temperature. Furthermore, the precipitation trace is corrected for pen reversal. When a pen reaches the edge of the chart, it reverses its direction of travel, so that the vertical range is unlimited.

The gage height value of the lower pen position is:

$$V_g - 5(G_i - L_i), \qquad (3)$$

where 5 is the ratio of the gage orifice cross-sectional area to the storage reservoir cross-sectional area,

V_g is the measured gage height (depth times 5) at a calibration point,

G_i is the distance between the instrument reference point and the gage height pen in *lap#1* measured using a steel tape, and

L_i is the distance between the instrument reference point and the lower fixed pen, the same value used for temperature data reduction.

The reversals of gage height pen direction must be kept track of and each traverse is assigned a variable called a lap number (*lap#*); see figure 14 for further explanation.

The gage height value relative to the lower pen gage height value (including corrections for paper expansion, contraction, and wandering) is:

$$5G_0(U_i - L_i)/D_c, \qquad (4)$$

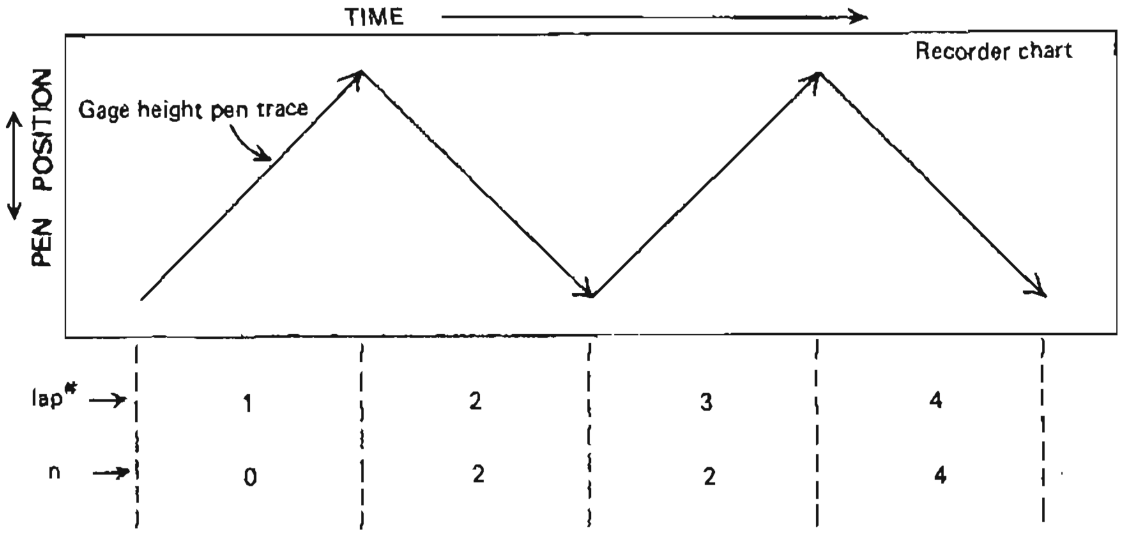

Figure 14.--Simulated chart record of precipitation gage pen going through several reversals in direction and the corresponding values for the variables *lap#* and n, which are used in the calculations of gage height.

where G_o is the distance measured in the office from the chart record between the lower pen trace and the gage height pen trace.

The factor 5 comes from the ratio of the storage reservoir area to the gage orifice area. Before 1980, the paper size was assumed to be constant.

Combining the values derived from equations 3 and 4, the gage height value of the lower fixed pen, and the gage height value of the gage pen relative to the lower pen, we get an interim variable, G_1, which equals the gage height when the *lap#* is 1:

$$G_1 = 5G_o(U_1 - L_1)/D_o + [V_g - 5(G_1 - L_1)]. \tag{5}$$

This gage height value is corrected, depending on the *lap#*, by the following two equations to yield the gage height, H, in millimeters:

For an odd *lap#*, $$H = 1250n + G_1, \tag{6}$$

and for an even *lap#*, $$H = 1250n + 2V_g - 10(G_1 - R_1) - G_1, \tag{7}$$

where $$n = 2(lap\# \text{ DIV } 2). \tag{8}$$

The operator DIV (integer division) yields the integer portion of the quotient. The factor 1,250 is the difference in millimeters of gage height between one reversal and the next. R_1 is the distance between the instrument reference point and the gage height pen at lower reversal as determined from measurements with a steel tape during servicing visits when the gage is being pumped out and recharged.

Once the gage heights are determined, a density adjustment is necessary to yield a water equivalent gage height. The density of the methanol-glycol-water solution (fig. 15) varies with its temperature and the water concentration (Mayo, 1972).

The temperature of the gage fluid used in the density correction is assumed to be the same as the measured daily average air temperature because the tank is painted white. A time lag of 4-6 hours has been observed between air temperature changes and thermally caused gage height changes (fig. 16), indicating that the fluid temperature lags behind the air temperature because of heat storage in the fluid. This time lag may vary with the mass of fluid in the gage. If the air temperature follows a normal daily cycle, the daily mean air temperature should generally coincide closely with the actual air temperature in early evening and, therefore, should closely approximate the temperature of the gage fluid at midnight. No attempt has been made to improve on this method of accounting for the time lag, as it is not considered to be a source of significant error.

The water concentration, W, used in the density determination is calculated by:

$$W = (H-H_0)/H, \tag{9}$$

where H_0 is the initial gage height after emptying and recharging the gage with an antifreeze solution.

The gage height and initial gage height values used to calculate the water concentration are not density corrected. A sensitivity analysis determined that the use of these values uncorrected for density could lead to errors of less than 1 mm in daily gage catch, caused only by rounding of small numbers, and less than 3 mm in cumulative gage catches. A fully correct solution would be iterative and was not done because the calculated water concentration and the density depend on each other.

The following empirical solution is used to approximate the relation between density, temperature, and water concentration:

$$\rho_s = 1.00 + (T-T_0)(d\rho_s/dT) + (W-W_0)(d\rho_s/dW), \tag{10}$$

where ρ_s is the solution density,

T_0 is the temperature that produces a density of 1.00 kg/L for any given water concentration (see table 2),

$d\rho_s/dT$ is a constant -6.67×10^{-4} (kg/L)/°C,

W_0 is the water concentration truncated to one decimal place, and

T_0 and $d\rho_s/dW$ depend on the value of W (table 2).

Estimated densities compare well with Mayo's (1972) results (fig. 15) and correspond within ±0.4 percent of the measured values for the range of temperatures found at Wolverine Glacier.

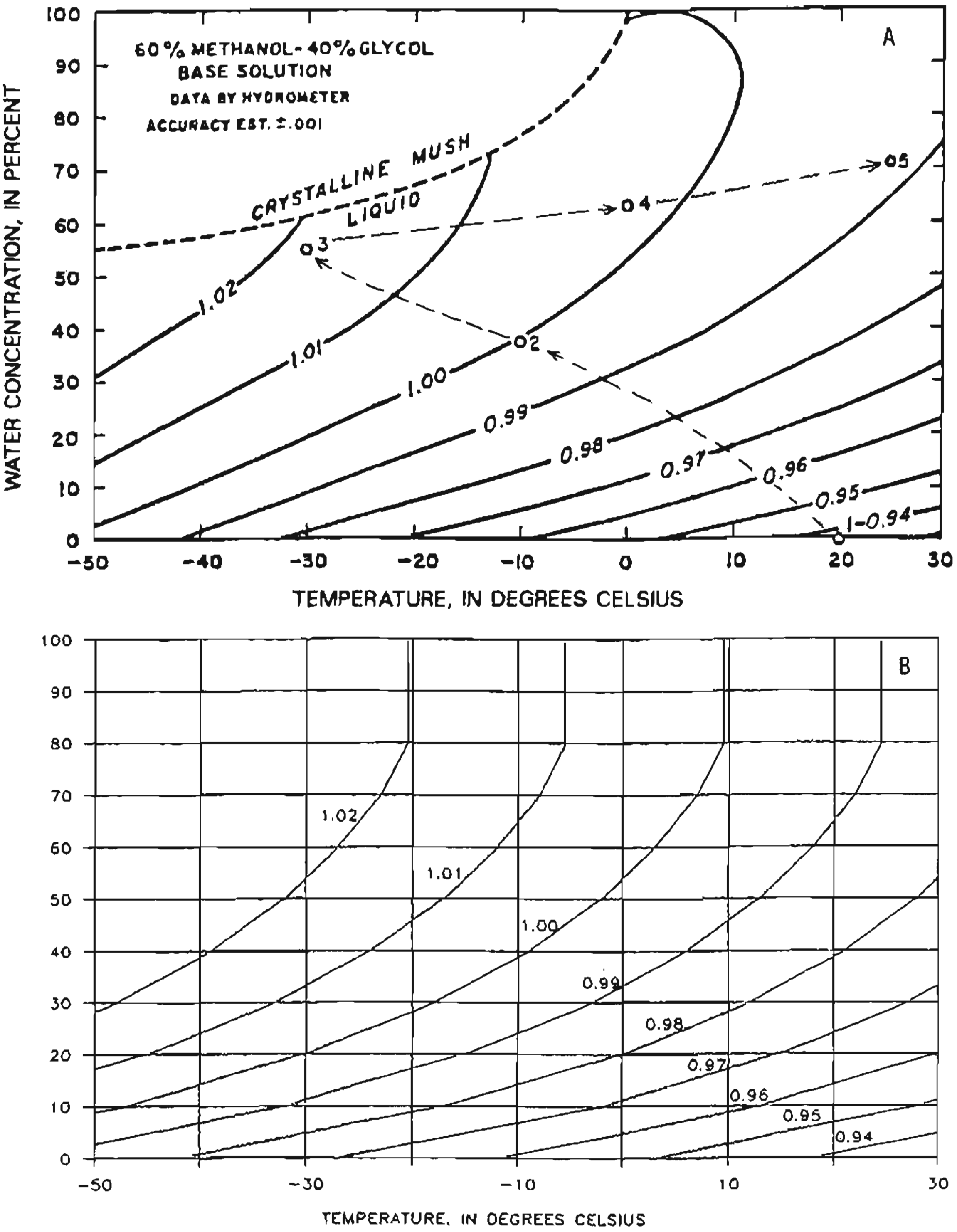

Figure 15.--Antifreeze mixture density (contour values in kilograms per liter) as a function of temperature and water concentration: **A**, published density values (Mayo, 1972). Open circles with numbers connected by dashed line show hypothetical seasonal variations of density that are possible as precipitation is added and temperature varies. **B**, simplified density values (equation 10) used in this report for the determination of precipitation.

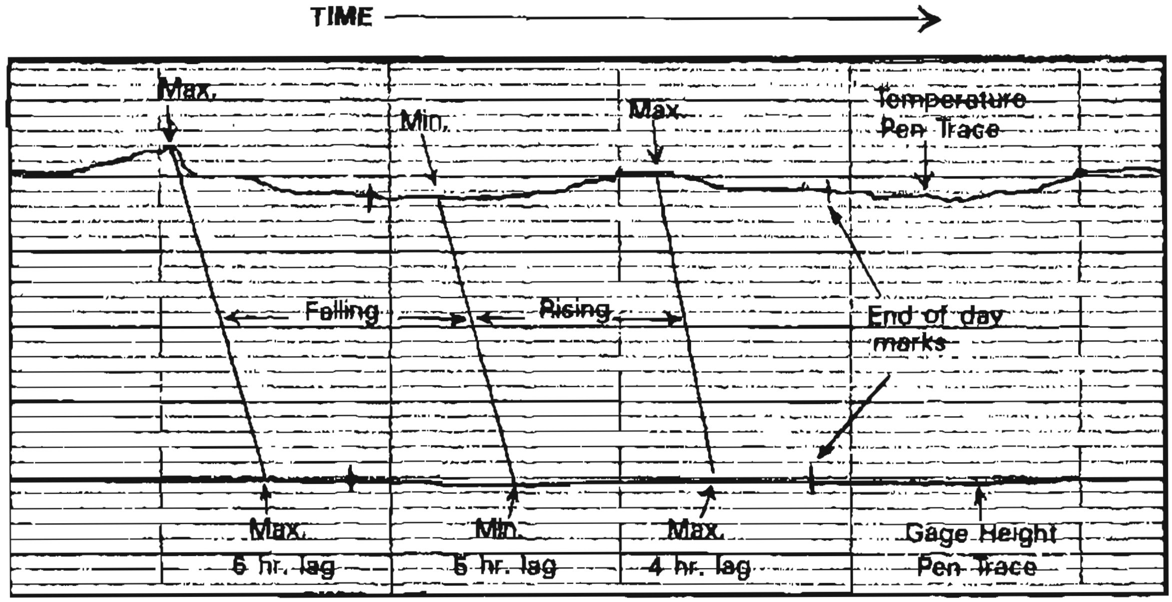

Figure 16.--Copy of chart record of September 24-26, 1981, showing the instrument's sensitivity to small fluctuations of gage height caused by thermal expansion and contraction of the gage fluid. Calculated gage catch is zero for each of these 3 days. Gage height lags behind the air temperature by 4-6 hours due to heat storage.

Table 2.--Values of density change ($d\rho_s/dW$) and temperature (T_0) for calculating density of liquid in the precipitation storage tank using equation 10; values are dependent on range of water concentrations

Water concentration	$d\rho_s/dW$ (kg/L)	T_0 (°C)
$0.0 \leq W < 0.1$	0.167	-72
$0.1 \leq W < 0.2$	.111	-47
$0.2 \leq W < 0.3$	.081	-30
$0.3 \leq W < 0.4$	.061	-18
$0.4 \leq W < 0.5$	.046	-9
$0.5 \leq W < 0.6$	.034	-2
$0.6 \leq W < 0.7$	.027	3
$0.7 \leq W < 0.8$	.017	7
$0.8 \leq W$	.000	9.5

The water equivalent of precipitation in the gage is the gage height of the stored liquid, H, times its density relative to that of water, ρ_s/ρ_w, where ρ_w is the density of water. Daily gage catch is the difference between one day's water equivalent gage height and the previous maximum value for the water equivalent gage height. The reason that daily catch is not just the difference between the water equivalent gage height on two successive days is that this value is sometimes negative. Negative calculated gage catch is not real, but is the result of small errors in the data reduction, such as reading of the pen trace, or is due to incomplete circulation, diffusion, and mixing that can take place in the liquid for several days after precipitation is added.

Accuracy

Daily precipitation catch (appendix 2) is estimated to have uncertainties ranging from ±1 to ±4 mm, depending mainly on the uncertainties of antifreeze solution density caused at times by rapid temperature changes and rates of precipitation. Cumulative gage catches for periods of a month or a year are accurate to ±8 mm. These errors are relatively small compared with the errors in precipitation catch caused by wind.

Any precipitation gage operated in a windy environment is subject to differences between actual precipitation and what is caught by a gage because the catch efficiency is related inversely to wind speed (Goodison, 1978). Catch efficiency for snow is low because snow falls through the air relatively slowly and much of it is carried over the gage orifice by wind. Rain falls faster than snow and probably is caught by the gage more efficiently than snow. Blowing fog at Wolverine Glacier deposits significant quantities of water on exposed surfaces, so it can be considered to be hydrologically similar to rainfall. It is doubtful, however, that a representative part of the blowing fog is caught inside the gage orifice.

In winter, the precipitation record occasionally contains sharp rises of the float pen trace that are probably caused by rime ice (accumulation from supercooled fog droplets) or snow falling from the inside of the orifice into the storage tank (fig. 6A). Unfortunately, there is no way of knowing the length of time that the ice had been attached to the orifice. Identification of this type of gage error from an analog chart is easy to do. If such an error in a recording precipitation gage were not detected, the resulting data set would indicate highly erroneous amounts of precipitation for all days when snow is either sticking to or falling from the gage orifice. Days with these splash events are indicated in appendix 2. The precipitation record during summer is believed to be reliable (fig. 6B).

During blizzard conditions, snow which has been eroded by wind from upwind locations in the basin passes the gage site. It is likely that part of this redistributed snow is caught by the gage, but it is not known what part of the swirling snow is new precipitation and what part is eroded snow being redistributed. The gage catches more precipitation each winter than is found on the ground near the site. This is because most of the snow that falls at this site is carried away by wind. For this reason, no independent measurement can be made at the site to check the gage catch efficiency.

Interpretation of measurements of ice storage change in the basin and the water flowing from it in 1967 indicated that the precipitation gage catches significantly less than the actual precipitation (Tangborn and others, 1977). Actual precipitation into the basin (including condensation) can be estimated from the measured water discharge from the basin for a 10-year period. Precipitation data (appendix 2) and streamflow data from the Wolverine Creek basin (station 15236900, U.S. Geological Survey, 1976, and 1972-79) are available from October 1968 through September 1978. During that time, the average annual runoff rate from the basin, r_a, was 3.01 m/yr and the average catch rate of the precipitation gage, g_a, was 0.99 m/yr. At the same time, the cumulative mass balance of Wolverine Glacier, with a glacier area fraction, f_g = 0.71 of the basin area, was approximately 3.0 m water equivalent, and average mass balance, b_a, equaled +0.30 m/yr (Mayo and Trabant, 1984), so the glacier stored part of the total precipitation that fell into the basin. The fraction of stored precipitation, p_b, can be estimated by:

$$p_b = (b_a \cdot f_g)/[r_a+(b_a \cdot f_g)] = 0.07, \tag{11}$$

and the gage catch efficiency, p_e, relative to the basin precipitation is:

$$p_e = g_a/[r_a+(b_a \cdot f_g)] = 0.31. \tag{12}$$

In another analysis of the mass balance of Wolverine Glacier to obtain internal consistency of related data sets (unpublished), the average annual mass balance was +0.08 m from 1968 to 1978. This value indicates that the efficiency of the precipitation gage was 0.32, and that the catch efficiency calculation is insensitive to glacier mass balance because balance is usually a small number compared to runoff. Thus, for that 10-year period, the average net precipitation into the basin (true precipitation, plus up-wind sources, and minus down-wind losses) was approximately equal to runoff and about three times greater than the precipitation gage catch.

The large difference in gage catch (appendix 2) and basin average precipitation is most likely due to the combined effects of wind on the gage and the unrepresentative nature of the gage site. Uncertainty about the catch efficiency of the gage is increased further by the possibility that the actual catch efficiency varies with time because it is affected by the form of precipitation (rain, snow), as well as by the wind speed. When the wind is calm, the gage probably is accurate. Thus, the relation between the precipitation catch reported here and the true precipitation in the Wolverine Glacier basin is undoubtedly complex and irregular at all time scales.

ESTIMATION OF MISSING RECORD

The air temperature and precipitation recorder at Wolverine Glacier failed occasionally because of clock stoppages, clogged pens, and other mechanical problems. To complete the climatological data series for the site, we have made estimates of monthly average temperature and monthly precipitation catch using climatological data of the National Weather Service (1967-88) measured at Seward, Alaska (fig. 1), which is located at the head of Resurrection Bay, 40 km southwest of Wolverine Glacier.

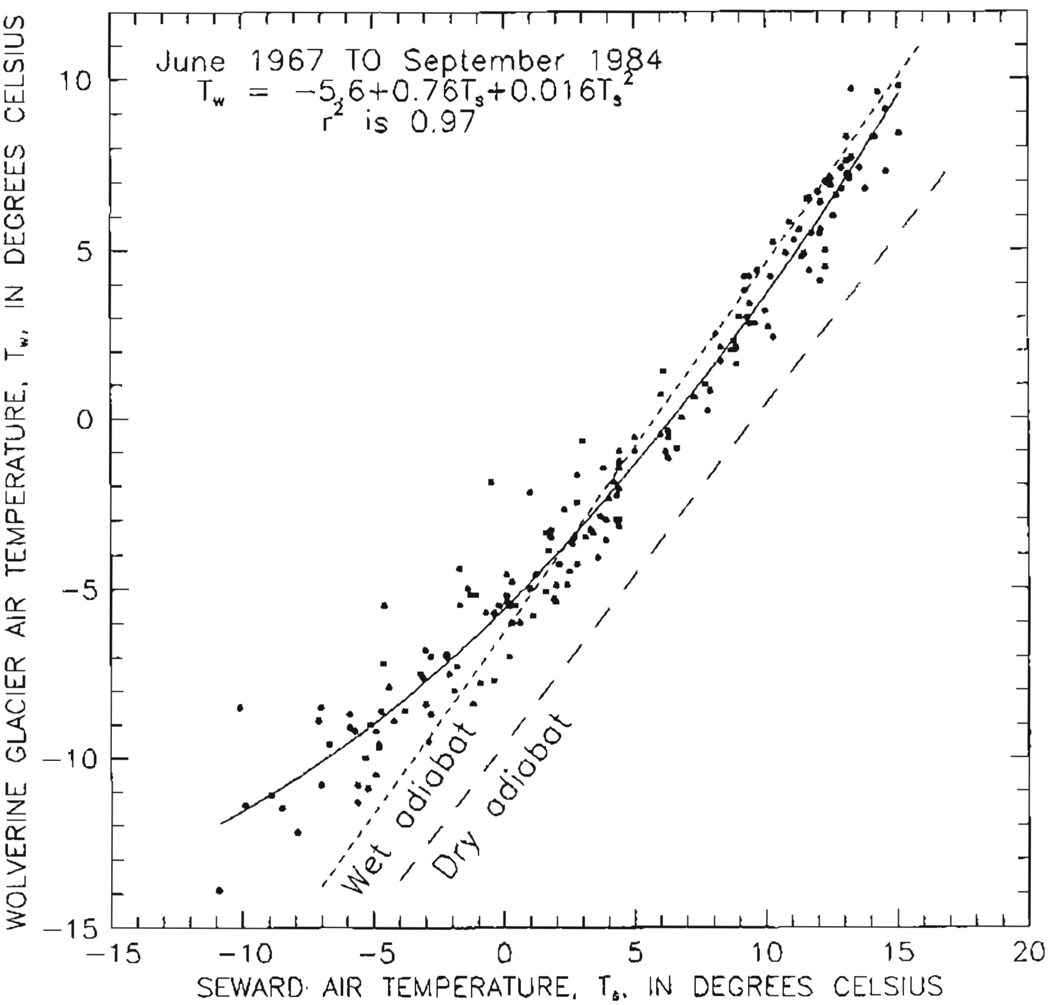

Figure 17.--Comparison of monthly average air temperatures at Wolverine Glacier and at Seward, Alaska. Solid line is a second order polynomial regression of the data. Saturated (wet) and unsaturated (dry) adiabatic temperature conditions shown with dashed lines.

A comparison of monthly average temperatures measured at Wolverine Glacier and at Seward from 1967 through 1984 (fig. 17) indicates that a single or annual correlation between the two is good, with the greatest departures taking place at low temperatures. The data cluster around the wet adiabat except at cold temperatures. Estimates of air temperature at Wolverine Glacier using temperature at Seward are slightly improved if each month is considered separately (fig. 18; table 3) than if they are mixed (fig. 17), because of the reduced data scatter in monthly plots. Estimates of monthly average temperatures during months with missing record are identified in appendix 1 and are made on the basis of data from Seward and the equations given in table 3 for each month.

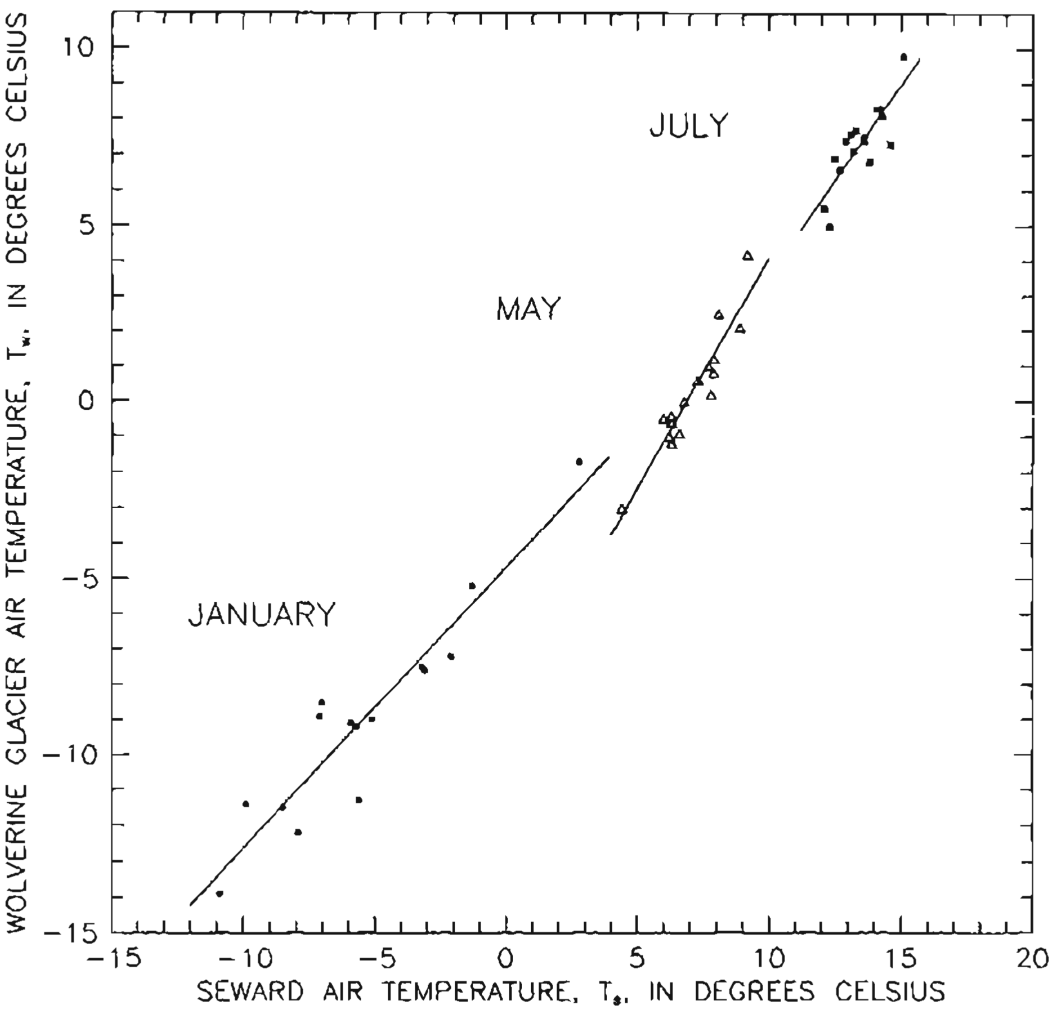

Figure 18.--Comparison of monthly average air temperatures at Wolverine Glacier and Seward, Alaska, for selected months. Data for each month shown using different symbols. Solid lines are linear regressions of the data (see table 3).

Table 3.--Equations determined by linear regression to calculate monthly air temperatures at Wolverine Glacier, T_w*; based on temperatures measured at Wolverine Glacier (1967-84, this report) and at Seward, Alaska,* T_s *(National Weather Service, 1967-84)*

[S_e is the standard error of the estimate; r^2, the coefficient of determination; and n, the sample size.]

Month	Equation	S_e	r^2	n
January	$T_w = 0.795T_s - 4.68$	1.1	0.88	15
February	$T_w = .740T_s - 4.95$	1.2	.77	15
March	$T_w = .952T_s - 5.99$	.8	.91	16
April	$T_w = 1.195T_s - 7.34$	.6	.87	15
May	$T_w = 1.308T_s - 8.98$	.6	.89	16
June	$T_w = .885T_s - 5.25$	.9	.55	17
July	$T_w = 1.076T_s - 7.16$	.6	.69	16
August	$T_w = 1.106T_s - 7.13$	.9	.58	16
September	$T_w = 1.496T_s - 10.76$	.6	.76	16
October	$T_w = 1.480T_s - 8.29$	.6	.88	16
November	$T_w = .994T_s - 5.31$	1.1	.77	14
December	$T_w = .560T_s - 5.58$	1.4	.61	15

The total precipitation catch by a storage gage can be determined from the pen trace on the chart for a period of recorder stoppage. In these cases, the gage catch recorded at Wolverine Glacier and given in appendix 2 was simply divided into monthly increments on the basis of precipitation data from Seward (National Weather Service, 1967-88). However, this was judged to be unreliable during the period before June 1968 when no effective windshield was in place and only a single metal shelter protected the recorder. The metal shelter is not totally windproof, so the gage catch was affected by windblown snow entering the storage tank through the recorder shelter, accumulating on the float sensor, and producing a strange and unreliable record (fig. 19).

VARIATIONS OF AIR TEMPERATURE AND PRECIPITATION

The results of the measurements are given in appendix 1--Air temperature, and appendix 2--Precipitation, at Wolverine Glacier. The mean annual precipitation was about 3.3 m in the Wolverine Glacier basin from calendar year 1969 through 1987 (fig. 20), and the average annual air temperature at 990 m altitude was -1.5°C from 1967 through 1987 (fig. 20). For comparison, the average annual air temperature near sea level at Seward is +4.2°C and the average annual precipitation is 1.77 m.

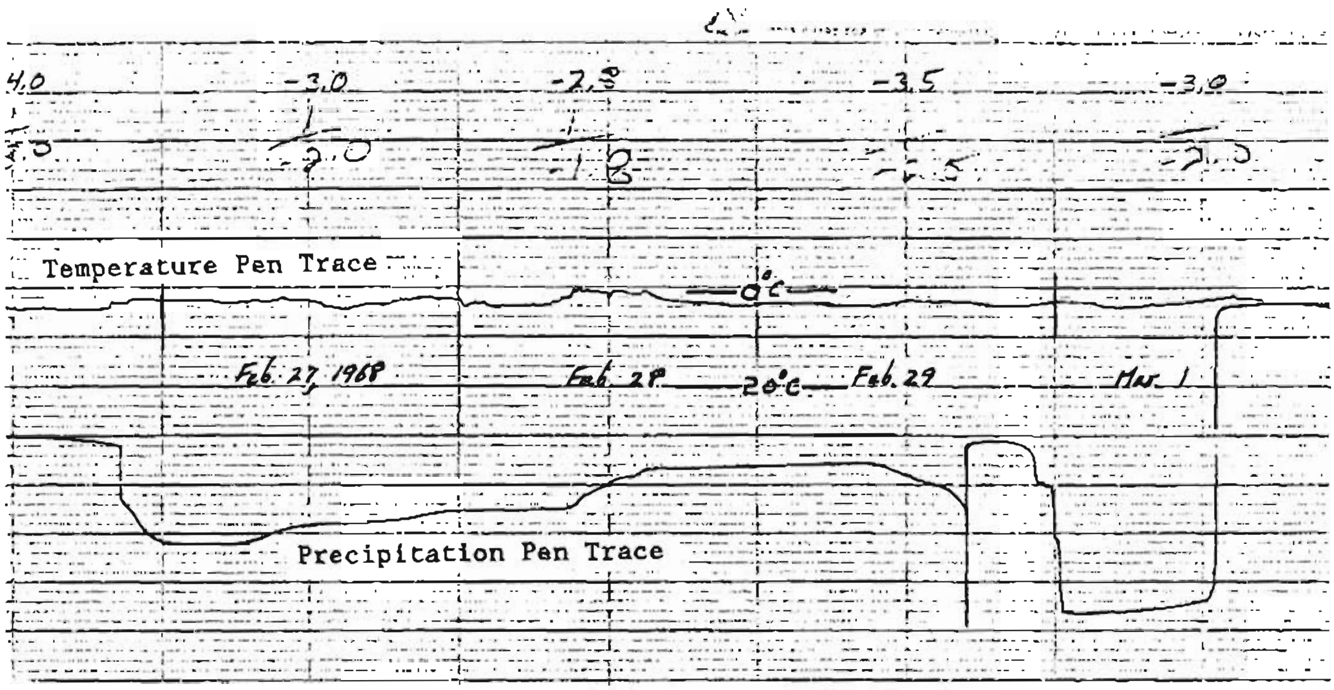

Figure 19.–Copy of gage chart February 26 to March 1, 1968, showing effects on precipitation record caused by snow blowing onto float sensor and then sliding from it. This record was rejected, and an internal baffle and a double-walled recorder shelter were added to the gage to correct the problem.

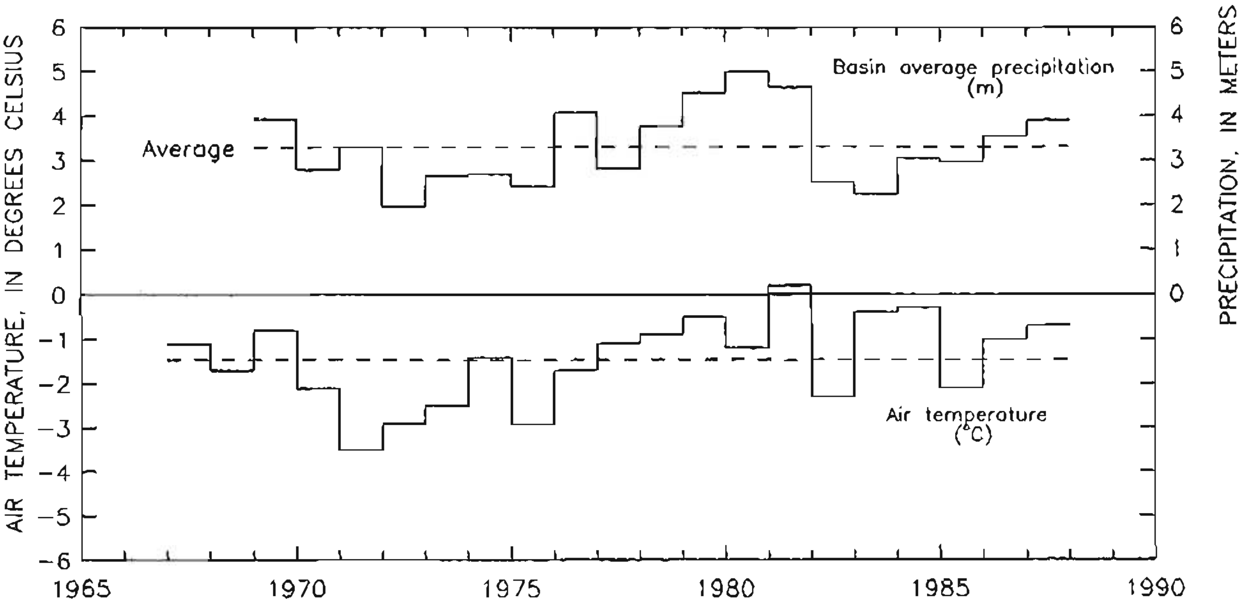

Figure 20.--Basin average annual precipitation and measured annual average air temperature at 990-m altitude at Wolverine Glacier. Dashed lines are averages for the period of record. Basin average precipitation is the gage catch multiplied by 3.

Monthly precipitation has no distinct seasonal pattern that is evident in a simple time-series plot (fig. 21A) because of frequent and strong precipitation anomalies, but seasonal variations of air temperature are pronounced (fig. 21B). However, a pattern of greatest precipitation in September and October, and a second maximum in January and February show up if a monthly subseries plot of the data is made (fig. 22A). Air temperature varied seasonally (fig. 22B), with an average of about 7 months per year being colder than 0°C. September was the wettest month with a mean value of 154±20 mm gage catch; and June was the driest month, 39±5 mm gage catch. Snow, which occurs at temperatures lower than about +2°C, is the dominant form of precipitation at Wolverine Glacier, is 70 to 80 percent of the total, and falls during all months of each year except July and August.

The relation between monthly average temperature and precipitation catch at Wolverine Glacier is different for summer and winter. Higher precipitation is associated with cooler temperatures (fig. 23) during May through August. This seasonal pattern was also found earlier by Diaz (1986) in Canada and Alaska using climatological data from low altitude stations.

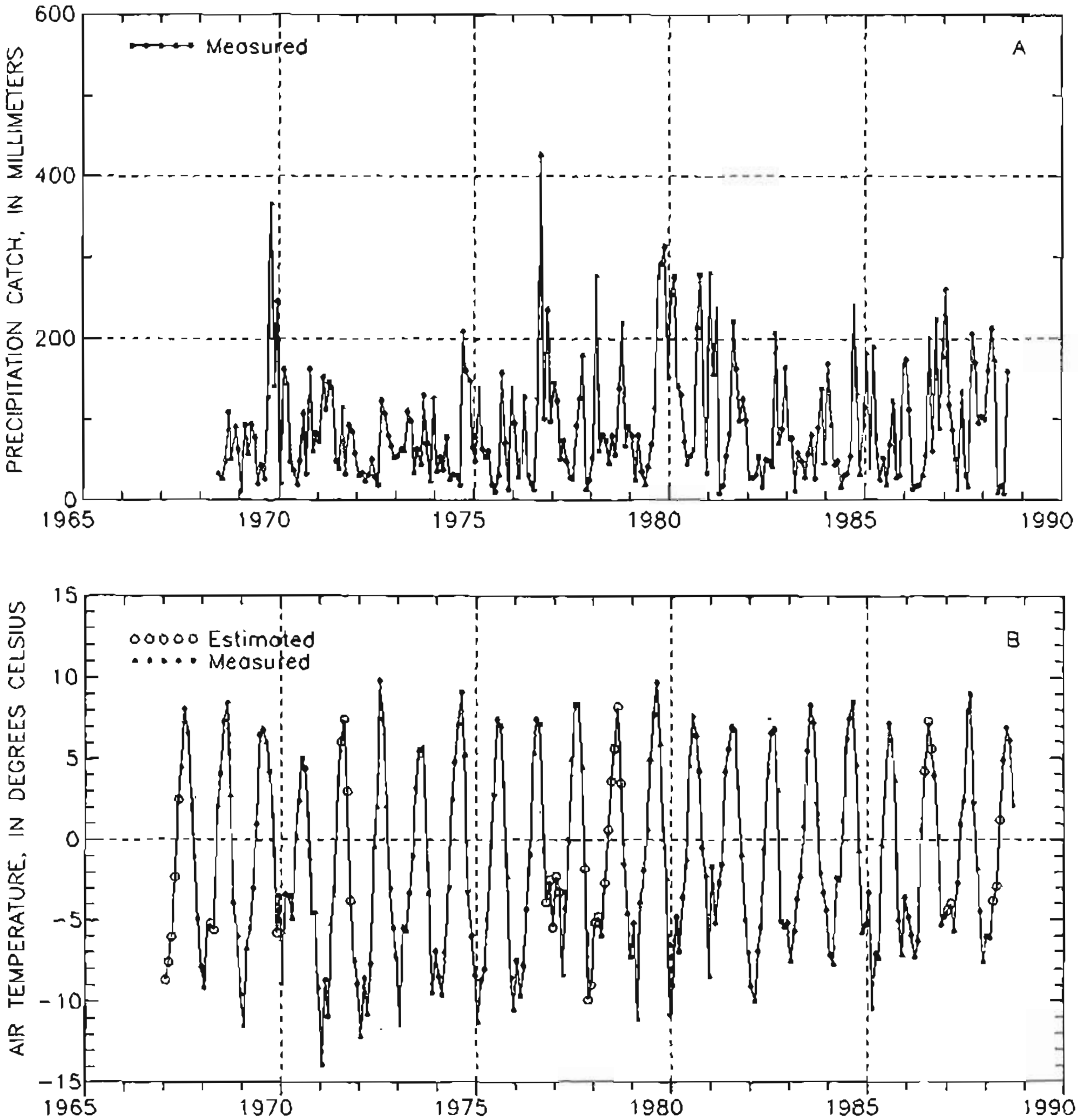

Figure 21.–Time series graphs of climatological data at Wolverine Glacier from 1967 to 1988: **A**, monthly precipitation gage catch (not true precipitation); **B**, monthly average air temperature. Measurements at Wolverine Glacier (dots), and estimates of missing record (circles) based on climatological data from Seward, Alaska (National Weather Service, 1967-88).

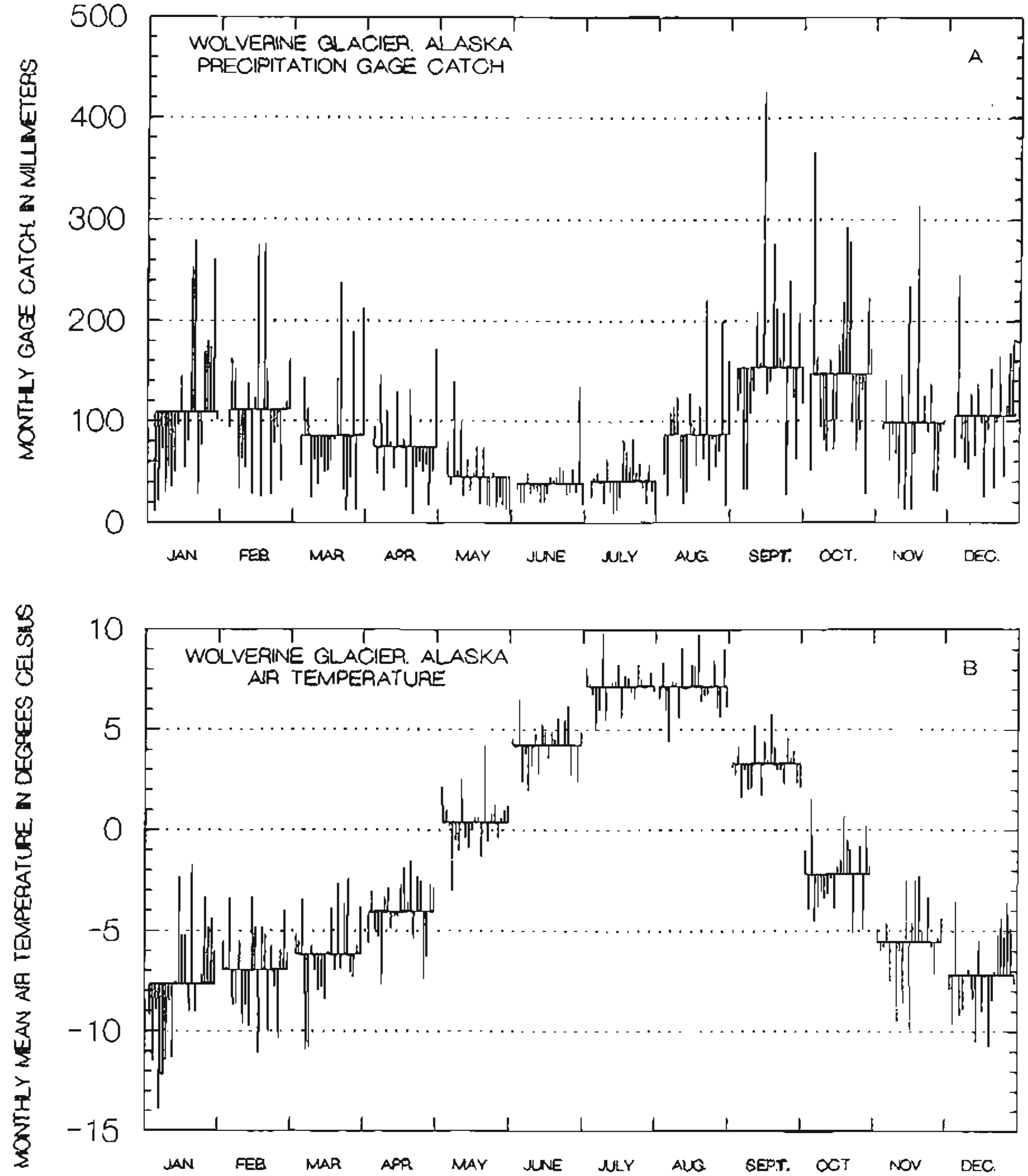

Figure 22.--Seasonal subseries plots (Cleveland and Terpenning, 1982) of climatological data at Wolverine Glacier from 1968 to 1988: **A,** monthly precipitation gage catch; **B,** monthly average air temperature. Horizontal bars are the averages for each subseries (month). Vertical lines indicate the time-series of departures from each monthly mean, so the end of each bar is the measured value.

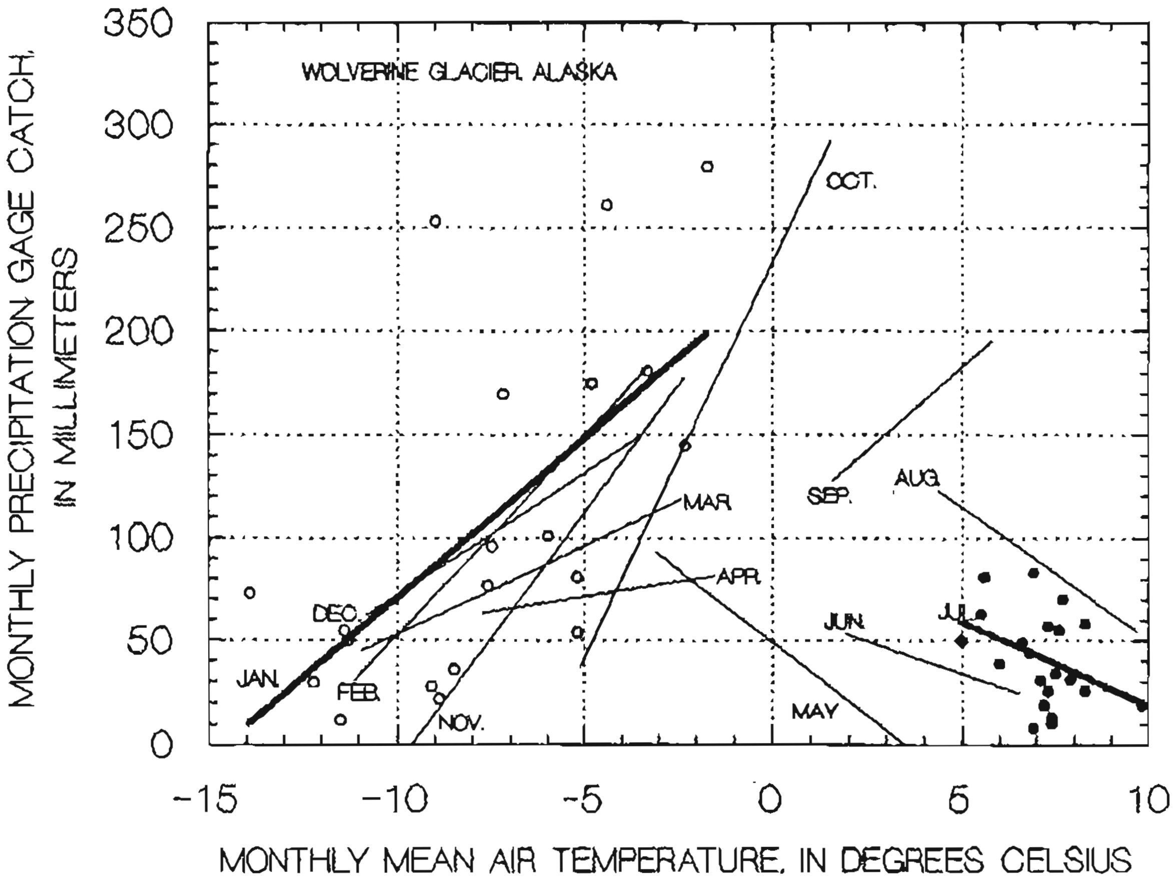

Figure 23.--Linear regressions of monthly precipitation gage catch as a function of air temperature at Wolverine Glacier. Data shown only for January (open circles) and July (solid circles) as examples; data for other months are presented in appendixes of this report.

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APPENDIX 1

Average air temperature, in degrees Celsius, at 990 m altitude at Wolverine Glacier, Alaska. Data are reported by *Measurement Years*, which extend from October 1 to September 30, and are designated by the year in which they end, a format used by the U.S. Geological Survey for reporting hydrologic information.

SYMBOLS

<u>Symbol</u>	<u>Explanation</u>
C	Clock stopped.
D	Part of daily temperature record estimated (generally less than 5 hours) due to door open on temperature sensor housing and sun shining directly on sensor for part of the morning.
E	Estimated value based on climatological data obtained by National Weather Service at Seward, Alaska. Temperatures estimated using regression equations, table 3.
F	Record not used due to paper frozen to recorder drive cylinder.
H	Temperature record not used due to hysteresis error caused by lack of proper freedom in pen carriage.
L	Data lost.
N	No data due to pen not inking.
P	Daily value estimated from intermittent pen traces.

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1967 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1									0.4	1.9	7.3	6.4
2									1.2	7.5	7.9	5.5
3									1.1	8.2	7.1	6.1
4									1.0	5.2	6.3	5.1
5									0.9	4.0	6.6	2.8
6									2.0	3.2	7.2	2.6
7									1.5	7.6	5.8	2.0
8									3.3	3.4	6.1	3.5
9									3.5	9.3	5.9	3.3
10									5.8	14.1	5.9	3.7
11									8.2	13.3	6.4	3.2
12									3.8	9.5	6.6	2.6
13									2.8	11.7	5.8	3.2
14									3.6	11.9	7.1	2.9
15									6.2	11.0	7.9	2.5
16									6.1	6.0	6.5	3.5
17									8.1	5.8	6.2	5.2
18									6.9	5.8	5.8	2.2
19									8.5	4.2	6.6	1.8
20									6.1	4.9	8.3	2.0
21									5.1	7.9	5.3	3.2
22									9.6	8.9	7.3	1.6
23									9.6	12.9	5.8	2.2
24									4.6	12.9	4.0	3.0
25									5.0	11.5	4.6	1.0
26									5.4	6.0	4.9	2.0
27									4.6	10.0	6.5	2.0
28									4.7	11.8	9.1	1.8
29									3.3	10.0	7.9	1.8
30								1.9	1.9	5.2	7.4	3.0
31								-0.4		6.0	8.2	
TOTAL									134.8	251.6	204.3	91.7
AVERAGE				-8.7 E	-7.6 E	-6.0 E	-2.3 E	2.5 E	4.5	8.1	6.6	3.1

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1968 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.0	-2.8	-13.0	-3.5	-17.1	-2.0	F	-3.5	3.0	5.0	6.5	6.6
2	4.2	-1.8	-14.0	-4.5	-17.0	-3.6	F	-2.9	4.0	4.6	6.0	5.5
3	5.0	-2.0	-19.0	-6.0	-19.5	-3.0	F	-1.4	1.2	5.2	8.5	6.0
4	2.0	-2.2	-16.5	-5.6	-21.2	-3.0	-2.5	-3.8	1.3	9.0	13.0	5.5
5	0.8	-5.5	-9.6	-7.0	-13.4	-2.0	-1.5	-3.0	2.5	9.2	16.5	6.0
6	1.5	-7.0	-7.8	-5.2	-4.4	-4.0	-4.4	-3.5	1.2	7.5	17.5	5.5
7	-0.5	-6.5	-6.5	-1.8	-3.5	-5.0	-4.5	-3.0	-0.5	8.9	16.5	4.5
8	3.0	-3.2	-8.0	-3.7	-3.0	-4.0	-9.7	-0.6	0.5	6.3	10.3	3.5
9	1.8	-3.7	-8.2	-4.5	-2.6	-3.5	-10.2	0.7	4.3	5.8	8.2	3.2
10	2.8	-3.3	-12.5	-7.5	-3.7	-3.6	-10.0	1.0	6.8	7.5	5.5	2.5
11	2.0	-3.2	-9.4	-13.6	-1.8	-2.8	-7.3	5.4	3.5	5.2	6.0	3.2
12	1.3	-2.0	-4.5	-16.5	-1.0	-4.8	-5.5	9.0	4.0	5.6	6.5	2.0
13	-0.5	-2.2	-4.0	-17.0	0.0	-3.0	-5.0	7.0	3.5	7.5	5.5	3.2
14	-1.0	-3.5	-4.2	-13.3	0.0	-4.0	-4.0	5.2	2.8	5.0	5.0	5.0
15	-1.3	-3.6	-6.8	-17.0	-1.2	-7.0	-3.0	1.2	3.0	6.0	5.5	3.5
16	-0.8	-3.4	-8.7	-13.0	-2.5	-8.5	-2.5	0.8	3.0	7.0	6.5	3.0
17	-1.5	-3.1	-10.0	-10.5	-5.1	-12.0	-4.3	5.3	2.8	6.5	10.0	3.5
18	-4.0	-3.0	-9.5	-14.1	-5.6	-14.0	-5.1	4.4	6.0	6.2	11.5	2.5
19	-3.0	-1.2	-8.0	-14.0	-5.5	-12.8	-3.4	7.5	6.8	9.5	11.0	1.5
20	-3.5	-0.8	-8.0	-14.7	-5.0	-7.0	-4.2	11.2	3.0	9.5	6.2	1.7
21	-3.2	-2.0	-9.2	-13.0	-4.0	-2.4	-3.9	8.5	1.5	8.7	6.0	1.4
22	-3.5	-3.2	-10.5	-4.6	-3.5	-5.5	-1.3	3.0	3.0	7.3	6.8	1.0
23	-6.2	-9.0	-7.0	-8.0	-3.5	-6.0	-1.5	2.8	2.2	6.9	7.0	1.0
24	-7.2	-15.0	-7.0	-7.8	-3.0	F	0.4	1.0	2.8	10.0	7.5	1.0
25	-6.5	-9.5	-4.5	-6.0	-3.0	F	-0.7	2.5	3.3	12.0	6.5	0.5
26	-1.5	-5.8	-3.5	-6.0	-3.0	F	-3.0	3.2	4.0	8.2	7.5	0.0
27	-1.0	-4.9	-3.2	-6.0	-2.0	F	-1.0	2.2	7.2	7.0	8.5	0.5
28	-4.0	-7.0	-2.8	-5.2	-1.8	F	-1.3	1.2	13.0	7.0	10.0	0.5
29	-3.2	-12.0	-2.4	-5.5	-3.5	F	-2.8	2.5	13.5	6.5	7.3	-1.0
30	-3.0	-16.0	-3.0	-13.0		F	-4.6	1.3	10.0	7.0	5.0	-3.0
31	-4.0		-4.0	-18.5		F		0.8		7.5	7.2	
TOTAL	-32.0	-148.4	-245.3	-286.6	-160.4			66.0	123.2	225.1	261.5	79.8
AVERAGE	-1.0	-4.9	-7.9	-9.2	-5.5	-5.2 E	-5.6 E	2.1	4.1	7.3	8.4	2.7
ANNUAL AVERAGE		-1.2										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1969 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	-2.4	-3.5	-12.5	-23.0	-11.4	-4.6	-2.6	-3.8	1.2	8.4	9.8	6.8 D
2	-1.0	-3.3	-14.4	-18.5	-14.0	-6.0	-2.4	-3.0	5.0	12.0	11.2 D	5.0 D
3	-1.0	-3.9	-16.2	-16.6	-16.8	-5.2	-1.0	-3.8	4.2	8.2	9.4 D	3.6
4	-1.0	-4.0	-13.8	-13.2	-11.8	-4.4	-3.6	-3.0	2.0	5.8	7.2	4.8 D
5	-1.8	-3.1	-17.5	-15.0	-10.8	-4.2	-4.6	-1.8	0.0	5.8	8.4	2.8 D
6	-1.2	-2.5	-12.5	-14.2	-8.0	-4.2	-4.0	-4.0	1.8	6.6	8.4	4.2 D
7	-1.3	-2.4	-11.2	-11.0	-6.6	-3.6	-3.8	-3.4	1.6	6.2	6.8	4.4 D
8	-0.2	-2.6	-11.7	-15.2	-8.4	-4.6	-4.2	-0.8	2.0	5.8	6.0 D	2.0
9	-1.6	-4.1	-17.0	-17.1	-7.4	-3.8	-3.2	0.2	2.6	7.4	4.0	4.0
10	-2.7	-6.3	-12.2	-16.0	-6.0	-4.0	-3.6	-0.4	3.4	8.0	6.0 D	1.8
11	-4.8	-8.1	-8.6	-17.2	-4.0	-5.4	-3.8	-1.0	4.0	7.8	6.2 D	3.4
12	-4.2	-7.0	-10.4	-17.8	-4.2	-6.6	-3.8	0.2	6.0	6.8	3.4 D	5.8
13	-4.3	-9.3	-8.0	-12.2	-4.0	-6.4	-3.4	3.4	13.6	7.0	1.8 D	6.2
14	-5.5	-8.5	-7.5	-11.3	-4.2	-9.8	-4.0	2.0	15.0	6.0	4.0 D	2.8
15	-5.8	-6.9	-6.2	-12.7	-2.6	-12.0	-3.6	-0.2	12.0	6.2	3.4 D	2.6
16	-6.0	-4.8	-14.7	-10.8	-4.8	-8.8	-1.0	0.0	5.8	6.0	3.4	5.2
17	-6.6	-3.7	-16.2	-10.1	-5.0	-8.2	-2.2	2.0	4.6	5.6	6.8 D	7.0
18	-4.6	-3.6	-12.3	-9.9	-5.6	-7.4	-1.6	8.0	3.2	4.8	7.4 D	5.8
19	-7.4	-4.0	-6.4	-10.1	-5.8	-7.0	-1.2	5.8	4.0	5.2	8.4 D	5.2
20	-6.8	-4.0	-2.3	-8.0	-6.2	-4.2	-2.0	0.6	6.0	5.4	7.6 D	3.6
21	-5.7	-4.5	-4.0	-9.5	-6.0	-4.6	-2.0	1.4	4.8	8.0	6.4 D	6.8
22	-4.0	-7.4	1.0	-9.4	-5.6	-5.4	-2.8	2.2	5.0	7.8	3.2 D	4.8
23	-2.6	-6.0	2.1	-6.6	-6.0	-5.0	-1.6	5.0	6.6	10.0	1.4	4.6
24	-3.1	-4.2	-0.8	-2.1	-6.0	-5.4	-1.4	10.2	8.0	6.0	6.0 D	6.4
25	-3.9	-4.3	0.5	-3.0	-4.6	-6.4	-3.0	8.4	10.4	5.8	9.2 D	5.8
26	-4.0	-7.6	-6.9	-6.0	-4.6	-5.2	-3.6	6.4	13.2	8.0	6.6 D	2.8
27	-4.3	-8.8	-8.4	-5.8	-5.0	-4.6	-3.0	-0.4	15.8	8.0	7.2 D	1.8
28	-6.6	-12.0	-9.5	-6.8	-4.4	-4.2	-3.8	0.2	12.8	4.4	3.4	1.8
29	-6.1	-13.8	-10.1	-8.0		-3.6	-3.8	2.4	12.0	5.2	4.0	2.2
30	-6.3	-15.8	-11.4	-8.4		-2.8	-4.0	0.0	7.2	6.0	4.0	1.6
31	-5.2		-18.0	-9.6		-2.4		-0.8		7.0	4.6	
TOTAL	-122.0	-180.0	-297.1	-355.1	-189.8	-170.0	-88.6	32.0	193.8	211.2	185.6	125.6
AVERAGE	-3.9	-6.0	-9.6	-11.5	-6.8	-5.5	-3.0	1.0	6.5	6.8	6.0	4.2
ANNUAL AVERAGE		-1.8										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1970 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.2	-0.4	-4.8	-5.6	-10.4	1.0	-6.0	-2.8	0.2	7.8	4.4	4.8
2	1.8	-0.4	-2.6	-5.4	-4.8	-1.4	-7.0	-1.6	1.8	4.4	3.4	7.4
3	0.6	-1.8	-2.8	-6.0	-7.8	-6.6	-6.8	-2.6	2.0	5.6	5.2	6.0
4	1.2	-3.2	-3.6	-9.8	-5.0	-6.2	-9.6	-2.8	1.0	3.2	8.0	2.0
5	1.0	-5.0	-3.4	-12.4	-3.6	-4.0	-11.2	-2.2	2.2	2.0	4.8	3.8
6	2.8	-6.0	-2.2	-12.0	-4.0	-4.0	-7.8	-3.8	8.0	2.8	5.2	3.4
7	2.0	C	-2.0	-8.4	-3.4	-6.0	-6.8	-2.8	7.2	5.8	4.6	0.8
8	1.0	C	-2.4	-7.8	-5.8	-7.2	-5.8	0.4	0.2	4.6	3.2	-2.0
9	0.2	C	-3.0	-8.0	-5.6	-4.6	-4.2	3.2	1.8	3.0	4.8	0.2
10	-1.6	C	-4.4	-9.6	-3.0	-2.2	-8.2	4.4	2.2	2.4	5.0	1.6
11	1.0	C	-4.4	-15.2	-2.0	-0.6	-9.2	5.0	0.4	2.0	8.6	2.4
12	2.0	C	-6.0	-17.0	0.0	-2.2	-5.2	4.8	0.2	2.2	6.0	3.8
13	1.8	C	-4.4	-16.8	0.0	-3.4	-3.8	2.2	1.0	3.2	3.2	6.4
14	3.2	C	-6.4	-13.4	-0.2	-4.0	-3.2	-0.2	1.6	3.6	3.4	4.0
15	9.0	C	-5.0	-11.2	-2.2	-3.6	-2.6	-1.0	0.2	2.2	3.8	1.8
16	6.4	C	-3.0	-11.8	-4.4	-2.6	-3.8	-0.2	2.2	3.8	3.2	2.2
17	2.4	C	-1.2	-16.0	-3.6	-3.2	-3.4	-1.6	3.0	5.4	3.2	3.2
18	1.0	C	-1.8	-12.8	-3.4	-3.8	-1.4	-1.4	0.8	2.6	3.2	3.0
19	0.2	C	-1.4	-5.8	-3.4	-3.4	-2.0	-0.8	1.6	2.4	3.0	0.8
20	1.4	-2.0	-1.8	-2.2	-4.6	-4.4	-3.8	0.0	1.8	4.6	3.0	-1.2
21	-1.0	-2.6	-2.6	-1.8	-4.4	-3.8	-4.0	0.8	3.2	2.0	2.8	-2.8
22	-0.2	-2.8	-3.6	-2.6	-3.0	-4.2	-5.2	-0.2	3.2	3.4	2.6	-2.0
23	-1.0	-4.0	-4.6	-2.8	-3.6	-3.4	-4.2	-1.2	4.6	5.4	1.6	-1.8
24	1.4	-4.4	-4.0	-5.2	-4.0	-4.6	-3.6	-0.4	2.0	7.6	3.4	-2.0
25	2.2	-3.8	-3.8	-5.0	-3.2	-3.6	-4.0	2.2	3.4	11.6	6.0	1.0
26	2.2	-3.2	-4.8	-6.2	-1.0	-2.4	-3.4	3.0	3.2	14.0	7.4	1.6
27	1.0	-3.8	-3.6	-10.4	-1.4	-2.6	-3.8	1.2	3.0	12.8	6.4	0.2
28	-1.0	-2.6	-3.2	-10.2	2.8	-2.2	-2.2	1.0	2.4	10.4	4.2	-0.2
29	1.0	-4.8	-3.8	-11.4		-3.0	-2.4	1.2	3.0	6.0	4.0	-0.8
30	0.2	-6.0	-4.2	-7.4		-2.4	-2.6	0.6	5.2	3.8	3.4	-0.2
31	0.6		-4.0	-6.6		-3.2		0.8		4.0	4.0	
TOTAL	45.0		-108.8	-276.8	-95.0	-107.8	-147.2	5.2	72.6	154.6	135.0	47.4
AVERAGE	1.5	-5.8 E	-3.5	-8.9	-3.4	-3.5	-4.9	0.2	2.4	5.0	4.4	1.6
ANNUAL AVERAGE		-1.2										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1971 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.8	-2.4	-14.1	-12.2	-11.3	-4.7	-7.9	-4.2	-3.1	1.4	10.4	2.4
2	-0.5	-0.8	-16.5	-8.8	-12.2	-8.3	-7.3	-3.5	-1.9	1.4	12.0	2.2
3	-3.7	0.6	-16.5	-4.7	-12.4	-17.1	-5.6	-4.5	0.0	2.6	C	2.2
4	-2.8	1.6	-15.8	-3.4	-11.3	-24.8	-4.5	-5.4	4.0	9.0	C	0.6
5	-1.5	0.0	-8.6	-2.6	-7.3	-26.7	-6.0	-3.0	6.6	11.6	C	-0.5
6	-1.0	0.4	-11.1	-9.8	-4.1	-25.4	-6.9	-3.0	7.4	11.8	C	C
7	-1.6	0.0	-8.8	-10.0	-3.2	-19.0	-7.6	-5.2	4.6	12.4	C	C
8	-0.4	0.0	-9.4	-10.0	-3.5	-16.7	-6.6	-4.7	2.6	11.4	C	C
9	-2.0	-1.0	-8.3	-14.7	-4.7	-16.0	-6.4	-5.2	3.0	14.6	C	C
10	-1.2	-0.8	-6.8	-12.0	-7.5	-12.0	-7.3	-3.5	4.2	16.2	C	C
11	-2.8	-0.2	-6.6	-7.1	-5.8	-9.8	-6.4	-1.9	3.6	15.0	C	C
12	-1.0	-0.2	-3.7	-6.9	-4.1	-8.1	-5.4	-0.7	2.4	11.4	C	C
13	-1.0	-2.4	-3.4	-12.0	-4.7	-12.6	-5.8	-3.5	3.2	7.0	7.4	C
14	-3.1	-1.0	-4.1	-14.7	-3.2	-12.6	-4.9	-4.0	2.2	7.6	8.4	C
15	-6.7	-3.3	-4.7	-20.1	-5.8	-11.1	-7.3	-3.1	1.6	6.6	C	C
16	-6.4	-6.9	-4.5	-21.6	-7.7	-6.2	-4.5	-8.9	0.6	5.8	C	C
17	-8.6	-7.5	-4.5	-20.3	-6.0	-4.7	-5.8	-4.2	0.6	4.8	6.0	C
18	-9.6	-7.1	-5.8	-19.6	-6.2	-6.2	-4.9	-0.7	1.6	5.0	6.2	C
19	-9.2	-8.8	-3.0	-17.1	-6.9	-4.1	-6.2	-1.7	2.6	5.4	6.2	C
20	-10.1	-7.5	-1.2	-18.6	-4.7	-4.1	-7.1	-3.1	6.6	4.8	7.4	C
21	-9.4	-10.5	-6.2	-18.6	-4.3	-6.2	-6.6	-2.8	3.6	2.8	4.2	C
22	-10.7	-11.5	-5.4	-22.8	-10.9	-9.4	-5.1	-1.4	5.0	2.8	5.6	C
23	-12.8	-10.1	-3.7	-24.3	-18.6	-12.4	-3.5	-1.0	11.4	2.6	4.4	C
24	-12.0	-6.9	-7.5	-25.6	-20.7	-10.5	-5.6	1.4	7.6	3.6	5.0	C
25	-9.6	-5.6	-7.5	-16.9	-21.1	-9.6	-3.9	-2.6	11.4	4.8	4.2	C
26	-4.5	-4.5	-15.8	-11.1	-16.2	-10.1	0.4	-1.9	8.6	4.6	3.6	C
27	-2.8	-3.7	-17.1	-14.1	-11.5	-7.8	-0.5	-2.1	5.0	4.2	5.0	C
28	-1.6	-8.8	-17.5	-14.7	-8.4	-5.4	-1.9	-2.6	4.6	C	5.2	C
29	-2.4	-15.4	-14.9	-14.5		-4.3	-3.8	-2.4	2.6	C	5.8	C
30	-0.8	-13.2	-17.1	-13.0		-4.9	-4.2	-1.9	1.0	C	6.0	C
31	0.4		-15.2	-8.8		-7.3		-1.9		C	5.6	
TOTAL	-138.6	-137.5	-285.3	-430.6	-244.3	-338.1	-159.1	-93.2	113.2			
AVERAGE	-4.5	-4.6	-9.2	-13.9	-8.7	-10.9	-5.3	-3.0	3.8	6.0 E	7.4 E	3.0 E
ANNUAL AVERAGE		-3.3										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1972 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	c	-8.6	-10.2	-9.7	-3.8	-12.1	-8.6	-3.7	1.4	3.6	7.2	6.2
2	c	-10.4	-8.3	-8.1	-3.7	-16.0	-6.0	-3.9	-1.5	4.4	6.9	7.0
3	c	-7.2	-14.7	-7.9	-4.3	-14.8	-6.0	-3.1	-1.5	9.2	9.5	5.2
4	c	-7.0	-12.1	-7.4	-6.2	-13.8	-6.0	-2.8	-1.5	14.1	8.2	3.0
5	c	-5.5	-9.5	-9.3	-10.5	-16.4	-10.0	0.2	-1.1	15.7	6.7	2.9
6	c	-5.5	-4.4	-9.7	-14.3	-16.7	-8.3	1.1	-0.2	16.1	5.1	4.6
7	c	-3.4	-3.2	-14.1	-7.6	-17.8	-7.7	1.8	3.0	16.1	7.3	5.7
8	c	-8.2	-4.8	-16.8	-4.2	-19.0	-10.9	6.7	2.8	16.4	10.8	4.5
9	c	-10.6	-9.4	-24.5	-7.1	-21.2	-8.4	2.6	-0.5	14.3	13.2	3.8
10	c	-6.0	-12.1	-24.6	-7.5	-14.1	-10.2	-1.5	2.4	8.5	13.6	4.7
11	c	-5.8	-14.0	-22.3	-6.0	-10.9	-7.1	-0.5	5.5	9.2	12.1	3.9
12	c	-7.9	-12.8	-18.3	-9.1	-15.4	-6.9	-0.2	3.1	13.8	6.6	4.8
13	c	-7.4	-9.4	-12.8	-11.4	-9.8	-12.1	0.0	4.4	8.0	6.7	2.3
14	-3.6	-5.1	-5.9	-10.6	-8.0	-11.9	-12.7	-1.0	6.0	6.5	8.0	1.6
15	-2.9	-3.9	-5.8	-19.0	-12.7	-10.4	-12.9	-1.3	5.1	5.9	7.7	1.9
16	-1.3	-3.2	-7.6	-21.6	-17.8	-10.9	-10.6	-1.0	2.4	5.7	8.4	-1.7
17	0.0	-3.4	-8.6	-17.5	-22.0	-10.6	-6.5	-3.7	0.5	5.7	10.5	-2.2
18	-3.4	-1.8	-6.7	-12.8	-13.5	-3.7	-10.4	-2.8	0.4	5.5	9.4	-1.8
19	-5.8	-3.2	-16.6	-10.8	-9.2	-3.1	-10.6	-0.9	2.4	8.5	5.7	0.0
20	-4.1	-3.4	-19.4	-9.0	-10.5	-5.7	-5.7	-2.1	2.1	10.9	6.2	4.1
21	-1.8	-3.9	-16.4	-8.0	-8.6	-5.0	-7.1	-3.3	2.4	11.3	5.7	2.3
22	-4.6	-7.1	-12.9	-10.6	-1.5	-3.4	-7.4	-1.2	2.8	12.5	5.7	1.4
23	-8.8	-7.9	-7.2	-10.8	0.0	-7.1	-6.2	-2.3	1.6	13.0	3.9	-0.8
24	-12.8	-4.7	-0.9	-10.8	-3.7	-6.2	-6.2	-1.9	3.9	12.0	3.4	0.0
25	-10.6	-8.3	-5.8	-8.0	-8.3	-5.6	-5.9	-1.1	2.6	8.0	6.2	-0.5
26	-5.8	-14.0	-4.4	-6.4	-3.9	-4.1	-4.2	0.9	1.1	8.7	7.9	-1.3
27	-4.1	-11.7	-4.7	-6.0	-10.0	-4.2	-4.6	0.3	2.4	6.9	5.7	0.7
28	-4.7	-16.1	-5.9	-5.0	-11.4	-9.7	-2.8	-0.9	2.8	6.4	6.5	0.5
29	-7.2	-19.6	-8.6	-8.0	-12.9	-12.3	-3.9	3.1	2.6	8.5	4.4	1.6
30	-5.8	-14.0	-5.5	-9.4		-12.2	-4.5	5.4	3.3	9.8	3.6	-3.3
31	-6.3		-8.6	-6.9		-10.6		2.4		7.7	5.1	
TOTAL		-224.8	-276.4	-376.7	-249.7	-334.7	-230.4	-14.7	60.7	302.9	227.9	61.1
AVERAGE	-3.8 E	-7.5	-8.9	-12.2	-8.6	-10.8	-7.7	-0.5	2.0	9.8	7.4	2.0
ANNUAL AVERAGE		-3.2										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1973 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	-6.0	-3.8	-9.0	-7.2	-9.3	-7.1	-4.3	-2.0	-0.6	2.6	4.2	2.8
2	-8.6	-4.6	-6.5	-7.8	-4.9	-7.8	-3.9	-1.6	-0.1	5.4	4.0	5.4
3	-9.4	-1.0	-7.7	-7.2	-4.0	-8.6	-3.0	-2.0	-1.4	4.0	5.8	3.6
4	-5.7	-5.2	-0.3	-7.0	-0.7	-7.3	-3.2	-2.6	0.6	6.8	6.0	3.2
5	-1.4	-6.0	-5.8	-6.2	-1.8	-6.5	-4.9	-2.3	0.8	8.2	4.6	2.8
6	-1.4	-6.0	-1.8	-6.0	-3.7	-5.0	-4.5	-3.9	0.8	10.8	4.8	2.6
7	-4.4	-6.0	-2.3	-4.7	-2.6	-3.5	-3.2	-3.0	2.2	9.8	4.8	1.4
8	-5.8	-2.4	-2.6	-4.7	-3.0	-2.7	-3.1	-1.0	1.4	4.0	4.4	1.0
9	-5.2	-3.4	-4.6	-2.0	-5.7	-3.4	-3.9	-1.3	0.8	5.0	4.2	2.0
10	-3.6	-6.0	-2.7	-1.6	-6.8	-5.0	-4.5	-1.9	1.0	6.4	3.8	3.2
11	-2.2	-7.8	-4.5	-5.7	-9.8	-5.3	-2.5	-1.9	4.2	4.4	3.8	2.8
12	-0.2	-8.0	-9.0	-14.9	-13.5	-4.0	-3.2	-0.3	7.0	3.2	5.2	2.6
13	0.0	-5.8	-10.1	-18.2	-8.7	-7.5	-3.5	1.0	6.4	3.8	3.6	2.4
14	1.8	-5.0	-17.3	-21.0	-6.5	-8.7	-3.4	2.3	5.2	3.6	5.2	2.0
15	1.0	-5.6	-15.7	-20.3	-5.0	-9.0	-3.3	-0.3	2.8	4.6	7.2	4.8
16	1.8	-4.2	-12.8	-18.3	-4.3	-8.6	-2.3	-0.5	5.4	4.2	8.4	3.4
17	-0.2	-5.2	-8.7	-12.0	-3.9	-8.5	-2.8	-0.8	7.4	5.2	10.2	4.0
18	-3.0	-5.0	-8.7	-11.2	-3.3	-13.0	-2.9	-0.7	3.8	7.0	11.0	6.2
19	-4.8	-3.3	-7.8	-13.7	-3.5	-9.0	-3.4	-0.6	4.0	7.2	12.0	4.0
20	-4.0	-2.8	-9.9	-20.2	-3.3	-7.7	-3.9	-2.3	3.4	8.4	9.2	2.8
21	-3.4	-4.6	-10.2	-16.8	-4.2	-6.3	-1.9	-1.5	6.0	6.6	6.8	1.4
22	-2.0	-5.1	-10.5	-20.4	-5.8	-4.1	-1.6	-2.2	3.2	4.6	6.0	0.6
23	-2.0	-7.6	-7.0	-23.6	-3.9	-2.3	-3.0	0.2	6.4	5.6	8.2	0.2
24	-2.4	-6.3	-4.9	-21.2	-4.2	-1.9	-3.4	0.6	4.8	7.4	5.0	0.0
25	-1.8	-5.3	-4.0	-15.8	-6.6	-3.7	-3.2	-0.2	2.4	5.2	4.6	-0.8
26	-3.8	-9.2	-6.0	-9.9	-8.0	-2.3	-4.3	-1.8	2.6	4.0	4.8	-0.2
27	-3.2	-6.3	-8.0	-4.6	-9.8	-4.1	-4.7	-1.3	3.6	5.0	4.2	-1.2
28	-3.8	-6.3	-4.9	-3.2	-6.9	-3.1	-3.5	-1.5	6.2	5.4	4.6	-1.4
29	-2.8	-7.9	-4.9	-3.7		-3.0	-2.3	0.6	4.4	4.2	3.0	0.0
30	-2.2	-9.2	-5.8	-12.1		-3.8	-2.1	2.0	2.0	4.0	2.0	0.4
31	-2.8		-9.3	-13.0		-3.6		-0.3		4.2	0.8	
TOTAL	-91.5	-164.9	-223.3	-354.2	-153.7	-176.4	-99.7	-31.1	96.7	170.8	172.4	62.0
AVERAGE	-3.0	-5.5	-7.2	-11.4	-5.5	-5.7	-3.3	-1.0	3.2	5.5	5.6	2.1
ANNUAL AVERAGE		-2.2										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1974 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.2	-2.4	-9.2	-0.4	-11.8	-13.5	-4.6	2.1	3.1	11.9	6.7	9.0
2	-1.4	-3.8	-11.7	-4.9	-9.7	-11.3	-4.5	-0.2	2.4	9.2	7.3	9.3
3	-1.4	-6.5	-12.2	-1.5	-8.0	-13.7	-4.8	-0.8	1.7	6.7	7.2	10.7
4	-2.4	-2.2	-7.1	3.1	-9.0	-17.9	-4.7	-0.6	1.4	5.5	9.0	9.8
5	-1.8	-4.0	-6.1	3.9	-6.8	-13.8	-3.5	-0.9	1.6	4.4	8.9	8.1
6	-1.0	-6.7	-7.9	3.4	-5.8	-11.4	-3.8	1.2	3.0	4.8	6.6	7.3
7	-2.0	-7.9	-8.1	0.3	-4.9	-17.2	-5.5	0.9	1.4	4.7	6.5	6.4
8	-2.8	-9.0	-6.0	-2.2	-4.8	-10.0	-5.4	-0.8	5.2	5.9	4.8	9.3
9	-2.0	-8.3	-4.4	-6.6	-6.0	-12.5	-4.9	-0.5	7.6	5.5	4.8	7.3
10	-2.0	-8.3	-5.3	-7.0	-5.3	-12.8	-3.2	0.3	10.4	5.8	7.2	5.3
11	-3.0	-14.1	-4.3	-8.2	-8.9	-10.4	-1.2	0.8	8.4	5.2	9.2	5.9
12	-6.0	-13.6	-6.0	-13.9	-10.3	-12.5	-5.3	-3.0	3.8	6.1	11.1	5.4
13	-5.3	-14.2	-8.0	-12.3	-9.2	-9.9	-4.1	-2.3	3.4	6.1	14.1	5.3
14	-3.3	-12.0	-7.1	-10.1	-13.0	-7.0	-4.0	-0.5	3.2	7.8	15.5	6.5
15	-3.6	-11.0	-6.5	-17.4	-16.3	-5.4	-3.9	1.4	2.9	7.6	14.2	5.4
16	-3.8	-12.1	-8.1	-12.2	-13.8	-5.4	-2.8	3.6	1.4	9.3	14.8	3.4
17	-3.8	-11.2	-6.6	-11.1	-11.4	-5.4	-3.8	-0.6	2.3	12.5	13.5	4.0
18	-4.1	-8.8	-5.2	-12.7	-18.2	-6.1	-4.0	1.0	1.3	8.9	13.4	3.1
19	-4.9	-8.5	-5.1	-13.8	-12.9	-4.2	-2.8	3.3	3.1	5.8	12.2	5.0
20	-5.0	-10.1	-8.0	-12.0	-11.2	-2.5	-3.4	0.3	6.0	4.3	10.9	6.3
21	-6.2	-10.1	-12.1	-12.2	-11.8	-0.9	-0.2	4.4	3.3	4.2	10.8	5.0
22	-4.8	-8.7	-10.1	-9.8	-8.2	-1.7	-2.1	7.5	9.1	4.1	7.7	4.3
23	-5.2	-8.1	-7.2	-5.0	-8.3	-2.7	-2.9	7.8	9.8	5.3	5.2	3.1
24	-4.3	-7.6	-6.2	-5.8	-5.3	-1.1	-0.9	9.0	3.2	5.2	1.6	2.9
25	-4.2	-8.0	-5.6	-9.0	-9.0	1.6	-1.8	10.3	3.4	6.3	3.6	3.1
26	-2.8	-12.6	-4.1	-10.3	-7.0	1.1	-2.1	5.4	5.3	10.2	5.2	1.7
27	-2.6	-15.0	-4.4	-14.2	-9.3	-2.1	-0.5	2.1	8.3	13.3	7.6	1.3
28	-4.3	-14.2	-5.2	-19.7	-13.2	-2.5	-1.2	7.3	7.3	11.7	8.5	1.3
29	-3.4	-16.3	-7.0	-15.8		-2.3	2.1	9.2	9.6	6.4	9.3	0.3
30	-4.1	-10.3	-9.1	-12.9		-1.6	4.2	7.5	12.5	8.1	13.1	-0.6
31	-5.1		-0.9	-11.9		-2.9		3.8		6.3	11.4	
TOTAL	-106.4	-285.6	-214.8	-262.2	-269.4	-218.0	-85.6	79.0	145.4	219.1	281.9	155.2
AVERAGE	-3.4	-9.5	-6.9	-8.5	-9.6	-7.0	-2.9	2.5	4.8	7.1	9.1	5.2
ANNUAL AVERAGE		-1.5										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1975 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	-7.6	-2.3	-6.2	-22.2	-10.3	-4.2	-8.3	-1.8	2.2	4.6	5.7	5.3
2	-8.2	-2.7	-7.3	-22.3	-12.9	-7.1	-10.7	0.4	0.0	6.0	7.8	4.2
3	-7.4	-2.0	-12.7	-22.5	-7.5	-9.0	-8.8	-2.9	1.9	5.0	11.0	3.6
4	-4.5	-3.1	-6.8	-23.1	-3.8	-8.0	-6.3	-2.9	0.3	3.6	11.5	4.0
5	-0.4	-2.2	-4.6	-21.8	1.9	-7.9	-5.5	-4.2	1.7	8.0	7.3	2.3
6	0.2	-2.3	-3.2	-20.9	4.4	-7.6	-2.8	-4.1	0.6	12.5	10.0	2.7
7	-2.0	-2.9	-2.7	-17.9	2.0	-6.0	-2.8	-4.7	1.2	13.9	8.6	1.4
8	-5.0	-2.9	-3.7	-15.9	-3.5	-6.1	-4.9	-1.5	-0.4	13.6	6.6	0.6
9	-6.2	-4.8	-4.8	-15.4	-9.4	-8.2	-3.8	2.0	-0.1	14.5	6.7	1.2
10	-6.1	-9.9	-3.8	-13.3	-16.0	-7.1	-3.4	3.8	0.3	12.9	8.0	4.5
11	-4.8	-7.2	-5.1	-11.6	-18.0	-5.7	-1.7	1.5	-0.4	10.7	5.6	4.4
12	-4.0	-4.7	-5.5	-15.8	-16.8	-6.2	-4.0	0.3	0.0	5.9	6.7	4.0
13	-2.0	-5.7	-6.4	-17.3	-13.6	-6.5	-2.8	-1.8	1.4	5.8	6.9	4.8
14	-0.8	-5.2	-8.4	-12.4	-11.4	-6.2	-2.9	0.2	2.4	6.1	7.5	4.2
15	-0.5	-9.3	-11.2	-6.1	-16.1	-6.8	-1.9	-0.7	5.3	5.3	6.2	3.0
16	-1.6	-10.7	-14.1	-4.2	-10.1	-7.0	-3.0	-1.8	6.2	5.8	6.6	2.8
17	-1.5	-10.1	-9.4	-3.8	-5.6	-6.2	-1.7	-1.5	3.5	7.6	7.8	3.9
18	-2.5	-12.9	-6.1	-3.5	-7.2	-10.0	-9.4	1.4	4.5	8.0	4.1	3.7
19	-4.9	-13.8	-7.5	-5.1	-15.7	-11.9	-10.0	-1.7	1.3	6.4	3.6	2.4
20	-6.2	-13.0	-11.4	-6.0	-14.0	-15.2	-7.1	-1.5	1.9	5.7	4.4	3.5
21	-1.3	-6.1	-11.6	-4.9	-5.0	-15.6	-6.1	-0.6	3.7	5.4	5.7	3.6
22	-0.6	-6.1	-6.2	-2.7	-8.5	-14.0	-4.2	-0.7	1.6	5.3	7.5	4.4
23	-2.7	-5.0	-5.1	-2.9	-10.9	-9.6	-2.5	2.5	1.6	5.9	7.3	7.3
24	-0.8	-7.8	-7.4	-3.8	-9.7	-10.5	-3.8	-0.4	2.3	5.5	5.0	5.5
25	-1.5	-6.2	-10.9	-6.1	-4.9	-10.3	-4.9	-1.3	4.1	5.7	7.1	4.9
26	-2.5	-5.0	-12.9	-5.8	-5.2	-8.0	-4.7	0.1	5.7	7.5	9.4	2.9
27	-2.8	-4.0	-16.9	-5.0	-7.6	-2.8	-5.8	0.5	9.6	9.3	7.6	2.2
28	-2.8	-2.6	-13.7	-4.1	-7.3	-3.8	-5.3	1.2	10.8	8.7	7.4	2.0
29	-3.9	-3.0	-13.9	-10.7		-6.3	-3.8	1.0	5.3	4.7	8.0	1.5
30	-2.5	-5.0	-7.3	-11.8		-7.1	-2.9	1.8	4.4	4.6	5.3	1.5
31	-2.4		-13.0	-11.6		-6.1		3.6		5.5	3.3	
TOTAL	-99.8	-178.5	-259.8	-350.5	-242.7	-247	-145.8	-13.8	82.9	230	216.2	102.3
AVERAGE	-3.2	-6.0	-8.4	-11.3	-8.7	-8.0	-4.9	-0.4	2.8	7.4	7.0	3.4
ANNUAL AVERAGE		-2.5										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1976 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.5	-15.3	-18.0	-5.0	-9.5	-8.0	-4.9	2.6	7.0	4.8	14.3	2.5
2	1.2	-13.6	-18.0	-6.9	-6.0	-6.4	-5.8	-1.3	5.5	4.6	10.5	2.3
3	5.0	-17.9	-16.6	-8.0	-4.8	-5.0	-5.7	-1.8	2.4	4.4	11.8	3.6
4	3.6	-15.2	-20.1	-9.5	-3.0	-4.7	-5.8	-1.4	2.6	3.0	11.3	2.5
5	2.4	-9.5	-23.1	-10.8	-4.5	-5.5	-7.3	-2.6	0.7	4.5	6.9	4.0
6	2.0	-7.2	-19.7	-11.6	-3.9	-4.0	-7.7	-3.6	0.8	8.8	6.7	3.4
7	3.0	-9.4	-20.2	-13.5	-11.5	-5.8	-7.8	-3.1	3.5	12.4	6.8	1.4
8	1.4	-9.5	-18.1	-13.6	-21.0	-7.1	-6.1	-3.6	5.6	14.0	4.8	1.8
9	-0.7	-11.6	-18.6	-12.0	-18.0	-8.6	-3.7	-2.6	2.8	12.7	6.6	3.8
10	-2.4	-11.0	-16.5	-10.9	-14.9	-9.9	-5.8	-1.5	4.3	7.9	9.3	2.5
11	-0.7	-11.4	-17.2	-10.5	-11.3	-10.1	-4.8	-1.5	9.9	6.6	6.8	1.0
12	0.6	-9.3	-14.6	-9.8	-7.6	-7.9	-4.9	-2.1	5.4	7.0	7.2	1.4
13	1.0	-8.7	-10.5	-8.4	-6.0	-10.1	-4.8	-3.6	2.9	6.6	9.6	2.8
14	-0.4	-9.8	-10.9	-7.8	-7.2	-11.8	-8.8	-3.6	3.5	6.6	6.5	0.9
15	-0.4	-14.1	-7.0	-4.2	-8.1	-8.0	-6.6	-1.9	4.6	5.8	7.8	0.5
16	0.1	-12.6	-4.0	-3.8	-8.3	-10.9	-5.7	-1.5	2.5	6.8	6.7	0.6
17	-0.8	-7.3	-5.6	-4.8	-9.3	-10.4	-3.8	-0.6	1.7	5.6	4.7	0.6
18	-1.2	-2.9	-5.5	-3.9	-10.4	-7.9	-4.1	-2.4	2.6	8.4	3.7	0.7
19	-1.3	-2.5	-5.0	-5.0	-9.7	-9.9	-4.6	-2.9	3.1	8.9	4.6	0.6
20	-3.7	-2.6	-6.5	-5.0	-10.6	-7.9	-4.6	-1.6	4.2	6.6	8.1	3.0
21	-2.9	-2.9	-2.8	-5.0	-11.7	-5.5	-5.6	-1.1	2.8	6.6	10.5	4.4
22	-2.4	-3.7	-3.0	-9.8	-10.5	-4.6	-5.1	0.8	2.7	6.6	12.4	0.7
23	-1.9	-2.6	-3.2	-11.2	-14.2	-3.7	-3.3	-1.5	6.5	4.8	10.5	2.4
24	-2.6	-2.8	-3.8	-8.1	-9.8	-3.8	-3.6	-1.1	10.3	6.0	5.1	2.7
25	-2.8	-3.0	-3.1	-4.7	-8.4	-9.0	-7.0	0.7	10.8	7.9	4.5	2.4
26	-3.9	-3.8	-3.7	-3.3	-8.1	-9.0	-3.6	1.7	12.6	6.6	3.5	1.2
27	-4.8	-4.4	-4.9	-3.7	-10.3	-8.1	-2.5	1.5	5.6	5.4	3.0	1.0
28	-8.4	-7.2	-7.1	-5.7	-12.5	-8.2	2.5	-0.2	9.5	6.2	3.5	-0.6
29	-16.0	-11.6	-7.6	-3.8	-9.9	-10.3	5.4	2.2	12.7	6.8	3.8	-1.7
30	-18.0	-14.9	-5.0	-6.0		-11.8	5.7	3.5	10.6	11.6	5.9	-1.2
31	-20.0		-5.6	-6.9		-7.8		5.7		15.1	3.7	
TOTAL	-73.5	-258.3	-325.5	-233.2	-281.0	-241.7	-130.4	-28.4	159.7	229.6	221.1	51.2
AVERAGE	-2.4	-8.6	-10.5	-7.5	-9.7	-7.8	-4.3	-0.9	5.3	7.4	7.1	1.7
ANNUAL AVERAGE		-2.5										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1977 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	C	C	C	C	-6.1	-5.3	-2.9	6.7	11.3	6.6	8.1
2	-0.4	C	C	C	C	-5.7	-1.9	-1.4	7.9	9.3	6.1	9.1
3	-1.6	C	C	C	C	-5.7	-2.4	1.4	4.9	6.3	8.9	9.1
4	-0.3	C	C	C	C	-6.0	-3.5	2.2	0.9	5.1	8.5	9.6
5	0.7	C	C	C	C	-12.3	-3.8	-1.9	1.4	4.1	6.4	7.6
6	0.4	C	C	C	C	-11.4	-4.0	-0.3	2.4	4.8	5.7	4.5
7	-1.6	C	C	C	C	-11.3	-3.6	-0.9	2.6	6.5	5.9	3.2
8	-3.0	C	C	C	C	-11.2	-3.6	-1.3	3.6	8.9	6.6	2.6
9	-3.6	C	C	C	C	-10.4	-5.1	-2.0	3.4	11.8	7.2	2.1
10	-1.9	C	C	C	C	-8.8	-4.8	-1.6	4.3	13.1 P	6.1	4.7
11	-1.5	C	C	C	C	-10.5	-8.6	-3.4	4.1	15.1	6.3	5.6
12	-4.2	C	C	C	C	-9.2	-10.5	0.0	5.4	11.6	5.6	6.3
13	-3.7	C	C	C	C	-8.2	-12.4	1.5	6.2	6.6	8.8	5.4
14	-1.5	C	C	C	C	-8.2	-7.2	0.6	5.6	6.2	7.2	4.6
15	-1.1	C	C	C	C	-6.4	-8.0	0.2	4.2	5.1	8.0	3.9
16	-1.0	C	C	C	-1.0	-4.6	-7.8	-0.4 P	3.9	10.6	10.0	3.7
17	C	C	C	C	C	-8.5	-4.5	-0.9 P	3.8	12.6	8.6	4.6
18	C	C	C	C	C	-8.5	-5.8	-0.7 P	2.4	11.6 P	9.8	3.6
19	C	C	C	C	C	-8.1	-5.2	-0.2	4.4	7.6	10.6	4.1
20	C	C	C	C	C	-7.2	-1.7	-1.7	4.4	6.6	15.6	2.8
21	C	C	C	C	C	-7.4	0.1	-0.2	3.3	5.6	15.6	3.6
22	C	C	C	C	C	-10.0	1.0	0.1	4.2	5.4	12.1	3.8
23	C	C	C	C	C	-13.2	2.7	-0.1	5.0	5.9	10.6	4.6
24	C	C	C	C	-6.3	-11.5	0.1	-1.8	7.1	7.3	8.6	3.6
25	C	C	C	C	-7.0	-6.5	0.7	1.6	6.2	7.1	6.6	4.3
26	C	C	C	C	-7.0	-7.6	-5.2	2.8	7.1	6.9	5.9	4.1
27	C	C	C	C	-8.5	-10.6	-5.6	2.7	6.8	6.3	5.9	3.1
28	C	C	C	C	-7.1	-7.5	-4.4	2.6	8.3	12.1	9.0	2.1
29	C	C	C	C		-4.4	-6.3	0.6	6.4	12.1	10.1	-3.4
30	C	C	C	C		-6.0	-3.5	2.1	8.6	7.1	9.8	-0.4
31	C		C	C		-7.8		4.6		5.9	5.8	
TOTAL						-260.8	-130.1	1.3	145.5	256.5	258.5	130.6
AVERAGE	-3.9 E	-2.5 E	-5.5 E	-2.3 E	-3.3 E	-8.4	-4.3	0.0	4.9	8.3	8.3	4.4
ANNUAL AVERAGE		-0.4										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1978 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.9	H	H	H	H	-5.2	-3.8	C	C	C	C	C
2	0.7	H	H	H	H	-5.8	-5.4	C	C	C	C	C
3	1.1	H	H	H	H	-8.6	-5.3	C	C	C	C	C
4	1.1	H	H	H	H	-8.9	-4.7	C	C	C	C	C
5	1.6	H	H	H	H	-9.4	-4.6	C	C	C	C	C
6	0.8	H	H	H	H	-9.4	-5.9	C	C	C	C	C
7	0.6	H	H	H	H	-5.5	-4.0	C	C	C	C	C
8	-0.4	H	H	H	H	-7.2	-3.1	C	C	C	C	C
9	-0.1	H	H	H	H	-5.8	-4.2	C	C	C	C	C
10	0.4	H	H	H	H	-4.8	-4.7	C	C	C	C	C
11	0.4	H	H	H	H	-6.1	-5.2	C	C	C	C	C
12	0.4	H	H	H	H	-5.9	-3.3	C	C	C	C	C
13	-0.2	H	H	H	H	-5.9	-0.7	C	C	C	C	C
14	-0.6	H	H	H	H	-6.6	-2.8	C	C	C	C	C
15	-1.6	H	H	H	H	-4.5	-3.1	C	C	C	C	C
16	-1.9	H	H	H	H	-4.5	-3.0	C	C	C	C	C
17	-5.1	H	H	H	H	-6.7	-3.6	C	C	C	C	C
18	-6.5	H	H	H	H	-4.8	-1.5	C	C	C	C	C
19	-7.5	H	H	H	H	-4.2	-0.1	C	C	C	C	C
20	-2.9	H	H	H	H	-4.7	-0.6	C	C	C	C	C
21	-1.7	H	H	H	H	-4.2	-0.3	C	C	C	C	C
22	-2.6	H	H	H	H	-7.2	C	C	C	C	C	C
23	-3.6	H	H	H	H	-8.7	C	C	C	C	C	C
24	H	H	H	H	H	-4.0	C	C	C	C	C	C
25	H	H	H	H	H	-2.8	C	C	C	C	C	C
26	H	H	H	H	H	-5.5	C	C	C	C	C	C
27	H	H	H	H	H	-6.0	C	C	C	C	C	C
28	H	H	H	H	H	-7.3	C	C	C	C	C	C
29	H	H	H	H		-4.7	C	C	C	C	C	C
30	H	H	H	H		-5.5	C	C	C	C	C	1.5
31	H		H	H		-4.2		C		C	C	
TOTAL						-184.6						
AVERAGE	-1.8 E	-9.9 E	-9.0 E	-5.2 E	-4.8 E	-6.0	-2.7 E	-0.6 E	3.6 E	5.6 E	8.2 E	3.5 E
ANNUAL AVERAGE		-1.6										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1979 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	-4.0	-3.8	-4.2	-4.4	-8.9	-3.1	-0.5	3.2	9.4	9.3	9.0
2	0.2	-5.0	-4.1	-4.3	-7.6	-6.3	-3.8	-0.6	1.5	13.9	12.2	9.2
3	-0.7	-6.0	-8.2	-5.3	-14.8	-4.9	-3.2	0.0	1.1	6.0	12.7	6.8
4	-0.2	-4.2	-7.7	-5.3	-9.0	-2.6	-2.7	-1.3	1.7	11.4	10.8	8.4
5	2.1	-3.4	-4.2	-3.4	-16.0	-2.3	-3.2	-0.7	3.3	6.0	8.2	7.8
6	2.0	-4.7	-2.9	0.0	-16.1	-2.3	-4.7	0.9	2.1	5.2	9.5	10.0
7	0.6	-6.6	-1.8	-2.7	-20.1	-4.6	-2.9	-0.2	1.8	6.6	7.2	9.5
8	1.1	-5.8	-2.4	-4.6	-18.0	-5.4	-2.2	-1.9	2.5	5.7	6.5	10.1
9	-0.2	-4.8	-3.9	-2.5	-14.3	-3.0	-2.8	-1.4	9.0	6.5	7.5	9.6
10	1.2	-3.8	-7.5	-3.5	-13.1	-4.7	-2.1	-0.5	9.0	8.8	8.0	7.1
11	-0.2	-2.6	-6.9	-2.6	-12.4	-4.4	-3.5	-0.3	6.7	7.7	8.5	8.1
12	-1.0	-3.2	-5.5	-3.8	-13.3	-4.6	-4.3	-0.8	6.9	6.4	8.2	8.6
13	-1.3	-3.8	-4.7	-5.2	-14.7	-3.8	-6.7	0.2	6.0	7.8	8.1	8.0
14	-3.2	-4.8	-10.8	-6.0	-17.5	-3.2	-4.7	-0.4	7.8	6.0	8.6	7.2
15	-2.8	-8.5	-15.7	-4.4	-13.1	-3.3	-3.6	-1.0	7.4	5.0	7.9	5.5
16	-1.3	-9.7	-14.4	-5.9	-10.5	-4.1	-4.7	-2.1	2.8	6.2	8.2	5.4
17	-0.4	-7.4	-8.6	-8.0	-8.1	-3.7	-4.2	-1.8	4.0	9.0	7.7	5.9
18	-0.8	-5.0	-7.0	-8.3	-9.7	-4.8	-3.6	-0.3	7.0	8.2	8.0	4.3
19	-1.3	-4.2	-8.5	-8.3	-8.0	-3.9	-1.5	-0.3	5.5	9.5	7.8	6.0
20	-1.9	-3.3	-10.0	-7.7	-10.0	-3.0	-0.6	-0.5	4.1	10.2	8.8	4.6
21	-4.3	-3.4	-10.4	-6.0	-7.2	-2.1	0.4	-1.1	6.8	6.8	11.3	4.2
22	-6.0	-3.7	-9.2	-6.4	-3.8	-3.2	2.0	-0.8	10.0	6.8	13.0	3.9
23	-4.8	-5.8	-8.6	-8.5	-3.2	-2.9	0.3	0.1	10.1	5.7	16.0	3.8
24	-1.3	-6.7	-12.2	-7.3	-9.2	-0.9	0.0	0.1	4.5	6.7	16.2	2.7
25	-2.1	-3.5	-11.2	-6.0	-9.2	1.6	-0.1	3.3	2.6	7.1	15.5	0.2
26	-2.6	-2.6	-8.7	-7.6	-7.4	-0.9	-0.6	8.5	2.2	8.8	15.3	1.7
27	-3.3	-1.6	-7.0	-7.0	-9.9	-5.4	1.0	9.8	2.0	9.3	12.0	0.4
28	-4.0	-2.6	-5.0	-5.9	-10.3	-6.2	3.0	7.4	1.5	8.6	10.7	1.4
29	-2.7	-2.3	-4.5	-4.3		-6.8	0.9	1.2	5.1	8.5	6.1	2.7
30	-4.3	-5.0	-4.4	-5.0		-5.9	3.9	2.0	7.3	7.6	5.9	2.7
31	-4.1		-5.4	-2.0		-5.2		3.1		8.3	5.0	
TOTAL	-46.5	-138.0	-225.2	-162.0	-310.9	-121.7	-57.3	20.1	145.5	239.7	300.7	174.8
AVERAGE	-1.5	-4.6	-7.3	-5.2	-11.1	-3.9	-1.9	0.6	4.9	7.7	9.7	5.8
ANNUAL AVERAGE		-0.5										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1980 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	-1.4	-3.1	-11.9	-4.4	-5.8	-5.0	-2.4	3.2	5.4	8.0	6.4
2	1.8	-1.2	-3.9	-12.6	-4.2	-5.2	-3.8	-2.2	4.0	6.4	5.6	0.2
3	1.4	-0.5	-5.2	-12.0	-7.6	-4.2	-3.8	-3.2	7.8	4.4	7.8	-1.0
4	1.6	0.8	-5.9	-9.2	-6.2	-5.0	-3.6	0.6	8.2	7.8	10.0	4.5
5	2.0	0.1	-9.3	-6.9	-3.8	-5.4	-2.8	-1.6	9.6	7.2	11.0	4.8
6	1.4	-0.1	-11.5	-4.3	-4.8	-3.6	-1.6	-1.8	9.4	6.0	9.6	4.4
7	1.7	0.7	-11.2	-2.1	-10.2	-5.0	-3.2	-2.0	5.2	6.0	6.0	4.1
8	2.1	0.8	-12.8	-0.2	-6.8	-5.8	-4.0	-1.0	5.6	5.0	6.4	4.5
9	4.1	1.1	-12.0	-3.7	-5.4	-7.2	-1.6	-1.4	6.8	5.4	6.6	3.5
10	3.7	0.3	-13.2	-6.6	-2.8	-8.2	-3.4	-2.2	3.6	5.0	7.0	4.5
11	2.3	0.9	-16.7	-20.6	-1.6	-10.8	-2.6	-1.6	1.6	5.6	6.6	3.9
12	0.4	-0.1	-19.4	-22.2	-0.6	-11.2	-3.2	-1.2	1.6	6.4	6.0	3.6
13	0.0	-2.0	-14.2	-15.2	-4.4	-13.6	-5.0	-1.2	2.0	8.8	5.4	4.2
14	-0.1	-2.5	-11.7	-14.6	2.6	-15.8	-4.2	-1.6	3.8	10.0	4.6	5.2
15	1.4	-1.9	-10.1	-14.0	0.4	-11.8	-5.6	-1.6	3.6	6.8	4.2	7.4
16	0.6	-6.4	-2.9	-15.2	-2.2	-11.6	-4.8	-1.8	5.4	7.2	4.2	8.3
17	0.3	-8.4	-8.4	-6.0	-5.6	-9.8	-4.6	-2.8	1.8	6.4	6.0	6.3
18	1.6	-7.7	-18.0	-4.6	-8.4	-8.4	-3.6	-2.6	1.6	8.0	5.0	6.1
19	-0.3	-3.5	-14.4	-5.6	-11.4	-5.8	-1.8	-1.0	2.6	11.6	6.6	6.1
20	-1.2	-4.9	-10.3	-5.2	-9.4	-6.6	-3.6	-0.6	1.2	13.4	5.0	4.1
21	-1.8	-2.6	-11.3	-3.6	-7.4	-4.2	-4.0	-0.8	2.6	10.0	1.4	2.3
22	-0.6	-3.3	-10.7	-6.8	-5.8	-5.6	-4.2	0.4	5.0	12.0	4.2	2.7
23	-0.2	-5.4	-10.1	-13.6	-4.6	-6.8	-4.8	-1.4	5.8	11.6	8.8	3.4
24	-0.5	-6.9	-8.4	-8.6	-7.2	-5.6	-3.4	-1.4	3.8	9.6	8.8	2.9
25	-1.7	-5.9	-5.9	-7.8	-3.8	-5.4	-3.0	0.2	3.6	9.2	9.8	3.6
26	1.1	-6.8	-5.8	-9.0	-3.4	-4.4	-2.8	-0.6	6.0	8.0	9.4	4.7
27	1.0	-3.8	-6.0	-7.2	-3.2	-5.4	-3.0	0.0	8.2	6.6	5.6	3.4
28	-0.6	-1.1	-10.9	-5.4	-1.8	-4.8	-1.8	-0.6	3.8	7.2	4.4	3.2
29	-0.8	-0.9	-17.3	-11.0	-4.8	-6.0	-3.0	-1.4	3.2	5.2	5.0	4.3
30	-0.1	-2.2	-17.9	-10.0		-4.8	-2.2	-0.6	3.0	6.8	4.8	3.7
31	-2.1		-15.7	-3.2		-3.6		0.6		7.6	5.2	
TOTAL	22.4	-74.8	-334.2	-278.9	-138.8	-217.4	-104.0	-38.8	133.6	236.6	199.0	125.3
AVERAGE	0.7	-2.5	-10.8	-9.0	-4.8	-7.0	-3.5	-1.3	4.5	7.6	6.4	4.2
ANNUAL AVERAGE		-1.3										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1981 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.9	-0.4	-5.4	-0.9	-1.8	-3.5	-3.5	0.6	3.0	3.2	6.2	8.4
2	1.7	-1.4	0.9	-1.0	-2.0	-5.1	-4.6	1.0	2.2	4.0	6.6	6.1
3	0.6	0.6	-3.6	0.5	-3.0	-6.1	-3.8	0.3	1.7	5.0	8.6	5.1
4	1.1	1.7	-6.1	-1.3	-2.0	-6.9	-5.2	0.5	2.0	5.5	9.9	5.7
5	2.4	-0.1	-5.0	-1.7	-1.5	-4.0	-4.0	2.5	2.4	8.5	7.6	5.6
6	3.0	-1.4	-5.7	-0.6	-2.0	-5.1	-3.2	10.1	2.9	6.2	6.8	4.6
7	3.0	-2.6	-4.5	-0.7	-0.9	-3.0	-3.8	12.7	3.2	6.2	8.6	4.7
8	-1.7	-5.8	-5.3	-1.1	-0.8	-2.4	-1.8	10.6	1.7	5.0	6.6	5.5
9	-4.6	-4.4	-5.6	-0.5	-3.0	-1.7	-2.2	7.0	2.3	4.9	6.8	6.6
10	-3.6	-2.7	-9.2	-1.5	-5.0	-2.5	-1.6	2.0	4.0	6.4	5.6	4.9
11	-4.7	-1.9	-15.9	-0.9	-5.8	-2.8	0.5	2.0	6.4	6.0	5.0	4.5
12	-2.5	-1.4	-17.2	-1.6	-6.9	-2.9	-1.4	2.0	7.3	5.4	5.6	2.4
13	-2.3	-2.9	-18.2	-0.6	-8.2	-2.7	-4.0	3.0	7.3	7.3	5.6	2.5
14	0.9	-1.6	-18.7	-0.1	-13.2	-3.0	-4.2	3.8	6.6	5.8	4.1	3.4
15	0.5	-1.4	-19.8	0.4	-14.0	-2.5	-4.0	5.4	4.8	6.8	4.6	3.7
16	-0.8	-2.3	-20.7	-0.4	-11.8	-2.4	-3.0	6.0	9.4	7.6	4.6	2.5
17	-0.6	-2.5	-16.7	-0.2	-9.1	-2.0	-4.0	3.5	10.2	8.0	3.8	5.0
18	1.3	-1.5	-11.8	0.1	-6.6	-1.5	-3.5	3.3	8.2	7.3	4.8	4.2
19	0.5	-2.3	-10.7	-3.4	-4.6	-1.2	-1.8	1.5	9.9	6.1	5.6	3.8
20	0.0	-3.5	-8.6	-4.8	-4.0	-1.7	-1.0	1.0	9.4	6.6	4.6	2.1
21	0.2	-3.4	-4.6	0.3	-8.6	-3.0	-1.0	1.2	7.6	8.3	3.6	1.7
22	0.4	-1.6	-4.4	-0.5	-8.1	-2.5	0.0	1.7	7.8	9.4	4.6	2.2
23	0.3	-1.4	-4.7	-2.5	-6.9	-2.0	3.0	2.8	10.2	7.8	6.1	2.4
24	0.9	-1.9	-2.5	-2.5	-5.3	-1.1	1.0	4.6	7.2	7.6	8.3	0.5
25	-1.3	-2.1	-7.0	-2.3	-1.8	0.6	-0.5	7.7	6.4	6.8	13.4	-1.5
26	-1.5	-2.4	-8.6	-4.2	-2.8	-2.0	-0.5	8.8	5.0	7.6	12.8	-1.1
27	-0.3	-3.9	-10.6	-6.6	-3.0	-2.0	1.0	4.4	4.7	10.4	9.2	-2.2
28	-1.4	-5.9	-6.3	-5.3	-3.8	-2.0	3.0	4.2	3.6	7.9	9.8	-2.7
29	-1.5	-4.9	-2.6	-4.0		-2.5	4.0	7.1	5.2	9.8	7.0	-1.1
30	-3.9	-3.1	-3.3	-2.8		-1.1	5.2	6.1	6.2	8.8	5.6	-0.5
31	-5.3		-0.6	-2.0		-3.3		3.0		7.6	6.3	
TOTAL	-16.3	-68.4	-263	-52.7	-146.5	-83.9	-44.9	130.4	168.8	213.8	208.3	89
AVERAGE	-0.5	-2.3	-8.5	-1.7	-5.2	-2.7	-1.5	4.2	5.6	6.9	6.7	3.0

ANNUAL AVERAGE 0.4

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1982 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.2	-6.0	-5.3	-11.4	-3.0	-7.6	-12.7	-4.1	8.6	1.7	9.7	4.7
2	-0.2	-9.2	-9.9	-9.3	-0.3	-8.7	-12.8	-2.6	6.6	0.7	9.5	5.8
3	-0.3	-9.5	-9.5	-8.4	1.5	-8.4	-10.2	-2.6	4.9	2.0	10.6	2.3
4	-2.7	-9.5	-10.3	-8.5	0.9	-8.3	-4.1	-5.4	3.4	2.4	9.5	3.0
5	0.4	-12.2	-12.6	-17.3	4.8	-6.0	-3.1	-2.6	1.1	3.4	8.2	4.0
6	-2.1	-11.2	-8.5	-17.0	5.3	-4.6	1.5	0.4	1.1	6.3	6.9	2.1
7	-1.5	-3.3	-6.2	-13.8	6.4	-5.7	-1.1	-1.3	2.4	12.1	3.7	3.0
8	-3.5	-1.9	-6.6	-13.4	2.4	-6.6	-2.9	-0.9	3.1	7.4	4.7	3.6
9	-1.8	-0.9	-7.0	-8.3	-4.4	-6.8	-5.6	-1.3	4.2	5.1	4.7	3.3
10	-1.3	0.0	-9.4	-2.7	-7.9	-7.7	-6.7	-1.0	1.6	6.4	3.6	3.0
11	0.0	-0.5	-6.1	-3.3	-11.6	-8.6	-5.6	-1.9	0.1	5.4	3.3	3.8
12	2.7	-1.9	-2.4	-2.6	-11.1	-10.6	-7.5	-2.0	0.5	6.6	7.7	1.6
13	3.4	-2.0	-3.1	-4.9	-9.0	-12.1	-8.6	-2.4	1.8	9.2	11.5	3.3
14	1.4	-2.1	-3.3	-7.6	-17.8	-9.7	-6.6	-1.4	2.2	8.7	7.9	4.6
15	0.5	-4.4	-3.1	-6.7	-26.3	-4.9	-6.5	-1.6	2.7	3.4	4.1	6.3
16	0.4	-4.3	-2.1	-5.6	-21.9	-5.0	-4.3	-0.3	2.7	4.5	7.0	3.8
17	-0.5	-5.6	-1.8	-9.6	-20.3	-4.1	-5.1	0.0	3.4	4.9	6.5	2.2
18	-1.6	-4.7	-2.4	-8.8	-20.4	-4.3	-7.4	-1.6	3.4	6.2	7.8	4.9
19	-1.7	-7.5	-4.9	-7.4	-21.0	-3.6	-4.5	-1.4	3.4	11.4	8.8	3.8
20	-0.5	-5.5	-6.6	-8.2	-20.3	-3.2	-4.0	-3.0	2.7	13.4	9.7	2.7
21	1.7	-4.7	-8.3	-10.5	-19.8	-3.6	-5.2	-0.5	2.3	7.6	7.1	3.0
22	1.5	-4.0	-5.2	-13.7	-16.3	-2.4	-4.1	1.7	3.0	6.2	6.8	1.3
23	1.8	-8.2	-3.8	-14.4	-13.7	-5.8	-5.8	-1.0	6.9	5.1	7.6	0.6
24	0.8	-4.5	-7.2	-13.7	-13.9	-4.7	-4.4	1.1	11.6	5.6	6.6	2.4
25	-1.4	-4.5	-7.8	-10.6	-12.6	-8.0	-4.1	2.4	13.3	5.6	5.2	2.2
26	-4.3	-2.8	-9.3	-12.7	-9.3	-9.6	-3.7	-0.5	13.6	9.7	7.4	1.4
27	-2.2	-3.1	-10.1	-10.5	-10.3	-6.0	-3.1	-0.8	7.5	11.4	7.7	3.3
28	-2.0	-5.0	-9.3	-5.8	-9.5	-7.9	-4.0	0.2	2.7	10.9	6.1	1.6
29	-4.1	-6.9	-11.2	-5.2		-7.9	-4.5	2.3	1.6	5.2	5.2	0.8
30	-6.4	-3.5	-11.3	-5.1		-10.0	-4.8	5.4	2.8	7.2	3.8	0.4
31	-7.3		-11.5	-5.0		-11.7		6.9		9.4	3.3	
TOTAL	-30.6	-149.4	-216.1	-282	-279.4	-214.1	-161.5	-19.8	125.2	205.1	212.2	88.8
AVERAGE	-1.0	-5.0	-7.0	-9.1	-10.0	-6.9	-5.4	-0.6	4.2	6.6	6.8	3.0
ANNUAL AVERAGE		-2.0										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1983 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.3	-3.9	-15.8	-2.1	-3.2	-7.5	-2.7	2.8	1.3	7.0	8.4	5.4
2	-0.7	-4.8	-10.9	-2.3	-3.7	-7.4	-0.9	-2.3	2.4	7.7	11.6	6.5
3	-2.0	-7.0	-9.5	-3.5	-4.3	-8.4	-3.8	-2.0	0.9	9.8	14.9	4.5
4	-3.1	-5.5	-8.4	-3.8	-3.1	-6.4	-4.4	-2.4	2.4	9.3	8.6	3.9
5	-3.5	-7.4	-4.9	-7.9	-4.5	-3.2	-4.0	-2.5	5.6	9.1	6.0	3.3
6	-5.2	-8.9	-3.9	-15.0	-4.8	-4.0	-4.7	-1.4	8.1	7.3	7.1	4.3
7	-3.2	-7.3	-3.2	-14.3	-7.0	0.1	-4.6	2.3	6.9	6.5	6.8	6.1
8	-4.2	-5.8	-3.4	-18.1	-9.5	0.0	-7.2	3.5	7.4	4.5	8.2	3.6
9	-2.0	-6.1	-6.3	-17.6	-10.1	-2.8	-5.5	0.4	5.4	4.4	6.9	4.5
10	-5.7	-5.4	-3.8	-17.8	-12.7	-4.0	-6.3	-0.8	3.3	5.7	7.6	6.0
11	-3.5	-3.8	-2.6	-18.3	-12.5	-3.0	-7.1	0.3	2.4	4.1	8.3	6.5
12	0.0	-3.0	-3.2	-16.8	-11.8	-2.5	-2.3	0.8	1.8	5.4	6.9	3.6
13	-3.5	-3.7	-4.0	-11.9	-10.2	-0.9	-2.0	1.7	3.9	8.5	4.3	2.9
14	-3.9	-4.6	-3.4	-9.5	-9.2	-1.9	-2.4	1.8	3.2	10.8	4.4	0.3
15	-3.2	-6.3	-2.6	-4.8	-4.5	-4.1	-4.6	0.3	4.6	12.6	4.4	1.3
16	-2.9	-6.9	-3.0	-6.5	-3.7	-3.0	-3.4	-0.8	5.3	13.5	6.7	2.5
17	-2.0	-11.1	-4.1	-7.5	-2.0	-0.8	-2.9	0.5	9.3	10.2	6.4	4.0
18	-0.9	-11.5	-5.6	-3.9	-5.5	-2.3	-5.1	-0.7	11.4	8.4	8.4	1.5
19	-2.8	-8.7	-5.3	-7.9	-4.7	-4.7	-4.5	1.3	7.0	7.7	10.7	2.0
20	-8.2	-7.7	-5.0	-6.7	-4.4	-5.0	-4.1	6.2	5.5	7.5	6.9	5.3
21	-11.6	-5.5	-5.5	-5.9	-3.4	-5.6	-3.5	1.4	6.2	8.1	4.5	4.0
22	-9.2	-3.5	-7.6	-2.5	-2.6	-4.1	-0.8	0.6	8.6	9.1	5.6	3.5
23	-2.6	-2.2	-6.6	-2.0	-2.0	-4.3	-1.1	-1.4	6.4	6.0	5.9	-2.0
24	-6.5	-1.5	-5.5	-6.5	-5.0	-3.8	3.0	-0.9	8.1	7.7	5.5	-7.7
25	-10.1	-1.7	-6.1	-2.7	-4.7	-4.8	4.7	1.3	8.5	8.2	2.8	-6.2
26	-14.0	-1.9	-4.2	-2.1	-4.0	-4.1	3.5	0.1	5.1	9.1	3.9	-3.4
27	-13.4	-2.7	-2.8	-2.5	-3.2	-3.8	2.4	0.3	5.8	11.8	8.6	-2.8
28	-4.7	-4.3	-2.1	-3.5	-3.7	-4.1	1.9	3.0	5.9	10.6	11.0	0.9
29	-7.5	-4.5	-3.1	-3.6		-3.2	1.4	4.4	5.9	8.1	7.4	3.3
30	-10.1	-8.3	-5.3	-3.7		-1.8	1.9	5.6	7.4	7.7	6.8	2.7
31	-7.6		-2.6	-2.9		-2.2		1.4		10.1	6.5	
TOTAL	-157.5	-165.5	-160.3	-234.1	-160	-113.6	-69.1	24.8	166	256.5	222	70.3
AVERAGE	-5.1	-5.5	-5.2	-7.6	-5.7	-3.7	-2.3	0.8	5.5	8.3	7.2	2.3
ANNUAL AVERAGE		-0.9										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1984 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.4	-2.6	-3.0	-2.3	-6.7	-3.7	-1.7	-1.4	6.2	5.0	8.3	4.9
2	1.6	-1.0	-3.6	-1.9	-7.0	-4.7	-2.4	-2.6	8.3	5.2	9.7	8.2
3	0.3	-1.0	-6.3	-3.0	-6.0	-4.3	-3.6	-3.4	8.7	7.0	12.3	8.1
4	-0.6	-0.8	-5.8	-11.4	-6.5	-2.0	-2.2	-1.5	9.0	13.2	13.4	6.5
5	1.9	-3.1	-3.2	-11.9	-10.1	-1.4	-2.5	-0.7	7.8	15.8	9.7	7.5
6	-2.5	-2.2	-4.2	-7.3	-9.9	-0.3	-1.9	-1.8	2.3	15.2	11.8	4.4
7	-4.1	-3.0	-5.0	-6.3	-14.8	-0.1	-2.5	1.7	3.0	13.6	10.6	4.2
8	-4.2	-1.8	-4.5	-3.0	-15.0	0.2	-4.8	3.9	5.3	7.1	10.5	4.6
9	-2.8	-1.3	-7.3	-2.2	-16.5	-0.2	-2.0	5.6	4.6	6.4	10.7	6.5
10	1.4	-2.6	-6.2	-2.8	-11.5	-0.3	-3.4	4.1	5.9	5.8	10.2	9.2
11	1.1	-0.8	-5.4	-4.5	-5.1	-0.1	0.1	2.6	7.3	5.2	8.6	7.3
12	0.0	-3.6	-5.8	-2.3	-4.2	-0.1	0.7	1.0	6.9	5.7	11.8	4.8
13	-1.5	-3.5	-8.1	-2.1	-4.4	-3.1	-2.9	1.9	3.0	4.9	12.1	3.5
14	-3.0	-3.2	-11.7	-3.0	-12.7	-1.8	-0.4	1.3	4.3	5.4	14.2	3.4
15	-2.1	-4.0	-9.4	-2.6	-5.7	-3.3	-2.9	0.5	2.3	6.5	14.9	4.0
16	0.2	-5.8	-8.1	-2.1	-5.8	-1.2	-5.3	1.0	1.8	6.7	9.9	4.1
17	-0.2	-6.3	-4.8	-4.8	-5.4	-3.5	-3.0	0.5	6.2	5.0	7.8	3.9
18	-0.4	-7.2	-2.7	-6.3	-7.3	-3.4	-3.3	0.5	8.4	5.3	7.0	3.7
19	-0.3	-7.7	-5.2	-8.8	-9.3	-2.3	-3.0	3.4	10.1	5.2	7.6	2.2
20	-1.1	-5.0	-4.4	-8.2	-12.6	-4.4	-2.3	4.2	9.4	5.6	6.3	1.2
21	-1.3	-3.7	-4.2	-10.5	-8.2	-4.6	-3.9	1.0	9.0	6.4	6.1	6.3
22	-2.7	-2.9	-2.8	-18.6	-6.4	-4.4	-6.2	1.6	10.4	7.8	6.5	5.7
23	-4.7	-3.7	5.9	-20.5	-6.9	-3.4	-4.8	3.2	6.0	7.4	7.6	3.7
24	-4.1	-7.1	5.5	-19.6	-7.3	-4.2	-3.0	1.5	4.6	7.4	6.6	2.4
25	-7.6	-4.8	3.5	-15.2	-5.1	-2.3	-2.9	1.1	4.9	7.0	6.3	2.2
26	-7.0	-3.5	2.8	-8.1	-3.4	-1.9	-3.5	0.0	5.0	7.6	3.5	3.3
27	-4.2	-2.8	-2.5	-7.7	-4.1	-2.7	-1.3	-0.5	6.0	8.8	3.7	3.5
28	-3.3	-1.5	-7.5	-8.3	-4.3	-3.0	0.4	3.6	8.5	8.0	3.4	3.2
29	-2.7	-1.2	-8.4	-4.0	-4.9	-3.6	0.0	4.4	4.9	7.2	3.7	4.0
30	-6.1	-2.2	-9.3	-5.2		-3.2	-0.9	0.1	4.5	7.9	3.9	2.6
31	-5.7		-6.2	-7.3		-2.4		1.6		8.0	4.1	
TOTAL	-65.3	-99.9	-137.9	-221.8	-227.1	-75.7	-75.4	38.4	184.6	233.3	262.8	139.1
AVERAGE	-2.1	-3.3	-4.4	-7.2	-7.8	-2.4	-2.5	1.2	6.2	7.5	8.5	4.6
ANNUAL AVERAGE		-0.1										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1985 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.9	-4.4	-2.4	-1.7	-1.0	-9.0	-18.9	-4.0	-1.4	6.9	7.6	6.8
2	1.6	-1.9	-3.1	-3.1	-1.6	-9.5	-13.3	-1.4	1.0	4.8	7.5	7.2
3	1.1	0.4	-1.8	-3.4	-4.1	-9.6	-9.1	-1.8	2.9	4.7	6.5	4.7
4	0.9	-4.8	-1.9	-4.6	-4.4	-7.0	-11.3	-0.4	1.0	6.7	8.1	6.4
5	0.3	-2.5	-1.8	-6.0	-7.7	-5.7	-9.9	0.1	0.0	10.3	8.4	8.6
6	2.0	-3.2	-2.7	-4.0	-9.4	-6.6	-6.2	0.8	0.4	12.6	7.8	9.6
7	2.0	-6.0	-4.7	-2.2	-9.8	-8.5	-4.2	-1.6	-0.4	4.8	5.1	9.8
8	1.2	-8.0	-7.7	-1.6	-12.8	-5.1	-6.4	-4.1	0.4	6.4	4.3	5.4
9	0.5	-5.7	-9.9	-2.3	-17.4	-5.1	-11.8	-5.1	0.5	8.4	2.9	4.4
10	1.4	-5.7	-9.0	-2.1	-13.8	-5.5	-14.5	-4.5	1.0	11.3	6.0	2.6
11	0.2	-9.5	-7.2	-2.9	-15.9	-6.1	-13.0	-5.1	1.1	7.6	4.3	2.7
12	-0.8	-13.3	-10.0	-3.1	-17.2	-7.2	-12.9	-3.2	1.8	6.0	4.3	3.7
13	-0.6	-10.9	-10.0	-3.1	-13.0	-7.4	-13.0	-2.9	1.2	6.0	6.2	4.9
14	-1.2	-7.1	-10.9	-4.3	-16.9	-8.8	-9.6	-4.6	1.2	6.3	6.8	5.3
15	-1.3	-2.7	-7.1	-4.5	-16.5	-5.5	-4.6	-2.3	1.2	5.3	6.4	5.3
16	1.0	-2.8	1.2	-2.4	-15.1	-6.3	-5.8	-1.2	1.1	8.4	6.2	3.8
17	1.5	-3.7	-1.6	-2.4	-15.0	-7.1	-3.8	-2.4	-0.2	10.5	8.3	1.9
18	1.0	-3.5	-3.4	-3.0	-15.6	-6.3	-4.9	-2.8	1.5	11.0	6.4	-0.1
19	-1.5	-2.7	-2.7	-2.1	-14.4	-7.1	-7.0	-0.7	1.0	8.0	3.3	1.5
20	-2.6	-2.5	-4.0	-3.4	-12.0	-5.6	-6.1	-0.4	0.1	6.8	2.7	0.5
21	0.0	-3.2	-3.9	-3.0	-13.4	-5.8	-2.7	4.1	2.4	4.4	2.2	1.6
22	1.0	-6.0	-3.3	-3.1	-13.4	-5.8	-3.3	5.9	7.0	3.2	4.7	0.1
23	-4.0	-8.1	-5.0	-2.8	-8.6	-5.3	-3.1	8.5	3.8	4.3	5.6	3.1
24	-4.2	-10.8	-6.4	-5.1	-7.9	-5.4	-4.1	5.4	0.4	6.0	6.1	2.0
25	-3.1	-12.0	-6.4	-5.4	-4.7	-7.1	-5.5	3.9	2.0	9.2	3.4	1.0
26	-2.3	-10.5	-6.7	-2.7	-4.2	-6.6	-4.3	6.4	4.5	7.1	7.3	0.4
27	-1.6	-7.2	-9.2	-3.1	-4.2	-8.6	-1.9	6.4	10.8	7.2	10.8	1.8
28	-3.1	-6.5	-9.2	-4.3	-10.4	-7.7	-2.1	0.9	9.5	7.5	13.1	1.1
29	-7.1	-5.1	-7.3	-3.2		-6.9	-4.8	-0.8	13.8	7.2	5.8	1.6
30	-6.1	-4.1	-5.0	-3.1		-8.6	-4.2	-1.7	14.7	8.8	6.4	1.6
31	-4.1		-2.2	-3.0		-14.4		-2.3		5.8	5.9	
TOTAL	-25.0	-174.0	-165.3	-101.0	-300.4	-221.2	-222.3	-10.9	84.3	223.5	190.4	109.3
AVERAGE	-0.8	-5.8	-5.3	-3.3	-10.4	-7.1	-7.4	-0.4	2.8	7.2	6.1	3.6
ANNUAL AVERAGE		-1.7										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1986 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.2	-18.2	-6.0	-8.6	-2.4	-15.3	-10.9	0.1	-0.1	L	L	3.7
2	1.6	-17.5	-8.2	-8.2	-3.8	-11.7	-7.5	1.4	0.1	L	L	2.6
3	-1.5	-12.1	-9.2	-4.2	-6.3	-12.7	-6.4	-3.0	0.1	L	L	3.2
4	0.0	-8.9	-7.2	-3.6	-4.7	-11.6	-8.4	-1.4	0.5	L	L	5.8
5	1.6	-8.4	-7.8	-2.7	-4.8	-11.5	-8.7	-0.5	2.0	L	L	7.3
6	-1.6	-6.7	-8.0	-5.1	-3.3	-8.4	-16.8	-1.6	2.4	L	L	5.8
7	-0.6	-8.6	-6.0	-4.3	-3.6	-6.1	-19.2	-1.9	1.0	L	L	3.9
8	-0.3	-7.4	-2.6	-6.6	-3.3	-12.3	-15.8	-2.9	0.1	L	L	2.8
9	0.2	-8.4	-3.4	-5.4	-4.1	-6.8	-11.4	-3.1	1.2	L	L	3.1
10	-0.2	-5.3	-1.0	-6.0	-1.5	-4.8	-9.5	-2.7	0.7	L	L	6.3
11	-1.3	-5.1	-2.0	-4.8	4.7	-2.0	-7.4	-1.4	1.1	L	L	7.8
12	-0.7	-9.0	-2.6	-2.5	7.1	-2.5	-7.1	2.0	3.7	L	L	7.9
13	-0.5	-11.9	-1.8	-2.0	4.3	-1.6	-5.3	0.6	8.8	L	L	8.6
14	-1.4	-11.7	-2.3	-2.8	5.7	-2.1	-4.8	-2.7	9.9	L	L	12.1
15	-2.1	-13.1	-3.8	-3.7	2.8	-4.1	-5.2	-3.4	L	L	L	9.4
16	-2.9	-6.2	-3.1	-4.3	3.9	-5.8	-4.1	-2.0	L	L	L	8.0
17	-3.3	-4.5	-4.3	-6.1	-5.4	-4.2	-4.3	-0.4	L	L	L	4.5
18	-6.0	-2.1	-2.7	-5.3	-13.5	-5.0	-5.3	-2.0	L	L	L	4.5
19	-8.7	-2.5	-1.4	-6.3	-14.2	-5.3	-3.0	1.2	L	L	L	2.2
20	-7.8	-0.8	-1.3	-8.2	-12.0	-4.9	-3.0	2.6	L	L	L	4.3
21	-6.5	-4.8	-2.1	-6.6	-8.8	-3.5	-3.8	3.4	L	L	6.2	2.2
22	-8.6	-4.3	-1.9	-2.8	-11.2	-5.1	-4.9	1.2	L	L	6.1	1.1
23	-10.8	6.3	-0.1	-2.1	-13.7	-3.4	-4.8	3.3	L	L	3.4	-0.1
24	-13.2	2.4	-1.7	-3.7	-11.8	-0.9	-4.4	7.6	L	L	4.1	-0.2
25	-15.3	-5.7	-3.2	-5.0	-13.1	-2.8	-4.7	3.3	L	L	5.6	-2.2
26	-11.6	-8.0	0.8	-4.3	-18.8	-7.9	-4.3	4.3	L	L	6.4	-1.3
27	-8.9	-9.8	-2.3	-5.8	-21.3	-9.3	-1.3	3.8	L	L	5.1	0.4
28	-7.6	-7.6	-3.4	-6.3	-18.4	-10.8	1.8	4.5	L	L	4.9	2.0
29	-9.4	-8.4	-3.2	-3.6		-15.5	1.5	6.6	L	L	4.3	2.5
30	-11.9	-6.4	-3.6	-3.7		-16.1	-0.2	1.8	L	L	2.5	2.3
31	-15.4		-5.4	-4.5		-11.5		1.1		L	3.2	
TOTAL	-154.5	-214.7	-110.8	-149.1	-171.5	-225.5	-189.2	19.8				120.5
AVERAGE	-5.0	-7.2	-3.6	-4.8	-5.9	-7.3	-6.3	0.6	4.2 E	7.3 E	5.6 E	4.0
ANNUAL AVERAGE		-1.5										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1987 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.7	0.2	-7.2	-2.6	C	-13.2	-2.9	-0.1	3.2	3.4	7.3	4.1
2	2.2	1.9	-6.6	-4.2	C	-13.0	-1.0	-1.0	2.5	4.9	7.9	4.1
3	2.4	-0.9	-7.1	-7.2	C	-14.5	-1.5	0.3	2.7	4.6	7.5	6.1
4	-0.5	-1.8	-4.9	-4.8	C	-16.3	-3.0	2.2	4.1	6.0	6.7	5.8
5	-1.3	-2.4	-5.0	-4.3	C	-16.7	-4.6	-0.2	6.1	5.6	5.9	5.9
6	-0.5	-3.0	-7.5	-4.4	C	-10.2	-3.3	-0.4	1.2	5.2	5.0	4.7
7	-1.3	-3.9	-6.4	-5.3	C	-6.1	-2.0	0.3	1.3	4.3	5.7	6.5
8	-0.4	-3.4	-3.0	-3.5	C	-3.1	-1.8	0.1	0.5	5.6	8.9	3.2
9	0.1	-3.8	0.8	-7.1	C	-0.8	-1.8	-1.0	-0.3	6.7	11.2	2.9
10	4.7	-2.3	-0.9	-17.8	C	-1.8	-0.5	0.8	-0.7	6.0	10.8	3.2
11	2.9	-0.2	-2.8	-16.8	-0.4	1.8	-1.0	2.6	1.7	4.6	7.6	2.1
12	1.7	-0.7	-3.8	-12.5	-1.5	-1.1	-3.3	3.3	1.8	4.6	7.8	1.0
13	1.3	-1.7	-3.8	-10.2	-2.5	-4.1	-3.6	1.9	3.0	5.7	8.4	0.4
14	-0.9	-2.2	-3.8	-6.7	-4.0	-4.1	-4.0	2.4	3.2	5.6	7.7	0.5
15	-1.0	-1.7	-3.8	-5.8	-3.8	-4.5	-3.4	1.4	2.8	7.8	6.1	0.0
16	-0.9	-3.0	-4.4	-5.9	-4.6	-4.2	-4.8	2.1	0.5	5.6	8.9	1.5
17	-1.9	-4.0	-4.0	-5.8	-5.3	-4.4	-5.2	0.6	0.5	6.1	7.8	2.3
18	-1.5	-9.8	-3.8	-5.8	-4.5	-5.7	-6.1	-0.2	0.7	8.3	7.7	0.4
19	-1.0	-9.5	-3.6	-4.8	-4.0	-5.0	-4.7	0.7	1.2	13.1	9.0	1.5
20	-0.3	-8.6	-2.5	-5.4	-4.2	-4.2	-1.8	0.7	4.7	13.8	8.8	2.2
21	-0.4	-8.2	-4.8	-2.4	-4.1	-3.8	-1.8	1.2	6.7	11.4	11.5	2.9
22	1.9	-9.3	-5.4	-3.1	-5.1	-3.6	-3.1	-1.1	2.0	6.2	11.4	2.2
23	-0.4	-11.5	-6.4	-4.2	-4.3	-3.3	-2.4	0.4	0.8	7.6	9.9	2.2
24	0.8	-11.2	-7.0	-3.6	-7.2	-4.2	-0.4	0.8	2.3	10.5	13.7	1.7
25	1.0	-11.3	-7.4	-3.2	-9.7	-3.9	-2.5	-0.8	1.7	10.0	14.7	1.0
26	1.2	-14.2	-8.7	-5.2	-9.3	-4.6	-3.0	0.0	2.5	14.2	14.3	0.0
27	1.2	-13.1	-6.9	-5.1	-8.8	-5.9	-1.1	-0.2	2.8	17.4	9.8	0.1
28	-2.0	-4.1	-4.3	-9.8	-10.7	-3.3	-1.9	-1.1	3.8	16.8	11.4	0.5
29	-3.7	-5.0	-3.2	C		-2.4	-1.8	1.0	5.5	10.0	11.3	0.1
30	0.3	-10.3	-5.7	C		-4.5	-1.4	7.5	4.4	6.6	9.0	-0.2
31	-1.0		-3.7	C		-4.6		5.8		7.5	6.3	
TOTAL	5.4	-159.0	-147.6			-175.3	-79.7	30.0	73.2	245.7	280.0	68.9
AVERAGE	0.2	-5.3	-4.8	-4.4 E	-4.0 E	-5.7	-2.7	1.0	2.4	7.9	9.0	2.3
ANNUAL AVERAGE		-0.3										

WOLVERINE GLACIER BASIN, ALASKA; AVERAGE AIR TEMPERATURE, IN DEGREES CELSIUS
990 METERS ALTITUDE

1988 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.4	-4.3	-11.2	-6.1	-3.3	-3.3	N	N	1.5	7.5	5.4	2.8
2	-0.2	-4.5	-6.7	-6.2	-7.7	-4.0	N	N	3.5	6.8	5.3	3.2
3	-0.4	-4.2	-8.8	-4.0	-10.4	-4.9	N	N	7.3	8.1	7.2	4.7
4	0.6	-2.6	-10.1	-2.3	-5.6	-3.9	N	N	10.9	6.5	10.6	2.3
5	0.7	-3.2	-7.5	-3.3	-3.6	-4.2	N	N	5.9	5.9	6.3	1.8
6	-0.3	-4.6	-5.5	-3.6	-3.7	-4.8	N	N	3.0	4.8	5.3	3.0
7	-0.2	-5.6	-2.9	-2.3	-3.2	-4.3	N	N	5.4	5.2	5.4	1.8
8	0.4	-6.6	-3.6	-2.8	-4.2	-4.8	N	N	6.2	7.1	8.8	4.3
9	0.9	-1.5	-4.5	-3.8	-5.7	-5.8	N	N	6.5	8.7	8.8	3.3
10	-0.8	0.5	-8.0	-5.6	-4.5	-4.3	N	N	5.2	8.0	5.7	3.0
11	-1.3	0.0	-9.4	-7.8	-5.5	N	-4.8	N	6.1	5.6	5.6	2.2
12	-0.4	-2.7	-12.4	-6.1	-5.3	N	N	N	4.9	7.3	8.0	2.3
13	0.3	-7.3	-14.5	-4.4	-5.3	N	N	N	5.5	6.5	7.8	2.6
14	-1.0	-11.1	-13.6	-5.3	-5.3	N	N	N	4.7	8.6	8.8	4.3
15	-2.1	-7.7	-12.1	-5.9	-9.9	N	N	N	3.8	8.8	9.7	2.7
16	-2.9	-3.1	-7.3	-6.9	-6.6	N	N	N	2.8	8.5	8.6	2.9
17	-1.0	-3.5	-10.1	-6.3	-5.3	-3.0	N	N	5.3	8.4	5.8	2.7
18	0.2	-3.3	-8.1	-6.3	-3.5	N	N	N	4.3	8.6	5.0	4.2
19	-0.3	-2.4	-4.2	-5.8	-3.9	N	N	N	2.4	8.2	4.1	2.2
20	-1.9	-2.0	-6.1	-5.5	-14.5	N	N	N	2.4	7.4	4.4	2.7
21	-0.9	-2.7	-9.3	-4.0	-16.3	N	N	N	6.0	5.0	4.3	-0.8
22	-0.2	-5.4	-7.9	-3.3	-7.0	N	N	N	5.6	4.9	4.0	-0.8
23	-1.6	-7.4	-3.1	-6.0	-4.6	N	N	N	4.2	4.9	3.4	0.2
24	-2.1	-8.4	-4.1	-10.2	-3.5	N	N	N	4.3	7.6	5.2	1.5
25	-3.0	-2.7	-6.7	-12.7	-4.2	N	N	N	7.1	6.6	6.3	0.1
26	-3.0	-3.3	-8.4	-11.1	-7.1	N	N	N	3.8	7.5	5.4	-0.4
27	-5.8	-4.5	-7.7	-8.9	-6.4	N	N	3.9	2.7	6.1	5.3	-0.1
28	-7.8	-6.2	-4.4	-8.8	-4.6	N	N	1.1	5.1	4.6	5.4	2.0
29	-7.7	-6.3	-5.6	-8.6	-4.8	N	N	1.0	4.8	5.9	5.7	0.8
30	-9.8	-6.6	-5.7	-7.0		N	N	1.7	5.3	7.5	4.5	
31	-5.9		-7.2	-4.4		N		0.2		6.7	2.8	
TOTAL	-57.1	-133.2	-236.7	-185.3	-175.5				146.5	213.8	188.9	61.5
AVERAGE	-1.8	-4.4	-7.6	-6.0	-6.1	-3.8 E	-2.9 E	1.2 E	4.9	6.9	6.1	2.1
ANNUAL AVERAGE		-0.8										

NOTE: Data since September 19, 1988, not yet recovered from the gage.

APPENDIX 2

Precipitation gage catch, in millimeters, at 990 m altitude at Wolverine Glacier, Alaska. Data are reported for *Measurement Years*, which extend from October 1 to September 30, and are designated by the year in which they end, a format used by the U.S. Geological Survey for reporting hydrologic information.

SYMBOLS

Symbol	Explanation
*	Sharp jump in float pen trace (gage catch record) due to snow dropping into tank, earthquake, animal disturbance, or gage foundation instability. Indicated gage catch may contain precipitation which fell on previous days.
A	Gage catch record not used due to new antifreeze solution thawing ice accumulated in the tank.
C	Clock stopped; cumulative gage catch during stoppage shown on date clock restarted.
E	Estimated value based on climatological data obtained by National Weather Service at Seward, Alaska. Precipitation estimated by distributing catch at Wolverine Glacier by Seward precipitation.
L	Data lost.
P	Daily value estimated from intermittent pen traces.
S	Gage catch record not used due to snow depressing float into solution. Data from 1968 not used for estimating because windblown snow entered gage through recorder shelter.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1967 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1									1	3	0	6
2									0	0	0	7
3									1	0	0	0
4									0	1	0	1
5									1	1	1	7
6									0	4	2	74
7									7	3	24	24 P
8									3	6	5	0 P
9									0	4	0	0 P
10									6 *	0	0	0 P
11									0	0	0	8 P
12									0	0	3 *	34 P
13									0	0	12	20 P
14									0	0	7	18 P
15									0	0	0	16 P
16									0	1	1	31 P
17									0	0	0	56 P
18									0	0	1	16
19									0	1	0	7
20									1	9	0	12
21									1	6	2	0
22									0	0	6	0
23									0	3	1	11
24									0	0	29	5
25									0	0	4	24
26									0	1	0	31
27									0	0	0	2
28									0	0	2	0
29									2	1	3	4
30									6	2	3	0
31										0	0	
TOTAL									29	46	106	414

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.
CAUTION: No windshield device on gage.
NOTE: Gage began operation June 1, 1967.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1968 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	S	S	S	S	S	S	S	3	3	5	0
2	0	S	S	S	S	S	S	S	3	0	0	0
3	0	S	S	S	S	S	S	S	3	1	0	0
4	1	S	S	S	S	S	S	S	0	1	0	0
5	1	S	S	S	S	S	S	S	1	1	0	0
6	0	S	S	S	S	S	S	S	3	0	0	0
7	0	S	S	S	S	S	S	S	0	0	0	3
8	0	S	S	S	17	S	S	S	1	0	0	17
9	1	S	S	S	10	S	S	4	0	0	0	33
10	0	S	S	S	2	S	0	10	2	1	0	10
11	2	S	S	S	0	S	0	13	7	8	0	1
12	1	S	S	S	33	S	0	0	0	0	7	2
13	0	S	S	S	24	S	0	0	1	0	0	4
14	3	S	S	S	19	S	0	0	0	1	5	2
15	3	S	S	S	3	S	0	7	0	0	4	0
16	S	S	S	S	S	S	5	0	0	0	8	0
17	S	S	S	S	S	S	5	0	0	0	0	0
18	S	S	S	S	S	S	4	0	3	0	0	5
19	S	S	S	S	S	S	0	0	2	0	4	0
20	S	S	S	S	S	S	5	0	4	1	9	0
21	S	S	S	S	S	S	S	0	0	0	3 *	0
22	S	S	S	S	S	S	S	0	0	0	0	0
23	S	S	S	S	S	S	S	0	0	0	0	0
24	S	S	S	S	S	S	S	0	0	0	0	0
25	S	S	S	S	S	S	S	0	0	0	2	0
26	S	S	S	S	S	S	S	0	0	0	0	8
27	S	S	S	S	S	S	S	0	0	3	0	16
28	S	S	S	S	S	S	S	1	0	0	0	5
29	S	S	S	2		S	S	8	0	2	0	0
30	S	S	S	4		S	S	4	0	0	2	4
31	S		S	5		S		0		4	0	
TOTAL									33	26	49	110

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.
Wind-blown snow entered gage at recorder shelter until shelter modified June 5, 1968.

NOTE: Windshield device installed at orifice on June 5, 1968.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1969 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5	0	0	2	3	2	2	1	0	0	8	0
2	10	10 *	1	1	3	1	20	2	0	0	0	0
3	7	7 *	5	0	1	1	12	6	0	0	0	2
4	0	0	0	0	0	0	4	0	1	0	0	1
5	7	2	2	0	0	0	3	1	1	0	1	0
6	0	13 *	0	0	0	0	3	5	6	0	0	0
7	0	0	0	0	0	10	1	2	0	0	0	0
8	0	10 *	0	0	0	10	5	2	0	0	0	13
9	0	2	3	0	3	1	1	5	1	0	0	21
10	1	2	0	0	7	0	3	1	1	0	0	34
11	3	4	4	1	11 *	0	2	2	0	0	0	4
12	0	9	8	3	0	2	13 *	0	0	0	0	0
13	0	3	0	0	0	0	0	0	1	0	0	2
14	0	0	0	0	0	5	0	0	1	0	0	1
15	2	0	8	0	1	1	1	1	3	0	0	1
16	0	0	15	0	0	0	0	0	5	0	0	0
17	0	4	0	0	0	0	2	0	0	0	0	0
18	0	6	0	0	4 *	0	0	0	1	0	0	0
19	0	0	0	0	20	5	0	0	0	0	0	0
20	0	0	0	0	2	0	1	0	0	0	0	1
21	0	1	0	0	12 *	4	1	21	0	0	0	0
22	0	4	3	0	0	1	1	9	0	0	0	0
23	0	0	0	0	8 *	1	0	0	0	3	8	1
24	2	0	5	0	0	0	0	0	0	4	0	0
25	2	0	0	0	0	2	7	0	0	16	0	0
26	7	8	6	0	2	2	2	1	0	0	0	0
27	1	2	0	0	12	0	3	9	0	0	0	7
28	4	2	1	2	5	0	4	0	0	10	7	23
29	0	0	2	2		3	3	0	0	4	2	14
30	0	3	1	0		4	1	3	0	3	1	3
31	0		0	1		2		8		4	0	
TOTAL	51	92	64	12	94	57	95	79	21	44	27	128
ANNUAL TOTAL		764										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1970 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6	19	9	2	3	0	2	0	1	0	3	0
2	1	8 *	10	0	6	1	0	1	0	0	1	1
3	28	3	0	0	2	4	0	1	0	0	3	1
4	4	2	5	0	0	0	0	1	0	5	0	6
5	7	1	5	0	0	0	0	1	0	2	1	0
6	69	1	11	0	6	14 *	0	9	0	0	3	0
7	23	C	1	0	0	9	0	2	0	0	0	0
8	32	C	3	0	22 *	1	0	6	6	1	1	2
9	3	C	0	0	15 *	8 *	0	0	0	0	0.	0
10	14	C	0	0	13 *	0	0	0	0	1	0	0
11	50	C	0	0	11 *	1	1	0	1	5	0	0
12	40	C	3	0	21	0	5	0	3	9	2	0
13	26	C	3	0	0	1	8	1	1	0	5	0
14	7	C	1	0	0	8	3	3	0	0	9	1
15	0	C	18	0	1	4	1	2	1	2	0	1
16	3	C	34 *	0	3	3	6	0	2	0	6	0
17	4	C	31 *	0	1	12 *	2	2	2	0	19	0
18	8 *	C	7	0	6	24 *	1	0	2	2	11	1
19	3	C	13	6	4	13	0	1	0	0	1	1
20	0	11	20 *	1	4	6	4	0	0	0	13	1
21	2	2	1	5	5	0	7	0	0	9	3	1
22	0	0	1	1	7	0	2	0	0	0	4	0
23	0	1	2	0	9	0	1	6	0	0	3	0
24	0	2	11 *	2	12 *	2	1	0	0	0	4	0
25	0	38 *	5	0	12 *	11	0	0	0	0	0	3
26	0	18 *	3	1	0	5 *	0	0	0	0	0	1
27	0	19	3	4	0	7 *	0	0	0	0	0	6
28	1	11 *	15 *	0	0	5	0	0	1	0	4	3
29	0	5	11	0		3	0	0	0	2	7	1
30	10	1	3	0		1	4	0	0	4	5	3
31	24		17	0		0		1		8	1	
TOTAL	365	142	246	22	163	143	48	37	20	50	109	.33
ANNUAL TOTAL		1378										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1971 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	4	0	0	7	4	0	4	6	1	15	7
2	4	1	1	31	4	0	3	3	7	2	0	1
3	1	8	0	14	1	7	15 *	6	0	0	C	0
4	3	6	0	10	1	1	2	0	0	0	C	6
5	0	2	0	0	12	2	3	3	2	0	C	10
6	6	0	0	7	15 *	0	1	4	0	0	C	C
7	0	3	0	0	7 *	0	0	1	1	0	C	C
8	0	3	0	0	6 *	0	3	0	4	1	C	C
9	3	0	6 *	2	11 *	0	0	0	21	0	C	C
10	0	0	1	0	2	1	0	3	0	0	C	C
11	0	4	7	0	1	6 *	15	4	0	0	C	C
12	0	1	3	0	0	1	9	10	0	0	29 C	C
13	14 *	3	7	3	0	4	16	3	0	7	1	C
14	3	0	4	0	0	0	27 *	18	1	0	0	C
15	6	0	6	2	1	0	3	2	0	0	C	C
16	0	2	3	1	3	45 *	4	3	0	0	C	C
17	2	3	1	0	29 *	29 *	6	6	0	1	0 C	C
18	1	3	1	0	6	0	3	0	1	0	22	C
19	0	0	2	0	13	0	2	7	0	1	1	C
20	0	0	0	0	23 *	0	1	16	0	2	0	C
21	0	2	8	0	3	1	9	15 *	1	0	10	C
22	1	1	0	0	4	2	5	3	1	0	0	C
23	2	0	14	0	2	2	4	1	0	3	3	C
24	2	0	7	0	1	0	6	0	1	8	0	C
25	0	0	4	0	1	0	8	1	0	13	2	C
26	0	0	5	0	0	0	0	0	0	0	1	C
27	0	0	3	0	0	0	0	1	1	0	15	C
28	18	9 *	0	0	0	6	0	10 *	1	C	6	C
29	2	6	0	0		0	1	5	0	C	8	C
30	42	0	0	0		1	0	2	1	C	1	C
31	54		0	3		1		8		C	1	
TOTAL	164	61	83	73	153	113	146	139	49	39	115	33 E
ANNUAL TOTAL		1168										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1972 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	C	1	0	1	0	0	0	0	2	2	0	0
2	C	1	0	4	0	0	0	2	2	1	1	7
3	C	1	0	0	2	0	3	1	0	1	0	17
4	C	0	0	3	3	0	2	1	0	0	0	3
5	C	2	0	2	3	0	3	3	0	0	0	2
6	C	4	0	0	0	0	0	2	0	0	2	0
7	C	0	0	4	0	0	7	0	0	0	0	0
8	C	0	0	1	8	0	3	0	0	0	0	0
9	C	4	0	7	3	0	0	2	0	0	0	4
10	C	0	1	0	1	0	0	1	0	2	0	8
11	C	3	1	0	3	0	0	1	1	0	2	8
12	C	2	6	0	2	0	5	2	2	0	4	40
13	C	1	0	0	0	0	0	0	0	0	2	2
14	80 C	1	0	0	1	0	0	2	0	0	3	3
15	0	3	5	1	5	0	0	2	1	0	8	0
16	7	4	3	2	2	1	0	3	2	2	0	0
17	0	9	6	0	0	0	0	2	1	2	6	1
18	1	25 *	2	0	0	0	3	0	1	0	1	2
19	0	12	5	0	0	0	2	2	0	0	2	0
20	0	1	5	0	0	7	0	8	5	0	1	0
21	0	1	0	0	0	7	0	4	3	0	4	0
22	1	3	0	0	0	1	0	2	0	0	35	0
23	3	0	0	0	0	4	0	1	1	0	14	0
24	0	0	0	0	0	0	0	0	0	0	11	0
25	0	1	0	0	0	0	0	0	0	1	3	0
26	0	2	0	0	0	0	0	2	2	1	1	2
27	4	0	0	0	0	0	0	6	0	1	1	0
28	5	1	8		0	2	4	1	1	1	0	4
29	2	4	7	3	1	2	0	1	2	3	5	3
30	0	0	5	1		0	0	0	3	0	18	2
31	0		5	1		0		0		2	0	
TOTAL	94 E	86	59	30	34	24	32	51	29	19	124	108
ANNUAL TOTAL		690										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1973 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3	0	1	0	4 *	0	1	12	0	0	0	1
2	0	0	0	0	3	3	4	5	1	0	0	1
3	1	0	0	4	1	2	0	2	2	0	0	4
4	5	1	6 *	0	0	1	3	5	0	0	1	13
5	9	1	2	5	4	0	2	2	0	0	4	17
6	2	0	0	0	3	0	11	3	2	0	4	3
7	0	0	0	3	0	2	14	0	0	0	2	48
8	1	0	0	0	0	1	9	3	2	1	4	3
9	0	0	2	0	2	0	9	0	0	0	1	0
10	3	1	0	8	1	2	1	2	1	0	0	2
11	2	1	0	4	1	0	0	1	0	0	0	0
12	1	1	0	0	2	0	4	0	0	5	4	1
13	1	0	5	1	0	3	16	1	0	5	1	0
14	7	1	1	2	0	1	20	37	0	1	0	0
15	11	0	0	0	0	2	0	2	8	0	0	5
16	12	4	9	0	0	0	2	1	3	0	0	2
17	2	0	0	0	0	0	0	1	0	0	0	12
18	10 *	2	2	2	0	4	0	1	4	0	0	1
19	1	2	6	2	12	0	2	1	0	0	0	2
20	0	0	0	4	14 *	0	0	4	0	0	0	2
21	0	8	0	0	11 *	0	0	1	1	2	7	2
22	1	12 *	0	0	1	5	0	1	1	0	4	1
23	0	6	1	0	0	4	1	1	0	0	2	1
24	2	11	2	0	0	4	1	1	2	0	4	1
25	0	1	0	0	1	1	5	1	2	1	2	2
26	2	3	1	0	1	0	1	1	0	1	0	1
27	0	9	1	0	2	8	1	3	1	19	0	2
28	2	1	5	0	0	13 *	0	3	3	6	0	2
29	2	2	3	3		1	0	1	1	2	2	1
30	0	1	1	7		3	4	1	0	16	1	0
31	1		5	10		2		2		4	2	
TOTAL	81	68	53	55	63	62	111	99	34	63	45	130
ANNUAL TOTAL		864										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1974 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3	0	0	0	1	3	1	0	0	0	0	0
2	2	0	0	3	0	5	0	1	0	0	0	0
3	0	1	2	0	0	0	0	1	0	0	2	1
4	0	0	0	0	1	4	0	0	0	1	0	0
5	7	0	2	0	3	0	5	0	0	1	0	1
6	0	0	2	0	2	0	1	0	0	0	0	0
7	1	1	0	0	6	10	0	0	1	0	0	0
8	3	1	1	1	1	7	5	0	0	0	2	0
9	2	0	0	0	4	0	8	0	0	0	0	0
10	0	0	3	0	3	1	2	0	0	2	0	5
11	2	9	0	0	2	0	2	0	0	0	0	28
12	2	2	2	0	2	0	5	3	3	2	0	25
13	8	0	0	0	6	0	9	8	0	0	0	4
14	0	0	0	0	2	0	11 *	5	0	3	0	19
15	0	0	0	3	2	0	3	2	1	0	0	37
16	0	0	2	2 *	0	0	7 *	0	2	0	0	16
17	23	0	7	3 *	0	0	1	2	0	0	0	14
18	5	0	15 *	13 *	2	3	1	0	6	1	0	6
19	0	0	18 *	1	0	1	0	0	0	1	0	3
20	1	0	3	0	0	0	4	3	2	2	0	9
21	1	0	2	4	4	0	2	0	2	12	0	2
22	0	1	0	0	0	0	2	0	1	2	0	1
23	0	2	2	0	10	1	2	0	1	0	0	9
24	0	2	0	2	1	0	6	0	6	0	1	23
25	1	2	3	2	1	0	1	0	7	0	0	2
26	0	0	9	1	0	0	0	0	0	0	0	3
27	1	1	22 *	0	0	2	0	1	0	0	9	1
28	7	0	5 *	0	1	0	1	0	0	0	5	0
29	0	2	23 *	1		0	0	0	0	4	0	0
30	1	0	1	0		0	0	0	0	0	0	0
31	0		3	0		1		0		0	0	
TOTAL	70	24	127	36	54	38	79	26	32	31	19	209
ANNUAL TOTAL		745										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
980 METERS ALTITUDE

1975 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1	4	2	7	0	28 *	1	2	3	1	0	0
2	1	17 *	3	0	1	2	1	1	1	0	0	0
3	1	6	3	0	0	2	0	2	0	0	1	0
4	2	1	0	1	0	1	1	0	1	1	0	0
5	0	1	1	0	0	0	2	1	0	0	4	4
6	1	1	5	0	0	0	1	1	1	0	0	2
7	7	2	10 *	0	0	0	0	3	1	0	0	3
8	1	3	0	0	0	0	2	0	1	0	2	4
9	1	5	2 *	0	0	0	1	4	0	0	0	1
10	0	6	0	0	1	10 *	0	30	0	0	0	14
11	0	0	0	0	0	0	0	5	0	0	0	13
12	0	3	2	0	0	0	1	0	0	0	1	3
13	4	2	1	0	0	1	0	2	0	0	5	0
14	3	6	3	0	0	0	1	0	0	0	5	0
15	0	10	2	0	2	1	6	2	0	0	5	1
16	0	0	2	0	2	0	1	1	0	0	1	0
17	3	0	2	4	0	0	10	0	0	0	0	9
18	3	1	5 *	8 *	6	2	4	0	0	0	1	9
19	12	0	5 *	3	5	0	0	2	2	0	0	7
20	5	0	3	2	4	2	0	0	4	1	2	13
21	3	16	1	3	18 *	0	0	2	0	0	0	6
22	0	28 *	0	3 *	6	0	8	0	2	1	0	0
23	29 *	1	2	1	22 *	0	0	0	0	1	0	0
24	23 *	5	3	3	9	0	0	1	0	2	2	0
25	8 *	0	4	2	40 *	0	5	2	0	0	0	15
26	1	0	1	5	19 *	3	3	1	0	0	1	26
27	8	9	4	0	3	4	3	0	0	0	1	1
28	1	12 *	0	0	0	6	0	0	1	0	0	12
29	11	6 *	0	7		1	0	0	2	2	0	16
30	0	3	0	0		0	2	0	1	0	0	0
31	32 *		0	1		1		0		1	0	
TOTAL	161	148	66	50	138	64	53	62	20	10	31	159
ANNUAL	TOTAL	962										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1976 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1	0	1	1	2	0	5	3	0	0	0	2
2	4	0	1	1	0	7	14	1	1	0	2	6
3	5	0	0	1	8	4	16	5	3	0	0	0
4	2	0	0	1	0	1	3	2	0	2	0	4
5	3	0	1	0	4	1	2	0	0	0	2	0
6	0	0	0	1	9	2	0	1	0	0	0	0
7	0	0	0	0	0	1	2	1	0	0	0	62
8	0	0	0	0	3	1	4	0	0	0	2	7
9	2	0	0	0	0	1	2	0	0	0	0	2
10	1	3	0	0	0	0	1	2	0	0	0	0
11	4	0	0	0	0	0	0	2	0	0	0	1
12	2	0	0	0	0	0	0	1	0	0	1	18
13	4	4	0	0	0	12	5	2	0	0	3	21
14	10 *	1	0	0	0	1	7	2	0	0	2	17
15	3	0	7	0	1	1	0	0	0	0	0	22 *
16	1	0	20	0	0	3	0	0	9	0	0	3
17	1	0	20	6	0	0	0	1	6	2	2	48
18	1	0	19	9	1	2	6	3	0	0	5	18
19	1	1	5 *	13	0	0	3	1	0	0	0	1
20	2	2	6	3	0	0	1	1	0	1	3	64
21	2 *	0	8	5	1	0	1	1	0	0	0	28
22	0	0	13	4	0	0	0	1	2	2	0	16
23	16 *	0	3	1	0	0	0	1	0	1	0	2
24	2	0	3	1	0	2	2	0	0	0	4	36
25	0	0	9	6	0	4	8	0	0	3	9	16
26	1	0	3	0	0	0	22	0	0	0	71	2
27	0	0	8	2	0	1	13	0	0	2	15	5
28	4	1	3	9	0	4	9	0	0	0	3	21
29	0	0	1	25	0	1	1	1	0	0	3	2
30	0	1	6	7		1	1	0	0	0	0	2
31	0		1	0		0		0		0	1	
TOTAL	72	13	138	96	29	50	128	32	21	13	128	426
ANNUAL TOTAL		1146										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1977 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	C	C	C	C	1	0	1	0	0	0	0
2	2	C	C	C	C	3	2	1	0	0	0	0
3	14	C	C	C	C	7 *	1	0	0	2	0	0
4	4	C	C	C	C	2	12	0	9	1	7	0
5	4	C	C	C	C	4	10	1	0	3	3	0
6	2	C	C	C	C	0	2	2	2	0	7	9
7	2	C	C	C	C	0	0	0	4	0	27	17
8	2	C	C	C	C	0	0	1	0	0	9	1
9	1	C	C	C	C	0	3	2	1	0	13	5
10	0	C	C	C	C	2	6	0	0	0	9	5
11	0	C	C	C	C	4	3	3	1	0	0	0
12	2	C	C	C	C	0	3	0	0	0	5	4
13	0	C	C	C	C	3	3	0	0	1	3	0
14	2	C	C	C	C	1	13 *	0	0	5	0	3
15	0	C	C	C	610 C	0	2	0	0	3	2	11
16	10	C	C	C	9	10 *	0	0	4	0	0	9
17	C	C	C	C	C	6	0	8	6	0	1	0
18	C	C	C	C	C	0	0	18	1	0	0	2
19	C	C	C	C	C	0	8	2	0	0	0	0
20	C	C	C	C	C	0	0	2	0	0	0	23
21	C	C	C	C	C	0	0	0	0	1	0	17
22	C	C	C	C	C	0	0	0	0	0	3	1
23	C	C	C	C	36 C	4	0	0	0	0	1	0
24	C	C	C	C	0	0	1	2	0	2	1	0
25	C	C	C	C	0	0	0	0	0	0	1	0
26	C	C	C	C	1	0	3	0	0	4	0	0
27	C	C	C	C	1	0	0	0	0	1	1	6
28	C	C	C	C	1	0	0	0	0	0	0	8
29	C	C	C	C		0	3	6	1	0	0	6
30	C	C	C	C		2	0	0	0	3	0	0
31	C		C	C		2		0		0	1	
TOTAL	102 E	235 E	98 E	145 E	124 E	51	75	49	29	26	94	127

ANNUAL TOTAL 1155

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1978 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	1	0	0	1	0	0	C	C	C	C	C
2	0	0	0	0	0	0	1	C	C	C	C	C
3	0	0	0	0	0	0	0	C	C	C	C	C
4	1	1	0	0	0	0	1	C	C	C	C	C
5	0	0	0	0	1	0	0	C	C	C	C	C
6	4	2	0	0	10	0	2	C	C	C	C	C
7	0	0	0	0	6	7	0	C	C	C	C	C
8	8	0	0	4	17	5	1	C	C	C	C	C
9	15	0	0	2	0	5	1	C	C	C	C	C
10	27	0	0	3	10	0	0	C	C	C	C	C
11	20	0	1	1	10	4	0	C	C	C	C	C
12	8	5	0	2	15	7	0	C	C	C	C	C
13	1	2	0	1	9	3	0	C	C	C	C	C
14	7	0	7	1	4	5	0	C	C	C	C	C
15	4	0	0	1	2	11	0	C	C	C	C	C
16	2	2	1	0	2	0	1	C	C	C	C	C
17	6	0	2	0	0	4	0	C	C	C	C	C
18	10	0	0	6	10	0	0	C	C	C	C	C
19	0	0	0	8	43 *	0	0	C	C	C	C	C
20	8	0	0	6	19	2	0	C	C	C	C	C
21	8	0	1	0	12	0	0	C	C	C	C	C
22	10	0	1	7	4	2	C	C	C	C	C	C
23	6	0	2	4	26 *	1	C	C	C	C	C	C
24	1	0	2	1	17	0	C	C	C	C	C	C
25	1	0	1	1	43 *	0	C	C	C	C	C	C
26	19	0	2	6	1	1	C	C	C	C	C	C
27	0	0	3	0	0	2	C	C	C	C	C	C
28	2	0	0	0	14	1	C	C	C	C	C	426 C
29	9	0	0	0		0	C	C	C	C	C	0
30	2	0	2	0		2	C	C	C	C	C	3
31	1		0	0		0		C		C	C	
TOTAL	180	13	25	54	276	62	82 E	75 E	46 E	81 E	57 E	140 E
ANNUAL TOTAL		1091										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1979 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1	2	4	0	3	1	3	0	4	0	2	0
2	0	1	7	0	9	0	0	0	1	0	0	0
3	0	0	1	0	2	0	6	0	1	6	0	1
4	3	1	1	0	0	3	4	2	2	0	0	0
5	42	8	2	0	2	2	1	1	0	0	0	0
6	18	4	1	0	0	12	5	0	0	3	0	0
7	6	0	0	1	1	3	7	2	0	0	1	0
8	41	0	4	1	0	4	2	2	0	3	2	1
9	6	0	1	2	0	1	0	0	0	1	42	0
10	0	0	3	1	0	3	1	2	0	0	8	2
11	0	0	0	0	0	0	1	0	0	7	0	1
12	5	1	12	0	0	10	0	0	0	11	0	15
13	2	5	4 *	2	0	8	2	0	0	0	6	18
14	0	0	19 *	4	0	6 *	0	0	0	15	5	13
15	0	0	4	9	0	1 *	0	0	0	9	16	5
16	8	1	1	11	0	3	0	1	1	1	13	3
17	21	0	3	8 *	0	0	0	1	0	4	1	2
18	9	0	0	4	0	6	0	1	0	0	1	6
19	1	0	1	0	0	4	0	3	0	0	0	22
20	3	0	2	1	0	2	2	0	0	0	0	14
21	4	11	3	18	0	7	0	0	0	3	1	3
22	2	1	5	1	0	1	0	1	0	0	0	34
23	4	1	0	1	0	0	0	3	0	0	0	17
24	13	0	2	6 *	0	0	0	0	3	1	0	6
25	5	6	1	3	5	0	0	0	13	1	0	8
26	4	10	0	2	1	0	2	0	4	1	0	8
27	1	11	0	0	1	2	0	0	0	0	0	31
28	1	1	1	1	1	2	0	0	10	0	1	1
29	10	3	2	0		0	0	0	2	0	12	3
30	8	1	3	0		0	0	0	1	3	1	62
31	1		5	5 *		0		0		1	3	
TOTAL	219	68	92	81	25	81	36	19	42	70	115	276
ANNUAL	TOTAL	1124										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1980 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	0	1	0	0	4	19 *	0	0	0	0	0
2	37	0	6	0	3	0	9	1	0	0	0	10
3	12	4 *	5	0	12	0	5	4	0	1	2	2
4	23	0	2	0	45 *	0	2	0	0	0	0	0
5	14	0	10	0	17 *	4	1	0	0	0	0	1
6	2	0	5	0	6	0	1	1	0	0	0	0
7	4	3	2	0	13	6	3	0	0	0	4	7
8	29	3	3	0	0	5	5	0	0	0	3	35
9	18	4	0	0	51 *	3	0	2	0	0	5	1
10	7	3	10	A	3 *	0	0	4	0	3	3	0
11	23	14 *	10	A	33 *	7	0	0	0	17	1	0
12	4	7	2	A	9	0	4	0	0	1	8	0
13	0	4	0	0	12	6	10	0	0	0	1	15
14	1	1	0	0	0	3	0	0	0	0	5	7
15	10	18	0	0	0	0	0	0	0	2	1	4
16	11	15	0	1	0	0	0	4	0	0	7	3
17	1	5	0	12	0	0	0	4	5	3	0	0
18	0	2	8	85 *	6	0	1	17	6	0	1	0
19	0	8	0	47 *	5	0	0	24	1	0	0	0
20	2	13	0	47 *	0	0	3	1	14	0	1	0
21	0	9 *	0	14 *	0	0	36	4	0	0	13	0
22	0	8	0	31 *	8	0	8	0	0	0	0	1
23	7	4	0	16	25	0	9	1	0	0	0	2
24	2	7	17 P	0	3	6	1	0	0	0	0	4
25	3	3	16 P	0	0	2	0	0	4	0	0	3
26	0	4	11	0	16 *	4	4	2	1	0	0	55
27	1	31 *	10	0	6	1	2	0	0	0	0	9
28	4	93 *	14	0	0	3	5	1	5	0	3	2
29	4	20	14	0	3	22	0	3	9	24	0	37
30	28	30	7	0		27	4	1	0	3	2	15
31	12 *		0	0		39		0		1	3	
TOTAL	292	313	153	253	276	142	132	74	45	55	63	213

ANNUAL TOTAL 2011

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1981 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14	0	2	2	10	14	0	0	16	3	17	0
2	2	0	2	2	8	6	0	0	1	14	16	1
3	1	5	4	24 *	3	1	0	1	0	7	0	0
4	0	3	3	3	0	9	2	0	0	1	0	0
5	17	0	0	0	0	9 *	0	0	2	0	10	2
6	23	2	0	5	0	5 *	0	0	0	2	29	19
7	11	0	0	7 *	14 *	2	0	0	1	0	1	1
8	9	2	0	4	0	1	0	0	17	2	3	1
9	2	0	0	8	3	7	0	0	1	3	4	0
10	0	0	1	9 *	2	9	0	2	0	10	4	1
11	0	5	4	2	2	21	0	0	0	1	2	0
12	0	6	1	0	0	14	0	0	0	0	18	9
13	0	9	0	19 *	0	9	0	0	0	0	2	2
14	8	3	0	34 *	4	26 *	0	0	0	2	3	5
15	11	6	1	8	0	40 *	0	0	2	12	4	7
16	2	3	0	6	0	1	0	0	0	6	2	55
17	3	4	0	11	0	14	0	0	0	1	0	8
18	14	1	0	5	0	13 *	1	0	1	0	5	37
19	16	15	0	9	0	27 *	1	1	1	6	16	3
20	14	0	0	0	0	0	2	3	1	0	45	0
21	8	0	0	42 *	0	2	0	0	5	0	40	2
22	41	6	0	2	0	0	0	0	0	0	0	0
23	14	9 *	0	11	0	0	0	0	0	5	0	0
24	50	7	0	21	0	0	0	0	0	2	0	0
25	4	2	0	6	0	0	2	0	0	2	0	0
26	5	4	0	11 *	0	0	0	0	0	0	0	0
27	0	7 *	0	1	99 *	2	0	1	2	0	0	2
28	1	1	0	1	11	3	0	0	0	2	0	0
29	0	0	0	13 *		0	0	0	2	0	0	8
30	8	0	5	10		0	0	0	3	0	0	0
31	0		11	4		2		10		2	0	
TOTAL	278	100	34	280	156	237	8	18	55	83	221	163
ANNUAL TOTAL		1633										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1982 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	0	9	0	1	0	0	0	0	1	0	0
2	1	5	4	0	3	0	1	0	0	1	0	0
3	9	7	0	0	6	0	0	1	0	0	0	0
4	3	2	0	0	8	0	0	0	0	12	0	0
5	0	1	2	20	0	0	0	0	1	0	2	19
6	0	0	0	0	1	0	0	0	0	0	1	35
7	1	12	0	0	0	0	0	3	2	0	7	4
8	3	3	10	0	0	0	0	0	0	0	6	2
9	2	23	0	0	1	1	0	0	0	4	2	3
10	0	14	2	0	1	1	0	0	14	0	1	5
11	4	14	0	0	2	0	0	3	2	0	10	0
12	0	6	8	0	0	1	1	7	4	1	0	2
13	0	2	6	0	0	1	1	0	0	0	0	30
14	1	0	1	2	0	1	0	0	0	0	0	8
15	1	3	2	0	5	0	2	0	0	5	6	28
16	1	0	13	0	0	0	0	0	0	2	0	13
17	0	0	21	0	0	0	4	0	1	3	1	3
18	1	0	8	0	0	9	3	0	3	0	0	18
19	1	1	1	0	0	2	1	1	2	0	0	6
20	35	0	3	0	0	3	8	1	0	0	0	6
21	3	0	1	0	0	3	5	0	1	1	0	11
22	2	0	0	1	0	2	0	0	0	0	0	3
23	0	4	0	1	0	2	0	1	0	2	0	3
24	0	0	1	0	0	0	0	0	0	0	0	0
25	0	7	1	0	0	2	2	0	0	0	0	0
26	0	1	4	0	0	2	5	0	0	0	0	0
27	2	4	0	0	0	0	10	0	0	0	0	1
28	10	1	1	1	0	0	8	0	12	1	0	0
29	8	3	2	1		0	3	0	5	16	4	4
30	8	13	0	1		2	0	0	4	0	2	3
31	3		0	1		0		0		0	0	
TOTAL	99	126	100	28	28	32	54	17	51	49	42	207
ANNUAL TOTAL		833										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1983 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1	10	4	4	13 *	2	0	0	2	2	0	0
2	0	4	0	1	9	0	0	3	0	0	0	0
3	2	5	0	1	6 *	0	2	2	2	0	0	0
4	0	11	0	0	13 *	0	15	5	0	0	6	0
5	2	3	2	0	18 *	0	21	0	0	1	13	0
6	1	1	12	0	0	0	1	1	0	2	3	0
7	4	0	6	0	1	0	1	0	0	1	1	0
8	4	3	7	0	0	0	2	0	0	13	5	0
9	1	2	6 *	0	0	0	0	0	3	11	3	0
10	3	1	19 *	5	4	0	0	0	3	1	0	0
11	4	3	0	1	0	0	0	0	3	15	0	0
12	5	10	3	4	0	0	1	0	1	3	1	0
13	7	11 *	9	0	0	0	2	0	0	0	3	0
14	4	4	14 *	1	0	0	6	0	0	0	4	0
15	2	1	7	0	0	1	1	0	0	0	5	0
16	2	1	10 *	11	0	0	0	0	0	0	0	0
17	6	3	1	4	0	0	1	0	0	0	1	0
18	0	0	1	7	0	0	2	0	0	0	0	0
19	4	0	1	4	0	1	0	0	0	1	0	4
20	3	0	5	7	2 *	0	2	0	0	0	1	4
21	2	0	2	3	0	0	0	1	0	1	8	8
22	2	1	3	0	2	0	3	8	0	0	0	0
23	0	1	0	1	0	0	0	0	0	5	2	0
24	0	2	0	7 *	2	0	0	0	0	2	1	4
25	0	1	0	0	1	0	0	0	0	0	5	0
26	0	1	5	2	4	3	0	0	2	0	20	1
27	0	0	6	1	0	1	0	0	1	0	0	0
28	6	2	27 *	5	3	4	0	0	1	0	0	0
29	3	3	10	1		0	0	0	8	0	0	5
30	3	5	3	3		0	0	11	2	0	0	1
31	0		2	4		0		18		0	0	
TOTAL	71	89	165	77	78	12	60	49	28	58	82	27
ANNUAL TOTAL		796										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1984 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2	4	4	0	0	0	4	1	0	2	0	0
2	2	13	0	0	0	2	2	5	0	2	0	0
3	0	2	2	2	4	7	0	0	0	0	0	0
4	0	1	0	5	6	1	1	5	0	0	0	0
5	0	1	0	2	5	7	3	1	0	0	2	0
6	0	0	0	0	3	2	0	2	10	0	0	0
7	0	15	1	0	4	0	0	0	0	0	0	0
8	0	5	13	2	1	0	0	0	0	6	0	0
9	13	5	1	0	0	0	0	0	1	2	0	0
10	11	13 *	2	7	0	2	1	0	0	3	0	0
11	14 *	2	0	17 *	4 *	0	3	0	0	9	6	0
12	0	2	0	56 *	0	1	0	1	0	0	0	0
13	0	1	1	13 *	1	6	4	0	0	1	0	22
14	0	0	2	17 *	4	0	1	0	0	2	0	69
15	0	2	0	4 *	2	0	2	1	3	0	0	15
16	0	1	0	1	10	0	2	0	5	2	0	1
17	1	2	0	1	12	0	2	0	1	3	4	0
18	2	0	0	3	23	0	6	0	0	0	7	0
19	0	1	1	2	3	0	1	0	0	0	17	7
20	0	2	0	0	5	0	0	0	0	0	2	4
21	4	14	0	0	0	0	11	0	0	0	0	0
22	2	4	0	1	1	0	2	0	0	0	0	0
23	4	1	11	3	1	0	0	0	2	1	0	0
24	1	4	3	0	1	0	2	0	1	0	9	1
25	2	0	2	2	0	0	0	0	6	0	6	1
26	1	0	0	0	0	0	1	0	0	0	2	0
27	9	2	0	2	0	2	0	0	0	0	0	0
28	10	29	2	3	3	0	0	0	1	1	0	17
29	4	9	1	21	0	6	2	0	1	0	0	69
30	3	3	0	2		8	0	0	0	0	0	34
31	6		0	4		0		0		0	0	
TOTAL	91	138	46	170	93	44	50	16	31	34	55	240
ANNUAL TOTAL		1008										

CAUTION: *Gage catch may not equal actual precipitation due to errors caused by wind.*

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1985 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	37	0	0	2	1	2	3	2	2	0	0	5
2	8	1	5	0	1	0	0	0	5	0	0	0
3	0	1	4	3	8	0	0	0	30	2	0	1
4	0	0	19 *	3	2	0	0	0	5	1	0	0
5	5	0	26 *	0	2	0	0	0	2	0	0	0
6	23	1	0	2	4	4	0	0	0	0	0	0
7	3	2	3	10	0	8	0	1	3	2	1	0
8	25	0	13	19 *	2	1	6	6	2	0	1	1
9	2	0	0	7	3	4	5	1	0	0	4	2
10	0	0	0	23 *	0	17	2	0	0	0	0	4
11	4	0	0	9	0	5	0	1	0	2	0	0
12	5	0	0	4	0	11	0	0	0	3	21	0
13	0	0	0	1	0	4	0	3	0	0	11	0
14	0	1	1	6	1	3	2	4	0	0	1	15
15	1	0	0	3	0	3	4	0	0	0	0	1
16	2	0	0	4	0	5	13	0	0	0	2	1
17	0	0	0	11	0	15	19	0	3	0	0	1
18	0	0	0	5 *	0	24 *	0	1	0	0	0	3
19	2	0	3	4	0	7	0	0	0	0	5	0
20	0	18	1	1	0	10 *	0	1	0	1	9	5
21	2	2	0	5	2	10	0	0	0	3	10	0
22	8	5	0	4	0	15 *	0	0	0	1	0	1
23	3	0	5	13	0	29 *	0	0	0	1	0	0
24	0	1	0	12 *	0	2	0	0	1	0	0	7
25	0	0	2	4	2	2	0	0	0	0	2	0
26	1	0	0	0	5	2	0	0	0	1	0	6
27	0	0	2	1	2	3	0	0	0	1	0 *	46
28	0	0	0	0	5	0	0	0	0	0	0	0
29	0	0	7	15 *		0	2	0	0	0	3	25 *
30	0	0	8	5		0	0	0	0	0	0	0
31	0		17	5		3		5		1	0	
TOTAL	131	32	116	181	40	189	56	25	53	19	70	124
ANNUAL TOTAL		1036										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1986 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2	0	5	0	5	0	0	0	2	L	L	0
2	0	0	2	0	3	0	0	0	0	L	L	2
3	1	0	0	16	2	0	0	1	0	L	L	2
4	0	0	0	61 *	0	0	1	0	0	L	L	0
5	0	0	1	8 *	0	0	0	0	0	L	L	0
6	1	0	0	3	14	0	5	0	3	L	L	0
7	1	0	1	1	20 *	0	2	0	17	L	L	33
8	4	0	6	2	27 *	0	0	1	1	L	L	2
9	2	0	17	7	12 *	0	0	1	0	L	L	2
10	3	0	9	6	5 *	0	0	5	1	L	L	0
11	0	2	6	12	6 *	0	0	3	2	L	L	0
12	0	4	4	12 *	0	0	0	0	0	L	L	0
13	0	1	4	7	0	0	0	0	0	L	L	0
14	1	0	0	8	0	0	0	1	0	L	L	0
15	0	0	1	5	1	0	0	3	L	L	L	0
16	4	0	2	7 *	0	0	0	2	L	L	L	0
17	0	0	2	1	5	0	0	0	L	L	L	0
18	2	0	13 *	1	4	0	0	1	L	L	L	0
19	0	0	6	1	1	0	0	0	L	L	L	1
20	0	0	3	3	0	0	0	0	L	L	L	11
21	1	0	5	2	0	0	2	0	L	L	L	0
22	0	0	12	0	0	0	6	0	L	L	0	8
23	1	0	48 *	0	0	0	1	0	L	L	0	0
24	0	0	11	0	0	0	0	0	L	L	0	0
25	2	1	1	1	2	0	0	0	L	L	2	0
26	0	9	0	5	5	7	0	0	L	L	52	0
27	0	9	0	1	1	2	0	0	L	L	4	0
28	1	3 *	1	2	0	2	0	0	L	L	1	0
29	1	1	0	0		1	0	0	L	L	1	0
30	0	1	0	0		1	1	0	L	L	0	1
31	1		9	3		0		0		L	1	
TOTAL	28	31	169	175	113	13	18	18	30 E	57 E	200 E	62
ANNUAL TOTAL		914										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1987 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2	0	5	3	C	4	0	1	0	1	0	2
2	0	19	3	1	C	0	0	1	1	0	0	0
3	1	3	3	4	C	1	0	0	1	0	0	8
4	3	2	8 *	0	C	7	0	0	0	0	4	9
5	0	1	4	0	C	4	9	1	0	0	2	1
6	0	1	2	11	C	0	0	0	5	0	0	9
7	0	0	2	8	C	0	0	0	12	1	0	10
8	0	3	24 *	2	C	0	0	1	7	0	0	5
9	15	3	4 *	11 *	C	0	0	1	3	0	0	0
10	72	0	25	7	C	0	0	0	3	0	0	3
11	19	0	0	0	82 C	0	0	0	1	2	2	1
12	36	0	10	0	1	0	0	0	4	4	0	5
13	30	2	2	0	0	0	0	0	0	1	0	1
14	14	3	0	0	0	0	7	0	51	2	2	0
15	5	2	13	8	0	0	3	0	0	0	2	0
16	0	0	10	5 *	1	0	3	0	6	4	0	0
17	1	0	4	1	3	0	2	0	4	2	0	5
18	0	3	7	8	0	0	0	0	1	1	1	13
19	1	0	31 *	2	4	0	5	0	1	0	0	14
20	5	0	7	2	4	0	0	0	8	0	0	1
21	15	4	2	5	13 *	10	3	0	8	0	0	0
22	0	1	0	3	1	24 *	4	3	11	5	0	28
23	1	0	1	0	2	5	3	0	2	2	0	54
24	0	2	0	0	3	11	0	0	0	0	0	1
25	0	3	1	0	4	7	4	0	0	0	0	7
26	0	3	0	0	0	0	5	0	0	0	0	9
27	0	8	0	179 *	0	2	0	2	1	0	0	4
28	3	16 *	0	1	2	0	0	3	0	0	0	0
29	0	6	1	C		1	2	0	4	0	0	1
30	0	5	9	C		11	2	0	1	6	1	16
31	1		0	C		1		0		0	3	
TOTAL	224	90	178	261 C	120 C	88	52	13	135	31	17	207
ANNUAL TOTAL		1416										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.

WOLVERINE GLACIER BASIN, ALASKA; PRECIPITATION GAGE CATCH, IN MILLIMETERS
990 METERS ALTITUDE

1988 MEASUREMENT YEAR

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0	5	2	0	3	7	0	0	0	0	2	7
2	22	0	1	0	2	15 *	2	0	0	0	4	0
3	0	0	2	0	4	11	0	0	0	0	1	0
4	2	0	2	0	0	0	8	1	0	0	0	6
5	0	2	0	0	0	2	3	0	0	0	2	0
6	0	0	4 *	5	20	4	1	0	0	0	8	1
7	0	1	1	8	2	6	1	0	0	0	1	1
8	21	0	9	1	5 *	0	0	0	0	0	0	0
9	14	0	10 *	2	0	27 *	5	0	0	0	0	6
10	0	3	5	1	0	41 *	3	0	0	0	2	22
11	2	0	3	2	0	C	35 *	2	0	0	12	5
12	0	12	2	3	1	C	18 *	0	0	0	1	6
13	1	9	0	6	3	C	5 *	0	0	0	1	3
14	1	3	1	8	4	C	7	0	0	0	0	0
15	0	0	0	0	2	C	15	0	0	0	0	2
16	1	7	0	1	2	82 C	13	1	0	0	0	3
17	1	7	3	1	2	1	17 *	0	0	0	0	4
18	0	29 *	0	6	15 *	10	6 *	0	4	0	11	0
19	11	0	12	2	6 *	4	5	2	2	0	4	17
20	6	1	9	10 *	2	1	0	0	1	0	4	3
21	19	2	2	18 *	4	1	0	0	0	4	44	8
22	39 *	2	1	17 *	3	0	0	0	0	0	4	4
23	22	1	2	5	7	0	1	0	0	0	1	19
24	5	1	26	3	7	0	2	0	1	0	0	1
25	0	0	5	2	24 *	0	3	0	0	2	23	0
26	1	0	1	0	13 *	0	10	0	4	0	7	0
27	2	2	0	0	14	0	7	0	3	0	4	0
28	0	2	0	0	12 *	1	6	0	2	2	1	0
29	0	0	0	0	5	0	0	1	0	0	4	0
30	2	8	1 *	0		0	0	0	1	0	4	0
31	0		1	0		0		2		0	15	
TOTAL	172	97	105	101	162	213	173	9	18	8	160	118
ANNUAL TOTAL		1336										

CAUTION: Gage catch may not equal actual precipitation due to errors caused by wind.
NOTE: Data since September 19, 1988, not yet recovered from the gage.

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