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# Canadian Glaciers in the International Hydrological Decade Program, 1965-1974

## No. 4. Peyto Glacier, Alberta —Summary of measurements

G. J. Young and A. D. Stanley



**SCIENTIFIC SERIES NO. 71**  
*(Résumé en français)*

**INLAND WATERS DIRECTORATE,  
WATER RESOURCES BRANCH,  
OTTAWA, CANADA, 1976.**

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## **Abstract**

A summary is given of work performed within the glacier basin during the International Hydrological Decade 1965-74. The data collected fall into three categories—glaciological, meteorological and hydrological. The glaciological work is primarily concerned with glacier mass balance. The measurements of accumulation and ablation are described and annual summaries are given in the form of maps and tables. The collection of meteorological data near the glacier and the gathering of stream discharge data immediately below the glacier is described and illustrated in graphical form.

## **Résumé**

Le présent rapport traite des travaux effectués dans la région du bassin glaciaire durant la Décennie hydrologique internationale, 1965 à 1974. Les données recueillies se divisent en trois grandes catégories: les données glaciologiques, météorologiques et hydrologiques. Les travaux en glaciologie avaient trait principalement au bilan de masse. Le rapport décrit les mesures de l'accumulation et de l'ablation et donne, à l'aide de cartes et de tableaux, les conditions pour les diverses années. De plus, il fournit une description et une représentation graphique des données météorologiques recueillies dans la région immédiate du glacier et des données relatives au débit d'eau sous le glacier.

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### INTRODUCTION

The need for glaciological research on a global scale was emphasized by the General Assembly of the International Association of Scientific Hydrology (IASH) held in Helsinki in 1960 (IUGG/IASH, 1961). At that meeting more comprehensive work on glaciers was recommended to the Commission of Snow and Ice. The program subsequently prepared by the Subcommittee on Variation of Existing Glaciers was a major step forward in international glaciological research and was accepted by the Commission of Snow and Ice at the Symposium of Obergurgl in 1962 (IUGG/IASH, 1962). This led the 1964 General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) to implement the world-wide International Hydrological Decade (IHD) program on glaciers in Resolution I-13 UNESCO/NS/198.

Canada participated in glaciological research and part of its commitment to IHD was the survey of a chain of five glacier basins for the study of mass and water balance. This chain represents a transect across the southern part of the Canadian Cordillera and forms part of the IHD network of glacier basins which extends through Europe and Asia in a west-east direction and extends from Alaska to South America in a north-south direction.

The five glacier basins in southwestern Canada selected for a long-term detailed study of mass and water balance were Sentinel, Place, Woolsey, Peyto and Ram River (Fig. 1). The rationale for the choice of glaciers under study and details of the measurement program have been described by Østrem and Stanley (1969) and Stanley (1970). Responsibility for carrying out these studies was given to the Glaciology Section of the Geographical Branch, Department of Mines and Technical Surveys, which is now the Glaciology Division, Water Resources Branch, Inland Waters Directorate, Department of Fisheries and the Environment. This report deals with the data collected at Peyto Glacier during the International Hydrological Decade, 1965-74.

### GENERAL FEATURES OF PEYTO GLACIER

Location	In Banff National Park— lat. 51°40' N, long. 116°35' W
Glacier area	13.40 km <sup>2</sup>
Maximum elevation	3185 m a.s.l.
Minimum elevation	2125 m a.s.l.
Mean elevation	2635 m a.s.l.
Mean surface slope	12.9°
Mean azimuth of surface	33°
Mean specific winter balance, 1966-74	1.53 m (water equivalent) (standard deviation, 0.30 m)
Mean specific net annual balance, 1966-74	0.18 m (standard deviation, 0.65 m)
Mean equilibrium line altitude, 1966-74	2665 m a.s.l. (standard deviation, 113 m)
Accumulation area ratio	0.44
Area above stream gauge	22.07 km <sup>2</sup>

Peyto Glacier lies on the eastern side of the Continental Divide in the Rocky Mountains of Alberta. The site is shown in Figure 2.

The glacier is divided into two distinct sections by an icefall at the 2400-m level. About 15% of the glacier surface lies below the icefall, forming a gently sloping valley glacier that terminates in a narrow, confined and fairly steep snout. The entire lower section of the glacier is surrounded by ice-cored moraine covering an area of about 1 km<sup>2</sup>. Above the icefall lie three extensive accumulation basins with steep headwalls. The most southerly of these basins joins the Wapta icefield in a broad col. In general, Peyto is not a heavily crevassed glacier, although in certain restricted locations, especially in the steeper sections, crevassing is fairly pronounced.

Geologically, Peyto lies in a predominantly sedimentary area, the bedding planes dipping gently westward. The steep cliffs of the surrounding mountains are formed of hard, resistant dolomite.

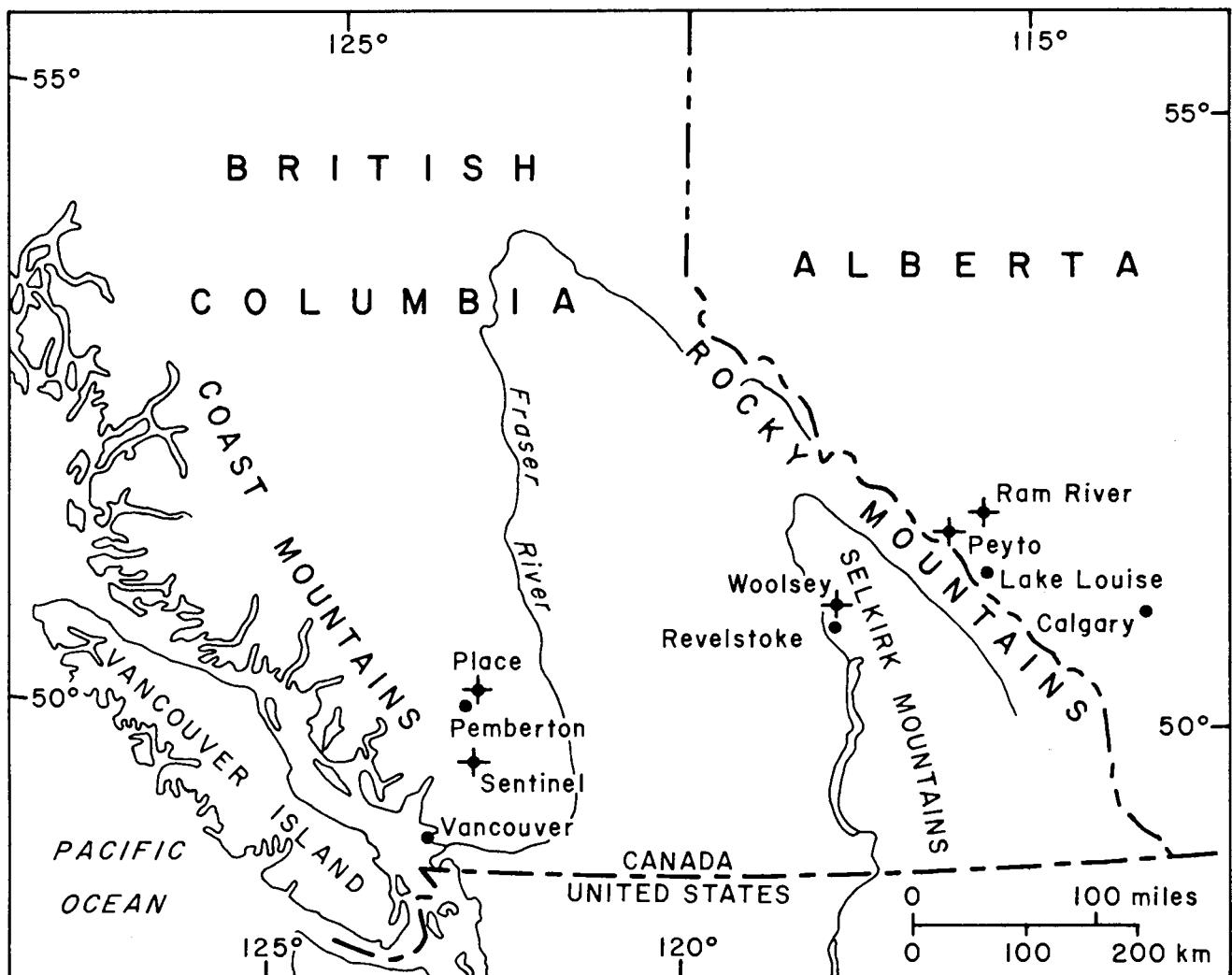


Figure 1. Glacier locations.

### THE MEASUREMENT PROGRAM

For the entire IHD period a field party was resident on Peyto Glacier throughout the summer months. Measurements were made of snow accumulation and ablation, meteorological parameters and stream discharge, according to the recommendations detailed in Østrem and Stanley (1969). There are few periods of missing data.

### Glaciological Measurements

Snow accumulation and ablation were measured approximately every 10 days throughout the ablation period at stake locations on the glacier surface (stake distribution shown in Fig. 2). Snow density measurements were made approximately once a month at several

locations on the glacier in order to convert snow depths into water equivalent (w.e.) values.

The accuracy of estimation of water equivalent values at stake locations varies from one part of the glacier to another and through time. In the ablation area where snow overlies glacier ice, snow depths at stake locations can be measured to within a few centimetres; however, there can be considerable variation in snow depth over short horizontal distances, requiring several depth soundings to be made. The higher into the accumulation area one goes, the less distinct is the interface between the annual snow layer and the underlying firn. The stakes themselves are less securely anchored and can sink into the firn. It is thus possible in the accumulation zone to be inaccurate by tens of centimetres; however, there is less horizontal variability in snowpack depth in this area. As

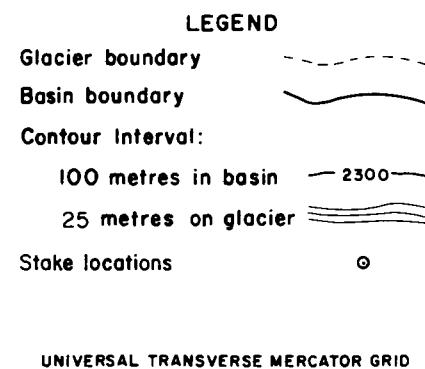
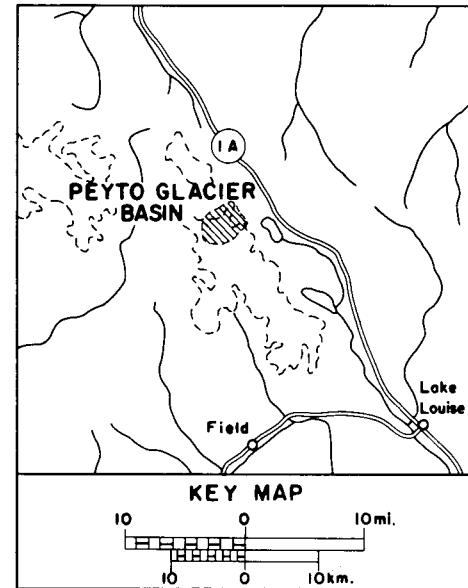
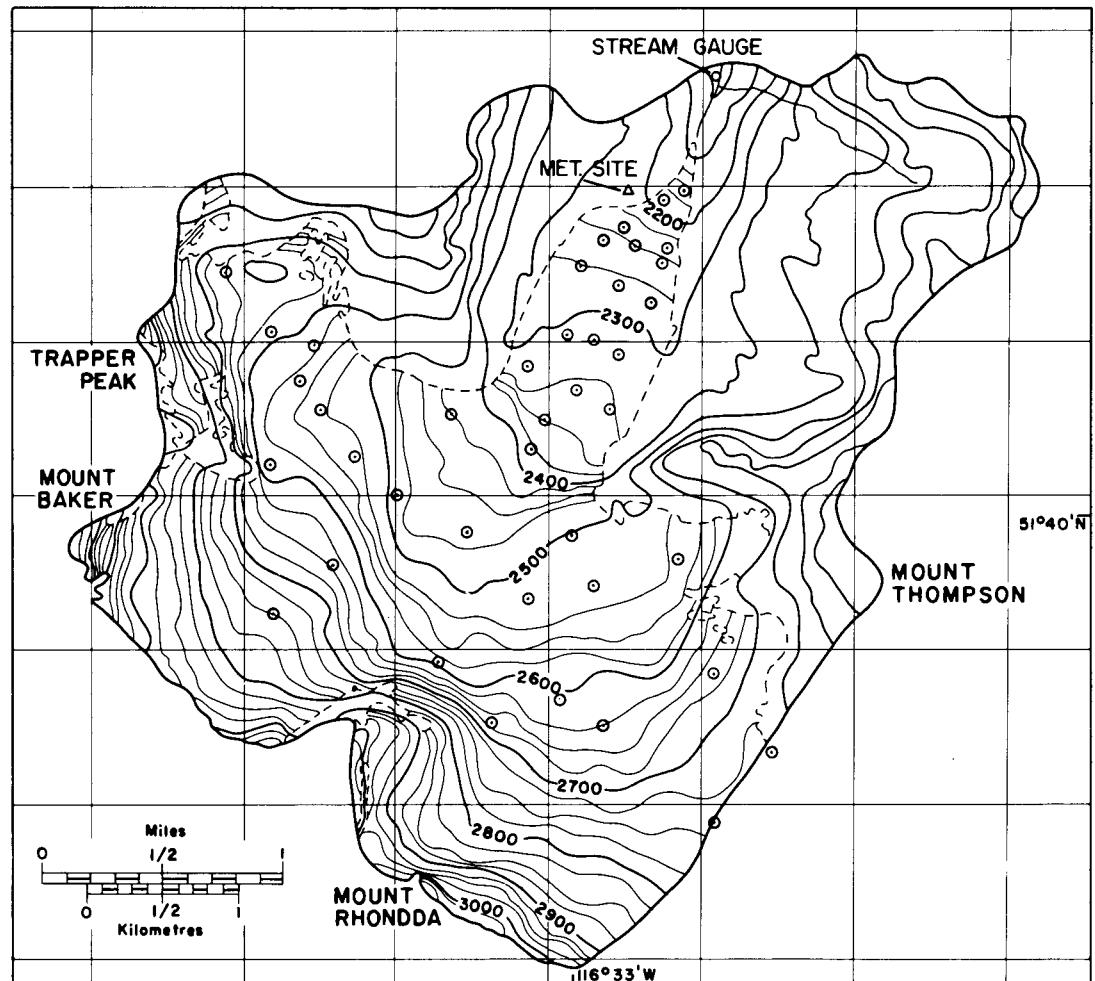


Figure 2. Stake distribution.

meltwater percolates from the annual snowpack into the underlying firn, the interface between them becomes progressively less detectable by sounding rods and so measurement inaccuracies tend to increase over the summer period. In general, mean pack density becomes more difficult to determine as the liquid content of the pack increases; difficulties are greatest when there is considerable lateral percolation of meltwater within the pack and when local ponding occurs. Internal alimentation in the firn area (i.e. the retention of meltwater within the firn) has not been rigorously considered in the measurement program.

A major problem on Peyto Glacier is that considerable areas at high altitudes are difficult of access (see Fig. 3). This problem is reflected in the stake distribution: there is very good spatial coverage at low altitudes, very poor coverage at high altitudes. Thus, when snow depth values are estimated by extrapolation for inaccessible areas, confidence in results is low. Figures for specific net annual balance ( $B_t$ ) can differ by as much as 0.5 m, depending on the mode of extrapolation used for these upper areas. In retrospect, this has probably been the most significant weakness in the Peyto measurement program.

#### *Calculation of Mass Balance Quantities*

Maps, graphs and tables summarizing net winter accumulations and net annual balances have been calculated by an algorithm described by Young (1976a). The algorithm determines relationships between terrain shape and mass balance quantities at stake locations, then uses these relationships to estimate quantities in unvisited parts of the glacier.

Results obtained by this method are very slightly different from results obtained by the "conventional" methods of computation described by Østrem and Stanley (1969). The two methods are considered to be approximately equal in accuracy. The main advantage of the new algorithm is its speed of execution, which was the prime reason for its use in these studies.

Mass balance quantities are considered to be most accurate in those areas of the glacier where many measurements have been made and least accurate in those inaccessible areas (especially high up on the glacier) where extrapolation over considerable distances has been necessary.

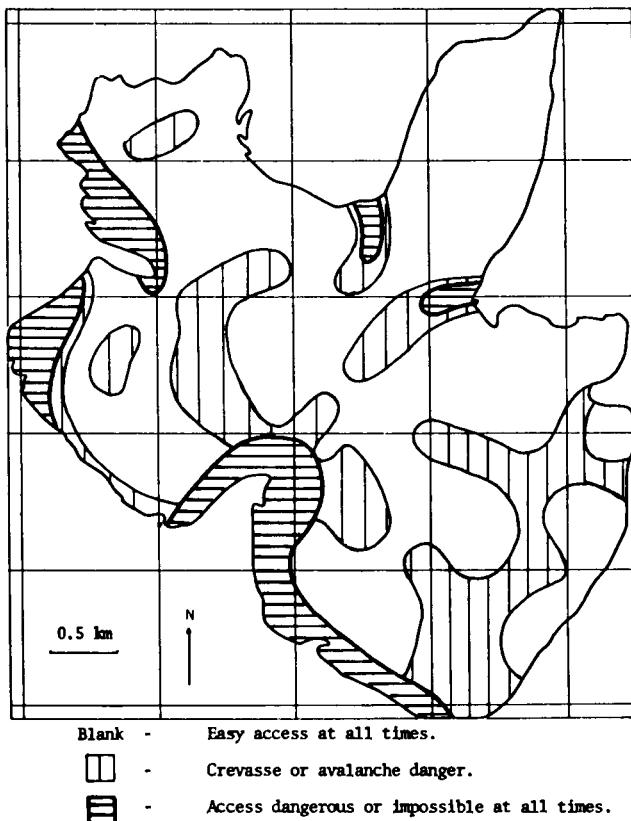


Figure 3. Accessibility over the glacier surface.

## Meteorological Measurements

An instrument station has been maintained at the base camp at 2220 m a.s.l., about 100 m from the glacier margin. Instruments used have always included maximum and minimum thermometers, thermohygrograph, totalizing pyranometer, totalizing anemometer, sunshine recorder and precipitation gauge. With few exceptions, instruments have been checked once per day and on most days readings were taken four times per day, at 0800, 1200, 1600 and 2000 hr standard mountain time.

Mean daily temperatures, probably the most important single indicators of energy income, are considered accurate to  $\pm 1^{\circ}\text{C}$ . While inaccuracies of this magnitude, coupled with the fact that the meteorological station is well away from the ice, pose problems for energy budget calculations, the temperature record does prove a very useful indicator of periods of high and low melt rates.

There have been several special projects (see below) conducted on the glacier involving meteorological measurements both on the glacier surface and on the surrounding rock; however, the data from these projects are not considered here.

## Discharge Measurements

A stream gauge (No. 05DA008) was maintained by the Water Survey of Canada, Calgary Office, from 1967 to 1974. A Stevens A35 stage recorder supplemented by numerous discharge measurements has produced a discharge record with few missing data from late May to early September each year. The gauge is located on a section of stream having a bedrock cross-section. However, as there are no lakes between the glacier and the gauge, the water is laden with silt and, in times of high flow, boulders. The stilling well has to be cleared of silt annually. Estimates of total summer discharge are considered to be between 5 and 10% of the truth. At high flows when few stage-discharge relationships have been computed, accuracy of discharge estimation is lowest.

## SPECIAL STUDIES

During the IHD not only were routine measurements made but the basin was also used for many special studies, most of which were designed to supplement directly the regular data collection program. The bibliography has been divided into two sections. References concerned totally or largely with Peyto Glacier that were

published during or after the IHD period appear in part A of the bibliography; those concerned only partly with Peyto Glacier appear in part B.

## Introductions

General introductions to the work done on Peyto Glacier are given by Østrem (1966), Østrem and Stanley (1969) and Stanley (1970). Ommanney (1972) and Sedgwick (1976, in press) give good summaries of work done in the Peyto area prior to the IHD investigations. Sedgwick and Henoch (1975) give a summary of the history of projects in the basin and also give a simple outline of glacier behaviour.

## Mapping

As a basis for much of the research work and as ends in themselves, two maps at 1:10,000 have been produced by Sedgwick and Henoch (1970) and Henoch (1975). The second of these maps uses a Swiss method for relief portrayal.

## Mass Balance

Traditional methodology is treated by Østrem and Stanley (1969). A newer method of calculating mass balance values, based on the association of accumulation and ablation with terrain shape, is given by Young (1970, 1973, 1974a, 1974b, 1974c, 1975, 1976a). Mass balance and glacier fluctuation have also been examined by Brunger (1966), Brunger *et al.* (1967) and Sedgwick (1966).

## Meteorology

Several studies have been explicitly concerned with meteorology, and others have emphasized the effect of meteorology on general hydrology. Goodison (1969, 1970, 1972b) dealt with radiation budgets over the Peyto Basin. Foessel (1974) investigated near-surface temperature distributions over the basin; Munro (1975) dealt with the energy balance over a small part of the glacier tongue.

Derikx (1975) and Foehn (1973) used energy inputs at a point on the glacier to explain melt rates, while the studies of Derikx (1973) and Derikx and Loijens (1971) incorporated meteorological inputs into more comprehensive basin runoff models. Goodison (1972a) linked climatic variables to runoff events.

## Hydrology

Besides the hydrology studies mentioned above which investigate the links between meteorology and hydrology, articles by Derikx (1972) and Young (1976b) deal with glacier hydrology alone. Whytock (1971) investigated links between water temperature and discharge in a supraglacial stream.

## Other Studies

Hobson and Jobin (1975) mapped depths of glacier ice using seismic techniques. Østrem (1975) used ERTS imagery in an attempt to monitor glacier mass balance by satellite surveillance.

## ACKNOWLEDGMENTS

The personnel of the Warden Service of Banff National Park have given encouragement throughout the history of this project. Their cooperation on numerous occasions is gratefully acknowledged.

Special thanks should be given to the personnel of the Water Survey of Canada, Calgary Office, for maintaining the stream measurements and reducing the discharge data collected.

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## **Appendix I**

### **Glaciological summaries**

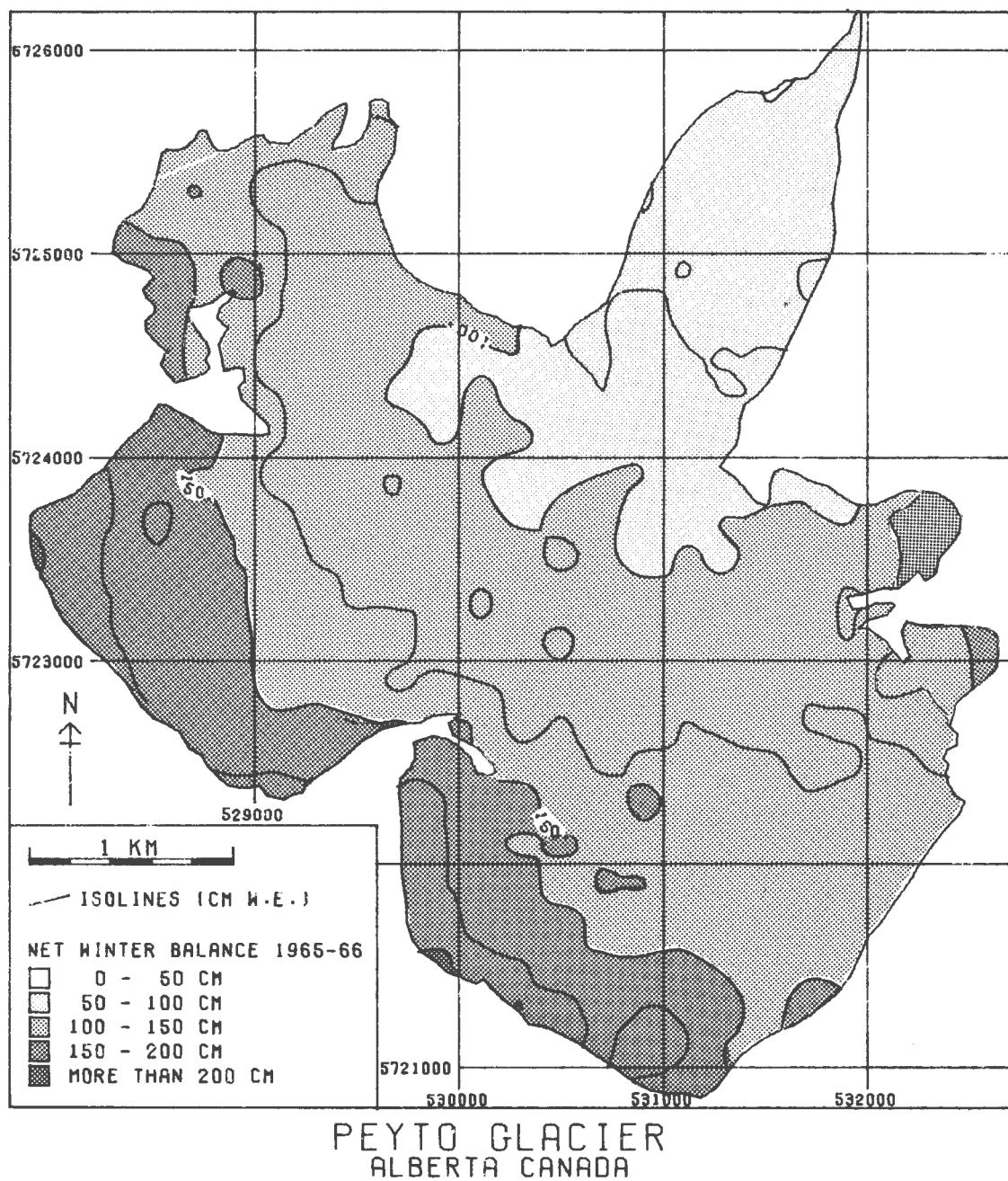


Figure I-1.

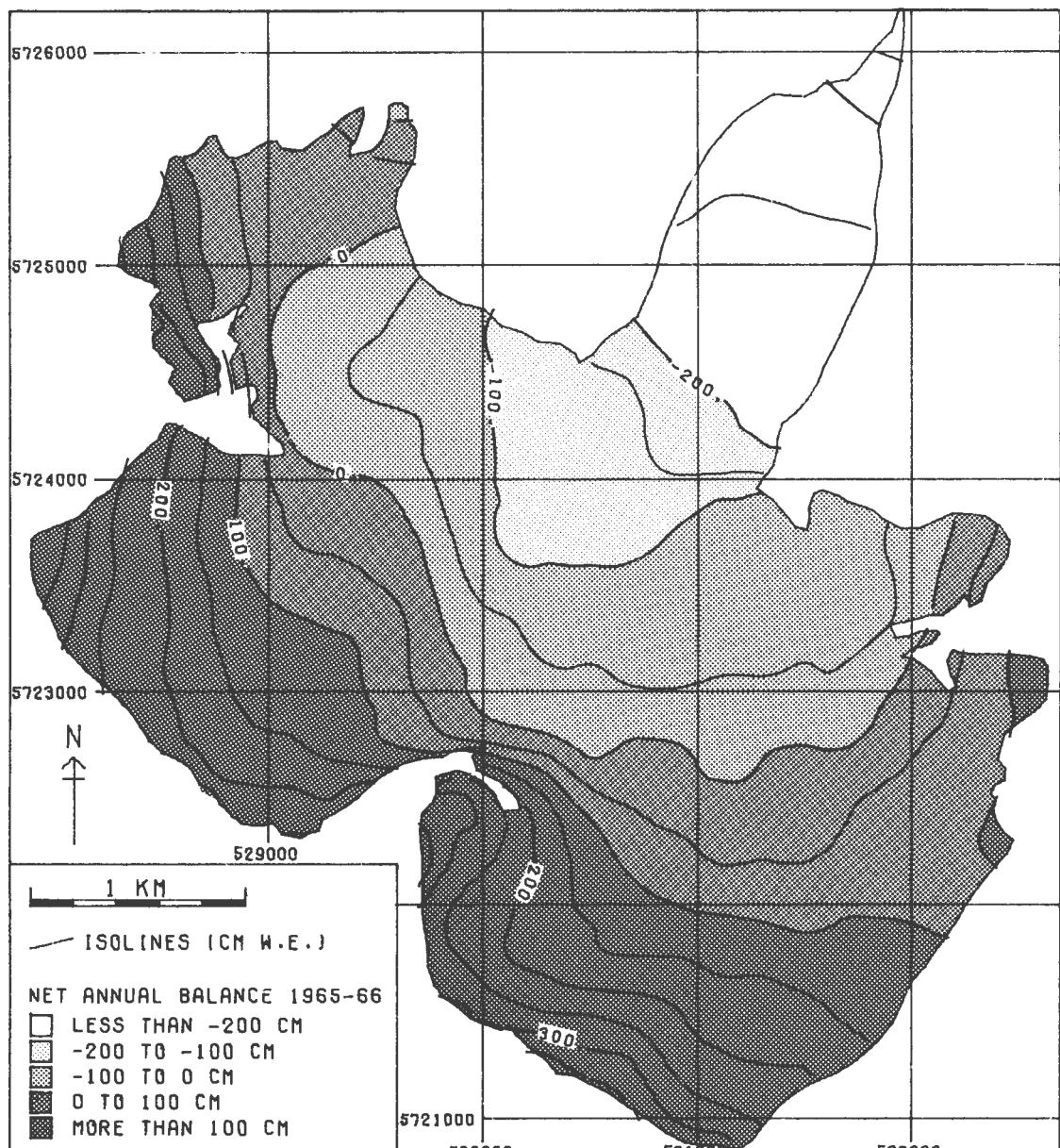
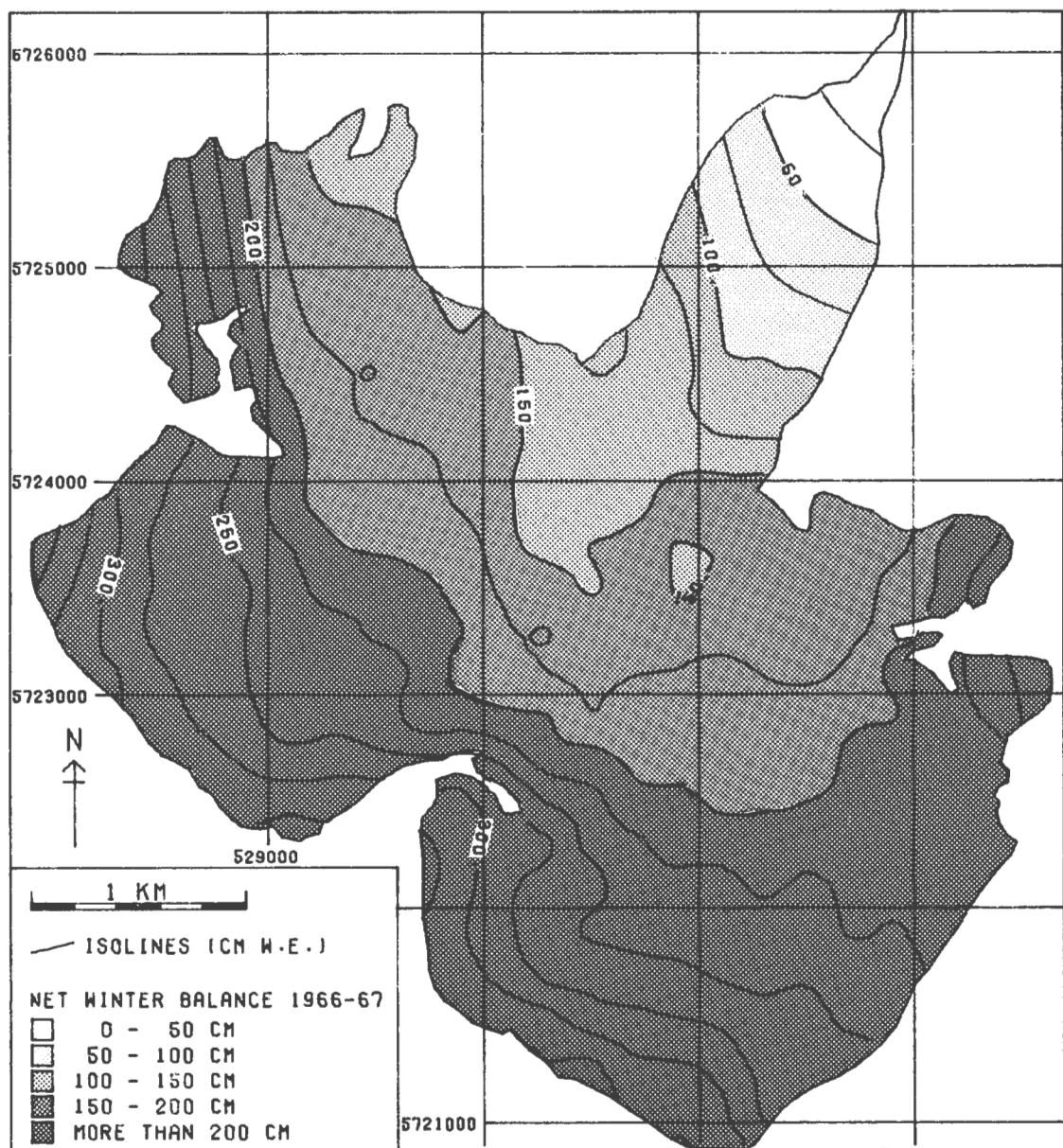
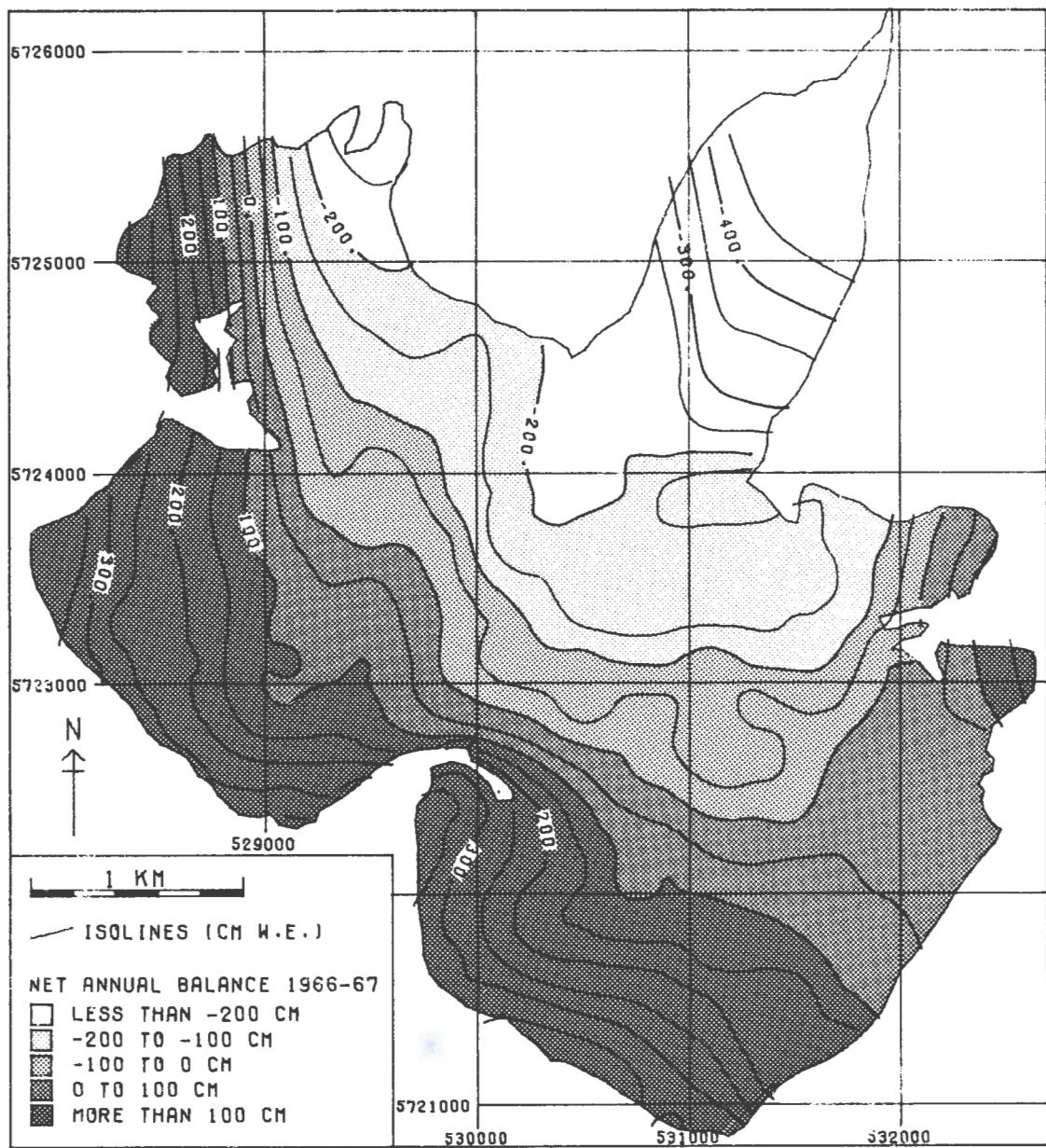


Figure I-2.



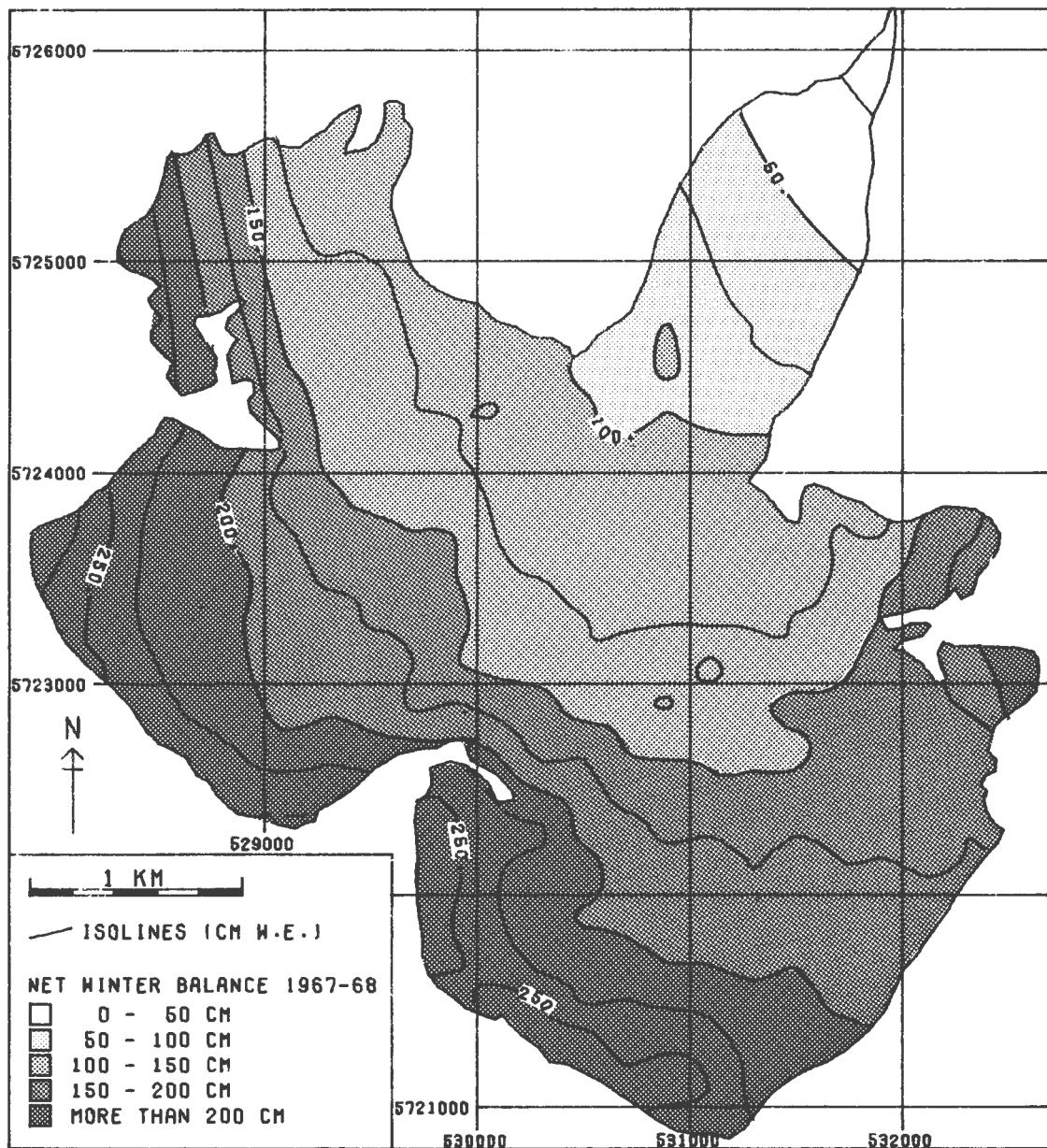
PEYTO GLACIER  
ALBERTA CANADA

Figure I-3.



PEYTO GLACIER  
ALBERTA CANADA

Figure I-4.



PEYTO GLACIER  
ALBERTA CANADA

Figure I-5.

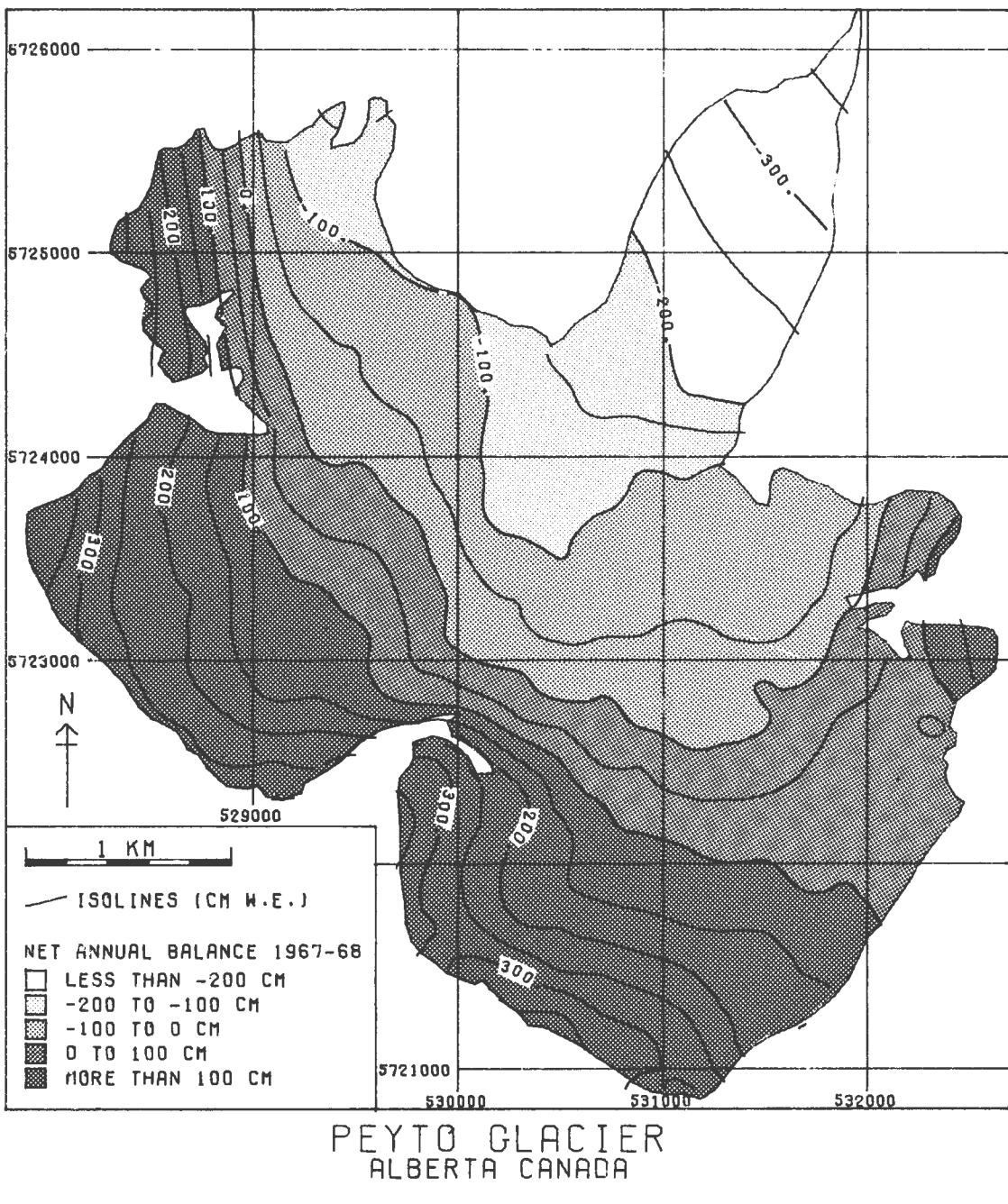


Figure I-6.

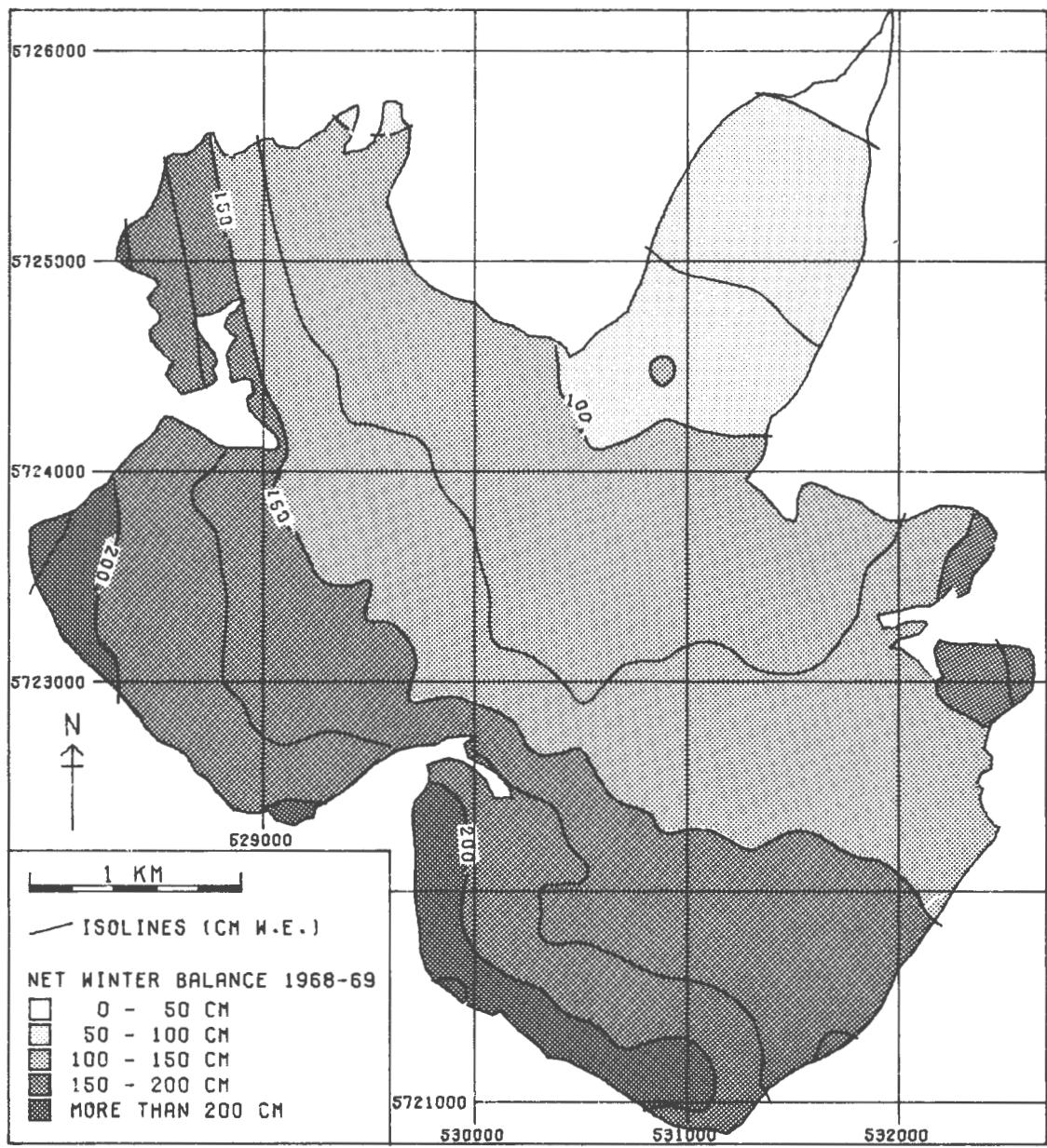
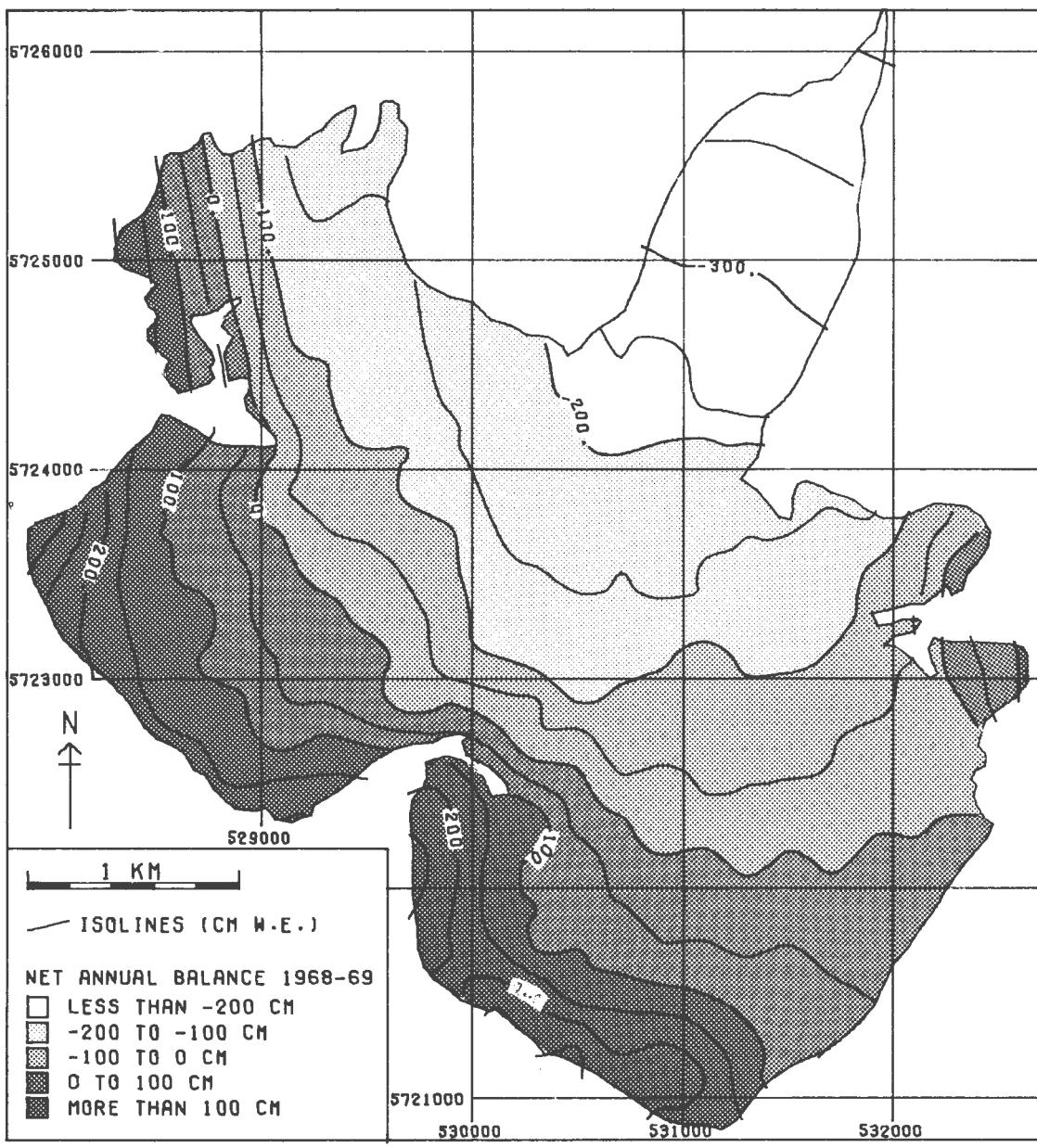


Figure I-7.



PEYTO GLACIER  
ALBERTA CANADA

Figure I-8.

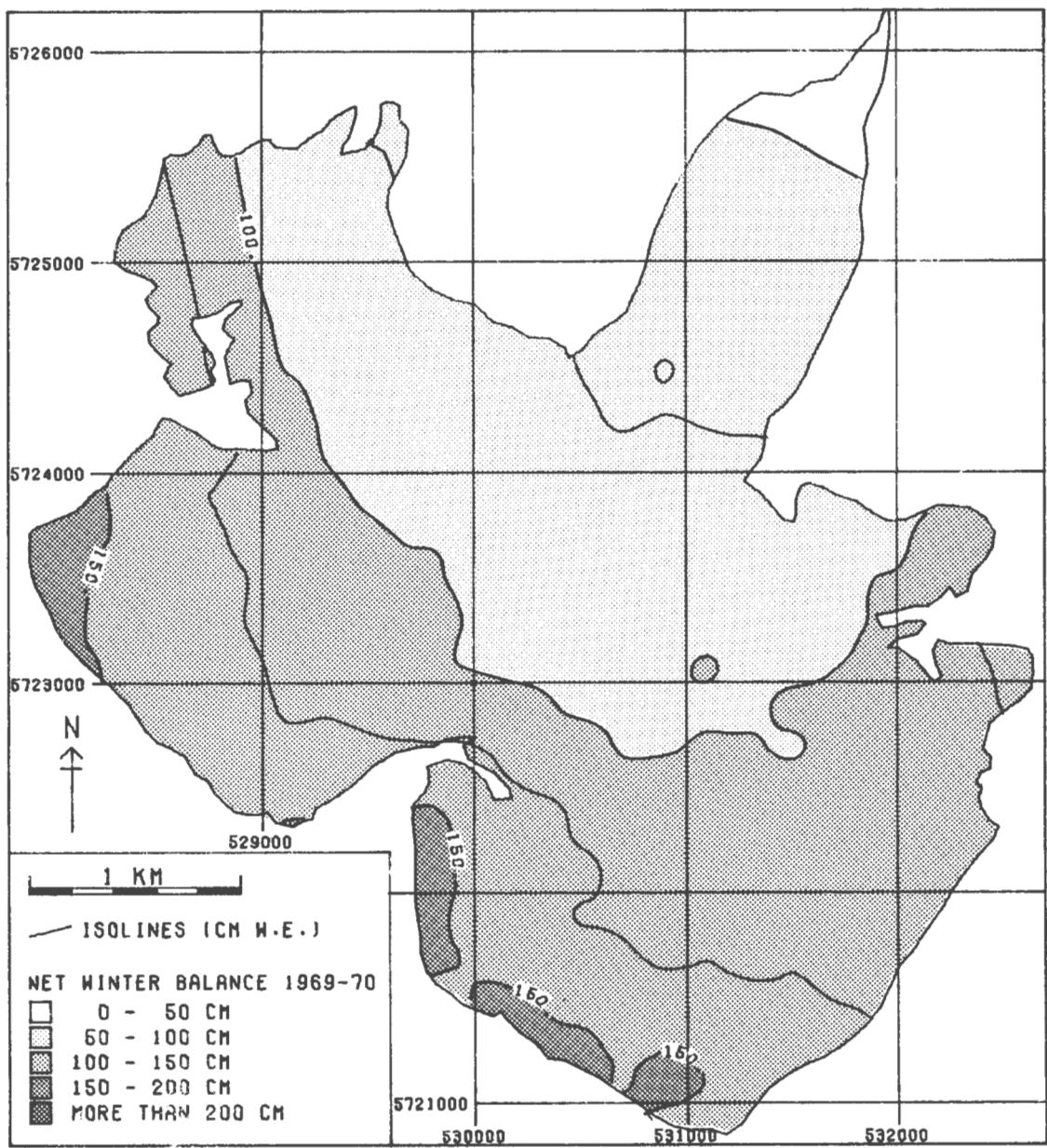


Figure I-9.

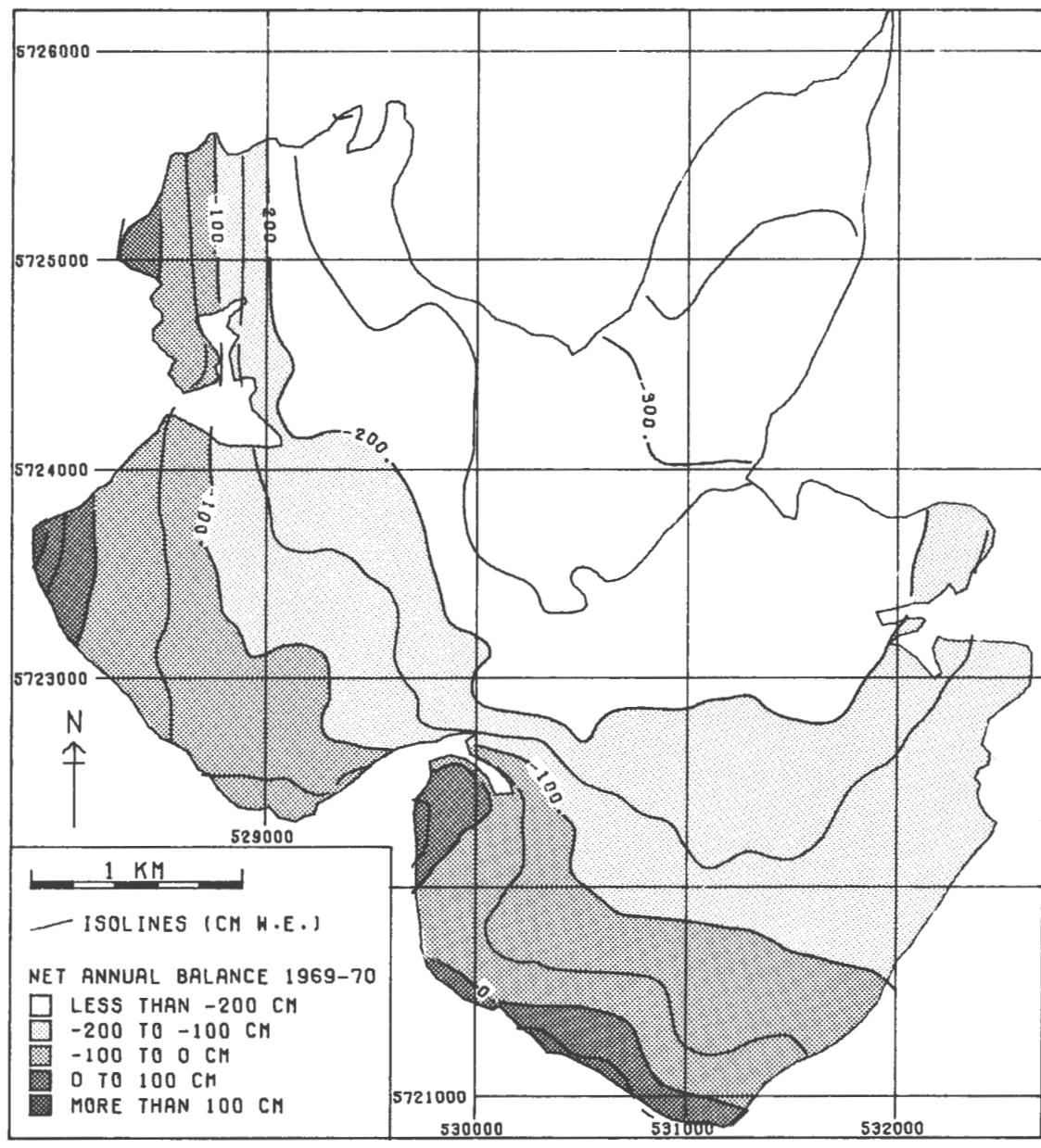


Figure I-10.

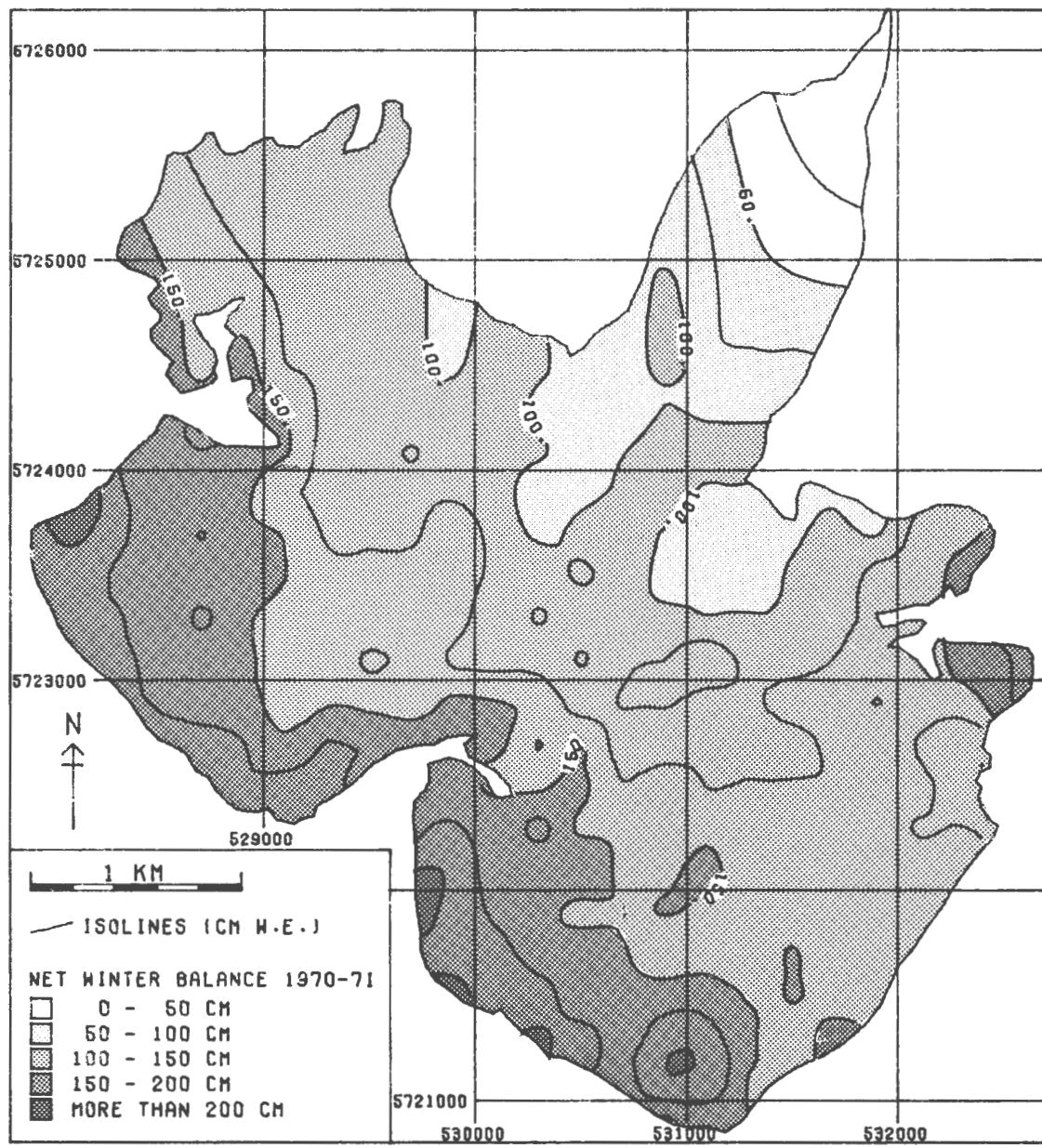


Figure I-11.

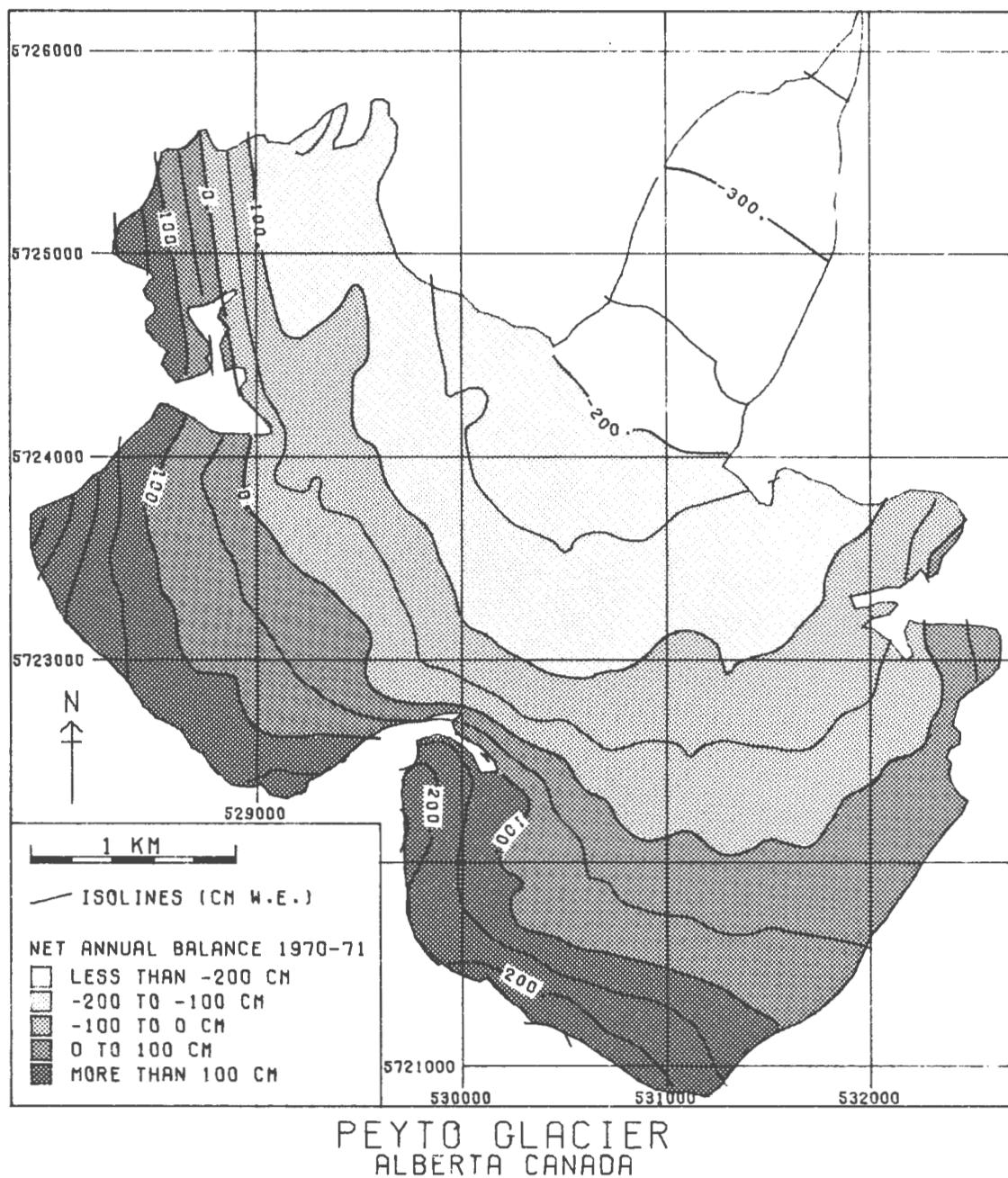


Figure I-12.

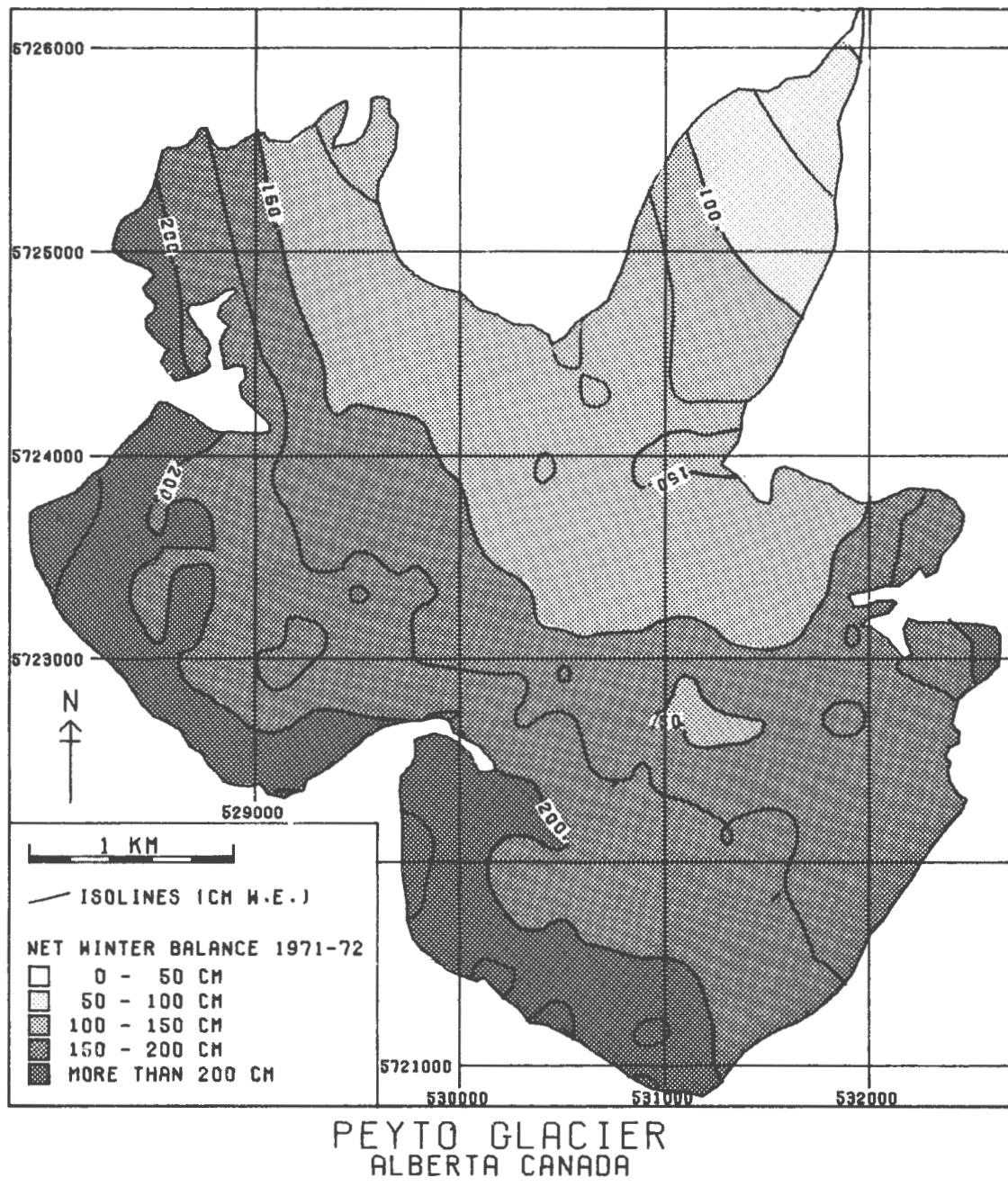
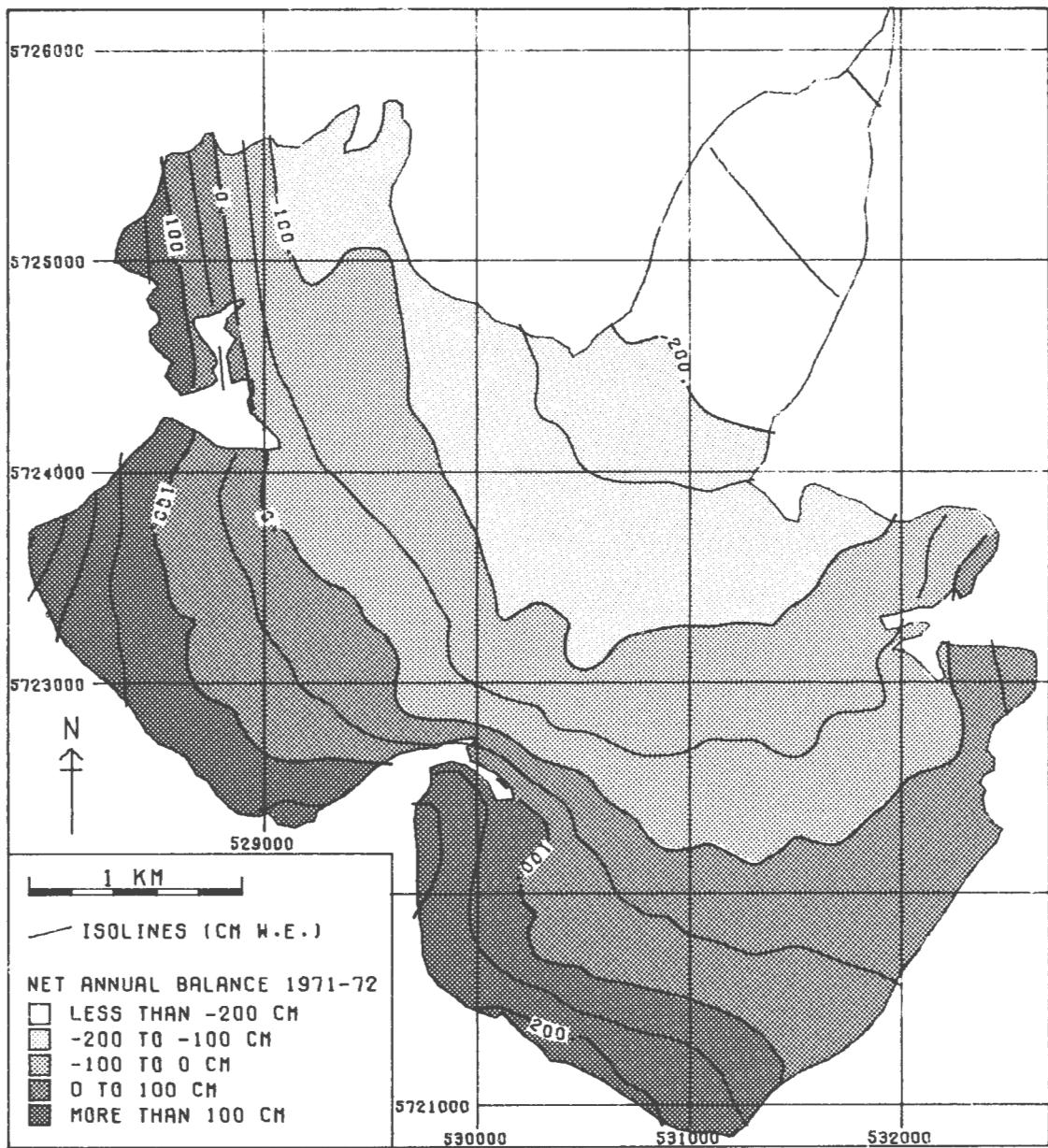
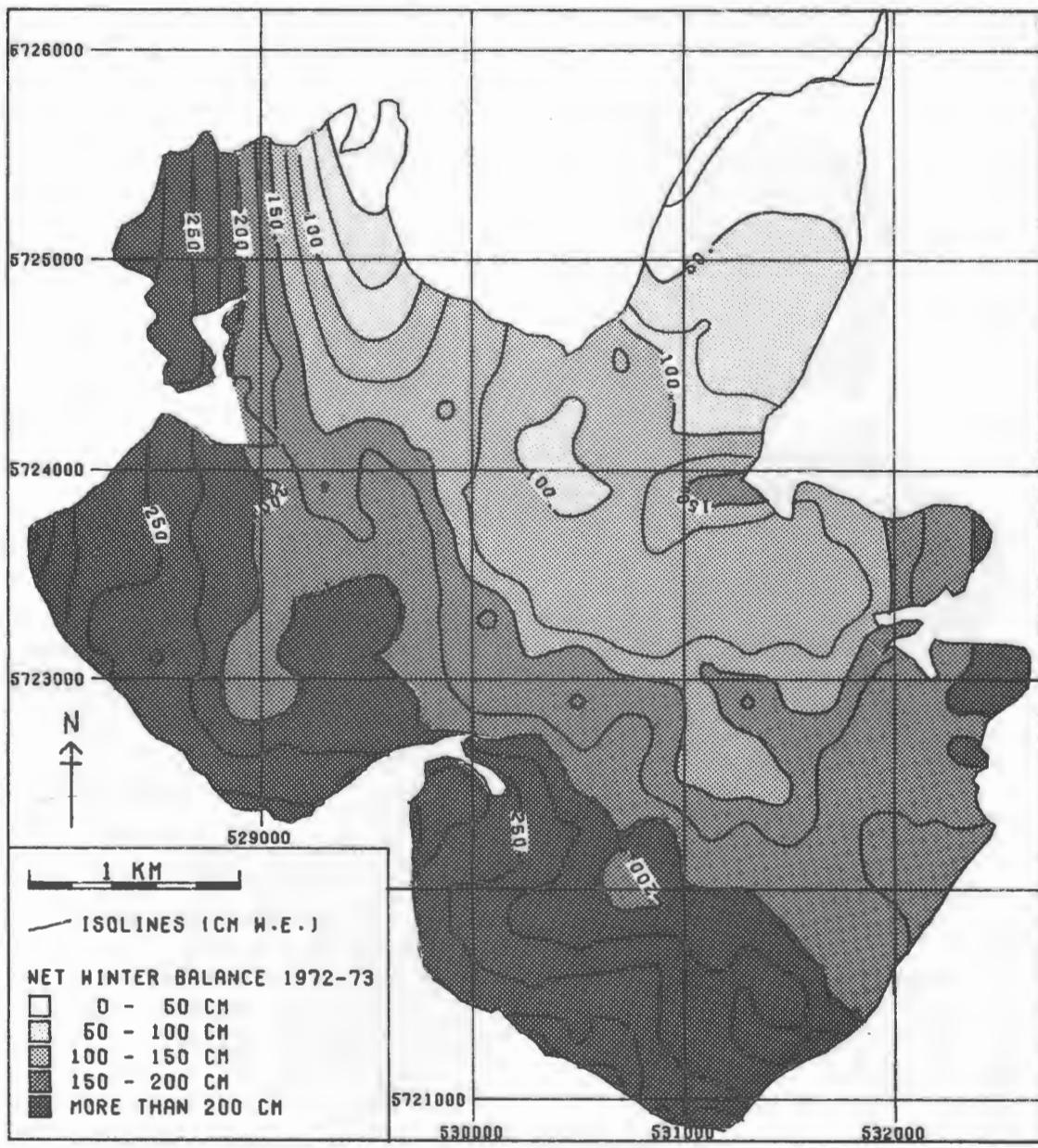


Figure I-13.



PEYTO GLACIER  
ALBERTA CANADA

Figure I-14.



PEYTO GLACIER  
ALBERTA CANADA

Figure I-15.

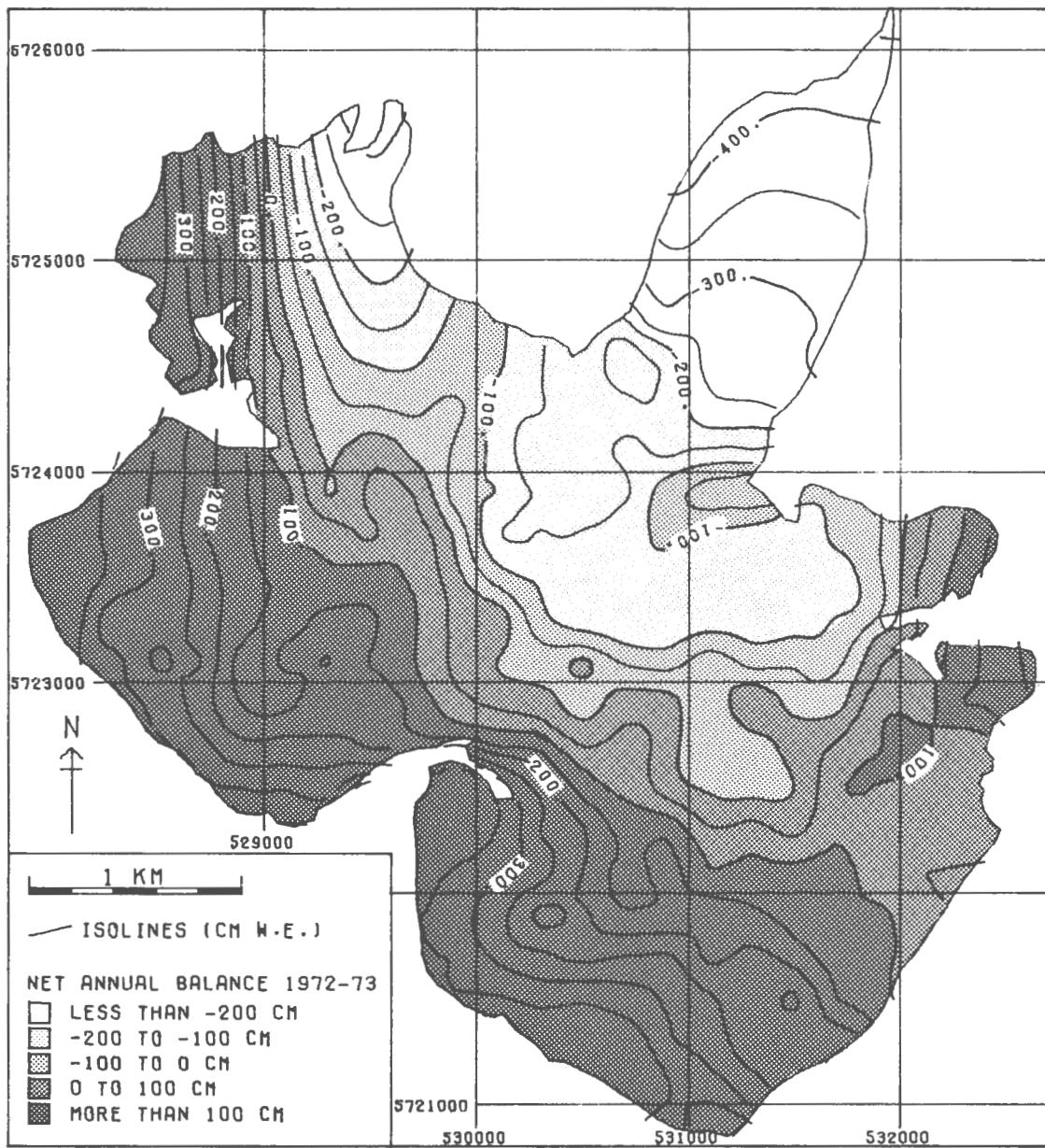
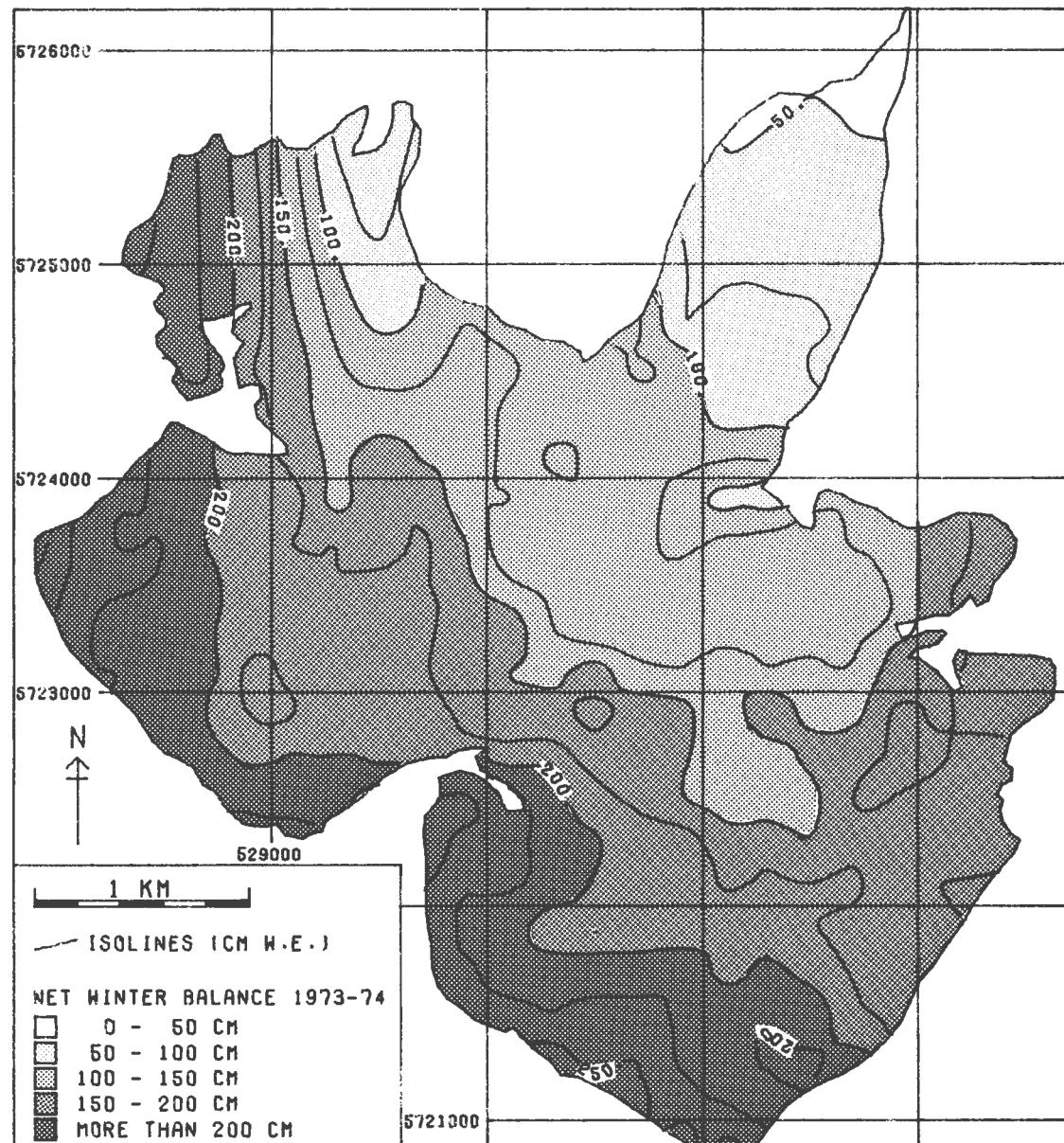
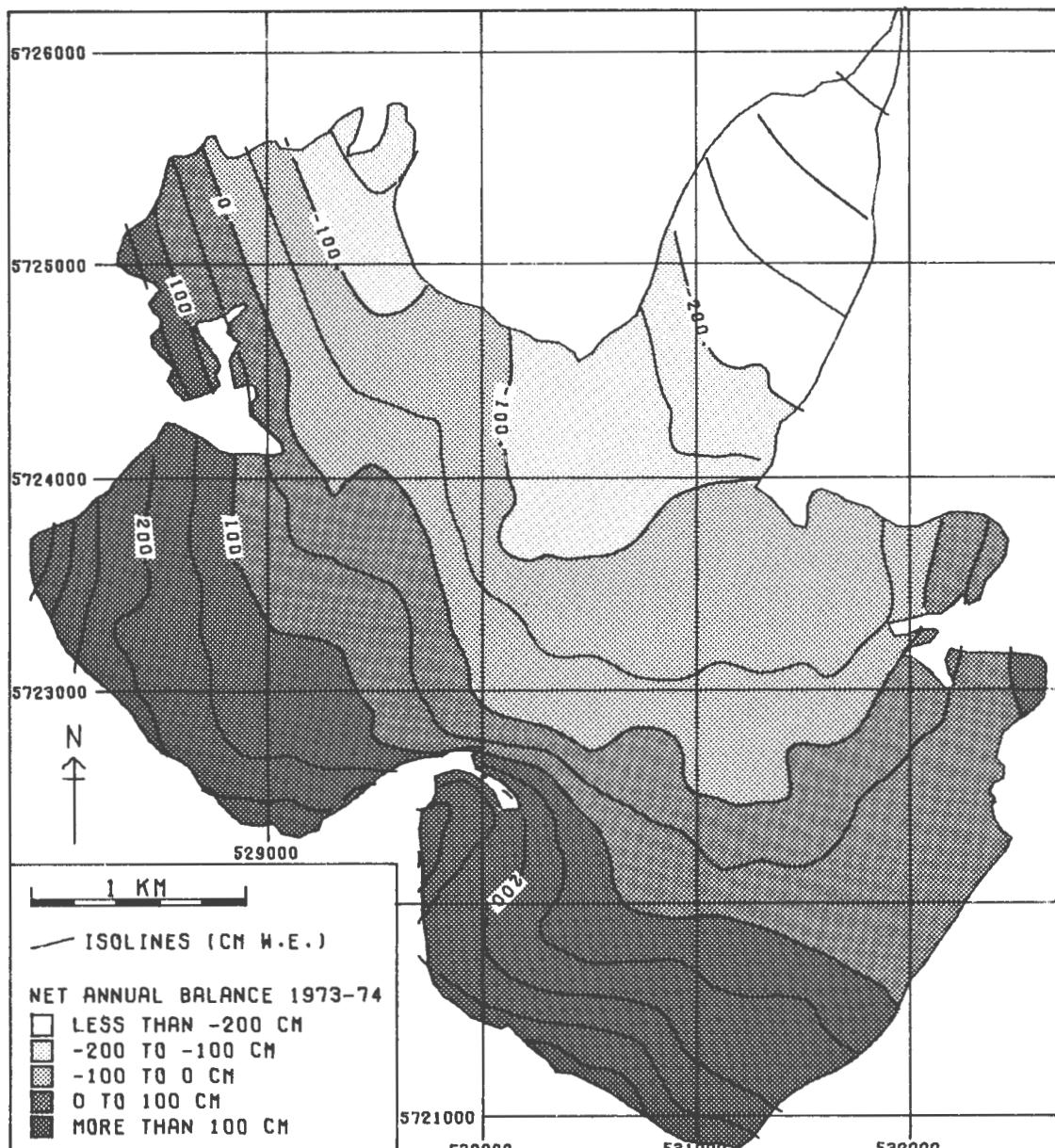


Figure I-16.



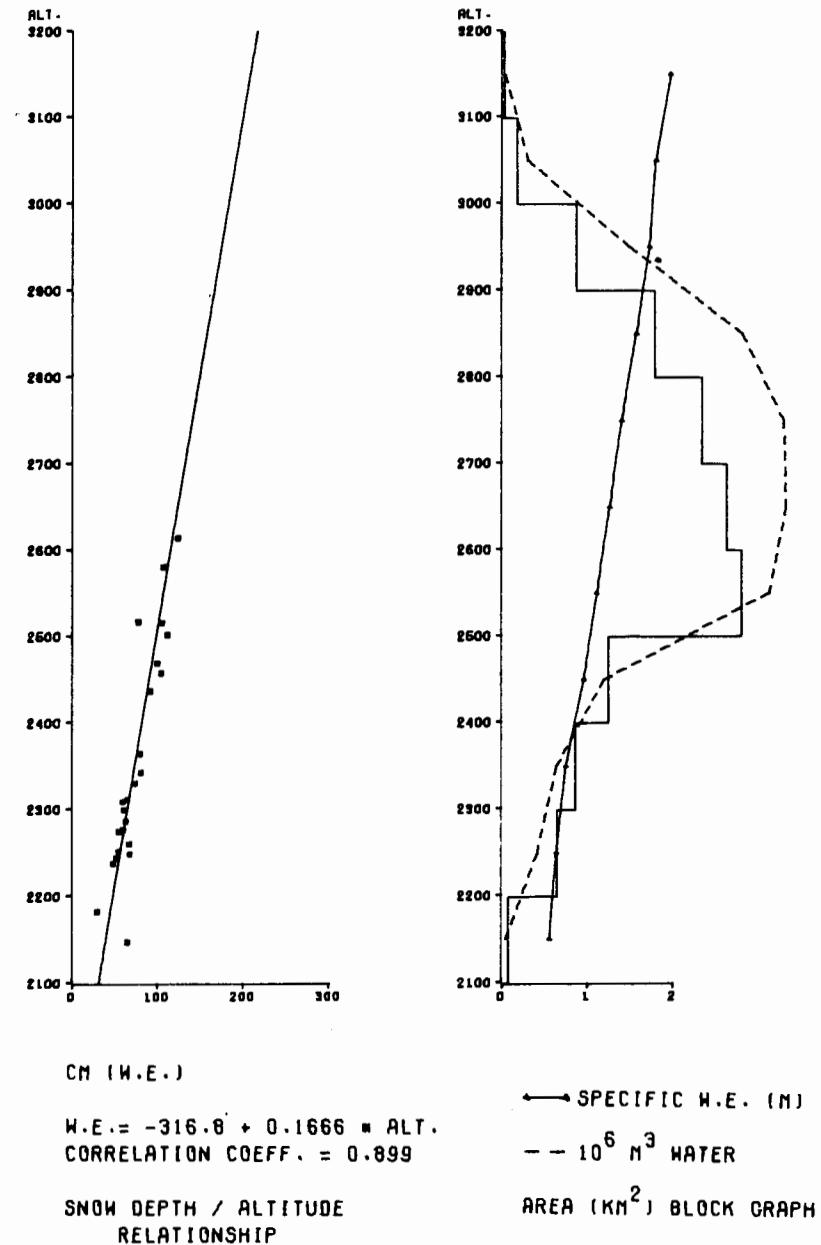
PEYTO GLACIER  
ALBERTA CANADA

Figure I-17.



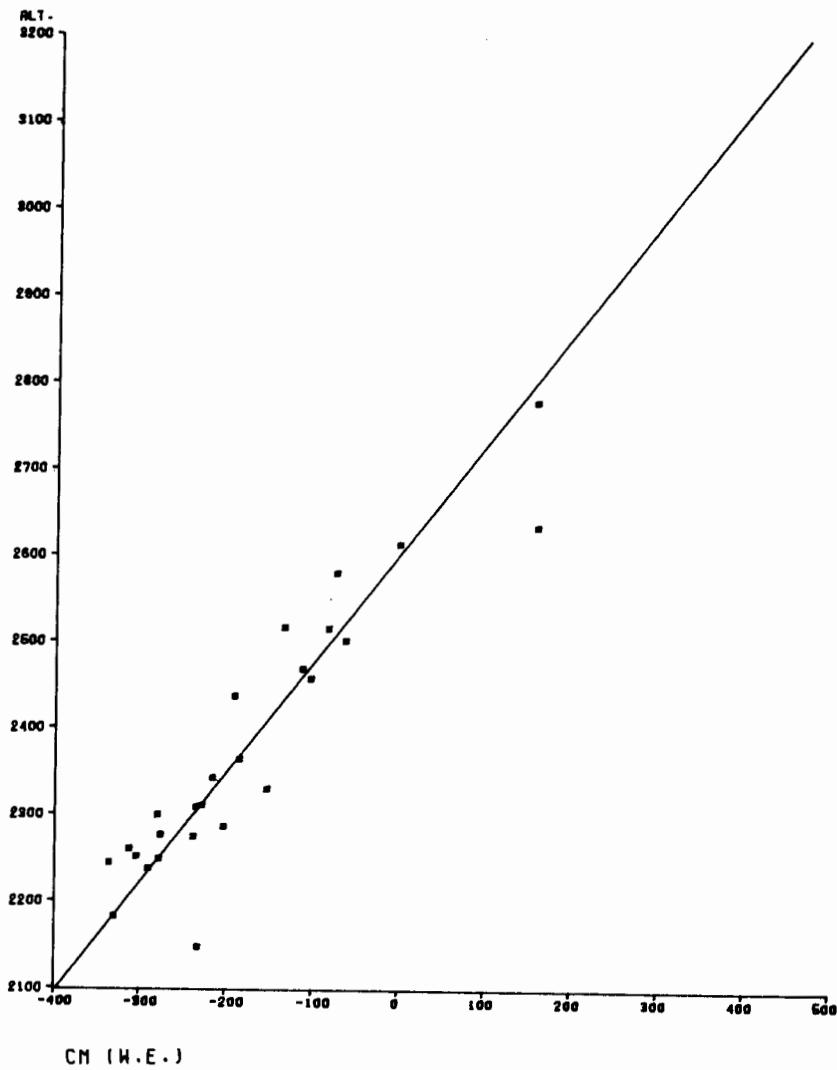
PEYTO GLACIER  
ALBERTA CANADA

Figure I-18.



PEYTO NET WINTER BALANCE 1965-66

Figure I-19.



$$W.E. = -2046.8 + 0.7864 \cdot ALT.$$

CORRELATION COEFF. = 0.929

SNOW DEPTH / ALTITUDE  
RELATIONSHIP

PEYTO NET ANNUAL BALANCE 1965-66

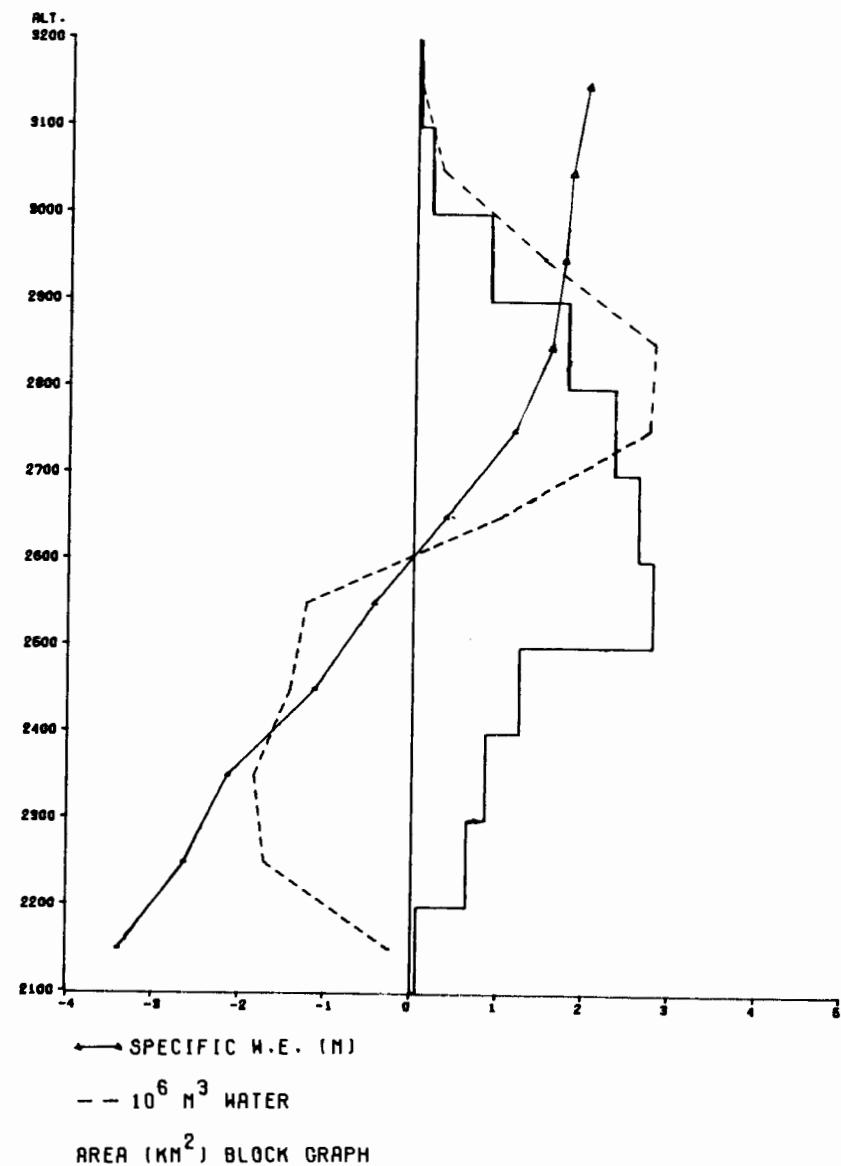
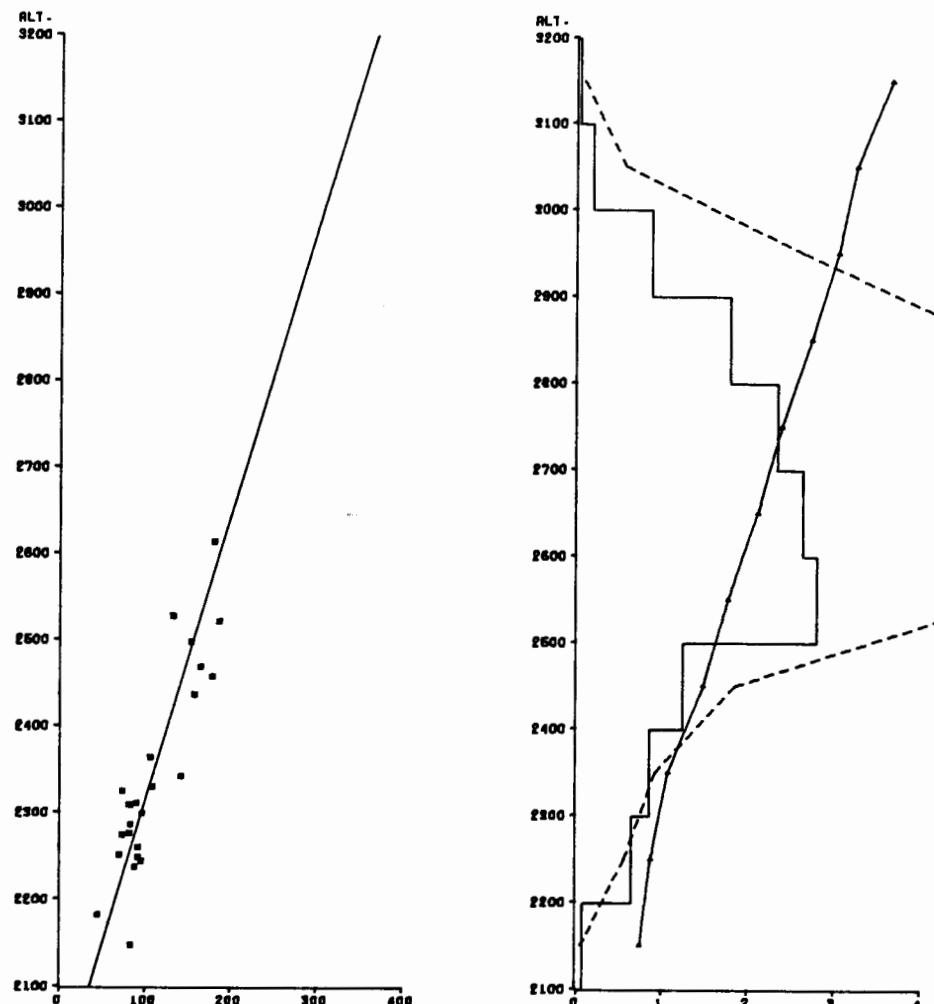


Figure I-20.

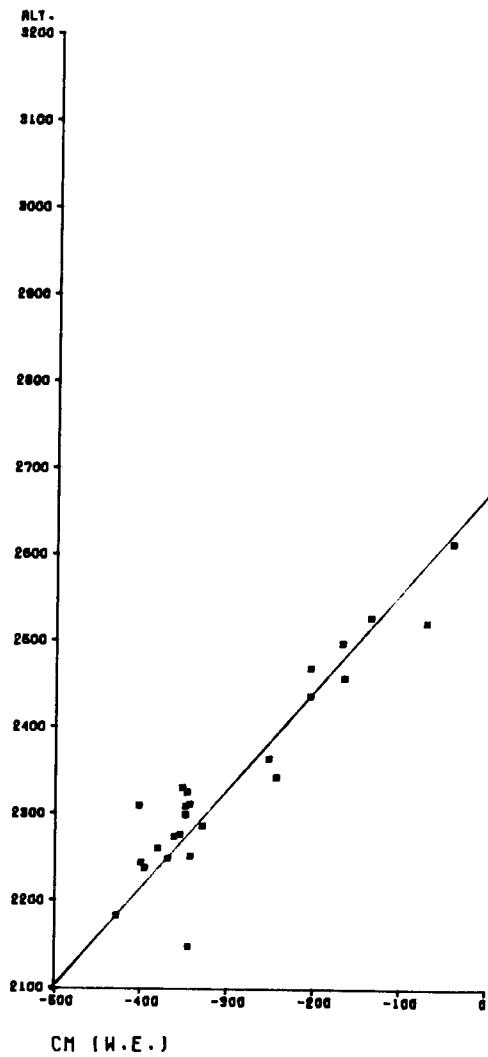


CM (W.E.)  
 $W.E. = -595.5 + 0.3011 \cdot ALT.$   
 CORRELATION COEFF. = 0.877  
 SNOW DEPTH / ALTITUDE  
 RELATIONSHIP

→ SPECIFIC W.E. (M)  
 - -  $10^6 \text{ m}^3$  WATER  
 AREA ( $\text{km}^2$ ) BLOCK GRAPH

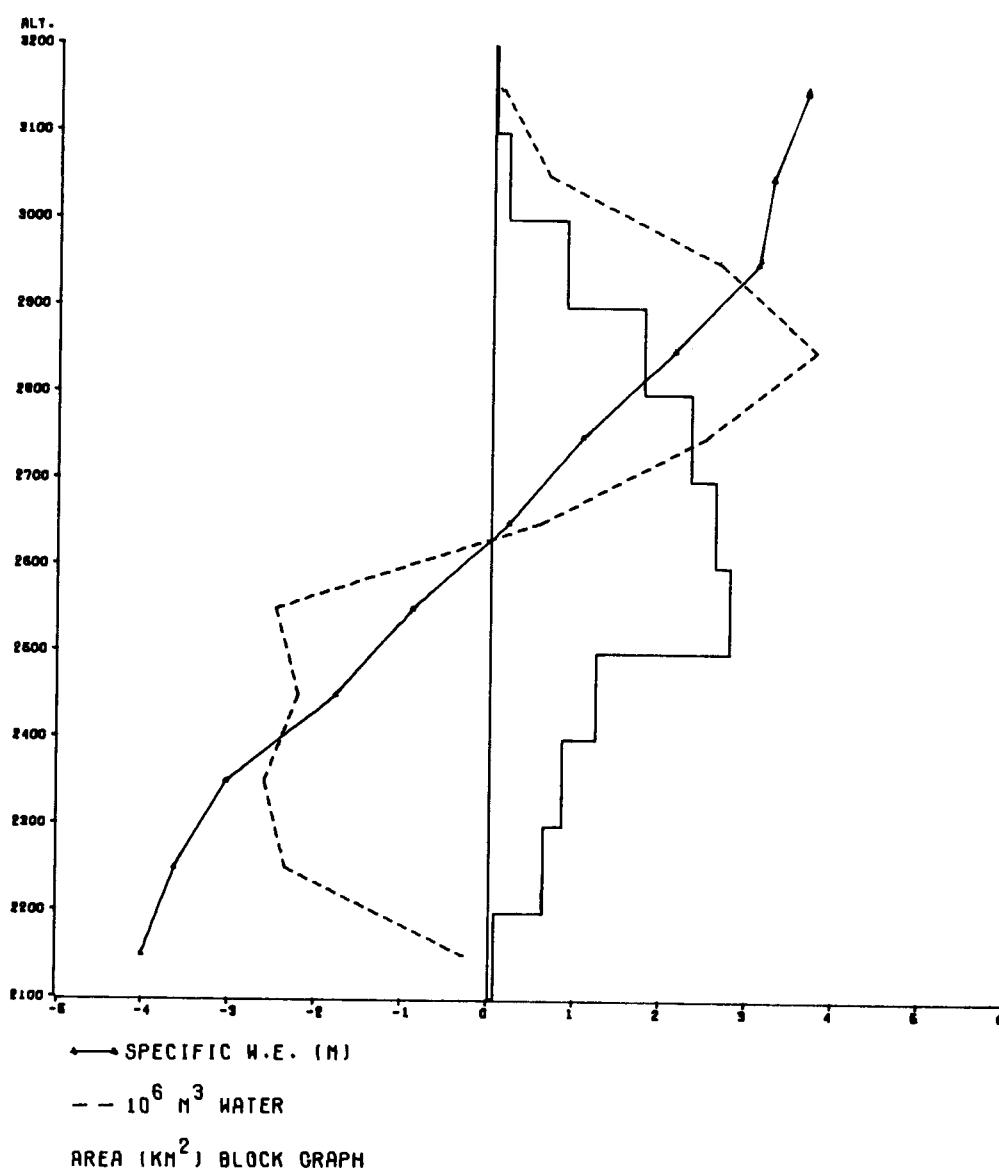
PEYTO NET WINTER BALANCE 1966-67

Figure I-21.

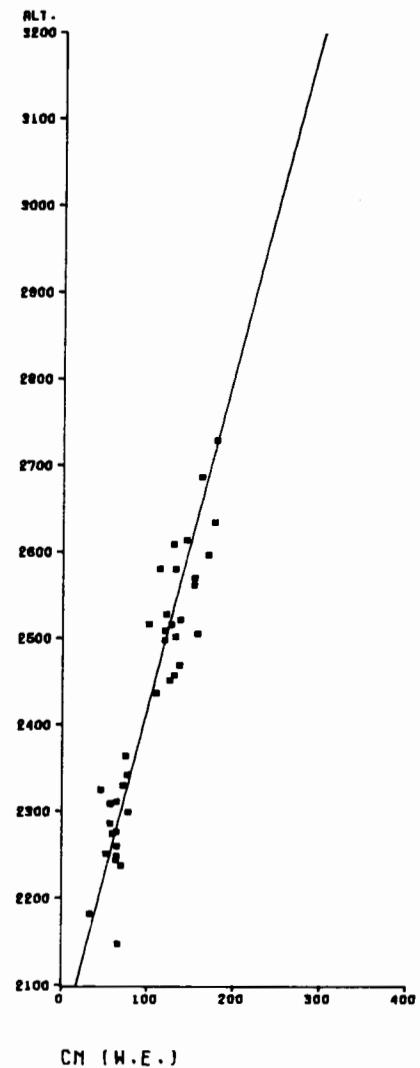


$H.E. = -2338.6 + 0.8734 \times ALT.$   
CORRELATION COEFF. = 0.933

SNOW DEPTH / ALTITUDE  
RELATIONSHIP

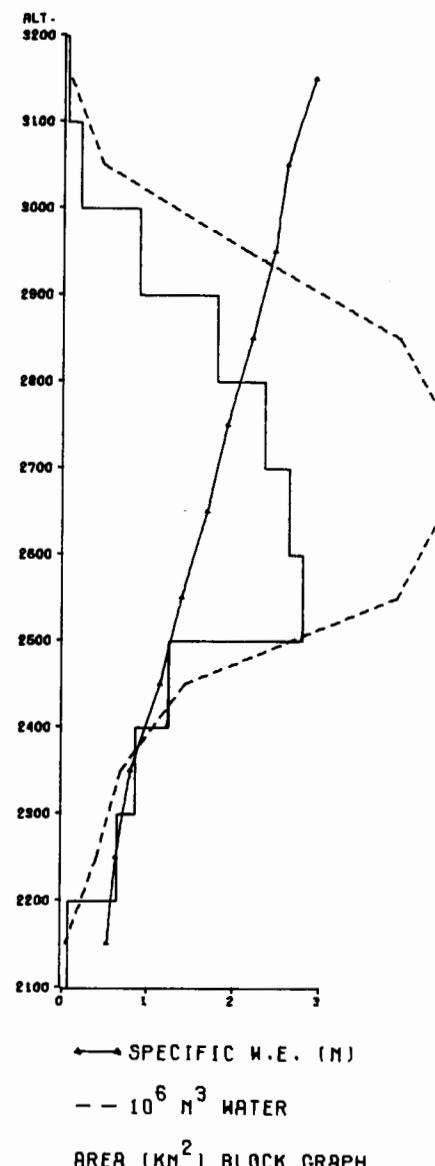


PEYTO NET ANNUAL BALANCE 1966-67



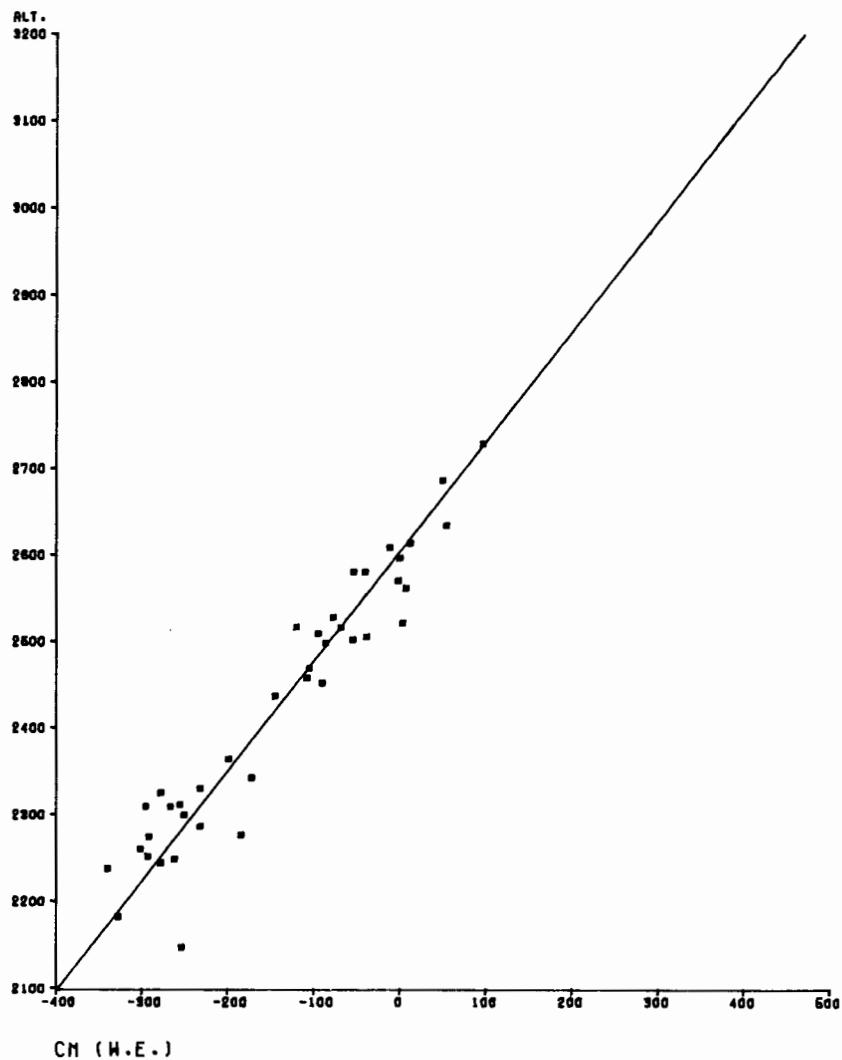
W.E. =  $-518.7 + 0.2565 \times \text{ALT.}$   
CORRELATION COEFF. = 0.926

SNOW DEPTH / ALTITUDE  
RELATIONSHIP



PEYTO NET WINTER BALANCE 1967-68

Figure I-23.



SNOW DEPTH / ALTITUDE  
RELATIONSHIP

PEYTO NET ANNUAL BALANCE 1967-68

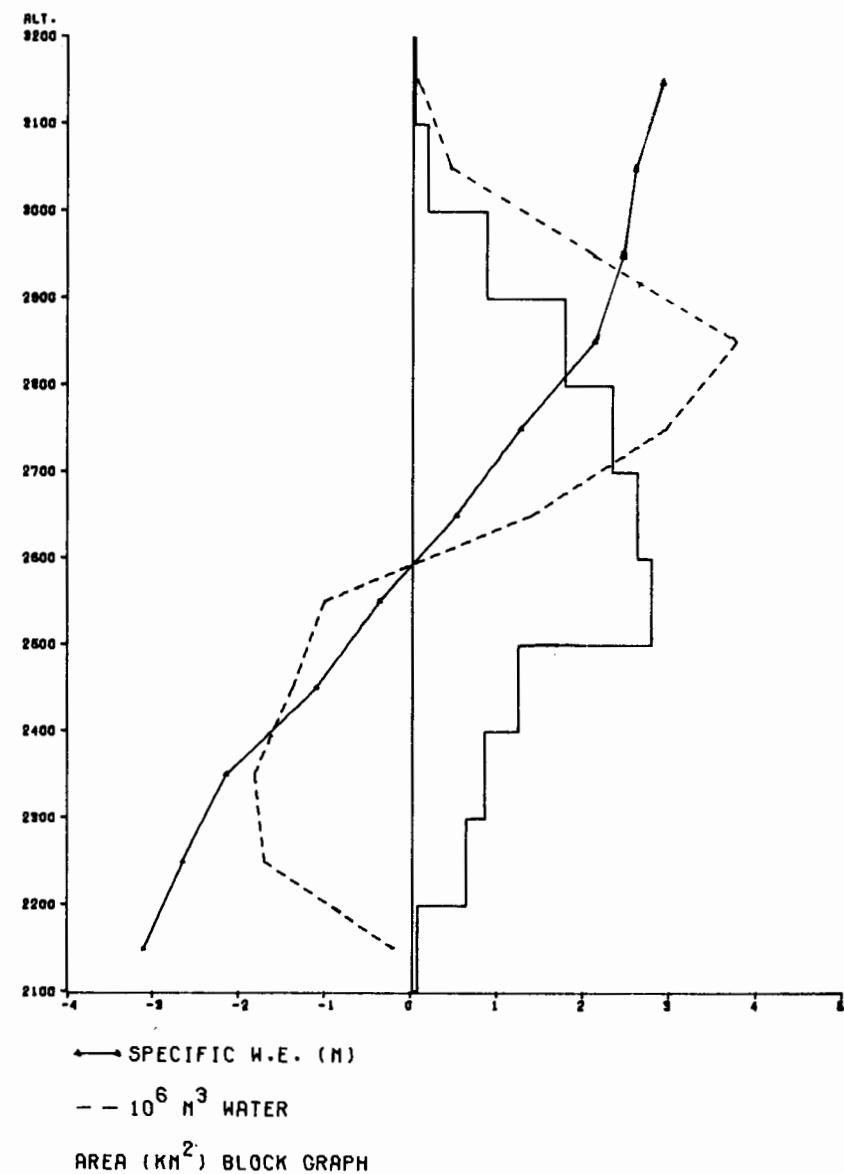
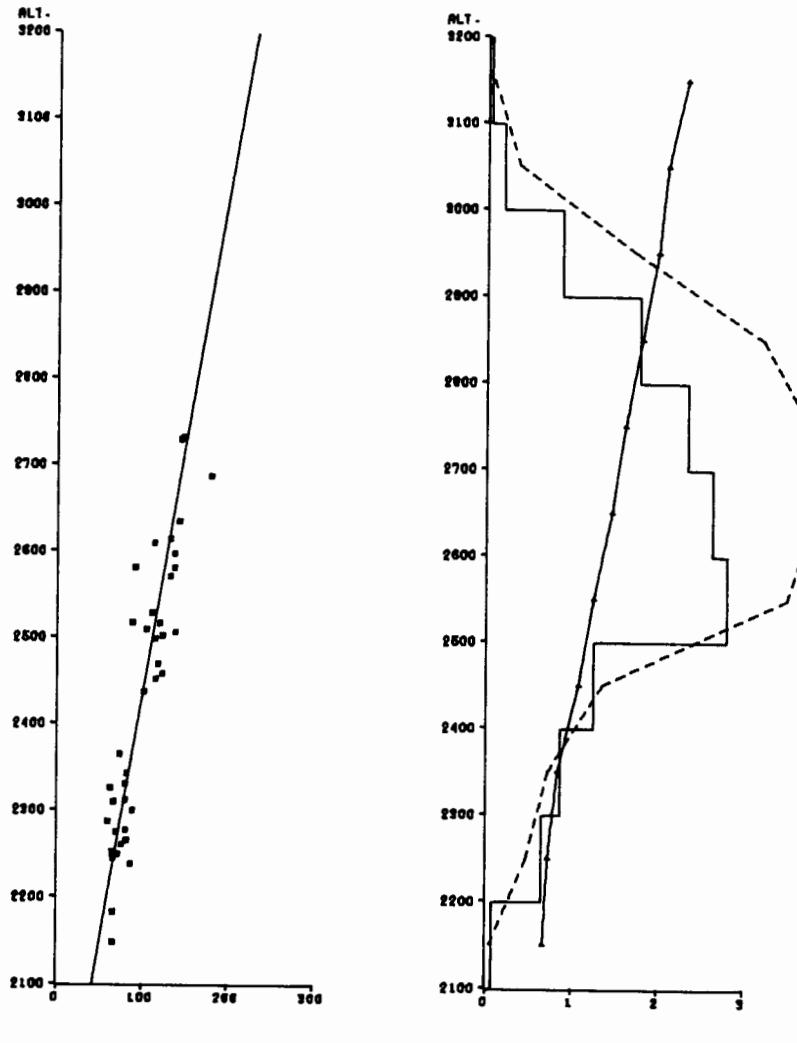


Figure I-24.



CM (W.E.)  
 $W.E. = -312.9 + 0.1702 \cdot ALT.$   
 CORRELATION COEFF. = 0.885  
 SNOW DEPTH / ALTITUDE  
 RELATIONSHIP

← SPECIFIC W.E. (M)  
 —  $10^6 \text{ m}^3$  WATER  
 AREA ( $\text{km}^2$ ) BLOCK GRAPH

PEYTO NET WINTER BALANCE 1968-69

Figure I-25.

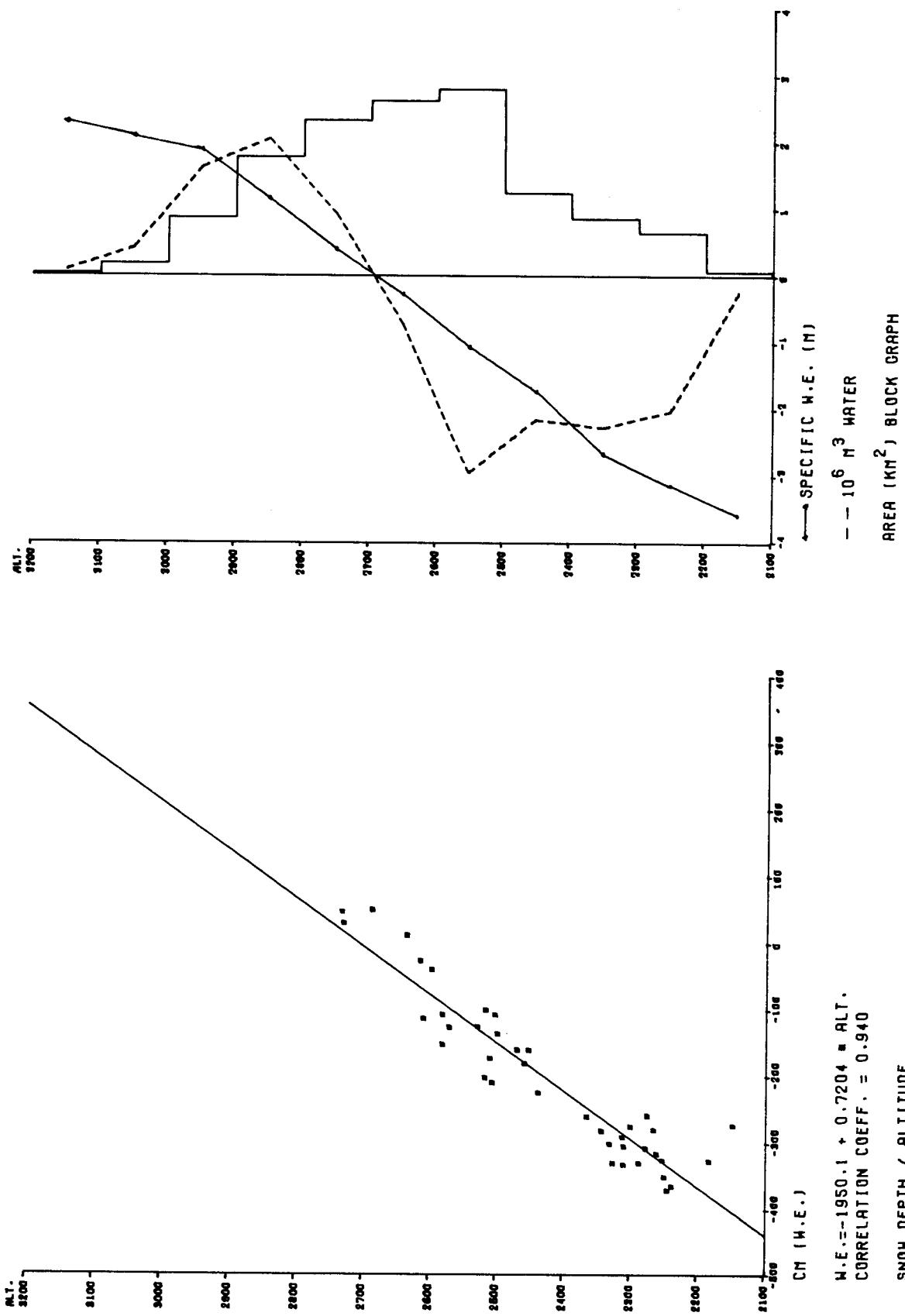
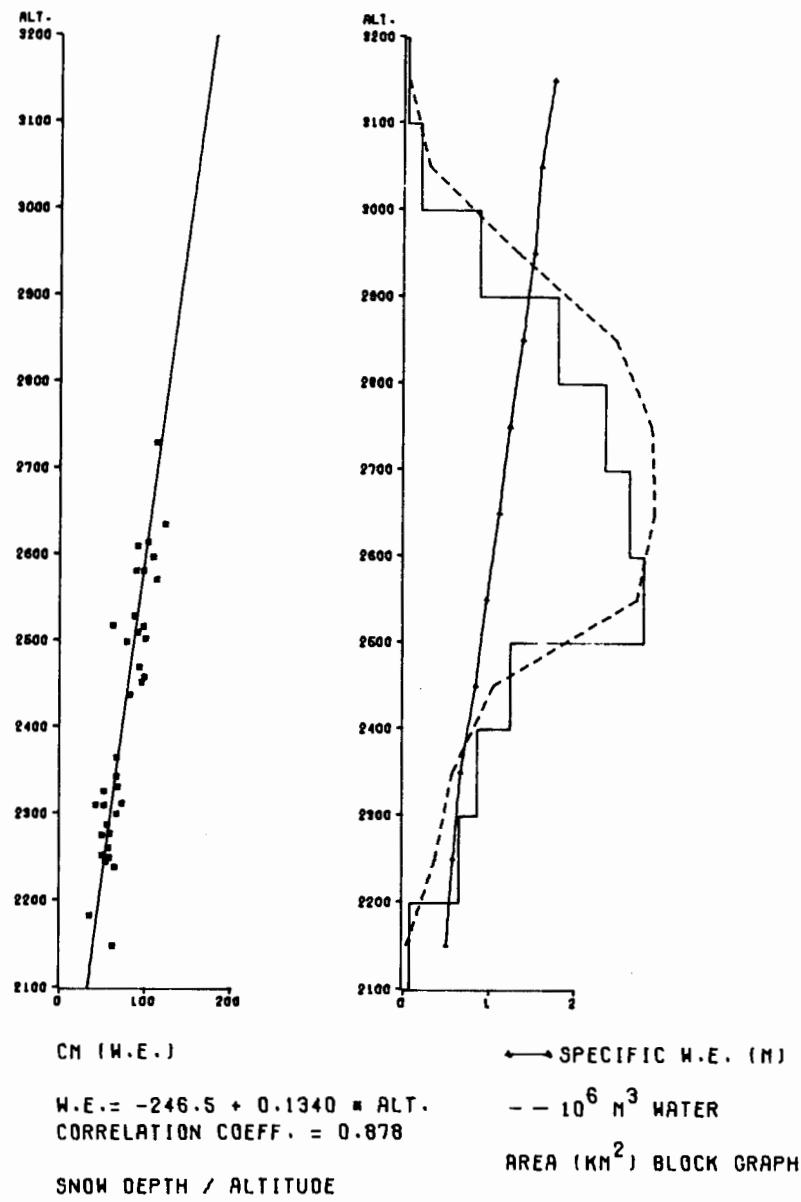
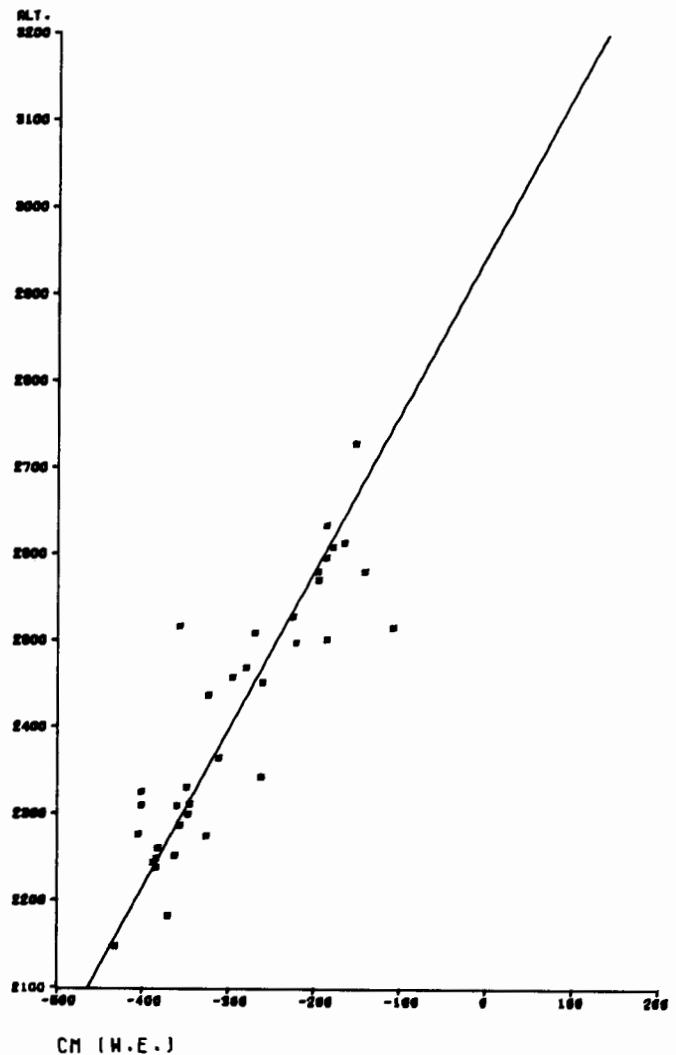


Figure I-26.



PEYTO NET WINTER BALANCE 1969-70

Figure I-27.



SNOW DEPTH / ALTITUDE  
RELATIONSHIP

PEYTO NET ANNUAL BALANCE 1969-70

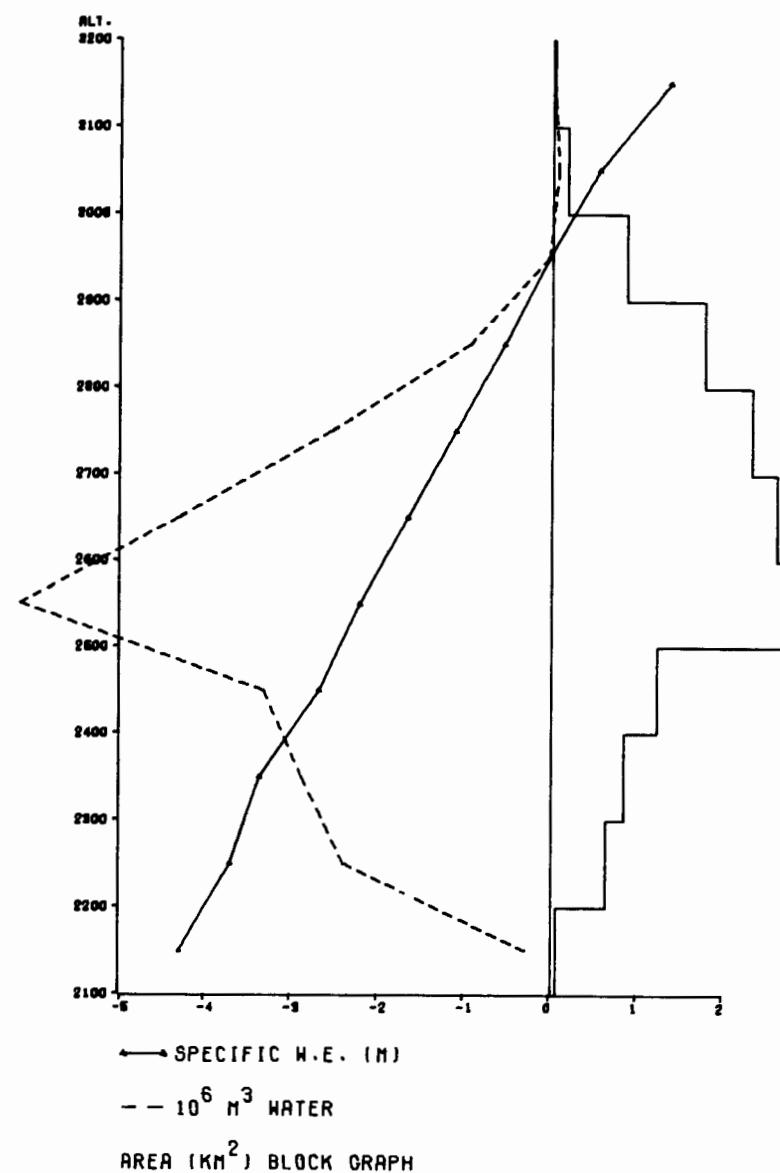
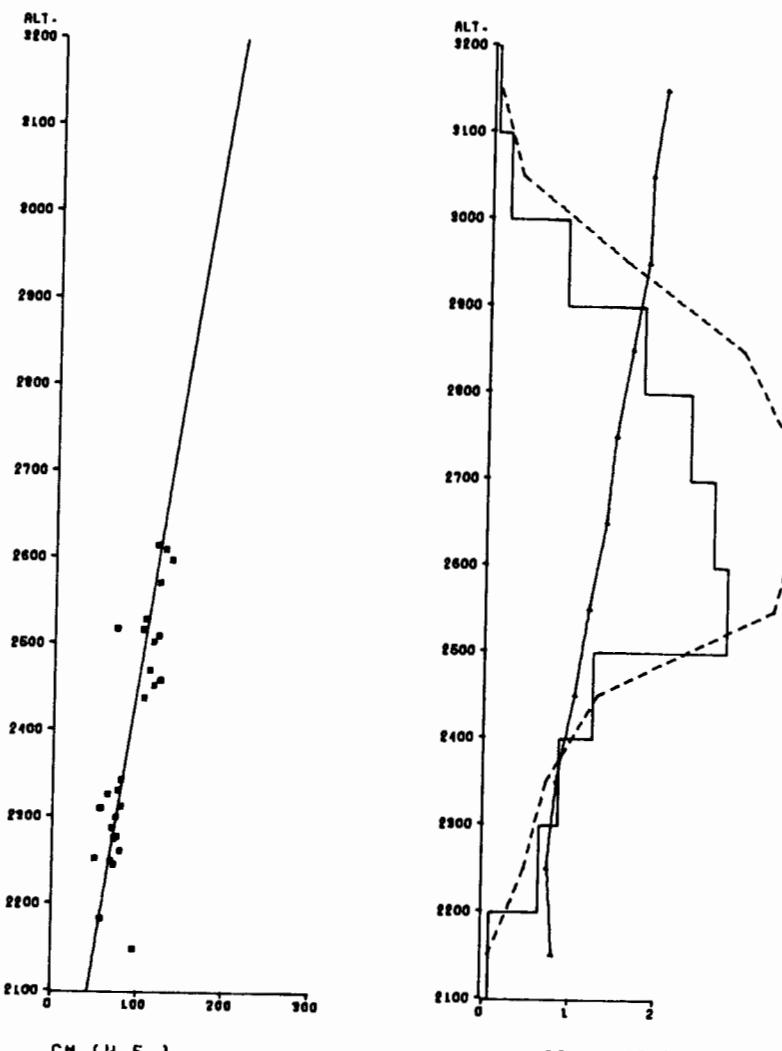


Figure I-28.



$$\text{W.E.} = -271.4 + 0.1513 \times \text{ALT.}$$

CORRELATION COEFF. = 0.804

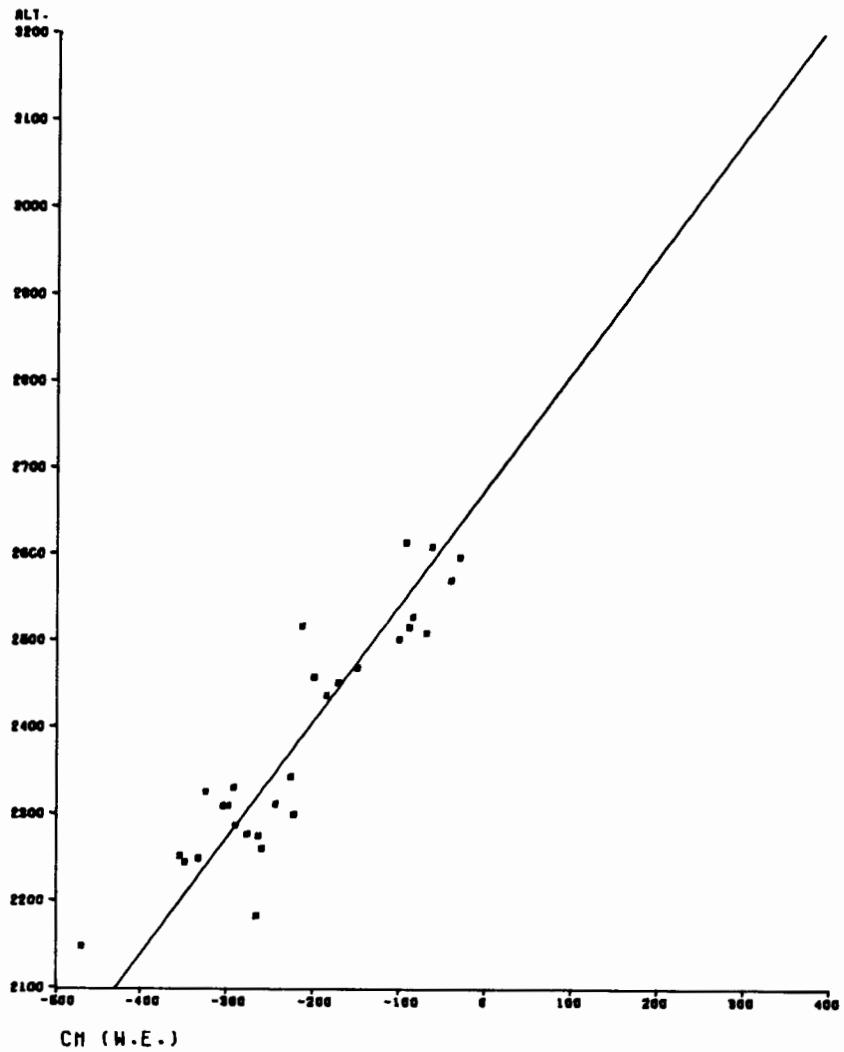
SNOW DEPTH / ALTITUDE  
RELATIONSHIP

$- 10^6 \text{ m}^3$  WATER

AREA ( $\text{km}^2$ ) BLOCK GRAPH

PEYTO NET WINTER BALANCE 1970-71

Figure I-29.



PEYTO NET ANNUAL BALANCE 1970-71

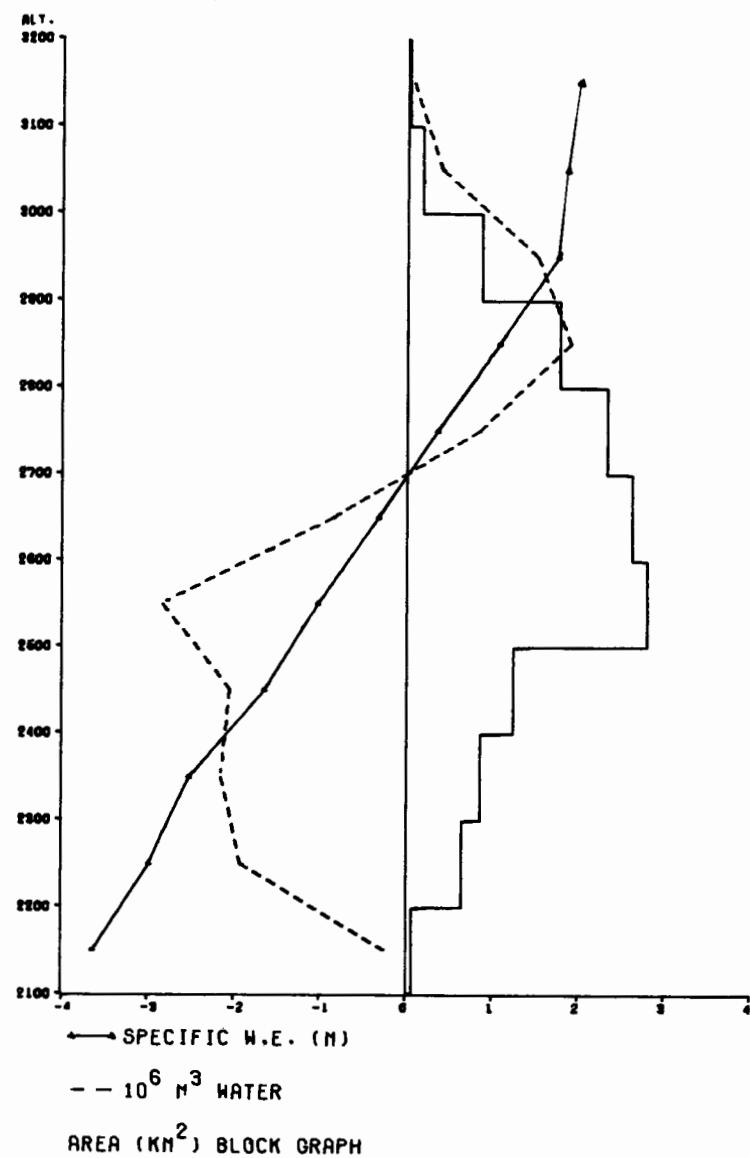
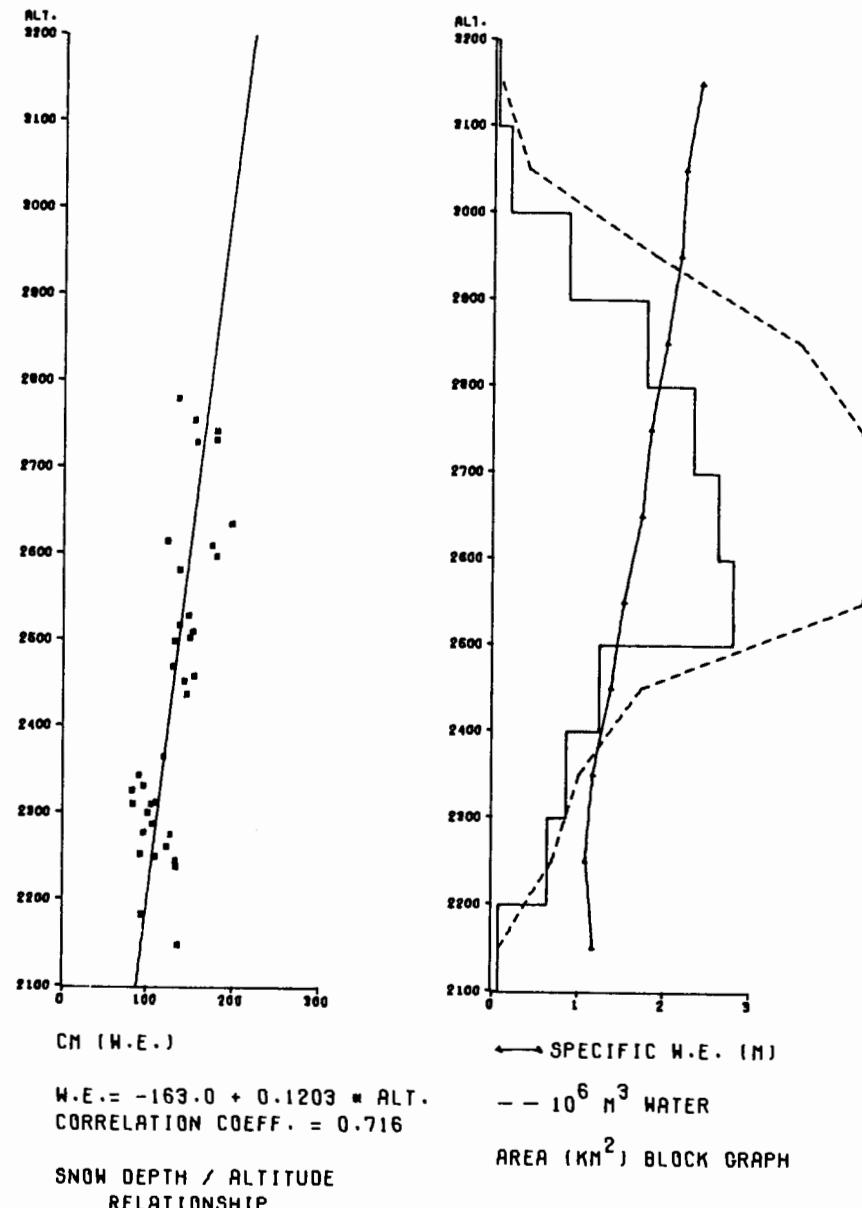
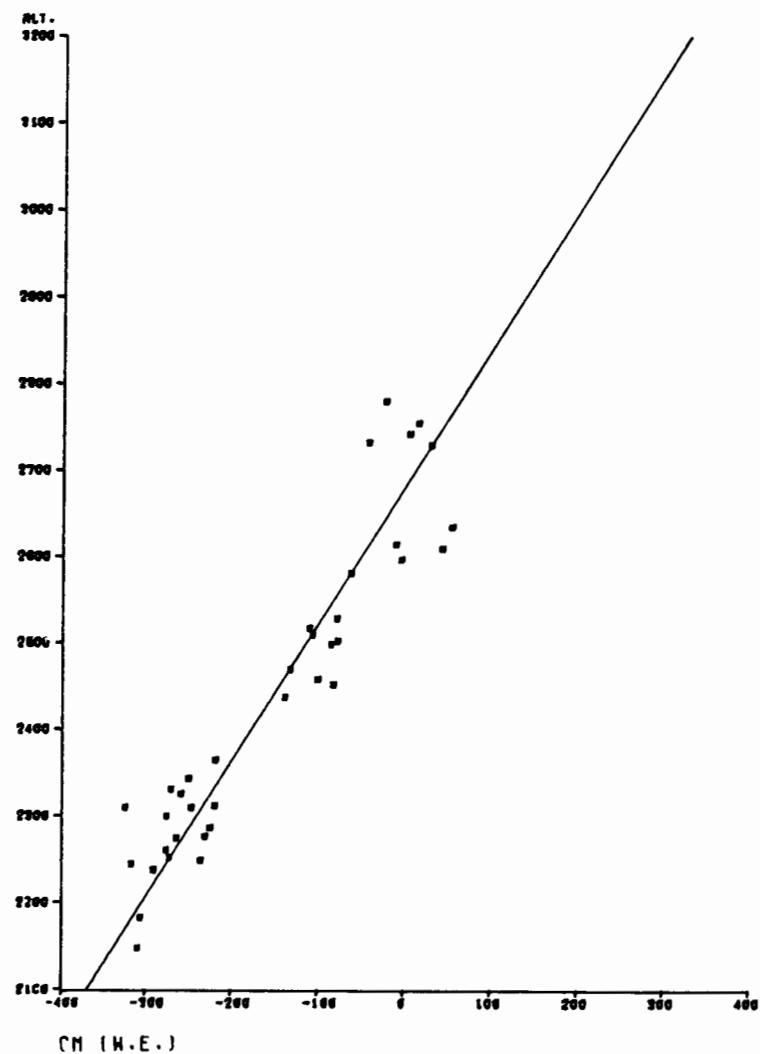


Figure I-30.



PEYTO NET WINTER BALANCE 1971-72

Figure I-31.

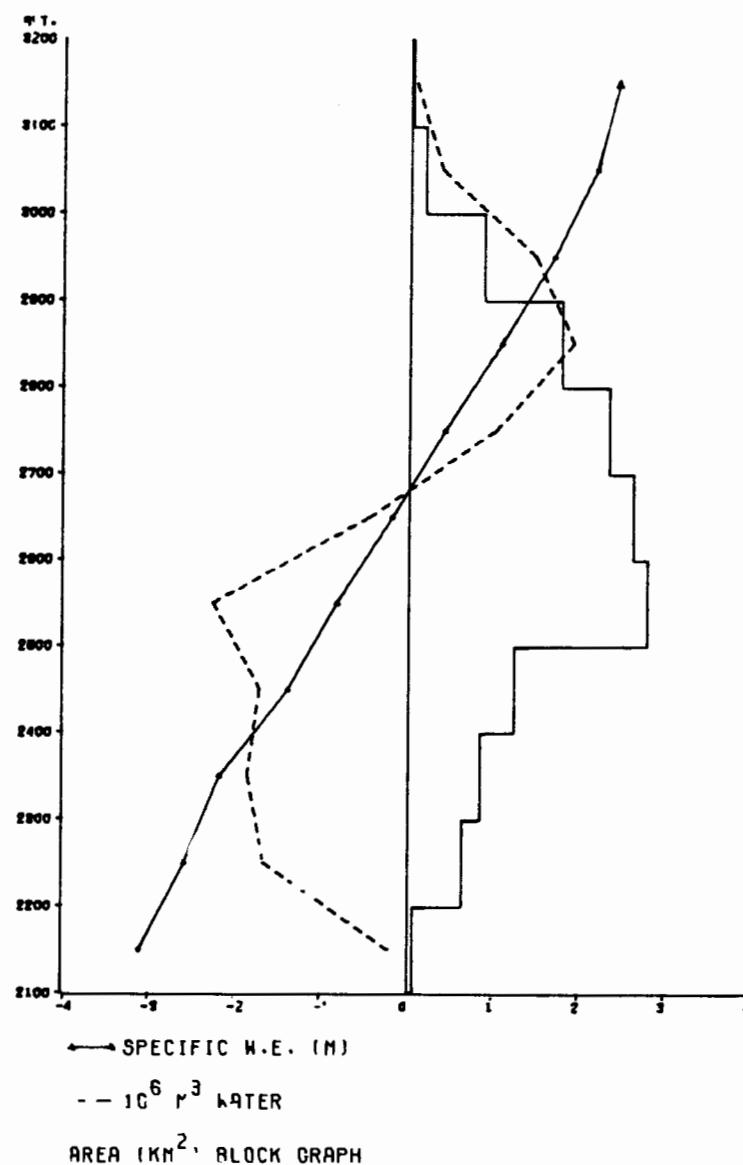


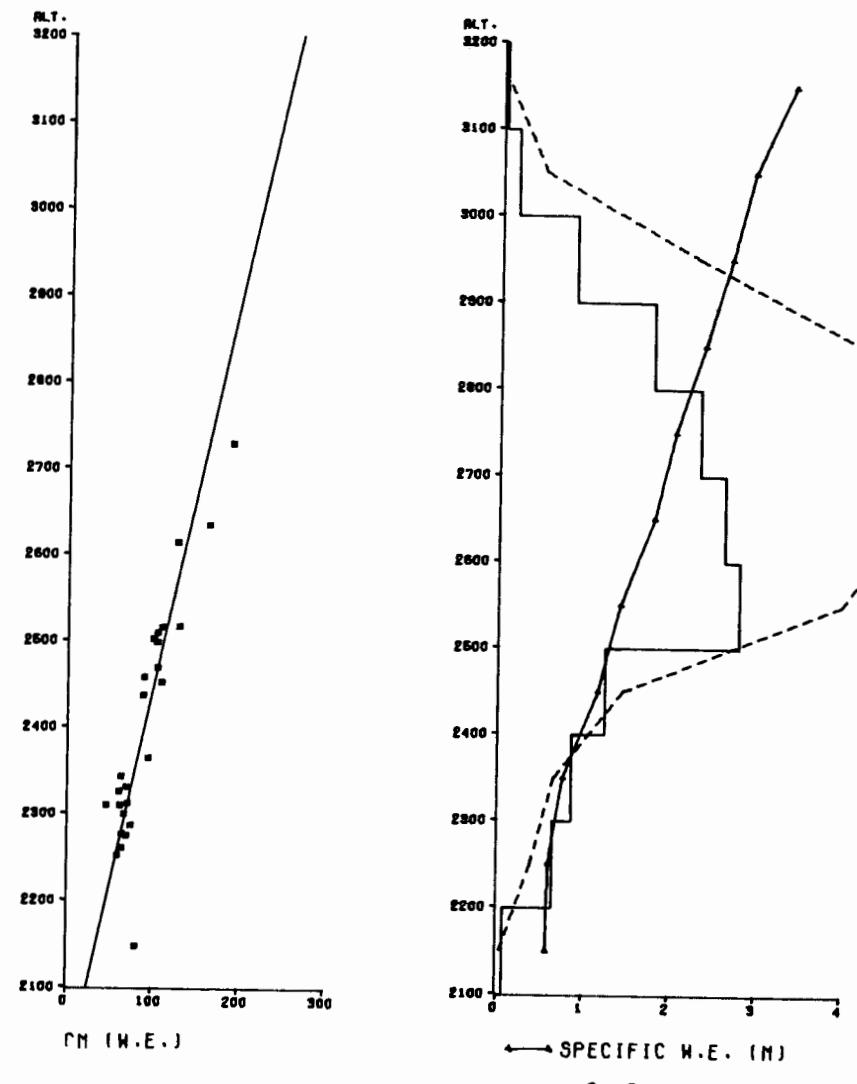
$$W.E. = -1694.8 + 0.6320 \times ALT.$$

CORRELATION COEFF. = 0.939

SNOW DEPTH / ALTITUDE  
RELATIONSHIP

FETTO NET ANNUAL BALANCE 1971-72





$$\text{W.E.} = -432.5 + 0.2180 \times \text{ALT.}$$

CORRELATION COEFF. = 0.893

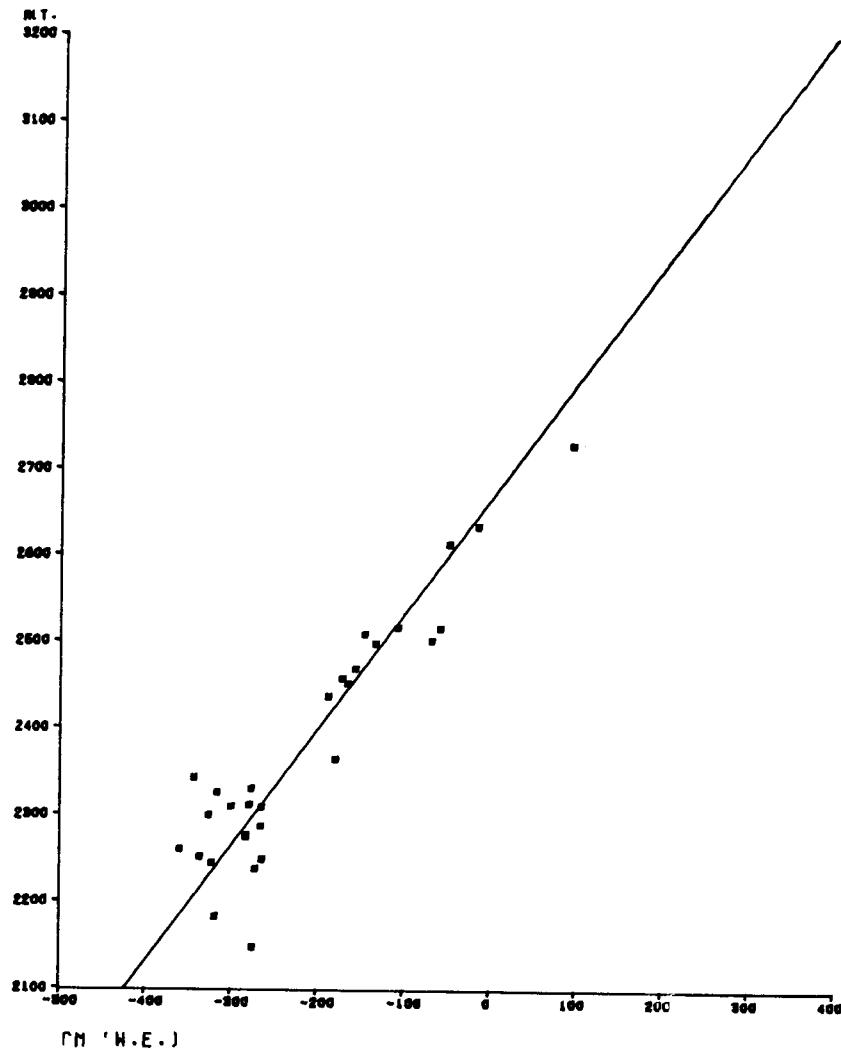
SNOW DEPTH / ALTITUDE  
RELATIONSHIP

$\rightarrow 10^6 \text{ M}^3$  WATER

AREA (KM<sup>2</sup>) BLOCK GRAPH

PEYTO NET WINTER BALANCE 1972-73

Figure I-33.



$SWE = 1986.3 + 0.7449 \cdot ALT.$   
 CORRELATION COEFF. = 0.925

SNOW DEPTH / ALTITUDE  
RELATIONSHIP

PEYTO NET ANNUAL BALANCE 1972-73

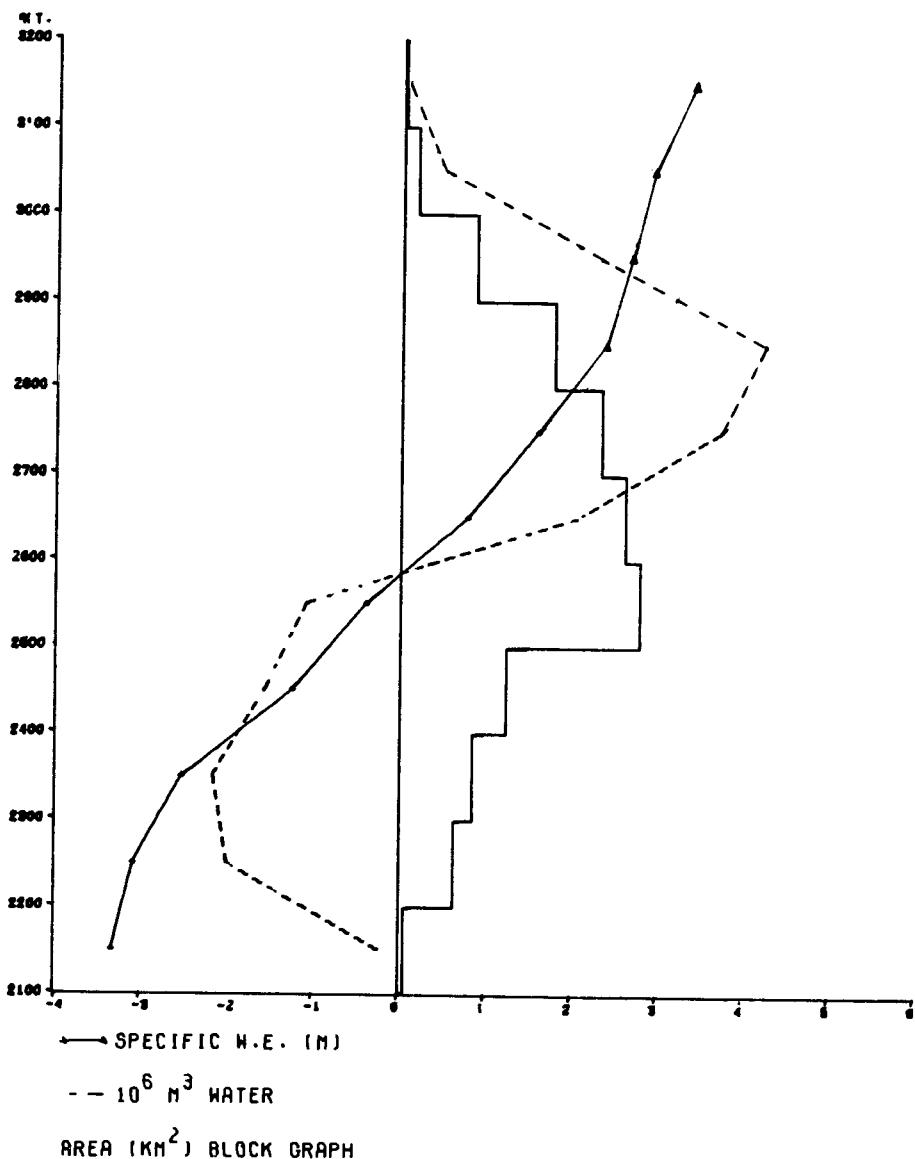
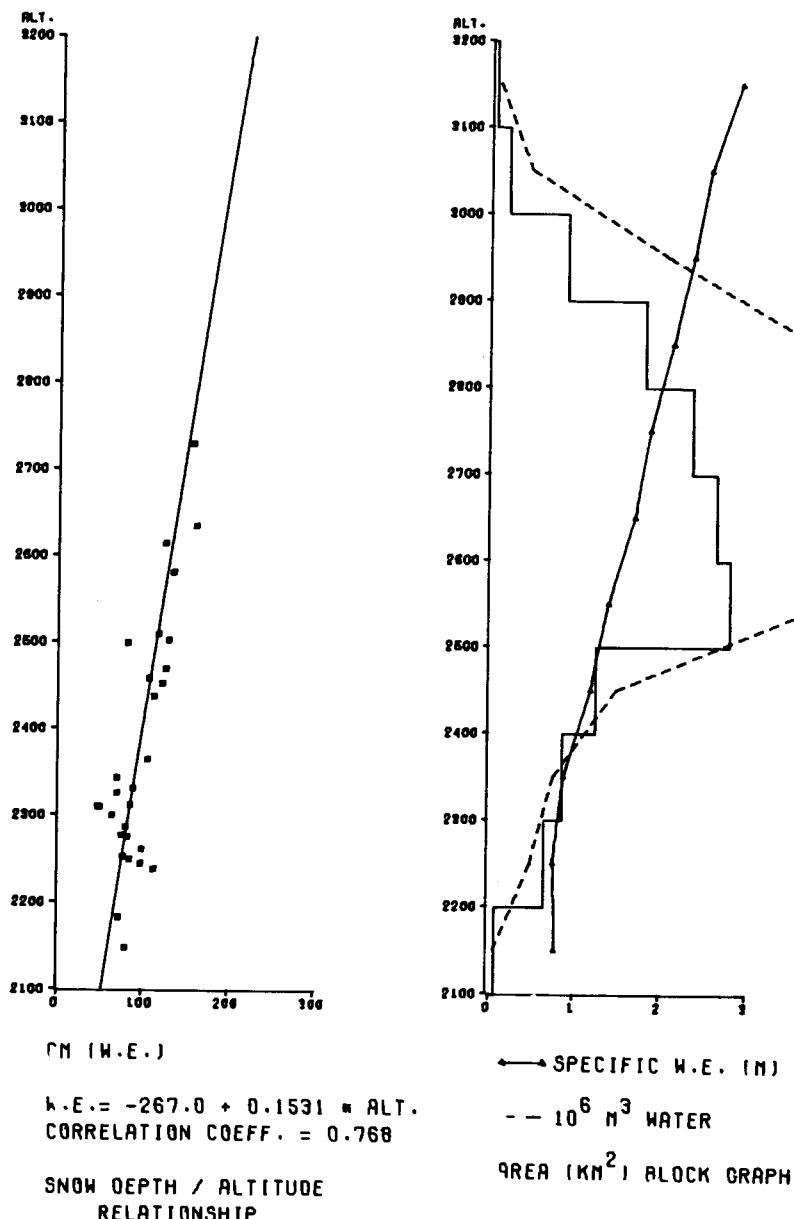
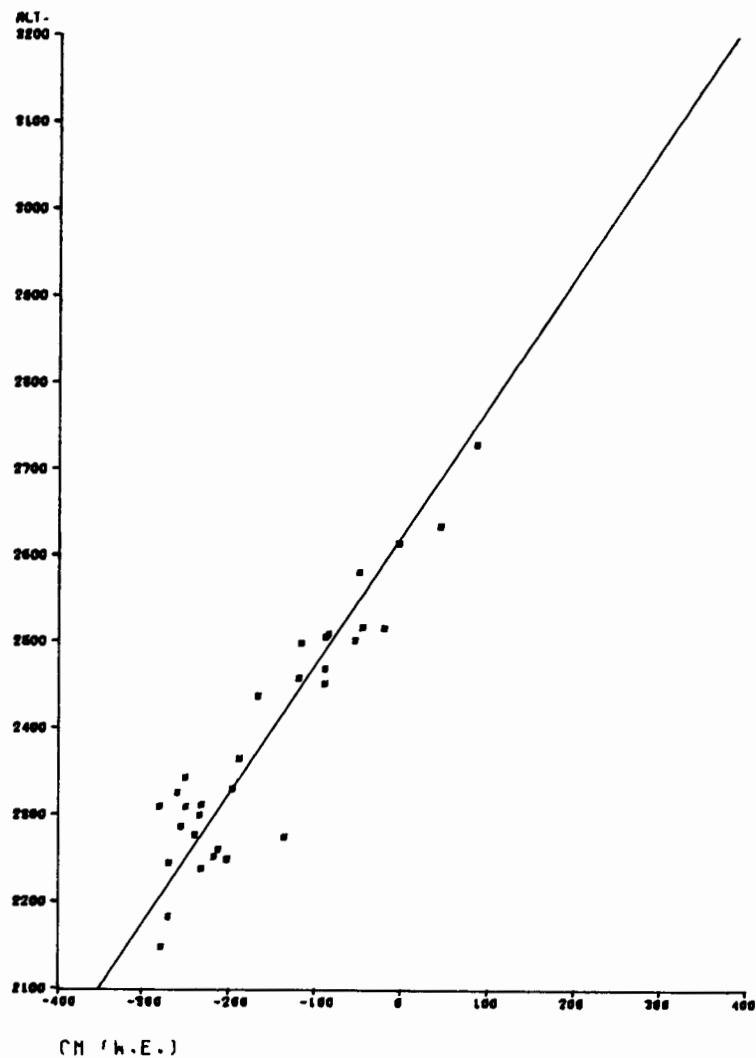


Figure I-34.



PEYTO NET WINTER BALANCE 1973-74

Figure I-35.



$W.E. = -1758.5 + 0.6707 \times ALT.$   
CORRELATION COEFF. = 0.932

SNOW DEPTH / ALTITUDE  
RELATIONSHIP

PEYTO NET ANNUAL BALANCE 1973-74

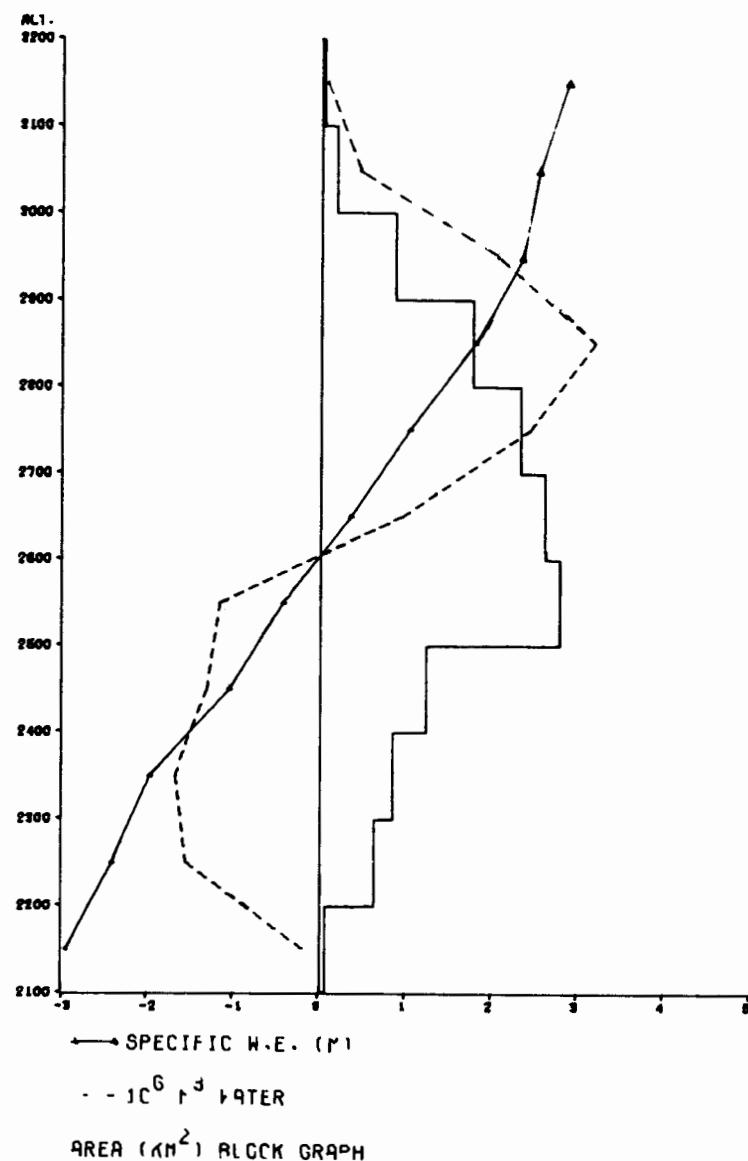


Figure I-36.

Table I-1. Peyto Glacier, mass balance, 1965-66.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.04	1.97	+0.04	+1.97
3000-3100	0.17	0.31	1.80	+0.31	+1.80
2900-3000	0.86	1.49	1.73	+1.49	+1.73
2800-2900	1.77	2.80	1.58	+2.80	+1.58
2700-2800	2.33	3.29	1.41	+2.73	+1.17
2600-2700	2.62	3.33	1.27	+1.00	+0.38
2500-2600	2.80	3.11	1.11	-1.23	-0.44
2400-2500	1.25	1.20	0.96	-1.41	-1.13
2300-2400	0.86	0.65	0.76	-1.83	-2.13
2200-2300	0.65	0.42	0.65	-1.71	-2.63
2100-2200	0.07	0.04	0.56	-0.24	-3.40
Whole glacier	13.40	16.62	1.24	+1.95	+0.15

Table I-2. Peyto Glacier, mass balance, 1966-67.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.07	3.65	+0.07	+3.65
3000-3100	0.17	0.55	3.26	+0.55	+3.26
2900-3000	0.86	2.61	3.04	+2.61	+3.04
2800-2900	1.77	4.83	2.73	+3.79	+2.14
2700-2800	2.33	5.57	2.39	+2.52	+1.08
2600-2700	2.62	5.55	2.12	+0.60	+0.23
2500-2600	2.80	4.96	1.77	-2.49	-0.89
2400-2500	1.25	1.85	1.48	-2.21	-1.77
2300-2400	0.86	0.93	1.08	-2.61	-3.03
2200-2300	0.65	0.57	0.88	-2.36	-3.63
2100-2200	0.07	0.05	0.75	-0.28	-4.01
Whole glacier	13.40	27.60	2.06	+0.19	+0.01

Table I-3. Peyto Glacier, mass balance, 1967-68.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.06	2.92	+0.06	+2.92
3000-3100	0.17	0.44	2.60	+0.44	+2.60
2900-3000	0.86	2.12	2.46	+2.12	+2.46
2800-2900	1.77	3.89	2.20	+3.79	+2.14
2700-2800	2.33	4.47	1.92	+2.96	+1.27
2600-2700	2.62	4.43	1.69	+1.39	+0.53
2500-2600	2.80	3.89	1.39	-1.01	-0.36
2400-2500	1.25	1.44	1.15	-1.36	-1.09
2300-2400	0.86	0.70	0.81	-1.84	-2.14
2200-2300	0.65	0.42	0.64	-1.72	-2.65
2100-2200	0.07	0.04	0.54	-0.22	-3.11
Whole glacier	13.40	21.84	1.63	+4.61	+0.35

**Table I-4. Peyto Glacier, mass balance, 1968-69.**

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.05	2.32	+0.06	+2.32
3000-3100	0.17	0.36	2.10	+0.36	+2.10
2900-3000	0.86	1.73	2.01	+1.63	+1.89
2800-2900	1.77	3.22	1.82	+2.05	+1.16
2700-2800	2.33	3.77	1.62	+0.93	+0.40
2600-2700	2.62	3.85	1.47	-0.73	-0.28
2500-2600	2.80	3.53	1.26	-2.97	-1.06
2400-2500	1.25	1.35	1.08	-2.16	-1.73
2300-2400	0.86	0.72	0.84	-2.30	-2.67
2200-2300	0.65	0.47	0.73	-2.04	-3.14
2100-2200	0.07	0.05	0.68	-0.25	-3.60
Whole glacier	13.40	19.16	1.43	-5.42	-0.40

**Table I-5. Peyto Glacier, mass balance, 1969-70.**

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.03	1.69	+0.03	+1.39
3000-3100	0.17	0.26	1.54	+0.10	+0.57
2900-3000	0.86	1.26	1.47	-0.01	-0.01
2800-2900	1.77	2.39	1.35	-0.94	-0.53
2700-2800	2.33	2.82	1.21	-2.54	-1.09
2600-2700	2.62	2.86	1.09	-4.30	-1.64
2500-2600	2.80	2.69	0.96	-6.16	-2.20
2400-2500	1.25	1.05	0.84	-3.34	-2.67
2300-2400	0.86	0.58	0.67	-2.89	-3.36
2200-2300	0.65	0.38	0.59	-2.41	-3.70
2100-2200	0.07	0.04	0.51	-0.30	-4.30
Whole glacier	13.40	14.34	1.07	-22.78	-1.70

**Table I-6. Peyto Glacier, mass balance, 1970-71.**

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.04	1.83	+0.04	+1.83
3000-3100	0.17	0.29	1.73	+0.29	+1.73
2900-3000	0.86	1.51	1.76	+1.51	+1.76
2800-2900	1.77	2.85	1.61	+1.91	+1.08
2700-2800	2.33	3.38	1.45	+0.84	+0.36
2600-2700	2.62	3.56	1.36	-0.84	-0.32
2500-2600	2.80	3.30	1.18	-2.86	-1.02
2400-2500	1.25	1.29	1.03	-2.05	-1.64
2300-2400	0.86	0.73	0.85	-2.17	-2.52
2200-2300	0.65	0.49	0.75	-1.94	-2.98
2100-2200	0.07	0.06	0.85	-0.25	-3.64
Whole glacier	13.40	17.55	1.31	-5.52	-0.41

Table I-7. Peyto Glacier, mass balance, 1971-72.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.05	2.37	+0.05	+2.37
3000-3100	0.17	0.38	2.21	+0.37	+2.19
2900-3000	0.86	1.86	2.16	+1.46	+1.70
2800-2900	1.77	3.54	2.00	+1.93	+1.09
2700-2800	2.33	4.24	1.82	+1.03	+0.44
2600-2700	2.62	4.51	1.72	-0.45	-0.17
2500-2600	2.80	4.28	1.53	-2.27	-0.81
2400-2500	1.25	1.73	1.38	-1.73	-1.38
2300-2400	0.86	1.01	1.18	-1.87	-2.17
2200-2300	0.65	0.71	1.09	-1.68	-2.58
2100-2200	0.07	0.08	1.18	-0.22	-3.11
Whole glacier	13.40	22.38	1.67	-3.38	-0.25

Table I-8. Peyto Glacier, mass balance, 1972-73.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.07	3.39	+0.07	+3.39
3000-3100	0.17	0.50	2.94	+0.50	+2.94
2900-3000	0.86	2.30	2.68	+2.30	+2.68
2800-2900	1.77	4.21	2.38	+4.21	+2.38
2700-2800	2.33	4.75	2.04	+3.73	+1.60
2600-2700	2.62	4.72	1.80	+2.04	+0.78
2500-2600	2.80	3.98	1.42	-1.09	-0.39
2400-2500	1.25	1.45	1.16	-1.55	-1.24
2300-2400	0.86	0.66	0.77	-2.17	-2.52
2200-2300	0.65	0.40	0.61	-2.00	-3.08
2100-2200	0.07	0.04	0.59	-0.23	-3.33
Whole glacier	13.40	23.05	1.72	+5.81	+0.43

Table I-9. Peyto Glacier, mass balance, 1973-74.

Elevation, m a.s.l.	Area, km <sup>2</sup>	Winter balance		Net annual balance	
		Total 10 <sup>6</sup> m <sup>3</sup>	Specific m	Total 10 <sup>6</sup> m <sup>3</sup>	Specific m
3100-3200	0.02	0.06	2.89	+0.06	+2.89
3000-3100	0.17	0.43	2.54	+0.43	+2.54
2900-3000	0.86	2.03	2.36	+2.03	+2.30
2800-2900	1.77	3.77	2.13	+3.20	+1.81
2700-2800	2.33	4.36	1.87	+2.45	+1.05
2600-2700	2.62	4.43	1.69	+0.97	+0.37
2500-2600	2.80	3.89	1.39	-1.15	-0.41
2400-2500	1.25	1.49	1.19	-1.30	-1.04
2300-2400	0.86	0.76	0.88	-1.69	-1.96
2200-2300	0.65	0.49	0.76	-1.56	-2.40
2100-2200	0.07	0.05	0.78	-0.21	-2.95
Whole glacier	13.40	21.71	1.62	+3.23	+0.24

**Appendix II**

**Meteorological and hydrological summaries**

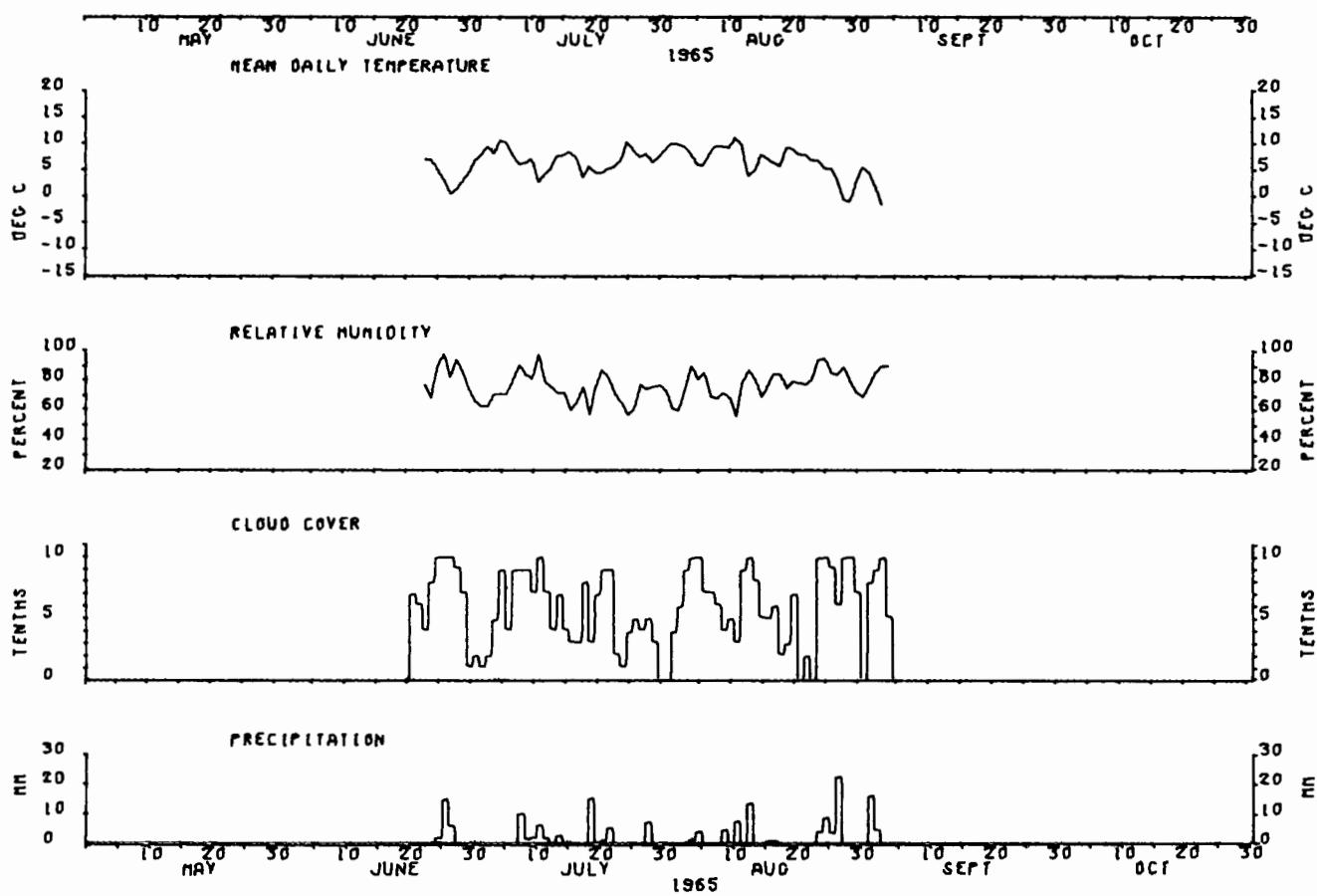


Figure II-1. Peyto Glacier, 1965.

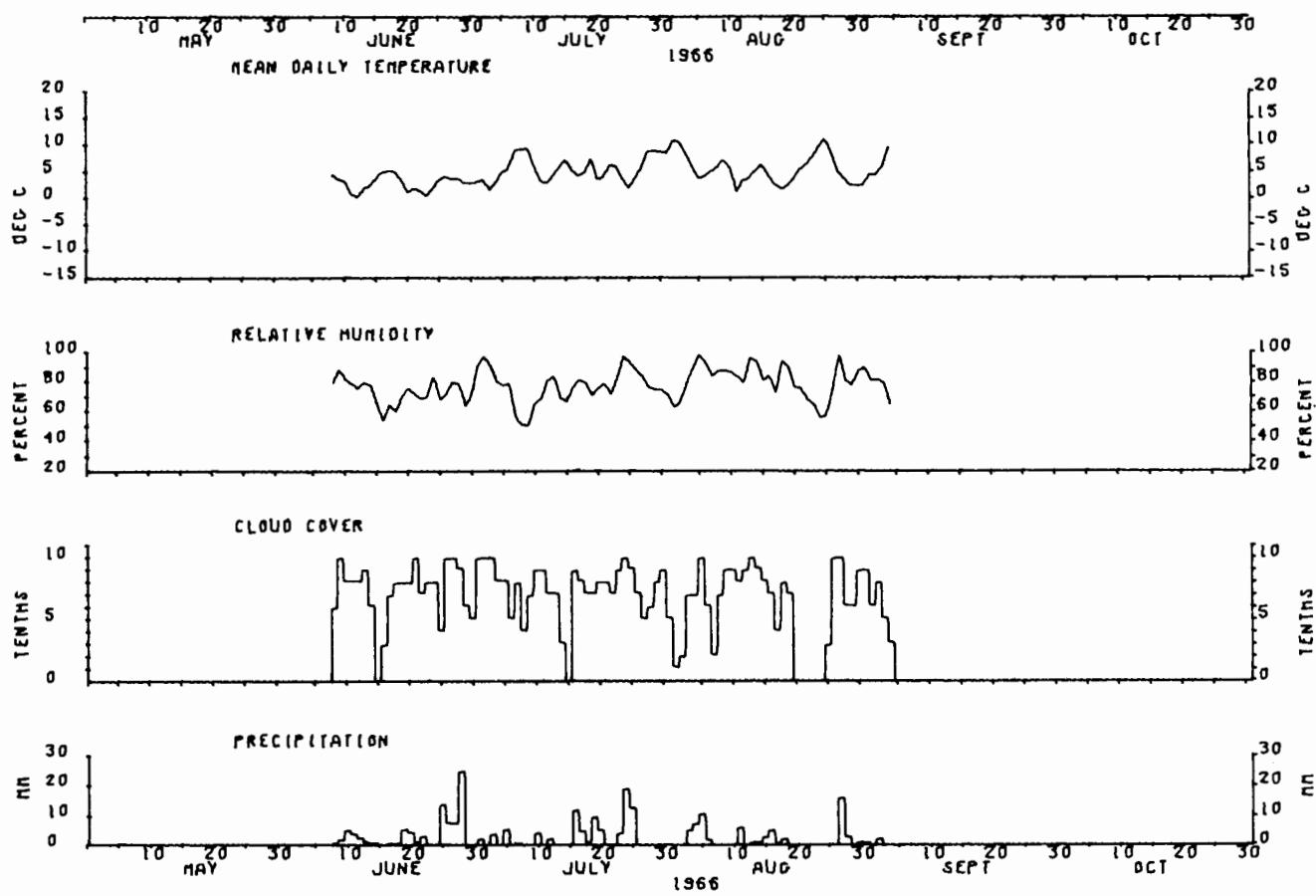


Figure II-2. Peyto Glacier, 1966.

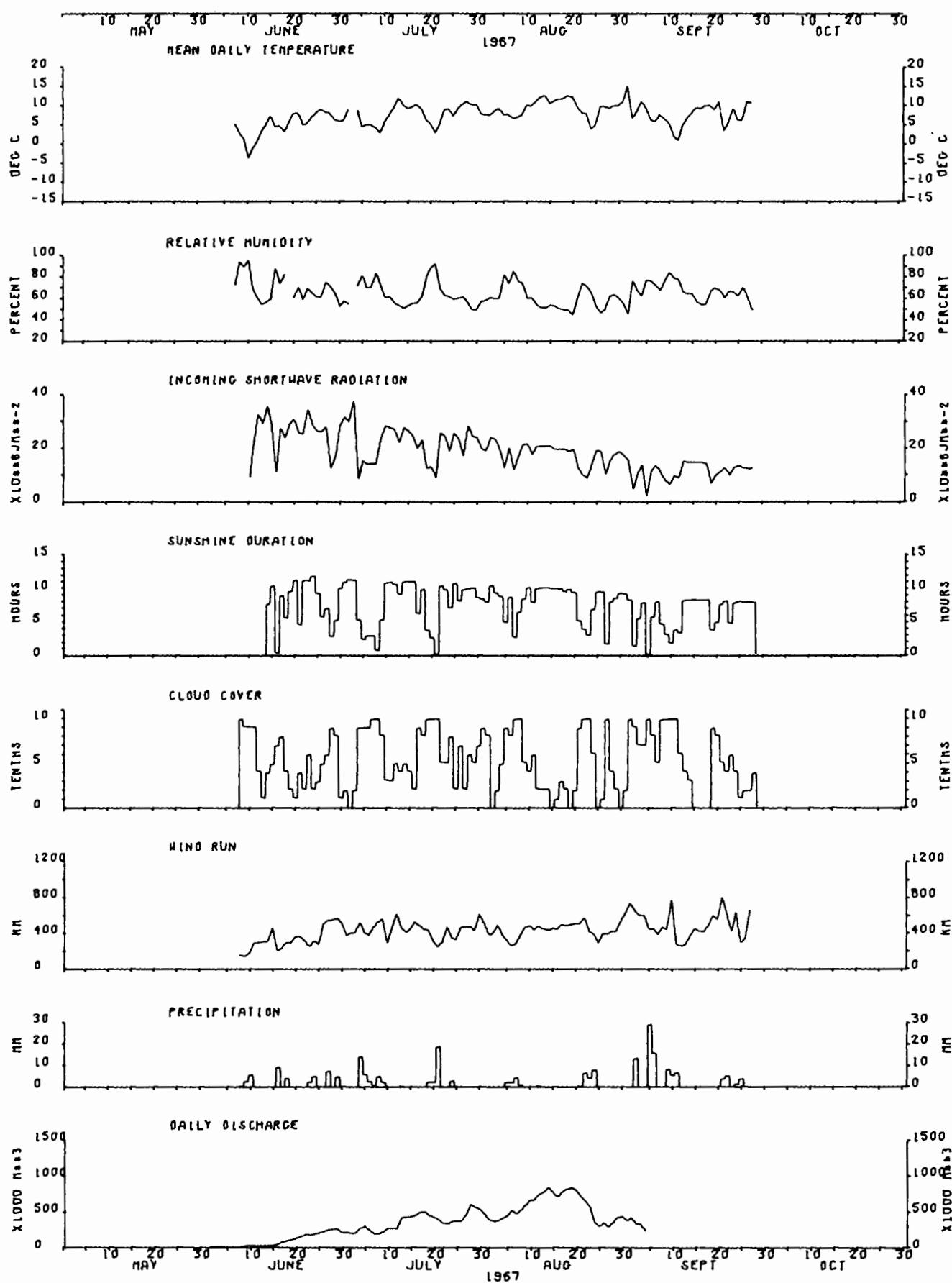


Figure II-3. Peyto Glacier, 1967.

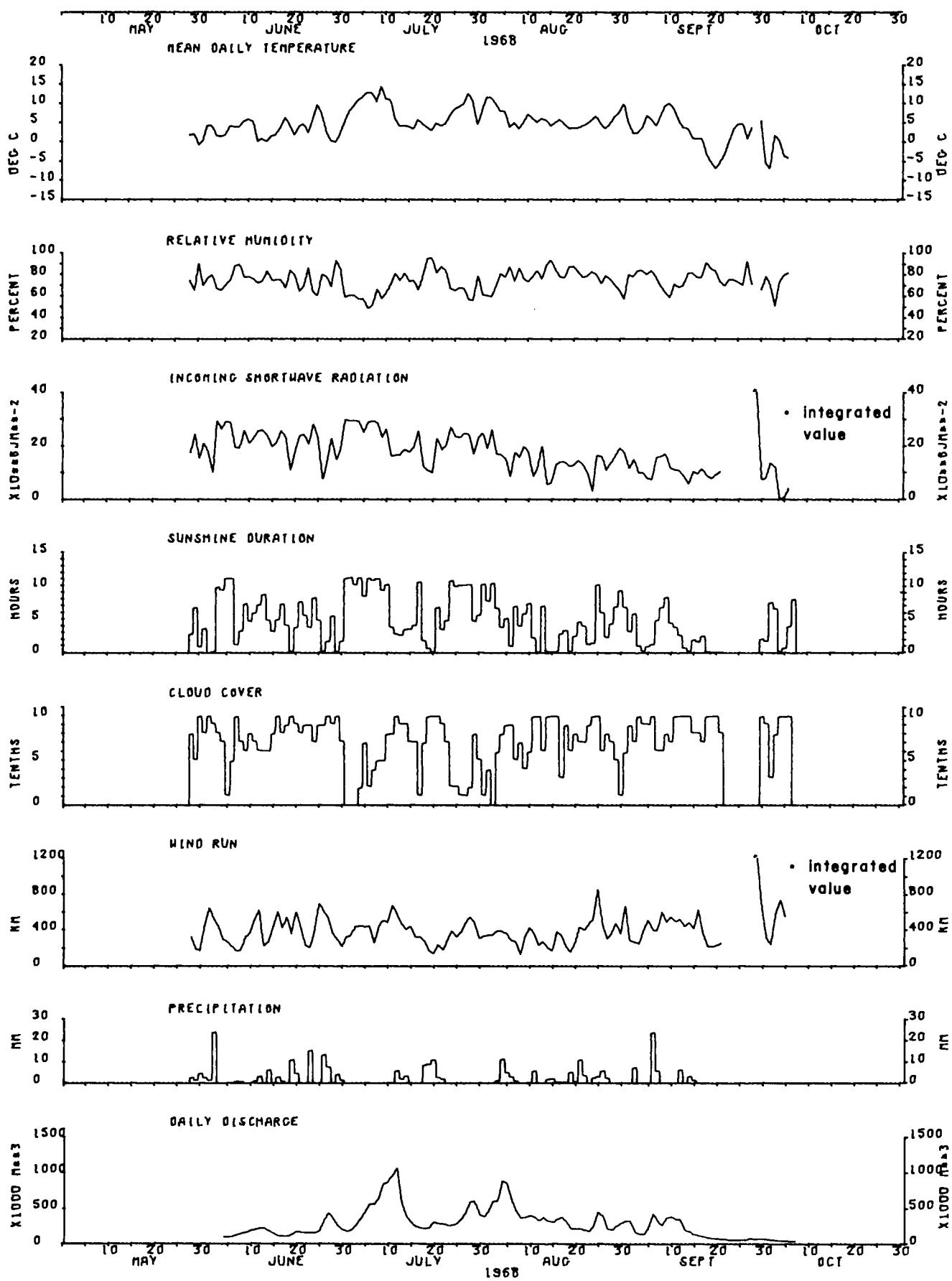


Figure II-4. Peyto Glacier, 1968.

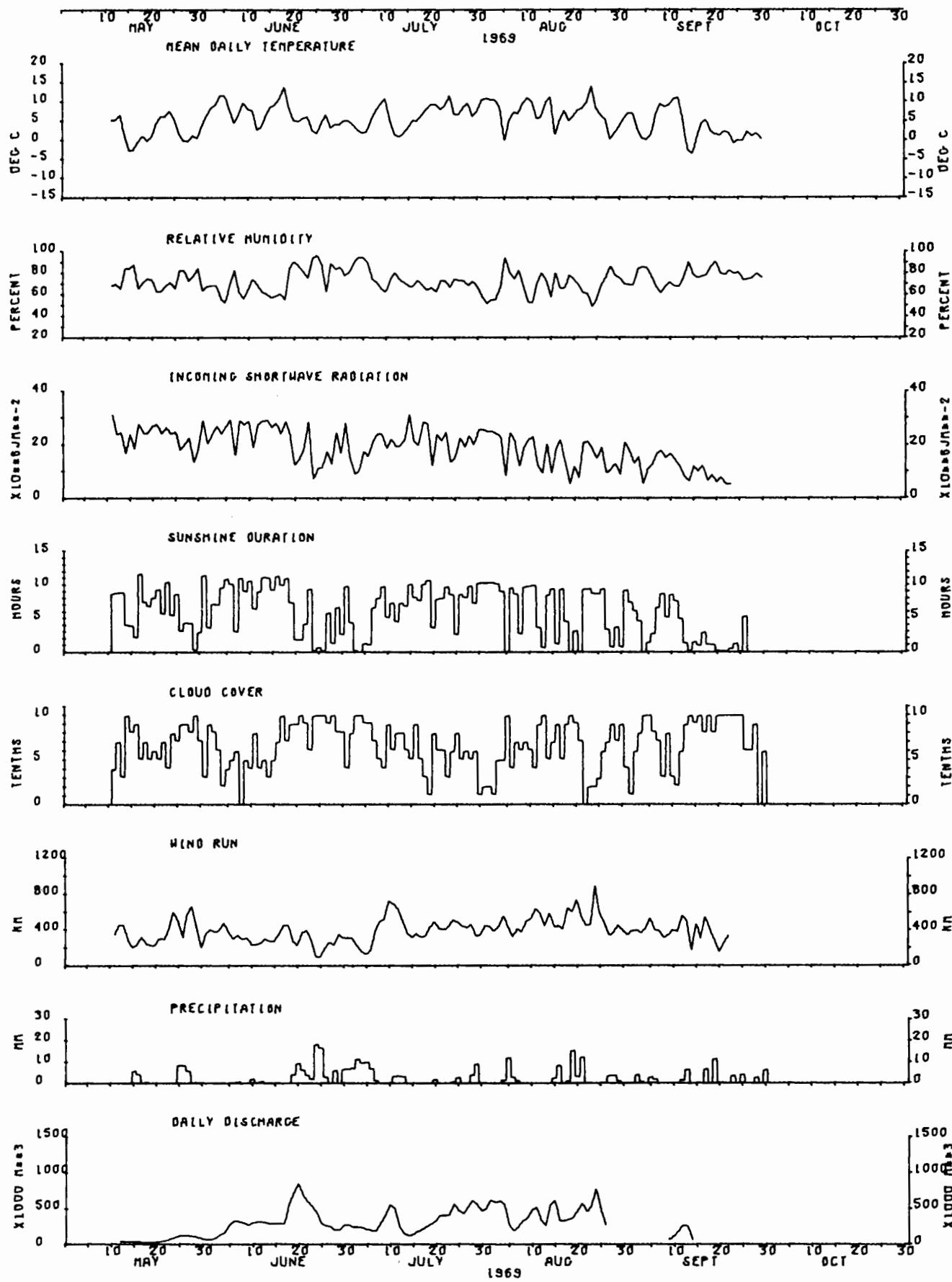


Figure II-5. Peyto Glacier, 1969.

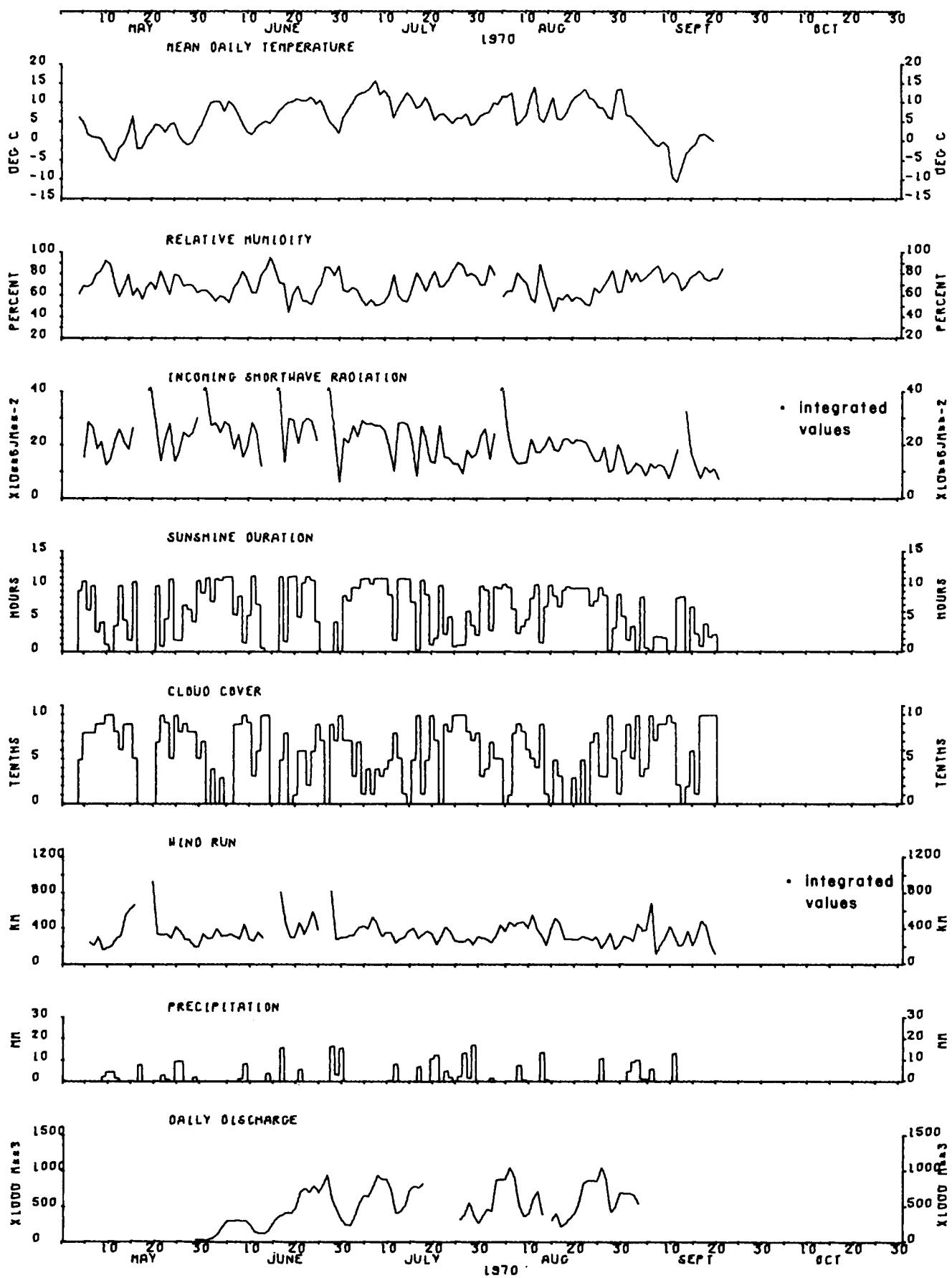


Figure II-6. Peyto Glacier, 1970.

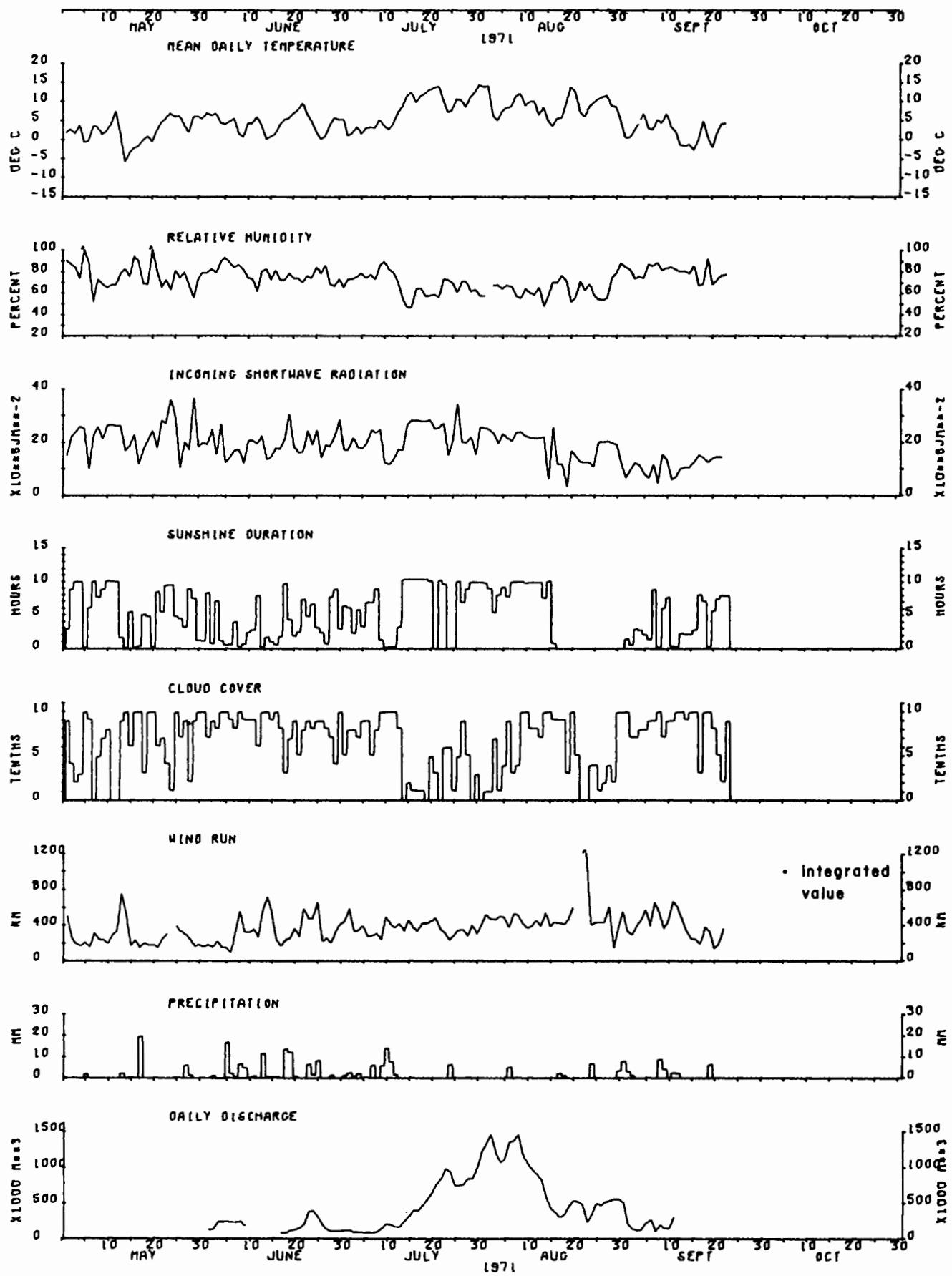


Figure II-7. Peyto Glacier, 1971.

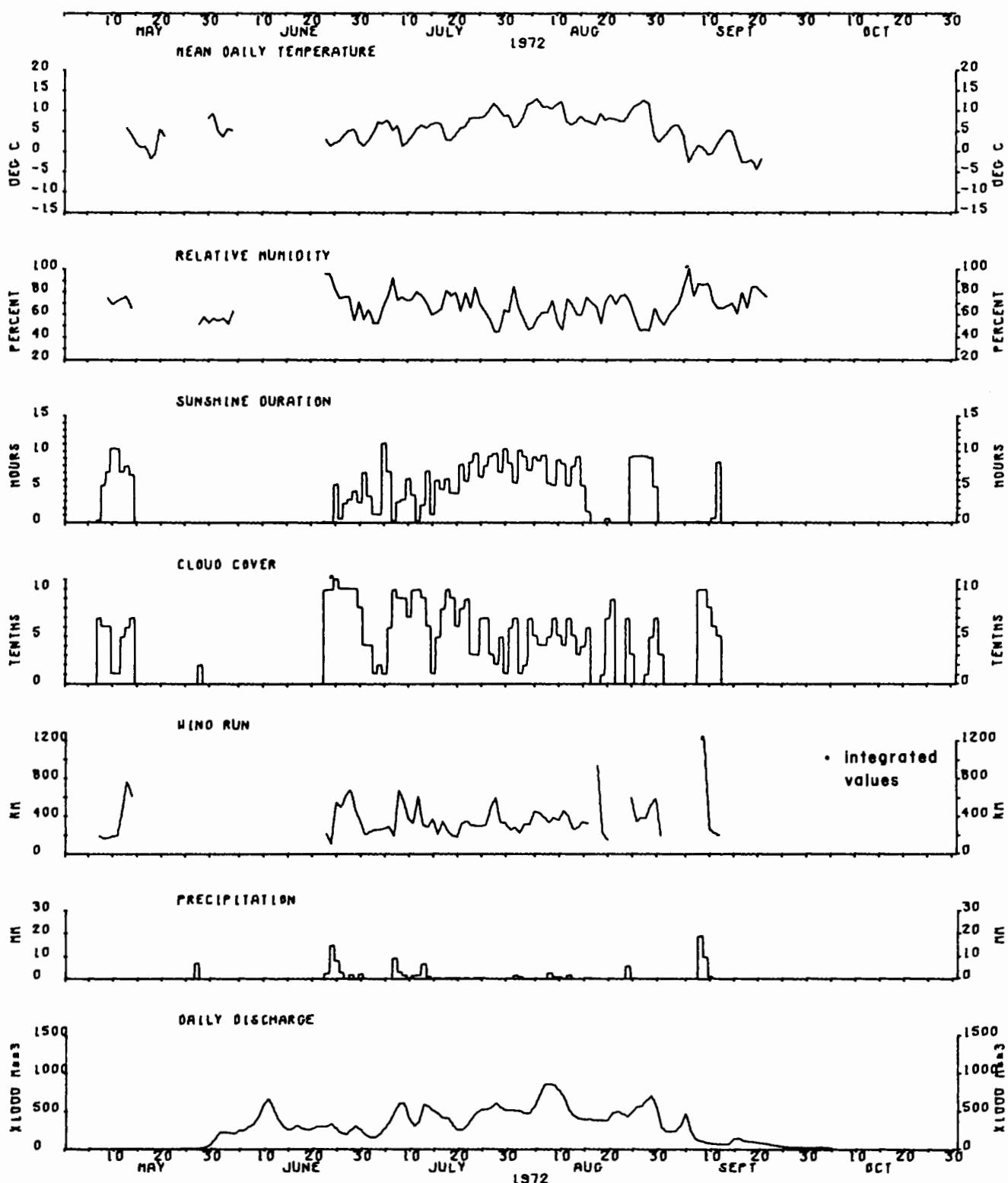


Figure II-8. Peyto Glacier, 1972.

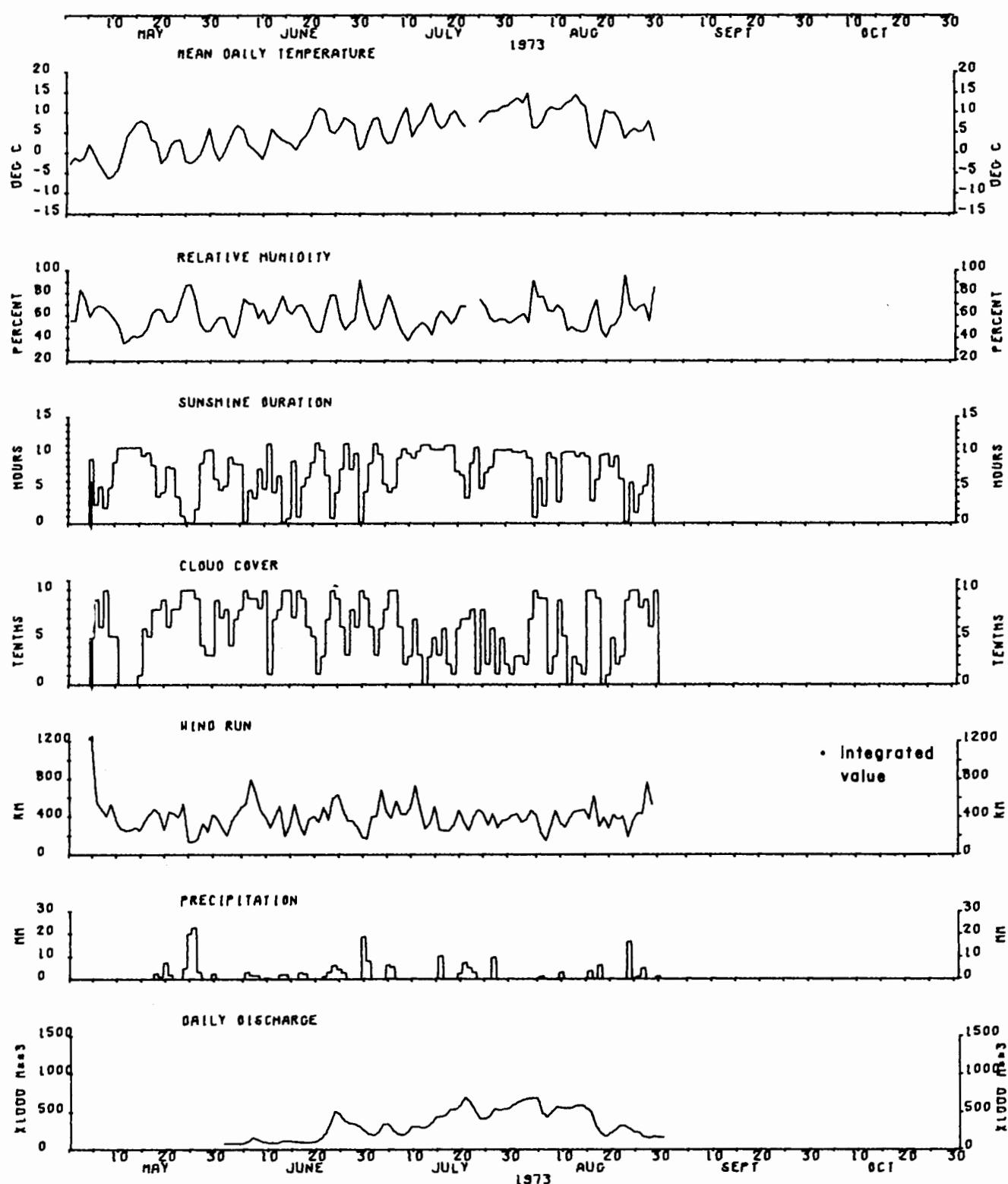


Figure II-9. Peyto Glacier, 1973.

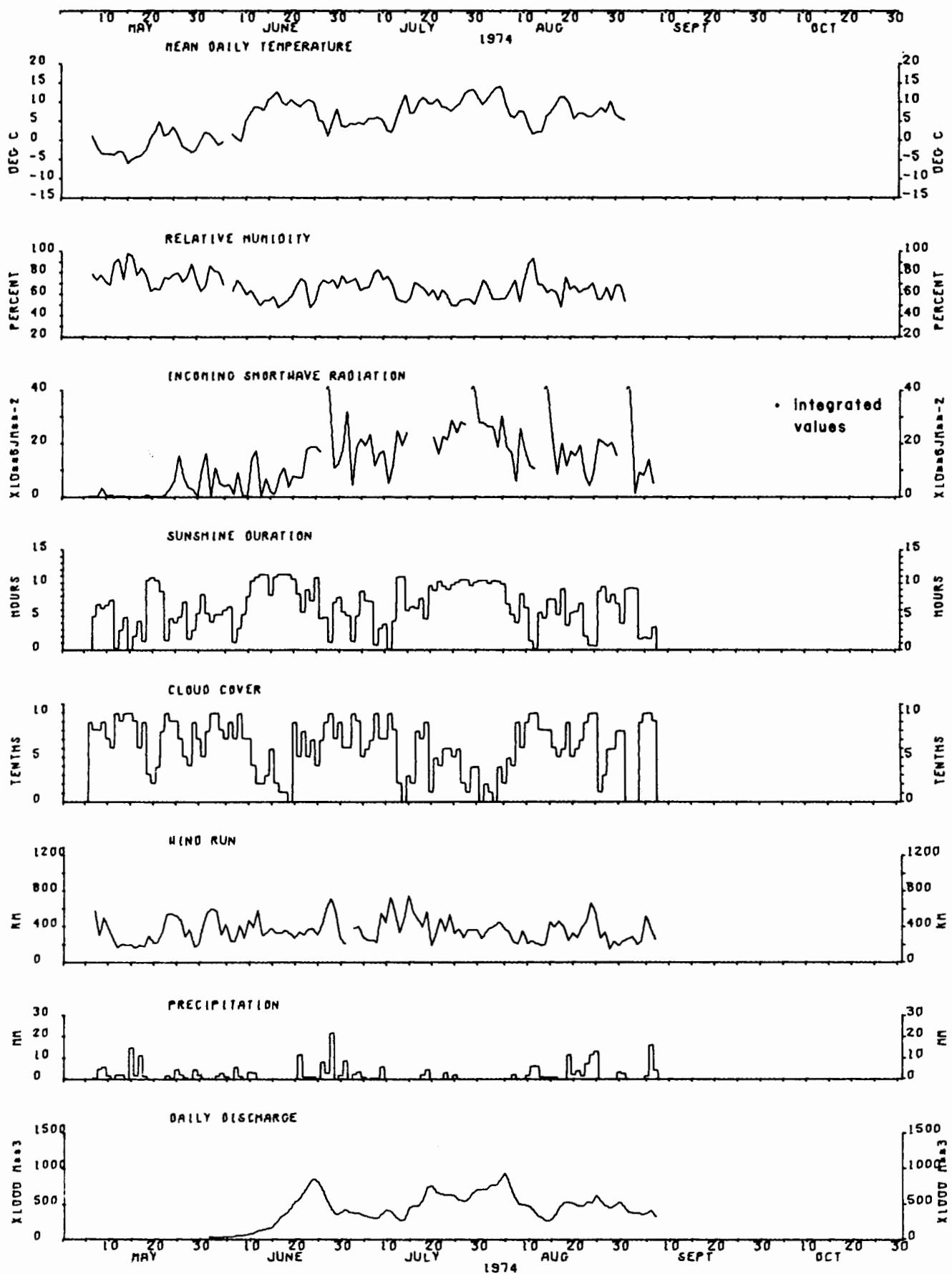


Figure II-10. Peyto Glacier, 1974.

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No.71 International Hydrological Decade  
Program, 1965-1974 : no. 4, Peyto  
Glacier, Alberta : summary of  
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