The Summer Climate at Sam Lake, Yukon Territory

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ABSTRACT. A weather station was established at Sam Lake in the British Mountains of the northern Yukon Territory in the summer of 1974. Information was collected on temperature, winds, cloud cover and precipitation. The summer conditions were found to be influenced mainly by arctic weather disturbances originating in the Beaufort Sea. A comparison of the information recorded at Sam Lake with that from coastal stations served to demonstrate the buffering effect of the mountains.

RÉSUMÉ. *Le climat estival au lac Sam, Territoire du Yukon.* Durant l'été 1974, une station météorologique a été installée au lac Sam dans les montagnes Britanniques au nord du Territoire du Yukon. Des renseignements sur la température, les vents, les nuages et les précipitations y ont été recueillis. On a constaté que les conditions estivales étaient surtout influencées par les perturbations météorologiques de l'arctique en provenance de la mer de Beaufort. Une comparaison des données enregistrées au lac Sam avec celles des stations côtières a permis de démontrer l'effet tampon des montagnes.

РЕЗЮМЕ. *Климат о. Сэм, Юкон, в летний период.* Метеорологическая станция на о. Сэм в Британских горах северного Юкона была создана летом 1974 года. Собираемая информация включала данные по температуре, ветру, осадкам и состоянию облаков. Было установлено, что летние климатические условия зависят в основном от изменений погоды в море Бофорта. Сравнение информации, собранной на о. Сэм, с данными прибрежных метеорологических станций помогло продемонстрировать смягчающее действие гор.

INTRODUCTION

In the summer of 1974, a weather station was established at Sam Lake (68°25'N, 137°37'W), incidental to a study of arctic mountain grizzly bears (*Ursus arctos* Linnaeus) in the northern Yukon Territory. The period of operation of the station was relatively short, but the data obtained are of significance since, although weather stations are in operation at Old Crow on the southern edge of the Old Crow Flats, and at Shingle Point and Komakuk Beach on the coastal plains, weather data from the mountainous Yukon are sparse (see Fig. 1).

STATION LOCATION AND OPERATION

Sam Lake is situated at an elevation of 420 metres above sea level at the extreme northeastern corner of the Old Crow Flats, in close proximity to the British and Richardson mountain ranges (Fig. 1). To the south, the Old Crow Flats form a relatively low (240-430 metres), lake-studded, inland delta covering an area of about 5,200 km^2. To the north, the British and Richardson mountain ranges

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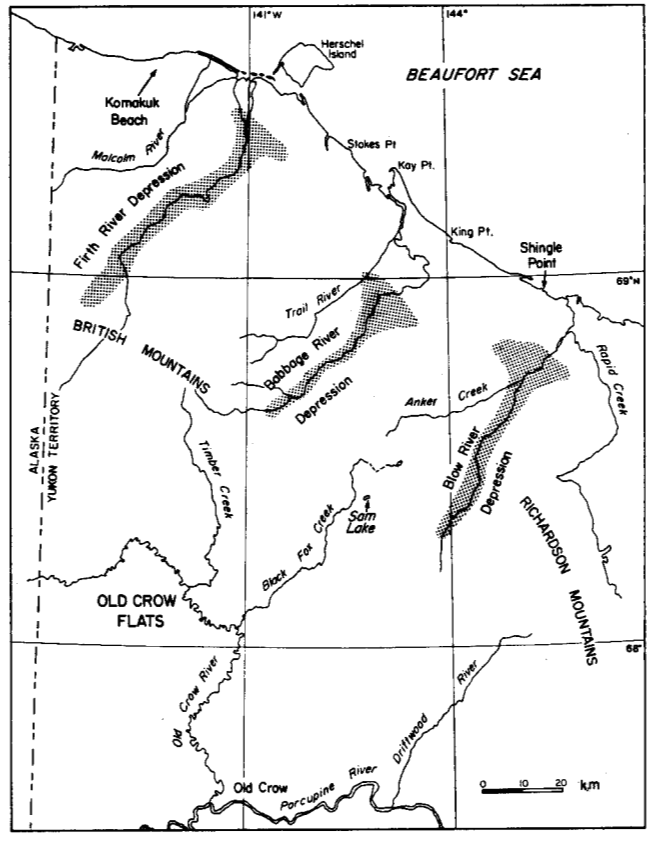

FIG. 1 Location of study programme.

form a coastal orographic barrier 450-1500 metres above sea level. Three major northeast-southwest-trending depressions along the Blow, Babbage and Firth river drainage systems transect these ranges between the coastal plains to the north and the Old Crow Flats (Fig. 1).

The weather station at Sam Lake was in operation from 2 May to 21 September 1974, during which time daily observations were made at 0800 and 2000 hours Yukon Daylight Time. Elements observed were: temperature maxima and minima of past 12 hours, wind direction and velocity, amounts of cloud cover, and precipitation.

RESULTS

The results are presented in Table 1; detailed data are on file at the Atmospheric Environment Service, Whitehorse, Yukon Territory. Some aspects of these data are discussed below:

Temperature

Daily temperature regimes are shown in Fig. 2. Warming trends were apparent during May, June and July, with the extreme daily maximum temperatures

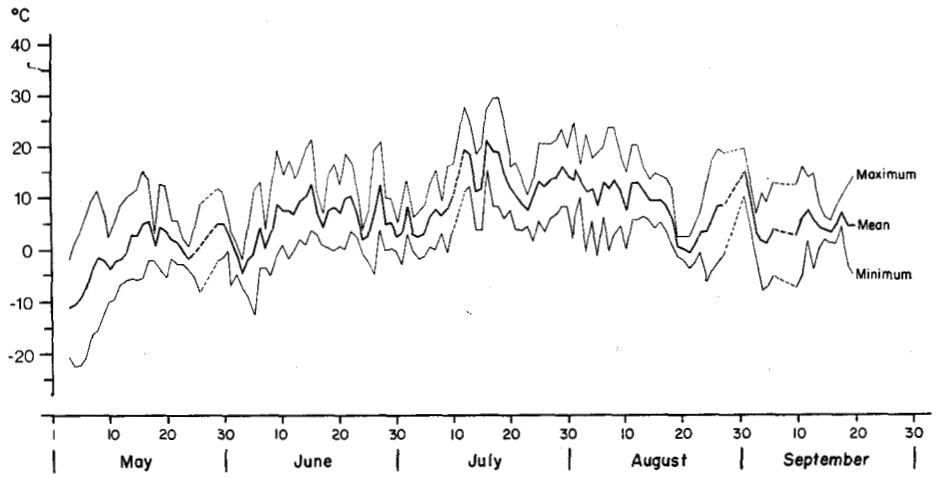

FIG. 2 Maximum, minimum and mean daily temperature observed during May, June, July, August and September 1974 at Sam Lake.

recorded during the week 12-19 July 1974. Cooling trends were noted thereafter.

The extreme maximum temperature range of 27.8°C was experienced in May when the extreme minimum for the period of observation was recorded. Characteristically, the maximum ranges occurred during periods of clear skies and little or no wind, when both solar and terrestrial radiation were most effective. Conversely, the minimum diurnal ranges were recorded during overcast periods with precipitation or strong winds, such as on 19 August when the fluctuation was 3.9°C. The highest and lowest monthly mean diurnal ranges were observed during

TABLE 1. Summary of observation at Sam Lake

Climatic factor	Month*				
	May	June	July	Aug.	Sept.
Temperature (°C)					
Mean daily	−0.3	6.1	11.5	8.3	4.8
Mean daily maximum	7.5	12.7	18.5	15.2	11.2
Mean daily minimum	−8.1	−0.6	4.6	3.2	−1.5
Extreme maximum	15.0	22.2	29.5	24.5	19.5
Extreme minimum	−22.8	−11.7	−2.8	−6.7	−7.8
Mean diurnal range	15.6	13.3	13.5	13.4	11.8
Wind					
Occurrence (percent monthly obs.)	58.2	91.7	85.5	75.0	64.9
Mean velocity (km per hr)	9.3	18.7	12.1	9.1	8.1
Mean maximum velocity (km per hr)	10.9	22.6	15.0	11.6	10.4
Mean minimum velocity (km per hr)	7.5	14.7	9.3	6.5	5.8
Cloud cover — mean daily (tenths of skydome)	2.9	4.5	5.6	5.8	4.8
Precipitation (*cm*)					
Total monthly		0.84	5.38	5.40	2.15
Total monthly snowfall		0.51		12.45	
Total monthly rainfall		0.79	5.38	4.15	2.15

*May — 11.3% observations missing; June — 3.2% observations missing; August — 9.7% observations missing; September — 40.3% observations missing.

May and September, as the amount of incoming solar energy increased and decreased, respectively (Table 1). Marcus and LaBelle (1974), who discussed the summer climate at the 5,360 metre level of Mount Logan, (60°34'N, 140°24'W) in 1968 and 1969, reported similar results.

The temperatures recorded at Old Crow showed that the months of May to September were slightly warmer on average in 1974 than during 1959-1973 (Table 2). However, June averaged 2.4°C cooler than in 1959-1973. It is likely that the 6.1°C June mean at Sam Lake was similarly lower than average and that the coastal temperatures at Komakuk Beach and Shingle Point were lower than the 1959-1973 averages shown in Table 2. The aberrant nature of the June climate in 1974 was a general phenomenon throughout the region of the western Arctic. It caused persistent ice in the Beaufort Sea throughout the summer and nearly complete reproductive failure in the snow geese and brant populations (Dr. T. W. Barry, Canadian Wildlife Service, Edmonton, personal communication).

The Old Crow Flats form a thermal basin, surrounded as they are by gently rising mountain slopes on the west, north, and east, which the spring radiation warms more quickly than the surrounding areas, causing an early melting of snow over the entire basin. Sam Lake, which is on the edge of that basin, had mean temperatures in May 1974 considerably higher than those of the coastal stations. The lake was ice-free several weeks earlier than those of similar size on the north coast. The differences between the thermal regimes of Old Crow and Sam Lake can be attributed in part to elevational differences, for one expects a decrease in temperature of 1.7° to 2.8°C per thousand feet (300 metres approximately) elevational gain during the summer months (H. E. Wahl, Atmospheric Environment

TABLE 2. Mean daily temperatures (°C) observed at Komakuk Beach, Shingle Point and Old Crow from 1959 to 1973, and at Sam Lake and Old Crow in 1974

Station	Years	Elevation (metres above sea level)	Months				
			May	June	July	Aug.	Sept.
Mean daily temperature							
Komakuk Beach	1959-73	9	−5.4	3.2	7.3	5.4	0.3
Shingle Point	1959-73	53	−4.5	5.1	10.7	7.9	1.1
Sam Lake	1974	420	−0.3	6.1	11.4	8.3	4.8*
Old Crow	1974	250	1.7	9.9	14.1	11.3	3.3
	1959-73		0.6	12.3	13.9	9.9	2.6
Mean daily maximum temp.							
Komakuk Beach	1959-73	9	−2.1	5.4	11.7	9.0	3.2
Shingle Point	1959-73	53	−0.8	9.3	15.4	11.9	4.4
Sam Lake	1974	420	7.5	12.7	18.2	15.2	11.2*
Old Crow	1974	250	8.7	16.1	20.9	17.6	8.9
	1959-73		6.0	18.7	20.3	15.3	7.4
Mean daily minimum temp.							
Komakuk Beach	1959-73	9	−8.7	−0.1	2.8	1.8	−2.7
Shingle Point	1959-73	53	−7.7	0.9	5.8	3.8	−1.8
Sam Lake	1974	420	−8.1	−0.6	4.6	1.5	−1.5*
Old Crow	1974	250	−5.4	3.7	7.2	4.9	−2.3
	1959-73		−4.8	6.3	7.4	4.4	−2.1

*Data available for only early portion of month.

Service, Whitehorse, personal communication, December 1974). The higher mean temperature calculated for Sam Lake in September may be attributed to lack of data after the third week of that month.

A comparison of unsummarized data showed that occasional periods of cold weather and summer precipitation occurred at Sam Lake, such as were not recorded at Old Crow. It appears that during major cold outbreaks or disturbances both Sam Lake and Old Crow are affected, but during minor or shallow outbreaks arctic air from the Beaufort Sea penetrates to Sam Lake through the three major river depressions but fails to reach Old Crow. The lower temperatures observed at Sam Lake can also be partially attributed to that phenomenon.

Winds

Selected wind direction and velocity roses are shown in Fig. 3. Burns (1974), discussing the climate of the Mackenzie Valley, indicated that the prevailing winds blowing over the northern Yukon were from the northwest during the winter, but were more westerly and weaker in the summer. Surprisingly, the prevailing surface winds at Sam Lake were from the north throughout the observational period. It appears that factors other than large-scale wind patterns, such as diurnal variations in orographic airflow, local air movements related to differential warming and cooling over the mountains and Old Crow Flats, the origin and degree of penetration of weather systems, and the channelling effect and orienta-

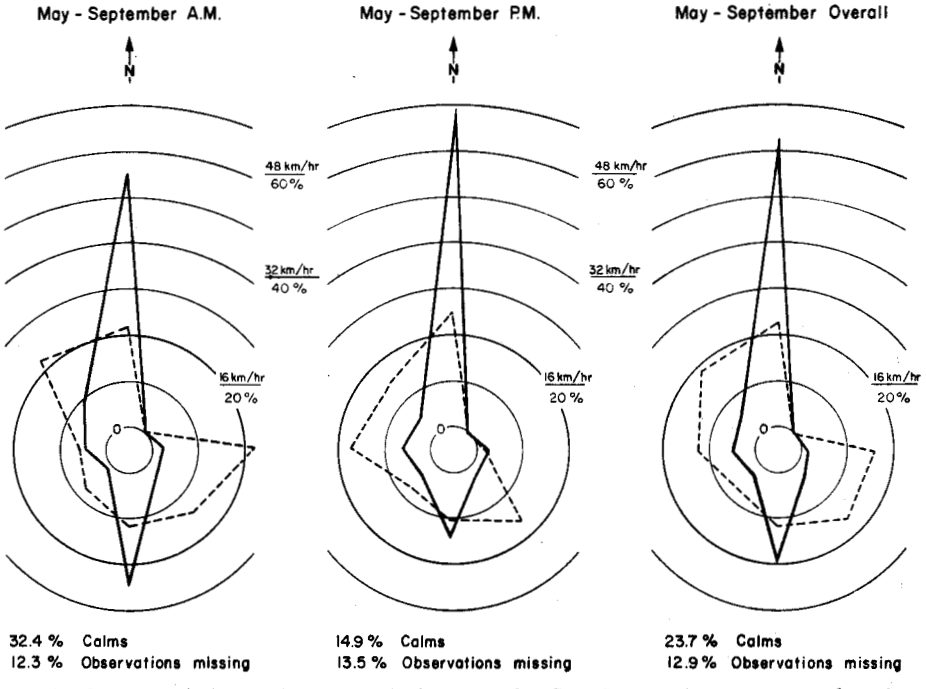

FIG. 3 Surface wind direction and velocity roses for Sam Lake. The vectors are based on the frequency of occurrence (———) and mean wind speed (— — — —) observed by direction. Occurrence of calms and missing observations are indicated below each rose.

tion of the major coastal-mountain river depressions, determine the direction of local winds.

The data indicated that winds were more frequent in June, July and August than in other months (Table 1). It was also observed that they generally increased from morning to afternoon as the amount of incoming solar energy was greater and the surface temperature became higher (Fig. 3). As the input of solar energy increases on a seasonal or daily basis, dominant air masses are modified and instability attains a peak (Burns 1974).

SPECIAL PROBLEMS

As the establishment of the station at Sam Lake was incidental to a study of grizzly bear population in the area, unavoidable gaps occurred in the recording of data when no one was present in the field camp. In addition to the measurements reported above, an attempt was made to determine the depth of the snow cover when the station was set up in May. Accurate measurements of snow cover were, however, impossible as the terrain was highly irregular, and the fallen snow in the area had been blown by winds to sheltered areas between tussocks and hummocks or to large depressions.

CONCLUSION

The weather data obtained at Sam Lake were comparable with, but should not be considered representative of, those for either the Old Crow Flats or the coastal plain of the northern Yukon. Climatic phenomena associated with both of those topographically different areas, as well as the Arctic Ocean, influence the local surface weather patterns and the climate of the Sam Lake area. The data reflect to a certain degree the influence and degree of penetration of major and minor arctic coastal disturbances. Although the data are derived from observations made only during the summer months of 1974, they do provide an insight into the nature of the climate in an area where very few recordings have been made.

ACKNOWLEDGEMENTS

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