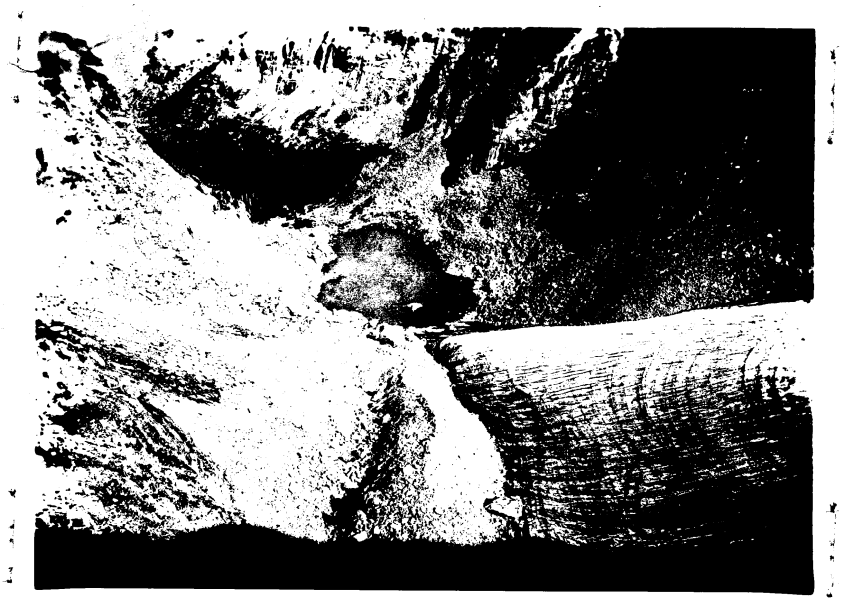
GLACIER SURVEY

ROCKY MOUNTAIN NATIONAL PARK

1937



1937 GLACIER STUDIES
ROCKY MOUNTAIN NATIONAL PARK

Introduction

Initiated in 1932, annual glacier surveys have been made in Rocky Mountain National Park through the year 1935. In 1936, no measurements were made, due to temporarily misplaced prior data, and the absence from the park of all persons taking part in previous surveys. Thus, the 1937 data will indicate the variation as between 1935 and 1937, a two-year period.

Andrews and Tyndall glaciers have been selected for these studies due to the facility of measurement, and feasibility of including both in a day's trip.

Method of Measurement

Desiring only data concerning the actual fluctuations in the terminus of the glacier, those setting up the survey devised a simple but roughly accurate system that lends itself to quick checking. Fixed stations were established, and from these, tapeline measurements to the nearest ice are made. Measurement is along the land slope from the station to the foot of the glacier.

1. Andrews Glacier

At Andrews Glacier, stations were established near the southwest corner of the lake, immediately below and to the east of the glacier. Station 1 was placed on an apparently stable rock at the margin of the lake, with Station 2 on a large mass of granite 44'7" WSW from Station 1. A triangle measurement from Station 1 to Station 2 (for check of position of Station 1); from Station 1 to the nearest ice; and from Station 2 to the measured point of the ice front is made.

2. Tyndall Glacier

At Tyndall Glacier, stations were established directly east of the apparent front of the main lobe of the glacier, on the most stable rocks in the recessional moraine east of the apparent glacier front. These stations were in a triangle, with Station 1 as the apex nearest the measured point of the glacier; Station 2 at a point 50' distant on a line N 10 E; Station 3 at the intersection of lines 59' (from Station 2 to 3) and 35' (from Station 1 to 3). Subsequent developments indicate that Stations 2 and 3 are stable, but that Station 1 is now shifting south and west, with the dissipation of the submorainal ice that represents the true, but undeterminable ice terminus. Data

prepared from the 1932 survey does not indicate an exact line of ice and surface debris has been used, and no doubt variations due to this uncertain measurement have entered into the recession figures derived in these studies.

Even with a definite angle taken from Station 1, measurement to the point of contact of clear ice with debris in front of the clear ice is not a reliable index of recession or advance of the true ice sheet. The fractured and jointed walls above and at the sides of the glacier will slough varying amounts of debris onto the surface of the ice according to seasonal conditions. Collection of this falling material at the foot of the steeply sloping face of the ice conceals the true terminus, and the covering of debris will move forward and backward with reference to movement or dissipation of the ice body proper. Of course, ablation of imbedded moraine from the melting front adds to this surface debris, but sliding from above is the primary factor on accretion of material to the rock cover over the terminus at the present time.

Measurement of Tyndall Glacier will be continued, using the same basis for determining apparent recession as in the past, but the value of these figures for the purposes of the National Research Council of the Geophysical Union will be negligible.

1937 Glacier Survey Party

1. Preliminary

On September 28, 1937, a party consisting of Park Naturalist H.R. Gregg, Ranger-Naturalist Bert H. Fraser, Louis Quam of the Department of Geology, Colorado University, and two CCC enrollees, visited Andrews and Tyndall glaciers, going through Loch Vale and returning via Tyndall Gorge. At the time this trip was made, efforts to locate data from the 1932-35 surveys had proved futile, and it was decided to make measurements for comparison with data collected by a survey made in September 1928, with thse idea that the 1932-35 data milght be tied into thse old survey figures from 1928-31. (This was not the case.) It was determined roughly, that Andrews Glacier had receded by some 90 feet from the station set at the exact front of thes glacier in 1928. Marks set in 1928 at Tyndall Glacier apparently had shifted from positions indicated on photographs made in 1928, and complete change of appearance of the glacier front between 1928 and 1937 led to the conclusion that measurement from any reliable point to the ice front would be impossible. In fact, the conclusion was reached that this glacier is no longer suitable for measurement.

Photographs were made at each of the glaciers, from points comparable to those from which photographs were made on previous surveys, for comparative study of appearance of the glaciers. These photographs were valuable in determining the actual point of ice front on the October 13, 1937 survey, at which time is snow covered the front of both glaciers.

The weather on September 28, 1937, was fair, with light wind. Copious flows of water issued from the snout of Andrews Glacier, flowing across a delta some thirty-five feet wide. The water carried a heavy burden of glacier flour and silt, and the lake into which it emptied was quite milky in color.

Surface flows were quite abundant at Tyndall Glacier, and much rock was melting out along the sides of the glacier, skidding and rolling to the base of the glacier. Ice tables were noted upon and within the moraine debris over the front of Tyndall, and about midway up the southern edge of Andrews.

2. October 13, 1937 Survey

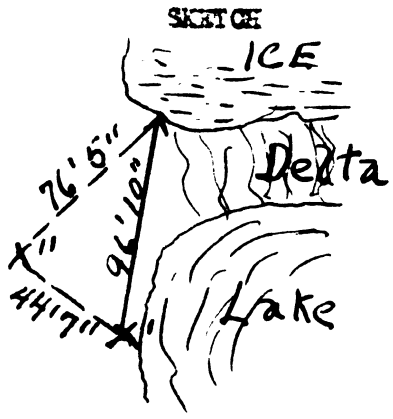
On October 13, 1937, Supt. David H. Canfield, Ass't. Supt. John S. McLaughlin, and Park Naturalist H. R. Gregg visited these glaciers, going through Loch Vale, returning via Tyndall Gorge. Mr. Mclaughlin had participated in several of the previous surveys, and was familiar with the location of stations established and used in those surveys, enabling the party to obtain comparable figures to continue the studies on the basis set up in 1932.

The weather was clear, with moderate wind. Both glaciers had stopped flowing at the snout, and a marked contrast was noted at Tyndall Glacier where little rock was found to be rolling down from the edges, as was the case on September 28, when continuous slide occurred during the presence of the party at the glacier. At Andrews Glacier, sub-draining of the lake through the recessional moraine that holds it to its summer level had reduced its depth more than two feet between September 28 and October 13, indicating that little melting had taken place since the former date. Likewise, the lake had cleared of its milky color to a marked degree.

(Measurement Data)

Andrews Glacier

Although a shallow cover of snow lay the snout of the glacier, the actual front was determined with no difficulty, and the tape was stretched from the exact center of Station 1 to the solid ice at the glacier snout.



Measurements and comparison with previous measurements are as follows:

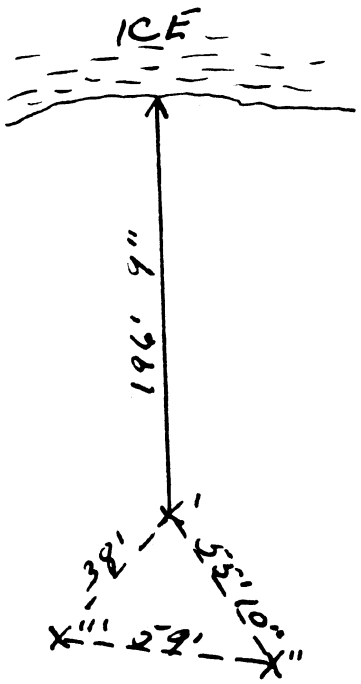
Station 1 to Ice		
1937	96'	10"
1935	66'	
1934	139'	
1933	58'	10"
1932	48'	7"

Apparent recession 1935-1937: 30' 10"

Net Recession 1932-1937: 48' 3"

Tyndall Glacier

SKETCH



Snow almost competely covered the basin between the steep-sloping ice and the recessional moraine ridge east of the glacier, making it difficult to establish wifth certainty the contact line of ice and debris. By study of photograph taken by Mr. Gregg on September 28, and location of identifiable points, the approximate point of contact was located, the snow cleared until solid ice against rock debris was located at a point almost due west of Station 1. Tapeline measurement along the ground slope was made from Station 1 to this point. Correction was necessary to allow for shifting of the rock upon which Station 1 is located. In 1932, the triangle formed by the three stations was as follows: Station 1 to 2, 50'; Station 2 to 3, 59'; Station 3 to 1, 35'. This means that Station 1 has moved forward in an east-west lilne by some 5'2", which figure has been added to the measured distance from Station 1 to the nearest ice, which was 169'9", giving a total distance comparable with the 1932 base figure, of 201'11".

Measurements and comparison with previous measurements are as follows:

St. 1 to Ice	
1937	201' 11"
1935	33' 6"
1934	72' 5"
1933	63' 4"
1932	30' 8"

Apparent recession 1935-1937 163' 5"
Net recession 1932-1937 171' 3"

NOTE:

For the benefit of checking the accuracy of previous reports, copies of which are not available in our files, the following notes on apparent errors in computation in the handbook used for the 1932-1935 surveys are included: (Geophysical people should check this)

1. In 1933, Andrews is listed in the field manual as receding 9'6", whereas the correct figure is 10'3". Error is in subtraction.
2. In 1934, Andrews is shown as receding 41'9". Correct figure is 80'2". Error is in the jumbling of figures.
3. In 1934, Tyndall is shown as receding 80'2". Correct figure is 9'1". Error is in using Andrews figures for Tyndall.

4. In 1935, Andrews is shown as advancing 44'7". Correct figure is 73'. Error is in deducting 1935 Station 1-Ice distance from Station 2-Ice figure from 1934, instead of from Station 1-Ice figure from 1934.
5. In 1935, Tyndall is shown as advancing 33'9". Correct figure is 33'11". Error is in carrying 10" rather than 12" on the foot unit borrowed for subtraction.

These errors, as reflected in the handbook used for field measurement may have been corrected in the reports submitted for use of the Geophysical Union, but if such is not the case, such corrections should be made.

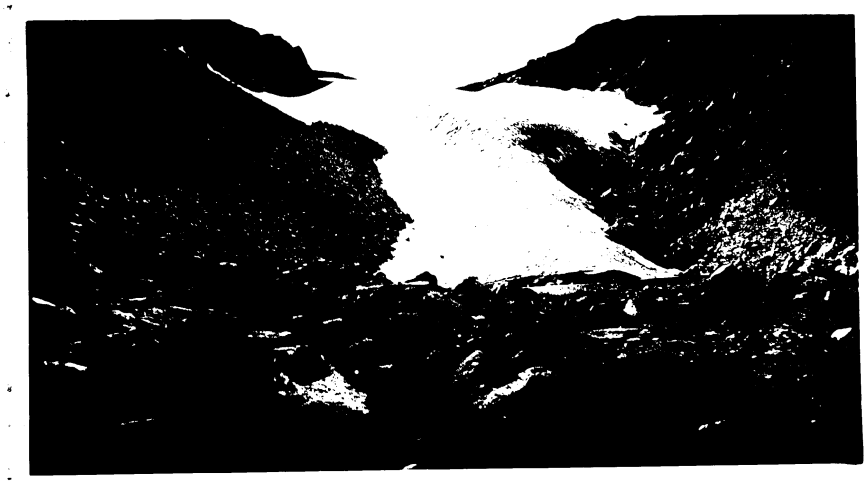
TEMPERATURE AND PRECIPITATION

It is not known what weather data was furnished with previous reports. Presumably, the temperature and precipitation (snow) readings for the Cooperative Observer's station at the Estes Park power plant on Fall River were supplied. Snow measurement data for the area of the park is available, but it merely records the amount of snowfall in depth at the time of the measurements, ususally monthly. More recently, water-content and snow-depth measurements have been made over several planned snow courses in the park, and that data is available, if it is thought to be of value for comparison with glacier measurements. However, again, these courses merely indicate the standing snow at the time of measurement. The dat furnished here is based on Cooperative Observer station reports, giving average mean temperatures, precipitation in the form of snow, both in inches depth of snow and inches of precipitation, and total precipitation, month by month. Figures from October 1935 to July 1, 1936 are taken from records at Estes Park only. Figures from July, 1936 to September, 1937 represent averages for the stations at Grand Lake and Estes Park.

Date	Mean Temperature	Snow		Total Precipitation
		Depth	In.Prec.	
Oct. 1935	41.5	15.50	1.08	1.08
Nov.	32.3	11.75	1.05	1.05
Dec.	28.0	01.50	0.11	0.11
Jan. 1936	23.0	08.75	0.41	0.41
Feb.	23.1	16.00	1.93	1.93
Mar.	32.5	16.00	1.28	1.28
Apr.	37.4	09.00	1.04	1.04
May	47.0			0.74
June	55.1			2.87
July	59.8			2.92
Aug.	58.0			3.46
Sept.	50.4	01.50	0.21	1.27
Oct.	38.3	08.20	0.68	0.99
Nov.	29.9	01.87	0.10	0.10
Dec.	22.1	12.62	0.60	0.60

Jan. 1937	11.8	08.25	0.59	0.59
Feb.	21.4	21.00	1.99	1.99
Mar.	26.9	18.75	1.09	1.09
Apr.	26.8	22.50	1.63	1.81
May	48.0	T		1.26
June	53.5	T		2.58
July	59.7			2.61
Aug.	56.9			2.73
Sept.	52.1			0.87
Total for Glacier year 1935-6:		80.00	7.11	18.16
Total for Glacier year 1936-7:		93.19	6.65	17.22

H; R. Gregg
Park Naturalist



SEPTEMBER 9, 1930

ANDREWS GLACIER
View of entire glacier as seen from east end of lake immediately below and to the east of the glacier.

SEPTEMBER 28, 1937

SEPTEMBER 1935

ANDREWS GLACIER
Similar views showing recession and shrinkage over the two-year period, 1935-1937. Note the splendid lateral moraine at the left of the ice in the lower photograph.

SEPTEMBER 1937

ANDREWS GLACIER

South edge of the glacier as seen from the north-east end of the lake immediately below and to the east of the glacier.
Rock at lower right of the picture is the same as that on which on which the man is standing in the 1938 photograph at the left.
Left photograph, Sept. 1928.
Right photograph, Sept. 1937.