

of receding, the terminal face has advanced generally, about 25 chains of it as much as from 250 ft. to 300 ft., except at the river-outlet, where the ice always wastes away at an abnormal rate because the water undermines it and great blocks then fall and are carried away by the river.

The terminal face was traversed in March, 1889, in November, 1890, and again in February, 1906, and its varying positions are shown on the accompanying plan.

I think I remarked in a former report that the Hooker River, flowing as it does along the face of the Mueller Glacier, made it an unreliable one on which to note short-time changes; nevertheless, its advance in 1906 is quite certain. A retrograde motion might have been caused by the river, but there is the forward one in spite of it. The Tasman Glacier terminal face was also traversed in November, 1890, and again in February, 1906, and this, too, shows an advance varying from 50 ft. to 150 ft. When the slower rate of the Mueller is considered side by side with the advance of its terminal face in the same period, there seems to be only one explanation of it—viz., that it is not melting away so rapidly as it did formerly. It is well known that the summers have been colder and the winter falls of snow lighter during the last eight years than they used to be, and this is apparently the only way to account for the slower movement and greater advance. It is a pity that no proper records of the temperature and falls of snow at the Hermitage have been kept.

I noticed more changes on the surface of the Mueller this year than I ever remember to have seen since it was under my observation. There are great holes full of water chains wide, and perhaps 50 ft. deep, where it has always been fairly even before, and ice faces are appearing where all was formerly deeply covered with moraine. The levels seem to show that the surface is, as a rule, about 20 ft. lower than it was seventeen years ago.

The gradual compression of the ice in its course from the *nêve* to the terminal face of a glacier is well illustrated by comparing the present with the original positions of the marked stones on the Mueller. Taking Nos. 8 and 2 as an example, it will be seen that on the 29th March, 1889, they were 5,680 ft. distant from each other; but on the 6th February, 1906, they were only 3,830 ft. apart. Thus it will be seen that as the ice between them was confined to a regular channel, and did not escape by any other exit, it was evidently compressed to the extent of 1,850 ft. This explains how the scattered medial moraines of the upper part of a glacier are gradually gathered together until they become a surface moraine covering the whole of the lower part of it.

It may be interesting to note the following rates of foreign glaciers for comparison with our Canterbury ones:—

Nansen records that the highest rate of the ice in three glaciers measured in the district of Julianehaag was some 12 ft. in twenty-four hours.

Lieutenant C. Ryder, in August, 1886, mentions a daily rate of 100 ft. in the Upernivik Glacier, in North Greenland.

W. S. Karr states that Muir's Glacier, Alaska, enters the sea at the rate of 40 ft. a day in the month of August.

Forbes noted in June, 1842, that the motion of the ice on the *mer de glace* of Chamouni opposite a point called the angle was as much as $17\frac{1}{2}$ in. in twenty-four hours.

You have also records of the observations made on our West Coast glaciers by Harper and Wilson. A. Harper gives as high a rate as 207 in. per day for one part of the Francis Josef Glacier, and W. Wilson as much as 13·4 in. as the winter rate of the Fox Glacier.

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APPENDIX III.

THE MAGNETIC OBSERVATORY AND THE MAGNETIC SURVEY.

DURING the past year the work of the Observatory has been carried on without interruption. The large quantity of reduction-work to be carried on did not permit of any extension of the routine observational work at the Observatory itself; but it was felt necessary at all costs to finish during the summer the observational work of the Magnetic Survey, and for this purpose a sum of £150 was placed on the estimates. During the summer complete sets of observations were made at thirty-three new stations in the southern part of the South Island, and one former station was repeated. A list of the stations is appended.

During the year Mr. B. V. Pemberton and Mr. E. Kidson, B.Sc., ably acted as assistants. The latter has however lately resigned in order to take up the position of Demonstrator in Chemistry at Canterbury College. On the 31st July the Observatory had the honour of a visit from Professor Ernest Rutherford, D.Sc., F.R.S., an erstwhile student of the New Zealand University.

The past year has been largely devoted to the measurement and reduction of curves, and this will shortly be finished over the period of antarctic research.

At the request of the Admiralty a published list of magnetic observations made here was furnished for use in the compilation of new charts. The magnetic survey will be of great value for this purpose when published.

I have to acknowledge with thanks the receipt of many publications, &c., from various institutions, too numerous to specify. I have also to gratefully acknowledge the cordial way in which various officers of the Department have given information and lithograph plans, &c., to facilitate field observation; also to thank the Telegraph Department for time signals afforded.