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NOTES ON FIRN TEMPERATURES AND ABLATION IN MACROBERTSON LAND, ANTARCTICA

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FIRN TEMPERATURES

Firn temperatures on the MacRobertson Land ice cap were observed in December 1954 and January 1955 by Mr. R. Dovers* during a sledging journey from the Australian National Antarctic Research Expedition base station "Mawson" (lat. 67° 44' S., long. 62° 54' E.) southward to lat. 70° S. These temperatures (Table I) were recorded by spirit thermometers which were lowered into boreholes to a depth of 5 m.

TABLE I. FIRN TEMPERATURES AT A DEPTH OF 5 METRES ON THE MACROBERTSON LAND ICE CAP

Station	Lat. (in ° S.)	Long. (in ° E.)	Height a.s.l. (in metres)	Temp. (in ° C.)
D 13	67.9	63.5	820	-20.8
E 6	68.4	64.0	1320	-25.2
E 10	68.6	64.1	1580	-27.2
E 17	69.0	64.4	1710	-28.2
F 5	69.3	64.5	1850	-30.6
F 10	69.7	64.7	2080	-31.0

Early in January the near minimum annual temperatures in the firn occur at a depth of 5 m. and are estimated to be about 1° C. below the average. In Table II the mean annual temperatures (derived by interpolation) of the upper firn layers of MacRobertson Land are compared with the corresponding ones for Terre Adélie¹. The mean annual air temperatures are probably slightly lower². In the parts of the MacRobertson Land ice nearer sea level the temperatures are almost identical with those recorded in Terre Adélie, but in the more elevated parts the Terre Adélie temperatures are slightly lower. At a height of 2000 m. the Dronning Maud Land ice cap temperatures³ are higher than those recorded in MacRobertson Land. The more southerly position

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of the higher stations only accounts for a small part (estimated at 2°C.^4) of the fall in temperature. As is generally the case, there is a rapid fall in temperature with the increased height of the MacRobertson Land ice cap.

OBSERVATIONS ON ABLATION

Both accumulation and ablation of snow and ice in MacRobertson Land were measured in the vicinity of the base and on the ice cap along a line towards the south. Since these observations are still proceeding, the following remarks are only of a preliminary nature. Because of the loss of

TABLE II. MEAN ANNUAL TEMPERATURES OF THE FIRN UPPER LAYERS IN MACROBERTSON LAND

Height a.s.l. (in metres)	500	750	1000	1250	1500	1750	2000
Lat. (in $^{\circ}\text{S.}$)	67.7	67.8	68.1	68.3	68.6	69.1	69.3
Temp. (in $^{\circ}\text{C.}$)	-17	-19	-21	-24	-26	-28	-29.5
Terre Adélie							
Temp. (in $^{\circ}\text{C.}$)	-17		-21		-27.5		-34.5

ablation stakes near the edge of the ice cap during the sledging season, it is believed that the likely amount of summer ablation was under-estimated. Therefore, the following observations refer only to the period of markedly negative air temperatures (26 April to 18 November 1954).

Ablation stakes, at heights between 65 and 415 m. a.s.l. and between 0.4 and 7 km. from the edge of the ice cap, were observed at regular intervals. Even in mid-winter the surface of the ice cap to a height of 350 m. was bare ice, which would appear to result from exceptionally low precipitation in the Mawson area rather than by wind action as in Terre Adélie¹. Between the end of April and the beginning of October ablation must be almost wholly due to evaporation, because the prevailing low temperatures exclude an appreciable amount of melting.

At two separate points 0.4 km. from the edge of the ice cap, ablation for each of the periods May to July, August and September, and October to mid-November was 7 cm. For the latter period ablation values of 6 to 7 cm. were indicated at several localities further inland. In both Terre Adélie and McMurdo Sound a marked but smaller winter ablation of ice has been found^{1, 5, 6}. Evidence of the remarkable dryness of the winter climate in the vicinity of Mawson is the observed ablation of over 20 cm. of ice without important melting in this part of MacRobertson Land. However, further inland the rate of ablation decreases. At a point 250 m. a.s.l. and 5 km. from the ice cap edge the ablation of ice during the mid-winter periods, May to August and September to mid-November, was 7 and 8 cm. respectively.

Summer ablation by melting is remarkably active in MacRobertson Land and leads to the formation of distinct melt water rivulets on the slopes of the ice cap, a phenomenon that has never been observed at the same latitude in Terre Adélie.

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