COMMENTS ON THE DISCUSSION ON ANTARCTIC RESEARCH*

I. Snow Cover and Sea Ice

By Alan Reece
(Falkland Islands Dependencies Survey)

A 1. *Nature of Antarctic snow cover*

The recording of types of snow surface, as defined in *Snow Structure and Ski Fields*,† both at base and during journeys, is easily done and is of great importance in connection with appraising travelling conditions and the landing of aircraft. These records should, of course, be correlated with weather conditions. Examination of the walls of pits also yields information on the nature of the surface.

A 2. *Changes of snow level. Precipitation*

As stated by Dr. Brooks the problem of measuring snowfall has not been solved. Any attempt to collect snow above the level of drift is bound to be impracticable, since even in flat areas the upper limit of drift is often 30 to 40 ft. (9 to 12 m.) high. The measuring of accretion over a large flat surface is probably the best method at present, and was used at Hope Bay during 1946. Difficulty was experienced in finding an area that appeared to be free from eddies and therefore drifts; the one chosen was about a mile (1·6 km.) from the base and some 750 ft. (230 m.) above sea-level. This meant that observations were not carried out as frequently as was desirable. The average of measurements made from four stakes at the corners of a half-mile square would have given more reliable figures (*cf.* comment by A. Stephenson).

A 3. *Frequency of surface hoar, rime and depth hoar*

Much rime was deposited on the northern end of Trinity Peninsula during April and May, 1946, at heights varying from 4000 ft. (1219 m.) to sea-level. Fog deposit was also observed at Hope Bay during this period. In *Snow Structure and Ski Fields* it is stated that no records of fog deposit had been received from polar regions.

A 4. *Shapes and sizes of snowflakes and their connexion with meteorological conditions*

An attempt to record the types of snowflake was made at Hope Bay in 1946, using a very simple descriptive nomenclature, *e.g.* simple hexagonal plates, complex six-rayed stars, spicular, granular, etc. No attempt to make detailed drawings was made except in the case of some rather unusual "bamboo-like" forms that were once observed. Advice as to a more scientific classification would have been of great use.‡

A 6. *Snow swamps*

Answering J. E. Fisher's query, it has been found that the ice in the Crown Prince Gustav

* *Journal of Glaciology*, Vol. 1, No. 3, 1948, p. 105–15.
† Seligman, G. Macmillan: London, 1936.
‡ Probably the best classification of snowflakes is that of Nakaya, U. and Sekido, Y. General Classification of Snowflakes and their Frequency of Occurrence. Investigation on Snow, No. 8. *Journal of the Faculty of Science, Hokkaido University*, Series II, Vol. 1, No. 9, p. 243–64. A copy of this paper is in the possession of the Society. Ed.

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Channel, on the east coast of Graham Land, becomes swamped with slushy snow and water every summer. This is due to the accumulated winter and spring thaw water not being drained away through the ice beneath, except where tide cracks and other rifts occur. Two seasons' observations have shown that these conditions extend over most of the Gustav Channel, covering an area of 500–1000 square miles (1300–2600 km.^{2}) at sea-level and lasting about two or three weeks.

E 2. *Local distribution of the pack ice*

All the F.I.D.S. bases have been keeping records of the distribution and type of sea ice in their neighbourhood. The eventual correlation of such observations will give a much better idea of conditions around Graham Land. When plotting the distribution of the sea ice it was found useful to indicate the amount of ice cover in tenths, in the same way as meteorologists indicate cloud cover. It is difficult of course to identify the types and distribution of sea ice near the horizon and to distinguish between light and heavy pack.

E 4. *Icebergs*

Observations of the speed and direction of the drift of icebergs were carried out in 1945–46 in Antarctic Sound at the northern end of Graham Land. An apparent seasonal change in the direction of the current was observed.

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II. Temperature Measurements in Polar Ice

By Arnold Court

Meteorologist, U.S. Antarctic Service Expedition 1939–41

Abstract. Accurate measurements by electrical means of temperatures at various levels in shelf ice, glaciers or ice caps are of themselves insufficient; they must be accompanied by data on densities at the same levels and on incoming and outgoing radiation, as well as other things. Depths of measurements must be known accurately, and changes in them due to changes in surface level must be recorded. Levels chosen should be ½, 1, 2, 4, 8, 16, 32 and 64 m., and readings (if repeated to ensure accuracy) need be taken only once daily down to 4 m. and weekly or so at lower levels. Measurements should be free of external influences such as heat from buildings or deep drifts. Only when all other necessary data are available and all precautions observed will it be possible to explain the thermal structure of the ice sheet as shown by the sub-surface measurements of temperature.

Temperature measurements at various depths in Polar shelf ice, glaciers and ice caps need not be very intensive to be of value, but several precautions must be taken in their gathering, and certain allied data must be obtained concurrently, if the sub-surface temperature distribution is to be not only described but fully explained.

The following paragraphs have been written to amplify one point in the "Discussion on Glaciological Research in the Antarctic," held by the Society on 14 May 1947. They are based on intensive study and attempts at interpretation of the original observations of sub-surface temperature made at "Little America III" by Wade,[1, 2] and of reports of others who have measured sub-surface temperatures in snow and ice, chiefly Wegener,[3] Sorge,[4] Jülg [5] and Sverdrup.[6]

Suggestions for conduct of a program of temperature measurements are grouped under two headings: DIRECT, those pertaining to the measurements themselves; and COROLLARY, those pertaining to other measurements which must be made at the same time if the program is to have maximum value.

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