

Captain Giaever brings out well the difficulties of working under exacting conditions of blizzard, extreme cold and isolation. His book cannot be too highly recommended as an account of all the facets of a successful and well-organized expedition. D. S. BROCK

SNOW HYDROLOGY: SUMMARY REPORT OF THE SNOW INVESTIGATIONS.

Published by the North Pacific Division, Corps of Engineers, U.S. Army, Portland, Oregon, 1956. 437 pages, 70 pages of plates, maps and figs., 27 cm.*

THIS publication is a summary report of some snow investigations conducted in the western half of the United States of America by the federal Weather Bureau and the Corps of Engineers, the military body concerned with river floods in the Mississippi Basin. Its 437 pages of photolithographed typescript are accompanied by 70 plates, many containing several figures each, although these, like the typescript, are admirably legible.

The growing use of surface water resources in most countries has led to proposals for numerous engineering works, for whose proper design and operation hydrological information and theory have become increasingly necessary. Such theory has however, even in snow-provided countries, hitherto tended to be concerned with rainfall only and not snow, whose melt and run-off have been assessed by empirical methods.

The investigations now reported began with research in the physics of snow in three upland areas. From the data thus obtained basic relationships of phenomena were determined and methods were devised for applying these to the solution of snow hydrology problems. The results could then be used in such matters as the estimation of maximum probable and "standard" floods, the forecasting of seasonal run-off and the methods of predicting hydrographs of river discharge, such as are required for the operation of reservoirs and the fighting of floods.

The equipment used included a radio-isotope-radio-telemetering snow gauge and an electronic storage routing analogue. The former transmitted daily readings of snowpack water equivalent by high frequency radio from a remote site to a base station.

The editors of the report took the view that the basic relationships revealed by the investigations were probably applicable wherever snowfall was of appreciable hydrological concern. They therefore presented their information in considerable detail and even with some duplication, so that the reader could see for himself how conclusions were attained or methods could be applied, and could find individual subjects discussed completely without reference to other parts of the report. It is intended to be not a handbook or manual of procedure but a store of data, theories and methods to which hydrologists can turn time and again for material, when tackling their own problems. The two-word title of the report is conveniently brief but perhaps incorrectly comprehensive. Each chapter includes a brief bibliography; an index is lacking, but there is a generous table of contents.

It may not be irrelevant to mention that at the present time the irrigation engineers of Iraq are busy with hydrometric work for the assessment of the water resources of the Tigris and Euphrates basins and have already decided that they must bring into account the snows of the Iranian and Turkish mountains within the basins. In so doing they will surely be indebted for much valuable guidance to the publication now being reviewed; to their gratitude will be added that of the hydrologists and river control engineers of numerous other countries. W. ALLARD

ÉTUDES DE GLACIOLOGIE EN TERRE ADÉLIE, 1951-52. FRITZ LOEWE. *Expéditions Polaires Françaises*, No. 9. Paris, Hermann et Cie., 1956. (Actualités Scientifiques et Industrielles, 1247.) 159 pages, 10 text-figures, 8 plates.

THE book covers description of apparatus and observations of radiation balance at Port Martin on the coast of Adélie Land (lat. 67° S., long. 141° E.) and 1,800 m. up on the inland ice at lat. 80° S.,

* These reports may be ordered from the District Engineer, San Francisco District Corps of Engineers, San Francisco, California. Charges, including mailing, are as follows: "Snow Hydrology" \$4.65 per copy; "Development of Radioisotope-Radiotelemetering Snow Gauge Equipment," \$1.10 per copy. Drafts should be made payable to the Treasurer of the United States. Ed.

discussion of the thermal economy and structure of the ice and finally the role of the unique blizzards of Adélie Land.

270 radiation measurements were made at Port Martin and a smaller number on the inland ice. Both series were much interrupted by the blizzards of this formidable area: at the Adélie Land coast the average wind speed over the year is of gale force.

The snow surface with its high albedo has a small intake of radiation and, owing to the small vapour content of the air, a relatively strong loss.

With clear sky at Port Martin there is a net loss of radiation from the surface with sun heights up to 27 degrees; on the inland ice, with still higher albedo, with sun heights up to 40 degrees.

There is radiation loss at Port Martin normally from the end of March to mid November, but a gain at times in the summer period. At lat. 80° S. a net radiation loss was found in every month, and Loewe considers this typical of the Antarctic Ice Sheet.

The average radiation loss from the ice cap appears to be 36 kg. calories per cm.² per annum.

The author calculates from a mean meridional (*i.e.* southerly) wind component averaged through the depth of the troposphere of 2.9 knots at the edge of the Antarctic Ice Sheet that eight days would be a normal time spent by the air in crossing Antarctica. It is difficult to judge the representativeness of such a figure. The average cooling of the air layer in eight days over the inland ice would be 14° C.

Temperatures were taken at 1.5 and 20 cm. below the snow/ice surface. At Port Martin, except with very high sun or low overcast, the temperatures at 1 cm. depth were lower than at 5 cm. On the inland ice, the temperatures at 1 cm. depth were in all circumstances lower than those at 5 cm. even at mid summer with the sun high.

The snow surface at Port Martin and at lat. 80° S. is on average colder than the air above it. The winds are predominantly southerly; nevertheless a surface inversion is the normal condition.

The firn temperatures at depths down to 10 m. were measured in narrow bore-holes up to 200 miles (320 km.) inland. At lat. 67° S. and 1,000 m. asl. a yearly mean temperature of -21° C. was indicated and at lat. 69° S. and 2,000 m. asl. -34° C.

The inland ice in Adélie Land is considered by Loewe probably to be frozen right down to bedrock south of lat. 70° S., but faster-moving glacier tongues may thaw the ground underneath by heat generated through friction.

The amount of snow carried in the blizzards was measured in drift traps 50 cm. above the surface. The yearly mean at this height was 50 gm. carried through a vertical plane of one square centimetre each hour. The wind direction in Adélie Land is almost always south or south-east. This suggests a total transport outwards over each metre of the Adélie Land coast of 20,000 tons of snow yearly—probably removing half, possibly more than all, the snow which falls in the coastal belt up to 100 to 150 miles (160-240 km.) inland in this sector. In the reviewer's opinion it is unlikely that the quantities of snow removed by blizzards in other sectors are commensurate with the extreme conditions of Adélie Land. The question of whether the great Ice Sheet in east Antarctica is receiving adequate nourishment for its full maintenance at the present epoch remains open, but Loewe's study is an important contribution to our assessment of this in a specially interesting sector.

H. H. LAMB

INVESTIGATION OF ICE PRESSURE ON DAMS. FIRST REPORT ON MEASUREMENT OF COEFFICIENT OF LINEAR EXPANSION OF ARTIFICIAL AND NATURAL ICE. J. G. WILLMOT. *Hydro-electric Power Commission of Ontario. Research Division Report No. 56-392, 1956, 41 pages, illus.*

This report describes laboratory measurements of the coefficient of thermal expansion of ice in a direction perpendicular to the optic axis. The practical problem which prompted the study is