

The Editor,  
*The Journal of Glaciology*

SIR,

*Air Temperature and Solar Radiation*

It is not unusual to come across misconceptions in glaciological literature about the part played by direct solar radiation in the melting of snow and ice. For example, when discussing the processes causing ablation, O. Rogstad states on page 554, line 16, of the October 1951 *Journal of Glaciology*, that the amount of radiation is independent of the air temperature. Other examples of this type of misconception, although usually of a much less specific character, often occur in the literature.

In fact, the solar radiation which remains available for melting snow and ice is highly dependent upon the temperature of the free air above. This dependence is most easily appreciated from a few typical figures such as those given in the table below.

For these the solar heating was taken as averaging 60 calories per cm.<sup>2</sup>/hour on a horizontal surface, for a few hours round mid-day with clear sky in May to August, at about 60° N latitude. Owing to reflection only one-fifth of this would be available for heating the firn surface, leaving 12 calories to supply the outgoing radiation and cause melting. The values of atmospheric radiation used here are in accordance with recent observations.\*

<i>Free air temperature</i> ° C.	-5°	0°	+5°	+10°
Down radiation from atmosphere, cal./cm. <sup>2</sup> /hr.	15·8	18·0	20·3	22·7
Radiation loss from surface at 0° " "	11·3	9·1	6·8	4·4
Solar radiation available for melting " "	0·7	2·9	5·2	7·6
Radiation melting in 5 hours as mm. water . . .	—	1·8	3·2	4·8

When the free air temperature is several degrees below freezing convection will tend to cool the snow and prevent the small surplus of solar heat from being effective for melting, but for air temperatures above freezing convection is mainly dependent on the wind.

Although low clouds may greatly reduce the radiation in both directions, they do not always diminish the surplus available for melting. Here again the latter is highly dependent on air temperature.

*Ministry of Supply,*  
*London*  
23 November 1951

G. S. CALLENDAR

SIR,

*Glacier Tunnel Observations in Alaska*

In view of the recent emphasis on glacier tunnelling and englacial studies of the mechanics of ice movement, the following notes which I gathered in 1941 while returning by steamer from Alaska may be of interest. They represent descriptive information, without alteration, which I wrote down during a lengthy discussion with Dr. John Reed, who at that time was Chief of the Alaskan Branch of the U.S. Geological Survey. Dr. Reed had obtained this information a few weeks earlier in conversation with one L. Thornton, a prospector and miner, who had occasion to do a considerable amount of tunnelling into an unnamed glacier near Hyder, Alaska. The location is near the head of Portland Canal, on the extreme south-eastern boundary between Alaska and British Columbia, and lies approximately at lat. 56° N., long. 130° W. Unfortunately many details which would be of further interest to the glaciologist are lacking.

Intermittently between 1931 and 1941, Mr. Thornton had driven about 1830 m. of tunnels, adits, caves and pits into a small "ice cap" glacier south of Texas Glacier. The bulk of this work was distributed between 10 to 15 different tunnels, some of which were driven horizontally south-eastward from the steeply sloping face of the glacier, and upstream in a direction roughly parallel to the movement of ice. The tunnels penetrated to bedrock. According to Dr. Reed, Mr. Thornton, although not a trained observer, is a reliable person and one keenly interested in the scientific significance of what he saw. He therefore made a point of noting whatever aspects of interest he could. Since he was cut-

\* Robinson, G. D. *Quarterly Journal of the Royal Meteorological Society*, Vol. 76, No. 327, 1950, p. 37-51.