Letters to the Editor

Antarctic Geophysics

Sir,

In a recent paper Dr WEXLER (1958) states that ice loss by melting or evaporation is nil in Antarctica. The idea that melting and evaporation are negligible factors in the Antarctic ice budget is widely held, even though the evidence on which it is based is rather scanty.

It is true that meteorological and glaciological evidence from Maudheim (SWITHINBANK, 1957) suggests that ice evaporation on the ice shelf is negligible, but at other places measurable evaporation does occur. WADE (1945) assigns a very minor role to evaporation, but does acknowledge its existence at Little America, whilst appreciable winter ablation has been measured in McMurdo Sound (DAVID and PRIESTLEY, 1914, WRIGHT and PRIESTLEY, 1922) and Terre Adélie (LOEWE, 1956). In 1955 LOEWE reported a remarkably high winter ablation rate in MacRobertson Land and measurements in subsequent years have confirmed this as being normal. Measurements in 1957 showed that winter ablation also occurs in Princess Elizabeth Land (report not yet published). At Mawson the winter ablation rate is about 0.7 mm of water per day, whilst there is a daily loss of over 0.5 mm of water 20 kilometres inland and at an altitude of 450 metres.

David and Priestley give a figure for the annual evaporation at Cape Royds which leads to a value of 0.45 mm of water per day as a mean rate. Loewe has measured evaporation rates as high as 1.6 mm per day in Adélie Land.

It seems possible that evaporation could be produced in all the steeply sloping fringe regions of Antarctica by winds blowing from the colder interior. At $-45°$ C and 700 mb pressure the saturation mixing ratio is 0.064 gm/kg; at $-20°$ C and 1,000 mb the saturation mixing ratio is 0.646 gm/kg (SMITHSONIAN METEOROLOGICAL TABLES, 1951). It appears, therefore, that the saturation mixing ratios in the fringe regions may be ten times higher than those for the heart of the continent, so that the air descending the lower slopes is capable of taking up more moisture.

An annual mean figure of 0.5 mm of water per day would not be excessive for ice evaporation in a 100 kilometres deep coastal belt of MacRobertson Land, and evaporation at this rate could well occur on the plateau slopes in other parts of Antarctica. If this consideration is applied to the whole of Antarctica it gives a total evaporation loss of 0.27×10^{18} gm/yr, which is of the same order of magnitude as other terms in Dr Wexler's mass balance, and is definitely higher than the calving loss quoted. Even if the the figure were reduced by a factor of 10, it would still merit inclusion in such a budget. It might be added that the balance is hardly affected, since the uncertainty in the import estimates remains large enough to allow substantial evaporation losses to occur.

Further information on this question will come from observations of saturation deficit at the various inland stations operating for the I.G.Y., but even the data available for the fringe region indicate that evaporation should be considered in any mass economy studies for Antarctica.

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