Reply

Dear Sir,

Mr Mellor suggests that evaporation can play a significant role in the over-all loss of Antarctic ice.

The direct measurement of evaporation from any natural surface is difficult and published values must be viewed with caution. This is particularly true over snow surfaces where, with few exceptions (e.g., SVERDRUP, 1936) the careful vertical gradient measurements required for accurate computations have not been made.

Mr Mellor cites old and new surface values of evaporation rates in coastal regions of Antarctica ranging from 0.5 mm to 1.6 mm of water per day and takes the lower value, 0.5 mm per day, as applicable to a 100 km strip on the plateau slope, where katabatic winds have a high capacity for taking up moisture. Applying this value to a 100 km strip encircling Antarctica (approximately 1/10 the area of the permanent ice) Mr Mellor arrives at a total evaporation loss of $0.27 \cdot 10^{18}$ gm/yr, a value of the same magnitude as losses by other processes cited in my paper.

At Maudheim, located on an ice shelf in Queen Maud Land, it was found from energy balance computations that there must be a *negative* evaporation, or deposition of hoarfrost, amounting to 24 mm of water annually (LILJEQUIST, 1957). If we apply this value to the approximately 90% of Antarctic ice not found in the 100 km wide plateau slope considered by Mellor, then there is a deposition of $0.29 \cdot 10^{18}$ gm/yr or just about the same as Mellor's evaporation figure of $0.27 \cdot 10^{18}$ gm/yr.

In other words, using figures suggested by Mellor for the ice plateau slopes and applying Liljequist's value to the remainder of Antarctica, it is found that evaporative-frost deposition processes do not alter the over-all Antarctic ice budget; however, they must be important in the redistribution of water *within* Antarctica.

If there were any significant differences between the over-all evaporation and frost-deposition amounts in Antarctica this difference would be included automatically in the net import of water vapor by winds across the Antarctic coast. The chain of IGY meteorological stations encircling Antarctica will for the first time enable a good estimate to be made of this import.

It should be stressed again that both the figures of evaporation and frost-deposition are uncertain. For example, Loewe, whose results Mellor quotes, has himself recently characterized his Adélie Land value of about 10 cm of water lost per year by evaporation as a "very rough estimate" (LOEWE, 1957). Similarly a colleague of Liljequist, Charles Swithinbank, has recently concluded that at Maudheim "Rime and hoar-frost are rare, and their contribution to the snow surface is insignificant" (SWITHINBANK, 1957). It is hoped that the IGY observations will help settle this important problem.

Very truly yours,

HARRY WEXLER
Chief Scientist
U.S. IGY Antarctic Program
U.S. Weather Bureau,
2400 M. Street, N.W.,
Washington 25, D.C.

REFERENCE

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