ATMOSPHERIC ICE NUCLEI IN HIGH SOUTHERN LATITUDES

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(Manuscript received 29 August 1960)

Numerous sources of ice nuclei in the atmosphere have been proposed, but their relative importance has not been assessed except for particular cases. Typical sources are dusts of land origin, 2 aerosols resulting from industrial activity, 4 sea salt 5 and meteor dust. 6

Because many of the particles are known to be of the order of 1 μ in diameter or less, 7,8 they may stay in suspension for considerable periods, and it is difficult to find sites at which either land dusts or particles of marine origin are certainly absent, although, in the southern hemisphere at least, it is possible to avoid industrial pollution. Many observations have been made of the ice-nucleus concentrations in the southern hemisphere, summarized by Bigg, 9 at sites remote from centers of population. Although these were chosen for prevailing winds from the sea, both land dusts and marine aerosols could often have contributed to the nucleus populations. Comparison of these observations with those made at sea at various positions between Australia and Antarctica then offers the possibility of determining whether dust particles make a significant contribution to southern-hemisphere ice-nucleus concentrations.

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With the cooperation of the Director, Antarctic Division, Department of External Affairs, an expansion cold box of the type described by Warner 10 was therefore installed on the ANARE relief ship “Thala Dan,” proceeding to the Antarctic from Melbourne, Australia, in January 1960. The box was placed in an open corner of the upper deck. Mechanical and observational difficulties made it possible to operate only under relatively calm conditions, and altogether

it was possible to take only 13 sets of observations on 8 days between 12 January and 23 February (when mechanical breakages prevented further work.)

The individual measurements showed a degree of scatter no larger than is normally found with measurements on land, while the curves of number of nuclei active as a function of the temperature appeared to by typical of those found elsewhere in the southern hemisphere. Concentrations at three fixed temperatures are shown in the accompanying diagram, the dotted reference level being the mean given by Bigg for southern-hemisphere expansion cold-box measurements. If we bear in mind that the range of fluctuations in most long series of observations is greater than a factor of 10 about the mean, we see that the Antarctic counts are not significantly different from those nearer the equator. The conclusion is, then, that dusts of land origin cannot generally contribute greatly to nucleus concentrations in the southern hemisphere.

A further conclusion may be reached that, if the nuclei are of marine origin, their source is the open sea rather than the shoreline. It is not possible on the basis of these few measurements to further distinguish between maritime and meteoritic sources of nuclei, but clearly Antarctic waters are ideal for experiments of this nature, since the possibility of confusion due to other sources may be eliminated.

We should like to thank the Captain of the "Thala Dan," Captain H. C. Petersen, for his cooperation in allowing installation of the instrument and finding a suitable place for using it in the limited space available.