COUNTS OF ATMOSPHERIC FREEZING NUCLEI AT PALO ALTO, CALIFORNIA, JANUARY 1956

By R. N. BRACEWELL*

[*Manuscript received June* 29, 1956]

Summary

Measurements of freezing nucleus concentration were made at Palo Alto, California, each day during January 1956. They show maxima on two out of the three dates anticipated from the meteor theory.

I. INTRODUCTION

A cold chamber and cooling tank similar to that shown in Figure 1 of the preceding paper were operated at Palo Alto, California, during January 1956.

Instead of using dry ice as a coolant, the equipment was stored in a deep-freeze unit until required. Measurements were made in precisely the way described in the preceding paper, but were limited in number by the minimum temperature attained and the rate of warming of the cold chamber. Only three measurements were made daily (except on January 20 and 21 when four and five were made, respectively), at temperatures ranging between −20 and −16 °C.

II. RESULTS

The average number of crystals obtained is shown in Figure 1, together with the range of variation. The change in temperature between readings probably contributed to their scatter, but there were insufficient observations to make the necessary correction, except by forming an average over the whole period. Application of this correction made little change to the form of Figure 1. As the South African and Western Australian experience suggests that this procedure may be invalid, the rate of change of number of ice crystals with temperature varying from day to day, the results treated in this way have not been shown.

A peak on January 13 is quite clear in Figure 1, and if the curve is divided into three, representing first, second, and third (or warmest) trials, it shows on each. The peak of January 21 is clearly less significant because of greater scatter and appears on only the first and second experiments.

* Stanford University, California, U.S.A.

III. Weather Conditions

Detailed meteorological records for the period were not obtained, but the weather was foggy, overcast, or raining except on January 25 and January 28 to February 5 when it was fine. On the days of particular interest the conditions were :

13 : Overcast all day, no rain or fog.
21 : Raining lightly.
27 : Raining all day.
30 : Clear all day.

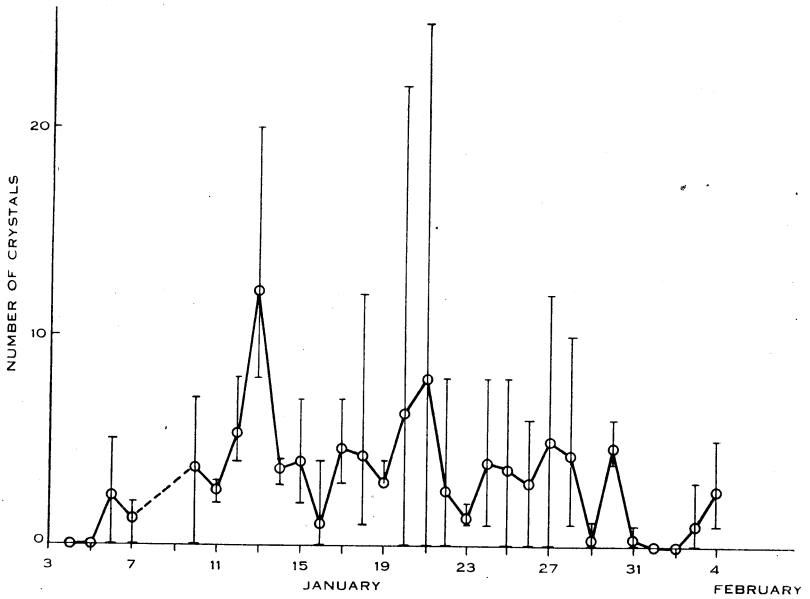

Fig. 1.—Total number of crystals observed in 3 l. at a mean temperature of —18·4 °C at Palo Alto, California.

IV. Discussion

The mean nucleus concentration for the whole sequence of observations was 3·3 per litre at a mean temperature of —18·4 °C, whereas the mean South African temperature for a count of 3 crystals per litre was —34 °C and the mean West Australian temperature —22 °C. Thus the nucleus concentration was apparently very much greater than in South Africa and significantly higher than in Western Australia. Since the South African measurements were made at heights of several thousand feet and the West Australian measurements were made in what was often pure sea air, there is a suggestion that the nuclei counted at Palo Alto included some of terrestrial origin. Of course, the reason for making measurements over Pretoria and at Carnarvon was to avoid possible contamination of the air by nuclei which could mask the meteoritic contribution being sought.

On any one day the consecutive readings showed a scatter consistent with the expected spread due to " patchiness " in the distribution of nuclei plus an

erratic component associated with the technique. This scatter, together with the non-meteoritic contribution, considerably reduced the sensitivity of the sequence of observations to any increases in nuclei which might be due to meteoritic dust.

In spite of this, the two principal peaks of Figure 1 fell on January 13 and 21, two of the critical dates in January already established by Bowen.

The author concludes (i) that these measurements support the earlier evidence from rainfall records that certain dates in January have worldwide significance and (ii) that ground level observations with simple equipment in unselected localities appear promising for studying this phenomenon.