

## CORRESPONDENCE

## CLOUD-SEEDING IN WESTERN VICTORIA IN 1966

by G. O'Mahony

The June 1968 issue of the Australian Meteorological Magazine, Volume 16, No. 2, pp. 56-63 contains a paper "Cloud Seeding in Western Victoria in 1966" by E.E. Adderley, and this paper is a reply to my contribution "Cloud Seeding in Wimmera/Mallee Victoria in 1966" which appeared in the September 1967 issue of the Magazine, Volume 15, No. 3, pp. 133-147.

Part of Mr. Adderley's objections to my analysis rests on the fact that I had used a restricted network of gauges and that these were selected after the seeding operations were completed. It would be apparent that my selection could be made only after details of the exercise had been published. My selection of gauges was made with the object of obtaining an adequate coverage of the target and control areas, bearing in mind the meteorological situations in which rainfall had occurred during the period August to October 1966.

Since reading Mr. Adderley's paper I have tested the adequacy of my selection by correlating the average values of my rain gauge readings in the various areas - that is, target, northern control, southern control, and western control - with the estimates of areal rainfalls which were derived from planimetered isohyetal patterns. To eliminate any suggestion of bias the isohyets were drawn and the planimetry was carried out by staff of the Hydrometeorological Section of the Bureau. The data used consisted of all available rainfall records for the relevant 42 periods of August to October, that is, from 1925 to 1966 inclusive. These cross-correlations were compared with those which were obtained using the planimetered values as one variate and the respective average of the rain gauges in the CSIRO networks as the other. For easy comparison the results are shown in tabular form in Tables 1 to 4, in which all correlation coefficients are based on 42 pairs of values, made up of readings for the years 1925 to 1966

Table 1 - Target Area

- p = planimetered value  
 1 = mean of CSIRO network of 20 stations\*  
 2 = mean of my original network of 5 stations  
 3 = mean of my secondary network of 8 stations

$$r_{p.1} = +0.997$$

$$r_{p.2} = +0.985$$

$$r_{p.3} = +0.992$$

---

\* This appears as 20 stations instead of 21, Berriwillock being omitted because its 1944 total is missing from Bureau records.

Table 2 - Northern Control Area (C.1)

- p = planimetered value
- 1 = mean of CSIRO network of 12 stations
- 2 = mean of my original network of 2 stations
- 3 = mean of my secondary network of 5 stations

$$r_{p.1} = +0.983$$

$$r_{p.2} = +0.961$$

$$r_{p.3} = +0.964$$

Table 3 - Southern Control Area (C.2)

- p = planimetered value
- 1 = mean of CSIRO network of 12 stations
- 2 = mean of my original network of 2 stations
- 3 = mean of my secondary network of 5 stations

$$r_{p.1} = +0.994$$

$$r_{p.2} = +0.969$$

$$r_{p.3} = +0.987$$

Table 4 - Western Control Area (C.3)

- p = planimetered value
- 2 = mean of my network of 3 stations

$$r_{p.2} = +0.981$$

In all cases it can be seen that while the sample correlation coefficients fall off with reduced network density, the decreases are small.

My main interest had been in the western control where the correlation coefficient appears as +0.981. Mr. Adderley has stated that this western control area is not a valid one because seeding was carried out further west than Bordertown. I must admit that I did not realise this when I selected the western area as a control, but if seeding so far to the west has invalidated this western area as a control, it has also invalidated the northern and southern areas selected by CSIRO. Investigation of rainfall situations in the period August to October 1966 shows that falls occurred with

winds with westerly components, the actual winds varying between  $340^{\circ}$  and  $210^{\circ}$ . Now if a line be drawn from the most western point of CSIRO seeding at an angle of  $340^{\circ}$  it will be seen that about 90% of the Southern Control area C.2 lies to the east of it, and so 90% of the Southern Control area would lie in the direct path of seeding material. Similarly, if a line from the most western seeding point is drawn at an angle of  $210^{\circ}$  it practically bisects the Northern Control, so exposing about 50% of that area to the seeding material.

After considering Mr. Adderley's paper and performing the subsequent analyses with correlations, I can see no reason to change my earlier conclusions that there is no evidence that the seeding in the Wimmera/Mallee in 1966 has had any noticeable effect on the rainfall. I believe my earlier conclusions are valid, that the case is not proven and that with only one year's operations it is not probable. I had set this out, I thought, fairly clearly in the appendix to my paper, and a simple analogy would be that of a coin which may possess one of the three following attributes:

- (a) it may have a 10% bias towards "heads";
- (b) it may be unbiased;
- (c) it may have a 10% bias towards "tails".

It would seem to me that with one single throw of such a coin Mr. Adderley implies that he can make a pronouncement as to which of the three attributes the coin possesses. From the appendix of my paper and transferring the variance of rainfall of the area to this mythical coin, I am still suggesting that about 50 throws of the "coin" will be required before such a pronouncement can be made with any justification, provided of course that the whole exercise has not been rendered invalid by ineffectual controls.

Commonwealth Bureau of Meteorology,  
P.O. Box 1289K,  
Melbourne, Victoria. 3001.

10 February, 1969.

#### REPLY

by E. E. Adderley

Mr. O'Mahony, in his letter, has completely missed the point of my paper and has produced only a set of irrelevancies.

The fact that his selections of raingauges are inadequate is shown quite clearly in Fig. 2 of my paper. The high correlation coefficients he quotes, in view of the same Fig. 2, are not appropriate for the purpose and quite irrelevant.