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A Cloud Seeding Experiment in Western Victoria

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Mr Warner, Chief, CSIRO Division of Cloud Physics, introduced his topic by referring to the ten requirements for a successful cloud seeding experiment that have been advanced by CSIRO and adopted by the WMO EC Panel on Weather Modification. These ten points can be reduced to the three essential requirements that have to be met before a cloud seeding experiment should be commenced. Mr Warner outlined these requirements as:

- 1 Meteorological and cloud physics studies should be carried out to ensure that suitable weather will be experienced.
- 2 Statistical studies should be carried out to ensure that expected changes can be detected from the background variability within the duration of the experiment.
- 3 Economic studies should be carried out to ensure that operational seeding will cost much less than the marginal benefit of increased rainfall.

The talk then established that these criteria have been met in western Victoria, where an extensive experiment is due to commence in August 1980 and continue for 5 years during the late winter and spring months.

For three seasons light aircraft have been flying in the vicinity of Warracknabeal gathering cloud physics information. Frontal rainfall is the most frequent and it would be hoped that this system could be suited to seeding. Unfortunately, the prefrontal clouds have been found to be high based and the rainfall is trivial and likely to evaporate before reaching the ground. Postfrontal clouds naturally generate sufficient ice crystals for the rain producing mechanisms. Thus rain systems associated with fronts in this area are not expected to be suited to seeding.

A less frequent weather system (approximately five times each season) is the closed low pressure system moving from the northwest. Rainfall rates are low but the precipitation can last for extended periods. The clouds of the systems are of deep layer form and considered suited to seeding. Conditions for seeding may last from a few hours to greater than 24 hours.

The historical records of rain in the experimental area have been used to examine whether the effects of synthetically increasing rainfall by small

amounts on a random basis could be detected within a five year period. The analysis was complicated by variations resulting from the orientations of the control/target areas - the most favourable experimental configuration reduced the chance of detecting an increase. Given that a doubling of the rainfall rate to 2 mm/h may be expected under the most favourable conditions the experimenters accept the small risk of not detecting a real increase in precipitation during the experiment.

The economics of rainmaking in the area has been examined for the normal broadscale farming - wheat growing. Wheat yield for winter/spring rainfall totals give reasonable correlation, although there is the suggestion that no improvement is received for higher rainfall seasons; the best incremental advantage from cloud seeding comes from seasons with below average to average rainfall. It has been estimated that as 30 per cent of the spring rainfall is due to the suited cloud type then the expected increased rainfall will increase yield, on average, to the value of \$1 million for the target area. With experimental costs of \$300 000 per year, and operational costs much less than this, there is potential economic advantage.

Having established that the three essential criteria had been examined and found to be satisfied, Mr Warner proceeded to discuss some of the characteristics of the experiment: the types of rain gauges and network being established; the seeding mechanism employed to ensure the required growth characteristics; the randomising of the seeding opportunities to satisfy statistical criteria; and the measurements to be made in support of the statistical assessment.

Questions at the conclusion of the talk were directed to the physical basis of the hypothesis and experimental design: the effects of radiation; alternative nucleating materials; and problems of change in wind direction after seeding has commenced. A few Fellows were concerned with intra-seasonal rainfall variability and crop yield. The attendance and range of questions at the talk was indicative of the interest that is being shown in Australia's largest meteorological experiment of the coming decade.

W.R.K.