SOME OUTSTANDING PROBLEMS RELATING TO RAIN MODIFICATION

JERZY NEYMAN and ELIZABETH L. SCOTT
UNIVERSITY OF CALIFORNIA, BERKELEY

1. Introduction and summary

This paper deals with two aspects of the problem of rain modification by cloud seeding: the meteorological aspect, concerned with the rainfall itself and with the possibility of its being affected by cloud seeding, and with the statistical aspect, concerned with the methodology particularly suitable for the treatment of the meteorological problem. The conclusions presented stem from an analysis of five major American rain stimulation experiments and of a Swiss hail suppression experiment Grossversuch III.

Our basic premise in discussing the meteorological problem is that, as documented below, there exist two (at least two) sets of synoptic conditions, say A and B, in which the seeding of clouds has opposite effects: in conditions A it increases the precipitation and in conditions B it decreases the precipitation. In a series of storms (or "rainy incidents") passing over a given locality these conditions A and B are mixed in varying proportions and we hypothesize that it is this varying frequency of conditions A and B that is responsible for the disappointing results of a number of cloud seeding experiments: too many days with conditions B were included so that the net effect is negative or zero.

Thus far, the identity of conditions A and B is not established and there are only certain vague hypotheses regarding them. However, and this is our second premise, these two sets of conditions appear identifiable in terms of the usual meteorological parameters such as pressures, wind velocities, fronts, and so forth.

In the light of these two premises, the foremost outstanding substantive problem of rain modification by cloud seeding is the identification, or the definition, in terms of meteorological parameters of the conditions A and B. Most probably these definitions will be relative, referring to the local orographic conditions and to the method of seeding.

Unambiguous indications that cloud seeding can increase rain come from Grossversuch III [1], [2]. Specifically, on the 103 days selected for the experiment by one of the forecasters, Mr. F. Ambrosetti, seeding appears to have produced an overall increase in precipitation amounting to about 80 per cent

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