

SOME PROBLEMS IN EVALUATING CLOUD SEEDING EFFECTS OVER EXTENSIVE AREAS

GLENN W. BRIER, THOMAS H. CARPENTER, and
DWIGHT B. KLINE

INSTITUTE FOR ATMOSPHERIC SCIENCES
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

1. Introduction

Recently we had occasion to examine a number of operational cloud seeding programs for possible effects of silver iodide ground seeding on the rainfall in areas downwind from the nominal target area. This preliminary report gives the results of the analysis performed to date on 16 operational programs in 11 project areas in eastern United States, involving a total of 62 seeded months.

Cloud seeding operations as objects for statistical evaluation are in contrast to most of the remaining papers in this symposium which are concerned with scientific experiments. However, we feel that the results obtained as well as some of the statistical techniques used may be of sufficient interest and importance to be discussed along with the numerous other problems in weather modification.

2. Analysis and results

A common procedure for evaluating the possible effects of cloud seeding on the precipitation in a target area is to compare the actual precipitation during a seeded period with that which would have been expected in the absence of seeding. This expected amount is determined from a regression equation describing the relationship between the average precipitation in the target area and the average precipitation in a nearby control area which presumably is unaffected by the seeding operation. This regression equation can be determined from a historical record during a period when no cloud seeding operations were known to have taken place. A measure of the effectiveness of cloud seeding is the anomaly d , the difference between the actual precipitation (Y) in the target area and that expected (\hat{Y}) if no seeding had been carried out, that is,

$$(1) \quad d = Y - \hat{Y}.$$

Since our concern was more with the pattern of anomalies outside and beyond the nominal target area than with the average over the target, we decided in advance of any data processing to modify the usual procedure by determining