CORRESPONDENCE

An Historical Note on an Early Cloud-Modification Experiment

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The work of the past decade and a half in the field of cloud modification adds interest to the history of earlier efforts aimed at altering natural cloud processes. I have recently learned of one such effort that, unlike almost all of the others of its period, was carried out by competent scientists on the basis of laboratory experiments and with a fairly definite underlying scientific hypothesis. The work in question does not appear to be known to present writers in the field of cloud modification and hence deserves brief summary despite its having yielded no conclusive results.

The study was aimed at the dissipation of low clouds over airfields and was done in the early 1920's. It was pointed out to me by Mr. Lloyd Perper of Tucson who, after learning of it several years ago, had located official correspondence on the study in files then held in the Wright-Patterson Library at Wright Field. The files contained discussions of progress of the work, especially as related to use of Army Air Corps airplanes, and included a letter signed by President Coolidge turning down a request for additional supporting funds on the now astonishing ground that the requested $15,000 was too large a sum for the government to spend on such experimentation.

In order to secure further information on this interesting bit of meteorological history, I contacted the principal investigator, Dr. E. Leon Chaffee, now Professor Emeritus, Harvard University. The following summary is based on several personal communications which Dr. Chaffee has kindly sent in reply to my inquiries.

Chaffee's work was begun in the summer of 1921 as a result of suggestions made to him by an acquaintance, a Mr. L. F. Warren, who had speculated rather casually on the possibility that cloud particles might be made to coalesce by sprinkling charged particles such as sand over the cloud. Warren was unaware of whether sand particles could, in fact, be charged sufficiently to produce such a coalescence effect, so Chaffee carried out experiments at Harvard in 1921 that led to design of a nozzle for charging sand and dispersing it from an airplane.

The sand was fed through the annular space between two cones, the outer one of which rotated at about 1000 rpm, the inner one remaining stationary. A potential difference of 20,000 to 50,000 v was maintained across the space between the cones by using a kenotron rectifier in such a way as to permit the sign of the potential difference to be readily reversed. Centrifugal effects caused the sand to pass out along the inside of the rotating cone, thereby acquiring a high charge due to the intense field prevailing in the annular space. A pure silica sand of 50 to 100 mesh was used. Laboratory measurements indicated that the nozzle gave charges of 35 to 40 esu per g of sand. Since one gram of 50-mesh sand contains about 30,000 grains, the nozzle could deliver sand grains having surface gradients of the order of 10^3 v per cm. A patent filed by Chaffee in 1925 and granted as No. 1832096 gives specifications of the nozzle and charging technique.

Two Army Air Corps aircraft were equipped with such charging nozzles, externally-mounted wind-driven generators supplying the power required. About 500 lb of sand could be dispersed in a flight distance of the order of 10 to 15 mi.

Flight experiments were carried out at Aberdeen, Maryland in August and September, 1924, under direction of R. O. Chaffee. Clouds treated were cumuliform type, with tops usually at 5,000 to 10,000 ft altitude. For safely reasons, the aircraft were always flown in the clear air just barely above the cloud tops. If no effects were observed on first treating a cloud with sand, polarity was reversed and treatment repeated.

Dr. Chaffee's communications described several trials considered successful in the sense that the clouds sprayed with charged sand dissipated shortly after treatment. However, since much more extensive experience gained in the past decade with such experiments has taught the need for extreme caution in ascribing "success" in any treatment designs of this type, no details will be recounted here. After a two-month period of aircraft work, further flight experiments had to be stopped because of lack of funds, so no final conclusions were drawn.

It is interesting commentary on subsequent developments in cloud physics that no really definitive critique of the probable effectiveness or non-effectiveness of the Chaffee experiments can be made even thirty-five years later. The work of Pauthenier and collaborators has given some indication that charge-effects may play an important role in drop-coalescence, but the matter still involves many unknown factors. Chaffee's work is of historical interest as an early attempt at scientific cloud modification. That it was basically inconclusive cannot be regarded surprising when one considers the equally inconclusive but far more numerous cloud-treatment efforts of recent years.