C1

NEW ZEALAND METEOROLOGICAL SERVICE

TECHNICAL INFORMATION CIRCULAR NO. 142

WEATHER MODIFICATION

At the Sixth World Meteorological Congress held in Geneva, 5-30 April, 1971, the World Meteorological Organization adopted the attached statement for use as a basis for replying to relevant enquiries. The statement appears as Annex 1 to the Abridged Report with Resolutions, Sixth Meteorological Congress and is reproduced for the information of all concerned.

TIC 142

J.F. Gabites

(J.F. Gabites)
Director

N.Z. Meteorological Service
P.O. Box 722
WELLINGTON

21 April, 1972

NEW ZEALAND METEOROLOGICAL SERVICE

PRESENT STATE OF KNOWLEDGE AND POSSIBLE PRACTICAL BENEFITS IN SOME FIELDS OF WEATHER MODIFICATION

1. General

It has been demonstrated that ice crystals may be caused to form in supercooled clouds by seeding them with dry ice, silver iodide and other nucleants. Ice crystals are known to play an important role in the formation of precipitation and therefore cloud seeding provides a means for modifying the precipitation process in supercooled clouds. Conversion of a supercooled cloud to ice by seeding releases latent heat which can have important dynamical effects. The varied and controversial results of seeding experiments appear to be due to the complexities of the dynamics and microphysics of the precipitation process. An encouraging beginning in the understanding of these processes has been made through the development of numerical models which incorporate both the dynamics and microphysics and their interactions. Such models and their successors can be expected to define more clearly the most favourable seeding situations and the observations needed for the evaluation of the results. Although some experiments have apparently yielded positive results, the possible practical benefits of weather modification can be realized only through an increased research effort. This research should be directed primarily at cloud dynamics and the interactions of the dynamics with the microphysics, since knowledge of the latter is relatively more complete.

Some experiments have been made to test the possibility of seeding warm clouds with salt particles or water droplets in order to increase precipitation. The results obtained from these experiments have not been conclusive.

Particularly in the case of rain stimulation, it appears that the most sophisticated statistical procedures are an inadequate substitute for more complete knowledge of the atmospheric mechanisms. However, statistical design and evaluation of experiments are necessary partners of increased physical understanding in the further development of weather modification, particularly in connexion with the evaluation of the practical results of experiments.

It is important to emphasize that weather modification is still largely in the research stage. For this reason, operational efforts should be undertaken only after the most careful study of the particular situation by experts and with the understanding that the desired end results may not always be achieved.

Brief summaries of the current status of weather modification in several categories are given below.

2. Stimulation of precipitation

Of the many experiments conducted in this field, only a few have clearly demonstrated that seeding has increased the precipitation; in some cases there is even evidence of a decrease in the precipitation. However, there is some evidence that orographic precipitation can be modestly increased by seeding, particularly during the winter, over the mountain ranges of the western U.S.A. There is also some evidence that certain sub-tropical convective clouds, selected on the basis of numerical models, become taller and larger when they are heavily seeded so as to release latent heat. In view of the high correlation between the size of convective clouds and the rainfall from them, the seeded clouds presumably give more rain than if they had not been seeded. Confirmation, however, is required from further suitably designed experiments.

3. Dissipation of fog

Supercooled fog and stratus can be dissipated by seeding them with ice nucleants or by means of cooling agents. This has been brought into operational use at several airports at which there is a relatively high incidence of supercooled fog. The more common warm fog may be dissipated by the use of heat, hygroscopic particles and the down-wash of helicopters. Successful experiments have been reported with each of these techniques but, in addition to other disadvantages, they have been considered too expensive for general use. Recent experiments, guided by numerical modelling and using carefully sized hygroscopic particles, offer some prospects for a more economical technique.

4. Hail suppression

After extensive experiments and the development of a model of hail growth, substantial successes in the reduction of hail damage have been reported from the U.S.S.R. Recent experiments in other countries have shown some reduction in hail damage with varying techniques, but more adequate numerical and physical models need to be developed.

5. Hurricane modification

Recent hurricane seedings off the eastern U.S.A. coast have been accompanied by reduced maximum wind velocities for short periods. Confirmation is required from further experiments. In view of the limited opportunities for hurricane seeding, there is need for improved numerical hurricane models to strengthen the scientific basis of the hypothesized hurricane modification and to provide guidance for future experiments.

Note: A survey of several aspects of weather modification has recently been prepared by Professor M. Neiburger as WMO Technical Note No. 105, entitled Artificial modification of clouds and precipitation.