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STATEMENT ON WEATHER AND CLIMATE MODIFICATION

The following statement was issued by the American Meteorological Society on 27 October, 1967. It is the latest statement of that body on the current status of weather modification.

It is reproduced here for general information.

J.F. Gabites

(J.F. Gabites)
Director

New Zealand Meteorological Service,
P.O. Box 722,
WELLINGTON.

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AMERICAN METEOROLOGICAL SOCIETY

STATEMENT ON WEATHER AND CLIMATE MODIFICATION*

October 27, 1967

The objectives of weather and climate modifications focus on the deliberate production of beneficial changes in the weather or climate. These objectives are as ambitious as any ever set by physical scientists.

Interest in modifying the weather dates back to primitive times, but only in the last two decades have scientific methods been brought to bear on the problem. The development of greater knowledge of clouds and precipitation has indicated ways by which they may be modified. A growing understanding of advanced observational and computational facilities have brought about a growing feeling of optimism that it should be possible to modify weather on greater scales in time and space.

At present, man's influence over the weather and climate is still very limited; however, his knowledge of the behavior of clouds and the atmosphere is increasing. Meteorologists by and large are convinced that the promise is sufficient, and the economic and social benefits are so enormous, that greater research effort over an extended period of time is fully justified. Reasonable arguments lead to the conclusion that, with this effort, ultimately it should be possible to reach our goals.

Weather modification and control embrace a wide range of types and scales of phenomena and impinge on a great variety of human activities. In a sense, the cooling, heating and ventilating of houses can be considered an example of weather modification. As another example, a city changes the motion, temperature, and cleanliness of the air passing across it. Weather modification in a house is deliberate and controlled; the weather modification over a city is inadvertent and to a considerable extent uncontrolled.

On a larger scale scientists are working on controlled weather modification over areas the size of a watershed, principally in attempts to increase precipitation in order to augment the supply of usable water. On a still larger scale, research currently in progress is concerned with the possibility of affecting the development of storms and storm systems.

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* This statement supersedes the Statement on Weather Modification of May 10, 1967.

Reference to climate modification usually implies the possibility of modifying certain meteorological characteristics of an area over a long period of time. The size of this area may range all the way from a farmer's field in the lee of a windbreak to a region extending over several states or even continents. The effect produced by windbreaks is well understood, but discussion of ways and means to modify climate over large areas is still in the realm of scientific speculation.

A great deal of public interest is focused on the possibility of modifying precipitation. Most work in this type of weather modification has involved the seeding of clouds with small particles that become nuclei for the formation of ice particles and subsequently snow or rain. This approach is based on the still uncertain assumption that in many cases the air is naturally deficient in ice-forming nuclei. The National Academy of Sciences in 1966 reported "that precipitation increases of the order of 10% apparently can result from ground-based silver-iodide seeding of winter orographic storms" (note that this augmentation means 10% more than would have fallen in the same period had there been no seeding.) This conclusion refers specifically to winter mountain storms in the Western United States, but similar results apparently have been obtained from some experiments in other parts of the world. In some other projects, rainfall increases were not detected following seeding. In still others there is some indication that precipitation may have been decreased.

The National Academy of Sciences also reported that in "14 operational silver-iodide seeding projects in the Eastern United States, including but not limited to cumulus clouds, experiments have indicated variable rainfall increases averaging about 10% to 20% in the nominal target areas," but these results are not as clear-cut as in the case of orographic storms. Widely varying results have been reported for similar situations in other countries.

In general, we agree with the statement made by the National Academy of Sciences that "there is increasing, but still somewhat ambiguous, statistical evidence that precipitation from some types of cloud and storm systems can be modestly increased or redistributed by seeding techniques." It is essential that research in this area be expanded. Many crucial aspects need additional study; for example, the downwind effects of cloud seeding must be clarified, the immediate effects of seeding individual storms need specifically to be identified as opposed to their being subjected to statistical averaging and it is essential to develop a better understanding of the specific physical conditions under which seeding produces an increase or decrease of precipitation or has no effect at all. To this end, a vigorous program of research on precipitation mechanisms must be continued. This will involve considerable theoretical work in conjunction with laboratory and field experiments.

The evidence on hand indicates that cloud seeding can neither produce nor terminate droughts. Such conditions are

associated with persistent patterns of air motion which inhibit the formation of clouds and precipitation. Clouds must be present for the occurrence of natural or man-made precipitation.

The possibility of suppressing hail and lightning remains in doubt, but there are indications here and abroad that some degree of success may be possible and research should therefore be actively continued.

The clearing of supercooled or "cold" fog (consisting of liquid-water droplets at temperatures below freezing) is operationally feasible. But except by the expensive application of large amounts of heat it is not yet possible to clear a sizable area (such as a modern airport) of the more common "warm" fog characterized by temperatures above freezing. Further, no method has been found to clear fog composed entirely of ice crystals.

With respect to the possible modification of hurricanes, it is the scientific consensus that cloud-seeding techniques of sufficient merit have been advanced to warrant cautious field experimentation coupled with continuing effort to develop a more adequate understanding of the genesis and behaviour of these storms. With respect to storms and storm systems in general, the knowledge of large-scale characteristics is reasonable; however, the interaction of large- and small-scale phenomena such as precipitation bands and cells is not well understood, and practical success will be negligible until greater progress has been made in the development of adequate theories accounting for the interactions.

It is important to recognize that modification on the larger scales (storms and storm systems) either advertent or inadvertent, could be irreversible and deleterious. The rapid advance in computer modeling of atmospheric systems coupled with the capability of observing the weather on a global basis, should permit us to approach these possibilities with understanding and intelligence so that field tests can be planned to reduce the risk to acceptable levels.

Large-scale experiments aimed at weather and climate modification will of their nature be international in character and will, therefore, require international consultation and co-operation.

The legal consequences of weather modification can be foreseen in part, but until greater understanding is gained through research no definite statement can be made on this important aspect of the problem. At this time the American Meteorological Society cautions against detailed legislation which might inhibit instead of encourage the proper development of weather modification to the benefit of all people.

In summary, weather and climate modification present opportunities for achieving great benefit to mankind. They deserve the continuing attention and understanding of scientists and the general public.