

## Weather modification: Uncertainty, hope and three proposed goals

One matter always strikingly evident in discussions of weather modification is the contrast between the ingrained caution of atmospheric scientists and the enthusiastic convictions of commercial cloud seeders. In the early 1950's possibly as much as 10 percent of the land area of the United States was under commercial seeding operations. The annual cost was several million dollars. Most scientists at the time considered these programs premature and probably ineffective.

Today, two decades later, the central conclusion of a new report of the National Academy of Sciences entitled "Weather & Climate Modification" emphasizes that despite many advances, the subject is still fraught with uncertainties: "The panel now concludes on the basis of statistical analysis of well-designed field experiments that ice-nuclei seeding can sometimes lead to more precipitation, can sometimes lead to less precipitation, and at other times the nuclei have no effect, depending on the meteorological conditions."

This conclusion seems to portray accurately the awareness of scientists that the results of field experiments in weather modification have been mixed. Some experiments, like those carried out in recent years in Florida, have shown encouragingly positive results; others, like the still-debated Project Whitetop in the 1960's, produced less rain, not more.

Still, says panel chairman Thomas F. Malone of the University of Connecticut, "progress has been made during the past few years," although much slower progress than had been hoped for. The new report, issued this week, updates a 1966 NAS report on the same subject.

The most successful major weather-modification research efforts have been those seeding winter clouds over mountains to stimulate greater snowfall. This technique has "demonstrated that precipitation can be increased by substantial amounts."

The mixed results of projects to stimulate more rainfall emphasize "the complexity of the processes involved," says the report, and point to the need for "a more careful

search" to learn exactly when to seed what clouds.

As for hail reduction, the panel finds "there is now more optimism than there was seven years ago." It points to Project Stormfury's meager but encouraging data that hurricane winds might be reducible and also calls for a "vigorous program of tornado research" to help mitigate the destruction of these severe storms.

Longtime followers of weather-modification research efforts will find little new information in the report but will profit from its long-view perspective on a subject that has produced its share of controversy and debate.

The report takes full cognizance of the immense public-policy issues inherent in weather modification. Increasingly, it notes, the crucial question in the future will be: "What weather-modification activities are in the public interest?"

The report notes disapprovingly evidence that the United States carried out weather-modification activities in Southeast Asia in support of military operations during the late 1960's. Malone says the record of the Senate hearings a year ago on these activities "must rank among the more astounding testimony ever presented before the Congress." The panel proposes a United Nations resolution dedicating all weather-modification efforts to peaceful purposes.

All in all, the panel found the field of weather modification ready for the identification of major goals as part of a national strategy. It proposes three goals: place precipitation modification on a firm basis by 1980, develop the means in the next decade to mitigate severe storms and weather hazards and determine by 1980 the extent to which man is inadvertently modifying weather and climate.

To achieve these goals, the panel calls for a level of funding that would approximately double the extent of current research efforts. The request seems to have little likelihood of being met. As the panel itself notes, weather modification is not yet being funded at the \$30-million level recommended by the panel's earlier report in 1966.

ripens unevenly. It separates on the head and falls into the water a few grains at a time. A commercial non-shattering strain was developed in 1965 by the Manomin Development Co. at Deer River, Minn. Further research is needed in the area of plant diseases and parasites.

Yet, by 1972, 20,000 acres of wild rice paddies had been built in Minnesota. According to a report in the Department of Agriculture publication SOIL CONSERVATION, approximately 1,000 new acres of wild rice is expected to be added each year.

Those most affected will be the 3,000 Chippewa Indians living on the Red Lake Reservation. They own more than 40,000 acres of land suitable for growing wild rice. Yet, they face considerable obstacles cultivating it. Lack of money is the main one. Because wild rice is a new crop, specialized machinery is expensive, and for certain operations, the right machinery has not been developed. Loans and crop insurance are difficult to get. But if the wild

rice industry develops, the benefits for the reservation and surrounding areas are numerous.

The paddies could prevent flooding along the Red River of the North by serving as temporary water reservoirs for spring runoff.

They would provide nesting grounds for waterfowl and spawning grounds for the northern pike. Thus, the reservation could further increase its income by selling special hunting permits for migratory waterfowl.

Increased paddy acreage will increase labor demand. Eventually, a processing plant will be needed in the area.

"Paddy rice really helped the economy here," says Beltrami County Commissioner Carl Falk. "Before this started, you never saw any big tractors here, because no one could afford them. We were really in bad shape. There was nothing here—but now, look around town. And it's going to get bigger. I think water will finally be our controlling factor. Nothing else in the world is going to stop this." □

## Weather satellite fails to orbit

The latest in a series of advanced weather satellites failed to achieve orbit this week and presumably fell into the Pacific Ocean.

The Improved TIROS Operational Satellite (ITOS-E) was launched by NASA for the National Oceanic and Atmospheric Administration (NOAA) from the Western Test Range in California. According to preliminary analysis, the second stage of the Delta rocket shut off 50 seconds early, thus failing to boost the satellite into orbit.

ITOS-E would have joined NOAA 2 (SN: 6/9/73, p. 374), a twin spacecraft which was to serve as a backup. The failed satellite would have beamed global measurements of atmospheric temperatures directly to nations around the world. Its data would have provided a vertical temperature profile of the atmosphere from sea level to 20 miles above the earth. □