earth sciences

Gathered at the U.S. Weather Services' centennial symposium in Washington last week

WEATHER FORECASTING

Prediction batting average

The public's judgment of the accuracy of weather forecasts is at best subjective; a rain-drenched golfer is not likely to remember the correct forecasts of sunshine for the previous three days. The Weather Bureau, says Director George P. Cressman, has other ways of rating its own forecasts.

On a scale of 100, the forecasting of temperature anomalies is given an accuracy score of about 88 after one day, gradually decreasing to 15 after six days. Precipitation forecasts score 52 after one day, 10 after four and a half days. Forecasts of gale-force winds preceding hurricanes score 80 after a half day, 50 after one day, zero after three days.

Stated another way, the limit of imperfect but useful prediction is about five days for temperature anomalies, two days for precipitation, one and a half days for gales, 12 hours for hurricane-force winds and heavy snow and less than three hours for thunderstorms.

Over the last 25 years a steady improvement of forecast accuracy is evident. The number of errors has been cut almost in half. This has raised the percentage of correct forecasts in Chicago, for instance, from 82 percent to 90 percent. Hurricane forecasts have improved steadily but snowfall forecasts have not.

Surveys show, Dr. Cressman says, that the public's greatest need and desire is not for more extended forecasts but for more reliable forecasts in the 6- to 24-hour range. Many scientists agree that this is where improvement is most needed—and where it will be most difficult.

CLOUD SEEDING

Both pessimism and optimism

"The last 20 years of effort in cloud seeding have been a waste," proclaims Britain's leading weather official. "We have made very little progress in understanding or in improving the technology."

The remarks by Dr. Brian J. Mason, director-general of Meteorological Office in England, reflect the general feeling of disappointment in the results of efforts to increase rainfall by cloud seeding.

The goal has proved difficult. Some experimental cloud-seeding programs, like the Whitetop experiment, have even produced decreases in rainfall (SN: 2/14, p. 173).

The basic problem, says Dr. Mason, is a lack of sufficient understanding of medium- and small-scale processes in the atmosphere. The factors responsible for the atmosphere's large-scale circulation are generally understood, but the smaller processes such as those operating within a thunderstorm and within individual clouds represent a big problem.

Despite the unclear and puzzling results on many cloud-seeding programs, an experimental project on cumulus clouds by the Environmental Science Services Administration and the Navy has been giving encouraging results. Analysis of the 1968 tests has recently been completed.

The program differs from some earlier ones. Its initial goal was to enhance the growth of individual cumulus clouds rather than being directly concerned with increasing rainfall. But increased rainfall appeared to be a likely by-product of the invigorated cloud dynamics.

Of cumulus clouds seeded over Florida in the most recent field experiment, 13 of the 14 increased explosively. The average precipitation of the seeded clouds was about double that of the controls. One cloud dropped 850 acre-feet of water in the 40 minutes following seeding; a nearby control cloud leaked 26 acre-feet in the same interval.

"The work so far demonstrates that very large changes in size, duration and rainfall can under specifiable and predictable conditions be produced in individual cumulus clouds," reports the director of the project, Dr. Joanne Simpson of ESSA's Experimental Meteorological Laboratory. "Whether these results have important implications for larger scale meteorology depends on whether they can be reproduced frequently over large areas."

CLIMATOLOGICAL MODELING

Ice age in a computer

By the mid-1980's, predicts Dr. Edward N. Lorenz of the Massachusetts Institute of Technology, atmospheric scientists should be able to reproduce an ice age in a computer.

Such an achievement would be a significant extension of the work in numerical modeling of the atmosphere and of the ocean circulation now going on in several laboratories (SN: 9/6, p. 185, 12/13, p. 553). In these techniques mathematical equations are used to simulate the behavior of the fluid envelopes.

The first use of the ability to simulate an ice age in a computer would be to test the various hypotheses for origin of the ice ages. For instance, an investigator could put data on sea-ice and ocean-temperature variability into the computer model and see if an ice age would result. One might also be able to determine the long-range climatic effects of man's addition of carbon dioxide, water and dust to the atmosphere about which there are now conflicting views (SN: 11/15, p. 458).

INSTRUMENTATION

Radiosonde collision hazard

The advent of infrared soundings of the atmosphere from satellites (SN: 11/29, p. 509) makes feasible the reduction of one hazard associated with the use of radiosondes: collision with aircraft.

Dr. Vincent E. Lally of the National Center for Atmospheric Research urges the weather services to ban all radiosonde flights over the continental United States above 30,000 feet. The impact of one of these balloon-borne instrument packages with a jet airliner flying at 550 knots could shatter the windshield, he says. It is estimated that in the next 10 years one such collision will occur. He suggests the ban as a U. S. Weather Services centennial birthday present to aviation.