

White said. It will have its first meeting this spring, in the United Kingdom. WMO will soon begin approaching nations in the tropical Atlantic region—Venezuela, Nigeria, Gabon, Brazil, and others—on plans to set up stationary bases. Participating countries will decide before next January what funds, men, and equipment they will donate.

"The purpose of the Tropical Experiment is to examine and understand the energy transformation processes in the tropics," White said. He explained that weathermen cannot make truly accurate predictions unless they know and understand the weather all over the globe; satellites, beginning with TIROS I in 1960, have helped to provide such information, but there are gaps in coverage.

The Tropical Experiment will be the second large experiment of the Global Atmospheric Research Project, sponsored by WMO and ICSU. The first, the Barbados Oceanographic and Meteorological Experiment, took place during May, June, and July of 1969 in an area east of Barbados in the West Indies (*Science*, 28 March 1969).

The Brussels conference agreed that a third experiment would be carried out in a few years—probably some time after 1975, White said. The joint organizing body of WMO and ICSU was asked to come up with plans at another international meeting, to be held next year. Tentative plans call for around-the-globe simultaneous weather observations, designed to determine how efficient the existing weather observation system is and how it can be improved. All data would be fed into computers, and from them would emerge a 2-week forecast. This effort would require instantaneous transmission of data from even the remote parts of the world and the development of computers capable of turning out forecasts at very high speed.

The Brussels conference fell in the centennial year of the establishment of the United States weather service. In America, weathermen have progressed from simple observation, to theoretical models, to efforts to modify certain types of weather. The same pattern seems to be developing in the World Weather Watch.

American weathermen began by predicting storms on the Great Lakes and at sea, issuing frost warnings to farmers, warning of floods and hurricanes, and exchanging weather data with meteorologists in other countries. The first telegraphic network of weathermen



Early 20th-century weathermen frequently used kites to carry instruments aloft. This site is near what is today Washington National Airport.

was a group of amateurs, organized by Joseph Henry of the Smithsonian Institution in 1849.

A series of terrible storms on the Great Lakes led to the official establishment of the weather service as part of the military establishment in 1870. The work of the weather service was transferred to the Department of Agriculture in 1890, as it became increasingly important to civilian life.

Early weathermen used balloons, kites, thermometers, and barometers to make their observations, which were communicated by telegraph. After 1900, weathermen acquired the use of wireless telegraphy, radio, and airplanes. In 1908 the weather service began weekly forecasts and a warning system for forest fires.

The first sophisticated theory of weather was the polar front theory, developed by Norwegian professor Vilhelm Bjerknes and his son Jacob during World War I. Their theory postulated interacting air masses and warm and cold fronts. In 1926 the Weather Bureau was given its first clear-cut authority to conduct research (in support of aviation); this function was expanded into a Meteorological Research Division in 1936.

In 1939 Professor Carl-Gustaf Rossby and his colleagues at the Massachusetts Institute of Technology developed a mathematical technique for forecasting the movement of planetary winds. The winds, now called Rossby waves, steer the cold and warm air masses that cause surface weather; the waves are

hemispheric in scale and circle the globe.

Now, more sophisticated models of the many layers of the atmosphere are in use. Weathermen are assisted in making these three-dimensional models by computers, satellites, radar, and a wide range of new observational techniques.

By 1951, scientists of 30 nations, including the United States, were actively experimenting with weather modification. Artificial nucleation (seeding) techniques are used on clouds and hurricanes, for example. A snow modification project is being tried around lakes Erie and Ontario in an effort to spread inland some of the heavy snowfall in that region. Experiments are being conducted on modifying hail storms, fogs, and lightning.

On a global level, the international weathermen are still at the predicting and theorizing stage—and there are still many areas of the world where local weathermen base their predictions on rheumatic joints!

—NANCY GRUCHOW

*Erratum:* Due to an oversight, credit was not given for Fig. 1 of "Object-carrying by rats: an approach to the behavior produced by brain stimulation" by Anthony Phillips *et al.* (14 Nov. 1969, p. 903). The figure was modified from figures which appeared in J. F. König and R. A. Klippel, *The Rat Brain: A Stereotaxic Atlas of the Forebrain and Lower Parts of the Brain*, published by the Williams and Wilkins Company, Baltimore, Maryland, 1963.

*Erratum:* In "*Toxoplasma gondii* in cats: fecal stages identified as coccidian oocysts" by J. K. Frenkel *et al.* (6 Feb., p. 893), the last sentence of paragraph 1, column 3, page 894, should read "Two unfed kittens did not excrete oocysts, nor was *Toxoplasma* isolated from their fed feces or organ passages."