World Weather Watch

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In a memorable address before the United Nations in September 1961, President John F. Kennedy proposed a four-point program, for the peaceful use of outer space, to be developed under the auspices of the United Nations. One part of the program consisted of an international collaborative effort "in weather prediction and eventually in weather control." The General Assembly responded with a unanimous resolution calling upon Member States, governmental and nongovernmental organizations, to develop programs which would advance the state of the atmospheric sciences leading to a surer knowledge of the basic physical forces affecting climate, to the improvement of weather forecasting and to the exploration of the possibilities and limitations of large-scale weather modification. These resolutions stimulated extensive discussion, study, and planning within governmental and nongovernmental circles in this country and abroad.

From these discussions, it has become clear that new dimensions of scientific research and international cooperation have been opened up by the following three developments.

1) Theories on physical processes governing atmospheric motion have advanced to the state at which moderately realistic mathematical models can be constructed to simulate a variety of atmospheric systems ranging in scale from individual clouds to the global wind systems. Although still in a relatively rudimentary stage, these models constitute a point of departure for replacing empiricism with physically meaningful weather prediction techniques.

2) Our ability to measure quantitatively the variables that determine the state of the atmosphere has increased rapidly in recent decades. Radiosondes, meteorological radar, and a host of both direct and indirect sensing methods have been augmented in dramatic fashion by the development of the meteorological satellite which, for the first time, offers promise of bringing the global atmosphere under observational surveillance in a real-time data system.

3) The advent of high-speed electronic computers which has hastened the promise of being able to integrate the nonlinear, partial, differential equations governing atmospheric motions by numerical methods. Computers, in turn, provided a powerful new tool for the growing number of investigators seeking to understand atmospheric processes by means of analysis of the relevant mathematical equations and anxious to perfect the power of these methods in numerical weather prediction.

A two-pronged response has been generated to the United Nations' resolution. The World Meteorological Organization—a specialized agency of the United Nations—has advanced the concept of a World Weather Watch (WWW), an international system to bring the global atmosphere under observational surveillance and to disseminate worldwide weather data quickly and effectively. The Committee on Atmospheric Sciences, sponsored jointly by the International Council of Scientific Unions and the International Union of Geodesy and Geophysics, has proposed a global atmospheric research program (GARP) which has as its objective the scientific understanding of the general circulation of the earth's atmosphere below 30 kilometers. Quite clearly the two programs interact strongly with each other.

Recent developments in this World Weather Watch program will be discussed at a symposium to be held during the 133rd AAAS annual meeting, 28 December 1966. Speakers and their topics will be as follows: Robert M. White (Environmental Science Services Administration, Rockville, Md.), "World Weather Watch"; Walter Orr Roberts (National Center for Atmospheric Research, Boulder, Colo.), "Global Atmospheric Research Program"; Joseph Smagorinsky (Institute for Atmospheric Sciences, ESSA, Washington, D.C.), "Numerical modeling for the World Weather Watch"; and Morris Tepper (Meteorological Systems, NASA, Washington, D.C.), "Satellite tools for the World Weather Watch." They will discuss the two broad, continuous, and parallel streams of action of the World Weather Watch. The first stream involves the introduction of proven technology into the existing international weather system. The initial phase of the first stream should seek to achieve three significant improvements in this system by 1971—an improvement in the ability of the system to observe the global atmosphere and to acquire more complete data for weather forecasting, routine preparation of meteorological charts and analyses for the entire globe by electronic computers, and the development of an international communications network for the rapid exchange of raw data and for the timely dissemination of weather analyses and forecasts. The second stream will simultaneously pursue the work of research and development on new technology.

The goal of the second stream should be to bring the new technology to operational status in the early 1970's so that it can be fed into the first stream. The second stream is essential to bring the cost of the World Weather Watch down to a desirable level. The new technology on which the second stream is focusing involves the meteorological satellite, interrogation of horizontal sounding balloons by satellites to provide upper-level winds, automatic meteorological ocean buoys, the communications satellite, mathematical procedures for the creation of models of the atmosphere, and the high-speed electronic computer. Each of these components is in a varying stage of development.

The scientific objective of GARP

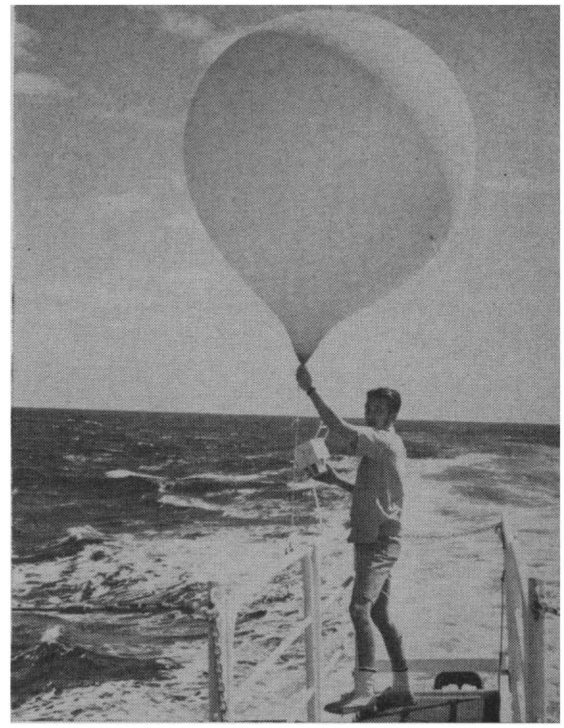
is to formulate a general theory of climate to extend the time range and improve the accuracy of weather forecasts and to explore the scientific aspects of large-scale weather and climate modification. It turns out that the large-scale elements of the atmospheric circulation are so strongly coupled that they can be understood only in combination, that is, the entire atmospheric envelope must be treated as a single physical system.

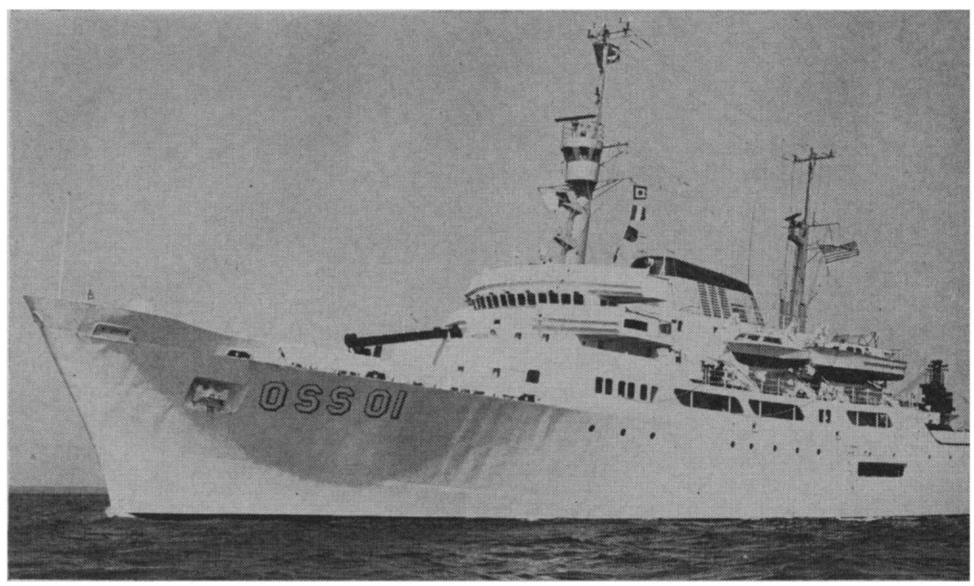
Recent studies have suggested that the large-scale features of the atmospheric circulation can be predicted in time and space for periods up to 2 weeks or more. Systematic exploitation of this possibility, however, is severely limited by the lack of observations sufficient to specify the initial state of the atmosphere as well as to verify the accuracy of integrations performed by finite difference methods. In addition, problems of the energy exchange between the atmosphere and the underlying surface, the role of water in energy transformation, the interaction of small-scale and large-scale phenomena, and the development of a computer two orders of magnitude faster than those presently available still remain to be resolved. Prospects, however, are attractive and a 12-month period in the early 1970's has been proposed for intensive observational study and analysis of the troposphere and lower stratosphere.

The ultimate benefits to mankind are attractive. The advantages to agriculture, commerce, transportation, and industry are potentially very large. The commonality of interest among all nations is precisely the kind of base upon which successful international cooperation has been built in the past and can be structured in the future. Since both the World Weather Watch and the GARP presume a worldwide integrated observational, communications, and data processing system, it is likely that quite new patterns and mechanisms for international cooperation will need to be devised. These problems, as well as the scientific and technological aspects of the program, will be discussed during the symposium.

The symposium was arranged by John E. Masterson (National Center for Atmospheric Research, Greenbelt, Md.). Louis J. Battan (University of Arizona) will preside.

THOMAS F. MALONE
Travelers Insurance Company, Hartford, Connecticut





*Equipment to be used in conjunction with the World Weather Watch Program—
Top: Radiosonde launching.
Center: Research vessel, Oceanographer.
Bottom: Automatic picture transmission station.*

[*Photos courtesy of ESSA*]