

METEOROLOGY

Long-Range Weather

A new method for long-range weather forecasting, based on a mathematical model and using a computer, gives meteorologists hope for accurate prediction.

► A WAY TO PREDICT weather patterns several weeks in advance has been discovered. An electronic computer and newly solved basic equations of atmospheric motion are the essential ingredients.

When fully worked out, the method will give a much more detailed description of long-range weather than now possible. Such a forecast might read: East Coast residents can expect generally clear skies and colder than normal days during the period from Feb. 17 to 21. However, it will not predict the weather for a specific city on a specific day 30 days in the future.

Nevertheless, the method will yield considerably more specific forecasts than the present 30-day ones. These predict only whether temperatures and precipitation for differing regions will average above or below normal for the period involved. Even such limited forecasts have been invaluable aids to the Government, business and the public, and saved unknown millions of dollars yearly.

Dr. Joseph Smagorinsky, chief of the Weather Bureau's general circulation research section, reported his success with the computer forecasts at the American Association for the Advancement of Science meeting in Washington. He told SCIENCE SERVICE the experimental predictions had been carried 35 days in the future and were being continued.

Dr. Smagorinsky said it took the computer approximately three hours to complete a forecast for one day, even though the

mathematical model used was a simplified one in which atmospheric motions are plotted only at two levels, about 8,000 and 35,000 feet above the earth's surface.

He said the mathematical model had originally been devised only to give long-term trends in weather patterns. However, when numerical solutions were worked out by the computer, the method also yielded some details, such as the presence of frontal structures.

Dr. Smagorinsky said the development gave meteorologists, for the first time, a "firm base for constructing realistic models" of atmospheric behavior. He reported that his mathematical model uses basic hydrodynamic equations never before previously solved successfully. The equations are set up to simulate the vertical structure of the atmosphere in a simple fashion.

Success in doing this, he said, now allows meteorologists to deal with much more complex atmospheric models.

Dr. Smagorinsky said work was now underway to improve the present method, including a separate attack on the problem of predicting precipitation several weeks in the future. Another problem due for investigation is the effects of changes in the sun's output on earthly weather.

He estimated that within three years he would be able definitely to determine how much influence the sun's radiation has on weather and the nature of this influence.

When the mathematical model is permitted to evolve in the same way the

atmosphere would, Dr. Smagorinsky said it yielded energy transformations that quite closely resemble the observed transfer of heat from equatorial to polar regions.

The atmosphere, he explained, seems to possess an inherent cycle that meteorologists have termed the index cycle. This is the period required for the general characteristics of atmospheric motion to change and then reach another stable pattern.

At one point in the index cycle, atmospheric flow is zonal, or relatively parallel to the equator. This pattern gradually breaks down until large troughs and ridges are formed and the atmosphere is comparatively turbulent. A change from a high index cycle, when the weather is usually fair in middle latitudes, to a low index cycle, when storminess is rampant, can take anywhere from one to six weeks.

Dr. Smagorinsky said his mathematical model worked out for all regions of the Northern Hemisphere from the equator to the pole. Previous models of the general circulation have hit snags in predicting weather developments for equatorial regions.

He said the present development was an outgrowth of pioneering work on numerical weather prediction done by the late Dr. John von Neumann, Drs. Jule Charney and Norman A. Phillips, now of Massachusetts Institute of Technology, while at the Institute for Advanced Study, Princeton, N. J.

Science News Letter, January 17, 1959

GEOLOGY

Arctic Tunnel Built To Test Ice Movement

► A TUNNEL 1,150 feet long has been carved out of the Arctic ice to test the properties of snow and ice in order to obtain information needed to help men build, live and work in the polar regions.

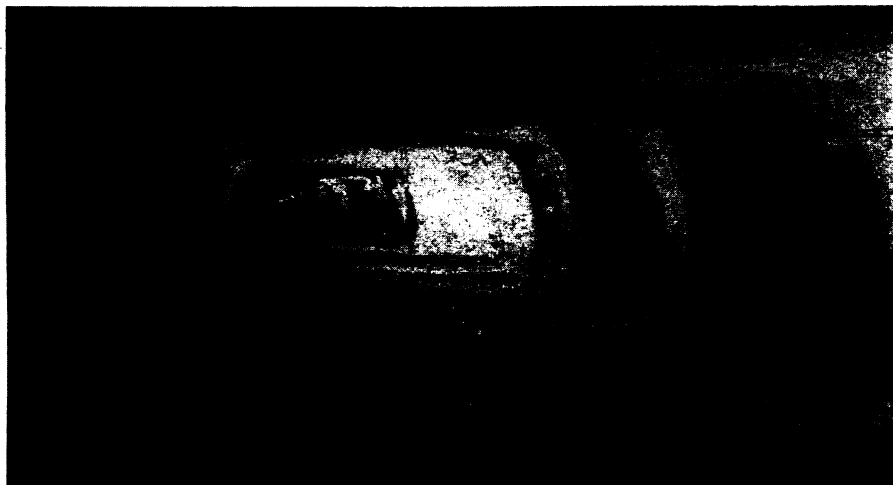
The tunnel was built by U. S. Army Corps of Engineers scientists, using modern coal mining machinery. In its large connecting rooms under the Arctic ice cap, experiments on ice movement and other research will be conducted by scientists from the Snow, Ice and Permafrost Research Establishment, called SIPRE, Wilmette, Ill.

The project will enable scientists to determine how much the ice closure caused by the gradual movement of ice can be reduced from that recorded in previous tunnels built in the ice cap. In 1956 and 1957 the closure was more than a foot per year.

Scientists from the SIPRE laboratories have estimated that closure rate in the new tunnel will be about six inches per year, since it is built nearer the surface of the ice cap. Entrance to the tunnel, which is located 110 feet below the ice cap surface, is about 60 feet higher than previous entrances.

A continuous coal miner, a machine that cuts the ice and automatically loads it onto a conveyor belt to transport the chopped ice out of the tunnel, was used to build the tunnel.

Science News Letter, January 17, 1959



ICE TUNNEL—A 1,150-foot experimental ice tunnel with large connecting rooms under the Arctic ice cap has been carved out by the U. S. Army Corps of Engineers scientists. The tunnel entrance is 15 feet by 15 feet; three rooms, presently 7½ feet from floor to ceiling, 21 feet wide and from 200 to 300 feet long, are reached by connecting tunnels extending out from the main tunnel at 45 degree angles.