

METEOROLOGY

Humidity increase in stratosphere

The stratosphere, the cold, stable layer of the atmosphere that begins at about 35,000 feet, is well above most of the earth's weather and relatively dry. But six years of measurements from balloons launched periodically by scientists at the Naval Research Laboratory in Washington, D.C., show that the water vapor content of the stratosphere has increased 50 percent over that period—from an average of 2 parts water per million parts air six years ago to 3 parts per million now.

"This was quite unexpected," says Henry J. Mastenbrook, head of the research team, "because you wouldn't have to reach too far back in time before the water content would have to be zero—or too far forward before there would be serious implications." He and other scientists therefore feel it is highly unlikely the trend will continue.

They have found no good explanation for such extensive variation, but are certain it is of natural origin. There are several possibilities. Some natural event could have caused an abrupt change. The tests could have begun by coincidence at a time of abnormally low water concentration. Or the variation could be associated with the 11-year solar cycle, which has recently reached its peak.

The NRL effort is the only study of stratospheric moisture content of a continuing nature that has reduced the probable error enough to gain significant data, according to Mastenbrook. Their findings have a 99 percent statistical significance. They will soon be submitted for publication.

PALEOMAGNETISM

Rotation of Sardinia

Paleomagnetic data from Middle Tertiary rocks—about 30 million years old—have failed to show conclusively any past rotation of the Mediterranean island of Sardinia. Since more ancient rocks seemed more likely to yield definite evidence, researchers from the University of Utrecht, the Netherlands, collected Permian rocks—at least 225 million years old—on Sardinia.

Their analysis, Drs. J.D.A. Zijdeveld, K.A. DeJong and R. Van der Voo report in the June 6 *NATURE*, indicates that Sardinia has rotated counterclockwise with respect to Europe approximately 50 degrees in the last 225 million years.

METEOROLOGY

Electricity in tornadoes

The origin of the extraordinarily high winds of a tornado is a scientific mystery. Explanation depends on understanding how such a high concentration of energy can exist in the storm's vortex. The intense electrical activity of thunderstorms associated with tornadoes may be a clue, and scientists have been pursuing this possibility in laboratory experiments.

Experiments reported in the June 12 *SCIENCE* show that a stable vortex can be initiated and maintained by the use of a high-voltage electric discharge. No externally provided region of low pressure is necessary.

Using a 2.5-ampere current of 5,000-volt electricity, Drs. R. T. Ryan of Arthur D. Little, Inc., and Bernard Vonnegut of the State University of New York at Albany have produced vortices as much as 1 meter high and 28 centimeters in diameter with air velocities as great as 360 centimeters per second. The electrical heat forms a vigorous vortex. The vortex in turn stabilizes the discharge.

From their studies, the two scientists conclude that the heating produced by electrical discharges in a large storm may play a significant role in forming and maintaining natural tornadoes.

GEOLOGY

U.S.-Mexican Gulf study

The first three-week phase of a series of marine geologic studies of a 65,000-square-mile area of the extreme western Gulf of Mexico was completed in early June. The project is sponsored by Mexico and the United States as a contribution to Cooperative Investigations of the Caribbean and Adjacent Regions, a marine research program under the auspices of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Scientists from the University of Mexico and the U.S. Geological Survey are participating.

Preliminary analysis of data from the first phase suggests some geologic structures of possible economic importance. There are indications of salt domes and other structures that might imply the existence of oil. In 1968 the drilling ship *Glomar Challenger* found oil in salt domes in the central Gulf (SN: 10/12/68, p. 361).

GEYSERS

Earth tides and Old Faithful

Analysis of the records of 30,000 eruptions of Old Faithful Geyser in Yellowstone National Park indicates that earth tides (SN: 2/14, p. 170) have a strong regulatory influence on the eruption cycle of the geyser. At times of full moon and new moon, for example, the average interval between eruptions is 10 to 15 percent longer than at in-between phases, according to Dr. John S. Rinehart of the Environmental Science Services Administration's Boulder, Colo., research laboratories.

"To my knowledge," says Dr. Rinehart, "this is the first time that one has ever found a regulatory influence of earth tides on geyser action."

Gravity variations associated with the earth tides produce slight changes in the volume of the porous subsurface rock that stores hot water beneath the geyser. At times of increased gravity, he suggests, the rock is squeezed like a sponge, adding hot water to the geyser's channels and shortening the interval between eruptions.

He has been able to detect semidiurnal, diurnal and fortnightly effects related to tidal action. Just a few weeks ago he returned from a trip to Yellowstone during which he found that many other big geysers there appear to be regulated by earth tides. The geyser Old Faithful of California at Calistoga, Calif., seems also to show the effect.

Dr. Rinehart believes future studies will show that solid-earth tides are important to many other geophysical phenomena.