GEOPHYSICS

Weather, Oceans and Climate

The atmosphere, a vast ocean of air surrounding the earth, will be probed most intensively during the International Geophysical Year, resulting in improved weather forecasts.

By ANN EWING

➤ THE ATMOSPHERE, a vast ocean of air that supports life on earth, is scheduled to be measured and sampled more thoroughly than ever before during the International Geophysical Year, or IGY, starting July 1.

It is so immense that if each human being on earth could be employed as a weather observer and given an equal chunk of atmosphere to watch, he would be responsible for approximately 2,000,000 tons of air.

Even under the special, world-wide program planned for the IGY, however, far fewer people will be recording the atmosphere's daily changes. And only a relative handful will be charting the seas' currents, temperatures and composition.

One certain result of these measurements of earth's two oceans, one of air and one of water, will be improved weather forecasts. Also expected is a much better understanding of climate, or long-term weather, and the part the world's seas play in storing the sun's heat.

Measuring the Ocean's Circulation

Water, in liquid or solid form, covers about four-fifths of the earth's surface. Some 70 ships from 30 countries will sail the oceans during IGY. Next to climate and the earth's heat balance, probably the most important problem the scientists on the ships hope to solve is the circulation of the oceans' deep water.

An answer to the question of how fast deep water rises to the surface must be found before oceans can be used as dumping grounds for atomic wastes. The peaceful development of atomic energy is expected to result in radioactive waste products equal to the explosion of somewhere between 10 and 100,000 hydrogen bombs a year.

The oceans would be ideal for storing this "hot garbage" if it could be done without harming fisheries or other resources of the sea, and without radiation damage to bathers. The wastes would have to be dumped in deep water that would remain at great depths until the radiation level was within safe limits.

The oceans and the air can be considered two parts of a planetary heat engine. The earth receives almost all of its energy from the sun, in all sorts of radiations from long-wave heat radiation to very short-wave ultraviolet. In the atmosphere, the heat energy from the sun is turned into mechanical motion, the shifting of cold and warmer air masses resulting in the winds.

In the oceans, water is warmed by sunlight in the tropics and cooled by melting ice and snow in the polar regions. Cold water near the poles sinks and flows along the bottom of the great oceanic basins toward the equator, where it displaces warmer water, but the changeover speed is unknown.

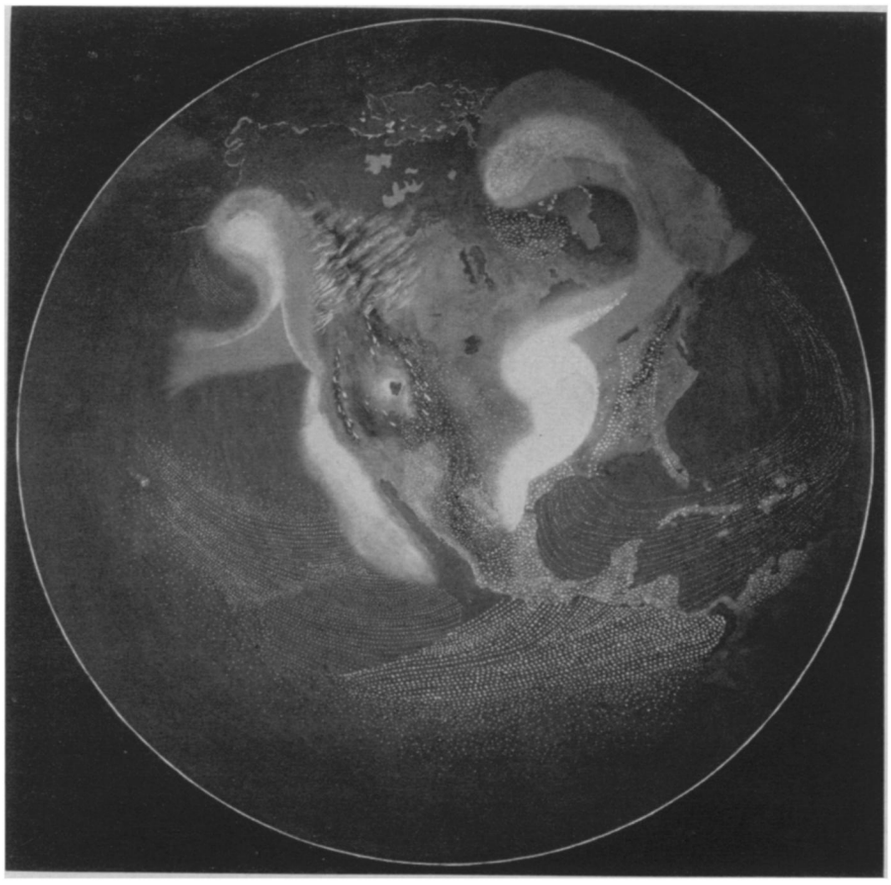
The oceans' fish and other marine life are one of a great, almost untapped natural resource. The fish population near Peru, for instance, is so large that the guano birds there catch about 3,000,000 tons of fish a year, almost as much as the entire Japanese fisheries. How oceanic currents affect sea life is one of the many subjects for study.

To learn about atmospheric circulation, one new method will be tested during IGY —charting the natural and artificial radioactivity in the air. This program looks at fallout in reverse, considering the radioactive particles as tracers for the world's circulation patterns.

There are six natural radioactive elements in the atmosphere. These include beryllium, carbon, two forms of phosphorus, sulfur, and tritium, the triple-weight hydrogen that results from cosmic ray bombardment of air or is produced in certain hydrogen bomb tests.

The total amount of tritium in the entire atmosphere is only about two pounds, but modern chemical methods are so sensitive the tritium in a small sample of water can be measured. Previous tests have shown there is about ten times as much tritium as expected in air, suggesting that the sun is blowing tritium into our atmosphere. It may also be hurling helium and perhaps other radioactive particles at the earth.

The problem of determining what differ-



U. S. WEATHER FROM 4,000 MILES—How a black-and-white television picture of the earth's weather might look from a satellite 4,000 miles above Amarillo, Texas, on a June 21 is shown in this U. S. Weather Bureau drawing. A cyclonic storm covers much of central United States.

ent kinds of particles are coming into the atmosphere will be attacked by a combined effort of meteorologists, oceanographers and upper air physicists. Experiments from the satellite will be included.

Glaciers, Frozen Libraries

A library of past atmospheric events is frozen in glaciers. By taking borings and studying the dust and chemical composition of various layers, scientists hope to learn what has happened to the earth over the past 1,000 years or more.

Glaciers cover about ten percent of the world's land area, and in the past have covered up to three times this area. How fast they form and how rapidly they disappear is one of the problems to be studied.

Scientists hope also to learn whether glaciers are now receding or growing.

Slow-growing lichens found right next to the ice in Antarctica indicates there probably has not been a recession in Queen Maud Land in many years, but conclusive proof is needed. Some of the glaciers on the white continent are 10,000 feet deep, and probably took 5,000 years to form.

The glaciological studies will also help to establish the earth's heat balance more accurately.

One factor affecting the heat balance is the amount of carbon dioxide in the atmosphere, and this will be measured for clues concerning whether or not the world is warming up. Reports indicate the carbon dioxide content of air has increased 10% in the last 50 years.

An increase of 20% would result in a considerable change in climate — northern cities would become warmer, for instance, and rainfall patterns could make deserts of southern California and a good part of Texas.

All these measurements, and many more, to be made during IGY will contribute to man's knowledge of his environment. (See SNL, June 8, p. 362.)

Meteorological Investigations

Extra effort will be exerted on specified days, known as world meteorological intervals, to take particular measurements. These intervals are a series of ten consecutive days each three months, including the solstice or equinox day.

Upper air soundings will be increased and special attention will be given to reaching extra high altitudes at that time. Most of the rocket launchings planned for the IGY are scheduled for these ten-day intervals.

Although there are thousands of meteorological stations scattered throughout the world, most of them take only surface observations and are mainly clustered within inhabited regions. Only a few hundred take vertical soundings that reveal the true three-dimensional structure of the earth's atmosphere.

Because it is impossible, even with the combined resources of all 70 nations participating officially or unofficially in IGY, to fill in all the immense gaps in the weather observation network, particularly over the oceans, the Arctic and most of the Southern Hemisphere, attention is being concentrated on several pole-to-pole lines of upper air meteorological stations.

These lines are located at 70 to 80 degrees west, 10 degrees east, 75 degrees east and 140 degrees east. To complete the southern positions of these lines, new stations were built where necessary.

In addition a complete surface and upper air meteorological program has been set up in the Antarctic, making possible for the first time a thorough exploration of weather there.

The United States runs the Antarctica Weather Central, distributing information to all nations with bases there.

Besides obtaining measurements in areas heretofore unexplored, special readings will be made of the amount of ozone in the vertical air column overhead. Although the ozone content is exceedingly minute, its presence is essential because it shields life from the destructive effects of certain ultraviolet radiations.

Ozone can also serve as a "tracer" for meteorological motions, both vertically and horizontally.

The emphasis on obtaining meteorological data from high levels of the atmosphere will shed further light on the origin and location of the high-speed, narrow rivers of air known as the jet stream. These wind systems, because of their swiftness, are assuming great importance in aircraft navigation and design.

The major pole-to-pole chains form a kind of coordinate system by which the movement of atmospheric disturbances of all kinds can be observed and mapped.

One undoubted outcome of the many measurements during IGY will be improved weather forecasting.

Science News Letter, June 15, 1957

ANTHROPOLOGY

Women Carry Their Fat Outside Their Frames

➤ THE WEIGHT of fat is about the same on men as on women, but the women carry more on the outside of their frames, Dr. Stanley M. Garn, anthropologist of the Fels Research Institute, Antioch College, Yellow Springs, Ohio, reports in *Science* (May 31).

Measurements of fat were made on 107 healthy women aged from 20 to 60 and compared with measurements on 81 men of equal age range. This was done by picking up the rolls of fat that can be picked up on various parts of the body, such as the famous "inner tube" around the waist, and measuring them. Out of nine sites measured, the fat rolls were larger on women for all but two.

When, however, the weight of the body fat in proportion to total body weight was estimated, it was not markedly different for the two sexes.

Science News Letter, June 15, 1957