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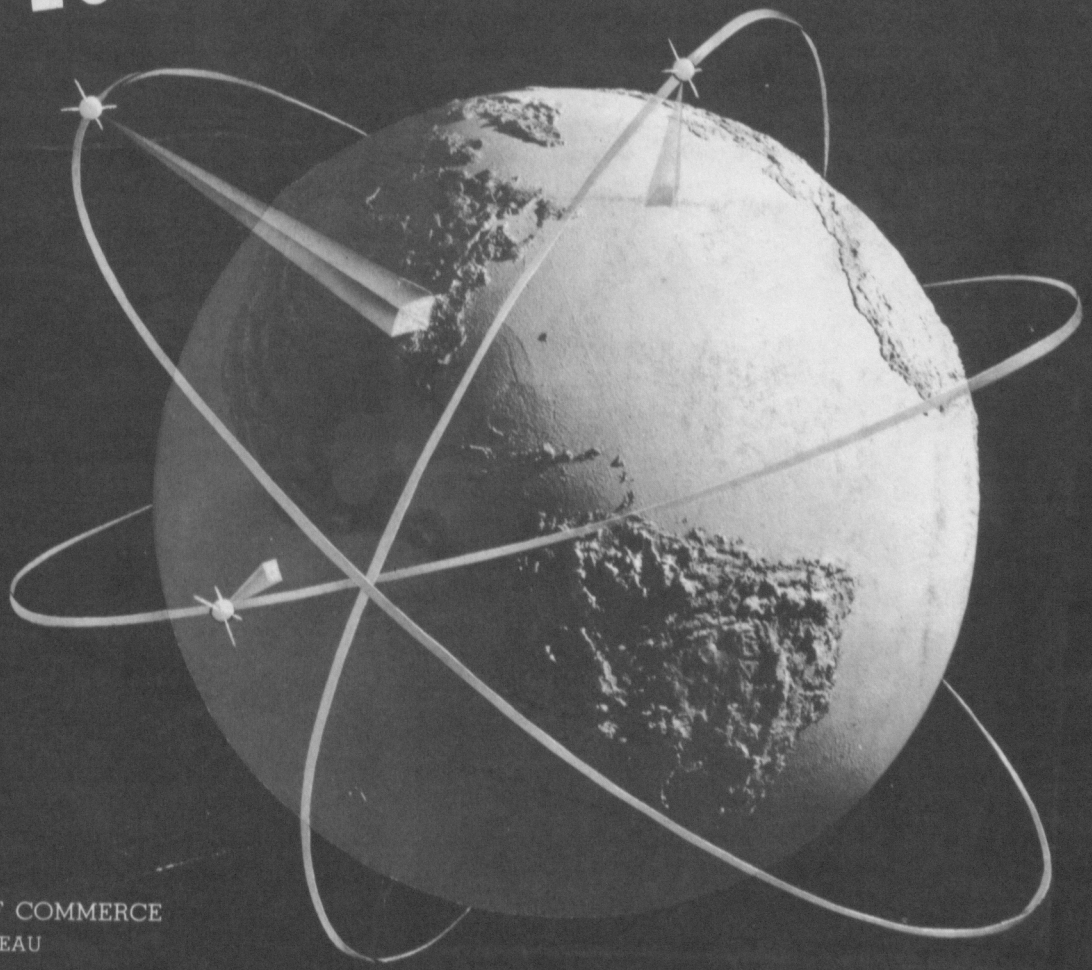
METEOROLOGICAL SATELLITES

GLOBAL WEATHER OBSERVERS



U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

National Oceanic and Atmospheric Administration
TIROS Satellites and Satellite Meteorology

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U. S. DEPARTMENT OF COMMERCE
LEWIS L. STRAUSS, Secretary
U.S. WEATHER BUREAU
F. W. REICHELDERFER, Chief

METEOROLOGICAL SATELLITES . . . GLOBAL WEATHER OBSERVERS

Washington, D.C. March, 1959

Weather information is presently available from only a small portion of the total atmosphere and it is possible for large storms to remain undetected for days in many isolated areas. Satellites orbiting the earth will provide a continuous surveillance of all storms, noting the birth of new storms and the dissipation of old ones. . . . . .

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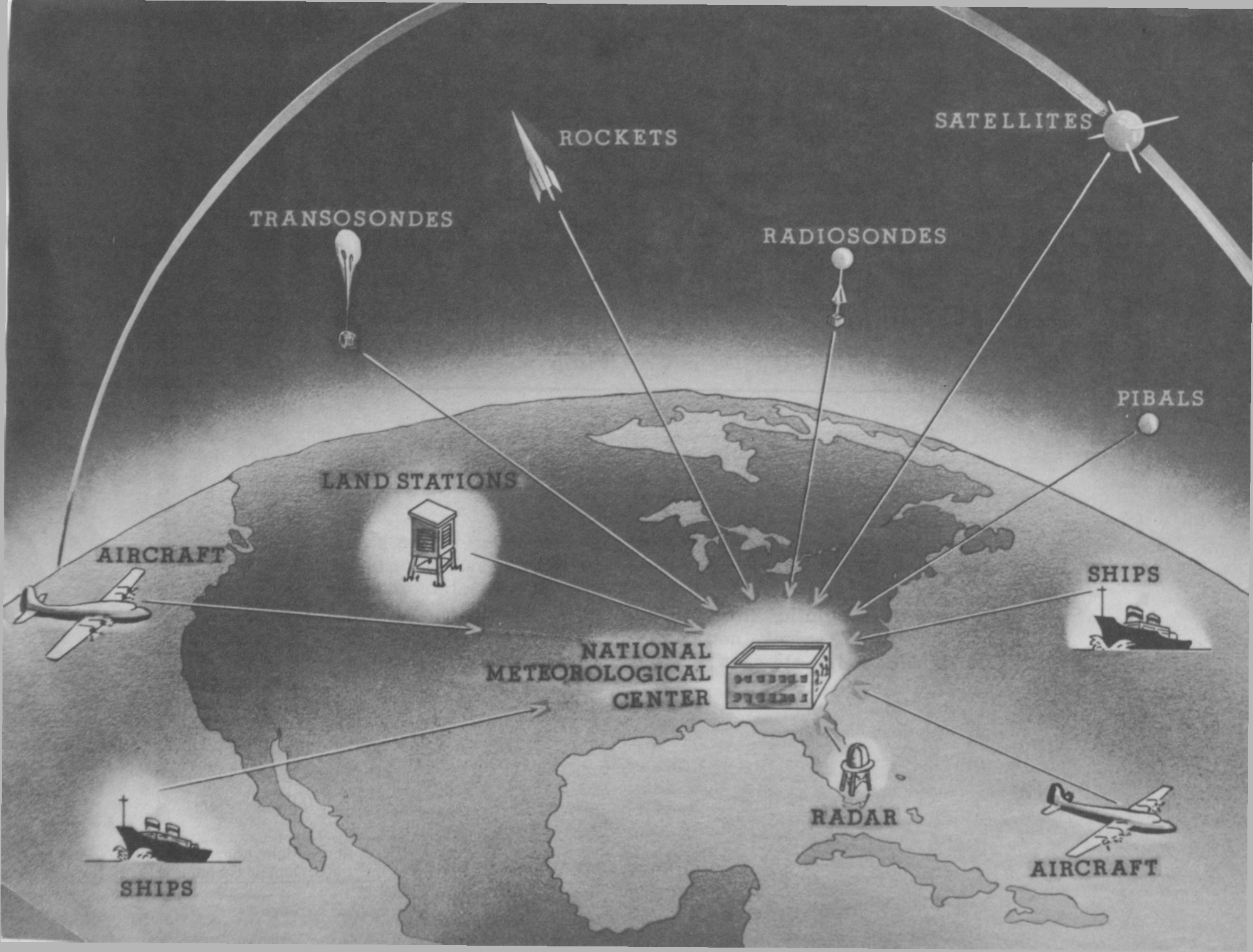
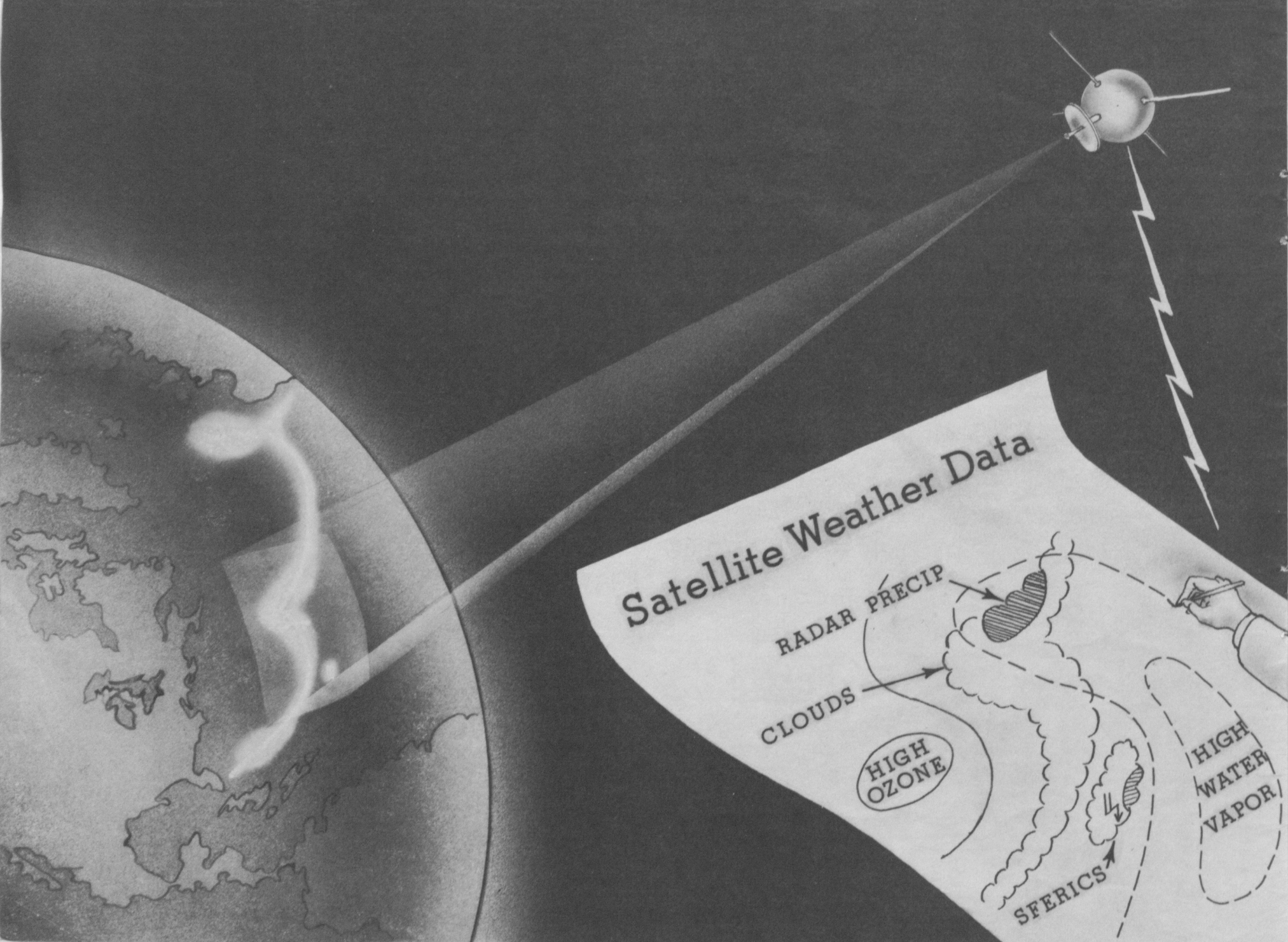

ROCKETS
SATELLITES
TRANSOSONDES
RADIOSONDES
PIBALS
LAND STATIONS
AIRCRAFT
SHIPS
NATIONAL
METEOROLOGICAL
CENTER
RADAR
SHIPS
AIRCRAFT

THE COLLECTION OF OBSERVATIONAL DATA

Meteorological observations are made by the Weather Bureau in order to: (a) forecast weather and flood conditions, (b) determine the climatology of the United States and adjacent oceans, (c) provide informational service directly to public interests, and (d) do research leading to the discovery of natural laws governing the behavior of the atmosphere.

The integration of satellite weather data with existing data will give man a more comprehensive picture of existing weather conditions.


Satellite Weather Data
RADAR PRECIP
CLOUDS
HIGH OZONE
SFERICS
HIGH WATER VAPOR

METEOROLOGICAL OBSERVATIONS FROM SATELLITES

Experiments scheduled for satellite launchings in the near future are as follows:

1. Cloud cover pictures from television cameras
2. Incoming and outgoing radiation (heat budget)

Future satellite experiments may include:

1. Radar measurements of precipitation
2. Infrared measurements to obtain information about water vapor, ozone, carbon dioxide and temperature
3. Detailed measurements of the solar spectrum
4. Thunderstorm distribution by visual and static (sferics) observations
5. Investigations of the optical properties of the atmosphere
6. Sampling of meteoric dust to test the theory that these particles may serve as cloud seeding agents
7. Measurement of surface atmospheric pressure

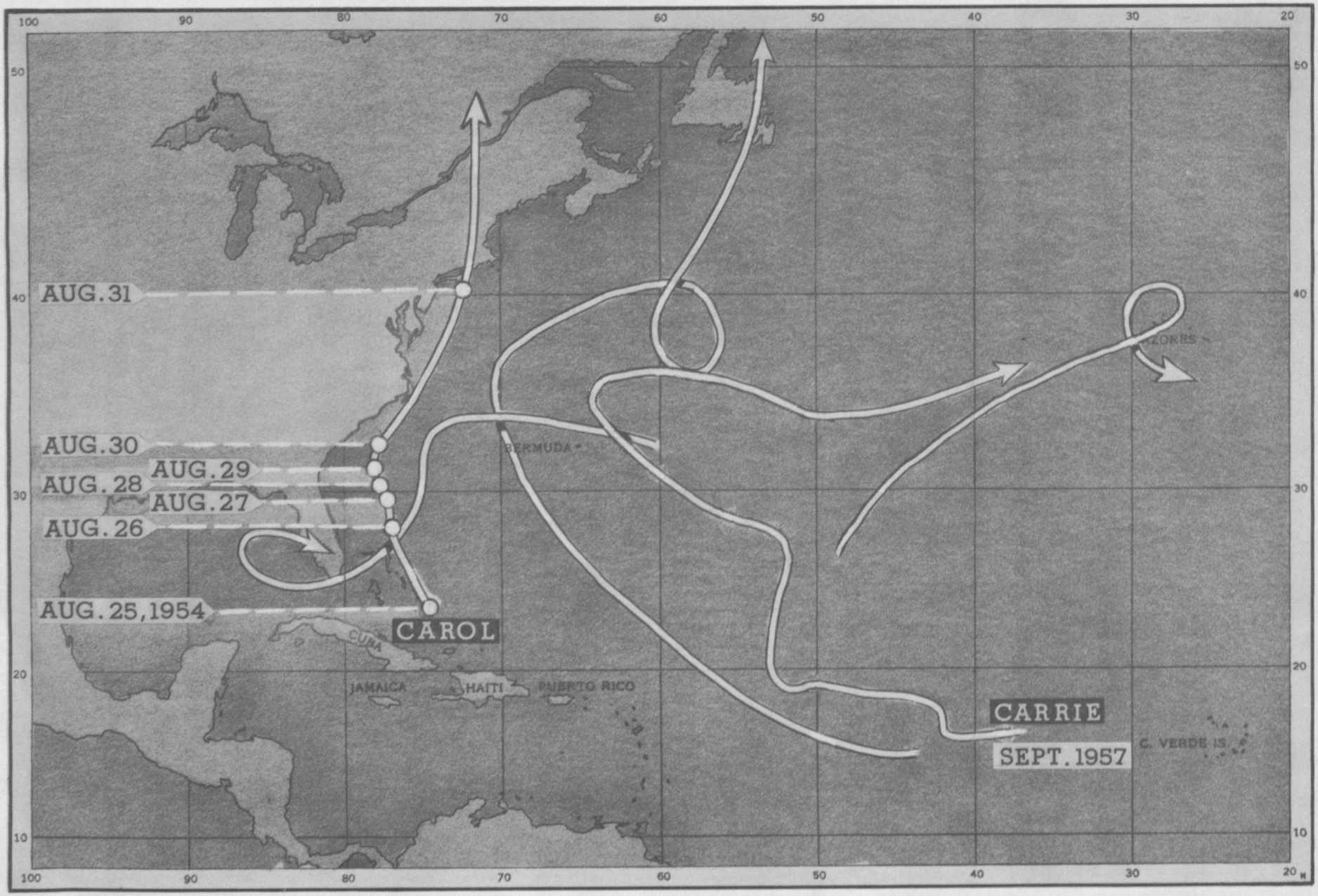
Also, the establishment of a network of communications satellites will make possible speedy world-wide dissemination of weather data.

SOUTH
EAST

A MAJOR PROBLEM - SPARSE DATA AREAS

The birth or intensification of storms in areas of sparse observational data is a major problem to the meteorologist. Numerous hurricanes have formed undetected off the west coast of Central America and their presence became known only when surface vessels encountered them without warning. Destructive storms have reached the Hawaiian Islands and the Aleutian Islands virtually without advance warning. In the tropical Atlantic, storms have reached full hurricane intensity before they were discovered by aircraft reconnaisance.

The rocket photograph taken from an altitude of about 100 miles shows two distinct weather systems that were not detected by the meteorological analysis made at the corresponding time. In the upper portion, just to the left of center, are clouds spiraling into an old tropical storm which produced over six inches of rain in three hours at Brownsville, Texas and flooding in the Roswell, New Mexico area. The storm in the lower right portion of the photograph produced a much lighter precipitation.

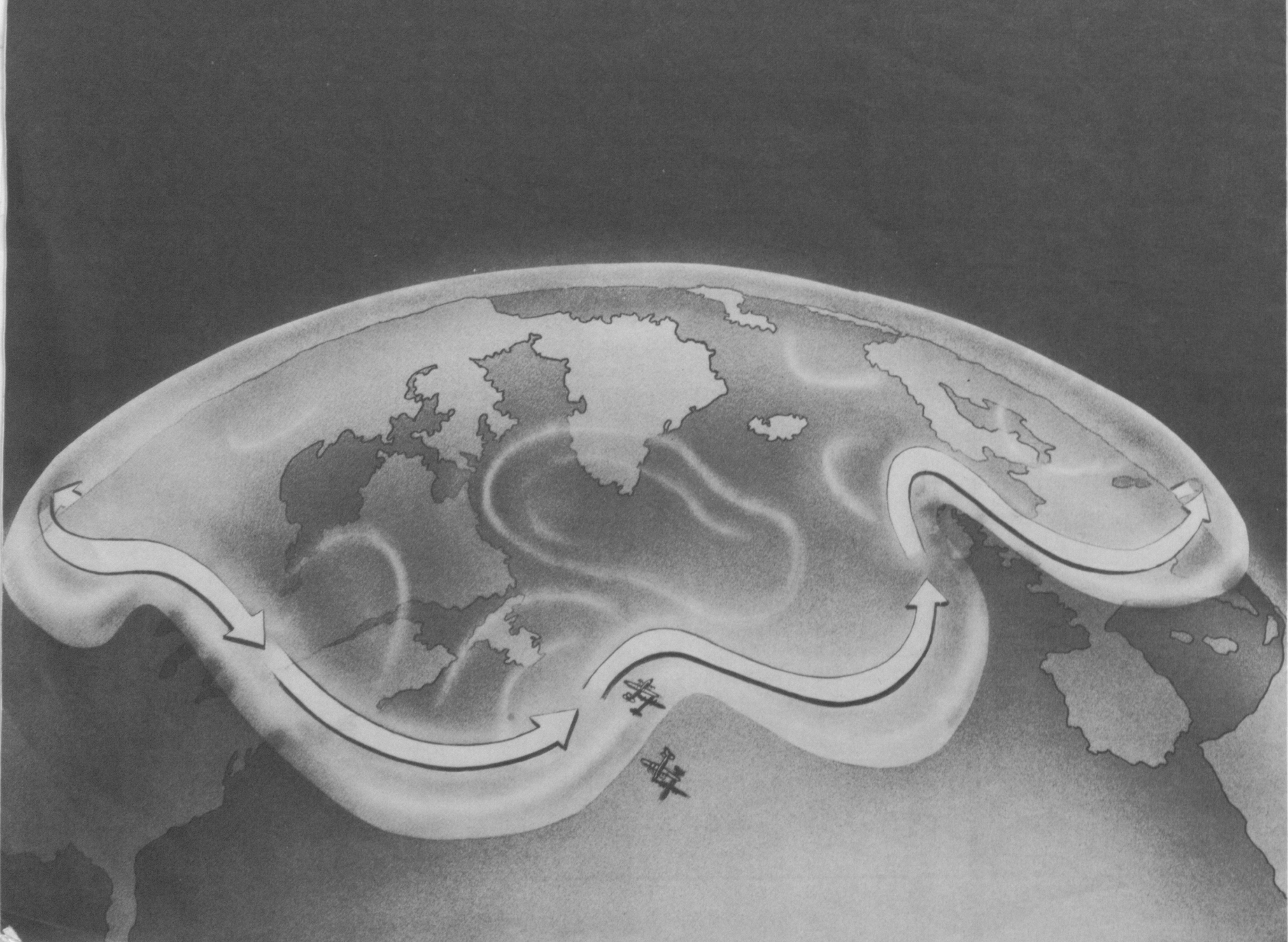

AUG. 31
AUG. 30
AUG. 29
AUG. 28
AUG. 27
AUG. 26
AUG. 25, 1954
CAROL
CUBA
JAMAICA
HAITI
PUERTO RICO
BERMUDA
AZORES
CARRIE
SEPT. 1957
C. VERDE IS.

THE ERRATIC MOVEMENT OF STORMS

Hurricane CAROL was responsible for 60 deaths and almost 500 million dollars in property damage as it moved up the east coast of the United States, through New England and into Canada. The track of CAROL is one of the classic examples of record in that it shows deceleration, stagnation, and finally, rapid acceleration.

Besides changes in rate of movement, storms occasionally will make radical changes in course, also shown on the illustration. The unusual track of hurricane CARRIE was reported to be responsible for the sinking of the German windjammer PAMIR with the loss of approximately 80 persons.

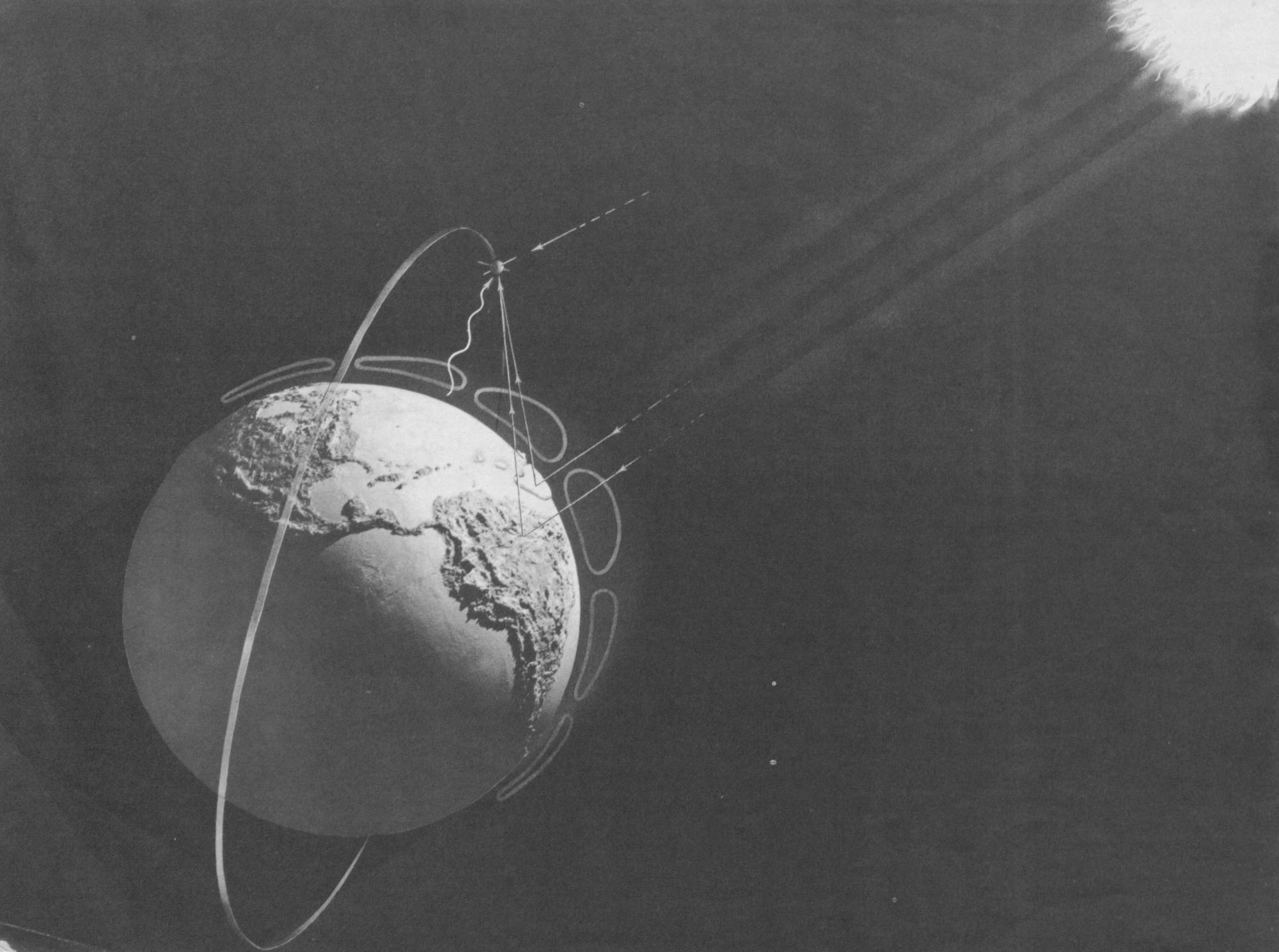
Meteorological satellites, orbiting the earth at frequent intervals, will provide valuable information which will enable the meteorologist to make earlier detection of the irregular movements of severe storms. Also, it is conceivable that several important forecasting techniques might be developed from the studies of high cloud formations as viewed from the satellite.



LOCATION OF JET STREAMS

Jet streams are considered significant features of the general atmospheric circulation and have an important influence on the development and movement of storms. Also, a knowledge of the location of jet streams is essential to efficient flight-planning operations for high altitude aircraft.

High cloud formations, as viewed over broad areas by television cameras aboard the satellite, will indicate regions of maximum cloud speed which can be directly associated with the position of a jet stream. Also, the use of infrared sensors on board the satellite may enable the meteorologist to detect strong temperature gradients which are associated with jet streams.



THE ATMOSPHERIC HEAT ENGINE

Special instruments on board meteorological satellites will record and transmit to ground receiving stations radiation from the sun, atmosphere and earth. Since "weather" results from winds attempting to equalize the non-uniform distribution of net radiant energy, it is important to keep an accurate account of the global distribution of this energy. The energy budget, when measured over long periods of time, will not only be useful in interpreting basic knowledge of the atmosphere but might also assist in formulating a new system of long-range forecasts and in anticipating climatic changes.