

Fishermen, Shippers, Flood Forecasters Helped by NOAA Satellite Information

Timely satellite information on ice in the Great Lakes and Alaskan waters, on the location of the Gulf Stream, and on snow cover in several major river basins is now available from the Commerce Department's National Oceanic and Atmospheric Administration.

Up-to-date ice observations help make maritime operations safer and more efficient, while information on the Gulf Stream can aid both commercial shipping and fishermen. Snow cover is an important factor in forecasting floods and estimating water supplies.

The experimental services, provided by NOAA's National Environmental Satellite Service, are based on detailed, half-mile resolution images obtained by very high resolution radiometer systems aboard polar-orbiting NOAA spacecraft.

To forecast future river flow and flooding, and to estimate potential water supplies, hydrologists in many areas must take into account the amount of water stored in the form of snow. In the western United States, seasonal snow accumulation is measured at thousands of surface locations, and aircraft are used to survey snow cover over large regions. But only the broader view from space can give a complete picture of the extent of snow cover.

Using high-resolution images from NOAA satellites, the extent of snow cover in river basins as small as 2,500 square miles can be mapped to an accuracy of about five percent. A satellite image and a map of the river basin are placed in an optical device called a "zoom transfer scope," which enables the operator to see the satellite image superimposed on the basin map

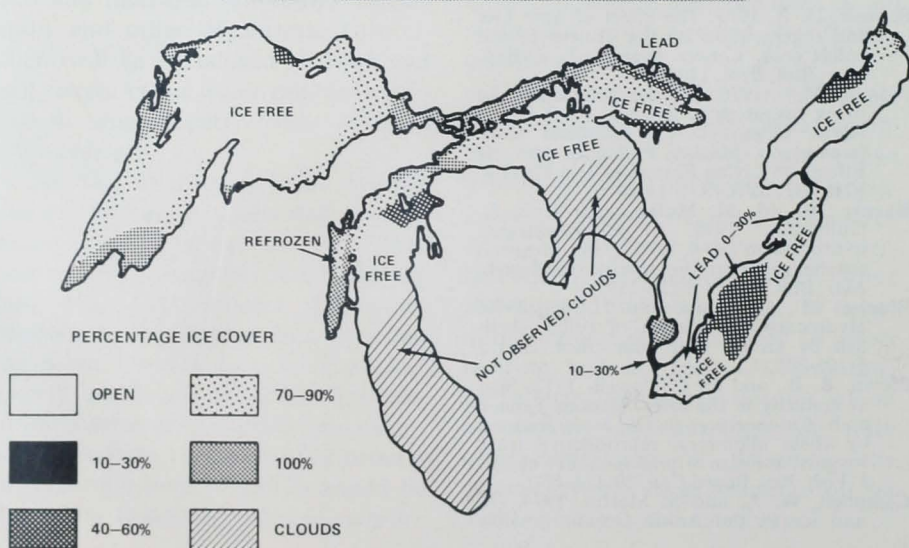
Great Lakes ice cover in early February, as mapped from NOAA-2 very high resolution images.

and to register the two. Snow areas appearing in the picture are traced on the map, the areal extent is measured, and the percentage of the basin covered by snow is calculated. The percentage figure is sent through National Weather Service communications systems to the NWS River Forecast Center responsible for predicting river flow, flooding, and potential water supply in the basin. This procedure is carried out each time a relatively cloud-free image of the basin is obtained, and is completed in 36 hours or less after the spacecraft has observed the area.

From the high-resolution images, the Environmental Products Group is currently calculating snow cover per-

centages for the American River Basin in California, the Willamette River Basin in Oregon, the Genesee River Basin in New York and Pennsylvania, and the Red River of the North in the Dakotas and Minnesota. Seven additional basins are scheduled to be added soon to the operational test program: Arizona's Verde, Salt, and Upper Gila river basins, and four on the upper Columbia River.

Each winter, sea, lake and river ice closes ports and shipping lanes in high latitudes, forcing commercial vessels to remain idle and hampering military ship operations. To plan sea transport in these areas, marine interests need to know where ice exists in ports and along sea routes, and whether the ice is forming or breaking up. The United States, Canada, and other nations operate aircraft reconnaissance programs to gather this



information. Although the reconnaissance is costly and complex, the economic savings and increased safety afforded to shipping operations have justified this expense. Now earth-orbiting satellites permit more efficient aerial surveillance over vast areas.

Infrared sensing systems on the NOAA satellites allow major ice features to be observed throughout the year over the entire earth. Significant ice boundaries, openings, and thin areas can be detected in the images, and improved estimates of the thickness and physical state of the ice can be deduced from surface temperature information in the infrared images.

Ice charts based on NOAA high-resolution images are prepared and disseminated through National Weather Service facsimile circuits on a regular schedule. Great Lakes ice analyses, issued twice weekly, show open water as well as areas where ice cover ranges from 10 to 30 percent, 40 to 60 percent, 70 to 90 percent, and up to 100 percent. Experimental ice analyses covering the Bering, Chukchi, and Beaufort seas and the Gulf of Alaska are issued weekly. These distinguish between new and multiyear

ice and indicate estimated thicknesses of young and first-year ice in ranges of 10 to more than 120 centimeters.

Each week, the Satellite Service prepares and transmits an experimental Gulf Stream analysis chart, showing the surface location and extent of shelf water, slope water, the Gulf Stream itself, and associated cold and warm eddies, as revealed by surface temperature contrasts depicted in the high-resolution infrared images.

Information on the Gulf Stream is of special interest to the shipping and fishing industries. Ships plying east coast routes make use of this large current to speed northbound runs and save fuel. Vessels heading south stay clear of the Gulf Stream, which would slow their progress. The satellite data show the frequent meanders in the Gulf Stream.

Commercial fishermen can use the data on water-mass boundaries from these charts to increase the efficiency of their operations. The nutrients on which fish feed accumulate on the boundaries between shelf and slope water and between slope water and the Gulf Stream, and large concentrations of fish are usually found in such areas.

Ossabaw Sound, Ga. These data are in various stages of processing and will be available in various forms, including magnetic tape, printouts, computer-plots and data analysis forms, from the National Ocean Survey (C33), Rockville, Md. 20852. In due course, the data will be incorporated in the tidal current tables published by the agency.

The data provide information on the speed and direction of the water that flows in and out of the estuaries, information essential to coastal planning, especially in determining the dispersion of pollutants. In connection with the latter, a special study was made aboard a NOAA ship by the Smithsonian Institution to determine the type of suspended sediments, including pollutants, in Port Royal Sound, S.C. This information is available from the National Ocean Survey (C33) or the Smithsonian Institution, attention Dr. J.W. Pierce, Curator, Division of Sedimentology, Museum of Natural History, Washington, D.C. 20560.

2. Shoreline maps which depict the high and low water lines as determined by aerial photography. Copies can be obtained from the National Ocean Survey (C3415). They are important in determining shoreline boundaries, including federal, state, and private. The area covered is from Morehead City, N.C., to St. Augustine, Fla. Not all maps are completely processed yet.

3. Aerial photographs. Coastal planners can use these for studies of the shoreline and for any type of shoreline construction. The boundaries (the high and low water lines) along the coast can be physically seen, although it may be necessary sometimes to enlarge segments of photos to achieve this. The photographs can be obtained from the National Ocean Survey (C3415) for the coastal area extending from Morehead City, N.C., to Cape Canaveral, Fla.

4. Field sheets (also known as boat sheets) which provide in great detail (much more so than on nautical

Ocean Environmental Information Available For Coastal Florida, Georgia, Carolinas

New ocean environmental data are now available for coastal planners of four southeastern states following completion of the first year of a two-year concentrated investigation of coastal waters off Florida, Georgia, and the Carolinas.

The investigation was conducted by four vessels, an aircraft, and several field parties of the Commerce Department's National Oceanic and Atmospheric Administration as part of a new program designed to compress into two years projects previously scheduled for completion in 15 years. Similar concentrated investigations are planned for other east, west and Alaskan coastal areas.

The project began in January 1973

and continued until November 1973. The second and final phase began in April, 1974. Impressive results have been recorded so far in the program which is designed to provide marine information about coastal zones to assist federal, state, local, and private agencies in making decisions concerning environmental problems.

Data processing has been accelerated for the project in order to expedite the release of information. The following data are now available from the 1973 phase of the operation, known as SCOPE (Southern Coastal Plains Expedition).

1. Tidal current data in the following coastal areas: Charleston Harbor, S.C., and southward to and including

charts) ocean soundings along the coast. Copies of these sheets are now available from the National Ocean Survey (C3233) for the outer coast areas from the Cape Fear River, N.C., to the vicinity of Savannah, Ga., and along the Florida coast from False Cape to Daytona Beach.

The information is important to commercial shipping, recreational craft, and coastal engineering. It also provides a picture of the sea bottom, useful in almost any study of the area, whether for engineering or scientific purposes or in connection with petroleum research and the recovery of minerals on the continental shelf.

Other data gathered in the project will be reflected later in updated nautical charts and tide and tidal current prediction tables. These data are important not only to ship navigation, but to all types of coastal engineering, including the construction of buildings and other structures, such as piers and seawalls.

The areas covered by this year's SCOPE operations include the offshore coastal region from Flagler Beach, Fla., to Brunswick, Ga., by the NOAA Ship *Mt Mitchell*; St. Helena Sound, S.C., and the waters off Cape Fear, N.C., by the *Peirce*; and St. Helena Sound to Savannah, Ga., by the *Whiting*. An instrument-equipped launch surveyed Florida's inshore coastal waters northward from False Cape. The *Ferrel* conducted estuarine circulatory studies in Georgia in the Savannah and Wilmington rivers and in the vicinity of Wassau Sound.

Elements of the Atlantic Hydrographic Party and other field units from NOAA's Atlantic Marine Center, Norfolk, Va., conducted hydrographic and coastal mapping operations from Cape Hatteras, N.C., to the vicinity of Daytona Beach, Fla. Aerial photography by the National Ocean Survey has now been carried out from Morehead City, N.C., to the vicinity of Cape Canaveral, Fla., in support of the hydrographic mapping program. The segment northward from More-

head City to Cape Hatteras will be completed in early 1974. Hydrographic surveys were conducted by the Atlantic Hydrographic Party at the Wando River, S.C., Wassau Sound, Ga., Nassau Sound, Fla., and the St. Johns River, Fla.

Commerce Fleet Sets 1974 Ocean Studies

Approximately 1,000 scientists, technicians, officers, and seamen will man 21 Commerce Department ships plus numerous smaller craft in a new season of investigations of the oceans and waters that lap the shores of the United States and foreign lands.

Their activities will take them up and down the coasts of the United States to the Caribbean and the Gulf of Mexico, across the Atlantic to Africa, off both coasts of Latin America, into the vast reaches of the Pacific, the Gulf of Alaska, and elsewhere.

They will probe the oceans, including the land beneath and the air above, the coastal waters and estuaries of the United States, the submerged continental shelves, the wrecks that dot America's shores, the treacherous currents that endanger seamen and their craft, and the water's abundant aquatic life.

Some work will be glamorous; much of it will be routine, but essential. The mysterious internal waves, which undulate below the surface of the sea, will be probed, as will the mountains, ranges, canyons, and massive fractures in the earth at the bottom of the sea. And scientists will seek additional evidence of the movement of the continents and sea floor spreading. Others will conduct investigations necessary for managing fisheries resources.

While the larger seagoing vessels are carrying on deep ocean activities, the smaller ships of the Commerce fleet will be conducting marine charting surveys, measuring the currents along the coasts and in estuaries,

bays, and harbors, and scouring coastal sea lanes for submerged wrecks, pilings, abandoned equipment, coral and rock formations, and other dangers to sea commerce and recreational boating.

Still other vessels will be studying fisheries resources, conducting investigations, such as tracking fish migrations, and gathering data for predicting areas of occurrence and levels of abundance, studying environmental parameters that affect survival and fluctuations in population, and assessing and evaluating the potential for use of the various fisheries resources. Various experiments will be conducted to advance man's knowledge of the ocean's living resources and to develop or perfect assessment equipment and techniques, such as remote underwater observation equipment and diving with or without submersibles.

The ships are operated by the Commerce Department's National Oceanic and Atmospheric Administration. The NOAA Fleet supports primarily the activities of three NOAA agencies—the National Ocean Survey, the National Marine Fisheries Service, and the Environmental Research Laboratories. They are based at Norfolk, Va., Miami, Fla., Detroit, Mich., Seattle, Wash., and, for those engaged primarily in fisheries research and studies, at various ports where fisheries laboratories and centers are located.

This year, as during the past few years, NOAA scientists are continuing their research on the interrelated theories of continental drift and sea floor spreading. According to the continental drift theory, the earth at one time had one or two large land masses which began to split some 200 million years ago. The theory postulates that, as the sea floor spreads, the continents are drifting at about one inch or so a year. The drifting resulted in the separation of the supercontinents. According to a related theory, the earth's crust is made up of gigantic, grinding, constantly moving plates or segments.

Deep ocean surveys will be conducted by the NOAA Ships *Oceanographer* and *Researcher*. These and other vessels will be engaged in extensive oceanographic research projects involving studies in such widely-separated areas as the North Atlantic, Puget Sound, the Great Lakes, the New York Bight, Gulf of Mexico, Caribbean, and the central and east-ern Pacific.

The studies will seek to extend man's understanding of the ocean and the atmosphere above; to evaluate the living marine resources of waters off the United States and South America; to assess the environmental impact of submerged coastal areas, such as the New York Bight; and to study the behavior of cloud clusters and their role in the larger circulation of the atmosphere. Some studies will involve other U.S. agencies and educational institutions and foreign countries. Various studies are tied in with efforts to obtain data which will help solve the problem of ocean pollution.

A study of tropical atmosphere and oceans and their effect on the earth's weather will be carried out by the Seattle-based *Oceanographer* and the Miami-based *Researcher* off the north-west coast of Africa in conjunction with ships and aircraft of 10 nations.

On the Great Lakes, the *Shenelon* will set current meters on Saginaw Bay, after which she will perform research work on the St. Clair and Detroit Rivers and lower Lake Huron, while the *Laidly*, using a newly-installed hydroplot system, will make hydrographic surveys on Lake Erie. The *Johnson* will conduct a water quality survey of Saginaw Bay early in the season and will then be shifted to chart revisory surveys on Lake Michigan. The *Virginia Key*, operating out of Miami, will conduct near-shore and coastal oceanographic studies.

Much of the work that will be done by NOAA ships in 1974 will be essential to safe navigation. Marine Charting surveys will be carried out by the *Rainier*, *Fairweather*, *Davidson*,

Mt Mitchell, *Whiting* and *Peirce* in the waters of the Carolinas, Georgia, Florida, California, Washington, Alaska, and other areas. The *McArthur* will conduct tide and current surveys in Washington and Alaskan waters.

Essential also to safe navigation are the wire drag surveys for under-water hazards conducted in the Gulf of Mexico by the *Rude* and *Heck*. Circulatory studies will be performed by the *Ferrel* in the New York Bight, the 15,000-square-mile area of ocean waters and continental shelf that extends from Montauk Point, Long Island, to Cape May, N.J.

While these activities are underway, NOAA vessels will be engaged in important fisheries surveys and research along U.S. coasts, in the Caribbean and Gulf of Mexico, off Nova Scotia, and in the Pacific.

These vessels carry out a wide range of studies as diverse as egg and larval surveys off the east coast to studies of the abundance and distribution of groundfish in the Gulf of Alaska and Bering Sea. They gather biological data vital to international discussions and agreements on fisheries, as well as data for the MARMAP program (Marine Resources Monitoring, Assessment and Prediction), a long-range study of our fishery resources. Essentially, the mission is to estimate periodically the size of stocks in total numbers and weights and their expected yields at given levels of fishing. This is done primarily by fishery catch analysis, egg and larval studies, and juvenile and adult stock surveys.

Major marine resources being studied include shrimp, lobster, tuna, snappers, billfish, pollock, sablefish, and salmon. Included among these vessels will be the *Oregon* and *Oregon II*, *Bowers*, *Albatross IV*, *Murre II*, *Jordan*, *Cobb*, and *Rorqual* and *Delaware II*. Another seagoing vessel, the *Pribilof*, will make four supply trips to communities on the Pribilof Islands in the Bering Sea, where the Alaska fur seal herd is maintained by the National Marine Fisheries Service.

Fisheries Pollution Abatement Surveyed

The Commerce Department's National Oceanic and Atmospheric Administration (NOAA) has launched a survey to identify research projects in the United States related to reducing pollution caused by fisheries activities. It is conducted by NOAA's National Marine Fisheries Service and seeks information from wide-ranging fields; harbor studies and fish processing plant design.

An NMFS spokesman said that while each Federal and state agency has information on what is being done in its own agency, there is no single source for obtaining the broad range of information being sought in the survey. Researchers throughout the Nation were asked to describe briefly aspects of their studies and resulting publications that relate to fisheries pollution abatement. Key words are used in the survey which relate to certain species of fish, types of processing, and the pollution technology being used or under study.

Results of the survey are distributed via an NMFS publication entitled "Current Information on Fisheries Pollution Abatement Technology." The information is free to researchers, processing plant personnel, fishermen, boatowners, State and Federal officials, regulatory agencies and others having a need for such information.

CORRECTION

Portions of the paper, "Home Freezing of Seafoods" by Melvin E. Waters, *Marine Fisheries Review*, Vol. 36, No. 1, p. 1-6, were taken from a paper "Home Freezing of Seafood" by Kenneth S. Hilderbrand, Extension Seafood Technologist, Oregon State University, Corvallis, Ore., for which proper credit was not given. Lack of the reference was inadvertently overlooked when the manuscript was reviewed and submitted for publication. We regret the omission.