Oceanography's New Catch: Roving Blobs

The latest beasts discovered in the Atlantic won't munch unwary swimmers or swallow luxury liners, but they may wreak havoc on French farmers and other landlubbers across Europe. The newfound creatures are an oceanographic phenomenon—giant patches of warm or cold water that drift slowly around the North Atlantic and may alter European weather.

Two Florida researchers identified these climatic critters by studying sea surface temperature records from 1948 through 1992. During that period, 14 of these temperature anomalies developed and roved the ocean basin, report Donald V. Hansen of the University of Miami and Hugo F. Bezdek of the National Oceanic and Atmospheric Administration in Miami. They describe their work in the April 15 JOURNAL OF GEOPHYSICAL RESEARCH.

"I think this is a seminal paper," comments oceanographer James J. O'Brien of Florida State University in Tallahassee. "They have identified a very important mode of ocean variability."

Hansen and Bezdek found that the large warm and cold blobs measured hundreds or thousands of kilometers across and typically had a lifetime of 3 to 10 years. Although the vertical thickness of these patches remains unknown, measurements made by ships passing through them suggest that they may reach depths of 400 meters.

As they drifted, the temperature anomalies followed the path of prevailing ocean currents, but they moved at only one-third to one-half the speed of the actual currents—an observation that scientists cannot yet explain.

The newly described phenomenon lasts much longer than the well-known El Niño warmings in the tropical Pacific Ocean, which usually persist for a year or two. Although Hansen and Bezdek focused on the North Atlantic, they suspect that long-lived temperature anomalies are also drifting around other ocean basins.

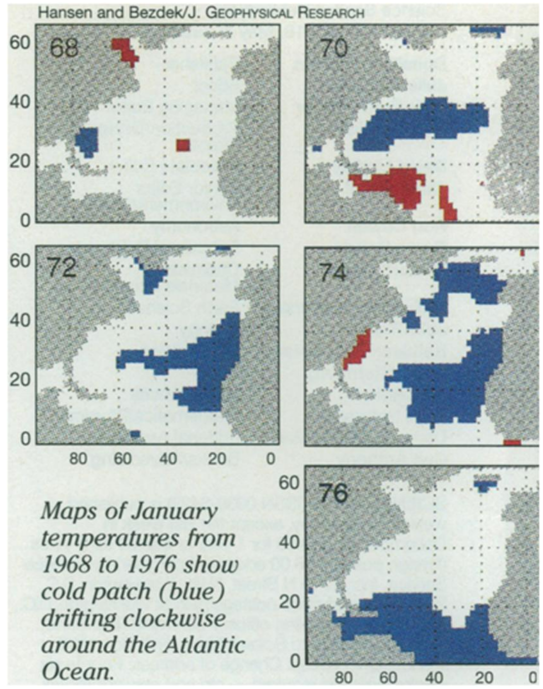
Previously, oceanographers believed that temperature anomalies were stationary. In the 1960s, the late Norwegian meteorologist Jacob Bjerknes found hints of traveling temperature anomalies in the Atlantic, and other researchers later detected similar isolated examples. But oceanographers did not pursue these sporadic sightings, says Yochanan Kushnir, a meteorologist at the Lamont-Doherty Earth Observatory in Palisades, N.Y.

Hansen and Bezdek identified five cold and nine warm patches moving around the Atlantic by making maps of January ocean temperatures that strayed furthest from average conditions. Their maps show blobs slinking across the ocean like amoebas on a microscope slide.

In one example, a cold patch developed off the coast of Florida in 1968 and started drifting eastward. By 1971, the anomaly had greatly elongated and hit the coast of Africa. It then turned south and traveled westward across the tropical Atlantic until it reached the coast of South America in 1975. Over the next 2 years, the cold region withered and finally disappeared.

Because sea surface temperatures strongly influence weather and climate, the researchers suspect that these long-lived Atlantic anomalies affect conditions in Europe and perhaps elsewhere. For instance, the researchers suggest that a warm patch in the late 1950s helped cause a prolonged Scandinavian drought.

Oceanographers cannot explain how these anomalies form or what drives them, but similar features appear in some computer simulations of ocean temperatures. By dissecting the computer versions, researchers hope to learn more about these wandering weather makers of the Atlantic. —*R. Monastersky*



Maps of January temperatures from 1968 to 1976 show cold patch (blue) drifting clockwise around the Atlantic Ocean.

Bright X rays to illuminate a new frontier

Much of what is known about the atomic structures of proteins and other biological molecules comes from studies of how crystals of these materials deflect X rays. Growing the protein crystals large enough to use with conventional X-ray sources, however, can be a difficult and frustrating task.

This week, researchers expect to get their first chance to use a new, intense source of X rays to begin probing tiny crystals of various proteins. "We've designed our [equipment] to work with extremely small crystals so that even when you don't get the world's best crystals, you can still study them [or parts of them]," says Edwin M. Westbrook, director of the Structural Biology Center at Argonne (Ill.) National Laboratory.

"We're going to test our setup on a variety of crystals over the next month or so," he notes. "By the end of June, we should be reliably on track."

Westbrook heads one of about a dozen collaborations, which include researchers from roughly 100 universities and nearly 50 companies and research institutions, that are gearing up to use Argonne's Advanced Photon Source. Designed as the world's brightest source of high-energy X rays for studying materials and chemical processes, the facility was dedicated last week.

The U.S. Department of Energy provided $812 million for constructing and operating the Advanced Photon Source. Federal agencies, universities, and other bodies contributed an additional $200 million for instruments and equipment.

When electrons and other charged particles traveling at nearly the speed of light are forced to change direction, they emit electromagnetic radiation (called synchrotron radiation), which emerges as a cone resembling the beam from a car's headlight. As the energy of the particles increases, this cone gets narrower and the average wavelength of the radiation decreases.

In the Advanced Photon Source, the charged particles are positrons, the antimatter counterparts of electrons. These particles are accelerated in stages to an energy of 7 gigaelectronvolts, then injected into a storage ring about 1 kilometer in circumference—large enough to encircle a baseball stadium. The particles circulate there at nearly the speed of light for about 10 hours.

The storage ring is an 80-sided polygon with alternating short and long sides. At the corners, the bending magnets deflect the circulating positrons and stimulate the emission of X rays with a broad range of wavelengths. Along most of the straight sections, the positrons pass through a gauntlet of magnets that jiggle the particles back and forth in a