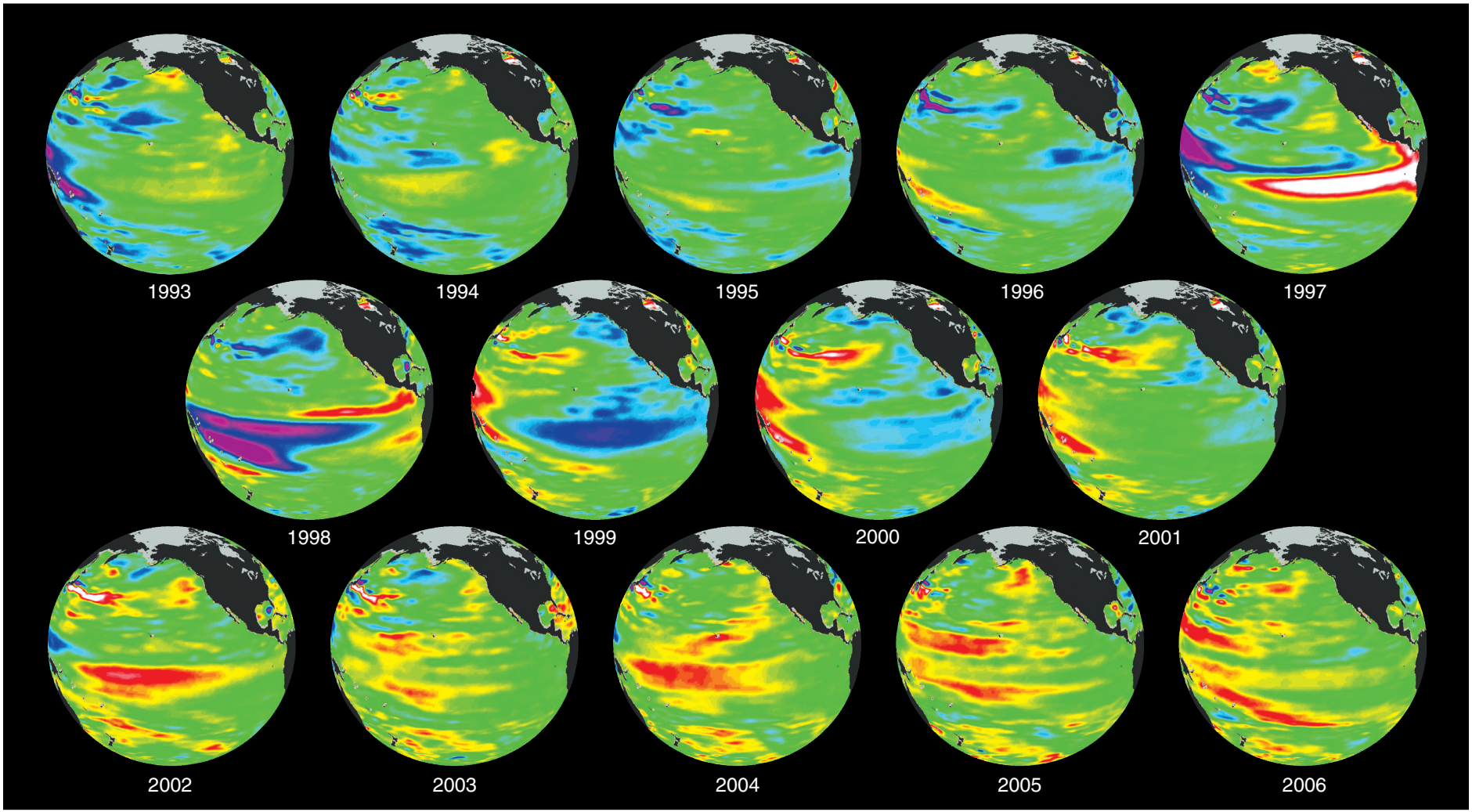

The Legacy of Topex/Poseidon

Since 1992, precise measurements of the global ocean surface topography from space have revolutionized our understanding of the ocean and global climate.

Faces of a Changing Ocean

These data globes, created with radar altimeter measurements from Topex/Poseidon and Jason-1, represent 14 years of science data delivered by these satellites during their continuing voyage of discovery. Launched on August 10, 1992, Topex/Poseidon was the first great oceanographic research vessel to sail into space. Its follow-on, Jason-1, launched on December 7, 2001, continues making the precise measurements of the ocean surface begun by Topex/Poseidon.

The globes show the average annual sea-surface height anomalies for the period from 1993 to 2006. An anomaly is the difference between the height of the sea surface measured by the satellites and the average sea-surface height. Sea-surface heights move up and down in a slow, regular pattern as the Sun warms the water of the upper ocean and as the seasons progress. This “normal” annual signal has been removed from these maps to show clearly the large year-to-year variations.

Sea-surface height reflects how much heat is stored in the upper ocean, an important factor in climate. In these images, “normal” sea-surface height appears as green. The blue and purple areas represent heights that are between 8 and 24 centimeters (3 and 9 inches) lower than normal and indicate cooler water. Red and white areas represent ocean heights that are between 8 and 24 centimeters (3 and 9 inches) higher than normal and indicate warmer water.

The Topex/Poseidon Mission

Topex/Poseidon was a joint effort between NASA and the French Space Agency, Centre National d’Etudes Spatiales (CNES). In 1979, NASA was developing the Ocean Topography Experiment (Topex) mission, while CNES was planning a similar mission called Poseidon. The agencies decided to pool their resources into a single mission in 1983. The satellite was launched aboard an Ariane II rocket from the European Space Agency’s launch facility in French Guiana. The Jet Propulsion Laboratory, California Institute of Technology, manages the U.S. portion of the ocean surface topography missions for NASA.

The mission’s most important achievement was determining the patterns of ocean circulation — how heat stored in the ocean moves from one place to another. Most of the heat that makes Earth capable of supporting life comes from the Sun. Both the atmosphere and the ocean absorb some of this heat, but the ocean does a much better job of holding on to it. The top three meters of the ocean contain more heat than the entire atmosphere. It is the ocean’s ability to hold heat that makes ocean circulation a driving force of climate.

Topex/Poseidon provided the most complete, long-term, global record of surface ocean circulation ever collected. For the first time, scientists could compare computer models of ocean circulation with actual global observations and use this information to improve climate predictions.

Topex/Poseidon gave us the first global perspective on El Niño, a three- to seven-year event in the Pacific Ocean that has profound effects on world climate. (See *http://sealevel.jpl.nasa.gov/science/el-nino-text.html.*) The satellite also provided a global viewpoint for La Niña and other short-term climate events. It allowed researchers to observe the development of these events and follow their evolution. It also gave us evidence of even longer-lasting phenomena, such as the Pacific Decadal Oscillation, a fluctuation in the Pacific Ocean that waxes and wanes over 20 to 30 years. (See *http://sealevel.jpl.nasa.gov/science/pdo.html.*)

Another of the mission’s major accomplishments was mapping global tides for the first time. Tides are the most visible changes in the ocean on a daily basis and play an important role in navigation. They are the major source of mixing in the ocean and have a major impact on biological activity.

Planned as a five-year mission, Topex/Poseidon operated successfully for more than 13 years. It provided more than 98 percent of the science data it was designed to collect to an international team of more than 600 scientists representing 54 countries. In October 2005, the satellite’s pitch reaction wheel, which helps keep the spacecraft in its proper orbital orientation stopped working, preventing any further science operations. Ground controllers transmitted the final command terminating the historic mission in January 2006. The satellite remains safely in orbit 1,336 kilometers (830 miles) above Earth.

Extending the Legacy
The Jason-1 Mission and Beyond

Jason-1 flew in a tandem mission with Topex/Poseidon for nearly three years before the older spacecraft ceased operations. Together the two satellites were able to collect twice the amount of data, revealing details of smaller-scale ocean phenomena such as coastal tides, ocean eddies and currents. Now flying solo, Jason-1 continues observations of ocean circulation, and is providing further insights into the relationship between the ocean and climate.

The Ocean Surface Topography Mission on the Jason-2 satellite (OSTM) will follow Jason-1. OSTM is scheduled for launch in June 2008 from Vandenberg Air Force Base. As were Topex/Poseidon and Jason-1, this new mission is a collaborative effort between NASA and CNES. In addition, the mission includes two new partners, the European Organization for the Exploitation of Meteorological Satellites and the National Oceanic and Atmospheric Administration. With new partners, improved instrumentation and satellite tracking, OSTM moves closer toward the goal of establishing operational satellite radar altimetry for oceanographic applications.

Societal Benefits

The data collected by Topex/Poseidon and Jason-1 are used in a variety of applications that benefit society, including climate research, studies of ocean circulation, and marine mammal research, as well as operational applications including hurricane prediction, navigation, offshore operations, and fisheries. For examples see the NASA JPL Ocean Surface Topography from Space website (*http://sealevel.jpl.nasa.gov*) and the CLS Aviso web site (*http://www.aviso.oceanobs.com*.)

Education and Public Outreach

The Ocean Surface Topography Education and Public Outreach program supports ocean education through a variety of products and activities. For more information see *http://sealevel.jpl.nasa.gov/education.*

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