



Ocean Surface Topography Mission/Jason 2

While our small cosmic outpost is called Earth, it might more aptly be called Ocean, since ocean covers more than 70 percent of our planet. Besides being the source of our life-sustaining water and providing food for Earth's inhabitants, the ocean acts as Earth's thermostat, storing energy from the sun and keeping Earth from heating up quickly. In fact, the ocean stores the same amount of heat in its top three meters (10 feet) alone as Earth's entire atmosphere does. Heat and moisture from this great reservoir are constantly being exchanged with our atmosphere in a process that drives our weather and climate.

Looking out at the ocean, it's hard to imagine it as anything but flat. Yet from space we can see that it has hills and valleys too, as do Earth's continents. These hills and valleys can vary globally by up to two meters (6.5 feet) in height from one region to the next. These small departures of the sea surface from a level surface are called ocean surface topography, which is caused by large-scale ocean currents.

Driven by blowing winds that pile up or depress the ocean surface, and directed by the Coriolis force (an Earth rotational effect that deflects ocean currents to the right in the Northern Hemisphere and to the left in the Southern Hemisphere), ocean

currents carry heat away from Earth's equatorial regions toward its icy poles. Just as winds blow around the extensive highs and lows of atmospheric surface pressure, these ocean currents circulate in enormous "gyres" around regions of raised or lowered sea level—the hills and valleys of ocean surface topography. The heat carried by these currents is slowly released into the atmosphere, regulating our climate.

By bouncing a radar signal off the surface of the ocean from a satellite and precisely measuring how long it takes the signal to return, scientists can map the topography of the ocean surface to within a few centimeters. Accurate observations of variations in ocean surface topography tell a larger story about the ocean's most basic functions—how it stores vast amounts of energy from the sun and how it moves that energy around the globe through ocean currents. Understanding where this heat is and how it moves within the ocean as currents and into the atmosphere are critical to understanding global climate.

Mission Overview

The international OSTM/Jason 2 satellite mission will extend into the decade of the 2010s the continuous climate record of precise sea surface

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height measurements begun in 1992 by the joint NASA/Centre National d'Etudes Spatiales (CNES) Topex/Poseidon mission and continued in 2001 by the NASA/CNES Jason 1 mission. Data from this new mission will be used to help scientists better understand the strong relationship between ocean circulation and climate. The mission will also monitor the slow, steady rise in global sea level, one of the most important indicators of global climate change.

Data from OSTM/Jason 2 will help scientists such as meteorologists, oceanographers and climatologists better understand how the ocean interacts with Earth's atmosphere and continents to control and change our climate. Information collected from OSTM/Jason 2 will help us improve predictive models of Earth's ocean and atmosphere and will also help improve hurricane forecasts. It will also allow us to identify and track large ocean/atmosphere phenomena such as El Niño, La Niña, and climate oscillations that operate on time scales spanning multiple decades.

OSTM/Jason 2 will serve as a bridge to transfer future collection of these measurements to the world's weather and climate forecasting agencies. These agencies will use the data for short- and seasonal-to-long-range weather and climate forecasting.

OSTM/Jason 2 data will be used in a variety of everyday applications such as routing ships, improving the safety and efficiency of offshore industry operations, managing fisheries and tracking marine mammals.

Launch and Orbit

OSTM/Jason 2 will be launched on a United Launch Alliance Delta II launch vehicle from California's Vandenberg Air Force Base. The spacecraft will orbit at an altitude of 1,336 kilometers (830 miles), the same orbit as Jason 1, where it will map 95 percent of the world's ice-free oceans every 10 days. Once OSTM/Jason 2 is in place and its data have been calibrated and validated, Jason 1 will be moved into a parallel ground track midway between two OSTM/Jason 2 ground tracks and the two spacecraft will conduct a tandem mission that will further improve tide models in coastal and shallow seas and improve our understanding of the dynamics of ocean currents and eddies.

Mission Duration

OSTM/Jason 2 is designed to operate for at least three years. At the end of that time, if useful data are still being collected, the mission may be extended by two years, or any additional period agreed upon by the mission partners.

Science Objectives

- ❑ Extend the time series of ocean surface topography measurements beyond Topex/Poseidon and Jason 1 to complete two decades of high-precision altimetry observations
- ❑ Determine how ocean circulation varies over long time periods using the combined data record from Topex/Poseidon and Jason 1
- ❑ Improve the knowledge of ocean circulation that does not

change with time

- ❑ Measure global sea level change
- ❑ Improve ocean tide models, including coastal tides

Payload Overview

OSTM/Jason 2 will carry five primary science instruments that are similar to or upgraded versions of those flown on Jason-1:

- ❑ The Poseidon 3 altimeter, provided by CNES, is the mission's main instrument. It measures the distance from the satellite to Earth's surface by sending radar waves to the sea surface and measuring how long they take to bounce back. It also calculates the speed of ocean surface currents and provides data on wave height and wind speed.
- ❑ The Advanced Microwave Radiometer, provided by NASA, measures the amount of water vapor in the atmosphere, which can delay the return of radar pulses to the satellite, interfering with sea level measurement accuracy.
- ❑ Three location-finding systems are used to measure the spacecraft's precise position in orbit: the Doppler Orbitography and Radio-positioning Integrated by Satellite (Doris) provided by CNES; the Global Positioning System Payload, provided by NASA; and the Laser Retroreflector Array, also provided by NASA.

Advances in OSTM/Jason 2's instruments will allow scientists to monitor the ocean in coastal regions with increased accuracy, almost 50 percent closer to coastlines than previously possible.

Three "passenger," or experimental, instruments will also be flown on OSTM/Jason 2. In addition to their own scientific objectives, these instruments are expected to improve the performance of the Doris location-finding system:

- ❑ The Environmental Characterization and Modelisation-2 (Carmen-2), provided by CNES, will study the effects of radiation in the satellite's environment on advanced components.
- ❑ The Time Transfer by Laser Link instrument, provided by CNES, will use a laser link to compare and synchronize remote ground clocks with high accuracy.
- ❑ The Light Particle Telescope, provided by Japan, will study radiation in the satellite's environment.

Partners

OSTM/Jason 2 is a collaboration among NASA; the National Oceanic and Atmospheric Administration (NOAA); CNES; and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). CNES is providing the spacecraft, NASA and CNES are jointly providing the payload instruments, and NASA's Launch Services Program at the Kennedy Space Center is responsible for Delta II launch management and related services. After completing on-orbit spacecraft commissioning, CNES will hand over operation and control of the spacecraft to NOAA. NOAA and EUMETSAT will generate the near-real-time products and distribute them to users. NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the mission for NASA's Science Mission Directorate, Washington.

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