# Ocean Altimetry Applications

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The successful December 2001 launch of the NASA/CNES Jason-1 satellite, follow-on to the highly successful TOPEX/POSEIDON mission, provides oceanographers and marine operators across the globe with the unique opportunity of a continuous stream of sea surface height data beginning in late 1992, and extending through the expected mission life in 2006. This unprecedented resource of valuable ocean data can be used to map sea surface height, geostrophic velocity, significant wave height, and wind speed over the global oceans.

Altimeter data products are currently used by researchers and operational users worldwide to monitor ocean circulation and improve our understanding of the role of the oceans in climate and weather. Altimeter data have also proved valuable for a suite of practical applications, including —

- Ocean forecasting systems
- Ship routing
- Precision marine operations: cable-laying, oil production, shipping . . .
- Ocean acoustics for Navy operations
- Fisheries management
- Marine mammal habitat monitoring
- Hurricane forecasting and tracking
- Debris tracking

The data have been cited in over 1,000 research and popular articles since the launch of TOPEX/POSEIDON in 1992, and almost 200 scientific users receive the global coverage altimeter data on a monthly basis. In addition to the scientific and operational uses of the data, the educational community has seized the unique concepts highlighted by these altimeter missions as a resource for teaching ocean science to students from grade school through college.

www.jason.oceanobs.com

www.jpl.nasa.gov

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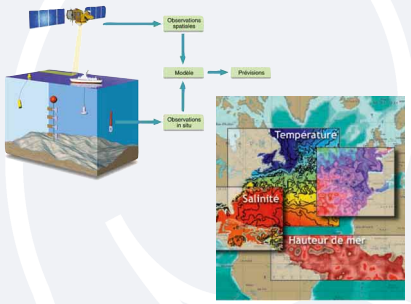
## MERCATOR

Ocean bulletins ... just like the weather forecast. MERCATOR, the French operational oceanography project, issues bulletins that forecast ocean conditions one and two weeks into the future. These forecasts provide data on currents, temperature, and salinity from the surface to the bottom of the ocean. Unique ocean monitoring and forecasting information is already used by the French Navy and meet the needs of research cruises. Operational products for all: end users, client-applications such as marine safety, oil spill monitoring, offshore operations, and commercial activities at sea, or research needs such as reanalysis results or near-real-time support for research cruises. Coupled with coastal and shelf models, and ecosystem and atmospheric models for climate seasonal forecasting, MERCATOR products will contribute to a wide range of applications.

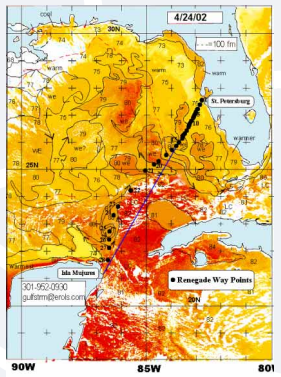



The forecasting system is based on routine assimilation of near-real-time ocean observations in a 3-D dynamical ocean model. Ocean altimetry data, including those of the TOPEX/POSEIDON and Jason-1 satellite missions, are a key element of ocean forecasting, just as pressure measurements are essential for weather forecasts. Scientists rely on these data to initialize and validate their models, and thus to ensurethat they reproduce a true picture of reality.

The MERCATOR ocean forecasting system is France's contribution to GODAE, the first international operational oceanography experiment of its kind.

www.mercator.com.fr

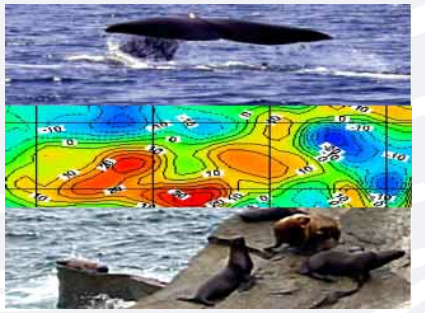
## Sports Sailing




The modern sport sailor is technologically sophisticated, often relying on satellite navigation and remote sensing to gain an edge over competitors. Navigational charts prepared using data collected by ocean and weather satellite systems are an important tool used by the tactical teams aboard each sailboat. Jenifer Clark, a charting veteran with over 30 years of experience who is known as the "Gulf Stream Lady," provides one such charting service. She uses satellite measurements of sea surface temperatures and ocean height to create charts of the ever-changing eddies, meanders, and currents associated with strong ocean currents such as the Loop Current and Gulf Stream. These ocean currents rush across sailing routes at speeds of over 4 knots. On race day, accurate charts can be the difference between winning and losing, since a sailboat that makes 5 knots in still water can almost double its speed by taking advantage of favorable currents and avoiding unfavorable ones. Satellite altimetry is an integral component of this monitoring because of its all-weather capability, allowing remote sensing even during cloudy conditions, giving a distinct advantage to sailors using it to fine-tune their race day tactics.

## Marine Mammals

In the Gulf of Mexico, sperm whales congregate in regions of increased biological productivity associated with cyclones — counterclockwise-rotating eddies that bring nutrients up from the depths of the ocean. These cyclones create ocean oases, or local spots with an abundance of primary productivity. Ocean height data from Jason-1 and TOPEX/POSEIDON are transmitted to users in near real-time. Researchers analyze these data, producing high-resolution maps identifying the locations of these ocean cyclones, the ideal places to watch for whales. Researchers at Texas A&M University have used this in-



formation to study and survey the whale population in the Gulf of Mexico. This research is an outgrowth of the shared desire by academia, industry, and government to protect marine mammals. These studies, aided by NASA's ocean monitoring satellites, are increasing knowledge of the population size, diversity, distribution, and habitat of marine mammals in the gulf. Altimetric techniques developed for the Gulf of Mexico are useful for monitoring the habitat of other marine mammals, such as Steller sea lions, in the Gulf of Alaska and Bering Sea.

## Oil & Gas Industries

Ocean currents as strong as 2–4 knots associated with the Loop Current and its large eddies impact oil and gas exploration and production activities in the Gulf of Mexico, a region that provides nearly half of all U.S. domestic oil production. An important component of Gulf of Mexico monitoring and forecast systems is the assimilation of near-real-time altimeter data into numerical ocean models of the gulf. Since 1996, the offshore oil and gas industries have made extensive use of Gulf of Mexico near-real-time altimeter data products and an operational nowcast/forecast system assimilating near-real-time altimeter data provided by the University of Colorado, Boulder.

## Marine Insurance

Damage claims on offshore installations and high seas shipping are difficult to verify by insurance adjustors investigating claims for the marine insurance industry. Satellite altimetry serves as a reliable data source of ocean circulation, winds, and waves to verify losses at sea, speeding up both the investigation and payment of claims of insured parties. One claim investigated was associated with Millennium Eddy, a strong anticyclonic eddy that shed from the Loop Current in the Gulf of Mexico during April 2001. The strong currents within the eddy impacted a number of offshore oil and gas producers on the Louisiana continental shelf and slope. The most remarkable event concerned a drilling rig where strong eddy currents on the platform riser prevented raising of the platform drill. The rig had to remain inactive for 8 weeks at a cost of $300,000 per day. Insurance claims paid for some of the damage; however, advance knowledge of the strong currents could have saved nearly $17 million dollars in leasing costs if drilling could have been planned around this event.