

OCEAN OBSERVATORIES INITIATIVE



The Ocean Observatories Initiative (OOI) is the largest research infrastructure investment by the NSF's Geosciences Directorate.

It is managed and operated by the **Woods Hole Oceanographic Institution**, which also houses the **OOI Program Management Office**, in collaboration with the **University of Washington** and **Oregon State University**.

Designed for long-term ocean monitoring over a span of 30 years, OOI uses moored, cabled and mobile systems to capture both short-term events and long-term changes. The observatory encompasses five arrays with over 900 instruments that collectively measure more than 200 physical, chemical, geological, and biological parameters.

Data is transmitted in near real-time and made freely available online to serve as a vital resource for advancing scientific research and informing policy and operational decisions across a range of domains including fisheries management, geohazard assessment, ocean health monitoring, national security and the blue economy.



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Global Station
Papa Array

Regional Cabled Array
and Coastal
Endurance Array

Global Irminger
Sea Array

Coastal Pioneer
Mid-Atlantic
Bight Array

GLOBAL

Irminger Sea

The Global Irminger Sea Array in the North Atlantic is a key site of deep-water formation driving global ocean circulation. Located in a region of strong winds, large waves, and intense air-sea exchanges, it plays a vital role in carbon sequestration, biological productivity, extreme weather formation, and active fisheries. Its moorings support sensors that measure air-sea exchanges, and physical, biological and chemical properties throughout the water column.

SCIENCE HIGHLIGHT: Data from the OOI Irminger Sea array showed, for the first time, how strong winter winds and shifting weather patterns near Greenland drive ocean heat loss and deep-water formation—key processes that help power the global ocean circulation and influence global climate. (Josey et al., 2019)

Station Papa

The Global Station Papa Array, located in the Gulf of Alaska, is one of the longest-running ocean observation sites and has been continuously monitored since 1949, most recently as part of a collaboration between OOI and NOAA's Pacific Marine Environmental Laboratory (PMEL). This region is critical for studying ocean acidification and supports one of the most productive U.S. fisheries. It is also influenced by the Pacific Decadal Oscillation (PDO), which shapes weather across North America over 20–30-year cycles. The array's data contribute to understanding climate variability, ecosystem health, and biogeochemical processes in the North Pacific.

SCIENCE HIGHLIGHT: Station Papa, together with two other OOI arrays in the Pacific and the NOAA PMEL surface mooring, enabled high-resolution monitoring of a 2014 marine heatwave known as “the Blob” and to track its impacts on key marine ecosystems. (e.g., Bond et al., 2015)

CABLED

Regional Cabled Array

The Regional Cabled Array (RCA) delivers real-time data from the seafloor and water column across the Juan de Fuca Plate, including an active submarine volcano off the Oregon-Washington coast. Its 900 km electro-optical cable network powers and connects sensors in the Cabled Continental Margin, Endurance, and Axial Seamount Arrays.

SCIENCE HIGHLIGHT: RCA instruments have been monitoring fine-scale seismic activity and seafloor uplift at Axial Seamount for the past decade, prompting scientists to issue warnings that an eruption at the site could be imminent. (e.g., Wang et al., 2025)

COASTAL

Pioneer Mid-Atlantic Bight

The Pioneer Array is the one OOI array that was intended to move. After more than five years off the coast of New England, it was relocated in 2024 to the Mid-Atlantic Bight north of Cape Hatteras. The region experiences a persistent south-flowing current, inputs from several rivers, highly variable winds, and occasional inshore meanders by the Gulf Stream. This complex region has significant impacts on regional, highly dynamic weather and hosts an extremely productive fishery.

SCIENCE HIGHLIGHT: Data from the Pioneer Northeast Shelf Array showed for the first time that warm water from the Gulf Stream can push onto the shallow ocean shelf off the Mid-Atlantic coast with potential implications for marine life, coastal weather, and fisheries. (Zhang and Gawarkiewicz, 2015)

Endurance

The Endurance Array, located off the U.S. Northwest Coast monitors ocean variability across multiple scales in a coastal upwelling zone—areas that represent less than 5% of ocean surface but yield 25% of global fish catch. The array operates and maintains two highly instrumented lines of data that cross the continental shelf off the Oregon and Washington coasts. These lines are tied together with glider transects running along and across the shelf. Data support research on ocean health issues like hypoxia, acidification, and impacts on marine life.

SCIENCE HIGHLIGHT: Data from Endurance Array helped show that unusually strong ocean upwelling in summer 2021 led to a sharp increase in low-oxygen (hypoxic) waters off the Pacific Northwest, a growing problem linked to changing marine conditions that threatens ocean and human health. (Barth et al., 2024)

