



GeoXO Ocean Color Instrument

What is OCX?

NOAA plans to fly an Ocean Color (OCX) instrument on its next generation of geostationary environmental satellites, Geostationary Extended Observations (GeoXO). OCX will observe ocean biology, chemistry and ecology to assess ocean productivity, ecosystem change, coastal and inland water quality, seafood safety, and hazards like harmful algal blooms (HABs). OCX will analyze ocean data within the U.S. [Economic Exclusive Zone \(EEZ\)](#) and Great Lakes every two hours.

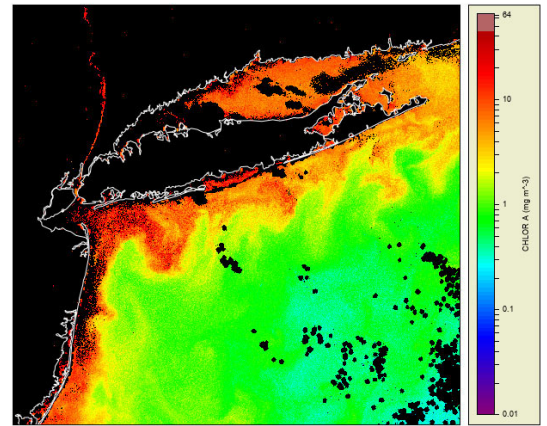
Why do we need OCX?

OCX will deliver a more frequent and comprehensive view of ocean and coastal conditions than is currently available. From its position in geostationary orbit, OCX will provide observations every two hours, while current low-Earth-orbiting sensors provide updates only once per day.

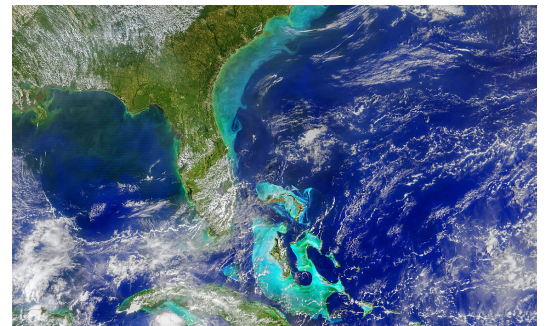
More frequent images will greatly improve the chance of cloud-free observations over areas of interest. Cloud cover often obscures the view from space and having many images of the same scene per day provides more opportunity for a clear picture and an accurate representation of real-time conditions. More timely data will allow scientists to assess both daily changes in ocean and coastal conditions and track rapidly-changing features like sea fog and oil spills.

Unlike current ocean color sensors, OCX is a hyperspectral instrument that will analyze a wide spectrum of light from ultraviolet to near-infrared. The additional spectral information will be critical for distinguishing types of phytoplankton to support aquaculture activities and for tracking algal blooms in coastal waters, which are more complex due to dissolved pigments and sediment.

OCX will provide ocean observations at approximately 390-meter resolution. High-resolution ocean color imagery will improve observations of water clarity and chlorophyll concentration as well as provide better detection of harmful algal blooms and coastal pollutants. Finer resolution will also allow scientists to better monitor water quality within smaller bodies of water and along the coast where urbanization and high nutrient runoff have an increasingly negative impact on the livelihoods of local communities.



OLCI Chlorophyll-a for the New York/New Jersey bight and Long Island sound on Oct. 9, 2020. This data estimates the concentration of phytoplankton pigment in the ocean surface, which has applications for ecosystem modeling, fisheries management, and water quality monitoring. Image credit: ESA



When Hurricane Dorian passed over the Bahamas and along the southeastern U.S. coastline, its waves re-suspended large quantities of sea-floor sediment, which give the ocean a milky, aquamarine appearance in this composite of VIIRS data collected on Sept. 7, 2019. The browner hues closer to the U.S. shore come from runoff generated by heavy rainfall from the hurricane.

Priorities for coastal imaging

Sensor	Operational/ Research	Orbit	Hyperspectral	Refresh Rate	Spatial Resolution
Sentinel OLCI	Operational	LEO	N	2-3 days	300 m
JPSS VIIRS	Operational	LEO	N	1-2 days	750 m
PACE OCI	Research 2024-2026	LEO	Y	1-2 days	1000 m
GLIMR	Research 2027-2028 (tbd)	GEO	Y	2-6x per day	535 m
GeoXO OCX	Operational starting 2032	GEO	Y	3-4x per day	390 m

Highest Utility

Higher Utility

Usable

What benefits will OCX provide?

NOAA is mandated to support the stewardship of 479 fish stocks and 164 endangered and threatened species throughout the 3.4 million-square-mile U.S. EEZ. OCX will provide a more timely and complete view of the U.S. EEZ and the Great Lakes.

Cloud cover is an issue over the nation's most valuable fisheries, protected species populations, and coastal communities. Today, NOAA can image only one out of five U.S. Pacific coral reefs due to cloud cover. This impacts NOAA's ability to manage reef systems, such as the Hawaiian Coral Reefs, valued at \$33.6 billion. OCX will provide more opportunity to capture cloud-free observations and an accurate picture of real-time conditions.

Acute health effects associated with marine pathogens and HAB toxins are estimated to cost almost \$1 billion per year. Improved ecological forecasts will provide more time for decision-making and mitigation efforts, reducing both the costs and effects



Fishermen unload halibut catch. Photo credit: NOAA

of HAB events. OCX data will also aid better predictions of when conditions will return to normal, allowing decision-makers to lift beach and fisheries closures as quickly and safely as possible.

Frequent, high-resolution ocean color imagery will help NOAA provide more accurate and timely forecasts and scientific guidance to federal, state, and local agencies. OCX observations will support ecological forecasters, marine resource managers, fisheries, health departments, water treatment managers, and the commerce, recreation, and tourism industries.



Taughannock Falls State Park in New York closed swimming area closure due to toxic algae outbreak. Photo credit: Jeff Katris

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| ✓ Better detection of harmful algal blooms and coastal pollutants | ✓ Fewer fisheries closures and reduction in unnecessarily restrictive catch limits |
| ✓ Enhanced data for determining phytoplankton types | ✓ Detection of hazardous sea fog threatening ship and land traffic in coastal areas |
| ✓ Improved observations of water clarity and chlorophyll concentration | ✓ Better identification and protection of endangered species and their preferred habitats |
| ✓ More detailed observations of coastal waters | ✓ Improved identification of health threats to coral reef ecosystems |
| ✓ Better identification of sites suitable for aquaculture | ✓ Reduced economic and public health impacts from HAB events |
| ✓ More refined estimates of fisheries yield | ✓ Critical data to protect U.S. Navy divers and underwater assets |
| ✓ Improved protection of shellfish stocks | ✓ Oil spill detection and tracking |
| ✓ Improved fishing efficiency (less time and fuel used to locate fish) | ✓ Improved numerical model forecasts |

How soon will we have OCX observations?

The first GeoXO satellite launch, carrying an OCX instrument, is planned for 2032.