

*Originally Compiled by Sage Lichtenwalner, Rutgers University  
Please note that this resource list is still in draft form.*

## What is an Ocean Observing System?

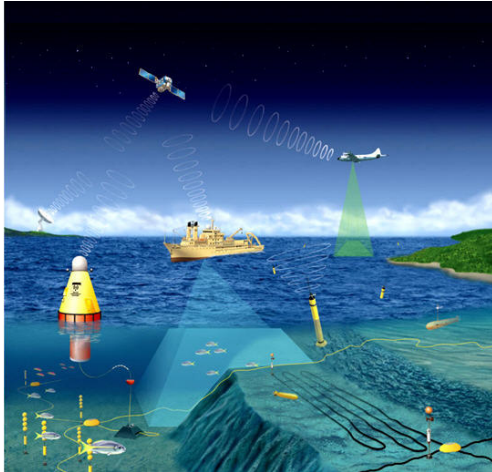


Image courtesy of IOOS <http://ioos.gov/>

One hundred years ago, oceanographers studied the ocean and the life within it by venturing out on ships. In order to discover what was happening within the ocean and Great Lakes, they would often literally throw a bucket over the side of the ship and analyze what came back. While these types of experiments expanded our knowledge of the ocean, scientists soon discovered that the ocean is a large, complex and dynamic environment. To gain a better understanding of the ocean, they would need a lot more than a few buckets, and they would need to find a way to monitor the ocean at all times, even during large storms when few people would venture out, or if they did, return alive.

As instruments, communication networks and even ships improved throughout the twentieth century, scientists were able to collect more and more complex datasets over larger areas and longer time periods. This new knowledge aided our understanding of physical, biological, chemical and geological processes in the ocean. But because many of these processes are interrelated, scientists need a way to study more than just one thing at a time. As a result scientists turned to elaborate networks of sensors to record many parameters at many places all at once in order to understand these complex relationships in the ocean and Great Lakes. This convergence of sensors and technology has led to the rise of “Ocean Observing Systems.”

Just as weather agencies have networks of metrological stations, weather radars, radiosondes and satellite sensors that help them record and predict the weather, ocean observing systems are now building networks of underwater cabled observatories, surface buoys, coastal radars, autonomous profiling floats and gliders, and satellite sensors of their own. All of this data is sent back to shore and in many cases is made available in real-time on the Internet where scientists, resource managers, educators, students and the recreating public can view and use it too.

By concentrating instruments within specific areas, and by amassing large collections of data from several instruments over time, scientists are able to study the complex issues facing the world today, including climate change, harmful algal blooms, recovery from oil spills, human-induced pollution, and maritime safety. Ocean observing systems are allowing us to observe the ocean and the Great lakes from more angles than ever before, and are helping us to increase our oceanographic knowledge.



Map of IOOS Regional Associations  
Image courtesy of IOOS <http://ioos.gov/>

## 1. Regional Ocean Observing Systems

A national initiative is currently underway to set up Regional Associations and affiliated OOS across the country. While several regional centers are currently in operation, the sites below showcase the best coastal and oceanographic datasets available.

- NOAA NowCoast (National Data Portal) – <http://nowcoast.noaa.gov> .
- Alaska – [http://ak.aos.org/observing\\_system\\_components.php](http://ak.aos.org/observing_system_components.php)
- Central and Northern California – [www.cencoos.org](http://www.cencoos.org)
- Southern California – <http://sccoos.org/interactive-map>
- Great Lakes – <http://www.glos.us/>
- GOMOOS – <http://gomoos.org>
- SECOORA - [www.secoora.org](http://www.secoora.org).
- HiOOS – <http://www.hioos.org>
- GCOOS - new IOOS-DMAC compatible web portal <http://gcoos.tamu.edu>
- NANOOS <http://www.nanoos.org/data/products/products.php>

## 2. Remote Sensing Satellites (Temperature, Ocean Color, Winds & more)

The best view of the ocean, of course, is from space. So scientists have long launched satellites hundreds of miles above the Earth's surface hoping to gain a better view of the ocean. A variety of sensors have been placed on satellites to measure the land, ocean and atmosphere of the Earth, but the most common oceanographic datasets available are:

- NOAA Coast Watch – <http://coastwatch.noaa.gov/interface/interface.html>
- Near-Real-Time Image Distribution Server – <http://nereids.jpl.nasa.gov>
- East Coast SST & Ocean Color – [http://marine.rutgers.edu/cool/sat\\_data](http://marine.rutgers.edu/cool/sat_data)
- California SST & Ocean Color – [http://sdcoos.org/data/modis/modis\\_california.cfm](http://sdcoos.org/data/modis/modis_california.cfm)
- Florida/Caribbean SST & MODIS – <http://imars.usf.edu>
- NASA Earth Observatory – <http://neo.sci.gsfc.nasa.gov/Search.html>
- Earth Observatory Global Animations – <http://earthobservatory.nasa.gov/Observatory>
- AOS Sea Ice link: [http://ak.aos.org/op/data.php?region=BSEA&name=amsre\\_sea\\_ice](http://ak.aos.org/op/data.php?region=BSEA&name=amsre_sea_ice)

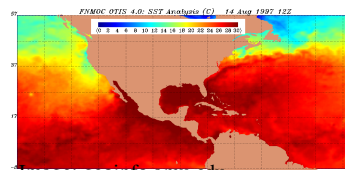


Image: geoinfo.amu.edu

## 3. Coastal HF-Radar (Surface Currents & Waves)

High-frequency (HF) radio waves (near the AM radio band) can be used to measure the surface currents and waves of the ocean. Data collected from a network of shore antennas can be used to generate maps of surface currents in the coastal ocean up to 140 miles offshore (depending on the frequency used). These maps typically use arrows to indicate the direction of current flow, and often times the color or size of the arrows indicates speed. Such maps are more suited for higher-grade students who are familiar with vectors.

- Rutgers Codar – <http://marine.rutgers.edu/cool/codar.html>
- Southern California Codar – <http://sccoos.org/data/surfacecurrents>
- Central and Northern California – <http://www.cencoos.org/sections/conditions/currents/index.shtml>
- Ocean Currents – <http://oceancurrents.us>
- SECOORA Region <http://iwave.rsmas.miami.edu/wera/>
- Oregon: <http://bragg.coas.oregonstate.edu/>

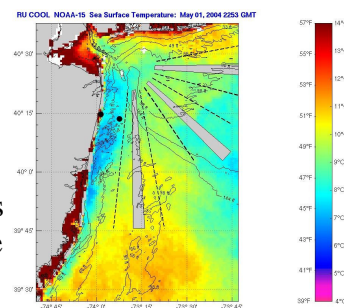


Image: Rutgers, CODAR data

## 4. Buoys and Shore Stations

To study changes in local environments, scientists use buoys or land-based stations outfitted with meteorological and in-water instruments. Buoys are also used to relay information from underwater sensors to satellites for transmission back to scientists on shore. By collecting data at buoys and stations over long periods, long-term changes can be observed as well as the impact of short-term events on the local ecosystem.

- NERRS Monitoring Sites – <http://cdmo.baruch.sc.edu>
- Carolinas RCOOS - <http://carolinasrcoos.org>
- Central and Northern California water quality <http://www.cencoos.org/sections/conditions/waterquality.shtml> and buoys <http://www.cencoos.org/sections/conditions/buoys.shtml>
- National Data Buoy Center – <http://www.ndbc.noaa.gov>
- MySound – <http://www.mysound.uconn.edu>
- COMPS - <http://comps.marine.usf.edu>
- Texas Automated Buoy System – <http://tabs.gerg.tamu.edu/Tglo>
- Eyes on the Bay - <http://www.eyesonthebay.net>
- Chesapeake Bay Observing System – <http://cbos.org>
- USGS Streamflow Conditions - <http://waterdata.usgs.gov/nwis/rt>
- Great Bay Buoy (New Hampshire) – <http://www.cooa.sr.unh.edu/buoydata/buoy.jsp>
- Alabama Water Watch – <https://aww.auburn.edu>
- Tidal Predictions & More – <http://tidesandcurrents.noaa.gov>
- HiOOS Water Quality and Wave Buoys – [http://www.soest.hawaii.edu/hioos/focus\\_area/water\\_quality.php](http://www.soest.hawaii.edu/hioos/focus_area/water_quality.php) and [http://www.soest.hawaii.edu/hioos/focus\\_area/conditions.php](http://www.soest.hawaii.edu/hioos/focus_area/conditions.php)
- AOS - [http://ak.aos.org/op/data.php?region=BSEA&name=avhrr\\_sst\\_daily](http://ak.aos.org/op/data.php?region=BSEA&name=avhrr_sst_daily)
- Puget Sound ORCA: <http://orca.ocean.washington.edu/data.html>

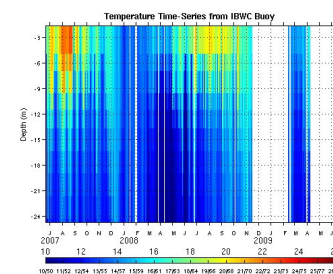


Image: Scripps, Buoy Data

## 5. Underwater Nodes

In the past, when scientists wanted to deploy instruments on the seafloor, they would have to use large battery packs to power their instruments, and wait months until the instrument was recovered to see their data. Cabled observatories are eliminating these two restrictions. A cabled node is essentially long extension cord that contains both power and communications lines. Researchers are able plug in their instruments into a node and directly communicate and control their instruments on the seafloor, retrieving data back in real-time. Only a few such observatories have been built, and most do not yet run year-round. However, plans are in the works to install several more within the next few years.

- **LEO-15** – <http://marine.rutgers.edu/cool/leodata.html>
- **Martha's Vineyard Coastal Observatory** – <http://mvcodata.whoi.edu/cgi-bin/mvco/mvco.cgi>
- **Kilo Nalu Reef Observatory** – [http://www.soest.hawaii.edu/hioos/focus\\_area/water\\_quality.php](http://www.soest.hawaii.edu/hioos/focus_area/water_quality.php)
- **MBARI MARS PROJECT**: <http://www.mbari.org/mars/>



Image: Oregon State, glider

## 6. Robotic Vehicles

- **Rutgers Slocum Gliders** – <http://marine.rutgers.edu/cool/auvs/> .
- **Scripps Spray Glider** – <http://spray.ucsd.edu/>
- **Global Surface Drifter Program** – [http://www.aoml.noaa.gov/phod/dac/dac\\_reports.html](http://www.aoml.noaa.gov/phod/dac/dac_reports.html)
- **Profiling Floats** – <http://www.coriolis.eu.org/cdc/default.htm> .
- **REMUS AUV** – [http://www.soest.hawaii.edu/hioos/focus\\_area/water\\_quality.php](http://www.soest.hawaii.edu/hioos/focus_area/water_quality.php)

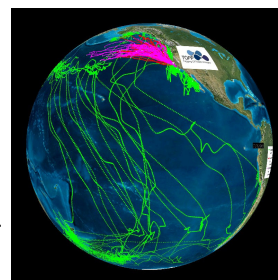


Image: NOAA, animal tracks

## 7. Animal Tracking

To track large animals (like turtles, whales and sharks) scientists attach a temporary radio transmitter to the animal that can be detected by satellites when the animal surfaces, thus revealing the animal's current location in real-time. Sometimes scientists also use data-loggers, which track an animal's depth (along with other factors like temperature and salinity) to study how the animal forages for food on its dives. In coastal areas, small acoustic transmitters can be surgically inserted into organisms (like striped bass, flounder and sharks), which in turn can be tracked by using an array of hydrophones (underwater microphones) that listen for when fish are nearby.

- **StriperTracker** – <http://stripertracker.org/>
- **WhaleNet** - <http://whale.wheelock.edu/Welcome.html>
- **Tagging of Pacific Pelagics** – [http://las.pfeg.noaa.gov/TOPP\\_recent/](http://las.pfeg.noaa.gov/TOPP_recent/)
- **Sea Turtle Tracking** – <http://www.seaturtle.org/tracking/>
- **Signals of Spring** – <http://www.signalsofspring.net>
- **HiOOS Hydrophone** – [http://www.soest.hawaii.edu/hioos/focus\\_area/ecosystem.php](http://www.soest.hawaii.edu/hioos/focus_area/ecosystem.php)

## 8. Ocean & Atmospheric Models

One of the primary uses of observatory data is to assist in the development of ocean, atmospheric and ecosystem (biological and chemical) models. Measurements are made to help understand physical and biochemical processes. Relationships are translated into mathematical formulas from which a computerized model can make predictions. But measurements are also required to “initialize” models, that is, to setup the current conditions of the ocean or atmosphere being modeled, from which future predictions can be made from. Climate models study very long-term trends in the ocean/atmosphere system. A key benefit of observatories is that they collect long-term datasets, which are necessary to understand global climate interactions. Most models are developed and used for research purposes. When a model is successful, it may be transitioned to an operational model, or incorporated into another model altogether. To date, relatively few oceanographic models are run in real-time. The following sites provide a few examples of some of the real-time atmospheric and ocean models currently available on the web.

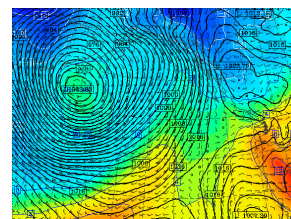


Image: Storm Surf, atm model

- **Weather Underground** – [www.wunderground.com](http://www.wunderground.com)
- **Rutgers Weather Forecasts** – <http://marine.rutgers.edu/cool/weather/WRF/>
- **West Florida Shelf** – <http://ocgmodel.marine.usf.edu/~ruoying/nowcast.html><http://ocgmod1.marine.usf.edu/WFS/>
- **Wave Watch** – <http://wavewatch.com/>
- **Storm Surf** – <http://stormsurf.com/>
- **NY Harbor [offline?]** – <http://onr.dl.stevens-tech.edu/webnyhos3/>
- **Hawaii Region Atmospheric Model** – [http://www.soest.hawaii.edu/hioos/data\\_product/forecasts.php](http://www.soest.hawaii.edu/hioos/data_product/forecasts.php)
- **Regional Ocean Model System (ROMS)** in Southern California: <http://www.sccoos.org/data/roms/>
- **AOOS Sound Predictions model**: <http://ak.aos.org/aos/index.html>; <http://ourocean.jpl.nasa.gov/PWS/>

- **Columbia River estuary (CMOP)** <http://www.stccmop.org/datamart/forecasts>
- **Oregon coastal ocean simulator:** [http://www.nanoos.org/data/products/oregon\\_coastal\\_ocean\\_simulator/oregon\\_coastal\\_ocean\\_simulator.php](http://www.nanoos.org/data/products/oregon_coastal_ocean_simulator/oregon_coastal_ocean_simulator.php)

**9. Educationally Focused Sites** The following sites are focused towards an education audience, and while they typically do not include real-time observatory data, several of the sites features lessons that link to observatory sites for data analysis.

- **Education and Research: Testing Hypotheses (EARTH)** – <http://www.mbari.org/earth/>
- **COOA** - <http://www.cooa.unh.edu/education.jsp>
- **COOL Classroom** – <http://coolclassroom.org>
- **CIESE** – <http://www.ciese.org/realtimeproj.html>
- **The Bridge** – <http://www.vims.edu/bridge>
- **USF Remote Sensing Lessons** – <http://education.imars.usf.edu/>
- **Educational Distance Learning** – <http://www.edlonline.org>
- **AMS DataStreme Ocean** – <http://www.ametsoc.org/amsedu/DS-Ocean/index.html>
- **AMS Water in the Environment** – <http://www.ametsoc.org/amsedu/WES/home.html>
- **WeatherBug Achieve** – <http://www.weatherbugachieve.com>
- **WISE** – <http://wise.berkeley.edu/>
- **Water on the Web** – <http://waterontheweb.org/>
- **NASA Earth Observatory** – <http://earthobservatory.nasa.gov/>
- **Our Ocean World Podcasts** – <http://www.ouroceanworld.com/2001/oceanworld.htm>
- **Student Data Mapper** – <http://kangis.org/mapping/SDM/>
- **MapZone** – <http://mapzone.ordnancesurvey.co.uk>
- **SECOORA** -- <http://secoora.org/classroom>



Image: NASA, Earth Observatories

## 10. Additional Resources

For more links to ocean-related data, check out these resource lists:

- The Bridge's Online Data Resources – <http://www.vims.edu/bridge/data.html>
- COSEE: Centers for Ocean Sciences Education Excellence - <http://www.cosee.net/>
- COSEE NOW- <http://coseenow.net/>
- COSEE– Ocean Systems - <http://cosee.umaine.edu/>
- DLESE - <http://www.dlese.org> A comprehensive database of oceanographic and Earth science resources specifically geared towards educators.
- Gulf Stream related data links – <http://www.science-house.org/nesdis/gulf/links.html>
- Google Earth Ocean Resources – <http://www.justmagic.com/GM-GE.html>
- Near Real-time Data Products – <http://rammb.cira.colostate.edu/wmovl/VRL/WebProducts/Web%20based%20products.htm>
- CIMAS (The Cooperative Institute for Marine and Atmospheric Studies) <http://oceancurrents.rsmas.miami.edu>
- PNW Shellfish Growers <http://www.nanoos-shellfish.org/>
- SATURN <http://www.stccmop.org/datamart> or [http://www.stccmop.org/datamart/observation\\_network](http://www.stccmop.org/datamart/observation_network)

And here are a few miscellaneous sites that offer interesting datasets and visualizations.

- Historical Hurricane Tracks – <http://hurricane.csc.noaa.gov/hurricanes/Run.html>
- Google Earth Blog (Weather Archives) – <http://www.earthblog.com/blog/archives/weather/>



Image: COSEE-OS, ocean climate interactive

*We welcome all comments, suggestions, edits and additions.  
Please direct all comments to [sage@marine.rutgers.edu](mailto:sage@marine.rutgers.edu).*