Introduction to CoastWatch

Dale Robinson

Operations Manager, West Coast Node

NOAA Satellite Workshop

Anchorage, Alaska

April 7-9, 2020

Versioning

-Robinson, 2020

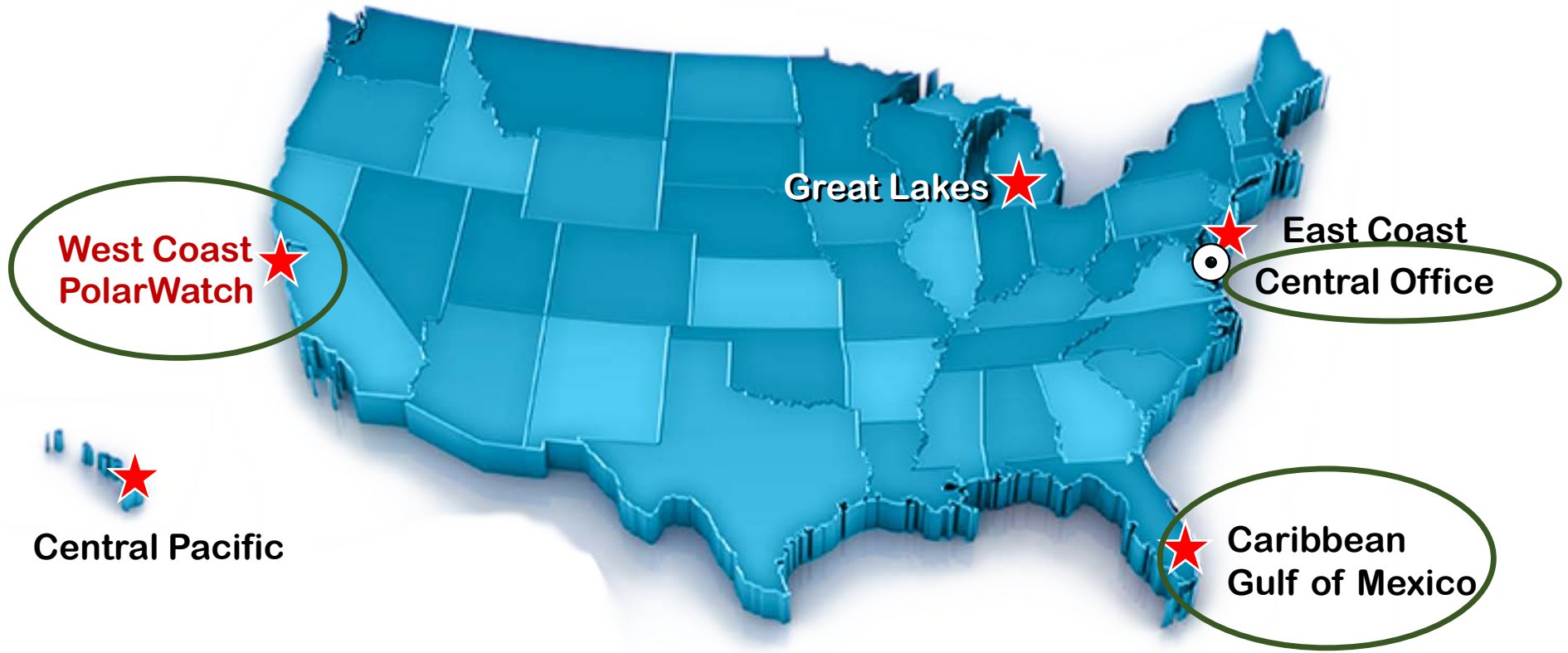
-Tomlinson and Vogel, 2018

-Abecassis and Howell, 2018

-Robinson, 2019

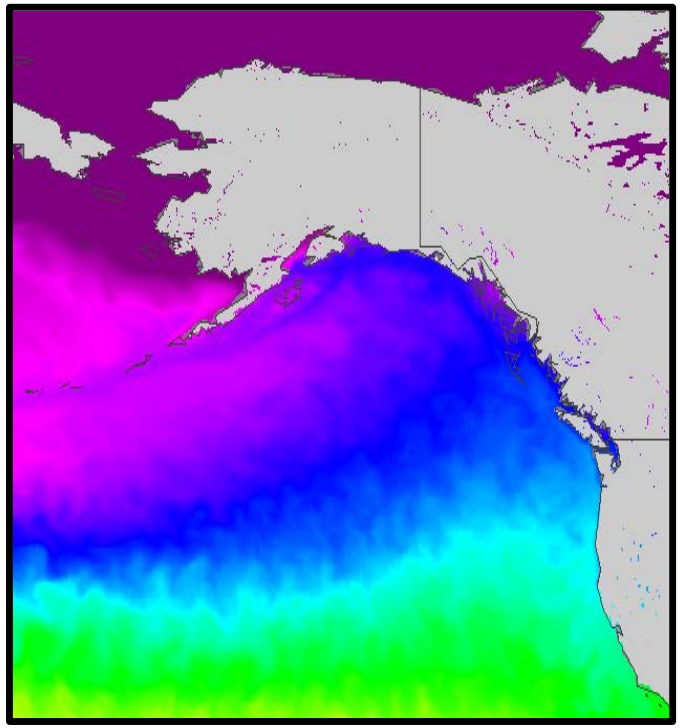
CoastWatch is a national program funded by NESDIS[1]

MISSION: PROVIDE ACCESS TO AND PROMOTE THE USE OF OCEAN SATELLITE DATA PRODUCTS



[1]National Environmental Satellite, Data, and Information Service

West Coast Node (WCN)
The service area is the West Coast, from California to Alaska



WCN region is from Alaska to California

Cara Wilson[1]
Node Manager

Dale Robinson[1,2]
Operations Manager

One stop shopping for data products
from many sources

Extensive data holdings
in the Eastern Pacific and Globally

[1]NOAA Southwest Fisheries - Environmental Research Division

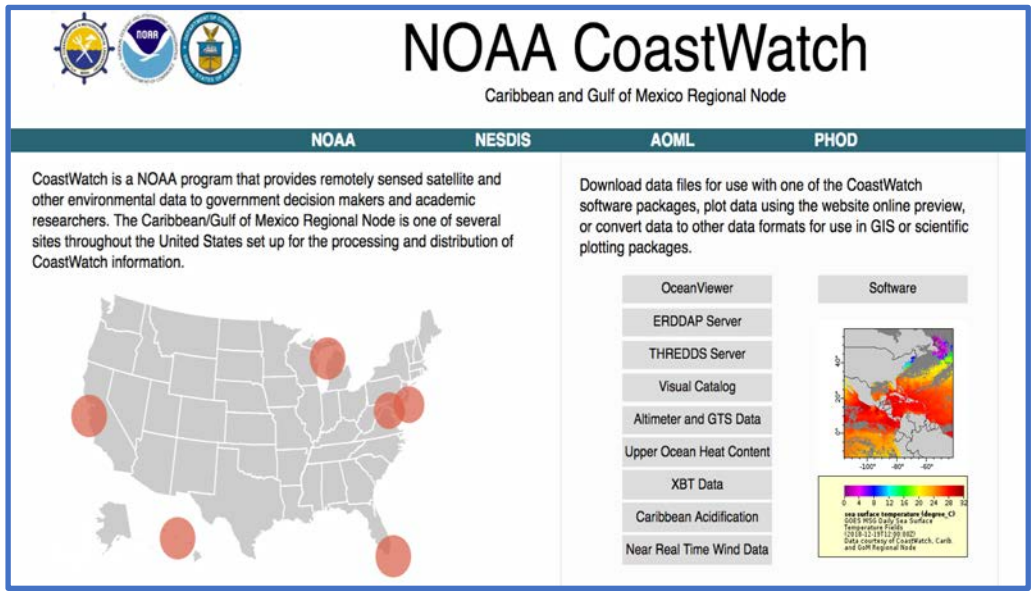
[2]UC Santa Cruz- Cooperative Institute for Marine Ecosystems and Climate (CIMEC)

West Coast Node is embedded in NOAA Southwest Fisheries Science Center locations

Cara Wilson
Environmental Research Division (ERD)
Monterey, California

Dale Robinson
Fisheries Ecology Division(FED)
Santa Cruz, California

The Caribbean/Gulf of Mexico Node serves Puerto Rico



https://cwcaribbean.aoml.noaa.gov/

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[1]NOAA Atlantic Oceanographic and Meteorological Laboratory - Physical Oceanography Division
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CoastWatch shares expertise among nodes

KNOWLEDGE, CAPABILITIES, AND RESOURCES OF THE NETWORK ARE AVAILABLE TO YOU

Contact information for the nodes and central office

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Node Manager
Cara Wilson

Node Manager
Dale Robinson

Website
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We offer several levels of service to help you use satellite data

Provide access to datasets with data servers

Develop tools and tutorials to help you interact with the server and use the data

Provide training and hands-on assistance

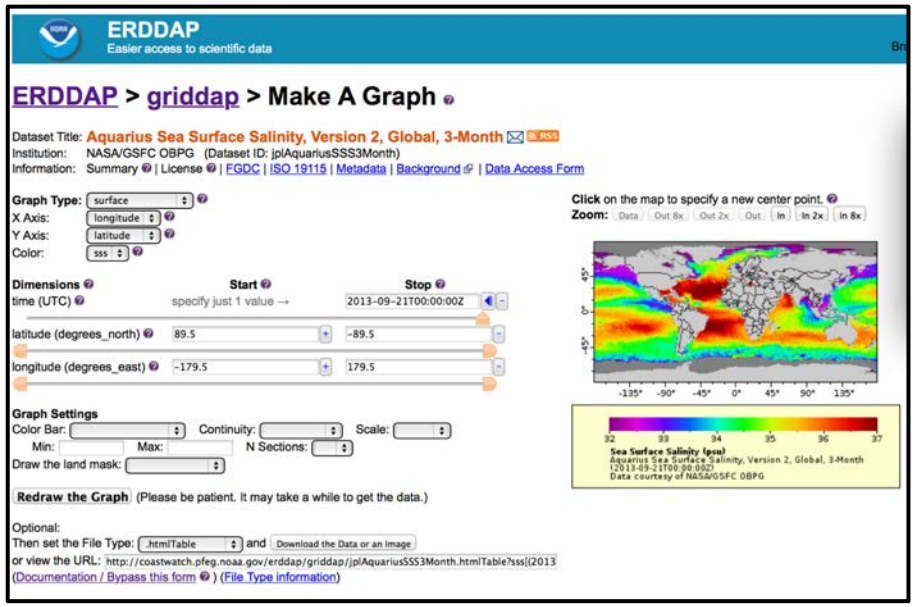
Find or create products and tools to address your needs

Work directly with you on projects

Data servers

ERDDAP is the primary data server at WCN

https://coastwatch.pfeg.noaa.gov/erddap/



ERDDAP Servers at CoastWatch

West Coast Node
https://coastwatch.pfeg.noaa.gov/erddap/

Caribbean/Gulf of Mexico Node
https://cwcgom.aoml.noaa.gov/erddap/

Great Lakes Node
https://coastwatch.glerl.noaa.gov/erddap/

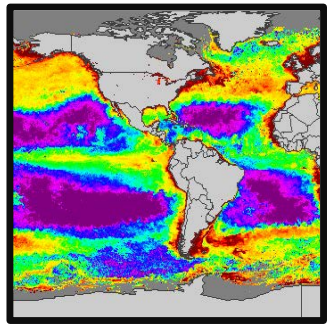
Pacific Node
https://oceanwatch.pifsc.noaa.gov/erddap/

PolarWatch
https://polarwatch.noaa.gov/erddap/

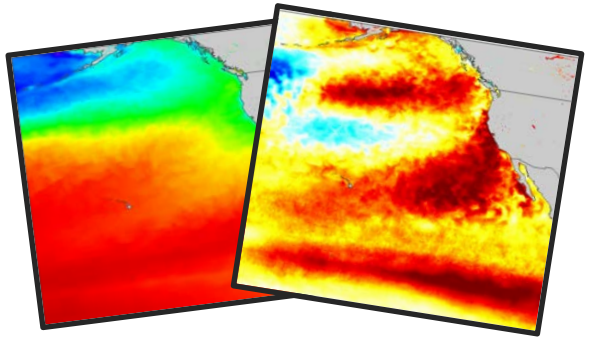
CoastWatch Central
https://coastwatch.noaa.gov/erddap/

WE WILL GO OVER THE USE OF ERDDAP DURING THE COURSE

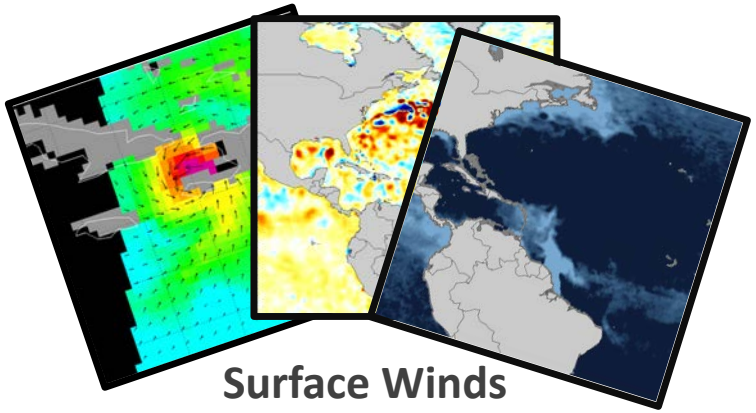
The WCN ERDDAP serves over 1,000 satellite datasets



Chlorophyll
Primary Productivity



SST
SST Anomaly



Surface Winds
Sea Surface Salinity
Sea Surface Height and Anomaly

Daily, weekly, and monthly composites

Blended products

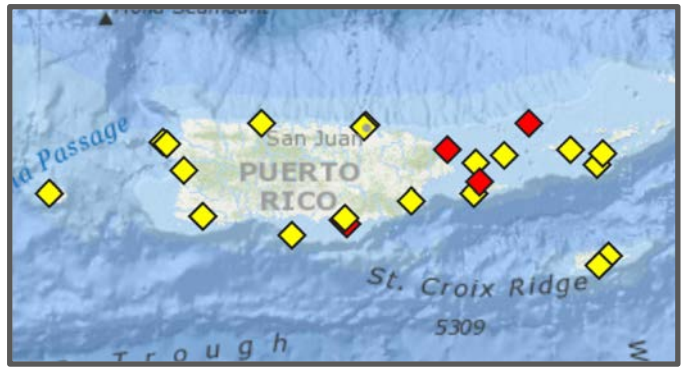
Interpolated products (gap free)

WE WILL GO OVER THE TYPES OF SATELLITE DATA DURING THE COURSE

Our data catalog contains over 400 non-satellite data products

In Situ Measurements

- Animal Telemetry Network
- NDBC buoys
- ARGO floats
- BioArgo floats
- Glider Data



NDBC buoys near Puerto Rico

Field Sampling

- CalCOFI
- California Fish Landings
- SWFSC Rockfish

Underway Data

- NOAA Vessels
- UNOLS Vessels

Models, Climatologies

- OSCAR Sea Surface Velocity
- SODA Model
- NOAA Coastal Relief Model
- NOAA Seafloor Topography
- USGS Topography
- NOAA RTOFS Models
- NOAA World Ocean Atlas
- NASA/NOAA CCMP Wind Atlas
- SWFSC Upwelling Index
- Navy HYCOM Model

AND MANY MORE…

Tools and tutorials

For help accessing and using data

Scripts and code snippets in R, Python, Matlab

Software modules (R, Matlab, Python) that do common tasks

Tutorials to complement the scripts and modules

A plug-in and techniques for getting raster satellite data into ArcGIS

TRAINING SESSIONS ON R MODULES AND ARCGIS ON THURSDAY

Training

You are attending a joint WCN / Car/GoM Satellite Course

WCN's has held an annual NOAA Satellite Course since 2006.

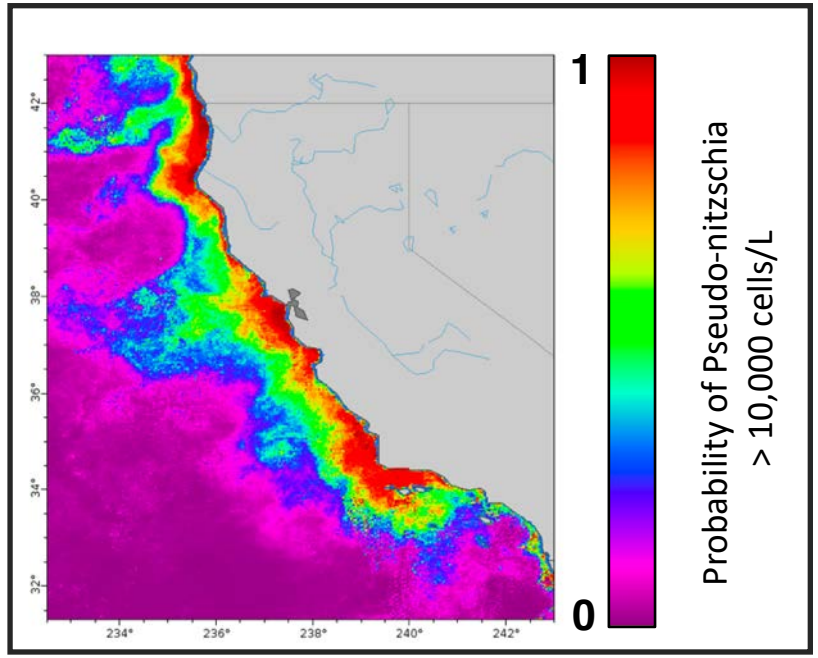
Starting in 2018, the course is offered by other CoastWatch Nodes and the Central Office.

List of All Upcoming Satellite Courses
coastwatch.noaa.gov/cw/user-resources/satellite-data-training-courses.html

West Coast Node Course Information
https://coastwatch.pfeg.noaa.gov/courses/satellite_course.html

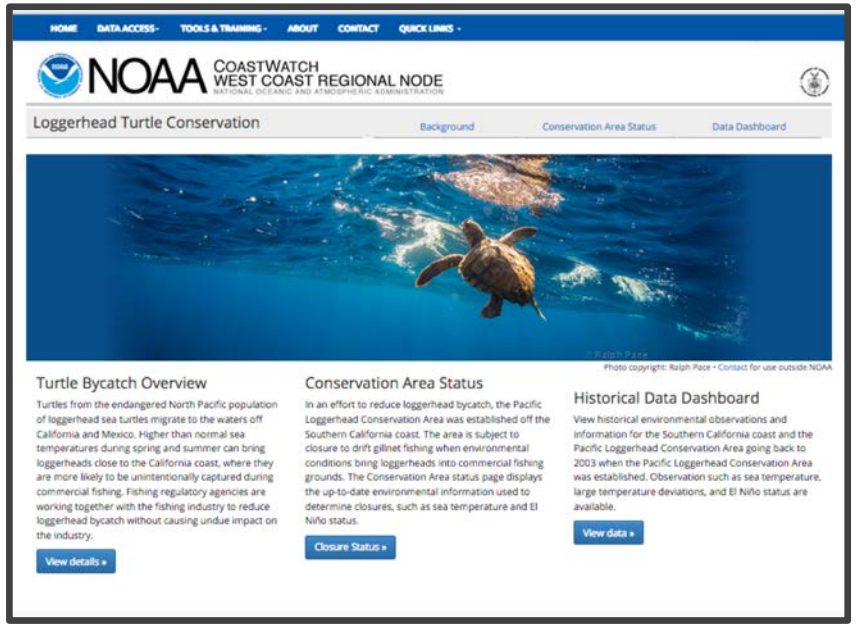
We can partner with you to create new products or tools

Harmful Algal Bloom Forecast



www.cencoos.org/data/models/habs

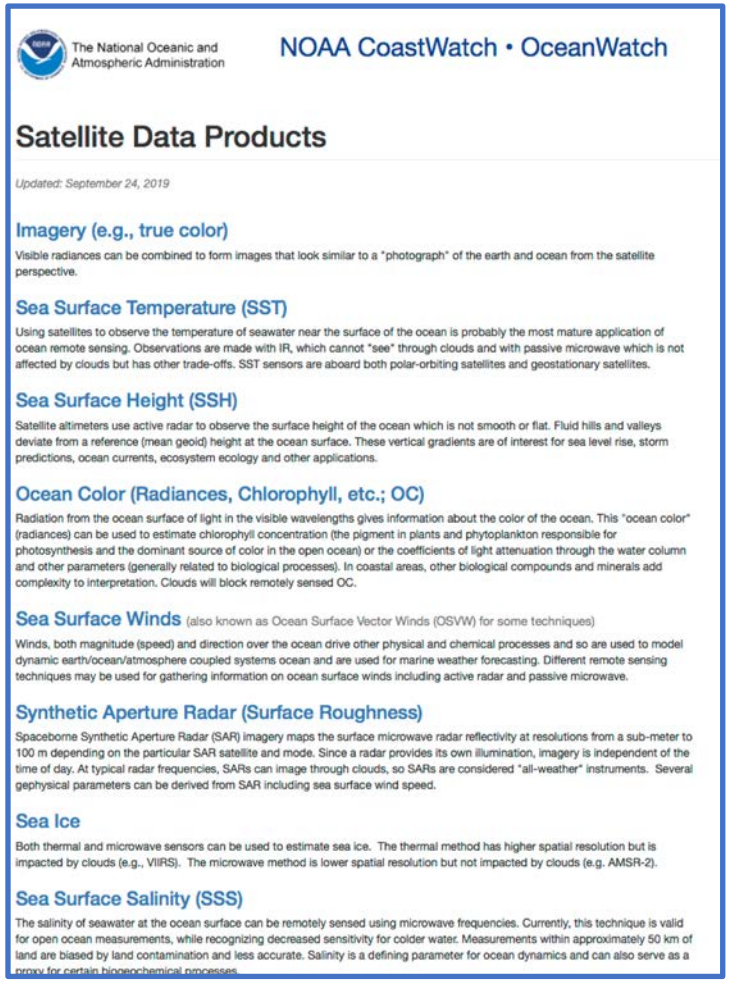
Fisheries Management Tools



coastwatch.pfeg.noaa.gov/loggerheads/

CoastWatch Central has many additional resources

CW Central Data Products Page



The National Oceanic and Atmospheric Administration

NOAA CoastWatch • OceanWatch

Satellite Data Products

Updated: September 24, 2019

Imagery (e.g., true color)

Visible radiances can be combined to form images that look similar to a "photograph" of the earth and ocean from the satellite perspective.

Sea Surface Temperature (SST)

Using satellites to observe the temperature of seawater near the surface of the ocean is probably the most mature application of ocean remote sensing. Observations are made with IR, which cannot "see" through clouds and with passive microwave which is not affected by clouds but has other trade-offs. SST sensors are aboard both polar-orbiting satellites and geostationary satellites.

Sea Surface Height (SSH)

Satellite altimeters use active radar to observe the surface height of the ocean which is not smooth or flat. Fluid hills and valleys deviate from a reference (mean geoid) height at the ocean surface. These vertical gradients are of interest for sea level rise, storm predictions, ocean currents, ecosystem ecology and other applications.

Ocean Color (Radiances, Chlorophyll, etc.; OC)

Radiation from the ocean surface of light in the visible wavelengths gives information about the color of the ocean. This "ocean color" (radiances) can be used to estimate chlorophyll concentration (the pigment in plants and phytoplankton responsible for photosynthesis and the dominant source of color in the open ocean) or the coefficients of light attenuation through the water column and other parameters (generally related to biological processes). In coastal areas, other biological compounds and minerals add complexity to interpretation. Clouds will block remotely sensed OC.

Sea Surface Winds (also known as Ocean Surface Vector Winds (OSVW) for some techniques)

Winds, both magnitude (speed) and direction over the ocean drive other physical and chemical processes and so are used to model dynamic earth/ocean/atmosphere coupled systems ocean and are used for marine weather forecasting. Different remote sensing techniques may be used for gathering information on ocean surface winds including active radar and passive microwave.

Synthetic Aperture Radar (Surface Roughness)

Spaceborne Synthetic Aperture Radar (SAR) imagery maps the surface microwave radar reflectivity at resolutions from a sub-meter to 100 m depending on the particular SAR satellite and mode. Since a radar provides its own illumination, imagery is independent of the time of day. At typical radar frequencies, SARs can image through clouds, so SARs are considered "all-weather" instruments. Several gephysical parameters can be derived from SAR including sea surface wind speed.

Sea Ice

Both thermal and microwave sensors can be used to estimate sea ice. The thermal method has higher spatial resolution but is impacted by clouds (e.g., VIIRS). The microwave method is lower spatial resolution but not impacted by clouds (e.g. AMSR-2).

Sea Surface Salinity (SSS)

The salinity of seawater at the ocean surface can be remotely sensed using microwave frequencies. Currently, this technique is valid for open ocean measurements, while recognizing decreased sensitivity for colder water. Measurements within approximately 50 km of land are biased by land contamination and less accurate. Salinity is a defining parameter for ocean dynamics and can also serve as a proxy for certain biogeochemical processes

coastwatch.noaa.gov/cw/satellite-data-products.html

Products

- High resolution datasets
- European Space Agency data
- Swath data

Delivery Methods

- ERDDAP
- FTP and HTTP
- THREDDS

Data Access Tools

- Image selection tools
- Data viewers

Home Page

- coastwatch.noaa.gov/cw

Contact us and visit the websites

Questions?

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Caribbean/Gulf of Mexico Node
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Remote sensing by eye

Access specialty products at CoastWatch Central

SENTINEL 2 COLOR DATA

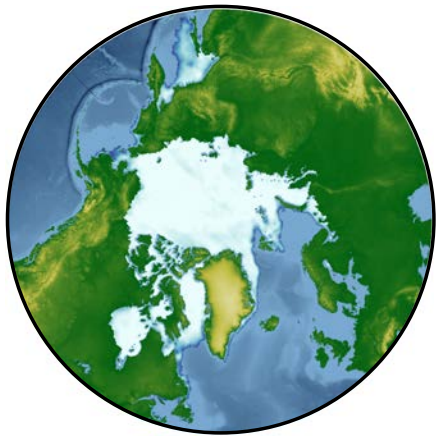
San Francisco Bay @10 m resolution

Specialty products like synthetic aperture radar winds, Sentinel 2, and LandSat data

Swath data (aka irregular grid or L2 data)

https://coastwatch.noaa.gov/cw/satellite-data-products/imagery.html

PolarWatch
The service areas are polar and subpolar waters



Jennifer Sevadjian[1,2]
Operations Manager

Cara Wilson[1]
Node Manager

Dale Robinson[1,2]
Deputy Node Manager

One stop shopping for data products
from many sources

Data holdings in the Arctic, Antarctic and globally

Products of interest for polar regions, e.g. sea ice

[1]NOAA Southwest Fisheries - Environmental Research Division

[2]UC Santa Cruz- Cooperative Institute for Marine Ecosystems and Climate (CIMEC)