Office of Coast Survey

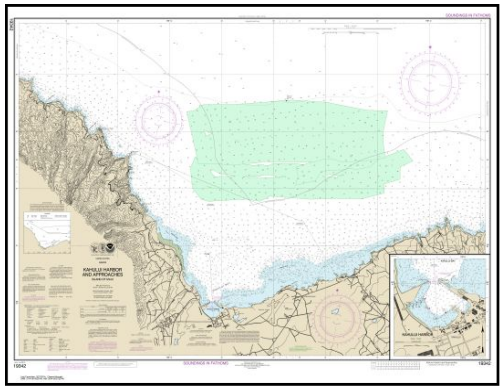
http://www.nauticalcharts.noaa.gov/

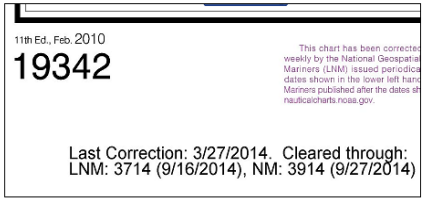
Navigational Charts

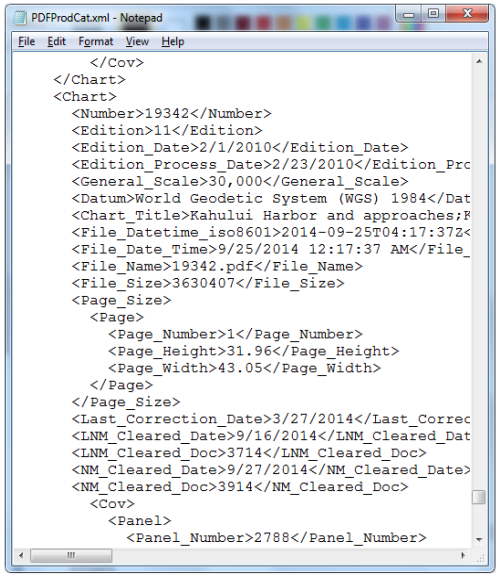
Marc.Higgins@noaa.gov

Interactive Catalog

http://www.charts.noaa.gov/InteractiveCatalog/nrnc.shtml







Electronic Navigational Charts

http://www.charts.noaa.gov/ENCs/ENCs.shtml
http://www.charts.noaa.gov/ENCs/ENCProdCat_19115.xml
http://www.charts.noaa.gov/ENCs/ENCProdCat.xml
http://www.charts.noaa.gov/ENCs

Raster Navigational Charts

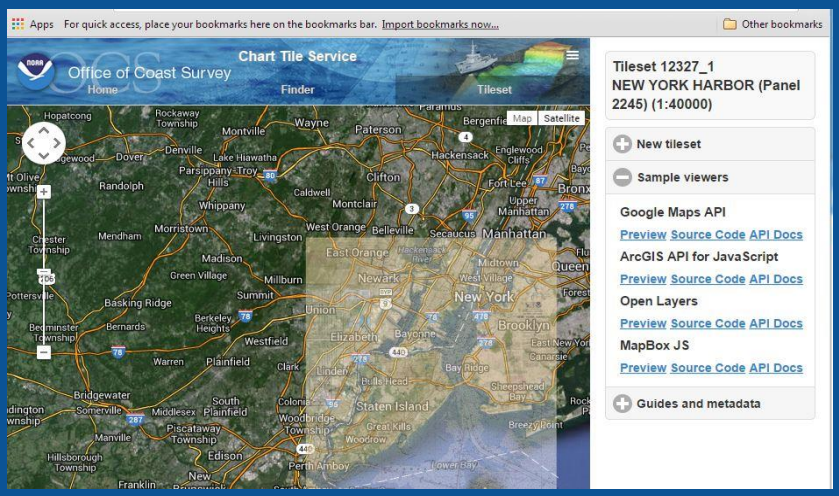
http://www.charts.noaa.gov/RNCs/RNCs.shtml
http://www.charts.noaa.gov/RNCs/RNCProdCat_19115.xml
http://www.charts.noaa.gov/RNCs/ENCProdCat.xml
http://www.charts.noaa.gov/RNCs

Print-On-Demand Charts

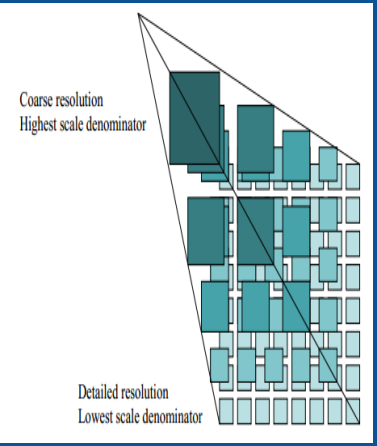
http://www.charts.noaa.gov/PDFs/PDFs.shtml
http://www.charts.noaa.gov/PDFs/PDFProdCat.xml
http://www.charts.noaa.gov/PDFs/PDFProdCat.xlstx
http://www.charts.noaa.gov/PDFs

NOAA Chart Tile Service
October 10, 2014

Mark Griffin, Chief, Format and Distribution Systems Branch
(mark.griffin@noaa.gov)
Pete Gomez, Developer, Lynker Technologies
(pete.gomez@noaa.gov)



- Will be completed with 5 different releases
  - Online Tile Service 1.0 (Single Chart)
  - Online Tile Service 2.0 (Quilted)
  - Metadata Service 3.0
  - Offline Tile Service 4.0 (MBTiles)
  - Offline Tile Service 5.0 (Delta Updates)
- Great performance for web applications
- Growth in smart phone and tablet usage means anyone with a device like this can use a digital chart easily.



Nautical Chart Tile and Metadata Service
October 10, 2014

- Charts are geo-referenced
- Charts have cropped borders
- Tilesets published weekly
- Releases 1.0 and 2.0 currently in development and testing
- NOAA raster (RNC) charts “cut” into 256x256 pixel images, at multiple zoom levels

Term	Definition
Tileset	A set of 256x256 PNG images representing a geographical area at multiple zoom levels.
Online Tileset	A Tileset published to a web server available for use by web applications.
Offline Tileset	A Tileset bundled in a single file to facilitate network transmit and offline use. Offline tilesets may also include chart metadata (including chart name, number, scale, zoom level, etc…).
Single Chart Tileset	A Tileset representing a single NOAA chart at multiple zoom levels.
Quilted Tileset	A multi-chart tileset covering a preset geographical area. Charts are “quilted together to provide a seamless view. Typically a chart will exist at a single zoom level.
Tileset Service	The availability of online and offline tilesets, both single chart and quilted.
Chart Metadata Service	A web service that provides a chart metadata list (including chart name, number, scale, zoom level, etc…) relevant to a specific coordinate.
MBTiles	A specification that “provides a way of storing millions of tiles in a single SQLite database making it possible to store and transfer web maps in a single file”.

High Resolution Seafloor Products

For further information, please contact: Richard.T.Brennan@noaa.gov

Multibeam sonars have been around since the mid 1980's but were typically only available for use on larger ships and in deep water. By the early 1990's technology allowed these sonars to be manufactured with transducers able to be mounted on smaller vessels, and with frequencies and resolution appropriate for use in shallower waters. In 1998 NOAA Ship *Rainier* was outfitted with multibeam echosounders (MBES) and began conducting hydrogaphic surveys in Alaska with these new sonars. In 2000 a system was installed on NOAA Ship *Whiting* and high resolution surveys soon were soon underway from Maine to the Caribbean. The tremendous data volume created by these sonars was unwieldy to manage in the traditional ways that single sounding measurements had been managed. So, in 2005 NOAA began gridding the soundings from these surveys and archiving these grids at the National Geophysical Data Center (NGDC) in Boulder, Colorado which can be found at: http://maps.ngdc.noaa.gov/viewers/bathymetry/. This data is also available in a GIS-friendly format at: http://gis.ngdc.noaa.gov/arcgis/rest/services/bag_bathymetry/ImageServer.

Gridded MBES data not only provided a more efficient and statistically robust means of managing sounding data, but it also provided a unique view of the seafloor that most people were not used to seeing. These high resolution grids (as fine as 0.5 meters) would frequently reveal geologic bed forms like sand waves, extinct underwater volcanos, bedrock fractures, and large boulders called glacial erratics. It also provided computational efficiency for creating new navigational products which could help mariners make better informed decisions on which route into port offered the deepest and safest path for their ship.

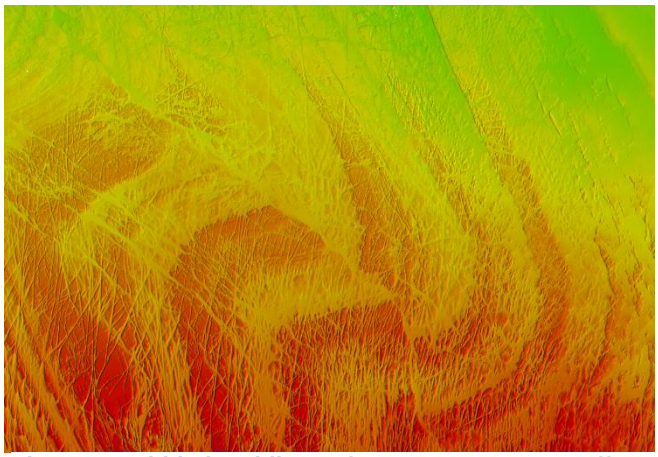


Figure 1: Gridded multibeam from survey H12451 off Chirikof Island, AK.

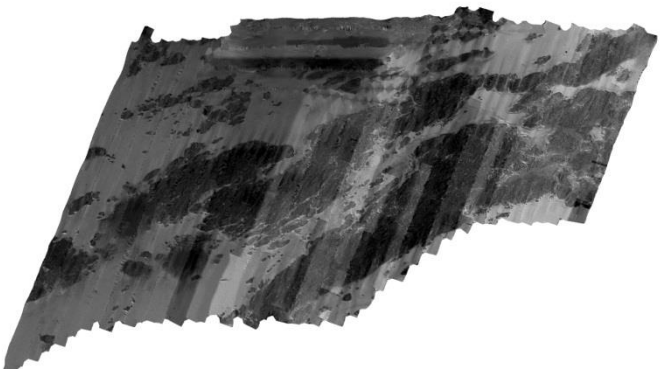


Figure 2: Backscatter data from survey H12614 off the coast of New Hampshire.

Multibeam sonars also provide ancillary data about the seafloor in the form of backscatter. This is a measure of the reflected sound intensity returning to the sonar after bouncing off the seafloor. Softer sediments like mud and silt will produce a weaker backscatter return, while rock will provide a stronger backscatter return. If these backscatter returns are mapped it can provide an indication of the composition of the seafloor. While NOAA does not have backscatter maps of all areas where MBES surveys were conducted, this is a product that we are moving towards providing regularly for all surveys and are seeking feedback on the interest in this type of data.

Lidar (Light Detection and Ranging) systems installed on NOAA aircraft are able to provide bathymetry and reflectance (similar to backscatter) maps for shallow water bathymetry and topography. This method of surveying provides dense bathymetry in shallow areas that are often difficult to survey from a vessel. Most new Lidar systems have both a bathymetric and topographic laser in the same system which makes surveying

across the land-water interface very efficient~~asy~~. Lidar data can be accessed at: http://coast.noaa.gov/digitalcoast/data/coastallidar.

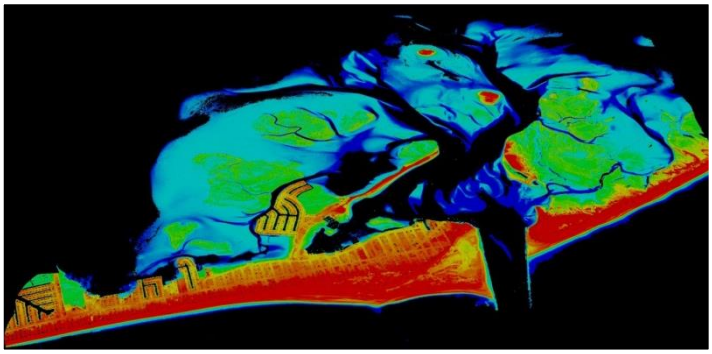


Figure 3: Lidar data from Barnegat Inlet

NOAA also has high resolution photogrammetry that is acquired simultaneously with lidar data. This high-resolution imagery provides a valuable bird's eye perspective on our nation's ports, harbors, and coastal waters and can be valuable for route planning or locating other shoreside infrastructure. Photogrametric data can be found at: http://coast.noaa.gov/digitalcoast/. NOAA uses both Lidar and photogrammetric means to determine the mean high water and mean lower low water shoreline that is used on nautical charts. Depending on the scale of the chart it serves, the derived shoreline data may be available at a higher resolution than depicted on the chart. This is typically available in a GIS-ready format and can be downloaded at: http://www.ngs.noaa.gov/NSDE/.

Other ancillary data produced from NOAA's hydrographic surveys are positions on discrete features that rest on the seafloor. Both MBES and side scan sonar (SSS) echosounders provide a high resolution view of what is on the seafloor. In addition to the naturally occurring geologic features, there are frequently features that are manmade in origin, like wrecks or other sunken debris. The features deemed to be of most concern to navigation will make it onto the chart. However, there are many features which are too small to be of interest to surface navigation, but which may hold interest to specialized groups of mariners like recreational or commercial fishermen. While this higher density of features is not currently available for use, it could be reconstituted for use should a significant demand be found.

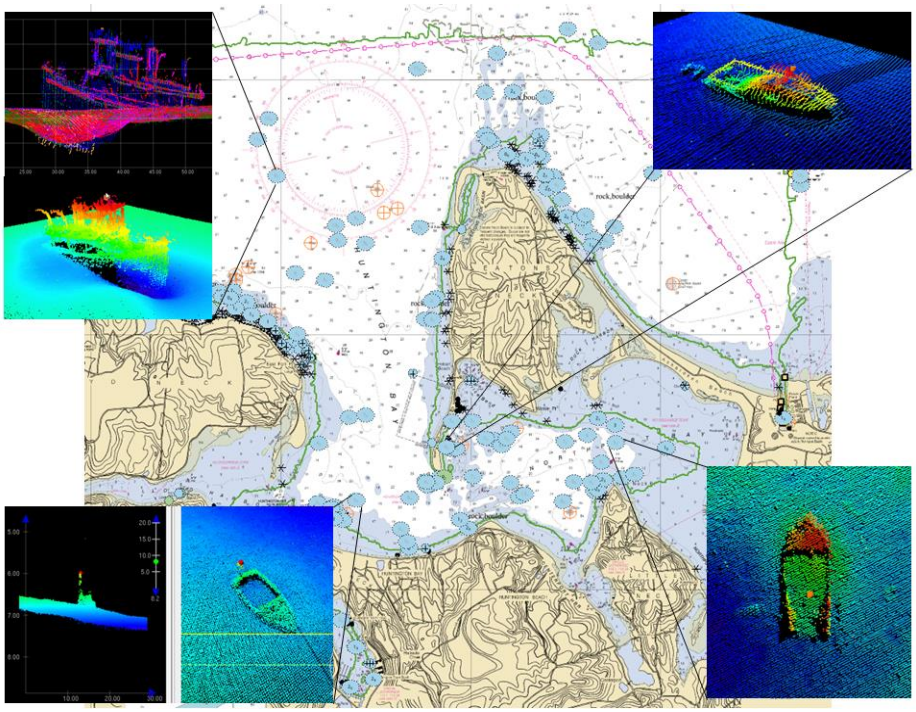
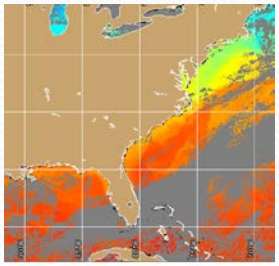


Figure 4: Images of wrecks from a survey in Long Island Sound. Blue circles indicate areas where a feature was identified on the seafloor.

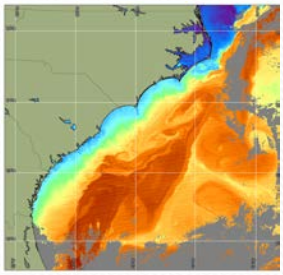
Sea Surface Temperature from NOAA Satellites

Sea Surface Temperature (SST) from satellites can detect ocean features such as currents and fronts, useful for navigation, fishing and many other applications. NOAA provides a variety of SST data products and imagery from multiple satellites:

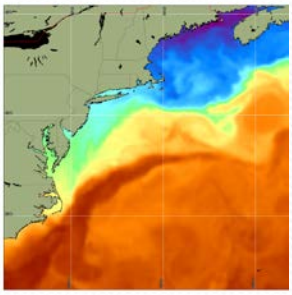
- Geostationary Satellites: observe an entire hemisphere multiple times per day
  - Atlantic and Pacific basins
  - 4 km spatial resolution
  - Every 3 hours



- Polar-Orbiting: currently 6 instruments orbit the Earth 14 times per day providing near-complete global coverage every 2 days
  - Morning, afternoon and nighttime passes over local areas
  - 750 m to 1.1 km spatial resolution



- Blended: a combination of Geostationary and Polar-orbiting data achieve cloud-free coverage for the entire Earth every day
  - 5 km spatial resolution
  - Available once daily
  - Day-night combination, and nighttime-only



All data available from: http://coastwatch.noaa.gov

Data formats: HDF, GeoTIFF, PNG

Feedback and suggestions: coastwatch.info@noaa.gov

ONLINE RESOURCES
TIDES & CURRENTS

http://tidesandcurrents.noaa.gov

Center for Operational Oceanographic Products and Services

REAL-TIME INFORMATION

TIDES ONLINE
http://tidesonline.nos.noaa.gov
Provides a quick and easy way of viewing recent oceanographic and meteorological data and also provides High Water Advisories and Storm Tide Alerts.

GREAT LAKES ONLINE
http://glakesonline.nos.noaa.gov
Provides a quick and easy way of viewing recent Great Lakes data. Information also available by automated voice system at (301)713-9596.

PORTS®
(PHYSICAL OCEANOGRAPHIC REAL-TIME SYSTEM)
http://tidesandcurrents.noaa.gov/ports.html
Provides real-time observations of oceanographic and meteorological conditions from locations throughout the United States.

MYPORTS®
http://tidesandcurrents.noaa.gov/myports
An application designed to let you create your own customized PORTS® pages.

PORTS® FOR MOBILE DEVICES
http://mobile.tidesandcurrents.noaa.gov

HIGH FREQUENCY RADAR SURFACE CURRENTS
http://tidesandcurrents.noaa.gov/hfradar/

SEA LEVELS TRENDS
http://tidesandcurrents.noaa.gov/sltrends

OBSERVED & HISTORIC DATA

HISTORIC DATA
http://tidesandcurrents.noaa.gov
Select Products – Water Levels

PREDICTIONS

NOAA TIDE PREDICTIONS
http://tidesandcurrents.noaa.gov/tide_predictions

NOAA CURRENT PREDICTIONS
http://tidesandcurrents.noaa.gov/noaacurrents/Regions

FORECAST SYSTEMS

OPERATIONAL FORECAST SYSTEM
http://tidesandcurrents.noaa.gov/models
Provides scientific predictions about the present and future states of water levels and possibly currents in a coastal area. These predictions rely on either observed data or forecasts from a numerical model.

WEB SERVICES

http://opendap.co-ops.nos.noaa.gov/axis/

PUBLICATIONS

http://tidesandcurrents.noaa.gov/pub

EDUCATION LINKS

http://tidesandcurrents.noaa.gov/education
http://oceanservice.noaa.gov/education
http://www.education.noaa.gov

Oceanographic and Meteorological Data at Your Fingertips…

TIDES & CURRENTS

http://tidesandcurrents.noaa.gov

For data request and general information, contact:

User Services
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, MD 20910-3281
Phone: (301) 713-2877
Fax: (301) 713-4436
E-mail: tide.predictions@noaa.gov

For Programmatic information, contact:

Maritime Services Program
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, MD 20910-3281
Phone: (301) 713-2981
Fax: (301) 713-4392
E-mail: darren.wright@noaa.gov

Resilience Program
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, MD 20910-3281
Phone: (301)) 713-2981
Fax: (301) 713-4392
E-mail: audra.luscher@noaa.gov

Mapping and Charting Support Services Program
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, MD 20910-3281
Phone: (301) 713-2981
Fax: (301) 713-4392
E-mail: laura.rear.mclaughlin@noaa.gov

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

Center for Operational Oceanographic Products and Services (CO-OPS)

8/2014

HIGH FREQUENCY RADAR SURFACE CURRENTS

CENTER FOR OPERATIONAL OCEANOGRAPHIC PRODUCTS AND SERVICES

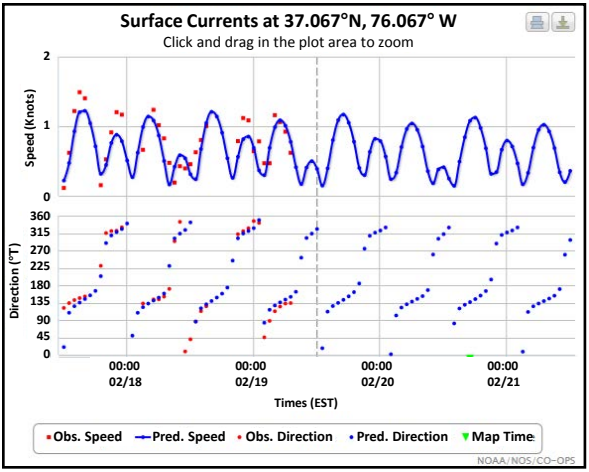
New web product provides near real time surface current observations and tidal current predictions

tidesandcurrents.noaa.gov/hfradar/

High Frequency Radar Surface Currents

The NOAA Center for Operational Oceanographic Products and Services (CO-OPS) using data from the U.S. Integrated Ocean Observing System (IOOS) has developed a new High Frequency (HF) Radar web product which provides near real time surface current observations and tidal current predictions in estuarine and coastal locations. The web product offers broad spatial coverage of surface currents in areas vital for both commercial and recreational marine navigation.

- Provides interactive maps and time series plots of surface currents
- Supports the NOAA Physical Oceanographic Real-Time System (PORTS®) in locations where data is available
- Benefits marine navigation, search and rescue, oil spill response and recreational users
- Now available for Chesapeake Bay and San Francisco Bay
- Coverage of New York Harbor coming soon



FOR MORE INFORMATION
NOAA, NOS
Center for Operational Oceanographic Products and Services
Phone: 301-713-2815
E-mail: Tide.Predictions@noaa.gov

For more information on the entire IOOS HF Radar network see:
www.ioos.noaa.gov/hfradar
Or contact Jack Harlan - jack.harlan@noaa.gov

10/2014

Accessing Operational Coastal Model Data

For further information, please contact: tide.predictions@noaa.gov

The National Ocean Service (NOS) develops and maintains real-time coastal models called Operational Forecast Systems (OFS) for the harbors and estuaries of the United States. These OFS create forecast simulations of oceanographic parameters (water levels, currents, salinity, temperature) over the next several days and disseminate the results to users over the web. These models are updated every 6 hours on a 24 by 7 basis. OFS predictions support safe and efficient navigation, search and rescue missions, pollutant tracking, and marine forecasting on our Nation's coastal waterways.

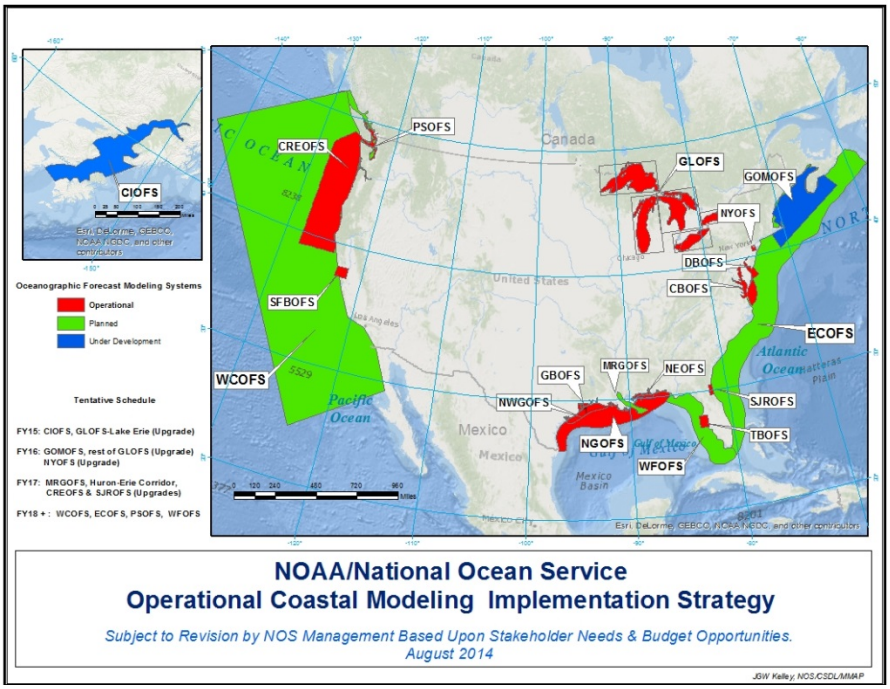


Figure 1. Location of Existing and Planned OFS Models.

Real-time data from NOS' OFS models are available for regions shown in red in Figure 1, with blue regions currently under development and green regions showing coverage planned over the next 5 years. Data are provided at points of interest along the coast along with animations of oceanographic conditions along the coast and in estuaries (including water level, currents, temperature, salinity). The OFS can be viewed and accessed on the web at: tidesandcurrents.noaa.gov/models.html.

Figure 2 shows an example of the water level animation field for the Chesapeake Bay and the water level time series at the Chesapeake Bay Bridge Tunnel.

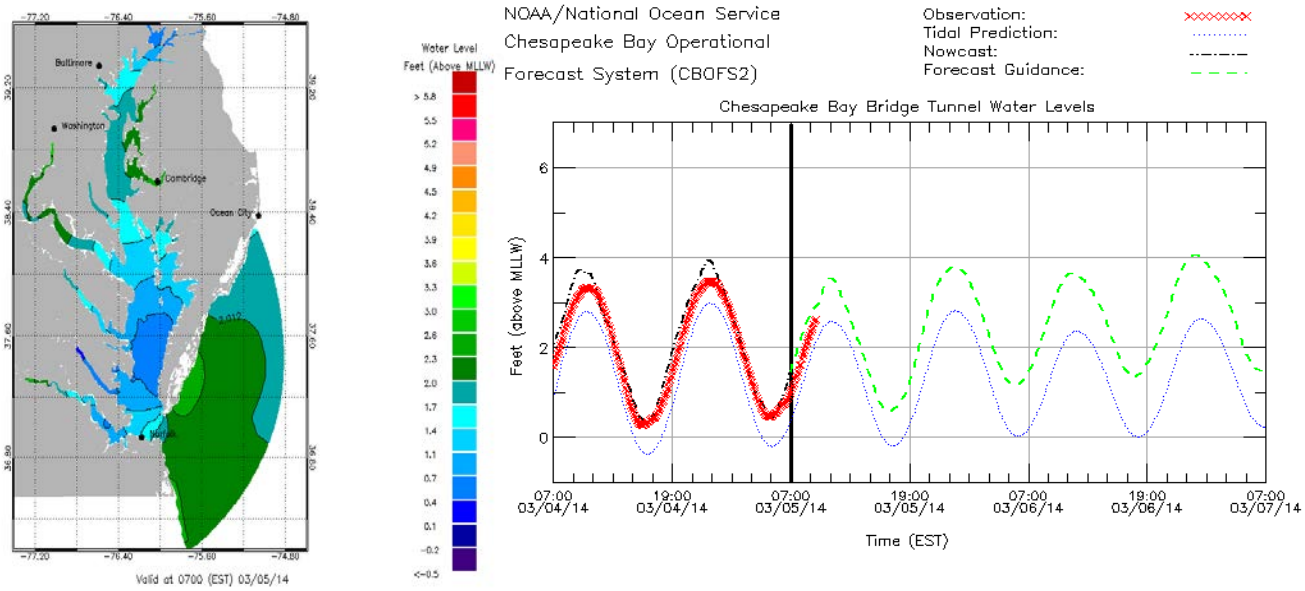


Figure 2. Water Level Predictions from the Chesapeake Bay OFS found on http://tidesandcurrents.noaa.gov/models.html.

All of the OFS model output data (which includes hourly records of water levels, currents, temperature, and salinity as well as more frequent data at critical point locations) is directly accessible via web services utilizing standard data formats. OFS model output is generated in Network Common Data Format (NetCDF; for more information see http://www.unidata.ucar.edu/software/netcdf/). A catalogue of the NetCDF gridded field and point station data is available on an NOS server which supports Thematic Real-time Environmental Distributed Data Services (THREDDS; https://www.unidata.ucar.edu/software/thredds/current/tds/). Many software utilities can directly access the OFS data available at: http://opendap.co-ops.nos.noaa.gov/thredds/catalog.html

NOS is also experimentally testing a web mapping portal for real time coastal data called *nowCOAST* (http://new.nowcoast.noaa.gov). For each OFS, *nowCOAST* depicts maps of surface currents along with water levels, current speed, sea surface temperature, or salinity. In addition to providing the visual web interface shown below, *nowCOAST* also provides access to maps of OFS output via Web Map Services (WMS) and ArcGIS Server Representational State Transfer (REST) Services. These maps are listed on the *nowCOAST* Map Services web page: http://new.nowcoast.noaa.gov/help/#section=mapservices&item=guidance-ocean

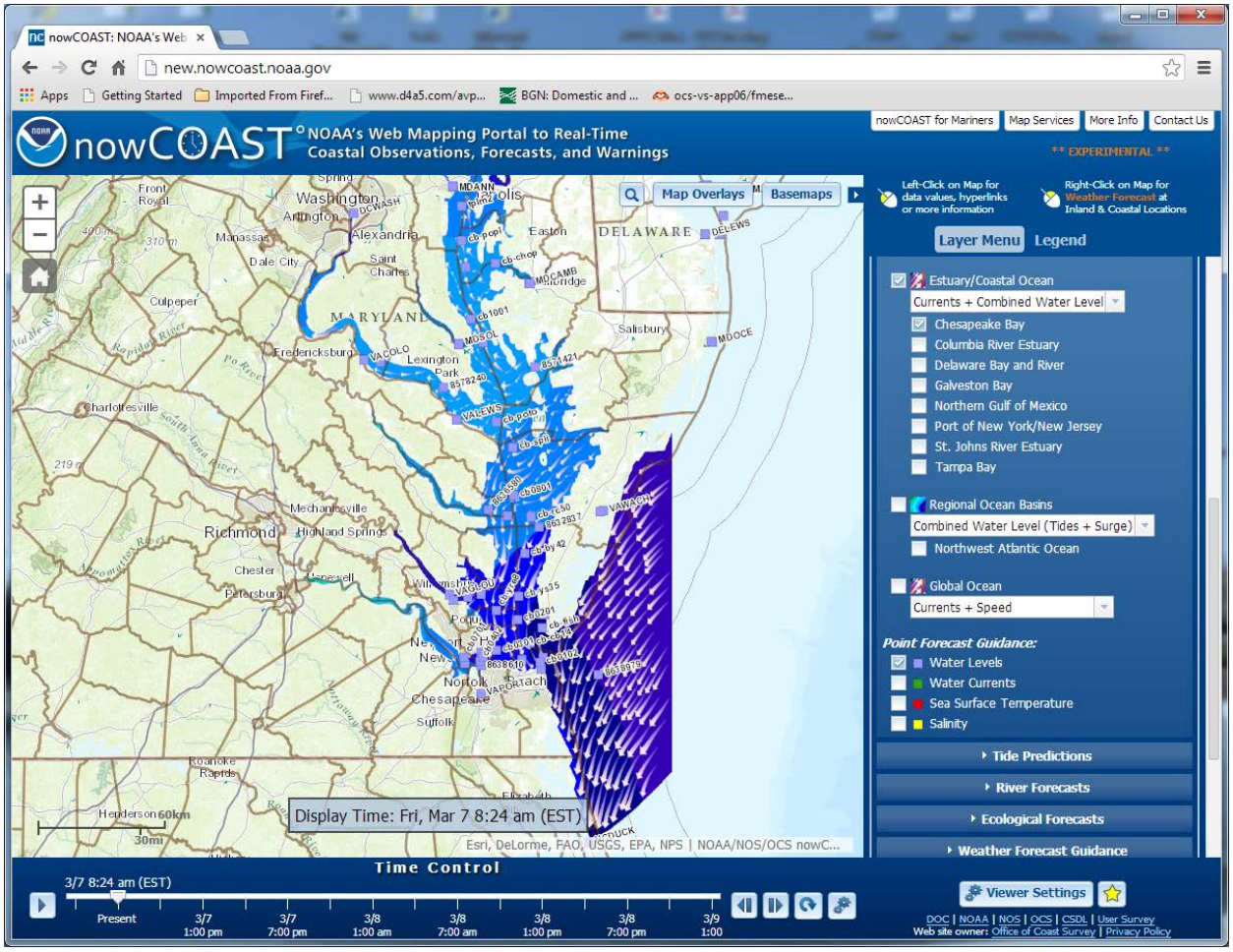


Figure 3. Chesapeake OFS Output Displayed on the experimental *nowCOAST* Web Map Viewer.

NOS also provides OFS water levels at point locations via text bulletins in the Standard Hydrometeorological Exchange Format (SHEF; http://www.nws.noaa.gov/om/water/resources/SHEF_CodeManual_5July2012.pdf). These time series data list recent observations and OFS predictions of water levels into the near future. The SHEF data are available through the National Weather Service (http://www.nws.noaa.gov/tg/cominfo.php) and find information at tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_026.pdf.

National Digital Forecast Database
http://www.nws.noaa.gov/ndfd/technical.htm
The NWS National Forecast Database (NDFD) provides gridded forecasts of sensible weather elements in a seamless mosaic of forecasts from NWS field offices and the National Centers for Environmental Prediction. Data are provided in Gridded Binary (GRIB2) format. nws.ndfd@noaa.gov

NOAA Graphical Forecast
http://preview.weather.gov/graphical/
The NOAA Graphical Forecast website is the user interface for the NDFD. The Oceanic dataset allows users to display gridded hazard, wave height, and wind information. w-nws.webmaster@noaa.gov

NOMADS Model Data
http://nomads.ncep.noaa.gov/
The NOAA National Operational Model Archive and Distribution System (NOMADS) is a web service that provides real-time and retrospective format independent climate and weather model data.
ncep.pmb.dataflow@noaa.gov

ASCAT Scatterometer Gridded Data
http://ftp.opc.ncep.noaa.gov/data/ascat_ab/
Surface wind vectors derived from the Advanced Scatterometers (ASCATs) on the METOP-A and B satellites are available to download in GRIB2 format. joseph.sienkiewicz@noaa.gov

Offshore Experimental Lightning Strike Density
http://www.opc.ncep.noaa.gov/lightning/index.php
The Experimental Lightning Strike Density is a gridded product displaying the number of lightning strikes per square meter per second across the Atlantic and Pacific Oceans. GRIB2 datasets are available for download.
joseph.sienkiewicz@noaa.gov

NWS Weather Radar and Warnings in GIS Format
http://radar.weather.gov/GIS.html
The NWS Doppler Radar Network output and associated warnings for severe thunderstorms, tornadoes, and flash floods are available in GIS format. w-nws.webmaster@noaa.gov

National Data Buoy Center

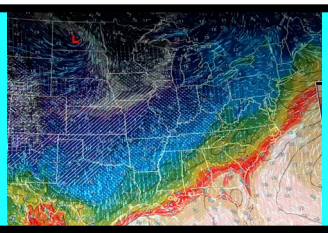
Stennis Space Center, MS

- Mission Control Center 24x7 data analysis and QC
  - 109 National Weather Service (Yellow) Buoys
  - 53 NWS Coastal Marine Automated Network (CMAN) Buoys
  - 55 NWS Tropical Ocean Atmosphere Buoys (Equatorial Pacific)
  - 39 NWS Tsunami Buoys (DART)
  - 400 NOAA Integrated Ocean Observing System (IOOS) Stations
- Data types
  - Classic meteorological observations
  - Oceanographic observations (SST, salinity, waves)
  - Camera images (small but growing number of stations)
- Data is available via
  - NDBC Webpage www.ndbc.noaa.gov
  - Mobile Access via NDBC webpage www.ndbc.noaa.gov/mobile
  - Dial-A-Buoy www.ndbc.noaa.gov
  - Machine to machine file transfer
    - Real time met/ocean data www.ndbc.noaa.gov/data/realtime2
    - Historical data (ASCII tables) www.ndbc.noaa.gov/data/historical
    - Real time and historical data – netCDF dods.ndbc.noaa.gov/threads/catalog.html
    - Data served via Sensor Observation Service (SOS) in user specified format sdf.ndbc.noaa.gov/sos
  - NDBC Points of Contact
    - Mission Control Center – Joe Swaykos joe.swaykos@noaa.gov
    - Senior Meteorologist – Rex Hervey rex.hervey@noaa.gov
- www.ndbc.noaa.gov 228-688-2835

State of the Art Data Visualizations

UNH - Center for Coastal and Ocean Mapping/Joint Hydrographic Center - Data Visualization Research Lab

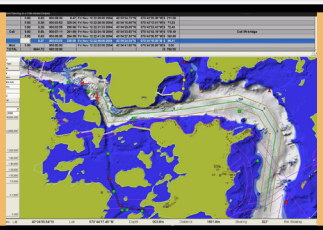
WindVis2



WindVis2 is a weather visualization package designed to show the latest weather forecast model data from NOAA. It can either be used as a tool for individuals to check on the current forecast, or it can be configured as a public display, which automatically updates forecasts every six hours.

http://ccom.unh.edu/vislab/projects/windvis.html

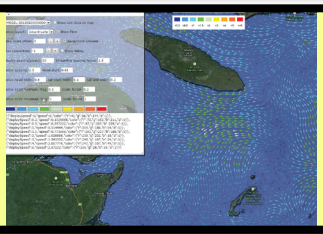
GeoNav3D



GeoNav3D makes the following possible:
*Real-time updating of water levels based on predictions and readings from tide gauges.
*The ability to make plans using predictions about tides and currents.

http://ccom.unh.edu/vislab/projects/chart_of_the_future.html

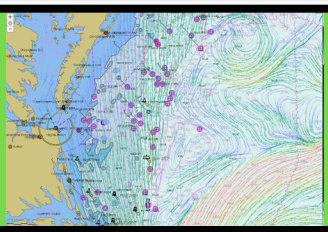
Streamline Flow



The Streamline Flow interface is a JavaScript application that is designed to see the difference between gridded and streamline representation of surface currents as well as help to customize the appearance of the arrows used, the separation of the streamlines and the density of the arrows on each streamline.

http://vislab-ccom.unh.edu/~roland/currents/slgo.html

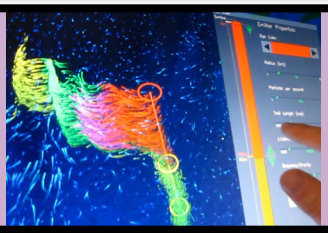
Animated Flow



Animating the flow of surface currents is a technique being researched at the lab that is designed to help solve the issue of occluding nautical chart data.

https://www.youtube.com/channel/UCAdLngCv3x1d5rPf4dWflVw

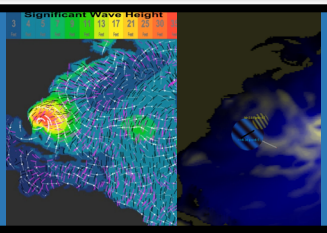
Flow-Touch3D



Flow Touch 3D is a system that employs a combination of stereoscopic rendering, to best reveal and illustrate 3D structures and patterns, and multi-touch interaction, to allow for natural and efficient navigation and manipulation within the 3D environment.

http://ccom.unh.edu/vislab/projects/2d_flow_vis.html

WWIII



Wave Watch III data is a topic of interest in a Navy project currently underway at the lab. The goal is to combine wind speed/direction, wave heights/direction/period and surface currents into a mission planning tool to help submariners with their decision making process.

https://www.youtube.com/channel/UCAdLngCv3x1d5rPf4dWflVw

Partnerships

The Industrial Associates Program allows CCOM to establish collaborative arrangements with the private sector and other government organizations. The Associate will have access to UNH-authored, non-patented software code and algorithms. They will receive early notice of workshops, seminars, and publications and collaborate with CCOM researchers through formal and informal exchanges of ideas.

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