NOAA's National Ocean Service

Center for Operational Oceanographic Products and Services

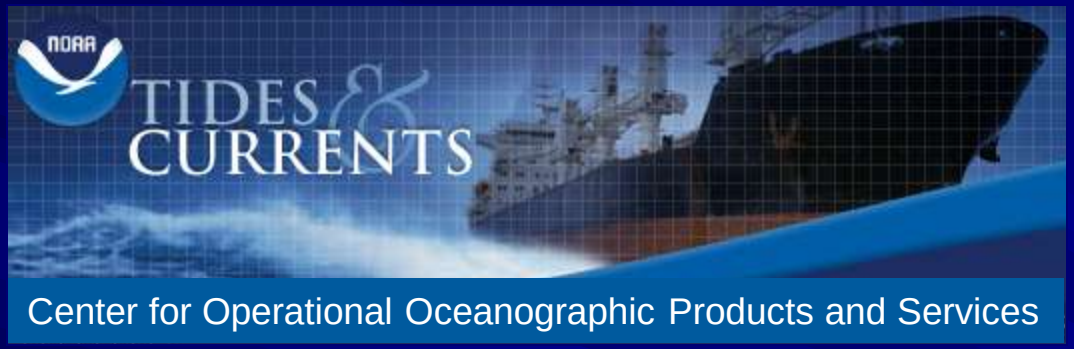
Richard Edwing, CO-OPS Acting Director

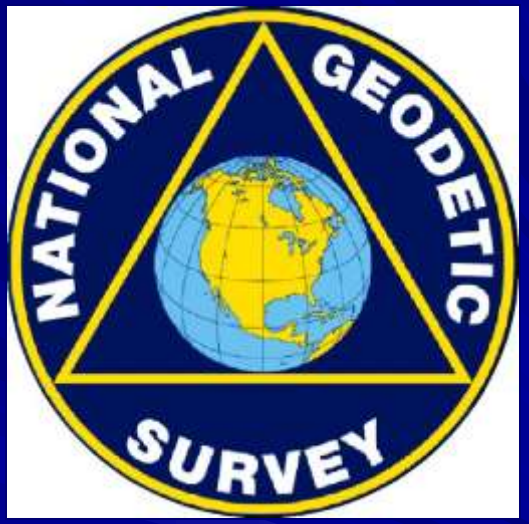
January 27, 2010

Outline

- CO-OPS Overview
  - Programs
  - Observing Systems
- PORTS
- Sea Level Rise

NOS Navigation Services

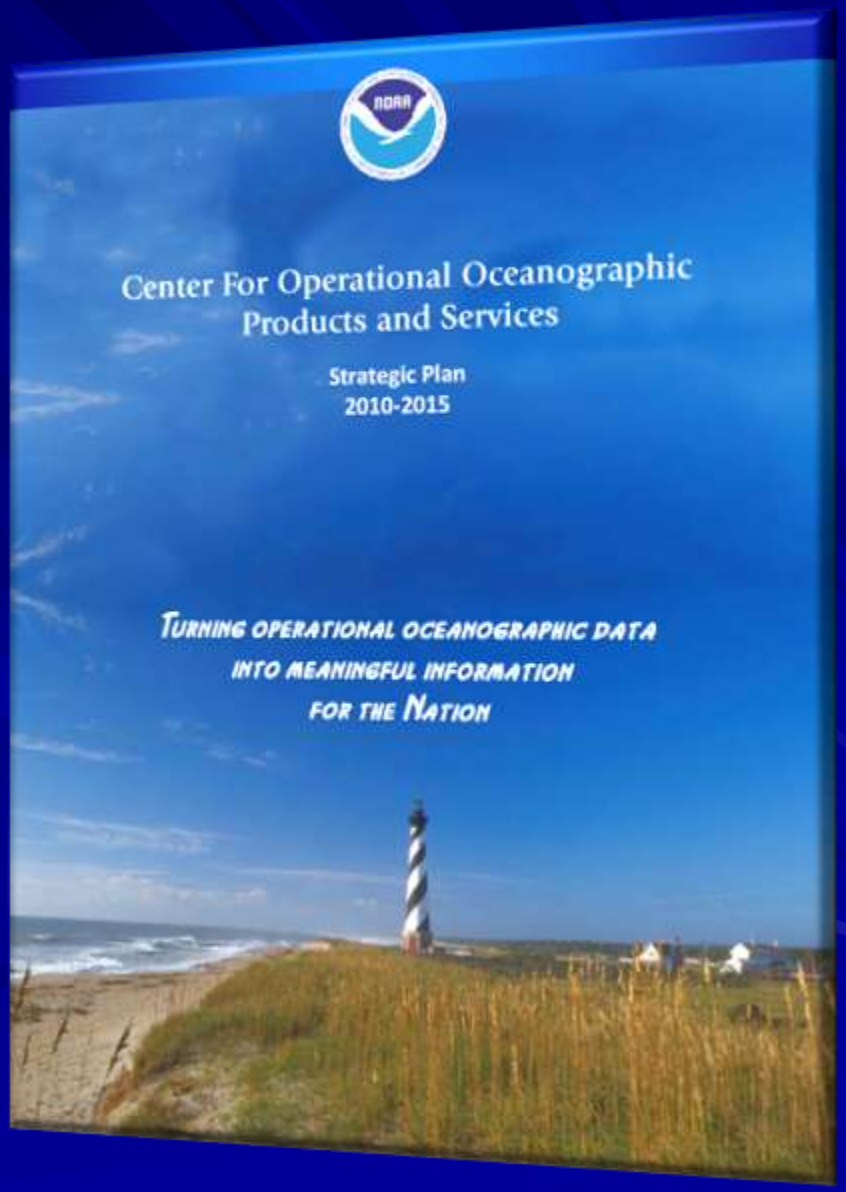




Turning Operational Oceanographic Data Into Meaningful Information For The Nation

Vision: *Everyone has ready access to tide, water level, current, and other coastal oceanographic information needed for informed decision-making.*

Mission: *To serve as the authoritative source for accurate, reliable, and timely tide, water level, current, and other oceanographic information to support safe and efficient navigation, sound ecosystem stewardship, coastal hazards preparedness and response, and the understanding of climate change.*

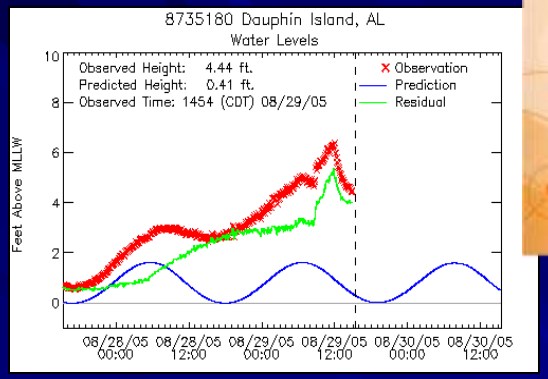


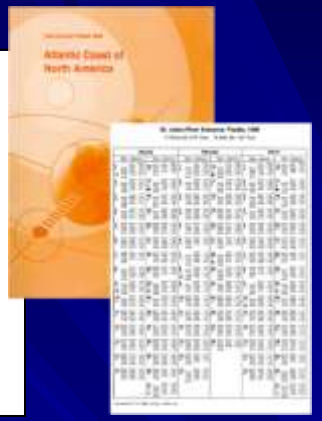
CO-OPS Programs

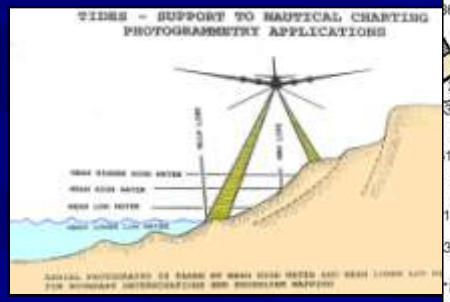
Maritime Services

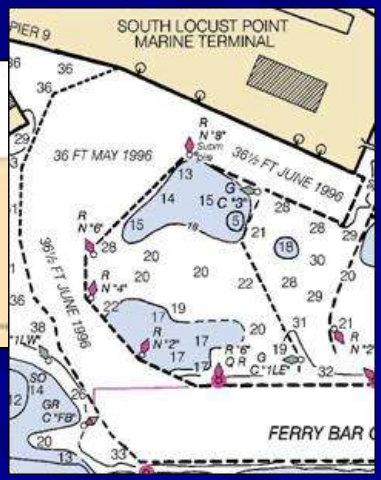
Mapping and Charting Support Services

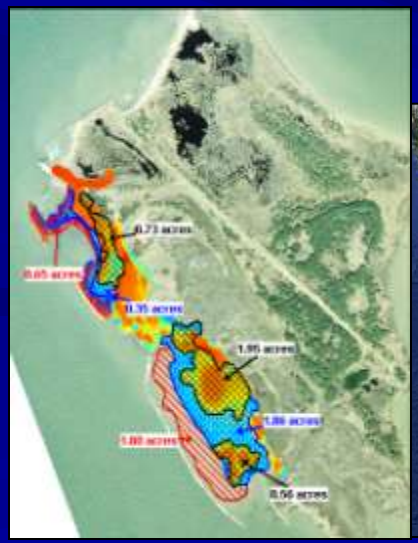
COASTAL





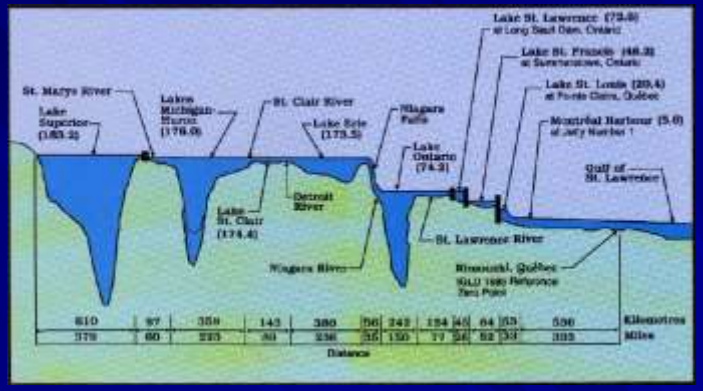


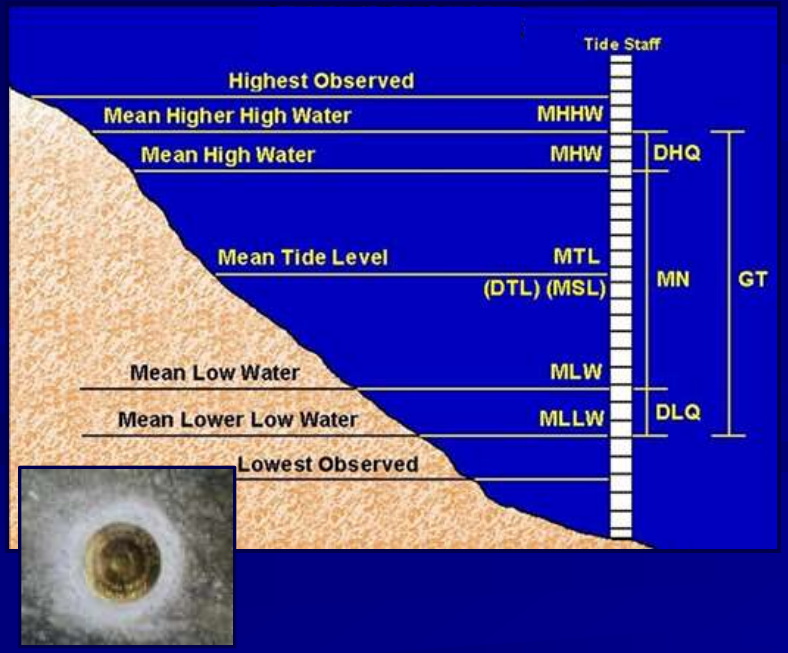


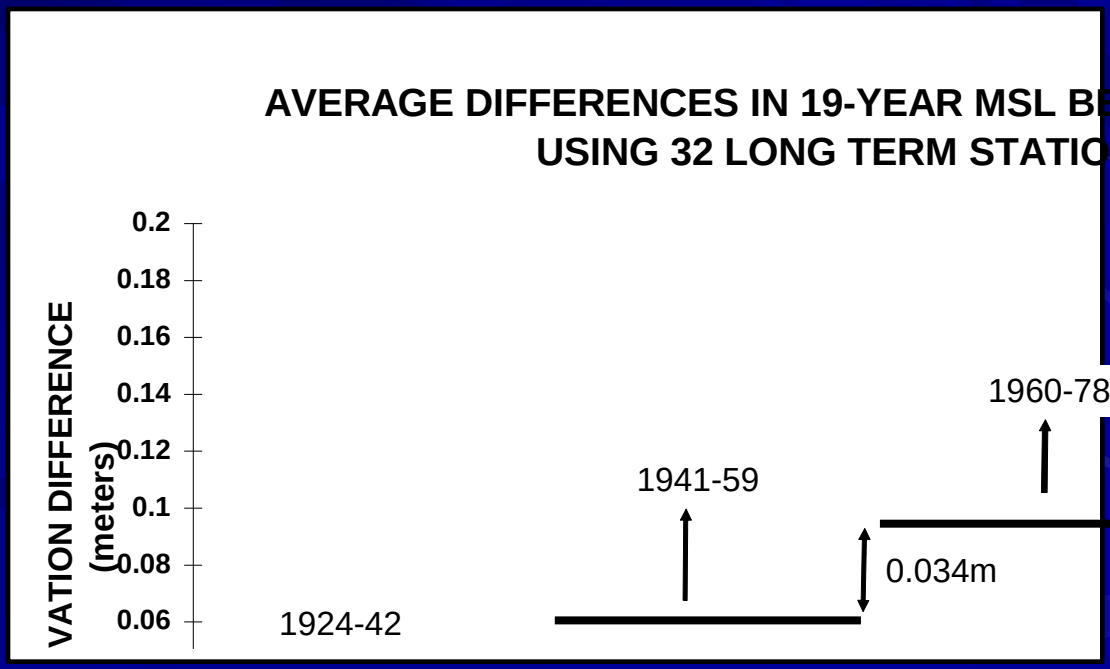


Maritime Services

- Provide vertical reference framework through tidal datums and International Great Lakes Datum
- Part of National Spatial Reference System
- National Tidal Datum Epoch (NTDE) is a common time period to which tidal datums are referenced

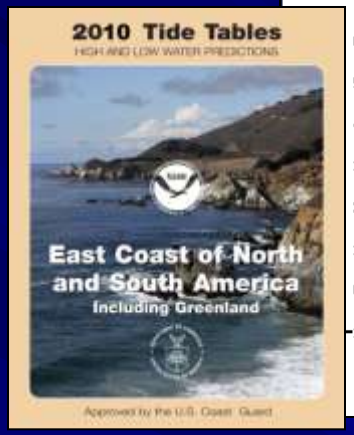


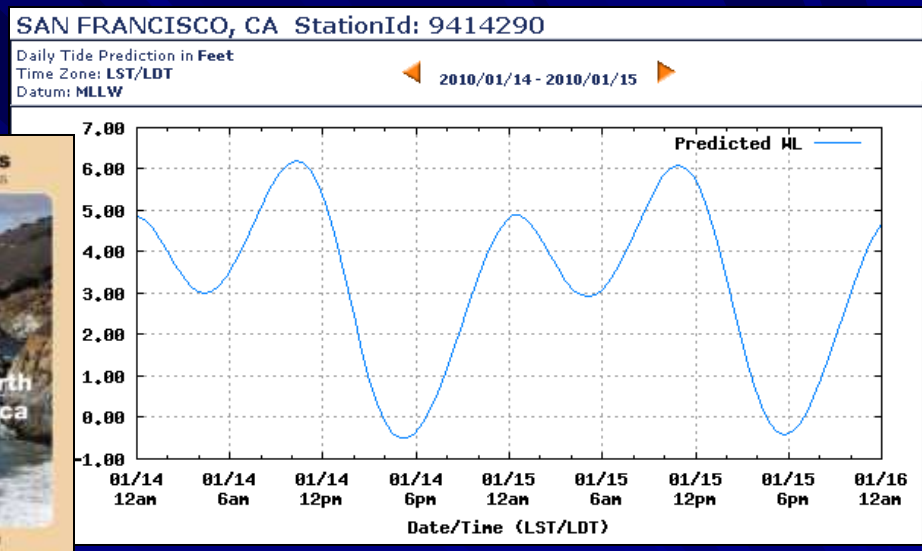


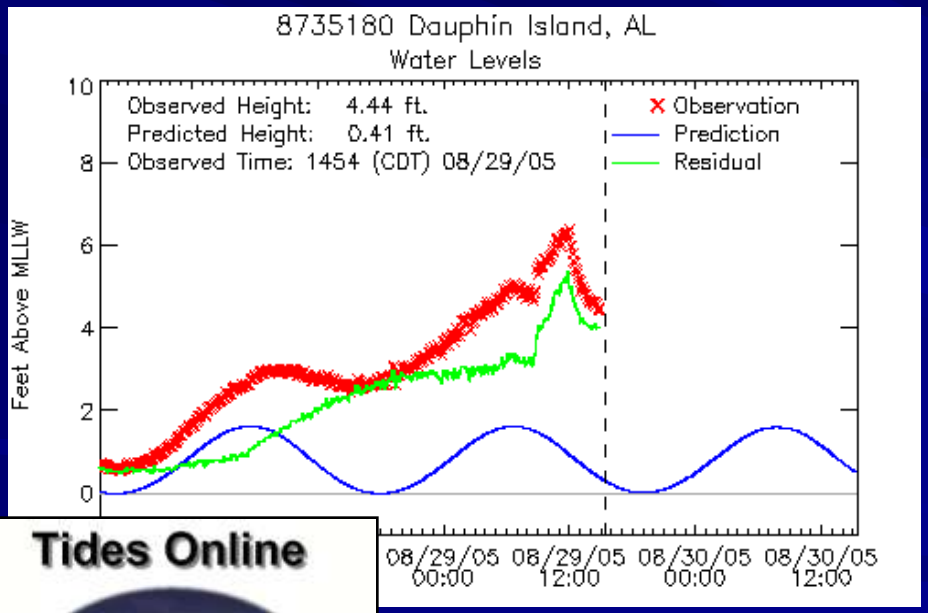


Maritime Services

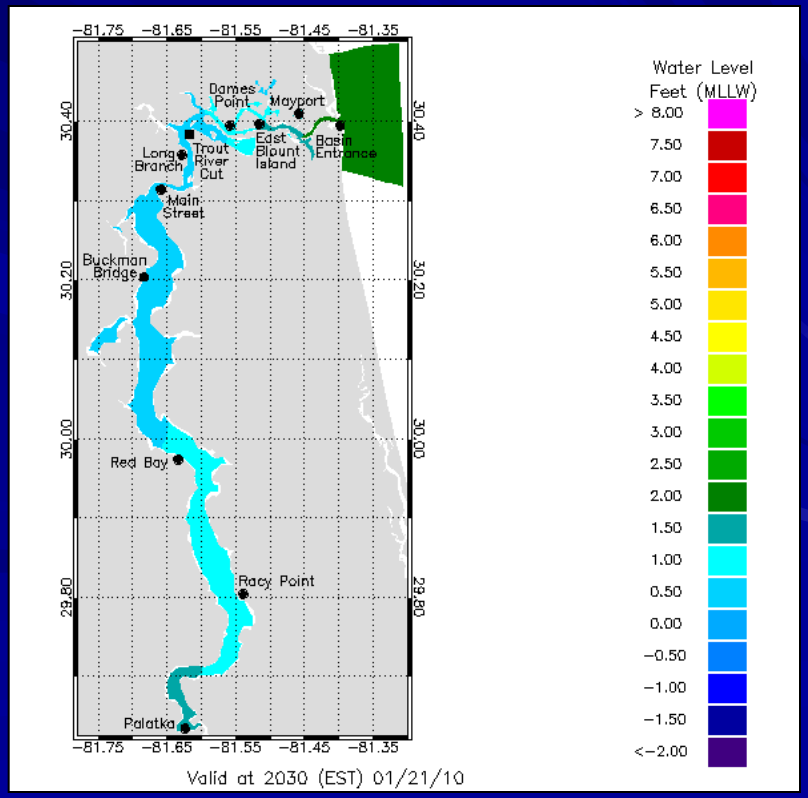
- Tide and current predictions
- Real-time data
- Nowcast/Forecast





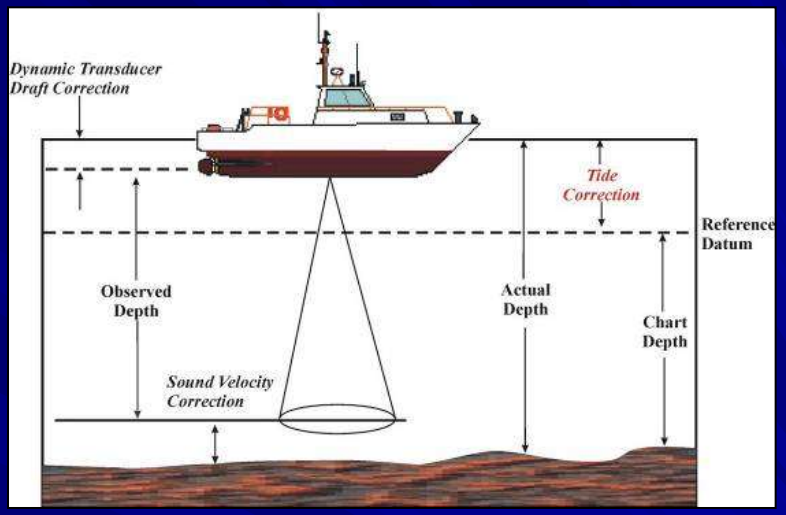


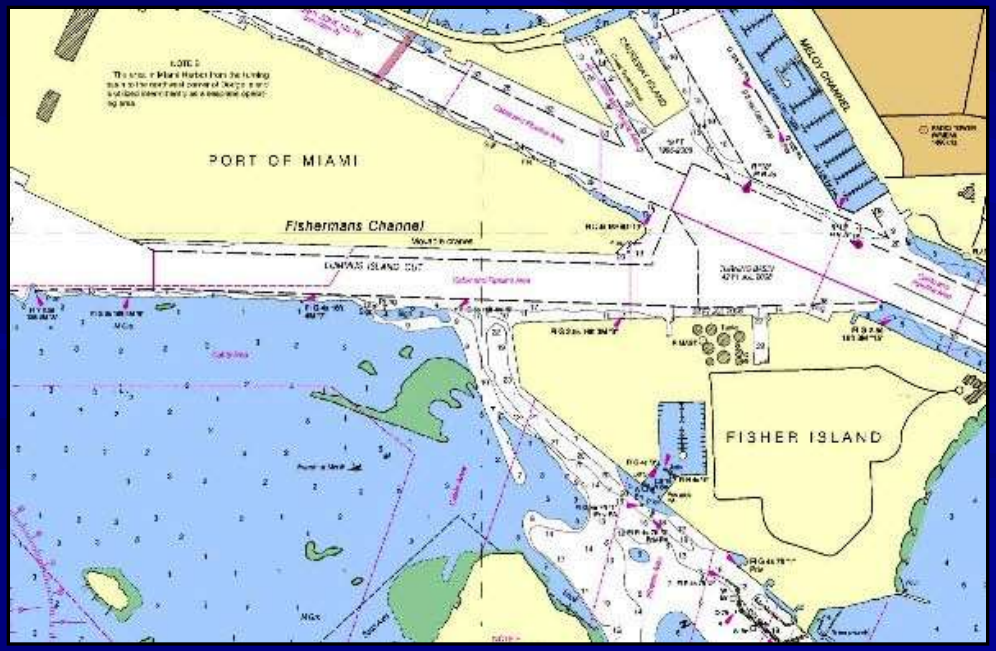
Quicklook from Dauphin Island, AL



Mapping and Charting Support Services

- Chart Datum and tide control for Hydrographic/photogrammetric surveys
- USACE/USCG
  - Dredging, coastal projects
  - Vessel Traffic Systems, Automated Identification System



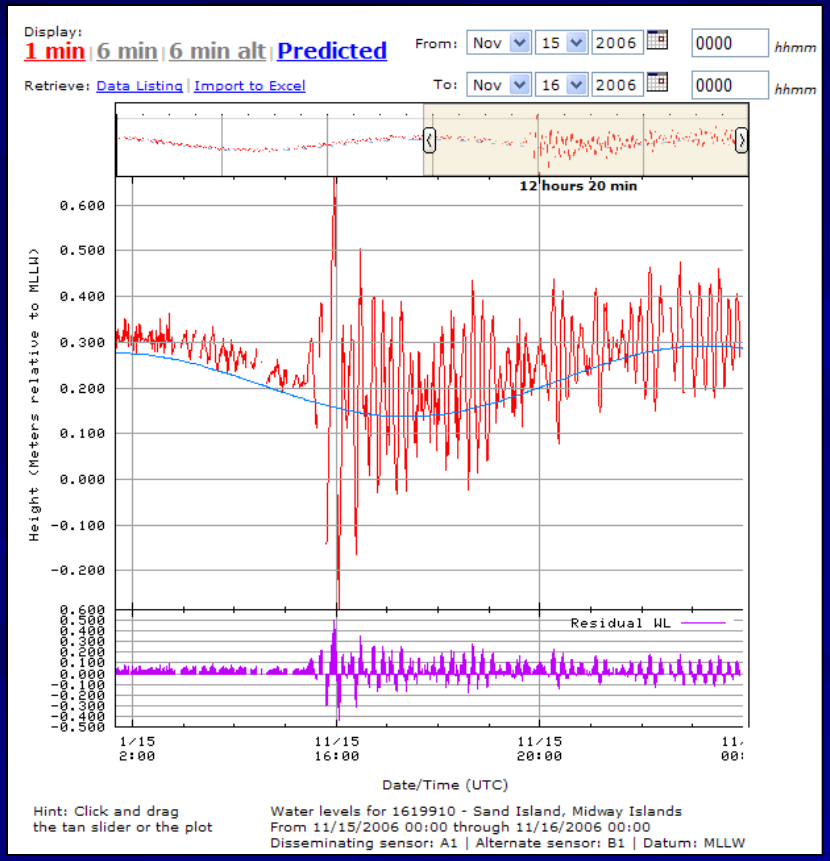


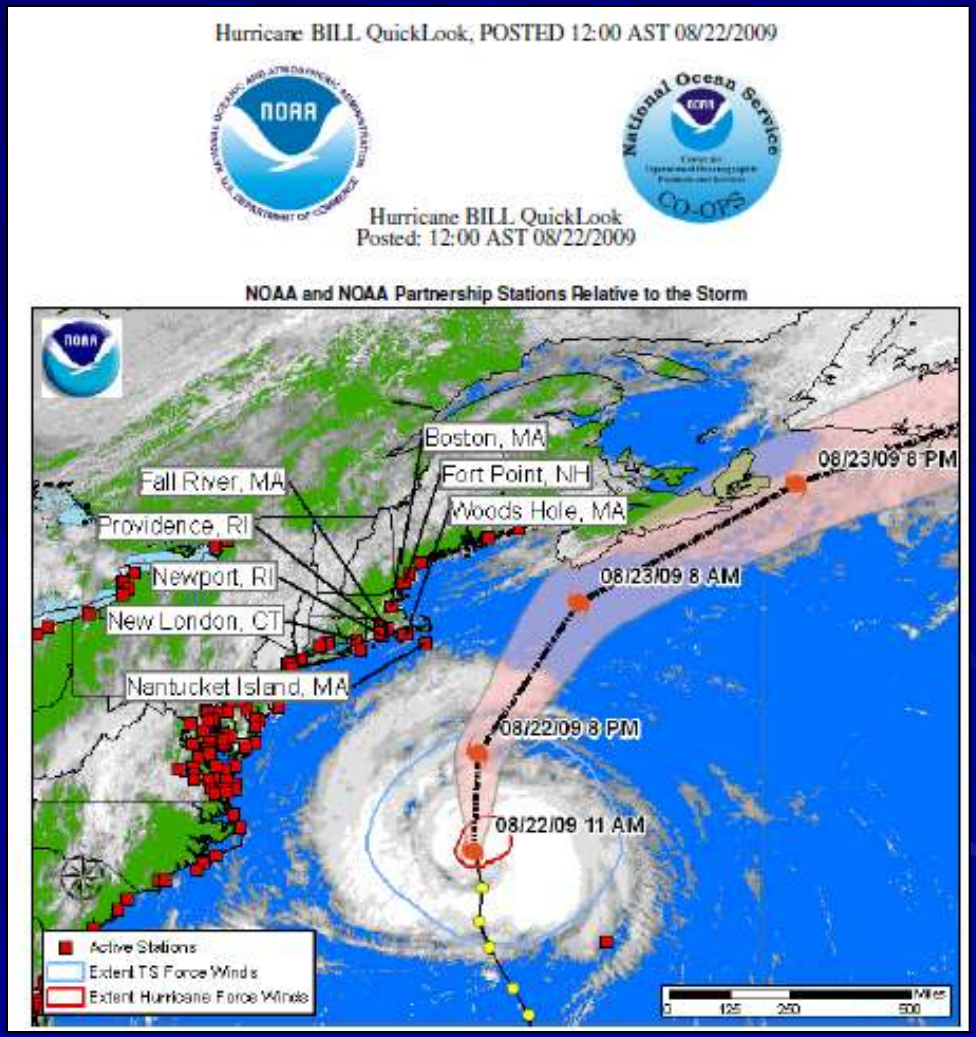
http://www.nauticalcharts.noaa.gov/index.html

COASTAL

Coastal Oceanographic Applications and Services of Tides And Lakes Program

- Storm Surge
- Tsunami

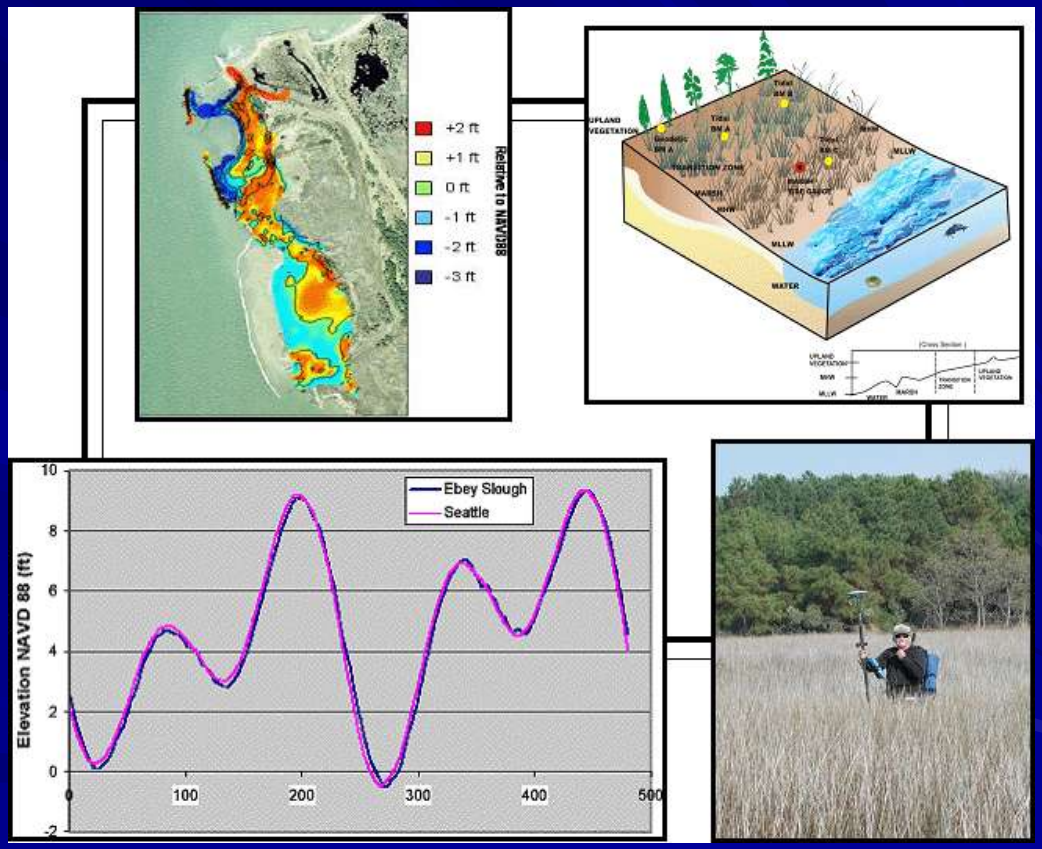




COASTAL

Coastal Oceanographic Applications and Services of Tides And Lakes Program

- Habitat Restoration
- Climate

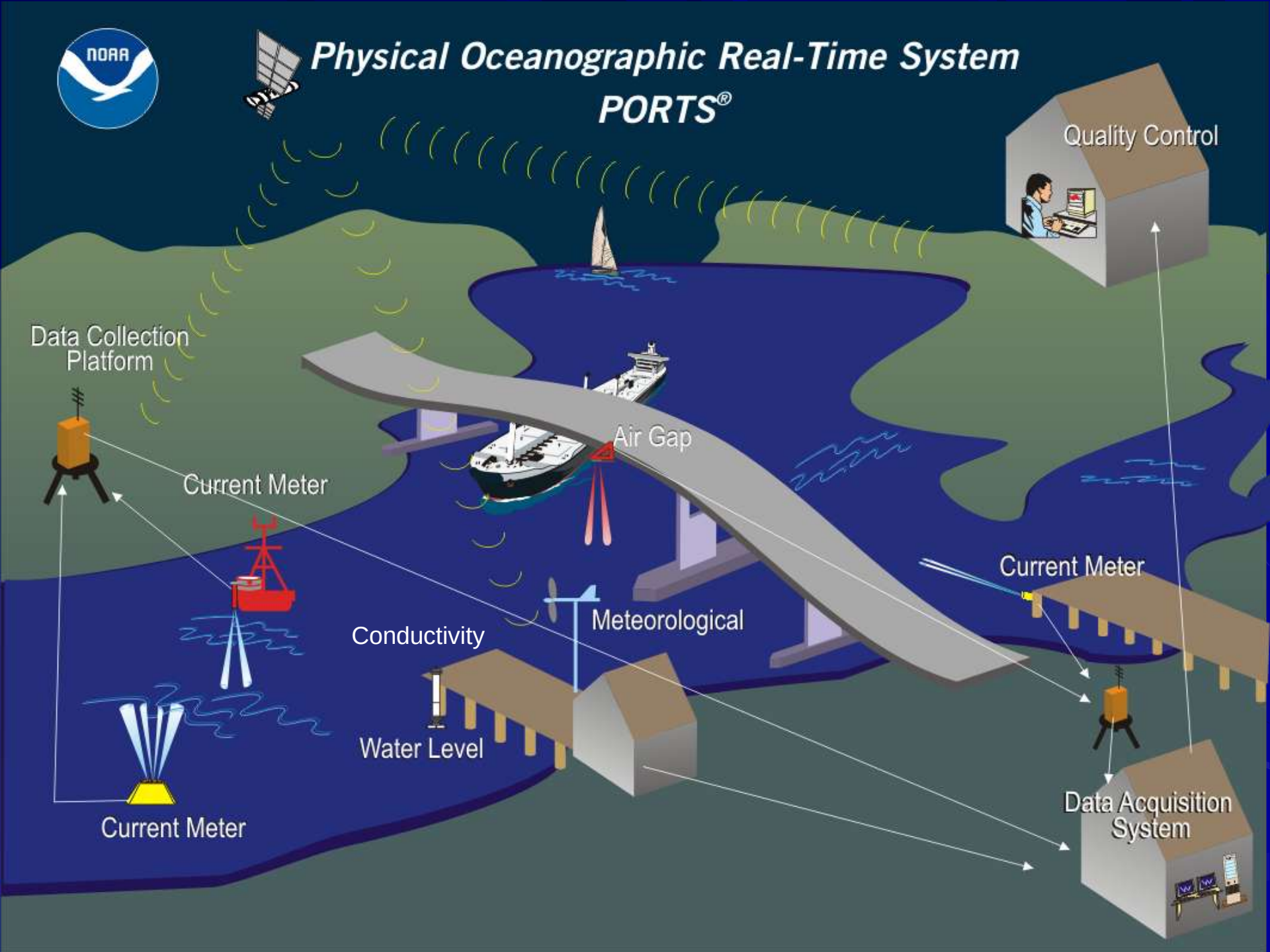


Observing Systems

- National Water Level Network (NWLON)

- Current Surveys

- Physical Oceanographic Real-Time System (PORTS™)


Physical Oceanographic Real-Time System
PORTS®
Quality Control
Data Collection Platform
Air Gap
Current Meter
Current Meter
Conductivity
Meteorological
Water Level
Current Meter
Data Acquisition System

Physical Oceanographic Real-Time System®

PORTS®

Maritime Safety and Efficiency

- Houston / Galveston, TX
  - 60% reduction in tugs and tows groundings
  - 50% reduction in ship groundings
- Tampa Bay, FL
  - 10% reduction in recreational distress calls
  - 50% reduction in ship groundings
- New York / New Jersey
  - Over 50% reduction in ship groundings

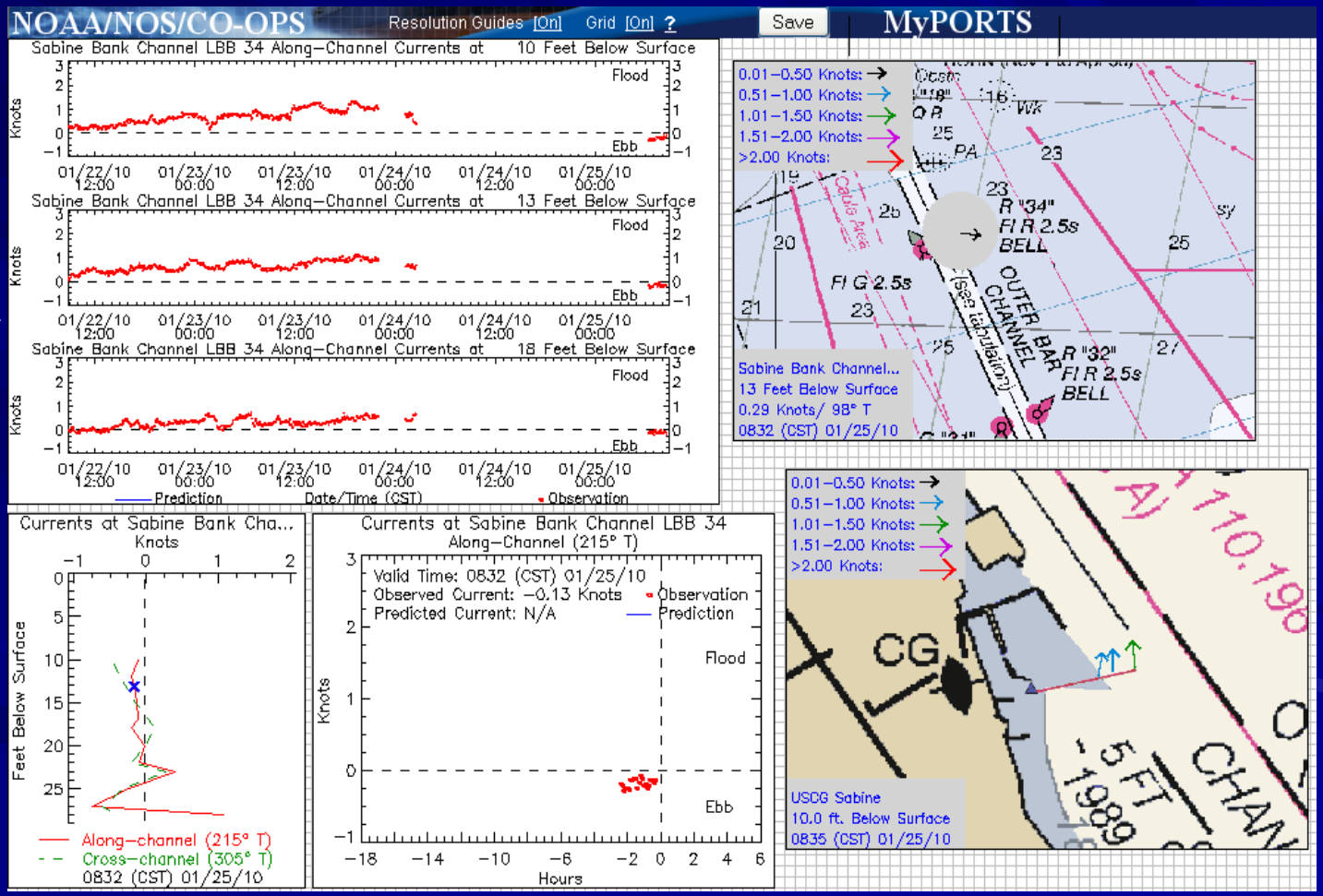

Houston Ship Channel

Statistics based on economic studies by Hauke Kite-Powell, Woods Hole Oceanographic Institution

My PORTS

- My PORTS allows users to create customized PORTS pages

View of currents at Sabine Neches PORTS



http://tidesandcurrents.noaa.gov/myports/

Technology Infusion

- **Microwave/Water Level Sensors**
  - Miros
  - Sutron
  - Design Analysis
  - Ohmart/VEGA
- **Visibility Sensors**
- **Air Gap**
  - Laser sensors enhance quality control

- **Waves**
  - Partnership with USACE and SCRIPPS to integrate wave buoy data into PORTS

CORMS

Continuous Operational Real-Time Monitoring System

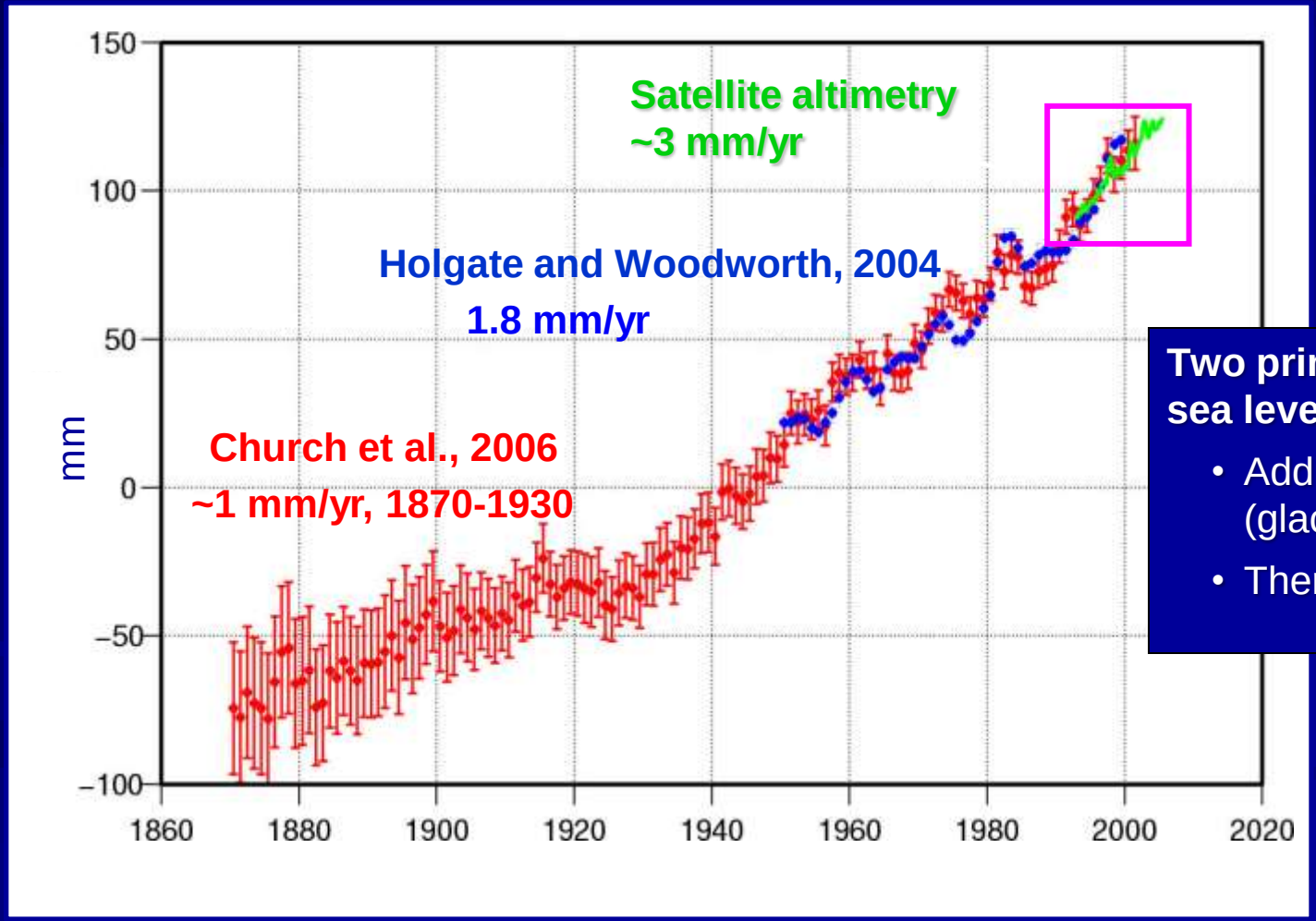
- *24-7* Quality Control-System Monitoring Operation

- CORMS / AI
  - Rule-based system
  - Performs QC and notifies Watchstanders of suspect data

Sea Level Rise

Global Sea Level

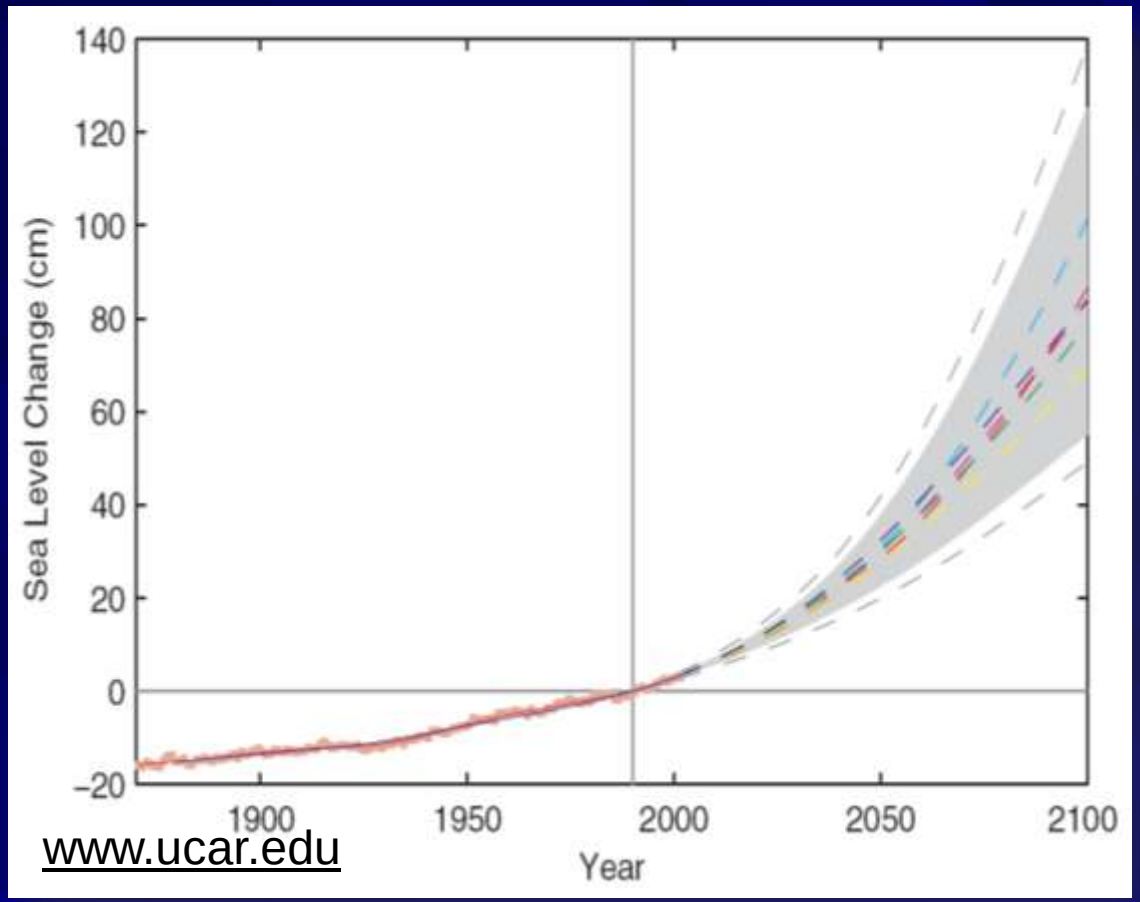
The Global Mean Sea Level Trend From Tide Gauges & Altimetry Suggests an Acceleration



Two primary causes of global sea level rise:

- Addition of water volume (glaciers, ice sheets, etc)
- Thermal expansion

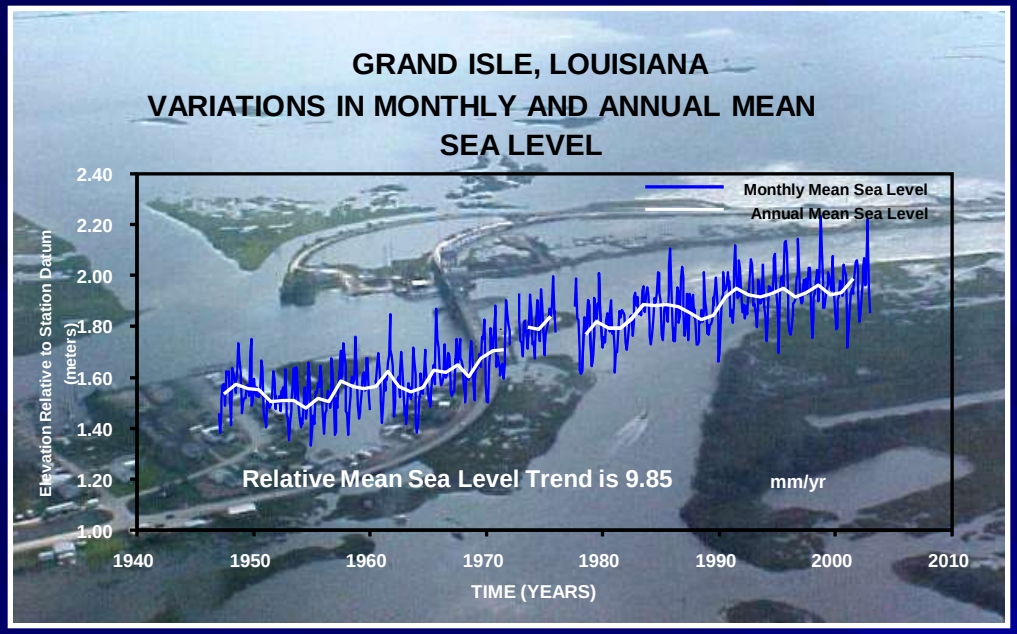
Sea Level Rise Trends and Projections



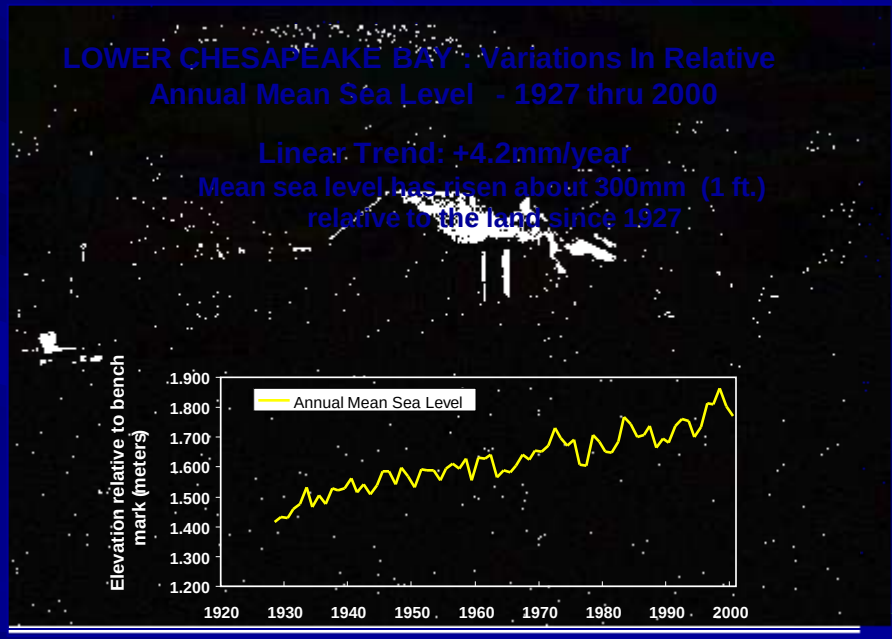
- Global sea level during peak glacial maximum (20,000 yr ago) was >120 m lower with temps 4°-7°C cooler than today
- 2 million years ago, the average climate was about 2°- 3°C warmer and sea level was >25 m higher than today

- The Intergovernmental Panel on Climate Change (IPCC) 2007 report projects a 18 to 59 cm sea level rise from a 1.1 and 6.4 °C temperature increase during the 21st century (this projection does not consider potential contributions from accelerated ice melt in Greenland and Antarctica).

Local Mean Sea Level



Mean sea level is locally derived through observations at tide stations and tied to bench marks on land



Local mean sea level Is dynamic and influenced by :

- Global Sea level
- Astronomical Tides
- Seasonal To Decadal Oceanographic/Meteorological Processes
- Local Land Movement

http://www.tidesandcurrents.noaa.gov/sltrends/index.shtml

TIDES & CURRENTS

Sea Levels Online

- Only source for local sea level trends in the United States
- Major contributor to Global Sea Level determination

TIDES & CURRENTS

News and Alerts

[2009-08-28]
NOAA Report Explains Sea Level Anomaly this Summer along the Atlantic Coast

[2009-07-02]
East Coast water levels running above predictions

ALERT: East Coast water levels are currently running above predicted tides

Starting in early June 2009, observed tides have been increasingly elevated above predicted tidal elevations along the entire U.S. East Coast from Maine to the east coast of Florida. During the period from June 19 thru June 24 for instance, these water levels were running between 0.6 to 2.0 feet above normal depending upon location. As of July 1, these anomalies continue, but running lower at 0.3 to 1.0 ft. above normal. It is not unusual for smaller regions and estuaries along the U.S. East Coast to experience this type of anomalous event at this time of year, however the fact that the geographic extent of this event that includes the entire East Coast event is anomalous. CO-OPS will continue to monitor this event and will provide further information on the causes, amplitudes, geographic extent, and the duration of the event.

For further information, please contact:

User Services
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, MD 20910-3281
E-mail: User Services

Back to Tides & Currents

NOAA Technical Report NOS CO-OPS 051

ELEVATED EAST COAST SEA LEVEL ANOMALY: June – July 2009

Silver Spring, Maryland
August 2009

noaa National Oceanic and Atmospheric Administration
U.S. Department Of Commerce
National Ocean Service
Center for Operational Oceanographic Products and Services

http://tidesandcurrents.noaa.gov/publications/EastCoastSeaLevelAnomaly_2009.pdf

Incorporating Sea Level Change

Incorporating sea level changes in civil works programs

Incorporating sea level change into restoration guidance

NOAA Coastal Services Center

Tools

Sea Level Rise and Coastal Flood Frequency Viewer

Produced and distributed by the NOAA Coastal Services Center

Use the slider bar beside the map to see how rates of sea level rise will impact a community. Flooding frequency information is also provided. This visualization tool (the prototype was developed for Wilmington, Delaware) is helpful for those involved in coastal planning and any effort to educate citizens about local sea level rise issues.

Launch Now

Features

- Portrays sea level rise scenarios and potential impacts
- Uses maps with prominent landmarks to increase recognition
- Illustrates how sea level rise will increase tidal flood frequency

Data Requirements

- High resolution elevation data

The Digital Coast Partnership

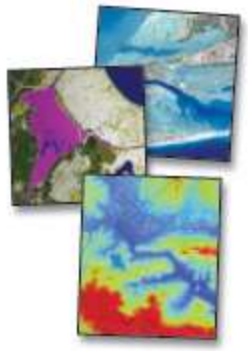
www.csc.noaa.gov/digitalcoast/

IT STARTED WITH A VISION. Wouldn't it be great if coastal data were accessible from one website? And the site could also include the training and tools needed to turn these data into useful information? And examples—the site should provide examples so others can learn.

And since we're dreaming—couldn't we come a little bit closer to changing the world if the site was used not only by the federal government, but also the private sector and nonprofits, county governments, state programs, and anyone else interested in the wise management of coastal resources? What would happen if these groups started working together?

The Digital Coast was developed by the National Oceanic and Atmospheric Administration (NOAA) in response to this vision. Users can download data and easily access the associated training, tools, and application examples.

Phase one incorporates data served by the NOAA Coastal Services Center. Phase two is being led by the Digital Coast partner network. These partners, who are either primary users of the system or content providers, will help NOAA prioritize the components that will be added during phase two and all future expansion efforts.



Digital Coast Partners

- Coastal States Organization
- National Association of Counties
- National States Geographic Information Council
- Association of State Floodplain Managers
- The Nature Conservancy
- NOAA

Partner Benefits

- Easier access to relevant data, tools, and training
- Ability to shape the future phases of the Digital Coast
- Opportunity to participate in demonstration projects
- Ability to contribute to a national, unified movement for the coast
- Opportunity to forge new partnership opportunities

TO LEARN MORE,
contact Nicholas (Mitch) Schmidt at (843) 740-1237 or Nicholas.Schmidt@noaa.gov.

DIGITAL COAST
It's More Than Data

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

http://www.csc.noaa.gov/

NOAA's National Ocean Service

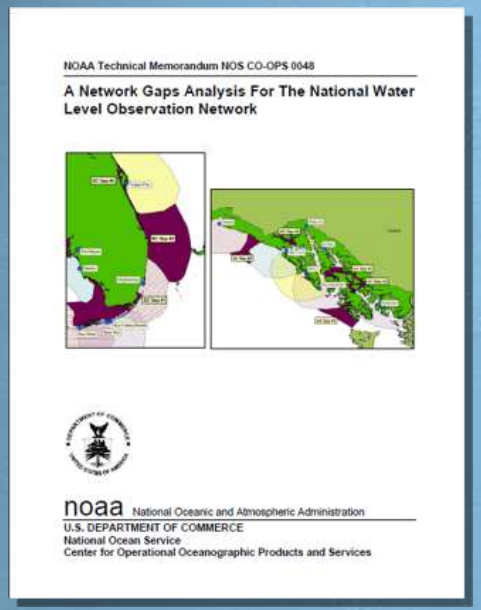
Center for Operational Oceanographic Products and Services

Background Slides

Authorization – Legal Precedents

- **1936 Borax, Ltd v. City of Los Angeles U.S. Supreme Court case**
  - Use of 19-year tidal datum epoch concept in legal context
- **United States v California, 332 U.S. 19, 26 (1947)**
  - Established use of ordinary low water mark as baseline for offshore submerged lands as defined and determined by Coast and Geodetic Survey.
- **National Tidal Datum Convention of 1980**
  - Authorized the NOAA definitions of MHW, MHHW, MLW and MLLW as the official policy of the U.S. Government.
- **Dinkum Sands Court case**

National Water Level Network


NOAA Technical Memorandum NOS CO-OPS 0048

A Network Gaps Analysis For The National Water Level Observation Network

noaa National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE
National Ocean Service
Center for Operational Oceanographic Products and Services

NWLON - 205 stations

National Water Level Observation Network

- Water Level
- Wind Speed/Direction
- Barometric Pressure
- Air Temperature
- Water Temperature
- Conductivity

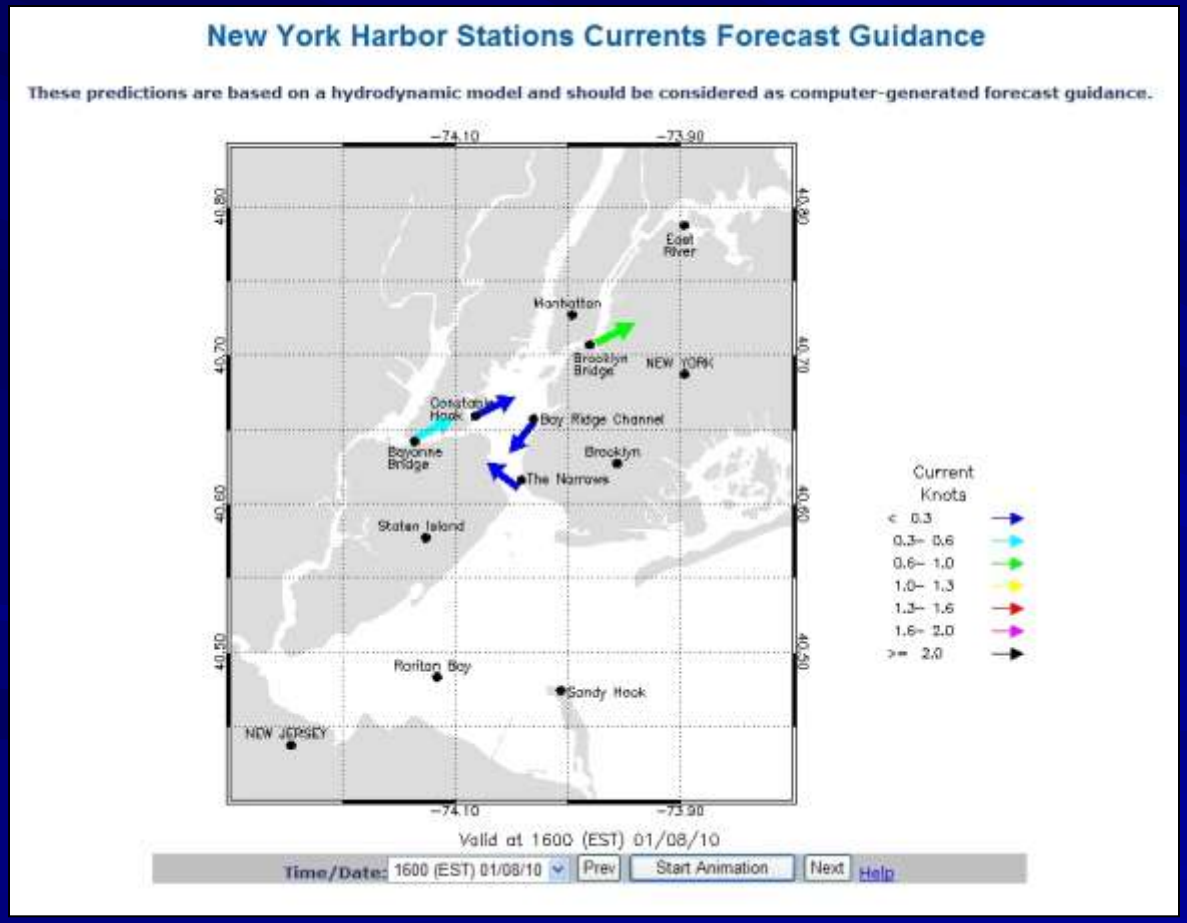
Maritime Services

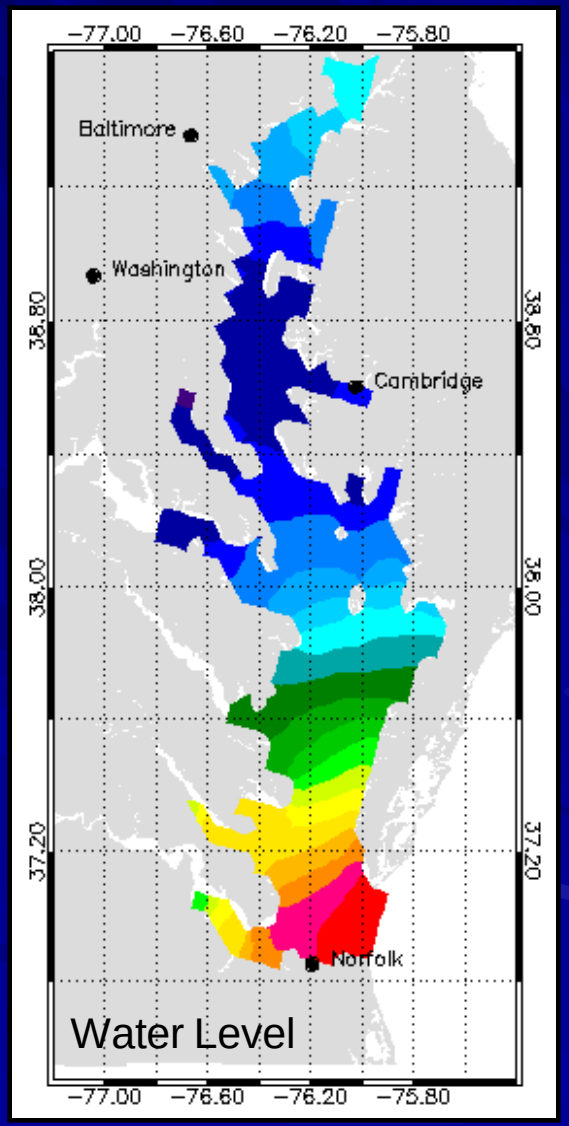
- Real time data - NWLON

NWLON stations are the foundation for NOAA's tide prediction products, and serve as controls in determining tidal datums for short-term water-level stations.

Maritime Services

- Operational forecast systems





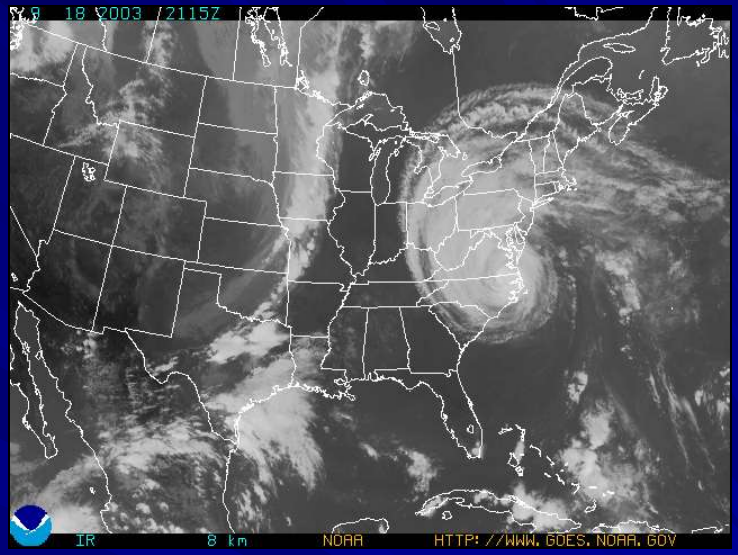
COASTAL

- Marsh Restoration

COASTAL stands for the Coastal Oceanographic Applications and Services of Tides And Lakes Program

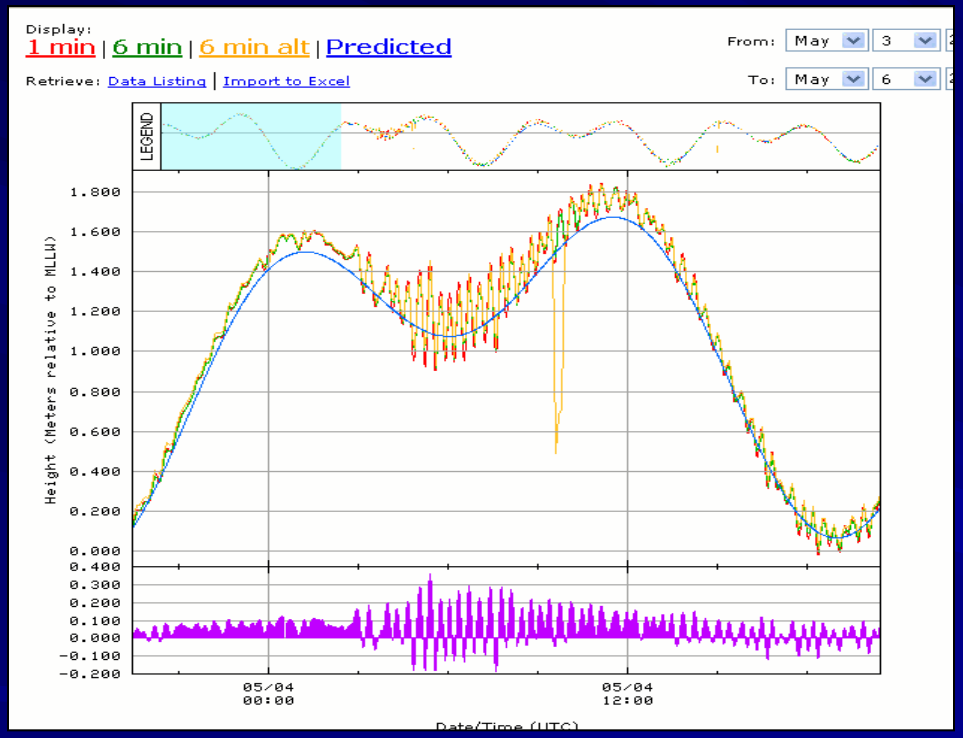
COASTAL

- Storm surge



COASTAL

- Tsunami



1-minute water level data is collected at tsunami-capable tide stations to support national tsunami warning and mitigation efforts.

COASTAL

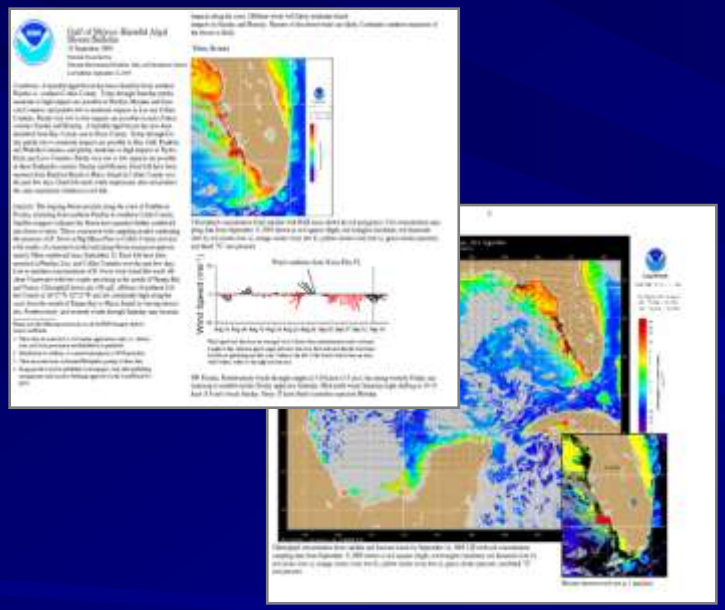
- Climate/SLR

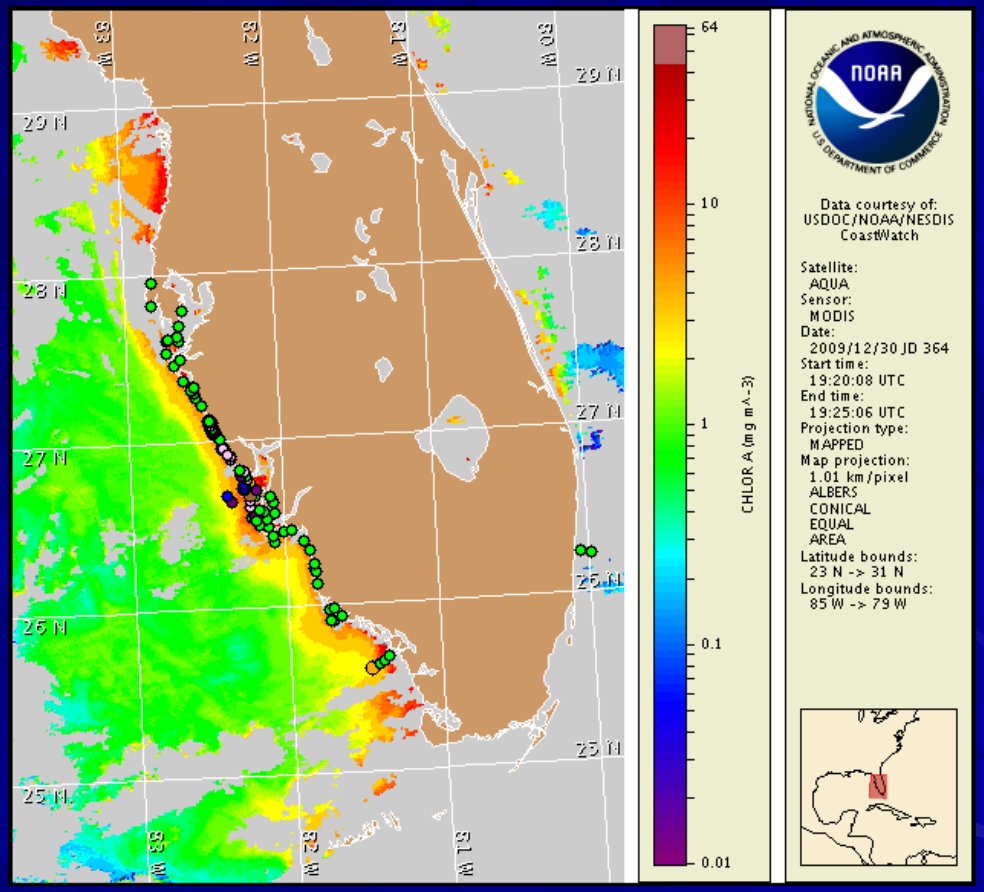
Mean sea level has risen about 4.4 inches relative to the land since 1950.

Sea levels provide an important key to understanding the impact of climate change.

COASTAL

- HAB Forecasts

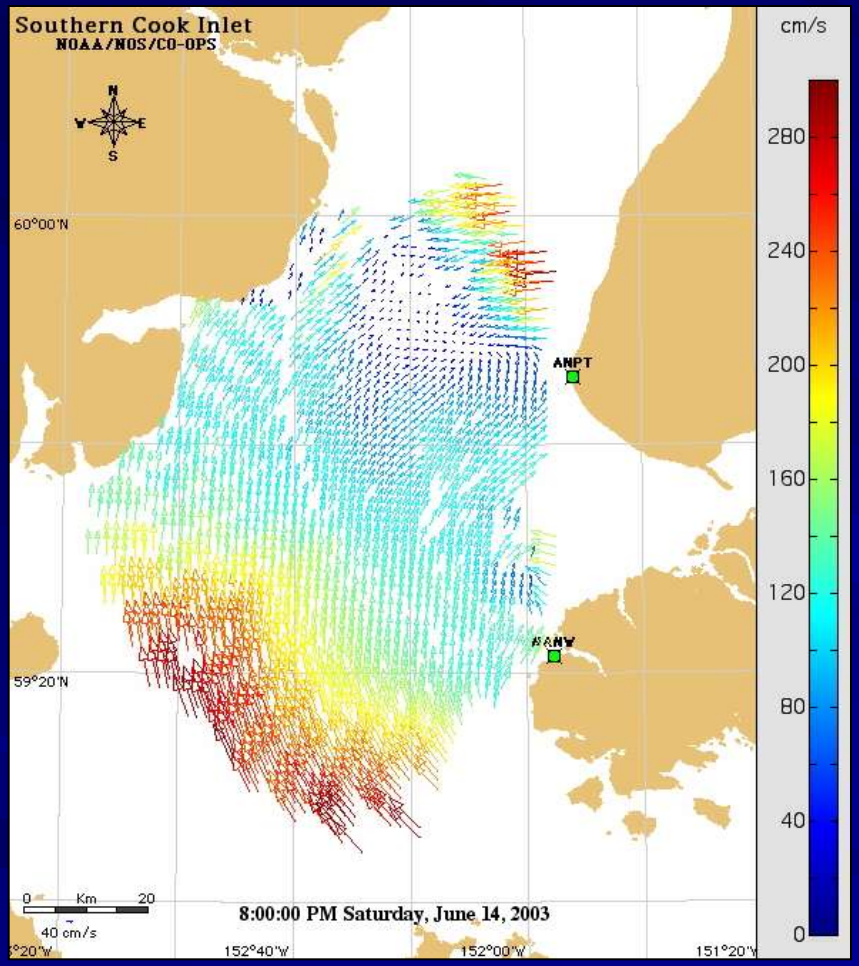




Harmful algal blooms (HABs) threaten the health and safety of humans and marine organisms.

National Current Observation Program

High Frequency Radar



Annual Economic Benefits (millions)

Annual PORTS® Benefits From Houston/Galveston and Tampa Bay

Maritime Commerce	***Houston/Galveston***	***Tampa***
Grounding avoidance	$10.5m	$1.1m-2.8m
Improved spill response	$1.0m-3.0m	$1.1m-1.8m
Increased cargo	$0.25m	$1.1m
Reduced delays	$0.125m	$0.01m
Weather/Hazards		
Improved weather forecasts	$2.5m-3.0m	$2.0m
Improved storm surge forecasts	$0.5m	$0.5m
Recreation		
Enhanced beach recreation	$0.12m	$0.2m
Enhanced recreational boating	$0.62m	$1.0m
Enhanced recreational fishing	$0.03m	$0.1m
TOTAL	$14.8m-18.3m	$6.8m-9.2m

Estimated annual benefits from a National PORTS® – $160 million

Incorporating Sea Level Changes in Civil Works Programs

Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

EC 1165-2-211

CECW-CE

Circular
No. 1165-2-211

1 July 2009

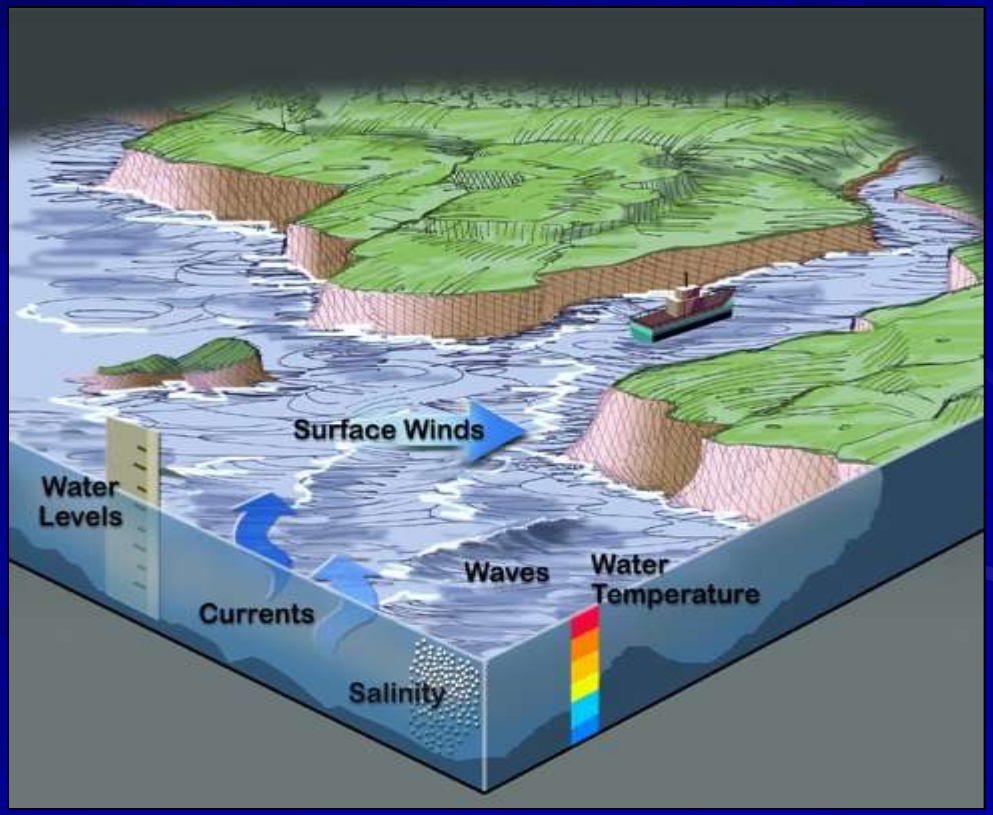
EXPIRES 1 JULY 2011

WATER RESOURCE POLICIES AND AUTHORITIES
INCORPORATING SEA-LEVEL CHANGE CONSIDERATIONS
IN CIVIL WORKS PROGRAMS

1. Purpose. This circular provides United States Army Corps of Engineers (USACE) guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Recent climate research by the Intergovernmental Panel on Climate Change (IPCC) predicts continued or accelerated global warming for the 21st Century and possibly beyond, which will cause a continued or accelerated rise in global mean sea-level. Impacts to coastal and estuarine zones caused by sea-level change must be considered in all phases of Civil Works programs.

National Operational Coastal Modeling Program

- National network of operational hydrodynamic models providing nowcasts and short-term (0 hr. – 48 hr.) forecasts
  - Water Levels
  - Currents
  - Salinity
  - Temperature



HAB Forecasts

Gulf of Mexico Harmful Algal Bloom Bulletin

6 December 2004

National Ocean Service

National Environmental Satellite, Data, and Information Service

Last bulletin: December 2, 2004

Conditions: A harmful algal bloom has been identified offshore between Cape Romano and Cape Sable. No beach impacts are expected through Thursday.

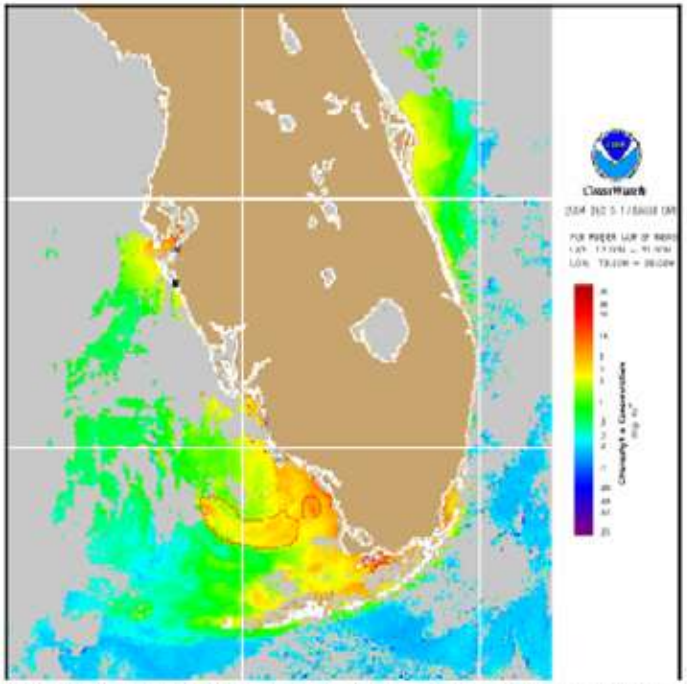
Analysis:

A confirmed K. brevis bloom is presently located northwest of Cape Sable. This bloom expanded offshore to the northwest and progressed slightly farther southward over the weekend. The bloom extends from 81°22' to 82°24' east to west and from 25°34' to 25°12' north to south, respectively, with a center at approximately 81°49'W, 25°18'N. Satellite imagery shows maximum chlorophyll levels up to 9 μg/L at 82° 19'W, 25° 30'N offshore and 81° 24'W, 25° 28'N closer to shore. Chlorophyll levels remain lower than 5 μg/L throughout the remaining bloom region.

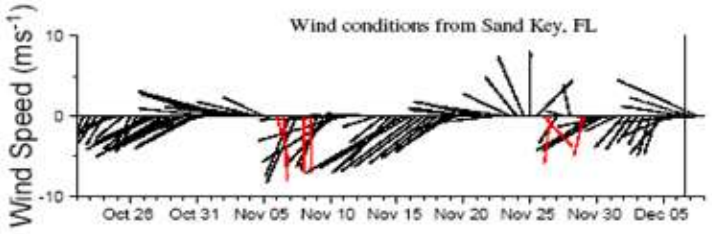
Mass fish kills and several crab and dolphin mortalities have been reported offshore from Shark River. Although both events seem to be located within the same general region offshore of Cape Sable, a precise location of this sighting in relation to the HAB is presently unknown. No K. brevis was identified in onshore or offshore (south of 25° 12'N) samples taken 11/27-12/2 by Mote Marine Lab and FWRI.

Beach impacts through Thursday are unlikely. Conditions should minimize further southerly transport and intensification of the bloom, however offshore expansion is possible.

~Fisher, Bronder



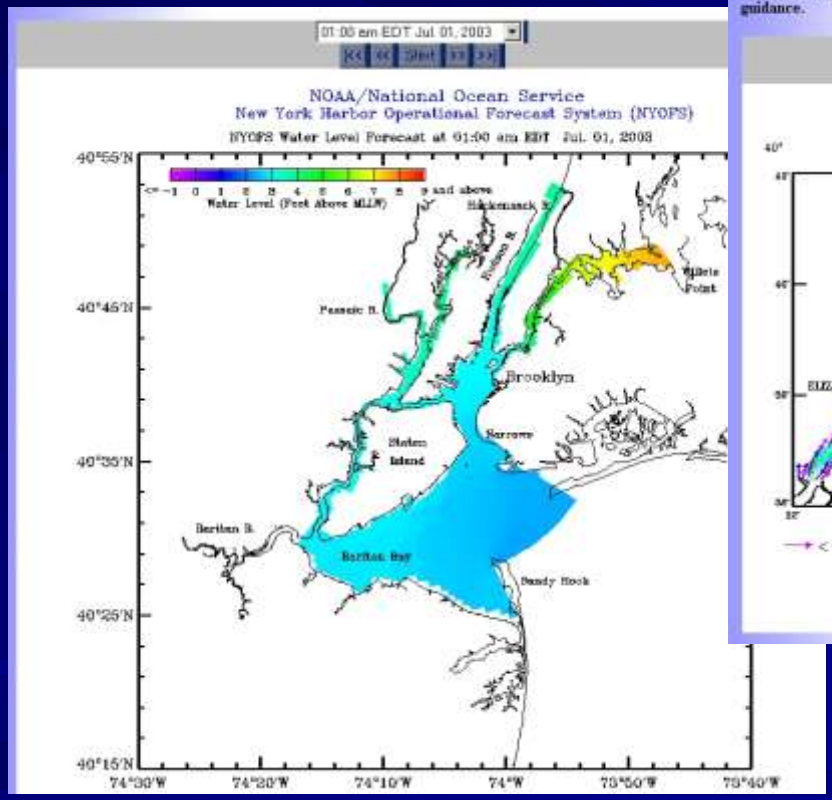
Chlorophyll concentration from satellite with possible HAB areas shown by red polygon(s). Cell concentration sampling data from November 30, 2004 shown as red squares (high), red triangles (medium), red diamonds (low b), red circles (low a), orange circles (very low b), yellow circles (very low a), green circles (present), and black "X" (not present).



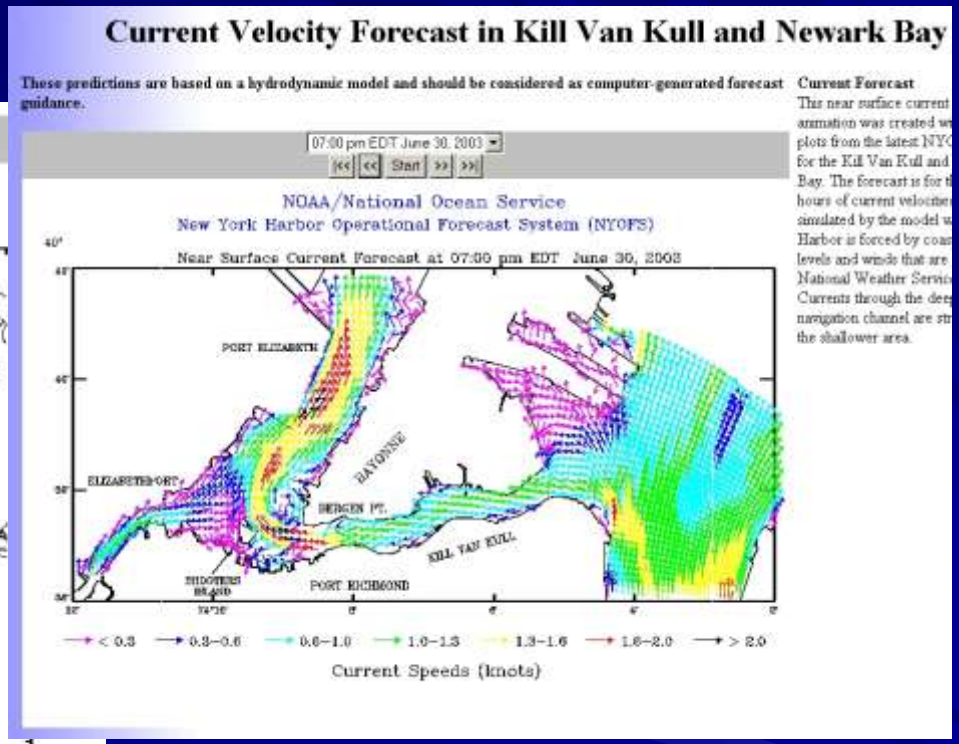
Wind speed and direction are averaged over 12 hours from measurements made on buoys. Length of line indicates speed; angle indicates direction. Red indicates that the wind direction favors upwelling near the coast. Values to the left of the dotted vertical line are measured values; values to the right are forecasts.

Continued east to southeast winds at 10-15 knots (5-7 m/s) are forecasted today through Thursday for Cape Romano to the Keys.

NYOFS
New York Operational Forecast System



Water Level Forecast



Velocity Forecast

Ocean Systems Test and Evaluation