

# Advances in Marine and Ocean Weather Forecasting

Vickie L. Nadolski

**NOAA Deputy Assistant Administrator for Weather Services**

American Boating Congress

**Washington, D.C.**

**April 28, 2008**

**Weather Impacts  
Recreational  
Boating**



# Boating Impacts on U.S. Economy

- \$39.5 billion in annual sales and service
- \$108 Billion impact on the American economy

*Source: NMMA*



# Weather Impacts on U.S. Economy

- One-Third of Nation's GDP is weather or climate sensitive
- \$4 Trillion in 2005

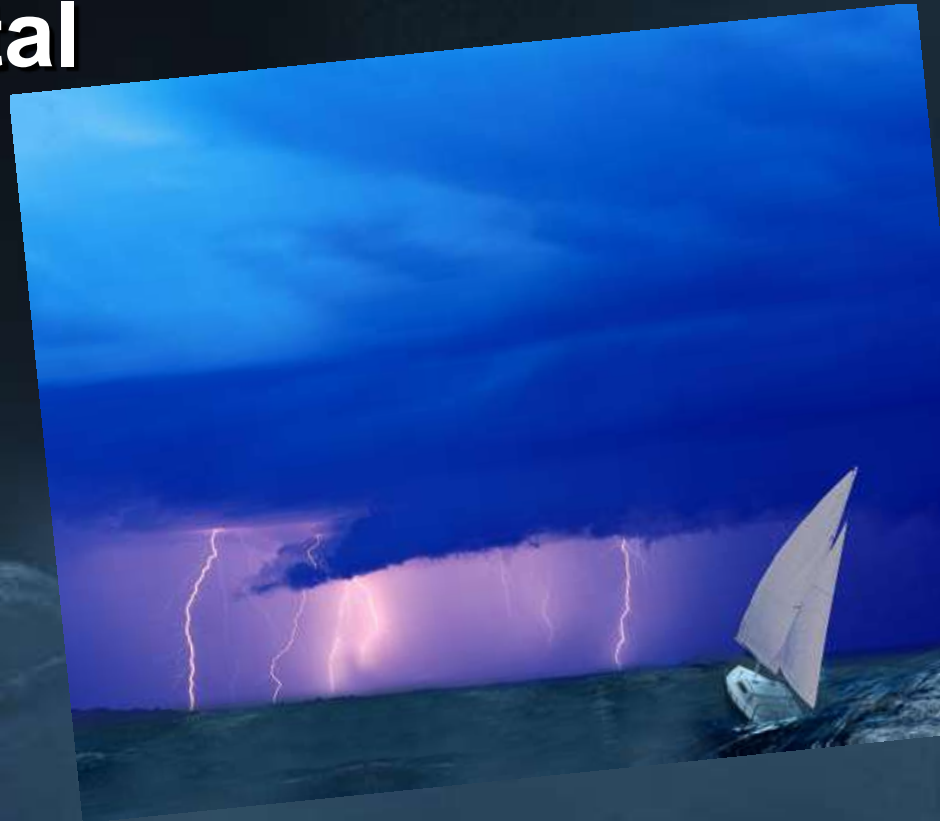
*Source: Economic Statistics for NOAA  
April 2006*



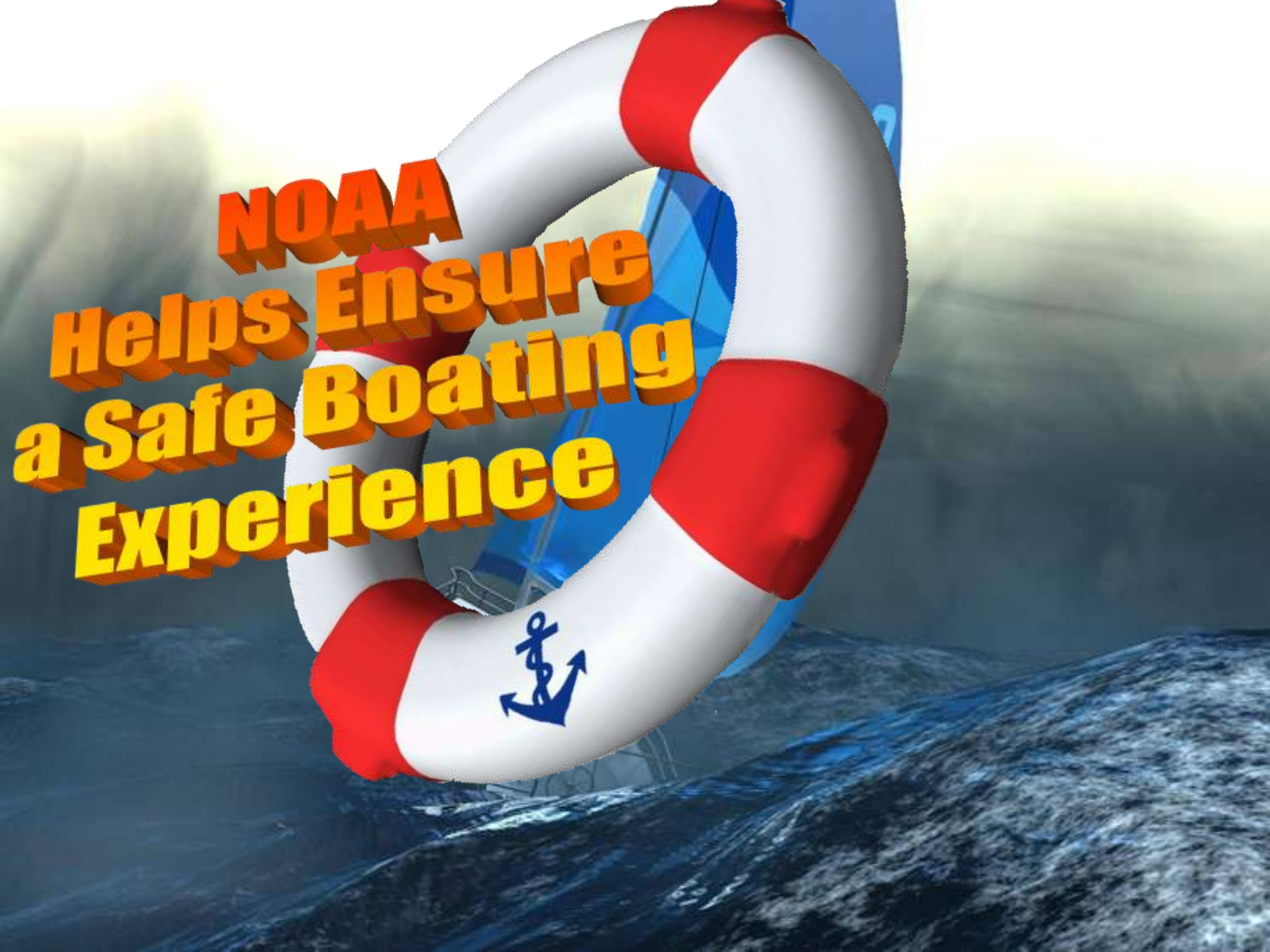
# Weather Impacts Recreational Boating

In 2006, environmental hazards resulted in:

- *621 accidents*
  - 123 due to weather
- *108 fatalities*
  - 34 due to weather

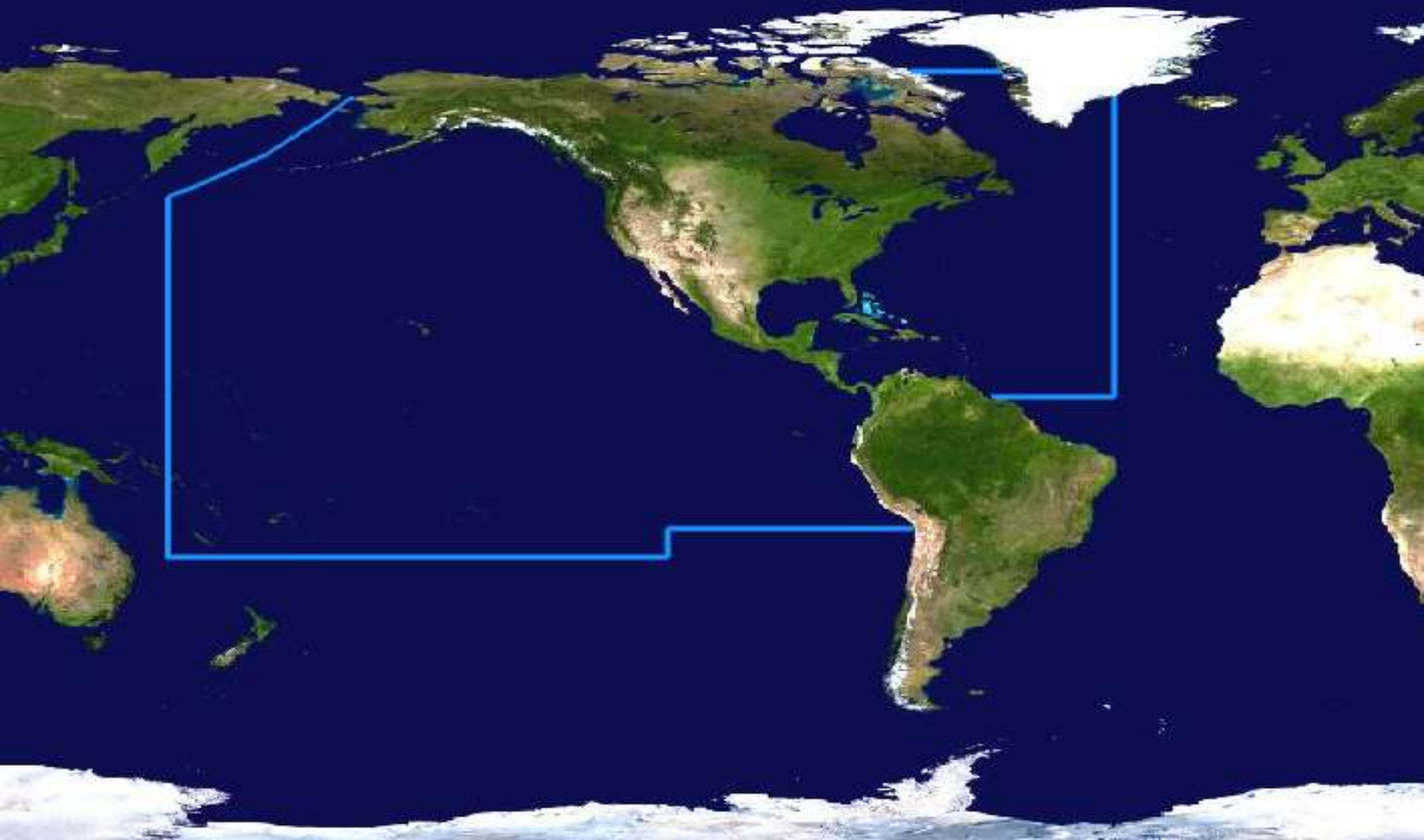


**Source: U.S. Coast Guard 2006 Boating Statistics**

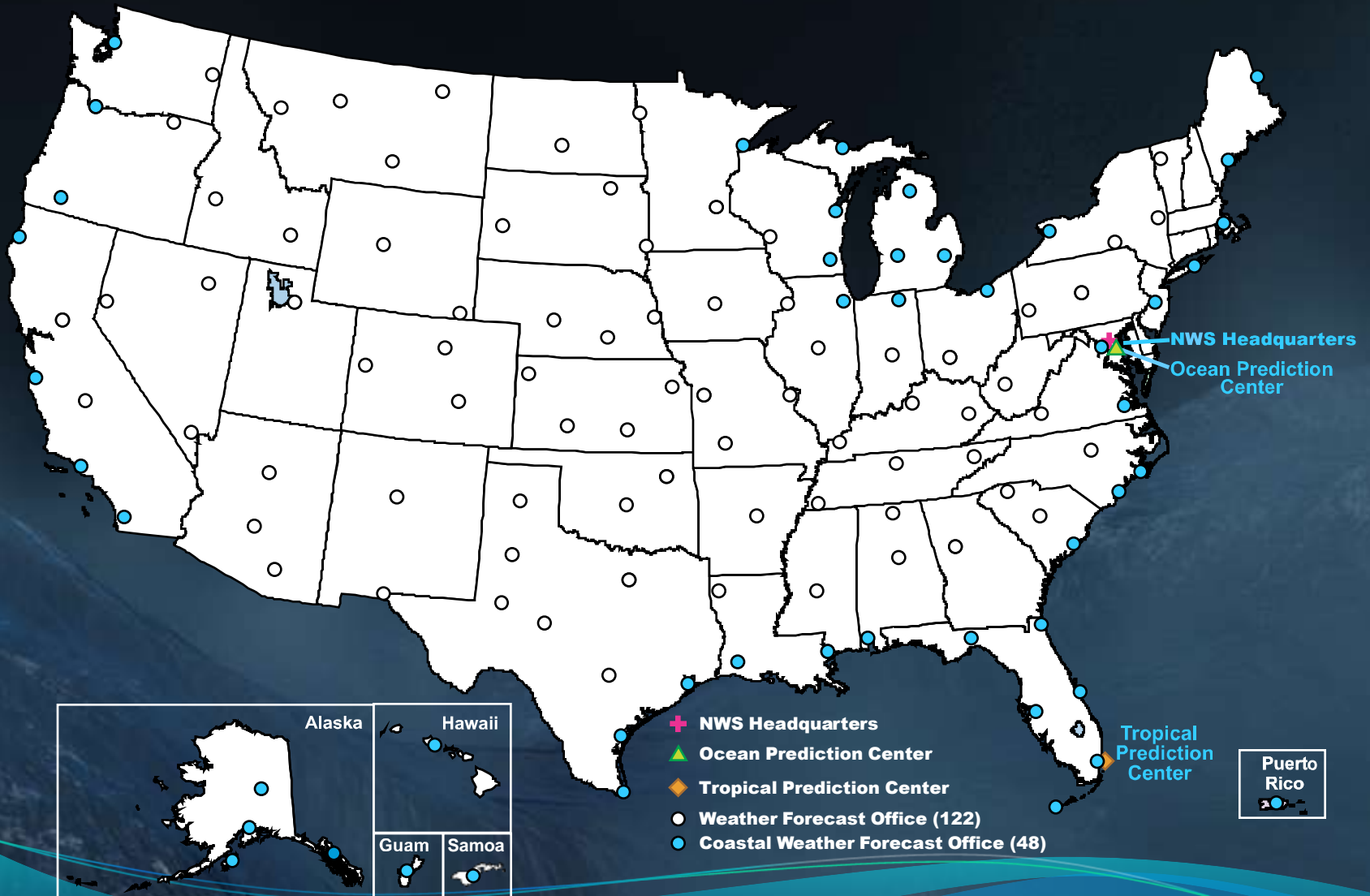


**NOAA  
Helps Ensure  
a Safe Boating  
Experience**

# NOAA Marine Forecasts

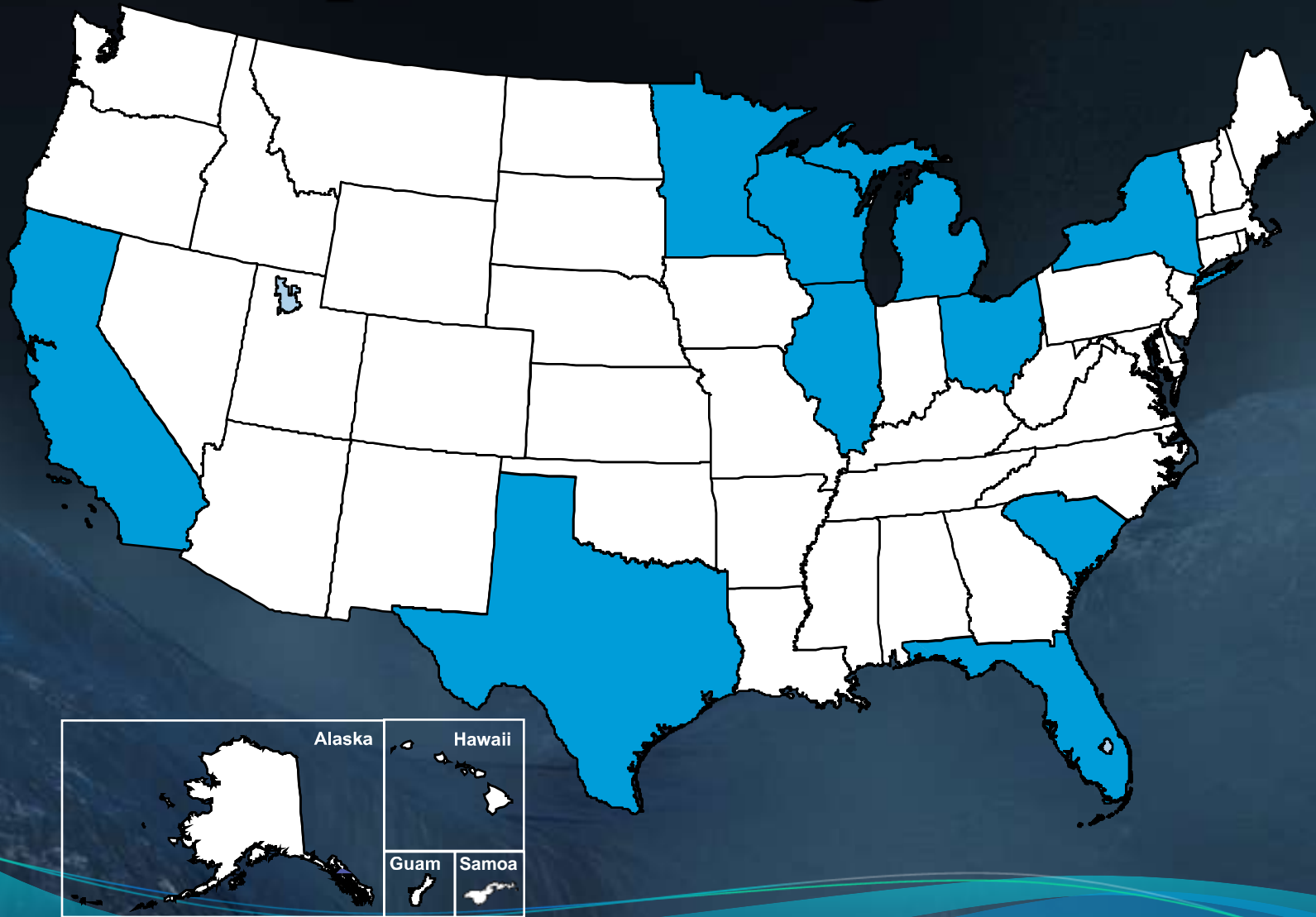


# NOAA Marine Forecasts



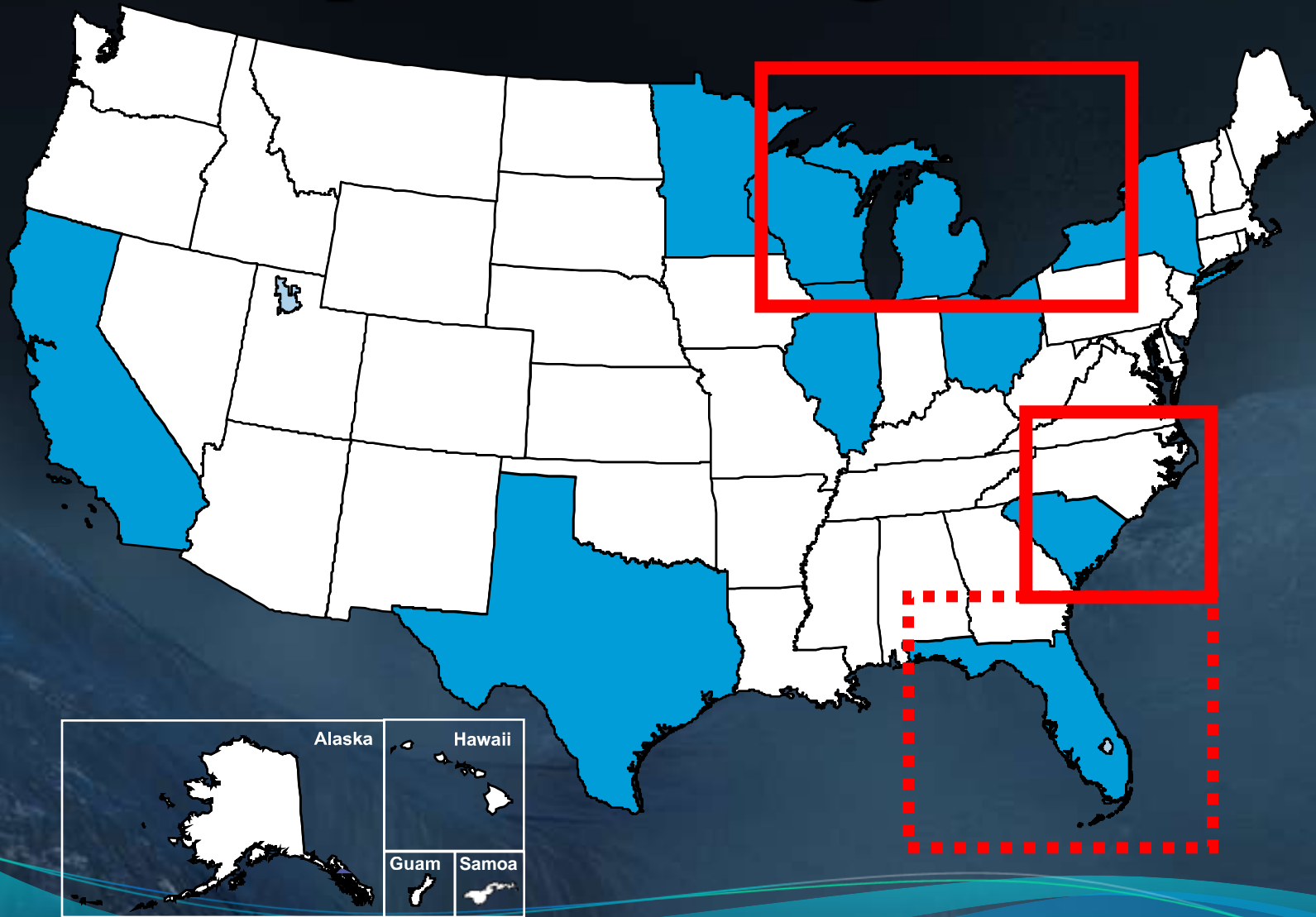


# Top 10 Boating States



**Source: 2006 U.S. Recreational Boat Registration Statistics**

# Top 10 Boating States



Source: 2006 U.S. Recreational Boat Registration Statistics

# NOAA Marine Weather Products and Services

NOAA's National Weather Service  
**Great Lakes**

Home Site Map News Organization Search for:

Local forecast by "City, ST" or Zip Code

Great Lakes  
Lake Superior  
Lake Michigan  
Lake Huron  
Lake Erie & St Clair  
Lake Ontario  
Radar  
Safety/Education  
Science  
Forecast Offices  
Partners  
Contact Us

Wave Height (Ft) For Tue Apr 22 2008 8PM EDT

NOAA/National Weather Service  
Graphic Created Apr 22 10:44AM EDT

Wave Height	Apr 22 - 2PM EDT	Apr 22 - 5PM EDT	Apr 22 - 8PM EDT
Wave Period	Apr 22 - 11PM EDT	Apr 23 - 2AM EDT	Apr 23 - 5AM EDT
Wave Period	Apr 23 - 8AM EDT	Apr 23 - 11AM EDT	Apr 23 - 2PM EDT
Wind Speed	Apr 23 - 5PM EDT	Apr 23 - 8PM EDT	Apr 23 - 11PM EDT
Wind Gust	Apr 24 - 2AM EDT	Apr 24 - 5AM EDT	Apr 24 - 8AM EDT
Weather	Apr 24 - 11AM EDT	Apr 24 - 2PM EDT	Apr 24 - 5PM EDT
Temperature	Apr 24 - 8PM EDT	Apr 24 - 11PM EDT	Apr 25 - 1AM EDT

NOAA's National Weather Service  
**Carolinas Coast**

Home News Organization Search

Carolinas Coast [\(Experimental\)](#)

Click on a yellow dot on the map to see near-real-time observations for that location.  
Click on the latest observation reading to view graphs of previous observations.

Observations **Hazards** Forecast Station List

Background Map:  Default  Sea Surface Temp  Radar  Radar Loop  Air Pressure  
 Bathymetry

Map Locations:  Cities  Coastal Locations  No labels  NOAA Weather Radio

Select a item from the list for more information. [get info about...](#)

Carolinas Coast is an experimental site that links observations and forecasts from a variety of data providers. Some data may be periodically unavailable. Please pay attention to time stamps on real-time observations.

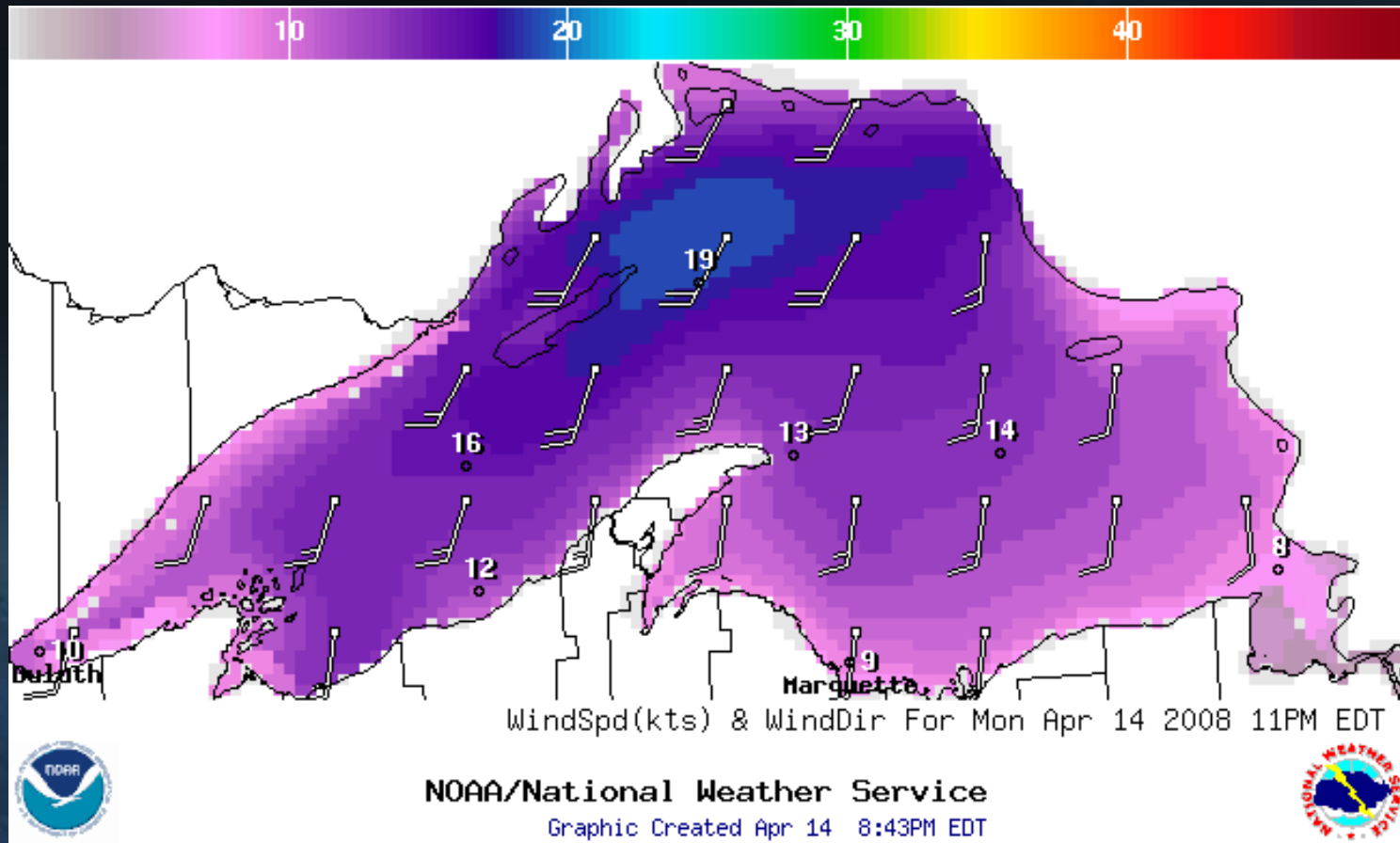
Your feedback is requested. Please take a few minutes to complete the survey. Your comments will help us improve our services.

[About Carolinas Coast](#)

[www.crh.noaa.gov/greatlakes](http://www.crh.noaa.gov/greatlakes)

[www.weather.gov/carolinascoast](http://www.weather.gov/carolinascoast)

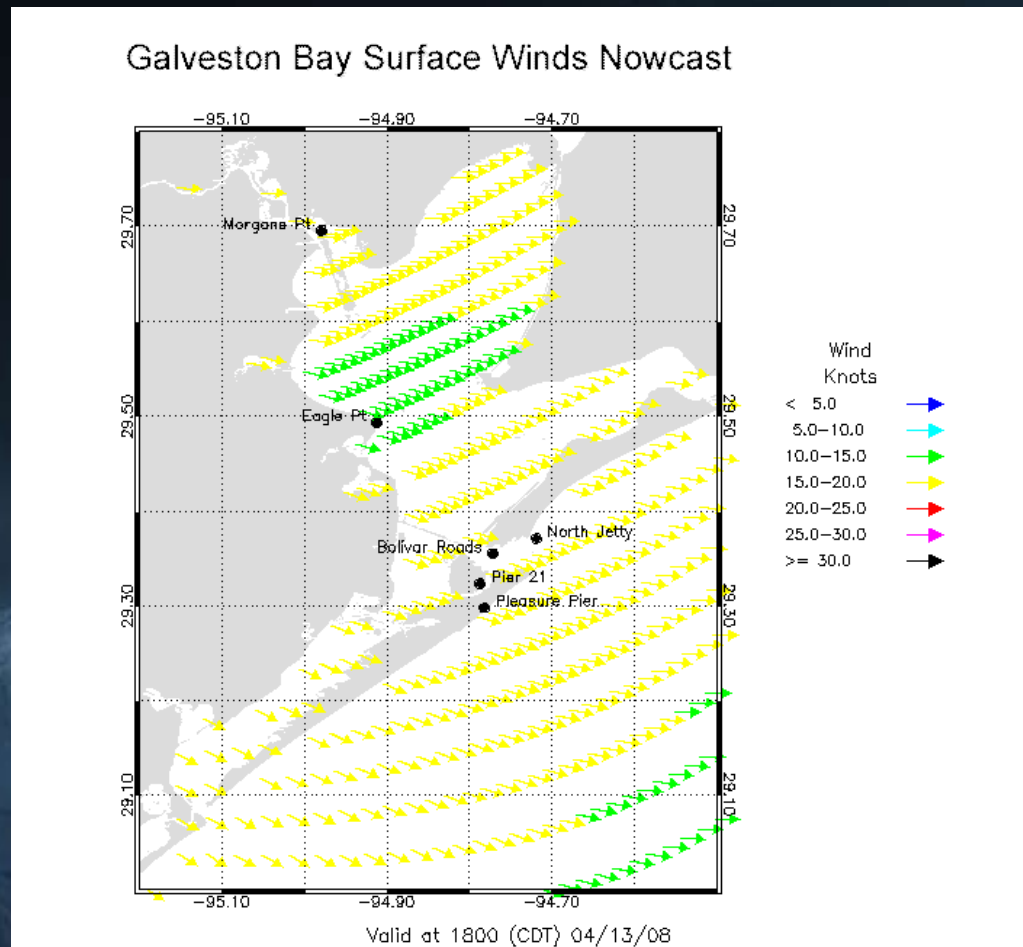
# Digital Marine Forecasts



# NOAA Tides and Currents

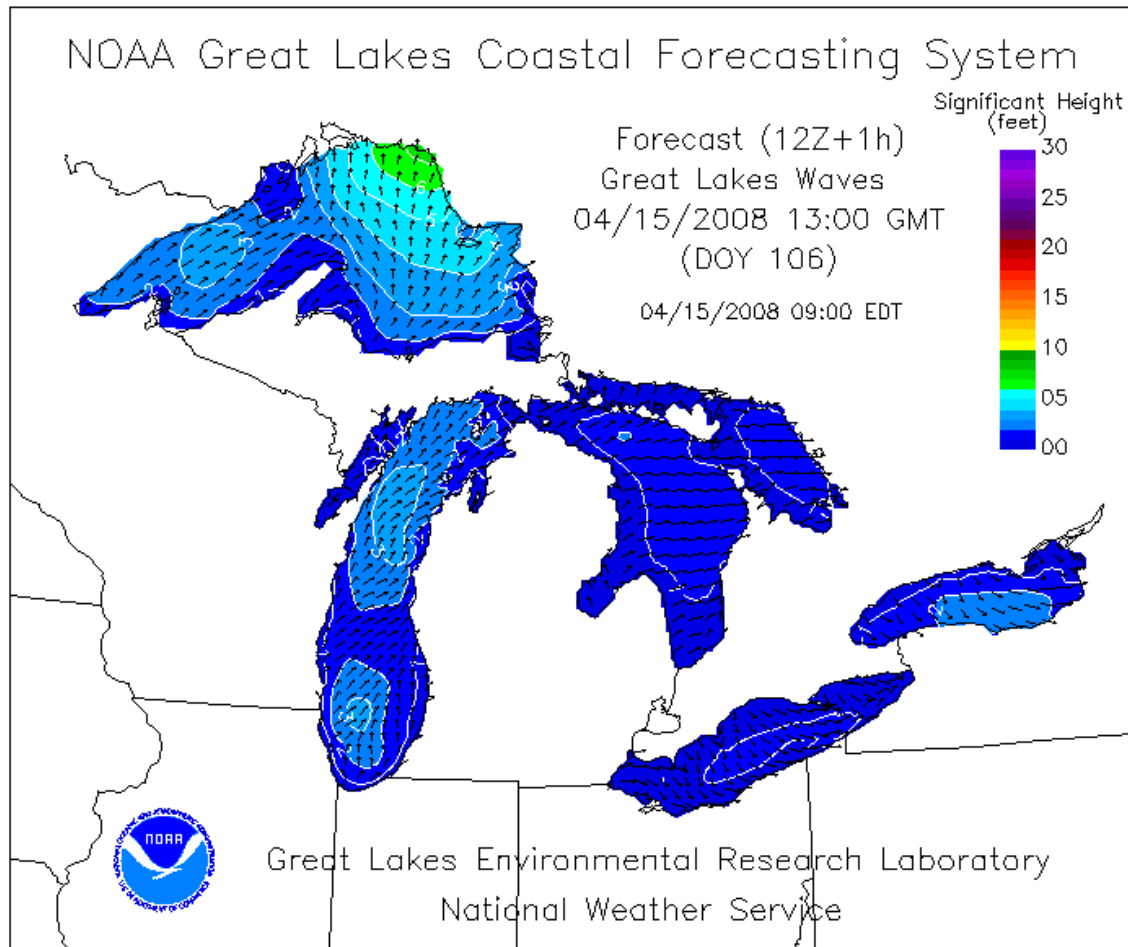
## CO-OPS Operational Forecast System

- Chesapeake Bay
- Galveston Bay
- Lake Erie
- Lake Huron
- Lake Michigan
- Lake Ontario
- Lake Superior
- New York and New Jersey
- St. John's River



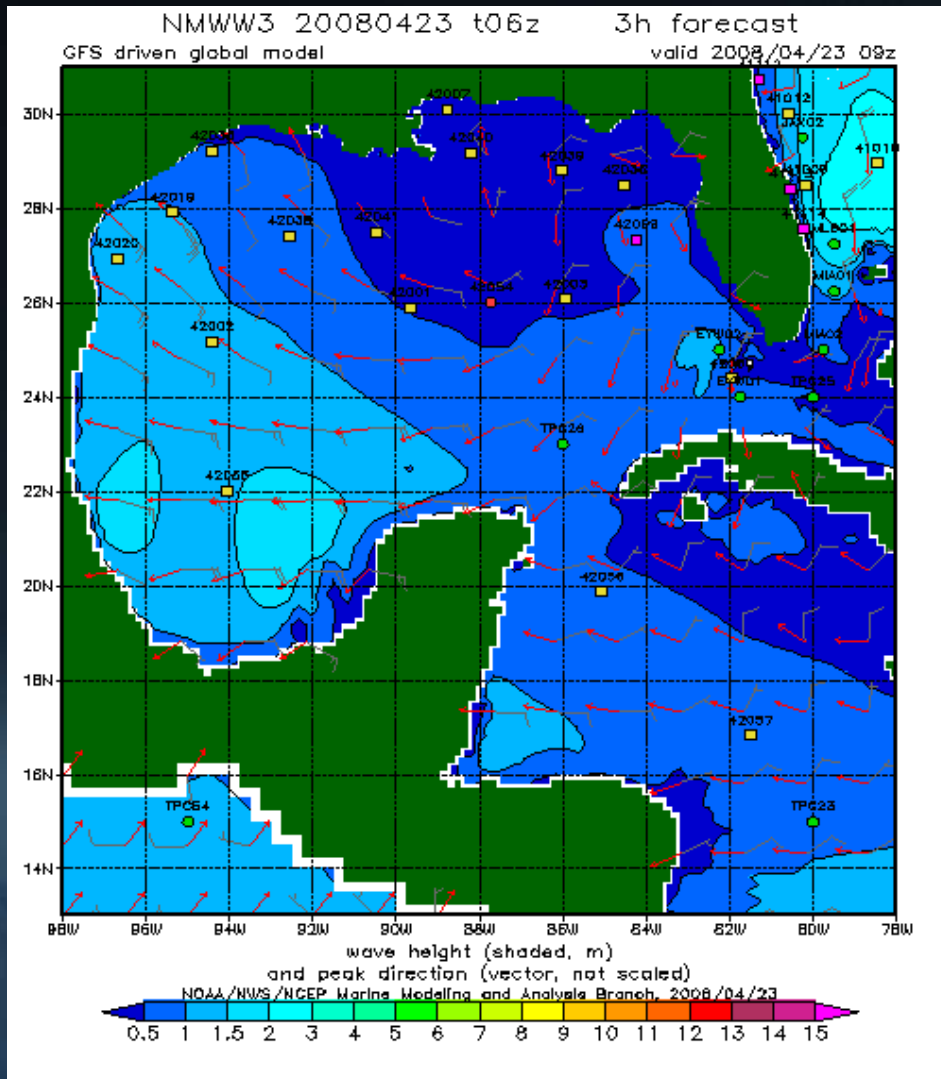
<http://tidesandcurrents.noaa.gov/models.html>

# Great Lakes Coastal Forecasting System



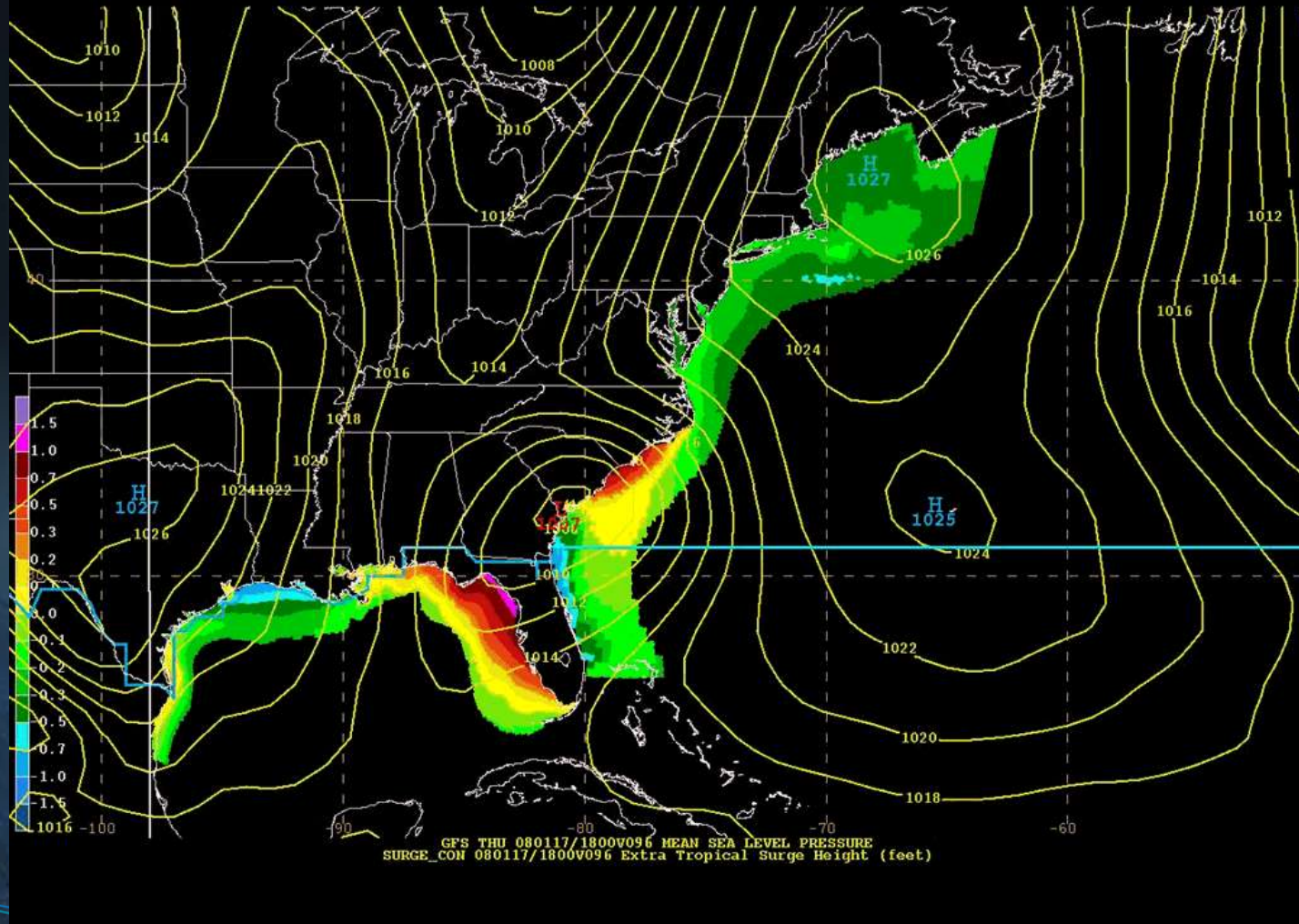
<http://www.glerl.noaa.gov/res/glcfs/>

# NOAA WAVEWATCH III



<http://polar.ncep.noaa.gov/waves/index2.shtml>

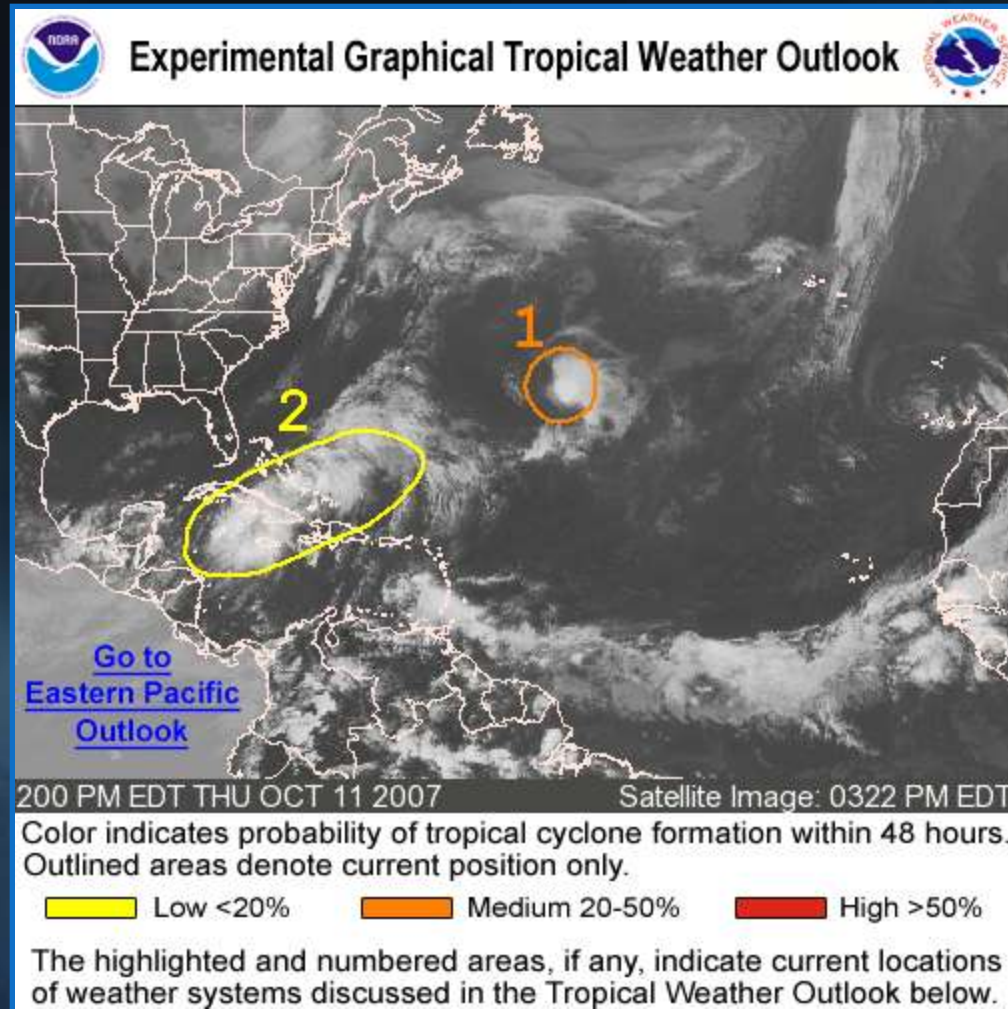
# Experimental Extratropical Storm Surge Height Forecast



<http://www.opc.ncep.noaa.gov>

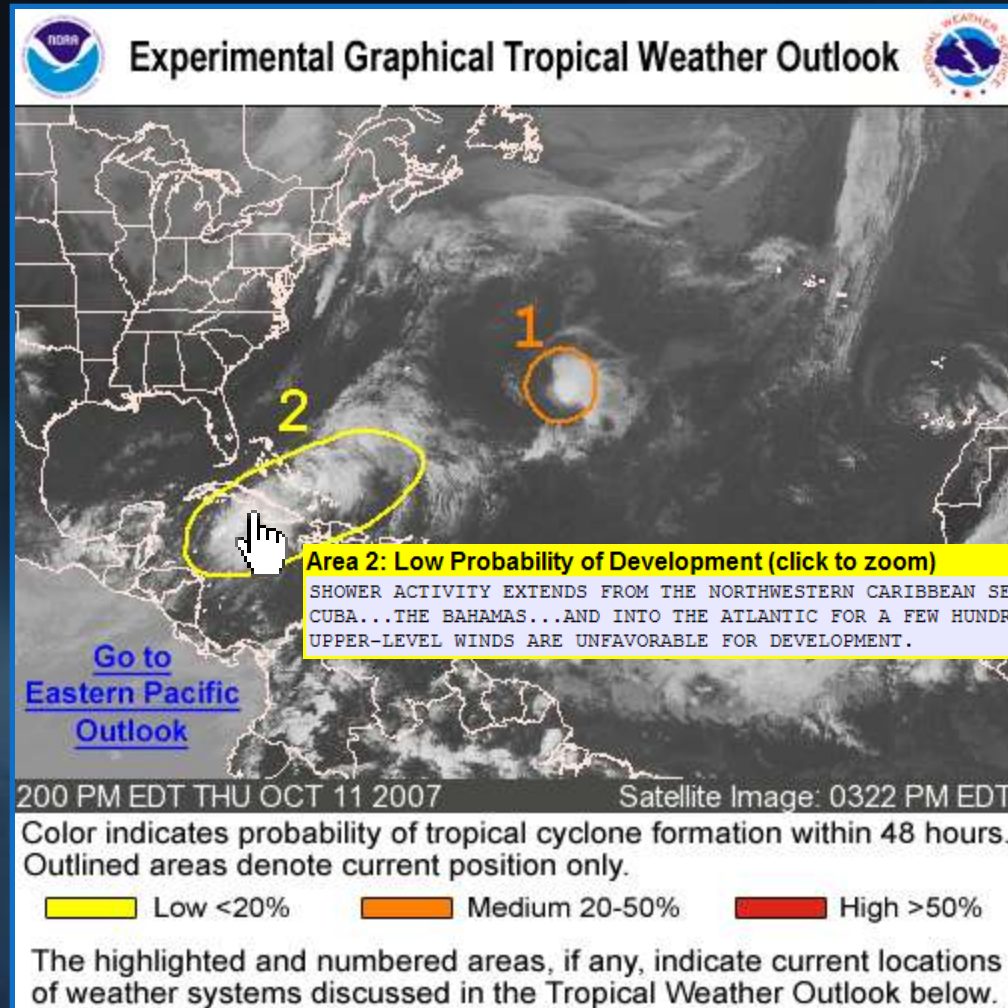


# Experimental Graphical Tropical Weather Outlook



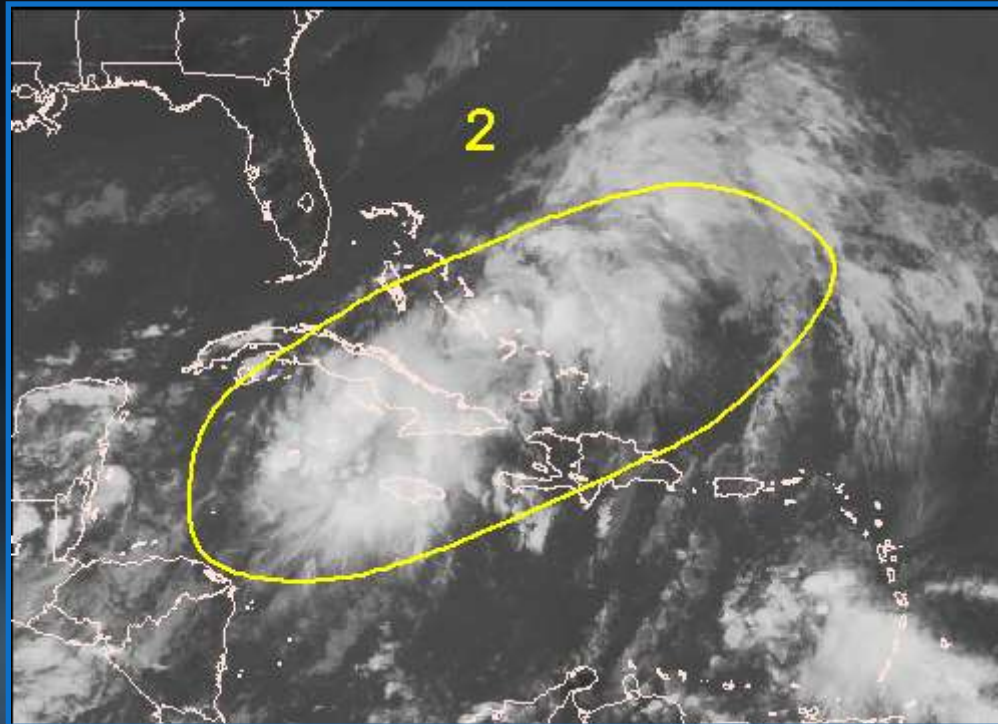
[http://www.nhc.noaa.gov/gtwo\\_atl.shtml](http://www.nhc.noaa.gov/gtwo_atl.shtml)

# Experimental Graphical Tropical Weather Outlook



[http://www.nhc.noaa.gov/gtwo\\_atl.shtml](http://www.nhc.noaa.gov/gtwo_atl.shtml)

# Experimental Graphical Tropical Weather Outlook



2. SHOWER ACTIVITY EXTENDS FROM THE NORTHWESTERN CARIBBEAN SEA ACROSS CUBA...THE BAHAMAS...AND INTO THE ATLANTIC FOR A FEW HUNDRED MILES. UPPER-LEVEL WINDS ARE UNFAVORABLE FOR DEVELOPMENT.

[http://www.nhc.noaa.gov/gtwo\\_atl.shtml](http://www.nhc.noaa.gov/gtwo_atl.shtml)

# Enhanced Delivery Methods



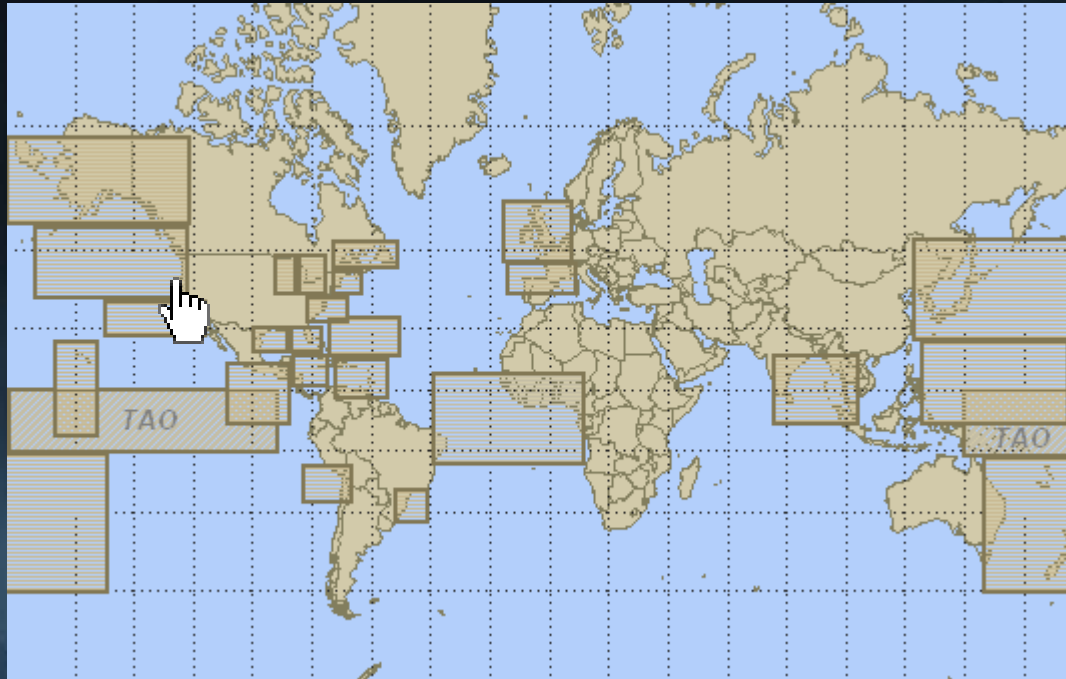
# Dial-A-Buoy

1-888-701-8992



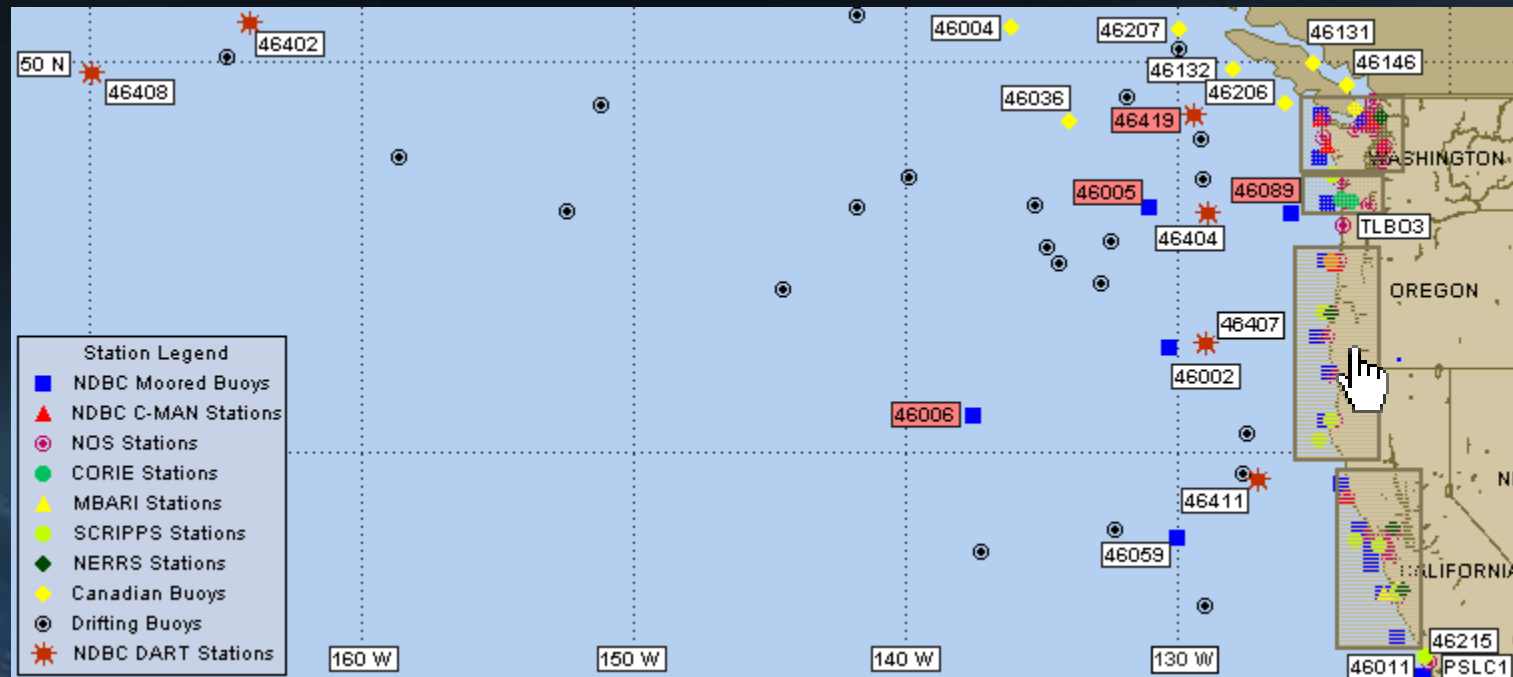
<http://www.ndbc.noaa.gov/dial.shtml>

# National Data Buoy Center



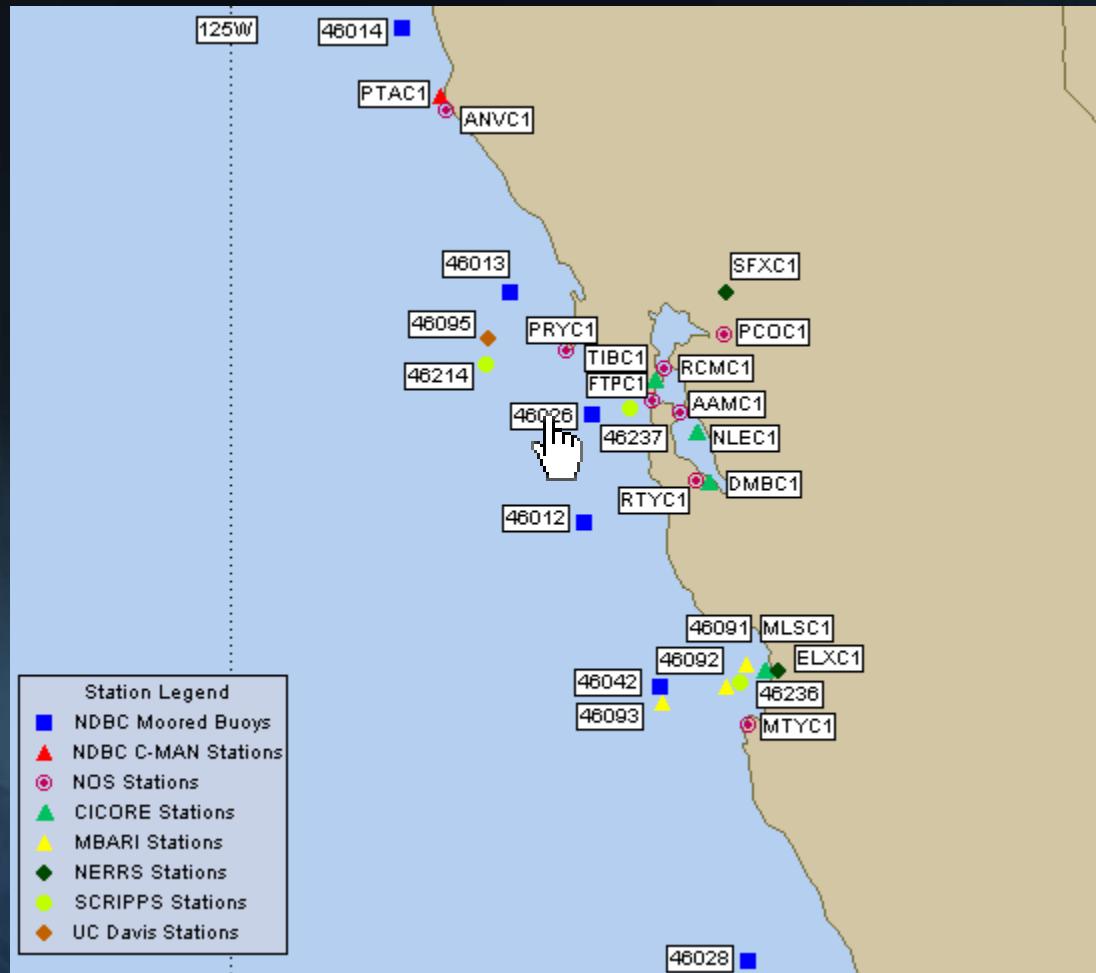
<http://www.ndbc.noaa.gov>

# National Data Buoy Center



<http://www.ndbc.noaa.gov>

# National Data Buoy Center



<http://www.ndbc.noaa.gov>



# National Data Buoy Center

National Oceanic and Atmospheric Administration's  
**National Data Buoy Center**  
Center of Excellence in Marine Technology

weather.gov

Home News Organization

Station ID: Search  
Station List



Observations  
Recent  
Historical  
Obs Search  
Snap Obs Report  
NOAA ODS  
APEX  
DAART  
MMS ADCP  
TAD  
DXDS  
HF Radar  
OSMC  
Dist-A-Buoy  
RSS Feeds  
Email Access

Station Status  
NOBC Maintenance  
NOBC Platforms  
Partner Platforms

Program Info  
About NOBC  
Buoy Program  
C-MAN  
VOS  
CSP  
IODS DAC

Publications  
Hurricane Data Plot  
Mariners Weather  
Log  
Observing  
Handbook No. 1

Science Education  
FAQ  
Contact Us  
Links

**Station 46026 - SAN FRANCISCO - 18NM West of San Francisco, CA**

Owned and maintained by National Data Buoy Center:  
3-meter discus buoy  
ARES 4.4 payload  
37.75 N 122.42 W (37°45'32" N 122°50'0" W)

Site elevation: sea level  
Air temp height: 4 m above site elevation  
Anemometer height: 5 m above site elevation  
Barometer elevation: sea level  
Sea temp depth: 3.6 m below site elevation  
Water depth: 52.1 m  
Watch circle radius: 127 yards

[Potential Evaporation Hazard Exists for this Buoy](#)

[Latest NWS Marine Forecast](#)

[Important Notice to Mariners](#)

[Search and Rescue \(SAR\) Data](#)

[Meteorological Observations from Nearby Stations and Ships](#)

[Regional HF Radar Surface Current Observations](#)

[Latest Satellite Wind Maps for this Area](#)

Conditions at 46026 as of  
(4:50 pm PDT)  
2350 GMT on 04/23/2008:

Unit of Measure: English Time Zone:  
Station Local Time

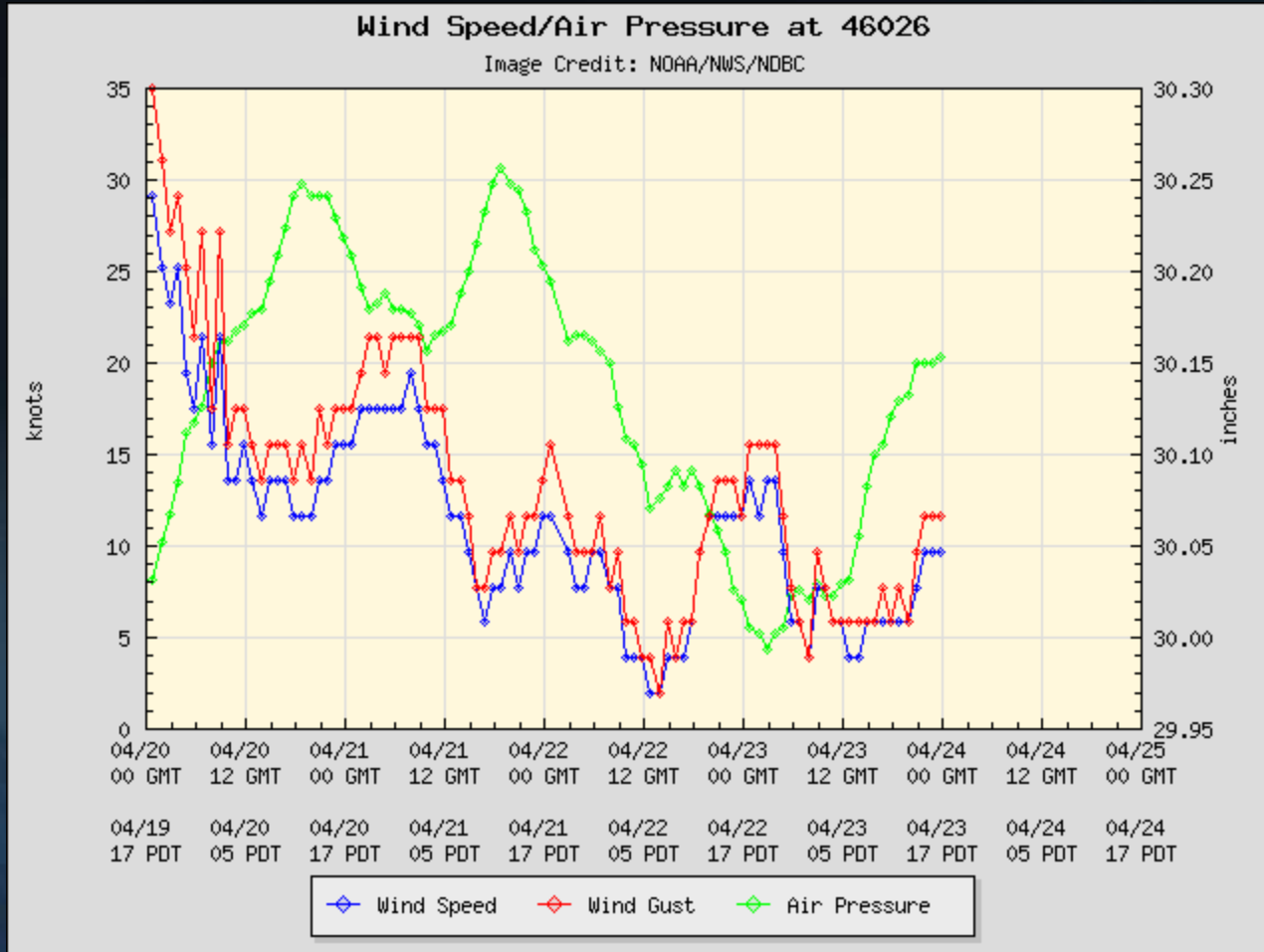
Click on the graph icon in the table below to see a time series plot of the last five days of that observation

	Wind Direction (WDIR):	NW ( 310 deg true )
	Wind Speed (WSPD):	9.7 kts
	Wind Gust (GST):	11.7 kts
	Wave Height (WHT):	4.9 ft
	Dominant Wave Period (DWP):	8 sec
	Average Period (APD):	6.5 sec
	Mean Wave Direction (MWD):	WNW ( 282 deg true )
	Atmospheric Pressure (PRES):	30.15 m
	Pressure Tendency (PTDY):	+0.00 in ( Steady )
	Air Temperature (ATMP):	50.2 °F
	Water Temperature (WTMP):	48.5 °F
	Wind Chill (CHILL):	45.9 °F

[Combined plot of Wind Speed, Gust, and Air Pressure](#)

<http://www.ndbc.noaa.gov>

# National Data Buoy Center



# SARSAT

## Lifeline to Survival



<http://www.sarsat.noaa.gov>

# Safe Boating Weather Tips

## Plan Ahead

- *Start accessing NWS extended outlooks several days in advance*

## Before Setting Out

- *Pay close attention to the local forecast*

## After Setting Out

- *Stay tuned to NOAA Weather Radio All Hazards (NWR) or other sources of weather info.*



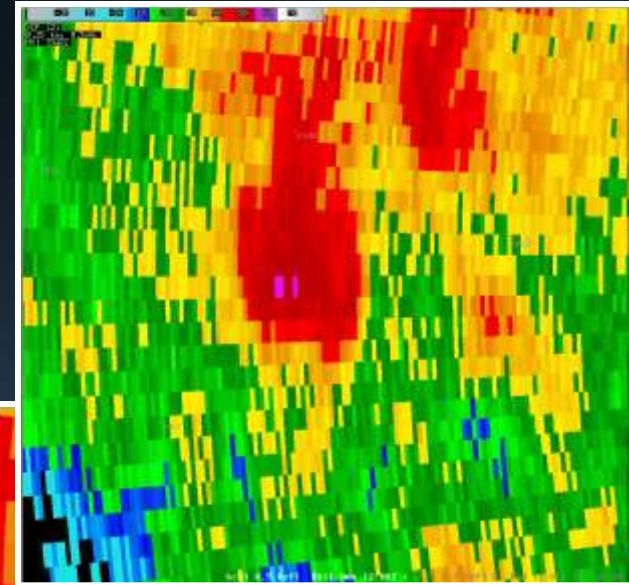
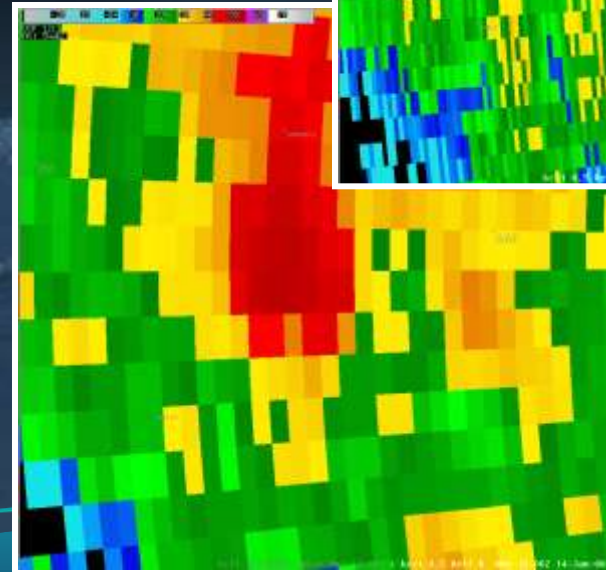
# The Future of Marine Weather



# Where We're Headed

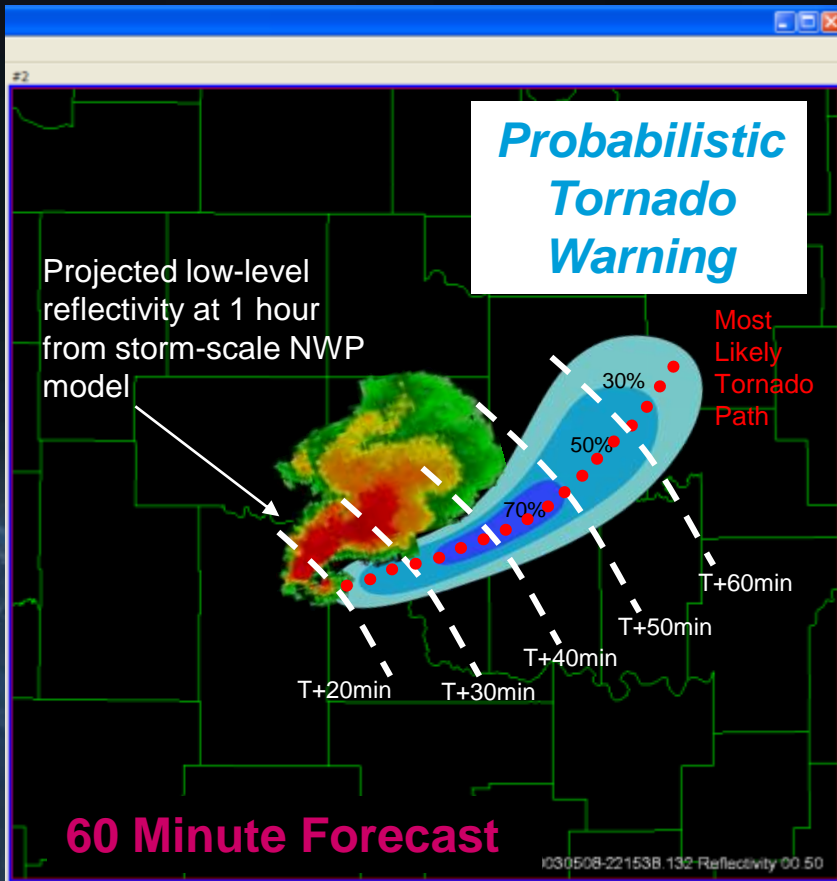
## Enhanced Capabilities

- *Super resolution radar*
- *Airborne Doppler Radar*
- *Unmanned Aircraft Systems (UAS)*



# Where We're Headed

Storm-scale Model Forecast at 60 min



## Severe Weather

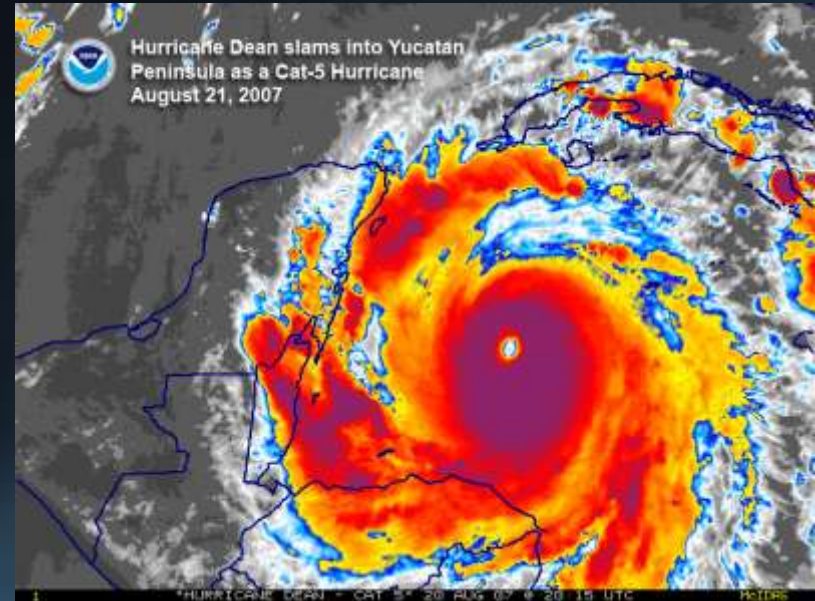
- *Warn-On Forecasts: Tornado warning lead time increases from an average of 13 minutes today to as much as 1 hour*
- *Severe Thunderstorm Warning lead time increases from an average of 18 minutes to as much as 2 hours*

- **Enables Emergency Managers to energize community response**
- **Lives saved and millions in savings**

# Where We're Headed

## Tropical Cyclone Services

- *Warning lead time for landfall increases from less than 24 hours to 3 days*
- *50% reduction in 48 hr intensity error (~8 kts)*
- *50% reduction in 48 hr track error (~50 nm)*



- **Saves lives/enhances public safety**
- **Improves response capability of emergency managers**
- **Mitigates property loss**
- **Economic impact increasingly complex (coastal development....)**



# Where We're Headed

## Forecast Uncertainty Information

- *Integral and essential part of all forecasts*
- *Enterprise-wide partnership to generate and communicate forecast uncertainty to decision makers and public*
- *Expressed in terms of probabilities*



- **Users decide whether to take action and appropriate level of response**
- **Thresholds unique to decision maker – based on mission risk**

# Needed Advances in Capabilities

## Advances

- *Earth Observations*
- *Data Assimilation*
- *Models*
- *Forecasting Techniques*
- *Information Technology*
- *Dissemination Methods*



## Results

Improved:

**Hurricane Track, Intensity  
and Precipitation Forecasts**

Tornado and  
Flash Flood Forecasts

**Marine**, Aviation, Fire, and  
Space Weather Forecasts

Flood, River, and  
**Ocean Predictions**

Seasonal Climate Forecasts for  
Energy, Agriculture, Etc.

# Working Together

*...toward a common future*



# Thank You

