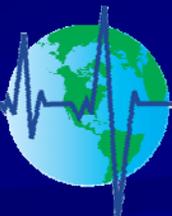


Climate Change and Human Health Adaptation Planning White House Conference Center June 28, 2011

A NOAA Perspective



Juli M. Trtanj, OHHI Director
NOAA, Oceans and Human Health Initiative Director



OCEANS & HUMAN
HEALTH INITIATIVE



NOAA Organization

**National Oceanic and Atmospheric
Administration (NOAA)**

```
graph TD; NOAA[National Oceanic and Atmospheric Administration (NOAA)] --- NESDIS[NESDIS]; NOAA --- NMFS[NMFS]; NOAA --- NOS[NOS]; NOAA --- NWS[NWS]; NOAA --- OAR[OAR]; NOAA --- OMAO[OMAO];
```

NESDIS

NMFS

NOS

NWS

OAR

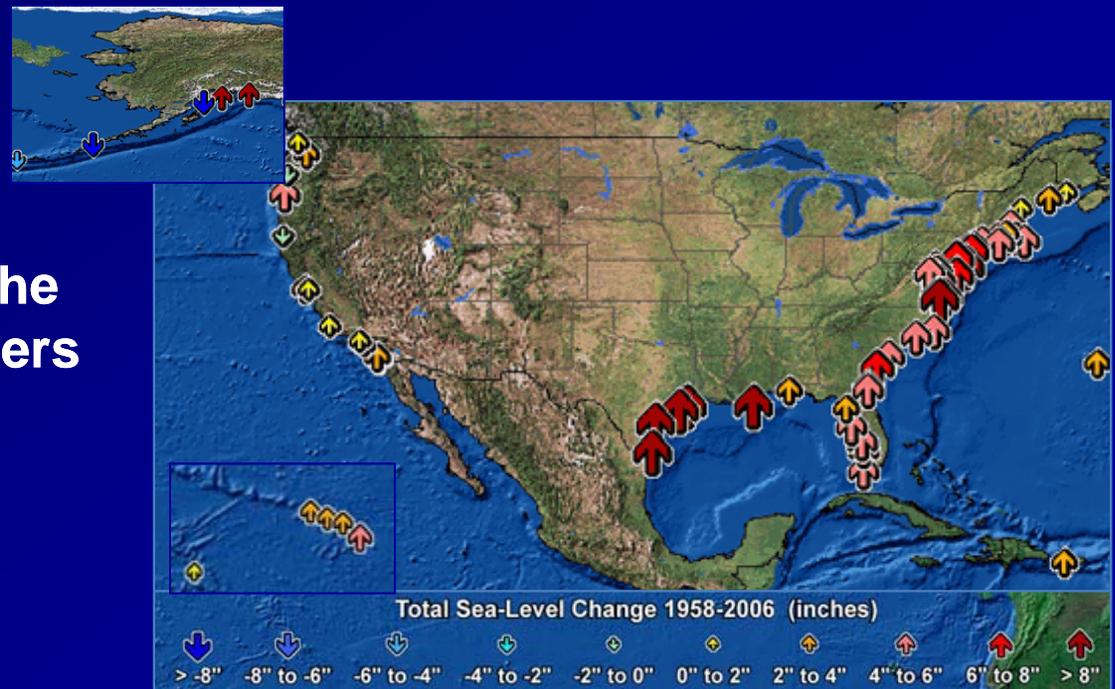
OMAO

To understand and predict changes in the Earth's environment, and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs.

Climate Changes Are Underway In The U.S. And We Will See More

- ✓ Temperature rise
- ✓ Sea-level rise
- ✓ Increase in heavy downpours
- ✓ Rapidly retreating glaciers
- ✓ Thawing permafrost
- ✓ Longer growing season
- ✓ Longer ice-free season in the ocean and on lakes and rivers
- ✓ Earlier snowmelt
- ✓ Changes in river flows

Observed U.S. Sea-Level Changes



Potential Health Effects of Climate Change

Climate Change:

- Temperature rise
- Sea level rise
- Hydrologic extremes
- Ocean currents
- Ocean acidification

HEAT

→ Heat stress, cardiovascular failure

SEVERE WEATHER

→ Injuries, fatalities

AIR POLLUTION

→ Asthma, cardiovascular disease

ALLERGIES

→ Respiratory allergies, poison ivy

VECTOR-BORNE DISEASES

→ Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, zoonotics, microbial contamination

WATER-BORNE DISEASES

→ Cholera, cryptosporidiosis, campylobacter, leptospirosis

WATER AND FOOD SUPPLY

→ Malnutrition, diarrhea, harmful algal blooms

MENTAL HEALTH

→ Anxiety, despair, depression, post-traumatic stress

ENVIRONMENTAL REFUGEES

→ Forced migration, civil conflict

What are the human health consequences of climate-related changes in ocean and coastal health?



increased flooding
and chemical contaminant runoff

Changes in Harmful Algal Blooms



bacterial/viral
contamination of
coastal and
drinking waters



decreased marine biodiversity
and ecosystem services

What does NOAA do to address the health impacts of Adaptation?

- Provide observation, monitoring, modeling and prediction tools—across time scales
 - Tornados, Hurricane, Heat waves, Drought, Climate
 - Ocean and Coastal, Climate and Weather, Fish
- Disaster Management and Emergency Response
- Develop Decision Support Tools for Human Health
 - Food security and supply (Seafood and Agriculture), Coastal Inundation, Beach management, Marine Mammal Health
- New emphasis on Climate Services
- Support Innovative Research and Technology development
 - Joint Announcement on Climate Variability and Human Health 1998-2004; NOAA, NSF, EPA, NASA and EPRI
 - Regional Integrated Science and Assessment, Oceans and Human Health,
- Partnering with Public Health--
Problem definition, Data, Communication, Research, Application

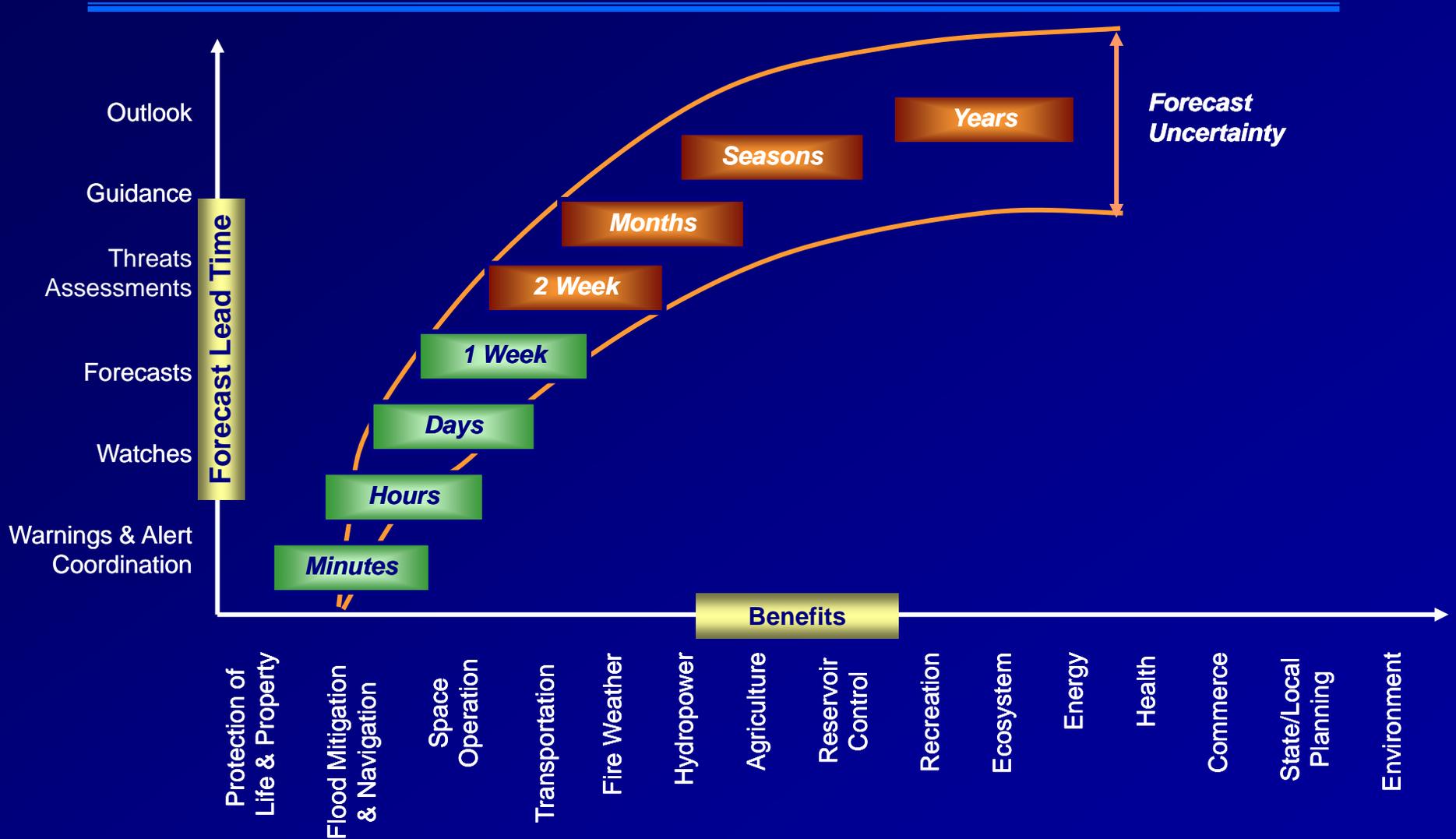
But Health Impact Assessment.....???

Health Across NOAA

- Across all NOAA Line offices
- Health is reflected in:
 - NOAA Strategic Plan, Goals, National Climate Assessment
- Science Advisory Board Recommendations –One Ocean, One Health, NOAA in the Lead
 - Forecasts of impending threats
 - Surveillance systems for emerging pathogens, contaminants, and toxins that affect health;
 - Climate change effects on ocean-related health outcomes
- Collaborations with health agencies, e.g., CDC, NIH, FDA, EPA, VA
- USGCRP Climate Change and Human Health Working Group
 - MEDS - Monitoring, Early Warning Systems, Data Integration, and Surveillance --Interactive inventory of Federal datasets
- Links to Observation Systems—IOOS, GCOS, GEOSS
- Data Centers-Climate, Geophysical, Oceanographic



Adaptation Across Time Scales: Forecast Products—Days to Decades



NOAAWatch

<http://www.noaawatch.gov/>



United States Department of Commerce

National Oceanic and Atmospheric Administration

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Search NOAA



Current Conditions

Local forecast by City, State

City, St

Weather Warnings



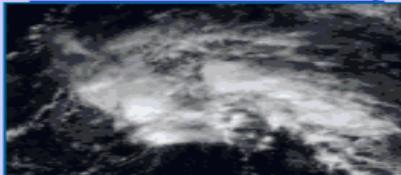
Doppler Radar



River and Lake Levels



NOAA Environmental Visualization Laboratory



Drought Outlook



U.S. Drought Monitor - Current Drought Conditions

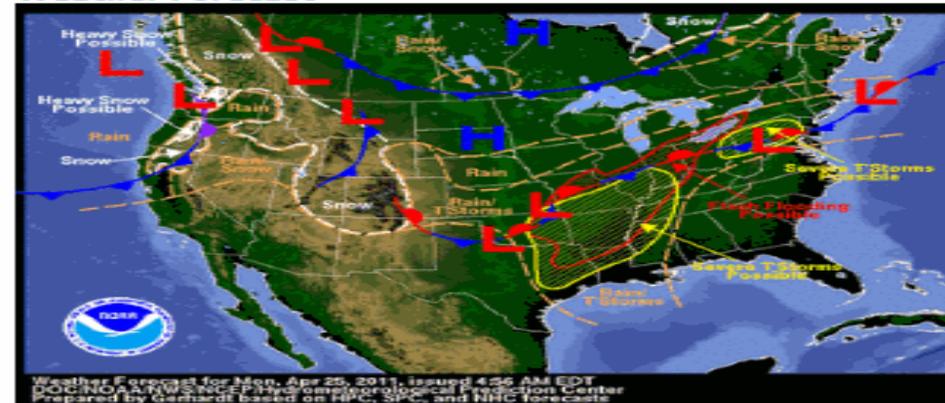
Surface Weather Charts



NOAAWatch

NOAA's All Hazard Monitor

Weather Forecast



[Weather Map - Click to Enlarge](#)

[Forecast map loop](#)

[Map legend](#)

[About these maps](#)

Weather Outlook for Monday

Mon, 25 Apr 2011 05:25:00 EDT

An upper-level trough will push into the Central Plains Monday evening, dislodging the front draped from the Mississippi Valley to the Mid-Atlantic coast. A strong mid-level shortwave will move across the Central Plains before developing into a low over the upper Midwest. This area of low pressure will remain over the Midwest through Tuesday, slowing the eastward progression of the front. The set up over the southeastern U.S. favors strong moisture return flow from the Gulf, creating an environment ripe with warm moist air. Instability from the front, along with strong upper-level dynamics will continue to support wide-spread heavy rainfall and thunderstorms. A Pacific system will enter the Northwest early Monday. Moderate to heavy rain will begin along the Pacific Northwest coast by daybreak Monday and will continue through the early afternoon. Strong upper-level dynamics will ensure the front stays together as it crosses the Intermountain West. [Latest local weather forecasts, warnings, watches, and advisories...](#)

[Monday's Severe Weather Outlook](#)
Mon, 25 Apr 2011 06:11:42 EDT

View All NOAAWatch Headlines

NOAAWatch & Learn
Explore NOAAWatch themes:

- [Air Quality](#)
- [Coral Bleaching](#)
- [Droughts](#)
- [Earthquakes](#)
- [Excessive Heat](#)
- [Fire Weather](#)
- [Flooding](#)
- [Harmful Algal Blooms \(HABs\)](#)
- [Hurricanes/Tropical Weather](#)
- [Storm Surge & Coastal Floods](#)
- [Oil & Chemical Spills](#)
- [Rip Currents](#)
- [Severe Weather](#)
- [Space Weather](#)
- [Tsunamis](#)
- [Volcanoes](#)
- [Winter Weather](#)

The Climate/Weather Scale v. Perspective

	Local Scale	Mid Scale	Large Scale	Approach
Scales	 Localities, points; mins to days	 States, regions; days to months	 Nations, globe; seasons to decades	
Past 	“Data Access”, “Climatological Data”	US Climate at a Glance; Archived Reports	Global Climate at a Glance;	What, where, when; how big.
Now 	“Nowcasts”, “Watches, Warnings & Advisories”	“Climate Monitoring”	“Cli. Monitoring”, “Cli. Assessment”	Analyze, describe as events unfold.
Future 	“Forecasts”	“Seasonal outlooks”, “long-term outlooks”	“Climate Projections”	Predict what will happen
Character	Deterministic: exact numbers detailed, precise, lots of noise	More focused on probability, historical fitness	Historical fitness; emphasis on uncertainty	

We've Got Data- Essential Climate Variables

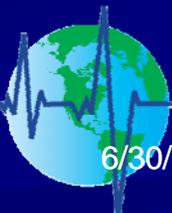
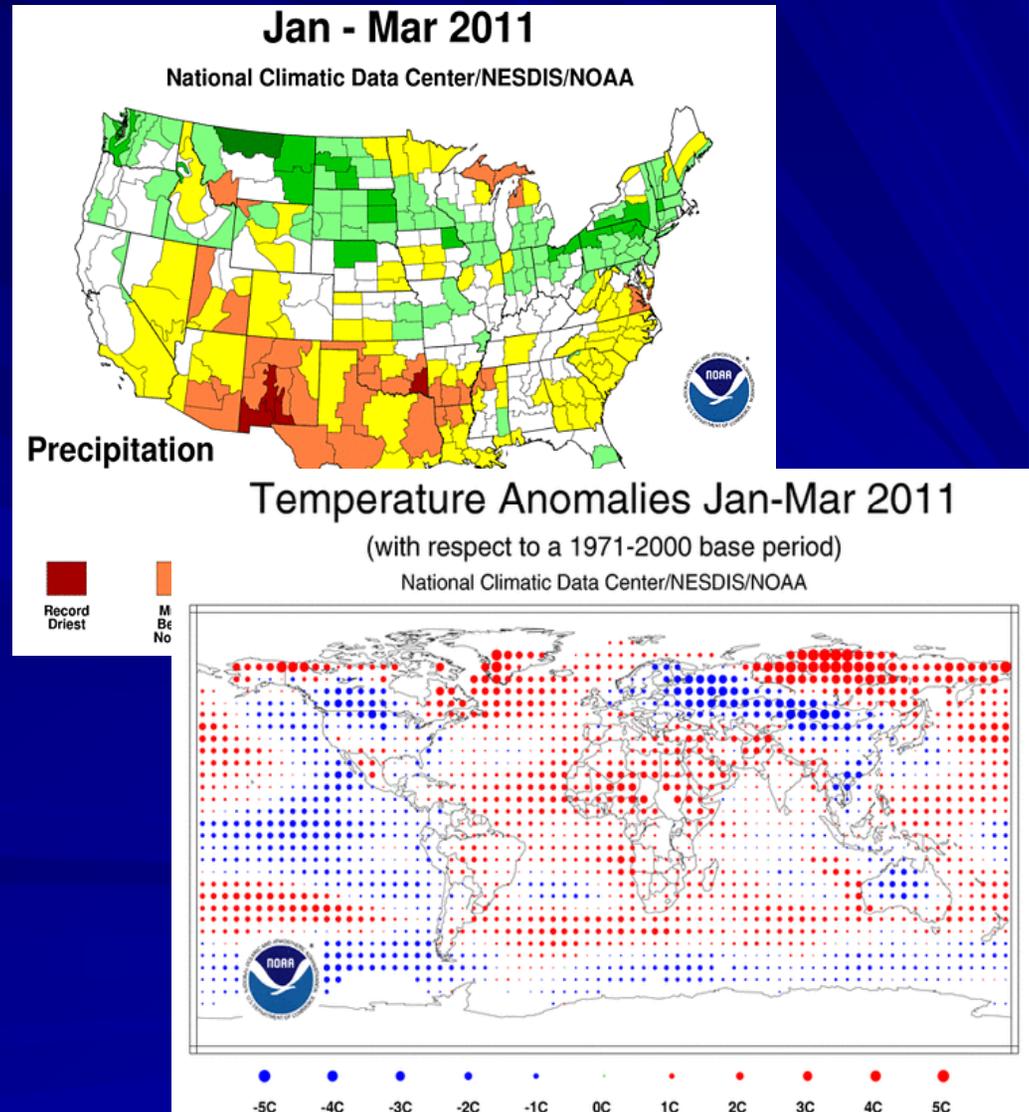
Atmosphere: Surface	Atmosphere: Upper-Air	Atmosphere: Composition	Ocean: Surface	Ocean: Subsurface	Terrestrial
Air Temperature	Earth Rad'n Budget	Carbon Dioxide	Temperature	Temperature	Soil Moisture
Precipitation	Temperature	Methane	Salinity	Salinity	Snow Cover
Air Pressure	Wind Speed & Dir	Ozone	Sea Level	Current	Permafrost + Seasonally Frozen
Sfc Rad'n Budget	Water Vapor	Nitrous Oxide	Sea State	Nutrients	Glaciers + Ice Caps
Wind Speed & Dir	Cloud Properties	CFCs	Sea Ice	Carbon	River Discharge
Water Vapor		Hydro CFCs	Current	Ocean Tracers	Water Use
		Hydrofluorocarbs	Ocean Color	Phytoplankton	Ground Water
		Sulfur Hexafluorides	CO ₂ Partial Pressure		Lake Levels
		Perfluorocarbons			Albedo
					Land Cover
					Percent Absorbed Photosynthetically Active Radiation
					Leaf Area Index
					Biomass
					Fire Disturbance



Climate Monitoring

<http://www.ncdc.noaa.gov/sotc/>

- Monthly reports since 1998
- Global Scale:
 - Temperature Analysis
 - Upper-Air Temps
 - Sea Ice & Snow Cover
 - Global Hazards (events)
 - ENSO Status
- National Scale:
 - Temperature & Precip Summaries
 - Drought
 - Wildfires
 - Hurricanes & Tropical Storms
 - Snow Cover / Winter Wx
 - Tornadoes



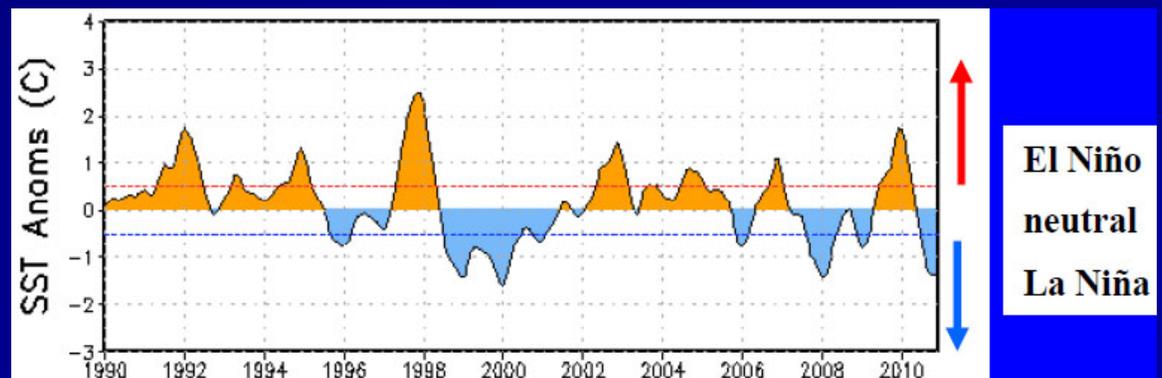
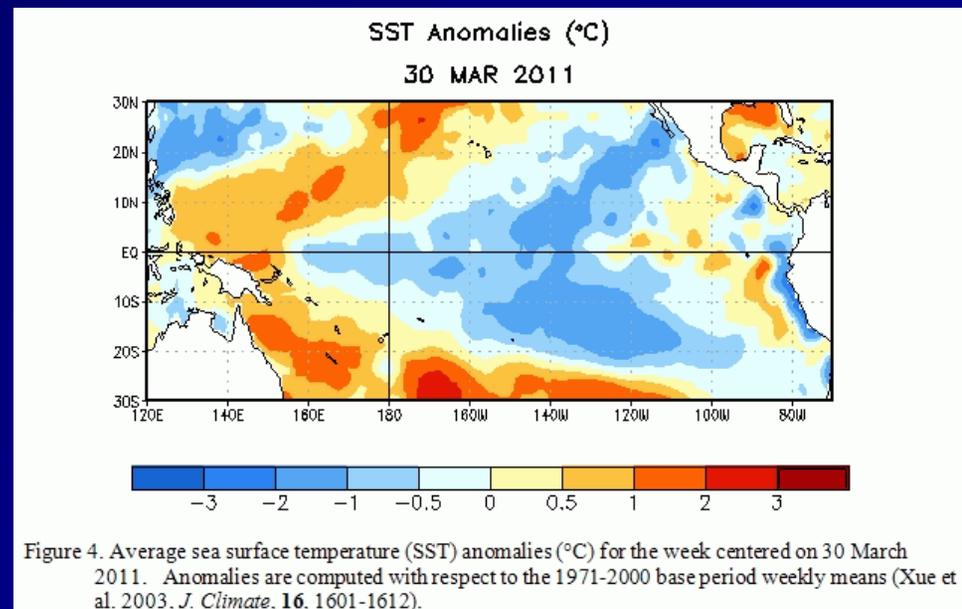
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6/30/2011

ENSO Monitoring

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

- What is the state of El Niño / La Niña
 - Two bookends of a sloshing phenomenon in and over the equatorial Pacific
 - ENSO has global reach and can strongly influence seasonal outcomes in your region.
- Report style
- Monthly diagnostics and analysis
 - Weekly updates



Drought Monitoring

<http://www.drought.gov/>

- What is the state of drought and its impacts?
 - Weekly updates, Very “holistic” approach
 - Underlying drought indicators available here

NIDIS National Integrated Drought Information System
U.S. Drought Portal
www.drought.gov

Contact Us | Log In | Text-Only
Search:

HOME WHAT IS NIDIS? CURRENT DROUGHT FORECASTING IMPACTS PLANNING EDUCATION RESEARCH RECOVERY REPORTS

Area Drought Information
Select State... >> Go
Select Region... >> Go

Maps & Tools

- Map & Data Viewer - **new!**
- Geodata Portal
- Drought Monitor Graphics
- CRN Soil Data

Events & Announcements

- NIDIS Engaging Preparedness Workshop June 8-9, 2011
- NIDIS Engaging Preparedness Communities WG Survey
- Workshop on Drought Monitoring & Early Warning - May 10th, 2011
- NHWC Training Conference and Exposition - May 9-12, 2011
- U.S. Drought Monitor Forum - April 13-14, 2011
- US Drought Portal Users Conference - April 15th, 2011
- California Preplanning Meeting - Feb 17

Featured Products
[Where are Drought Conditions Now?](#) [How is the Drought Affecting Me?](#) [Will the Drought Continue?](#)

U.S. Drought Monitor April 19, 2011
VMS 8 a.m. EDT

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- A - Agricultural (crops, pastures, grasslands)
- H - Hydrological (water)

Released Thursday, April 21, 2011
Author: Michael Brewer, L. Love-Brotak, NOAA/NESDIS/NCDC
<http://drought.unl.edu/dm>

NIDIS Feature
Drought in the South
NOAA Update on Drought Conditions in the Southern U.S.
April 25, 2011
Stateing slides available at www.drought.gov

Drought Information Statements

Regional Drought Early Warning Systems (DEWS)

6/30/2011

Extremes Monitoring

<http://www.ncdc.noaa.gov/extremes/records/>

- Daily updates of records broken or tied
- Summed and totaled for USA

U.S. Daily Precipitation Records set on April 22, 2011



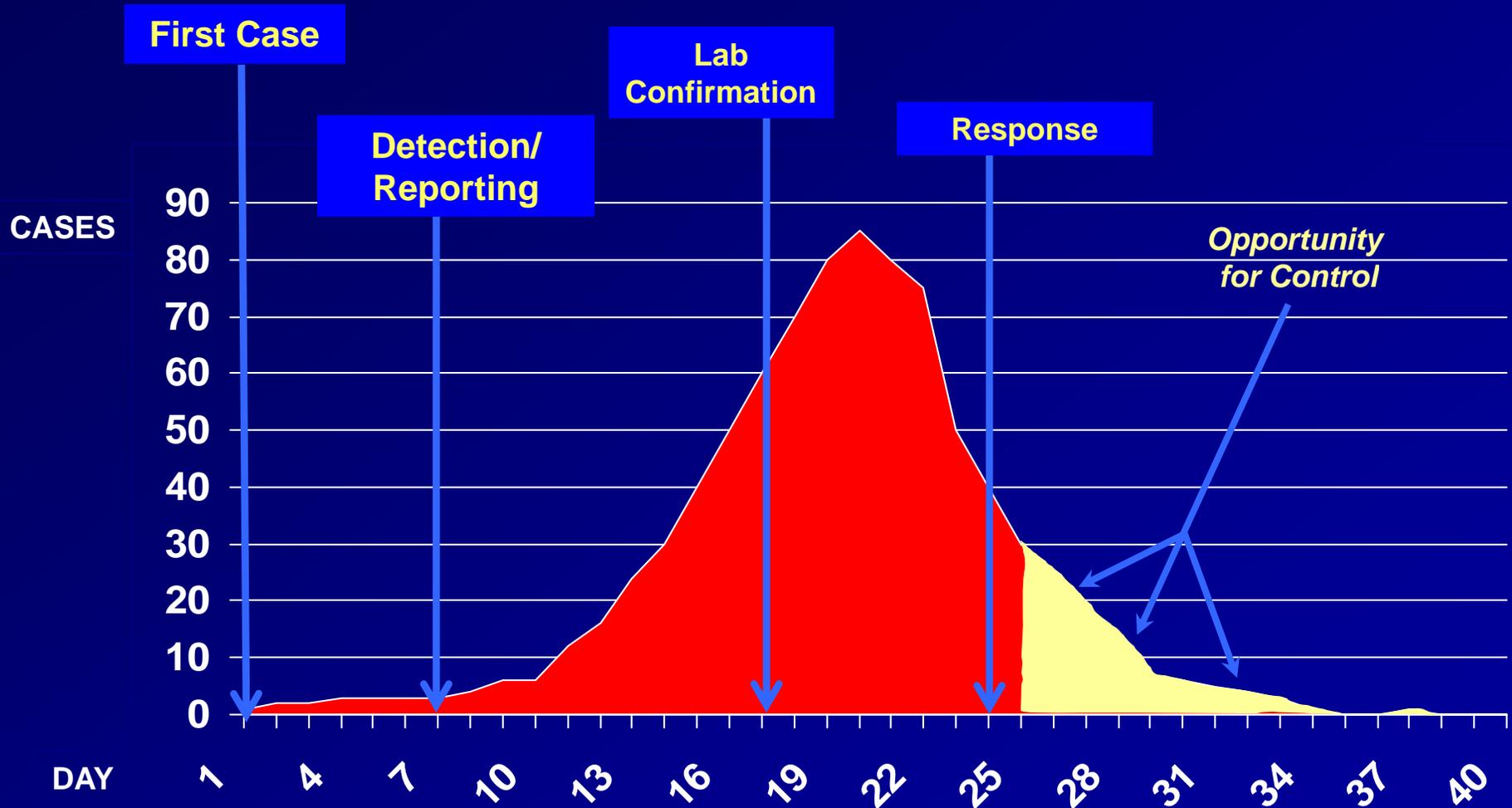
Out of a possible 11,326 records: **88 (Broken)** + **5 (Tied)** = **93 Total**

NOTE: These records are based on the historical daily observations archived in NCDC's Cooperative Summary of the Day data set and preliminary reports from Cooperative Observers and First Order National Weather Service stations, and as such are subject to change. The Period of Record (POR) represents the number of years with a minimum of 50% data completeness. All stations have a Period of Record of at least 30 years.

Data available as [Tab-delimited](#) and [XML](#).

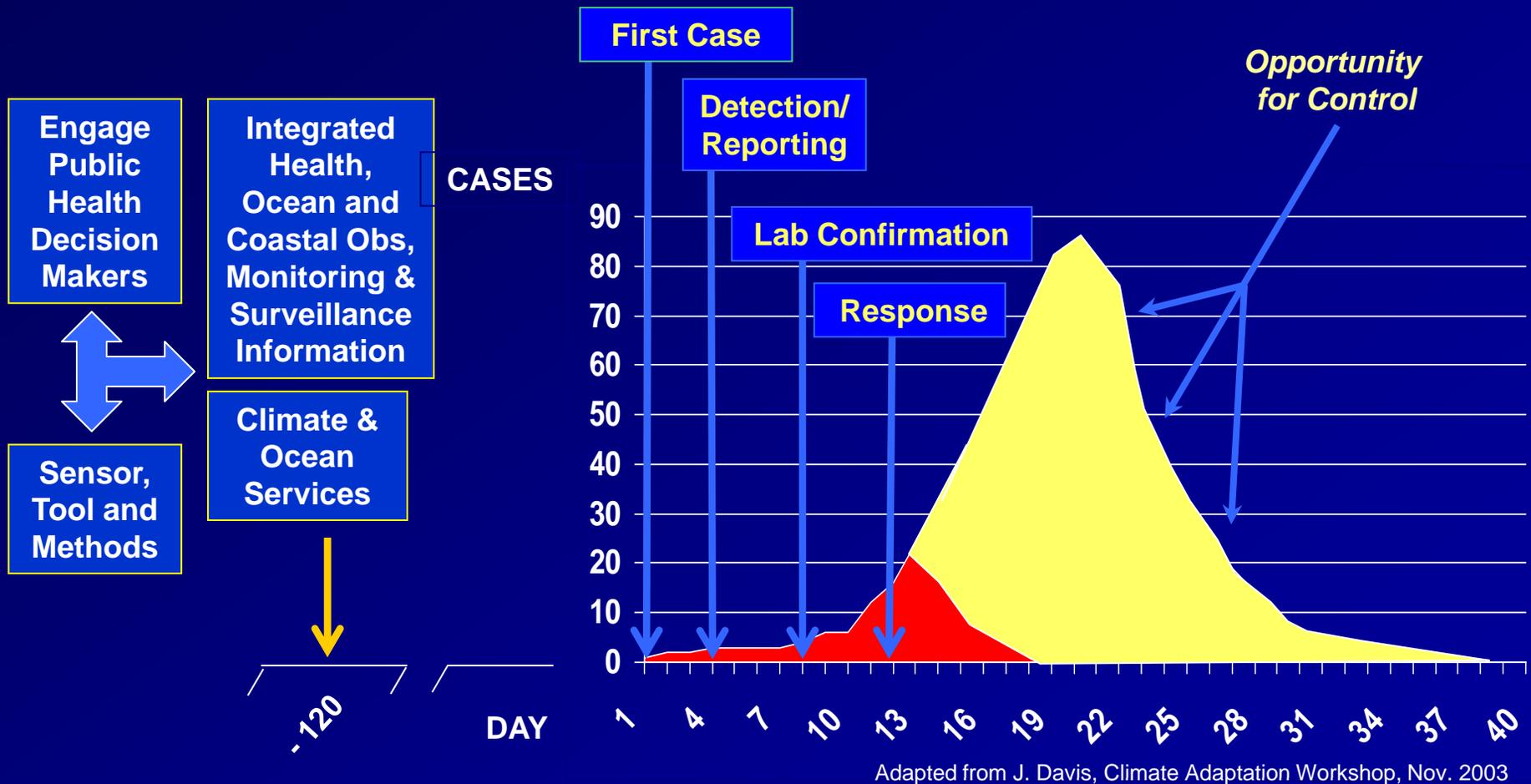
Station	County	State	Lat	Lon	COOP/ WBAI ID*	ASOS/ COOP	POR	New/ Tied Record	Record Date	Previous Record	Previous Date
PORTAGE GLACIER V C	ANCHORAGE	AK	80.78	-148.83	507502	COOP	38	2.62 in	2011-04-22	1.89 in	2005-04-22
SNETTISHAM PWR PLT	JUNEAU	AK	58.14	-133.74	508584	COOP	46	1.19 in	2011-04-22	0.4 in	2010-04-22
GRAVETTE	BENTON	AR	36.43	-94.45	032930	COOP	113	2.67 in	2011-04-22	1.55 in	1973-04-22

Current Epidemic Detection and Response Curve



Adapted from J. Davis, Climate Adaptation Workshop, Nov. 2003

Getting ahead of the Curve: Integrating Ocean, Climate and Public Health Information

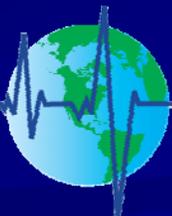


Enhancing Public Health Engagement, Outreach, and Feedback throughout

Challenge of Problem Formulation

The mere formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skills. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.

- Albert Einstein



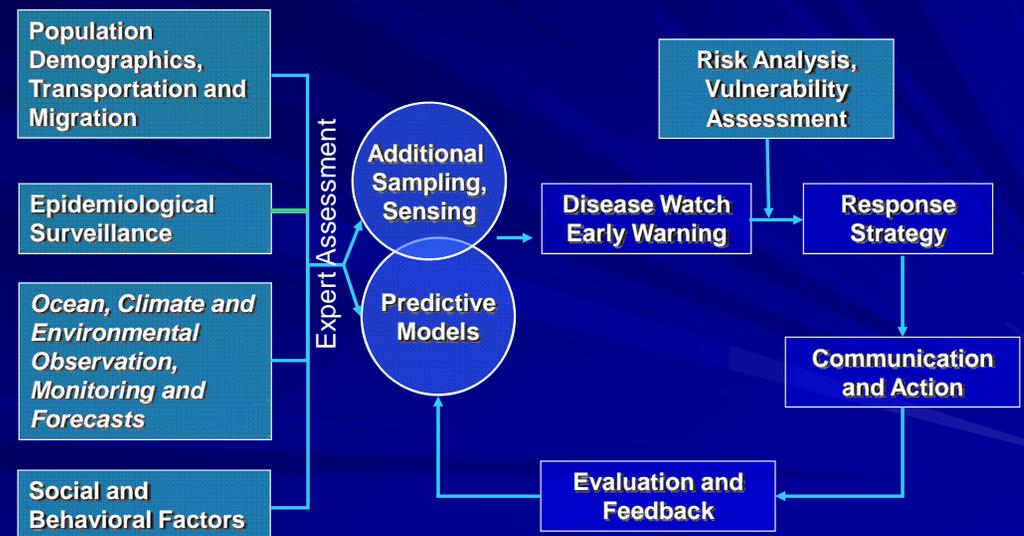
**OCEANS & HUMAN
HEALTH INITIATIVE**



Moving From Surveillance and Response to Prediction and Prevention: An Integrated Framework for HEWS

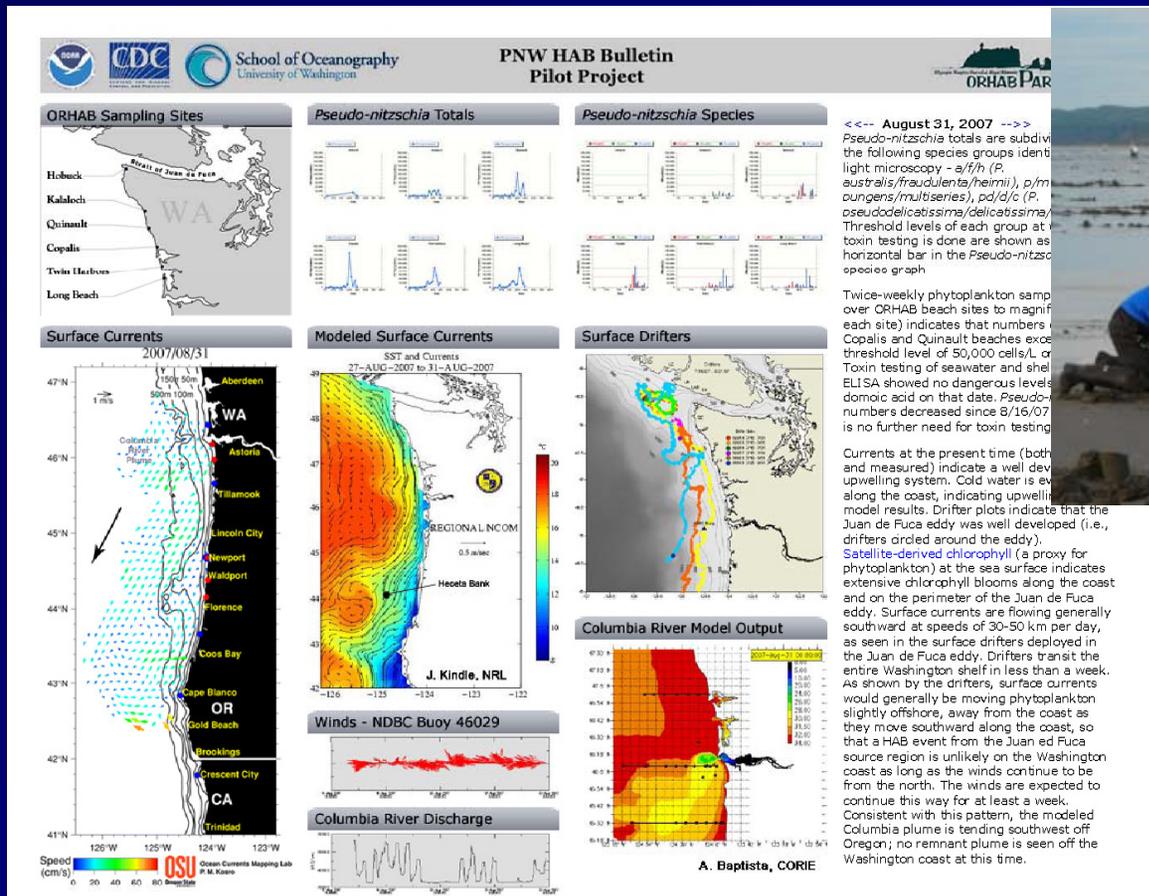
- **Problem-driven**
- **Scalable to local, regional, national, and international issues**
- **Addresses time scales from decades to days**
- **Involves research, monitoring, modeling, management, mitigation and prevention, and evaluation**
- **Well defined federal, state, local and academic roles and responsibilities**
- **Integrates with other human and animal health surveillance systems, and other biological and physical observation and monitoring systems**

Components of a Health Early Warning System



Adapted from Davis, J and J. Trtanj, Energy Modeling Forum, 2003

Public Health Forecasting



Pseudo-nitzschia in Pacific NW

Slide courtesy of V. Trainer

Sea Surface Temperature--Early Warning for Cholera and other Vibrios



Shellfish Safety Report

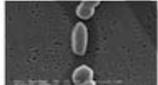


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Vibrio parahaemolyticus (Vp) and Oysters

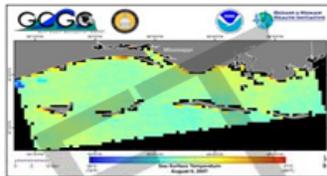
Gulf Coast oysters, especially raw oysters on the half shell, top the list of favorites for many diners. Although these bivalves are safe for most people to eat, some consumers are at risk. Oysters are filter-feeders, and they sometimes accumulate large numbers of naturally occurring bacteria.

This bacterial content calls for simple safety steps such as keeping oysters on ice after harvesting, and washing hands thoroughly with warm, soapy water after handling raw oysters. If oysters containing the naturally occurring bacteria, *Vibrio parahaemolyticus* or Vp, are harvested and not kept on ice, the Vp can grow to high levels. Vp in high enough densities can cause diarrhea in consumers who eat raw oysters, especially in those individuals who already have other health problems, such as weak immune systems, diabetes or liver disease.



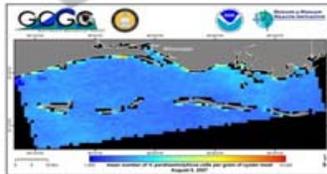
Vibrio parahaemolyticus (courtesy Janice Carr)

Latest Mississippi Sound MODIS SST



(click for full resolution)
Mississippi Sound SST Product Archive

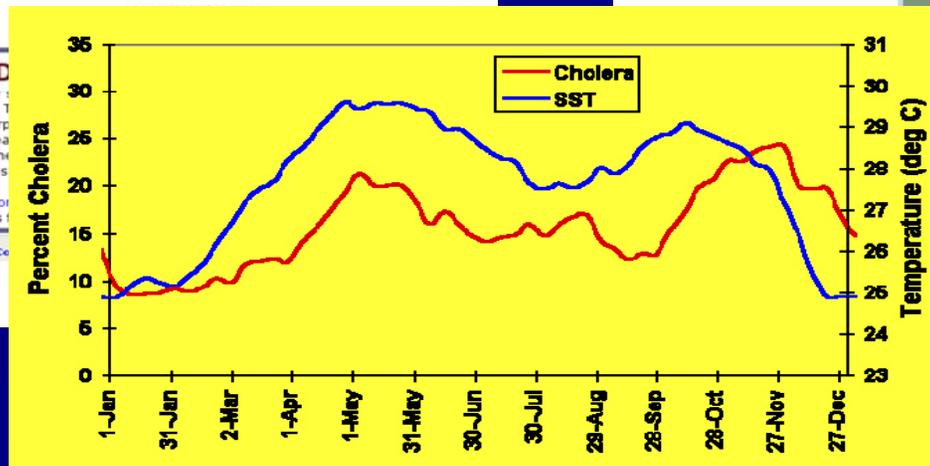
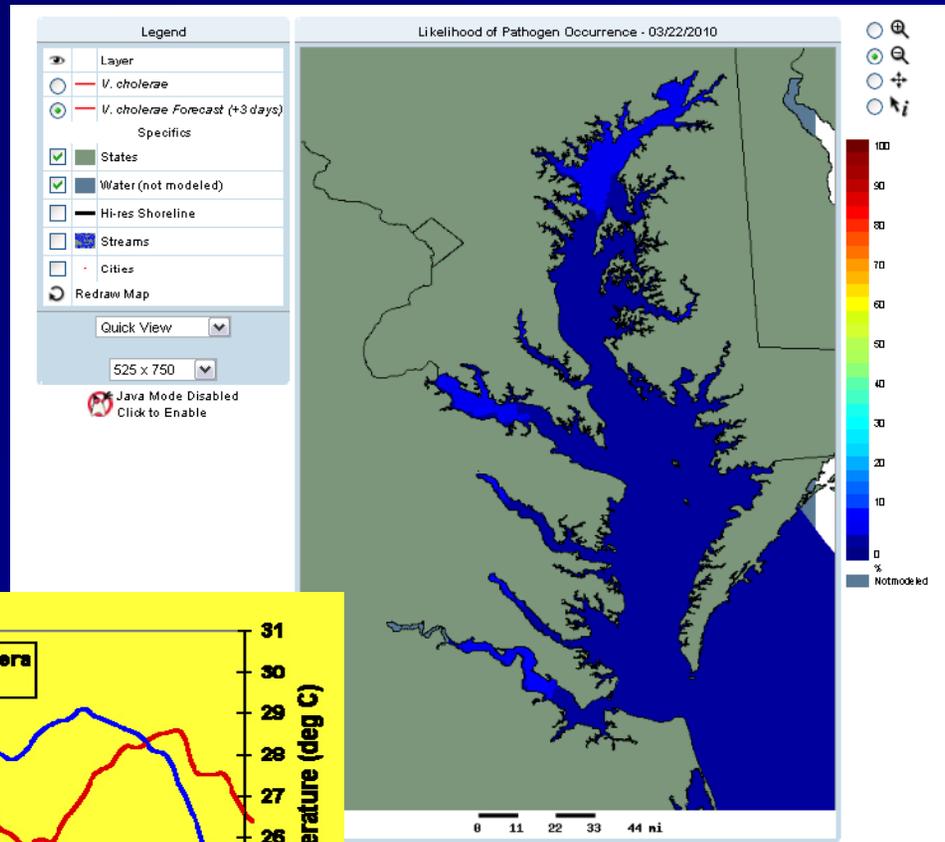
Latest Mississippi Sound Vp Density



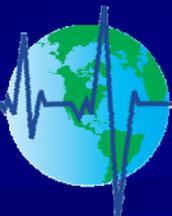
The densities of *Vibrio parahaemolyticus* : temperatures measured by a satellite. 1 absolute or actual values. The sole purpose used to assess the potential human health shown on these maps. Furthermore, the produce them and the maps themselves

The participating agencies and institutions consuming raw or undercooked oysters

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Advanced Planning in Pohnpei: a partnership built on trust



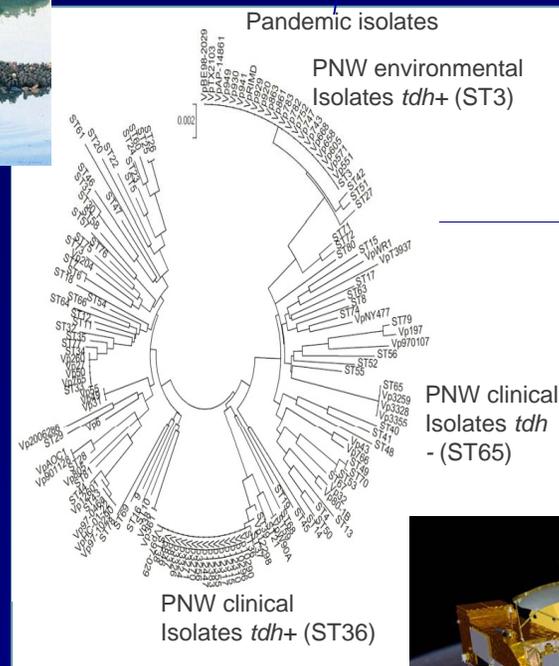
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From Genes to Satellites to in situ: Tools for Tracking and Health Early Warning Systems



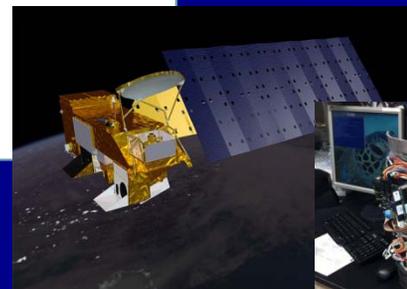
Oceanographic measurements and biogeographical linkages of pathogen to human illness



Virulent strains rare and less diverse

Genome sequencing of multiple strains to identify virulence markers

for *Vibrios*



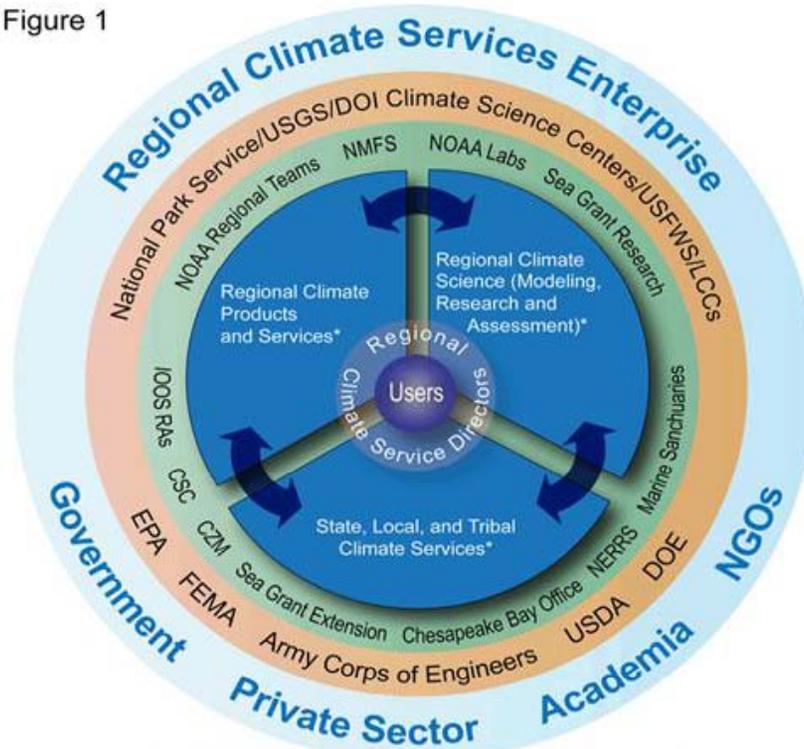
NASA Aqua w/ MODIS



Appropriate genetic markers on biosensors, linked to ocean observing

A Burgeoning Climate Service Enterprise

Figure 1

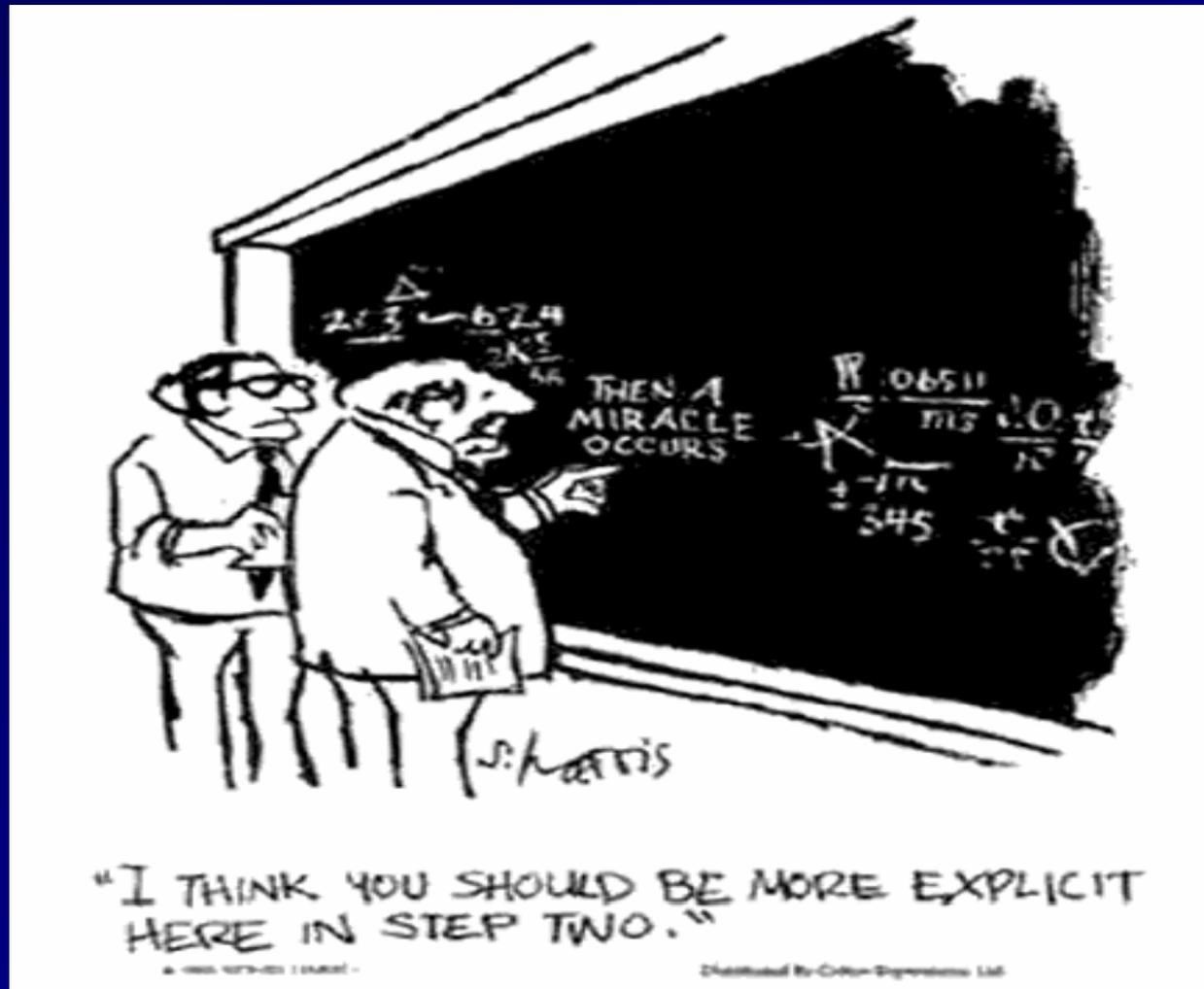


- National Partners
- NOAA Partners
- Interagency Impacts & Adaptation Support Partners
- NCS Keystone Partners

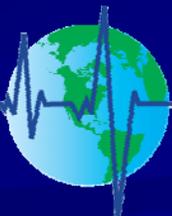
*See Figure 2 for details

Adding it all up....

Climate Change and Human Health Adaptation Planning



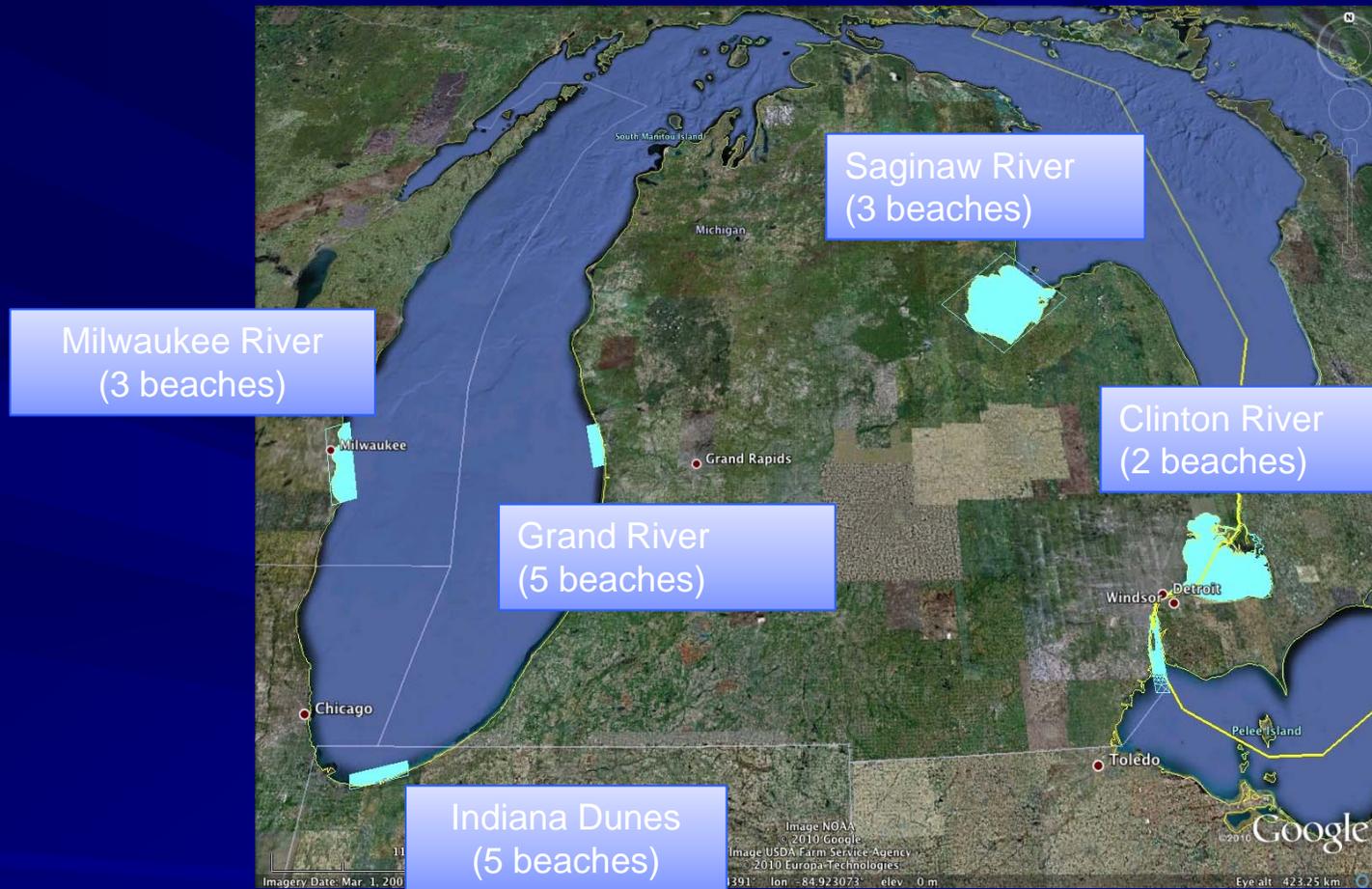
Questions or Comments?



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CEGLHH Operational Nearshore Beach Forecasts

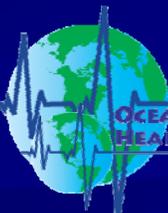


-Predict fate of water from tributaries and potential impact on swimming beaches

-Updated up to six times per day

-Forecasts up to five days in advance

Used as supplement to traditional beach closure methods



OCEAN & HUMAN
HEALTH INITIATIVE



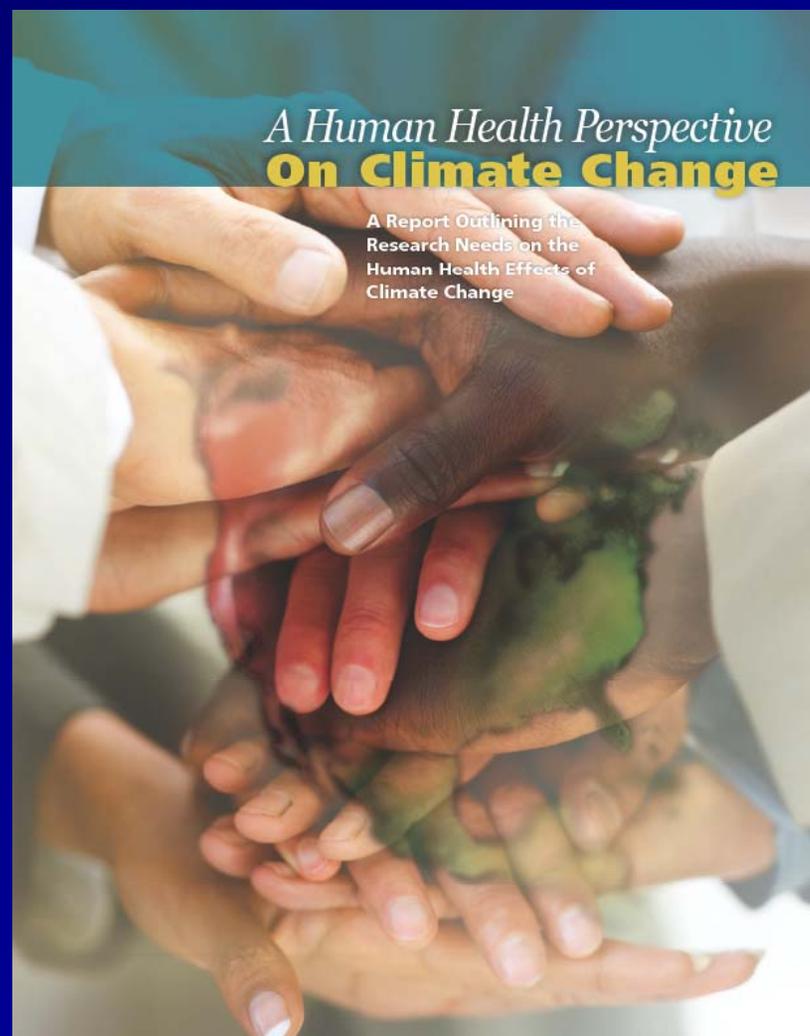
Interagency Working Group on Climate Change and Health Report

Congressional Rollout June 14, 2010

A Human Health Perspective on Climate Change

A report outlining the research needs on the human health effects of climate change

- Asthma, respiratory allergies, and airway diseases
- Cancer
- Cardiovascular disease and stroke
- Foodborne diseases and nutrition
- Heat-related morbidity and mortality
- Human developmental effects
- Mental health and stress-related disorders
- Vectorborne and zoonotic diseases
- Waterborne diseases
- Weather-related morbidity and mortality



US IOOS[®] Regional Component

IOOS Regional Component

A network of 11 regional coastal ocean observing systems that meet national and regional needs for local ocean observations, data management, and modeling

1 national partnership providing sensor validation/verification

- Meeting National missions through...
 - Expanded observations and modeling capacity
 - Connections to users and stakeholders
 - Implementation of national data standards
 - Products transitioned to other regions and to National operations
 - Sensor validation/verification



1. Alaska Ocean Observing Systems (AOOS)
2. Caribbean Regional Association (CaRA)
3. Central and Northern California Coastal Ocean Observing System (CeNCOOS)
4. Gulf Coastal Ocean Observing System (GCOOS)
5. Great Lakes Observing System (GLOS)
6. Mid-Atlantic Coastal Ocean Observing System Regional Association (MACOORA)
7. Northwest Association of Networked Ocean Observing Systems (NANOOS)
8. Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS)
9. Pacific Islands Ocean Observing System (PacIOOS)
10. Southern California Coastal Ocean Observing System (SCCOOS)
11. Southeast Coastal Ocean Observing System Regional Association (SECOORA)
12. Alliance for Coastal Technologies (ACT) {Sensor V & V}

IOOS[®] Core Variables

Availability of
Integrated Formats:

2010 – 7 variables

2011 – 15 variables

2012 – 1 potential

1. Temperature
2. Salinity
3. Water level
4. Currents
5. Surface Waves
6. Surface Winds
7. Ocean color

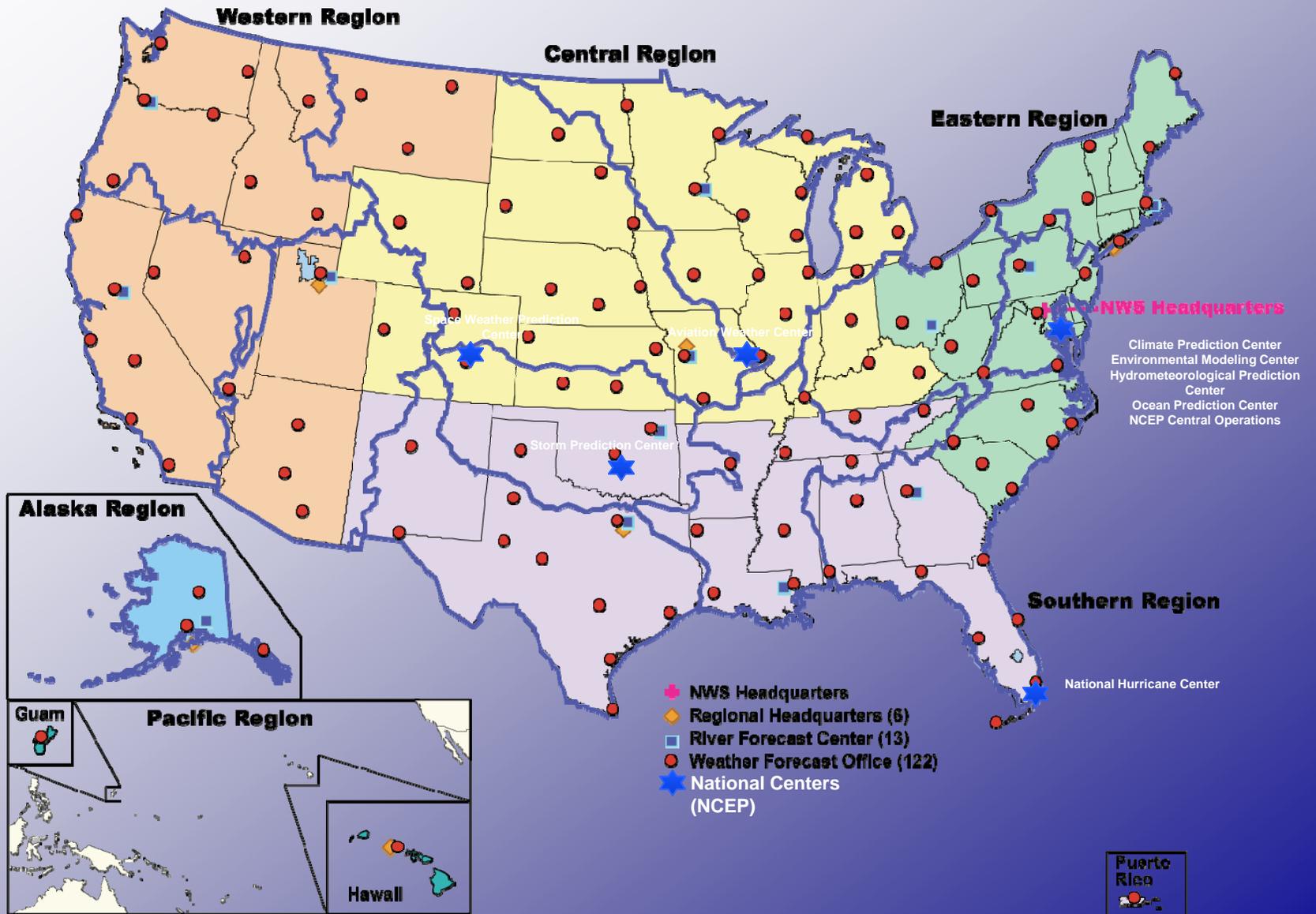
14. Bathymetry
15. Ice distribution
16. Contaminants
17. Stream flow
18. Dissolved nutrients
19. Optical properties
20. Total suspended matter

8. Dissolved oxygen
9. pH
10. pCO₂
11. Heat flux
12. Bottom character
13. Pathogens

21. Colored dissolved organic matter
22. Fish species
23. Fish abundance
24. Zooplankton species
25. Phytoplankton species
26. Zooplankton abundance

NWS Overview

Regional & Local





CENTER OF EXCELLENCE FOR GREAT LAKES AND HUMAN HEALTH



Experimental Lake Erie Harmful Algal Bloom Bulletin

2009-004

13 August 2009

National Ocean Service

Great Lakes Environmental Research Laboratory

Last bulletin: 06 August 2009

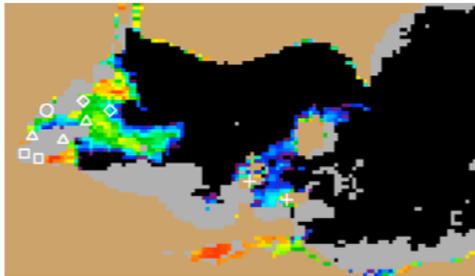


Figure 1. MERIS image from the European Space Agency. Imagery shows the spectral shape at 681 nm from August 11, where colored pixels indicate the likelihood of the last known position of the *Microcystis* spp. bloom (with red being the highest concentration). *Microcystis* spp. abundance data from August 11 shown as white squares (very high), circles (high), diamonds (medium), triangles (low), + (very low) and X (not present). Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.

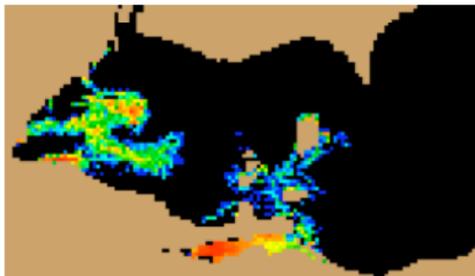


Figure 2. Nowcast position of *Microcystis* spp. bloom for August 13 using GLCFS modeled currents to move the bloom from the August 11 image. Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.

Conditions: A *Microcystis* spp. bloom has been identified in Maumee Bay and the adjacent waters to the northeast. The bloom may be visible from the shore, or near shore areas outside of Maumee Bay. A mixed cyanobacterial bloom is also present in Sandusky Bay. Moderate taste and odor issues have been observed and may continue to persist as a result of the bloom.

Analysis: The *Microcystis* spp. bloom in Western Lake Erie continues to persist and increase in both area and concentration. The bloom in Sandusky Bay is a mixed bloom dominated by *Planktothrix* spp. Wind stress is expected to be low for the next several days, which may intensify the bloom. The bloom is forecasted to remain relatively stationary, with a tendency to drift slightly to the NE. The feature present around the South Bass Islands has been identified as having very low concentrations of *Microcystis*. The feature has spread in area since last week's bulletin and may continue to spread. It should be noted that clouds covered Maumee Bay (gray pixels in the observed imagery). As a result of these clouds, the nowcast and forecast show no (or very little) concentration in Maumee Bay.

-Wynne, Dyble, Meredith

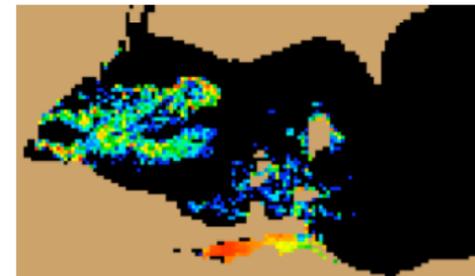


Figure 3. Forecast position of *Microcystis* spp. for August 16 using GLCFS modeled currents to move the bloom from August 11 image. Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.