Contribution of NOAA to the U.S. and International Global Ocean Observing System (GOOS)

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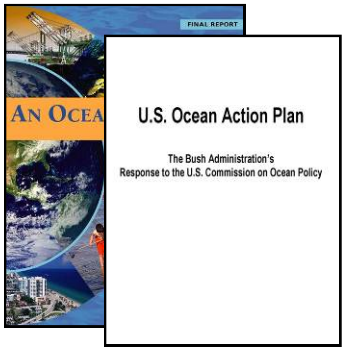
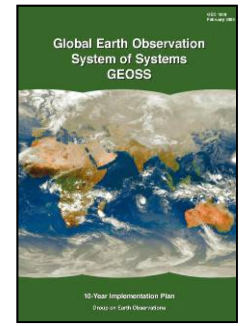
Background – IOOS the Big Picture

Ocean Action Plan / Ocean Commission



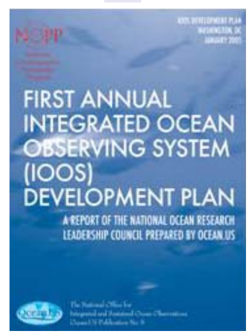
U.S. IEOS

GEOSS



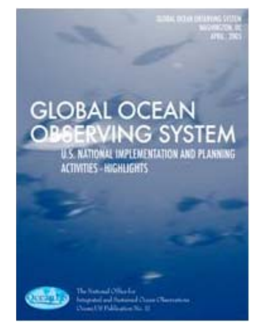
U.S. Component

Ocean Component of U.S. IEOS



U.S. IOOS

U.S. Component



GOOS

Ocean Component of GEOSS

Ocean Action Plan – "Build a Global Earth Observation Network, Including Integrated Oceans Observation"

GEOSS and IOOS Societal Goals Match NOAA's Mission Goals

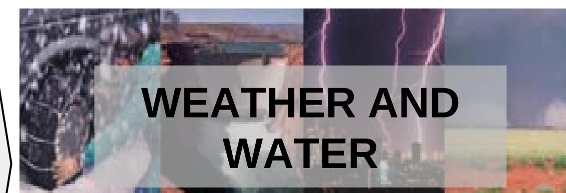
GEOSS Goals

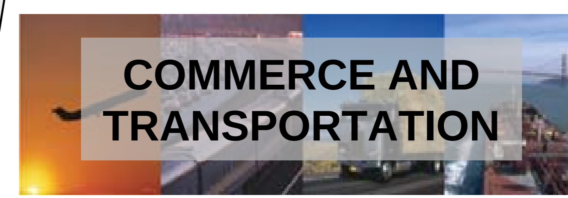
1) Improve Weather Forecasting
2) Reduce Loss of Life and Property from disasters
3) Protect and Monitor our ocean resources
4) Understand, Assess, predict, mitigate, and adapt to climate variability and change
5) Support Sustainable Agriculture and Combat Land Degradation
6) Understand the effects of environmental factors on human health and well-being
7) Develop the capacity to make ecological forecasts
8) Protect and monitor water resources
9) Monitor and manage energy resources

IOOS Societal Goals

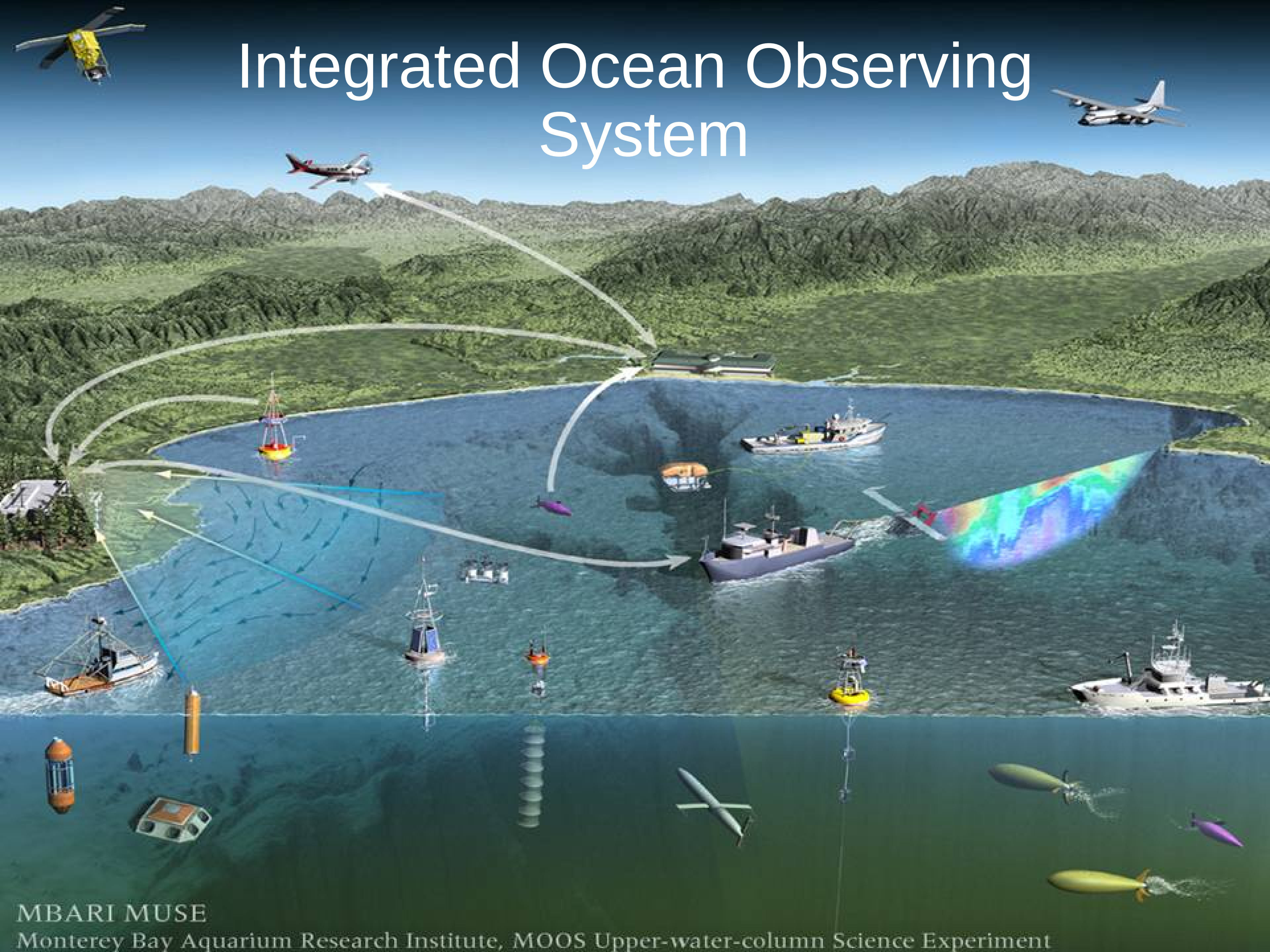
1) Improve predictions of climate change and weather and their effects on coastal communities and the nation;
2) Improve the safety and efficiency of marine operations;
3) Mitigate the effects of natural hazards;
4) Improve national and homeland security;
5) Reduce public health risks;
6) Protect and restore healthy coastal marine ecosystems; and
7) Enable the sustained use of marine resources.

NOAA Mission Goals





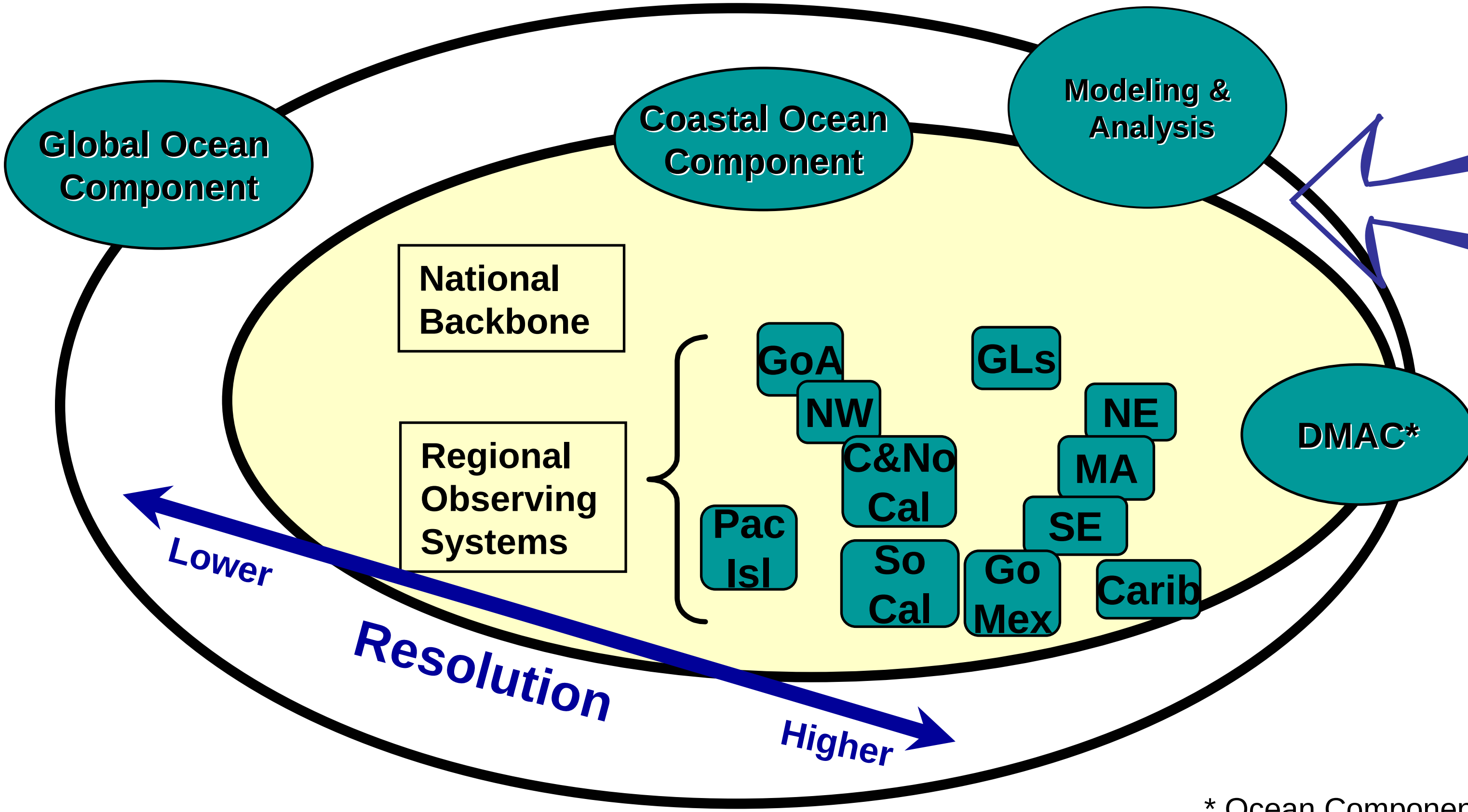
Integrated Ocean Observing System



IOOS Components

IOOS has three interdependent subsystems:

- Observing (Global and Coastal components)
- Data Management & Communication (DMAC)
- Modeling and Analysis



Partners:

Federal Agencies

- NOAA
- NSF
- Navy
- NASA
- EPA
- USGS
- MMS
- USACE

Regional Associations

State Agencies

WMO

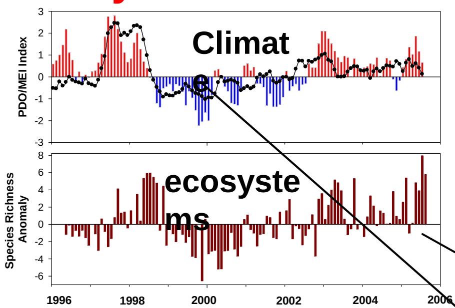
IOC

* Ocean Component of NOAA GEO IDE

Global Component

Reasons for Global Ocean Observing System

Ecosystem and Climate

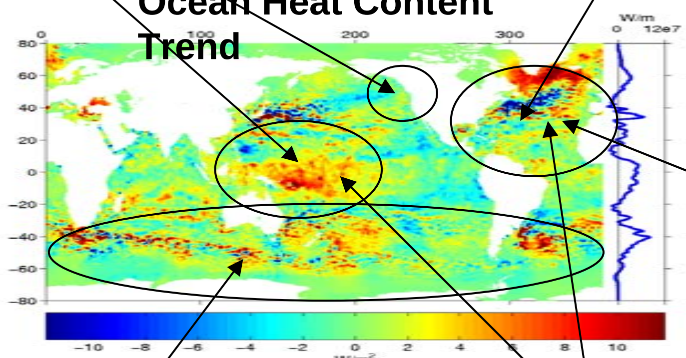


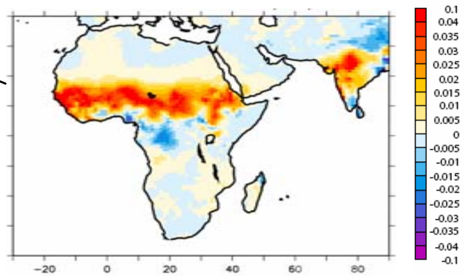
Climate

ecosystems

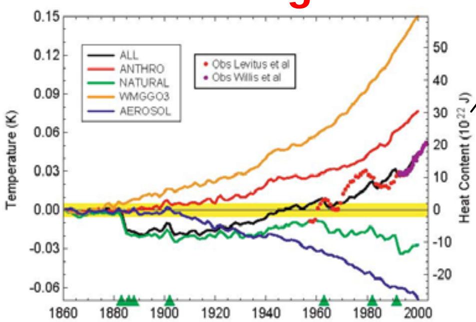
Hurricanes: Intensity and Climate

Ocean Heat Content Trend

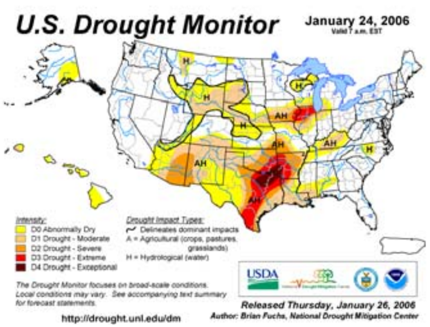




Evidence for Global Warming



S. Hemisphere most pronounced

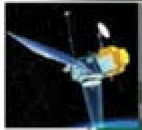


Droughts: Global and U.S.

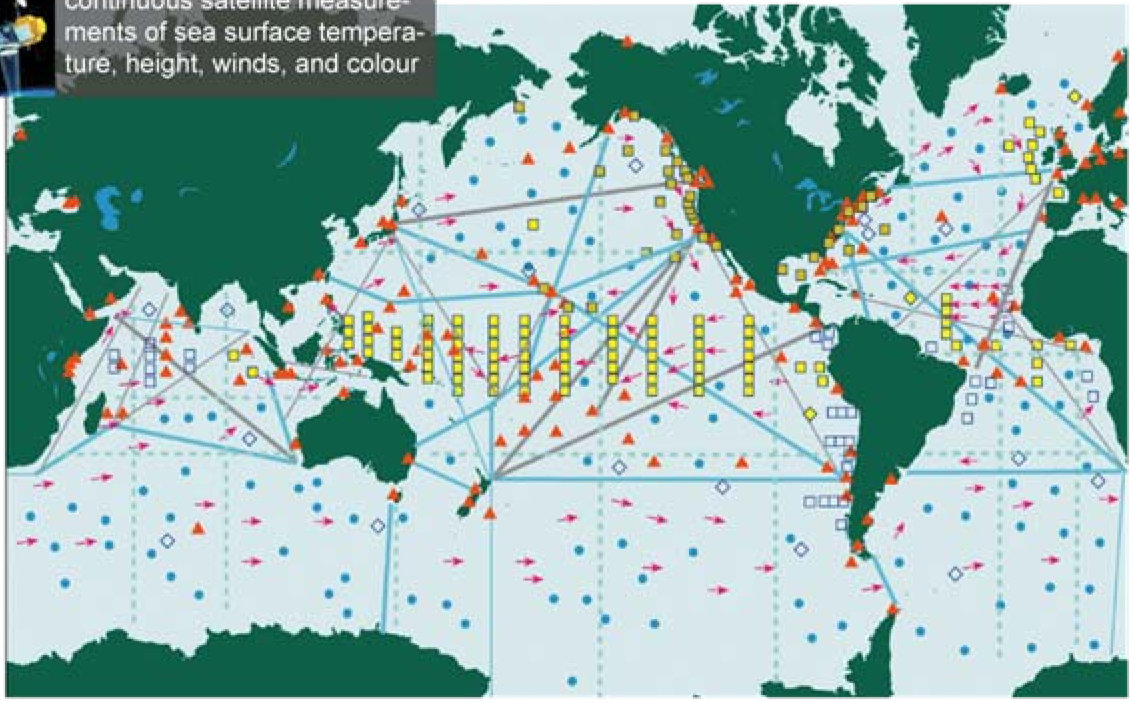
Initial Global Ocean Observing System for Climate

Status against the GCOS Implementation Plan and JCOMM targets

Total *in situ* networks **55%** September 2005



continuous satellite measurements of sea surface temperature, height, winds, and colour



57% **Surface measurements** from volunteer ships (VOSclim)

200 ships in pilot project

95% Global **drifting surface buoy** array

5° resolution array: 1250 floats

40% **Tide gauge** network (GCOS subset of GLOSS core network)

170 real-time reporting gauges

82% **XBT** sub-surface temperature section network

51 lines occupied

67% **Profiling float** network (Argo)

3° resolution array: 3000 floats

43% Repeat **hydrography** and **carbon inventory**

Full ocean survey in 10 years

Reference time series 21%

58 sites

48% Global **reference mooring** network

29 moorings planned

72% Global tropical **moored buoy** network

119 moorings planned

GCOS GOOS jcomm

- A total of 4725 platforms are maintained globally.
- The U.S. supports 2758, of which NOAA supports 2591.

Global Observing Systems

Argo Floats
- Temperature & Salinity profiles
- 2240 active floats

Global Drifting Buoys
- First Complete System of GOOS – 1250 buoys
- Sea Surface Temperature & surface velocity

XBT
- Upper Ocean temperature & salinity
- 39 occupied lines

Global Observing Systems

TAO/TRITAN & PIRATA
- •Sea surface temperature
- •Sea Surface winds
- •Air temperature
- •Humidity
- •Rainfall
- •Radiation

Tide Gauges
- •Water Levels
- •Sea Surface Temperature
- •Winds
- •Air Temperature
- •Barometric Pressure
- •143 real-time stations

Ocean Reference Stations
- •Meteorological & ocean profile data
- •42 active stations

Multi-Year Phased Implementation Plan (NOAA), 100% Requirement

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Tide Gauges	67	67	69	79	91	106	126	148	155	160	170	Real-time Stations Initial GCOS Subset
Surface Drifting Buoys	779	787	975	1250	1250	1250	1250	1250	1250	1250	1250	Number of buoys
Tropical Moored Buoys	79	79	83	86	91	97	104	115	119	119	119	Number of moorings
Ships of Opportunity	26	26	27	39	39	42	45	47	51	51	51	High resolution and frequently repeated lines occupied
Argo Floats	544	923	1500	2240	3000	3000	3000	3000	3000	3000	3000	Number of floats
Reference Stations	35	37	41	42	43	46	49	54	60	78	89	Number of observatories, flux, and ocean transport stations
Arctic System	12	12	13	24	21	24	24	41	52	54	54	Ice buoys, drifting and Moored stations
Ocean Carbon Network	1	4	9	15	17	20	23	28	31	34	37	Repeat Sections Completed, One inventory per 10 years
Dedicated Ship Time	370	458	458	458	472	493	659	831	882	882	882	Days at sea (NOAA contribution)

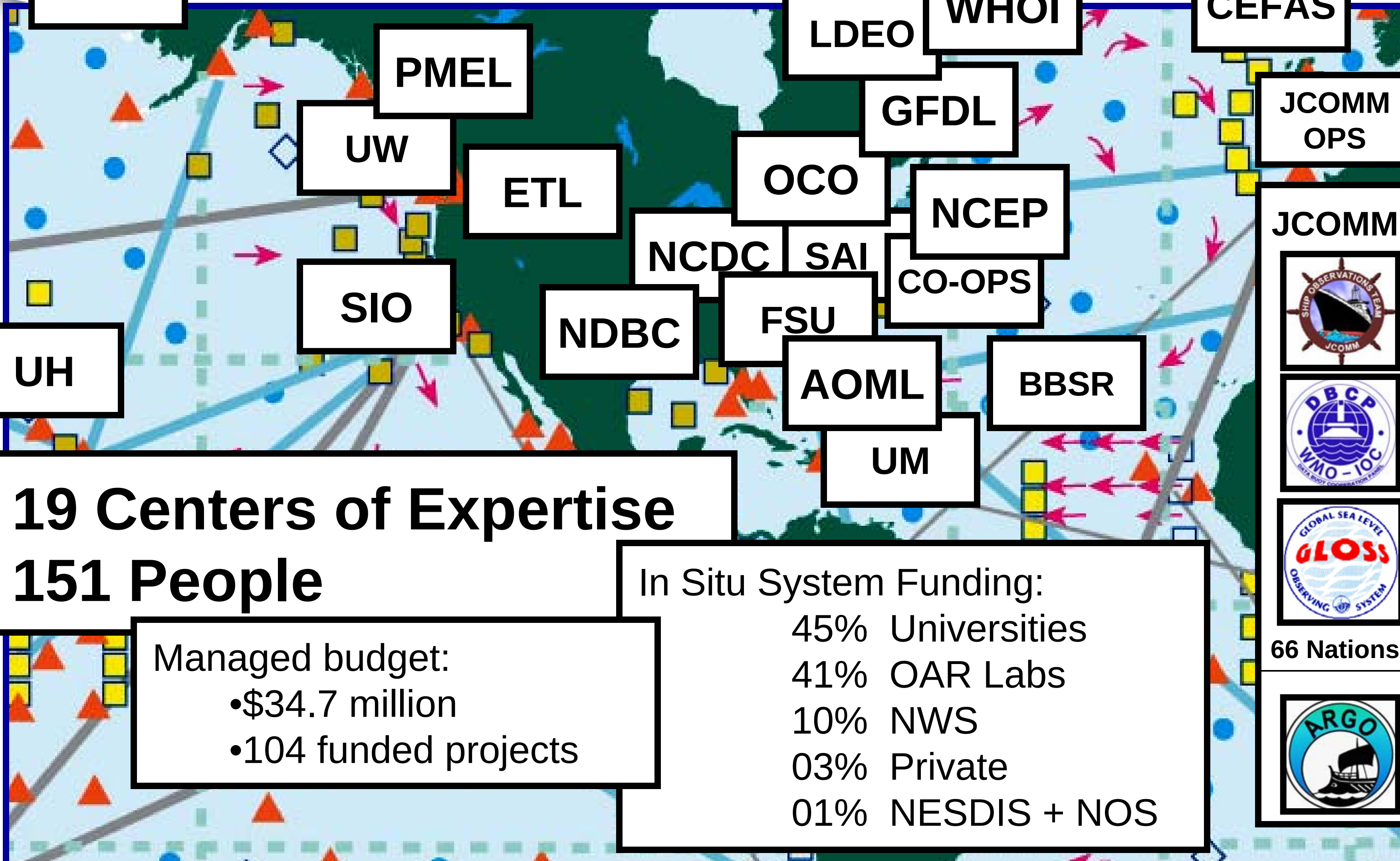
Representative milestones including international contributions

System % Complete

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total System	40	45	48	55	57	59	72	81	89	97	100

Base Budget
FY 07 President's Budget
Planning, Unfunded

Where the Work gets done



19 Centers of Expertise
151 People

Managed budget:
- $34.7 million
- 104 funded projects

In Situ System Funding:
- 45% Universities
- 41% OAR Labs
- 10% NWS
- 03% Private
- 01% NESDIS + NOS

International Partnerships

A global system by definition crosses international boundaries.

In the USA: the 4 Ns
NOAA, Navy, NASA, NSF

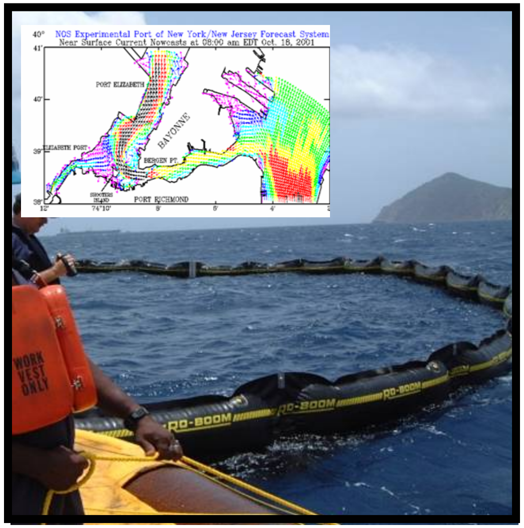
Global IOOS contributions are managed in cooperation with the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) -- presently 66 nations.

U.S. Coastal Component

Reasons for Coastal Ocean Observing System

SAFE AND EFFICIENT NAVIGATION
avoid groundings
avoid collisions
Increase throughput

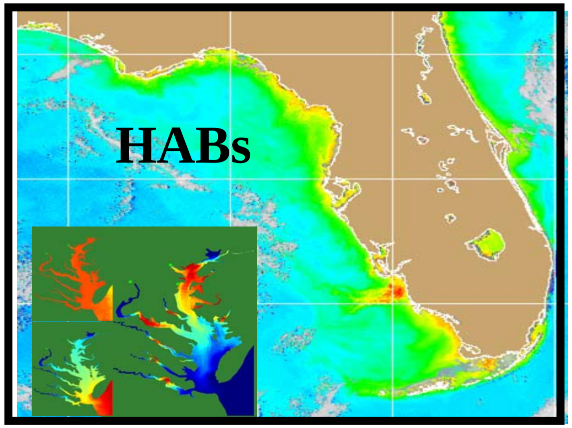
PUBLIC HEALTH



NATURAL HAZARDS
warnings for
high winds/waves
rip currents/storm surge

ECOLOGICAL FORECASTING

PROTECTION OF OCEAN & COASTAL RESOURCES



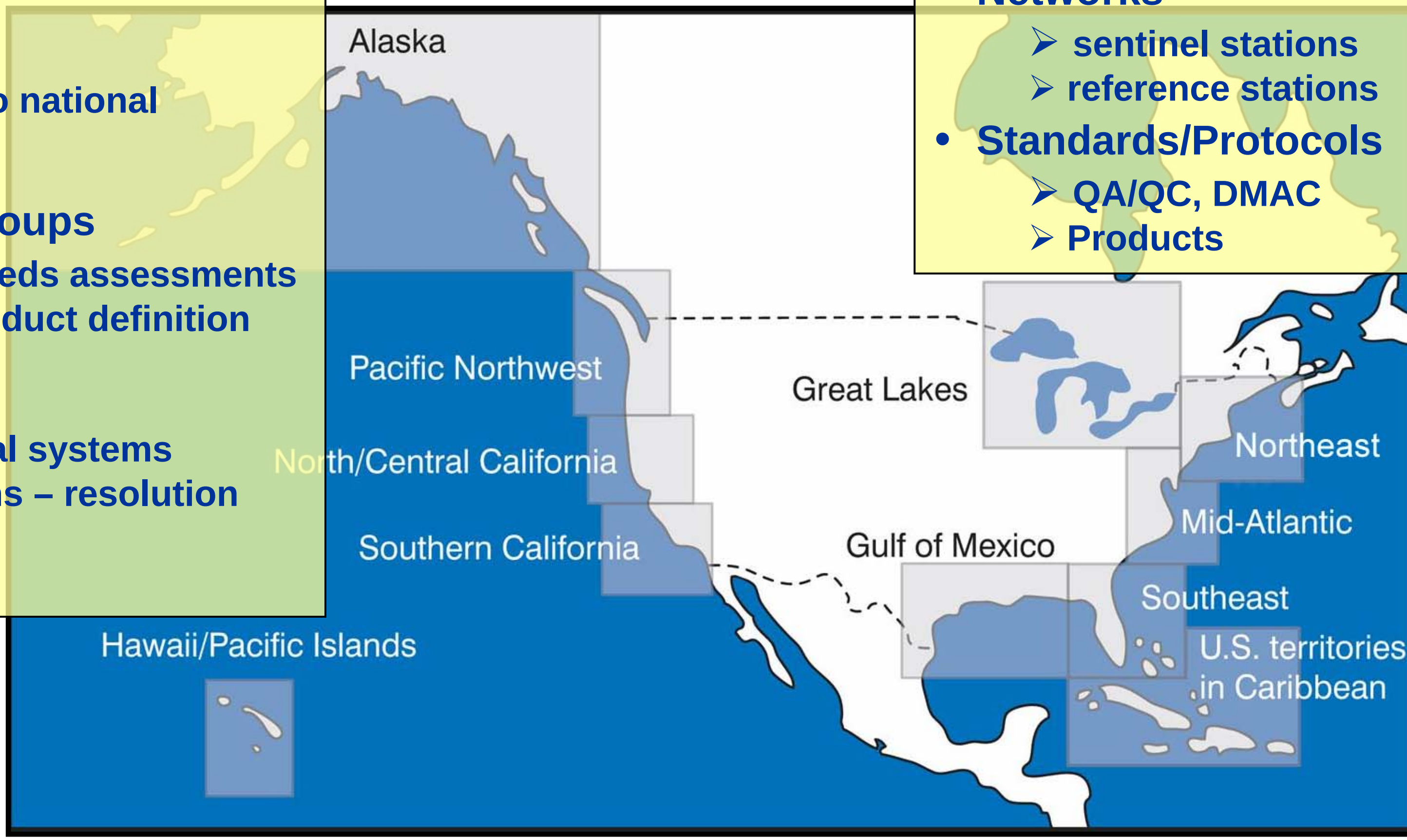
Coastal Component

Regional Systems

- Regional Associations
  - ➢ Develop
  - ➢ Operate
  - ➢ Contribute to national backbone
- Involve User Groups
  - ➢ Conduct needs assessments
  - ➢ Tailored product definition
- Incorporate
  - ➢ Sub regional systems
  - ➢ Observations – resolution and variables

National Backbone

- Operated by
  - ➢ NOPP Agencies & partners
- EEZ & Great Lakes
- Core variables
  - ➢ required by regions
- Networks
  - ➢ sentinel stations
  - ➢ reference stations
- Standards/Protocols
  - ➢ QA/QC, DMAC
  - ➢ Products



IOOS Observing Subsystem Components: NOAA's Contributions

- Designed to meet IOOS societal goals and all 5 NOAA Mission Goals
  - Also supports other agency and partner efforts to manage our Nation's oceans, coasts, and Great Lakes
- Coordinated nationally and regionally focusing on partnerships.
- System 25 – 35% complete.
- Better defining objectives and working on developing strong GPRA measures.
- NOAA capacities:
  - 24 programs contribute, 8-9 major contributors
  - Project Office in NOS AA's office coordinates NOAA-wide activities
  - NOAA contributes 55 - 65% of the present national effort.


Mussel Watch (NST)

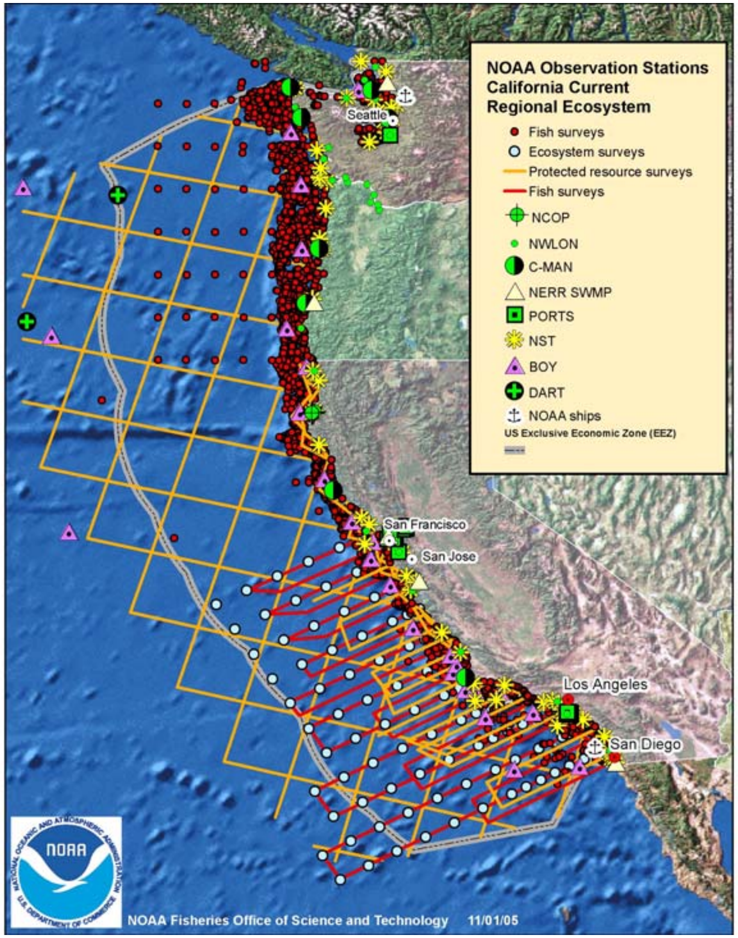

Physical Oceanographic Real-Time System (PORTS)


Hydrographic Surveys


Ecosystem surveys


Deep Ocean Assessment and Reporting of Tsunamis (DART)


National Water Level Observation Network (NWLON)




Protected resources surveys


Fish surveys


Moored Buoys (BOY)


Coastal-Marine Automated Network (C-MAN)


NERR System-Wide Monitoring Program (SWMP)


NOAA Ships

Coastal Observing Systems

Commerce & Transportation

- Hydrographic Surveys (includes bathymetry)
- National Current Observations
- National Water Level Observation Network (NWLON)
- Physical Oceanographic Real Time System (PORTS)
- Shoreline Surveys

Weather & Water

- Coastal Marine Automated Network (C-MAN)
- DART
- Voluntary Observing Ships
- Weather Buoys
- SEAWIFS*

Mission Support

- NOAA Ships
- NOAA Aircraft*
- NOAA Satellites

Ecosystems

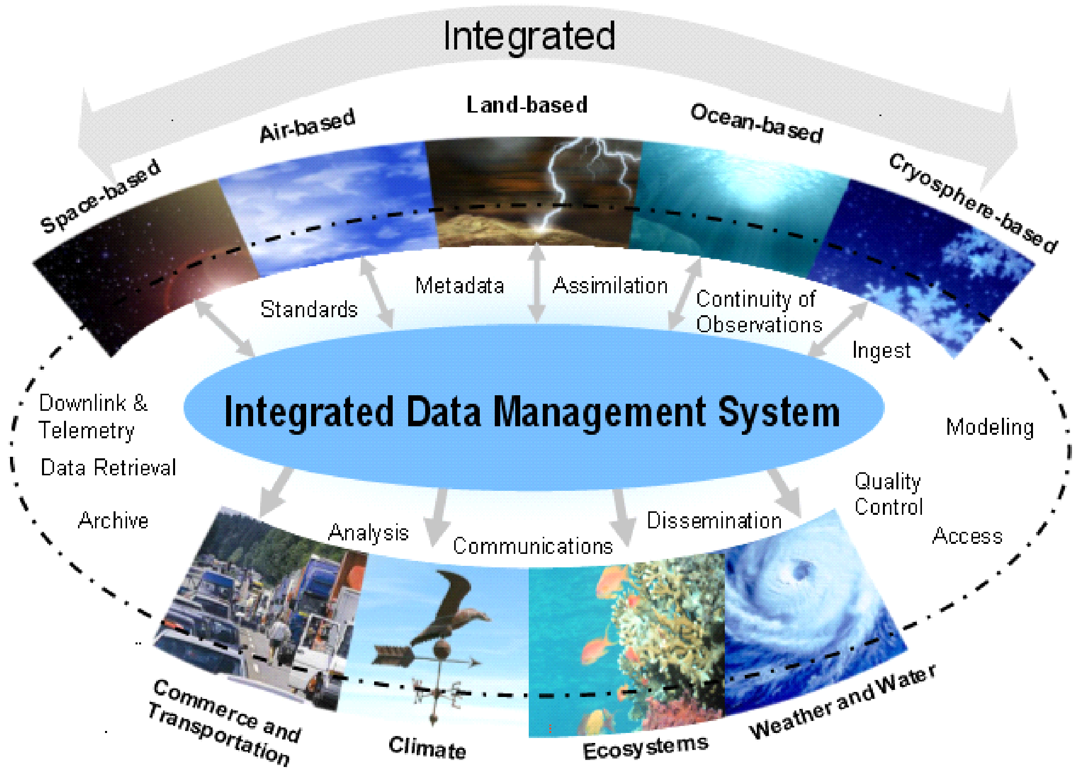
- Coastal Change Analysis Program (C-CAP)*
- Coral Reef Ecosystem Integrated Observing System (CREIOS)
- Commercial Fisheries-Dependent Data
- Economic/ Sociocultural Observing System*
- Ecosystem Surveys
- Fish Surveys
- National Observer Program
- Protected Resource Surveys
- Recreational Fisheries-Dependent Data
- System-Wide Monitoring Program (SwiM) for Marine Sanctuaries*
- System-Wide Monitoring Program (SWMP) for National Estuarine Research Reserves
- Passive Acoustics Observing System*
- National Status and Trends Program*

Data Management & Communications

NOAA's Observation System Target Architecture

<u>Target Architecture Principles</u>:

- Utility
  - •Focus on societal benefits
  - •Requirements-based
  - •All data archived and accessible
- Interoperability
  - •Full and open data sharing
  - •Standards-based
- Flexibility
  - •Leverages new technology
- Sustainability
  - •Build on existing systems
- Affordability
  - •Effectively use non-NOAA systems

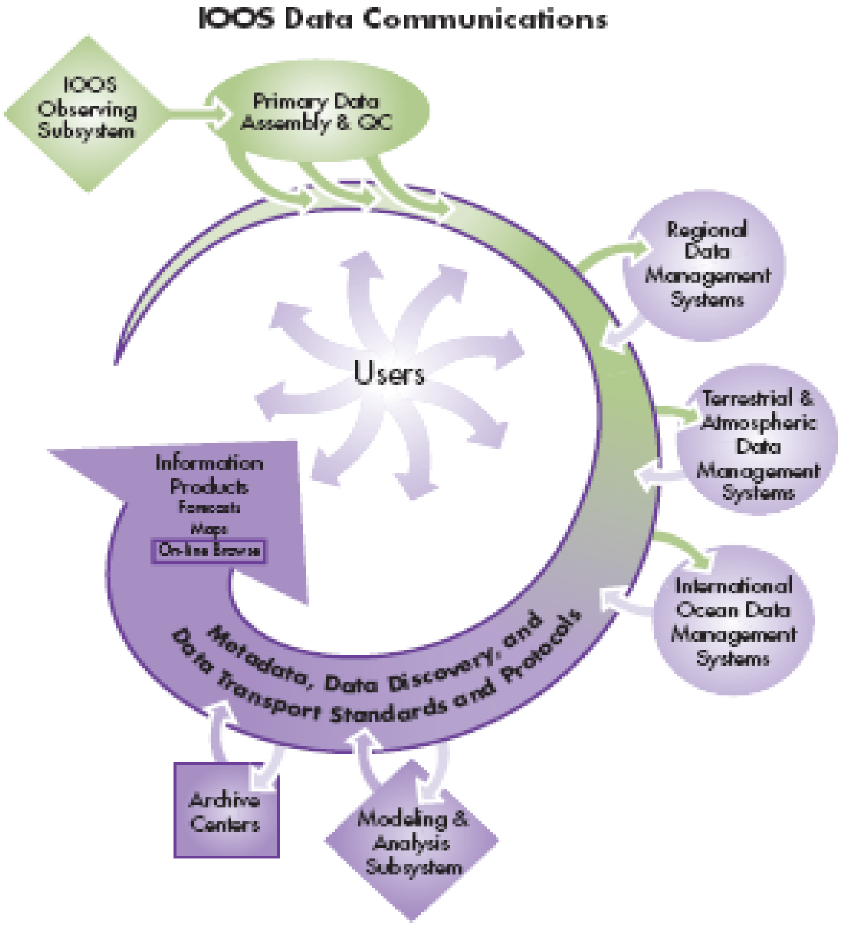


Partnerships

National International

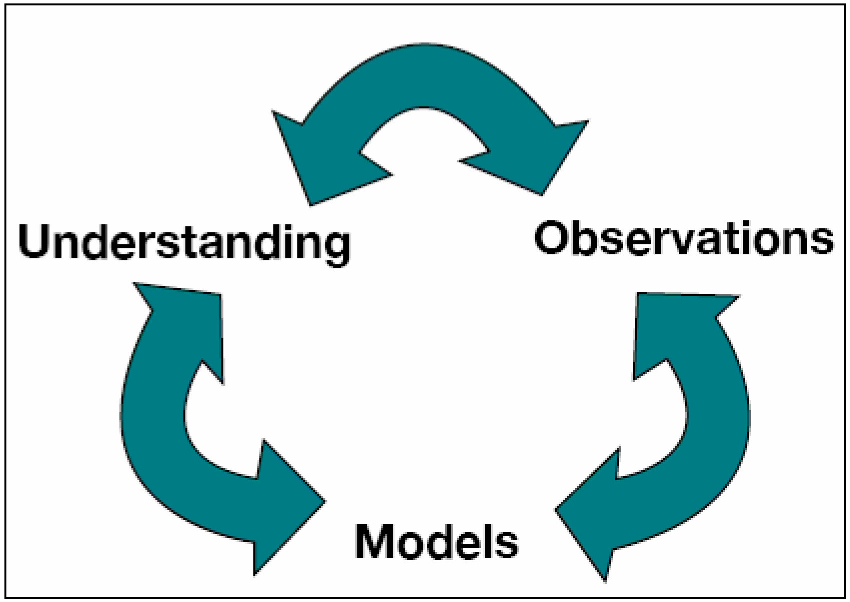
DMAC Work Areas

- Metadata
- Discovery
- On-Line Browse
- Transport
- Access
- Archive
- IT Security
- QA/QC
- System Design



Modeling & Analysis

Role of Modeling & Analysis



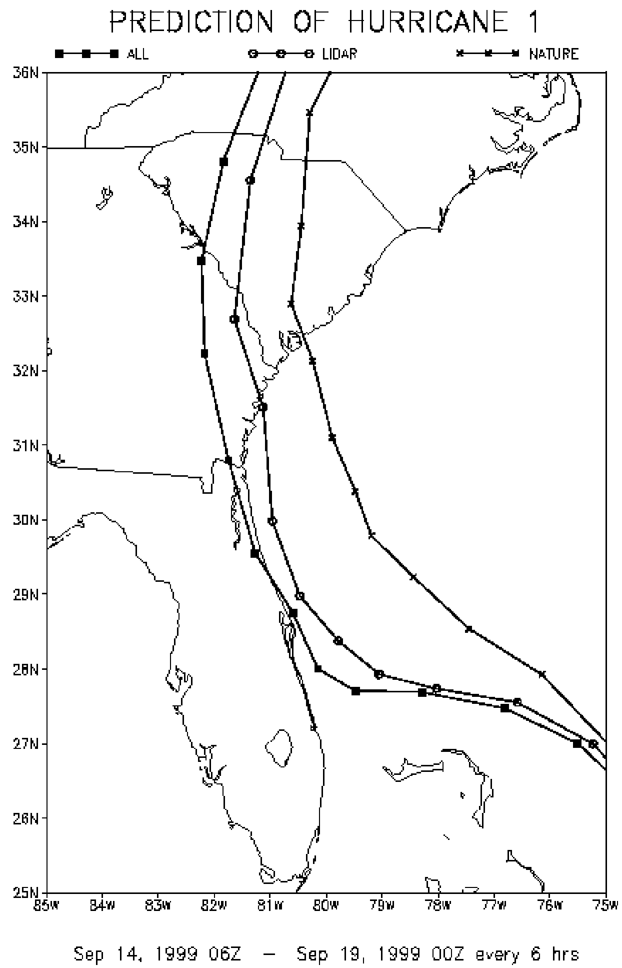
Mechanism to

- **Optimize observations**
- **Generate products**

Includes

- **Observing System Simulation Experiments (OSSE)**
- **Data assimilation**
- **Coupled ocean models**

Observing System Simulation Experiments (OSSE)



X nature track
■ forecast beginning 63 h before landfall using current data
● circles denote the improved forecast for same period using simulated lidar data.

Observing System Simulation Experiments (OSSEs) provide an effective means to:

- Evaluate the potential impact of proposed observing systems
- Determine tradeoffs in their design
- Evaluate new data assimilation methodology

Provide quantitative information on observing system impacts

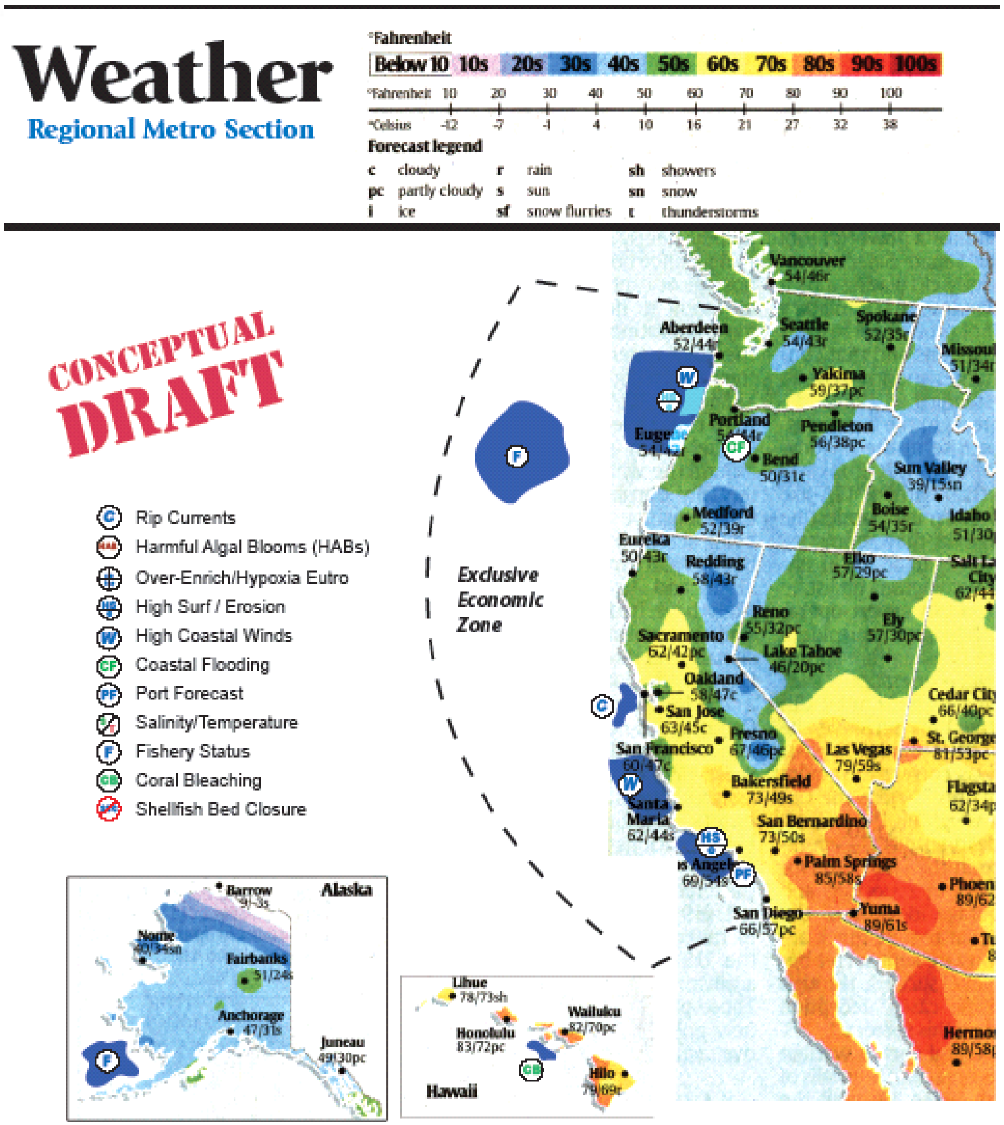
- New instrumentation
- Alternate configuration of existing instrumentation
- Data assimilation system diagnosis and improvement

Next Steps – FY06 Milestones

- **Complete IOOS Conceptual Design**
- **Develop NOAA IOOS Project Plan**
- **Complete Interoperability Plans for NOAA's IOOS Systems**
- **Continue implementation with other IOOS and GOOS partners**

The Big Picture: A Product & Service Delivery Tool

November 10, 2015



IOOS is:

- A federally-led, NOAA-managed partnership
- Web-based
- Fully interoperable
- A data and information delivery tool
- Integrates physical, biological, chemical, geological observations
- Scaleable to regional needs
- Addresses a wide range of applications – both internal and external
- Enables improved decision making through national and regional models
- A prime example of “One NOAA”

Questions?