

US EPA ARCHIVE DOCUMENT

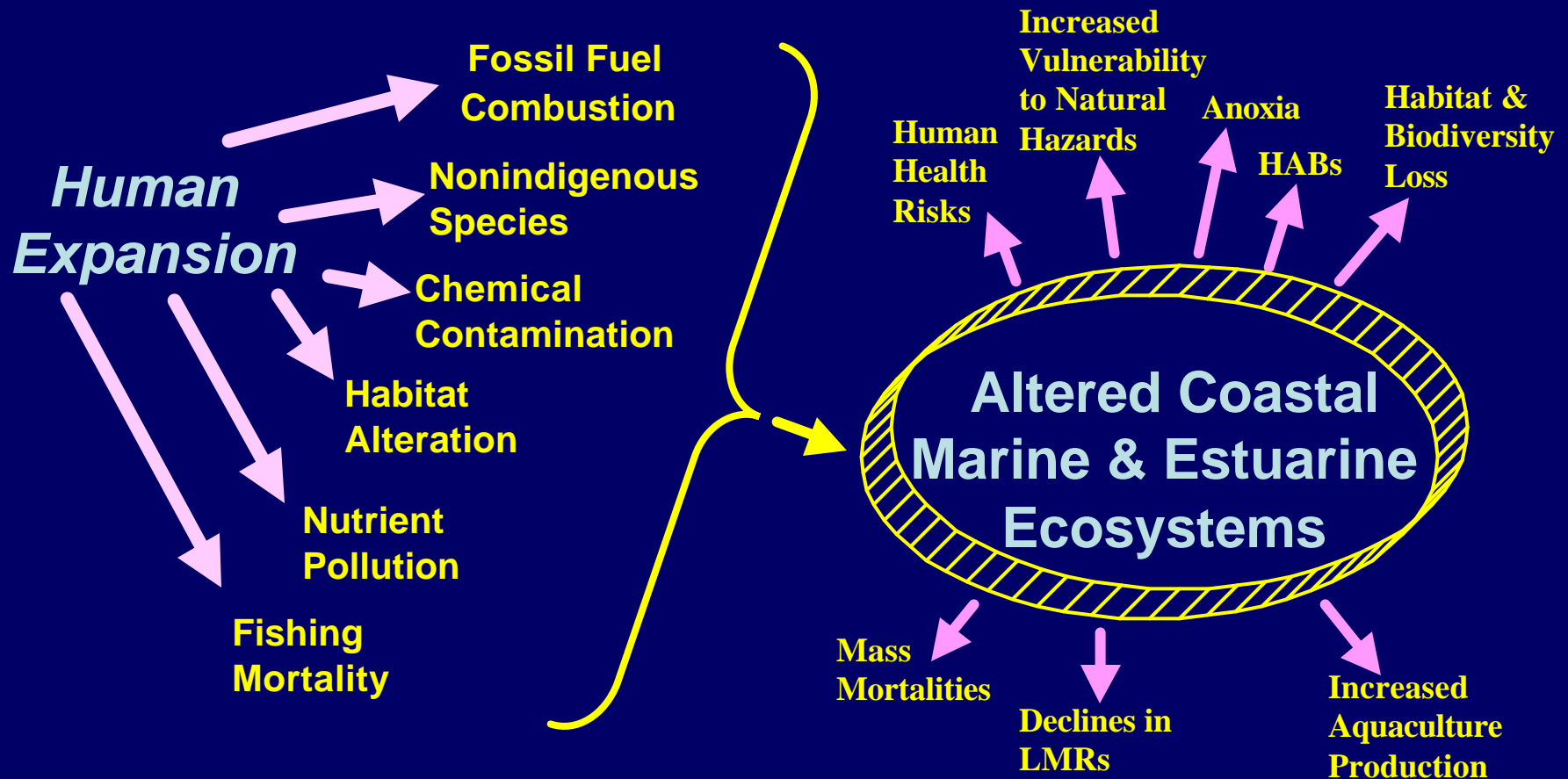
# **Assessing the Health of Coastal Ecosystem**

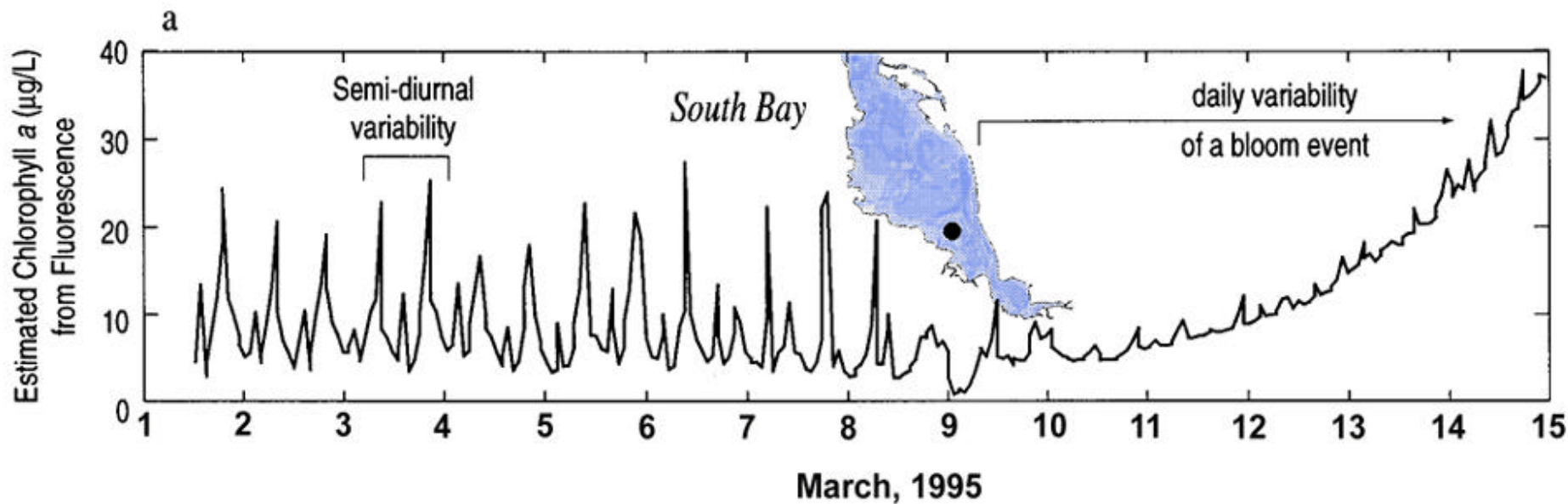
## **The Role of the U.S. Integrated Ocean Observing System**

**Tom Malone**  
**Director, OceanUS Office &**  
**Professor University of Maryland Center for Environmental Science**  
**<http://ocean.us>**

- **Drivers of change in coastal marine & estuarine ecosystems & associated scales of variability**
- **Requirements for Ecosystem–Based, Adaptive Management**
- **Development of the U.S. IOOS & EMAP**

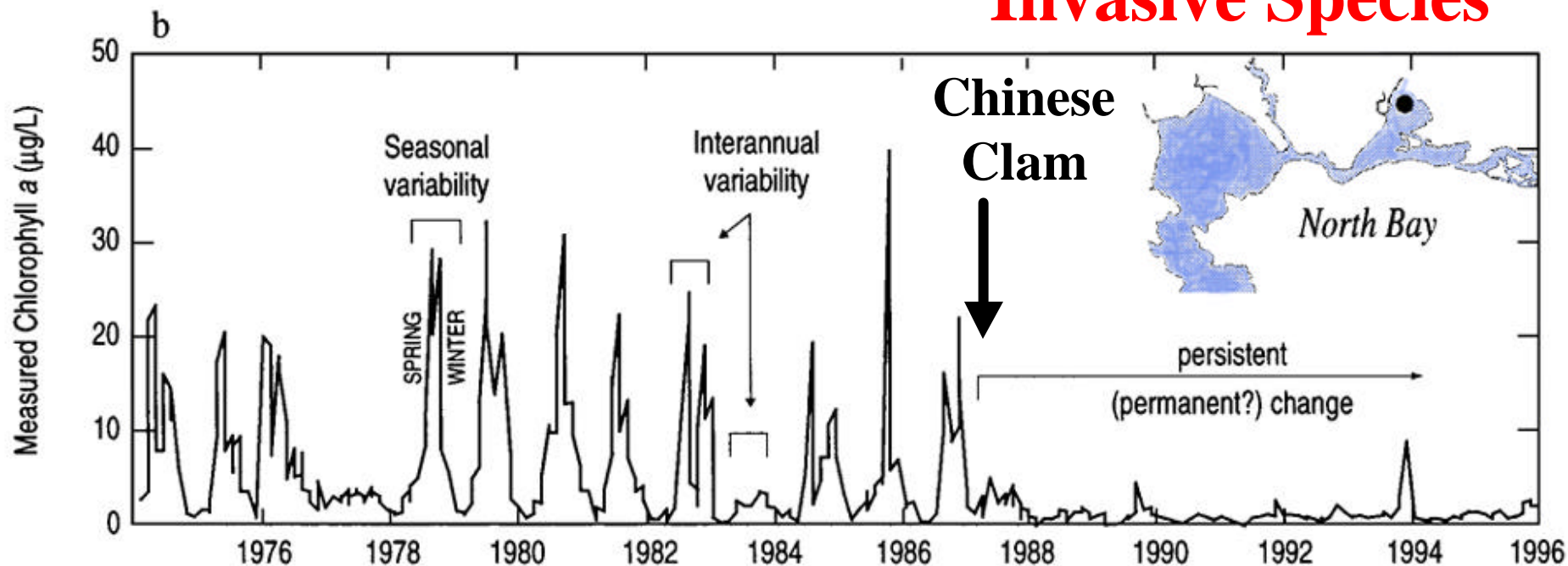
# Human Alterations of Coastal Ecosystem Condition, Integrity & Sustainability





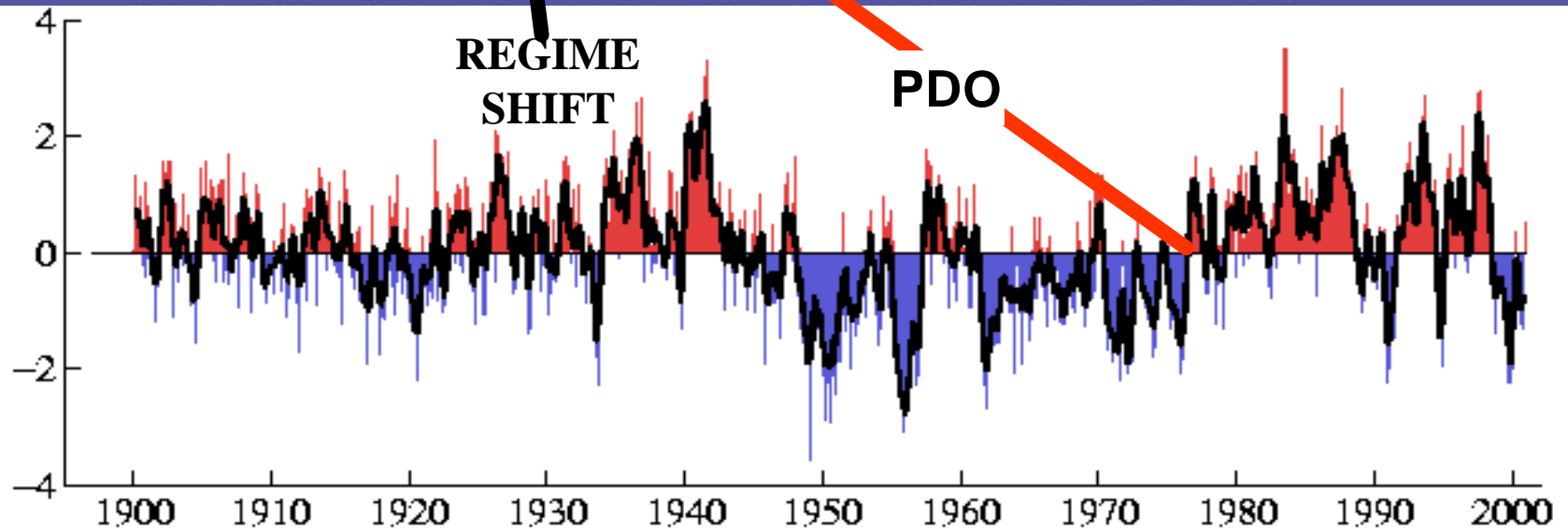
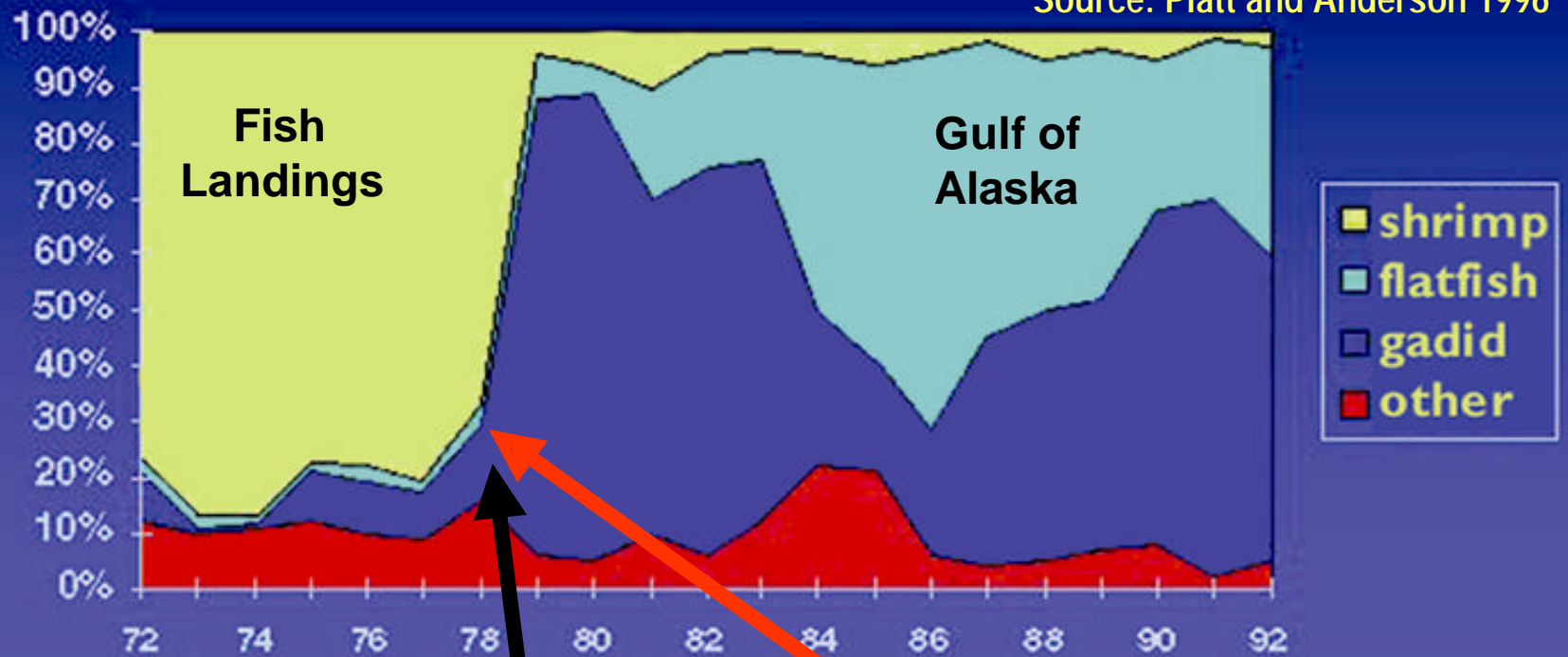
Jim Cloern

**Invasive Species**

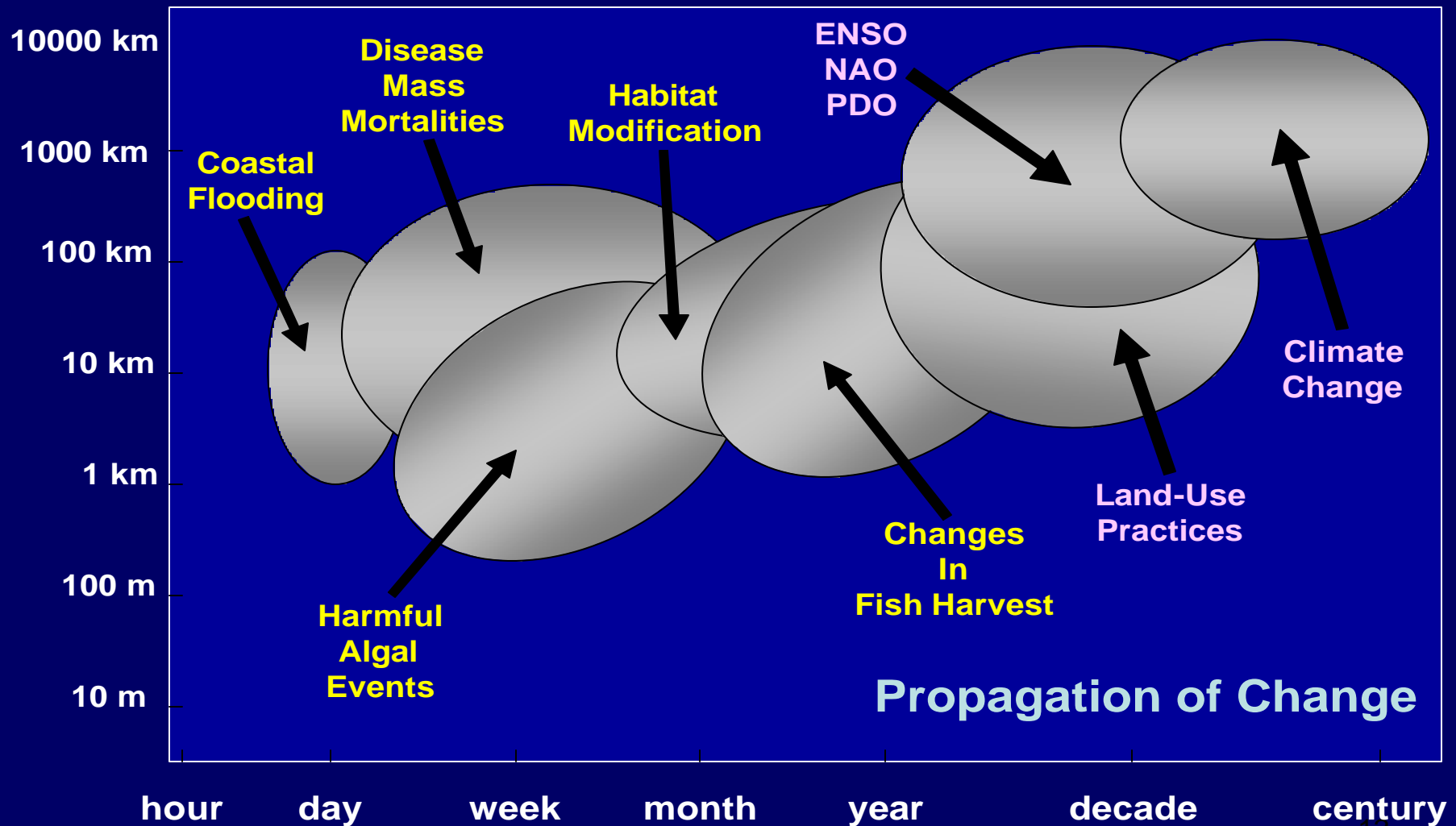




Source: Piatt and Anderson 1996



# Condition of Coastal Marine & Estuarine Ecosystems Varies Over a Broad Spectrum of Time – Space Scales



# Message 1

- **Successful management & mitigation of the effects of human activities, natural hazards & climate change depend on**
  - **The capacity to detect changes rapidly on time scales of days – decades &**
  - **The capacity to “anticipate changes with sufficient lead time to make informed decisions with desired outcomes”**

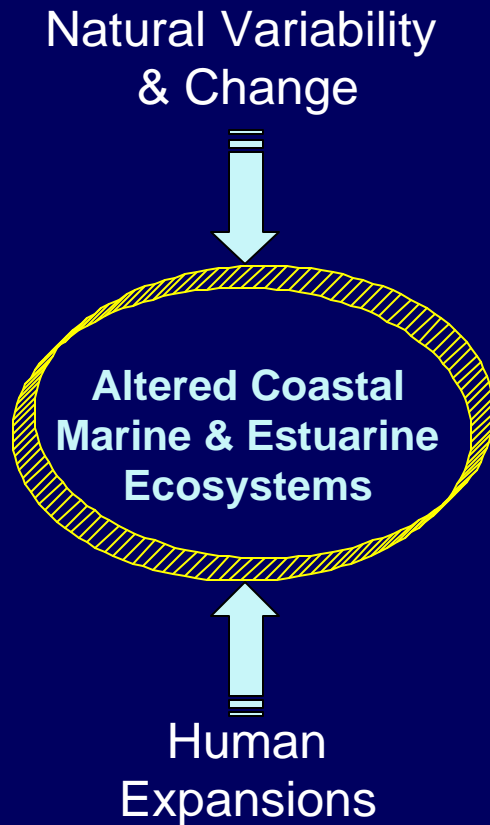
**Clark et al. 2001. Ecological forecasts: an emerging imperative. *Science*, 293: 657 – 660**

# Message 2

## Achieving these goals requires

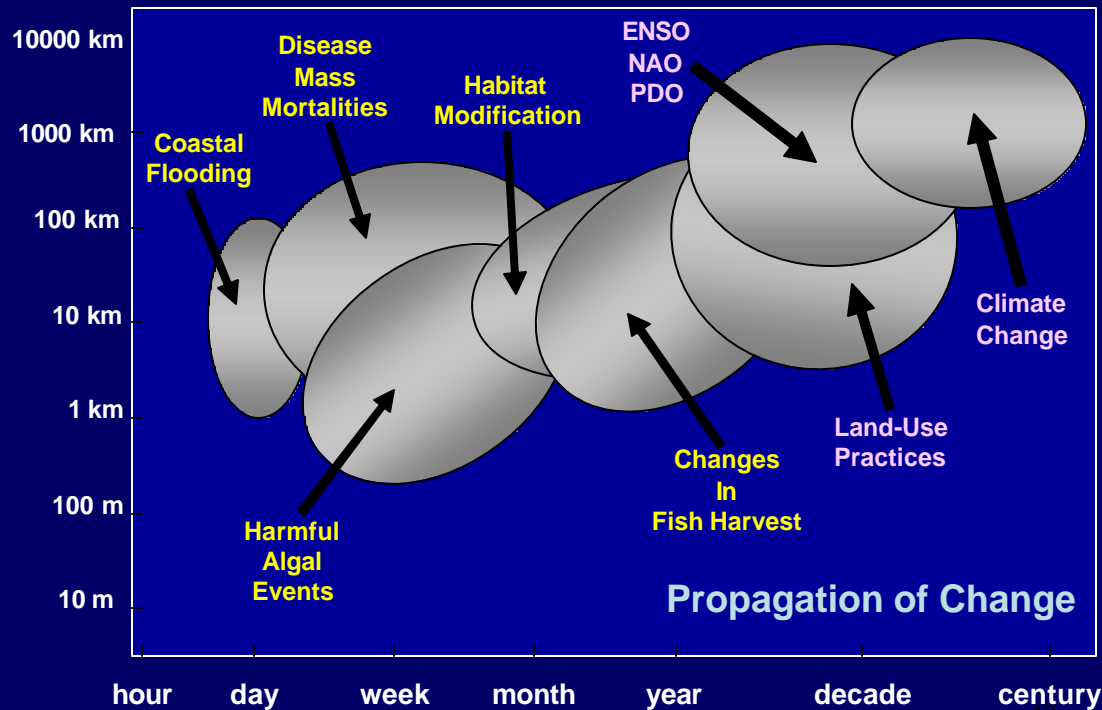
- **A more comprehensive approach to**
  - environmental protection,
  - management of living resources,
  - coastal zone management &
  - coastal engineering
- **An integrated observing system that serves data & information**
  - repeatedly
  - at rates on which management decision **CAN & SHOULD** be made

# An Approach



- **That considers the effects of human activities in terms of**
  - **Multi – species interactions**
  - **Ecosystem dynamics &**
  - **The forces of nature**

# Ecosystem-Based, Adaptive Management



- Rapid & Repeated Detection of changes
  - over a broad spectrum of time-space scales
- Timely Predictions of such changes

**WE DO NOT HAVE THIS CAPABILITY TODAY**

# WHY?

- **Inefficient, ineffective data management**
  - Data lost or not accessible
  - Time required to acquire, process & analyze diverse data from many sources (data fusion)
- **Under sampling in time, space & ecological complexity**
  - Inputs to coastal ecosystems poorly quantified
  - Lack of long term, high resolution time series
  - Lack of synoptic measurements of physical, chemical & biological properties & processes
- **Research & Monitoring needs transcend traditional boundaries between**
  - Government agencies
  - Private & public sectors
  - Research & Management

# 1998 Congress called for Integrated Ocean Observing System (IOOS)

Provide Data/Info Required for  
More Rapid Detection & Timely Prediction of State Changes

- Improve the safety & efficiency of marine operations
- Improve homeland security
- Mitigate effects of natural hazards more effectively
- Improve predictions of climate change & their effects
- Minimize public health risks
- Protect & restore healthy coastal marine ecosystems more effectively
- Sustain living marine resources

1 System, 7 Goals



# **Commission on Ocean Policy**

## **Governor's Draft**

**20 April, 2004**

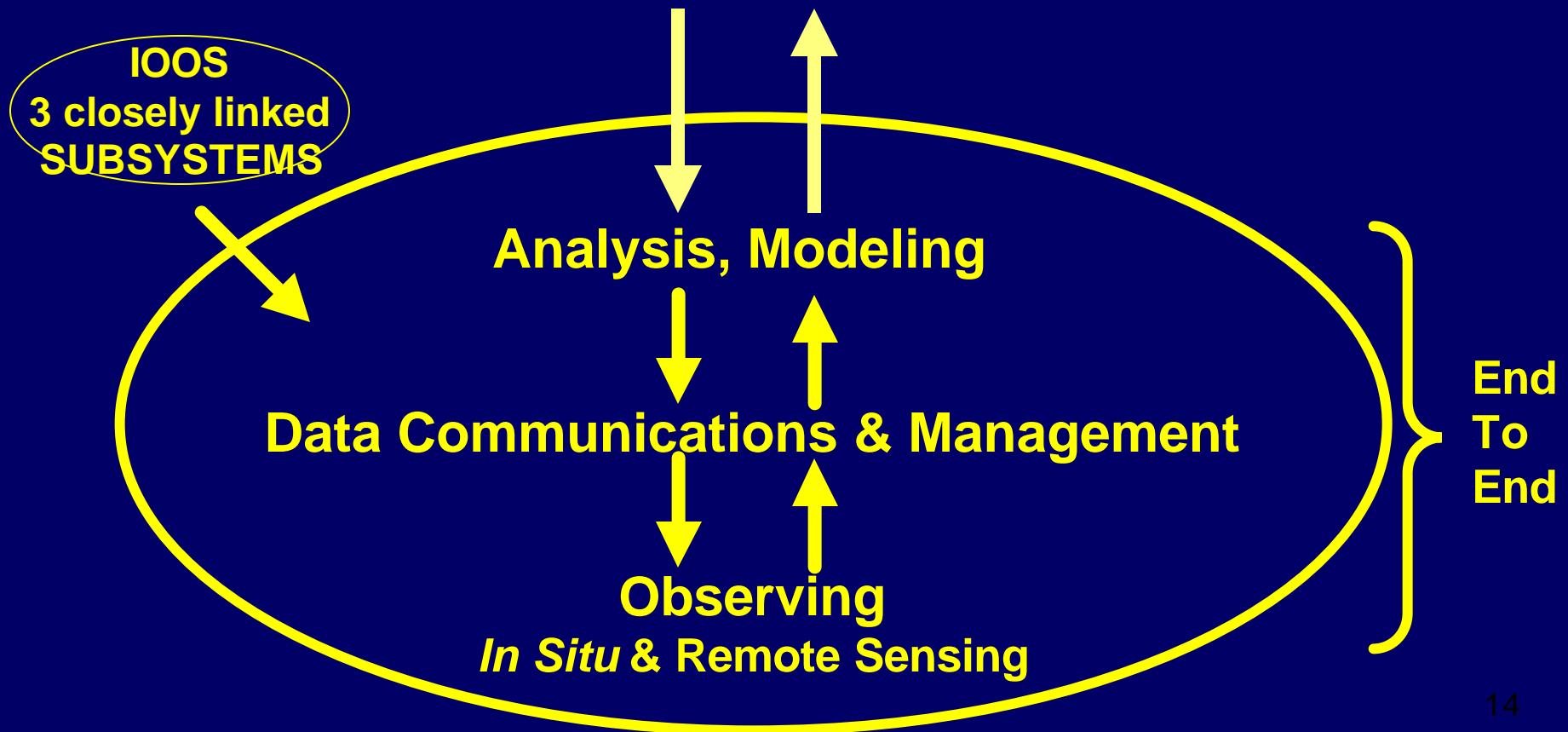
- **Implement an Integrated Ocean Observing System**
  - **Makes more effective use of existing assets**
  - **Enhanced over time as new technologies, knowledge & user groups develop**
- **Authorize & appropriate**
  - **\$138 M for FY 2006**
  - **\$600 M by FY 2010**
- **Interagency program funded through NOAA as the lead agency**
- **Codify OceanUS as the Planning Office for the IOOS**

# What is an Integrated Ocean Observing System (IOOS)?

- **A sustained system that repeatedly & routinely provides data & information required by groups & the public that**
  - use, depend on, manage, or study marine systems from waves to whales
- **An “end-to-end” system**
  - Multiple applications are efficiently linked to observations via integrated data management & analysis
- **A data management & communications subsystem that provides rapid access to diverse data from many sources – data fusion**
- **An interdisciplinary system that provides data required to rapidly detect & predict changes in the state of**
  - Physical, Chemical, Biological & Ecological systems
- **A system that makes more effective use of the collective assets of federal & state agencies, academia & private enterprise**

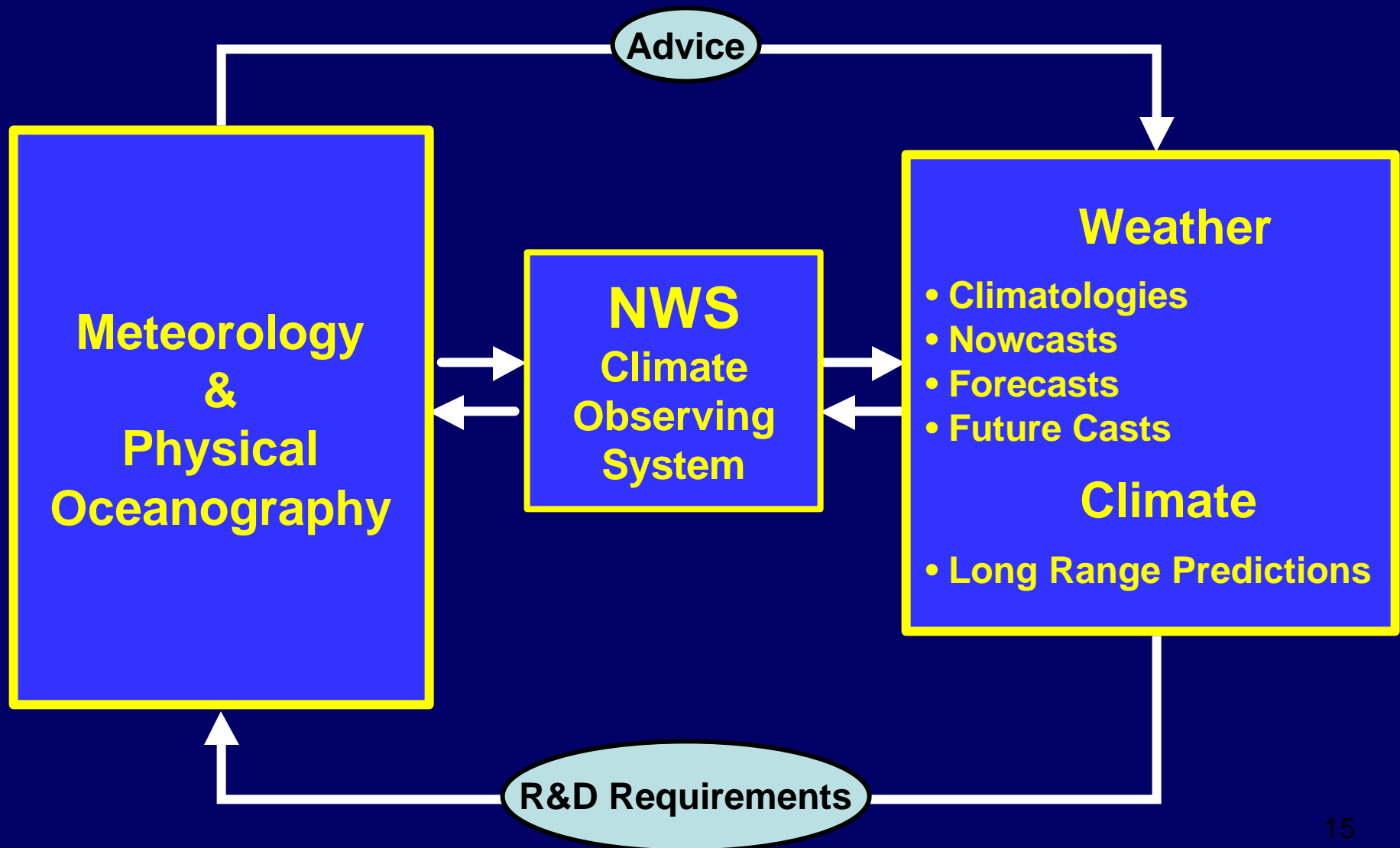
# User-Driven, End-to-End

Continuously, routinely & repeatedly  
Provides Data & Information  
Specified by Multiple User Groups

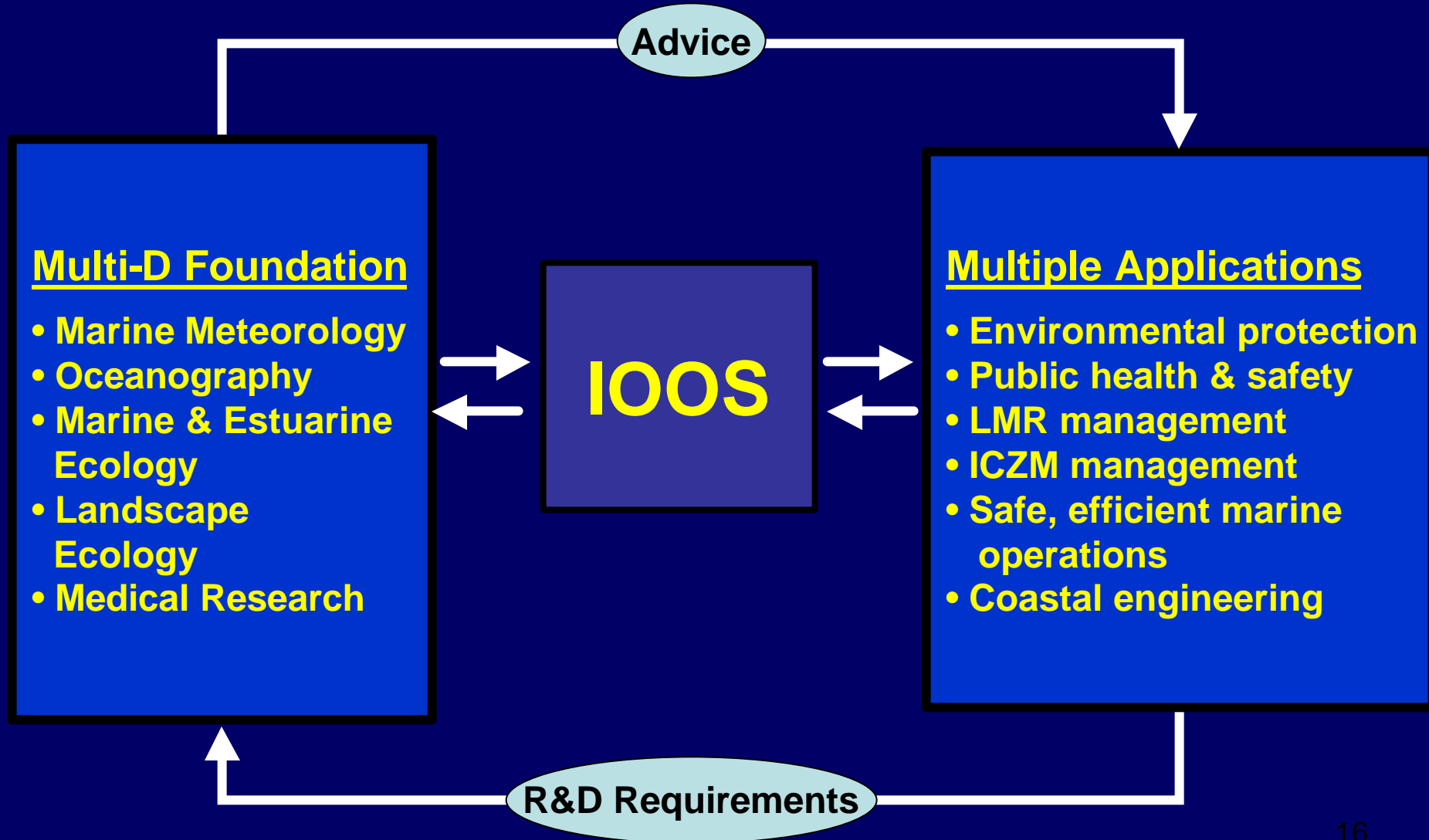


# National Weather Service

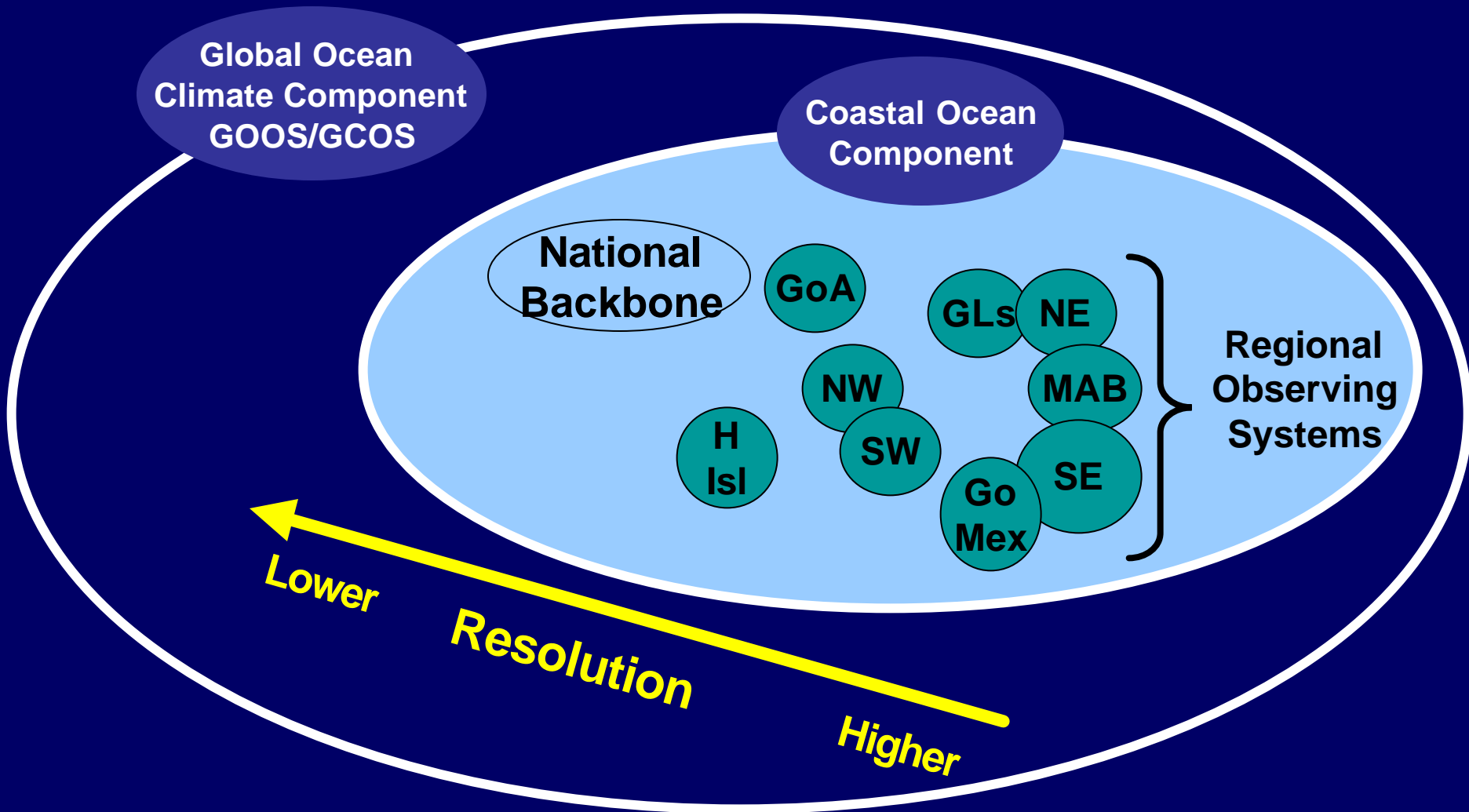
## A Model for an Operational, End to End Observing System



# Detecting & Predicting Change in Oceans & Coasts



# IOOS: Hierarchy of Observations



# U.S. Coastal Component

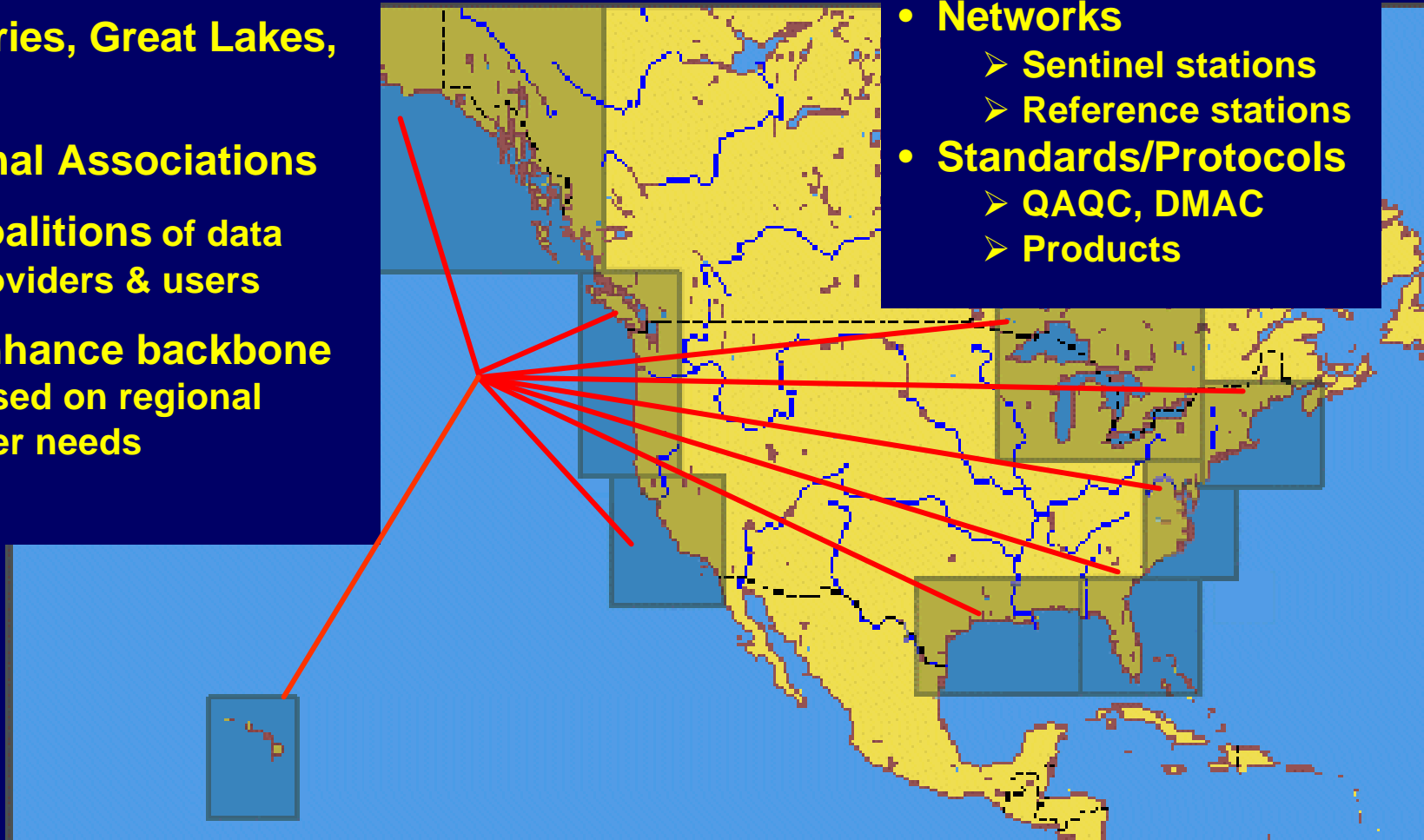
<http://ocean.us>

## Regional COOS's

- Estuaries, Great Lakes, EEZ
- Regional Associations
  - Coalitions of data providers & users
  - Enhance backbone based on regional user needs

## National Backbone

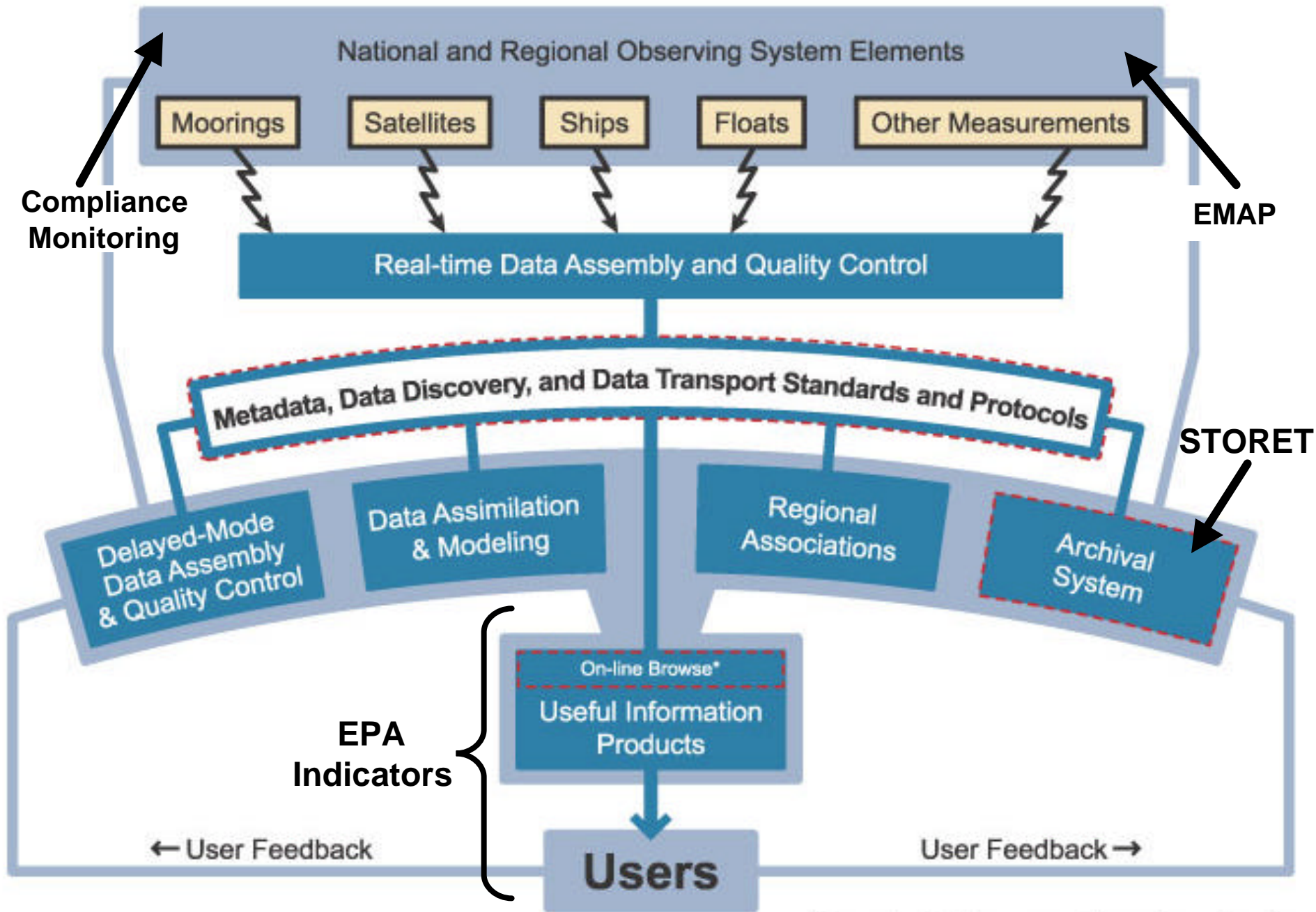
- EEZ & Great Lakes
- Federal Agencies
  - Design
  - Operate
- Core variables
  - Required by regions
- Networks
  - Sentinel stations
  - Reference stations
- Standards/Protocols
  - QAQC, DMAC
  - Products



# Developing Operational Ecology for Environmental Protection

- **EMAP is a research program to**
  - “develop the tools necessary to monitor & assess the status & trends of national ecological resources”
- **A major objective of the STAR Program**
  - develop indicators of ecological condition, integrity & sustainability
- **If indicators are to be used for management purposes,**
  - they must be determined routinely & repeatedly at rates specified by decision makers, e.g., daily, monthly, yearly.
- **Requires a sustained & integrated observing system for coastal ecosystems**
  - that EPA can benefit from & contribute to
  - as both a user & a provider of data & information generated by the IOOS

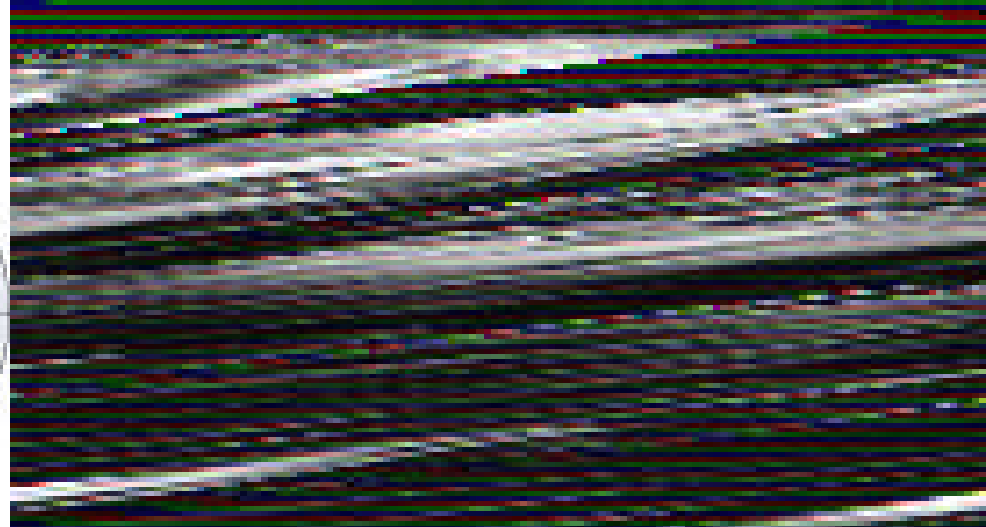
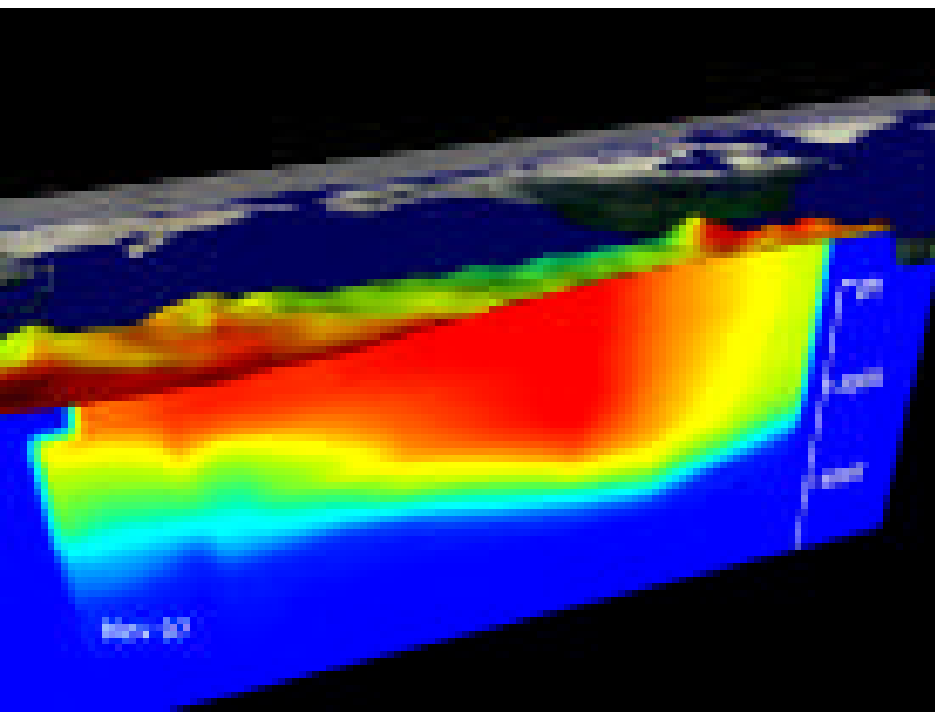




\*Guaranteed minimum geo- and time-referenced on-line browse and subsetting capability for all IOOS data












<http://ocean.us>

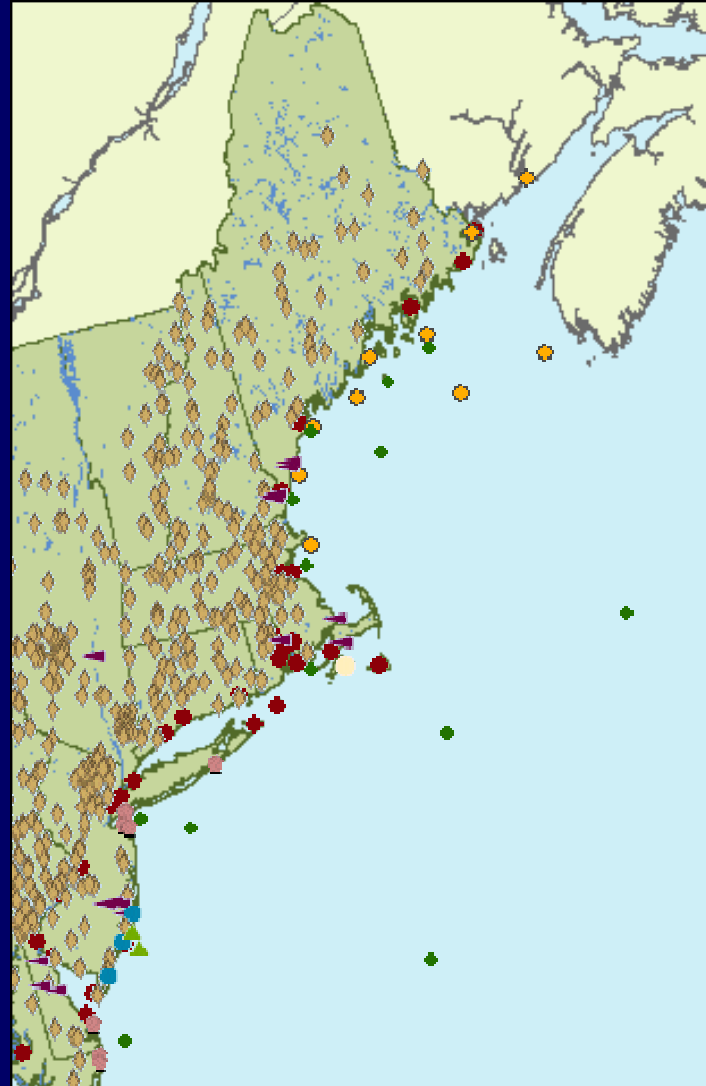


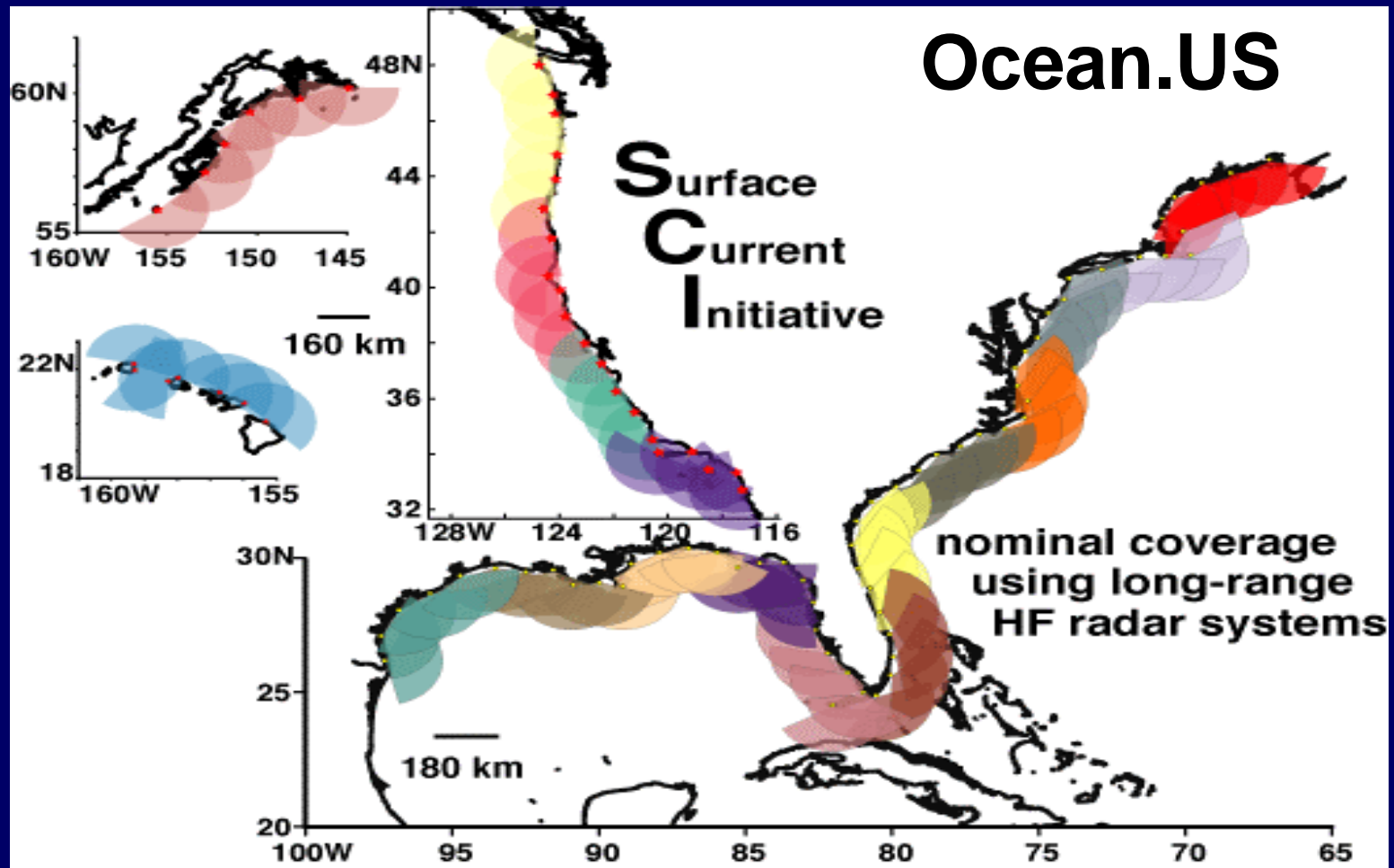
THANK YOU

# Northeast Atlantic Region

## Observing Systems

COOL

NJ CMN

Marthas Vineyard

NERR

GOMOOS

NDBC

COE Waves

NWLON

USGS Stream






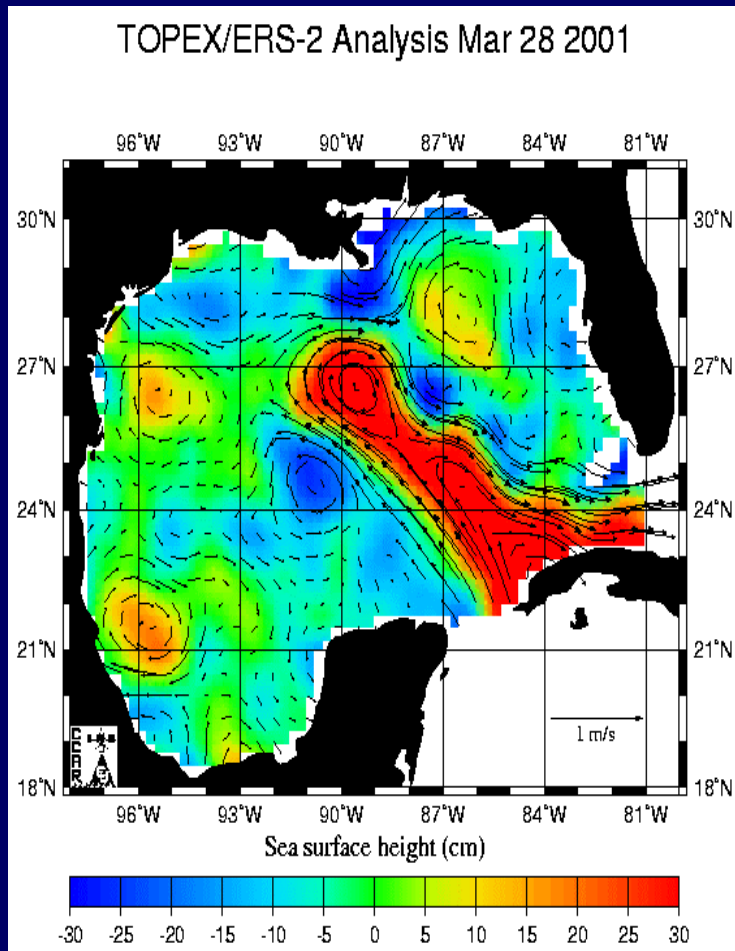
**Goal:** Serve surface current velocity maps in real – time

**Challenges:**

Establish coastal network of HF Radar systems &

Rapidly integrate data from HF Radars, Satellites, & *In situ* instruments<sup>23</sup>

# Surface Current Mapping: Multiple Applications

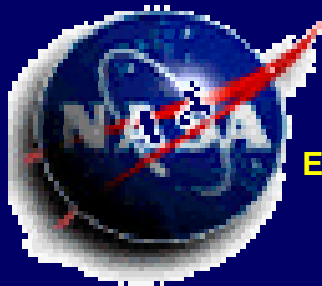


- **Search & Rescue**
  - More rapid recovery
- **Ship Routing & Detection**
  - Improved fuel efficiency, safety
- **Mitigate effects of oil spills, point source plumes & HABs**
  - More accurate forecasts of trajectories
- **Sustainable Fisheries**
  - More accurate estimates of recruitment
- **Ocean Science**
  - Improved understanding of marine & estuarine ecosystems



# A Sampling of Federal Agencies & Programs Engaged in Coastal Research & Monitoring

~\$ 650 M year<sup>-1</sup>



Earth Science  
Enterprise



NOAA's National  
Estuarine Research  
Reserve System



Environmental Monitoring and  
Assessment Program



EPA's BEACH Watch Program



National Coastal  
Assessment –  
Coastal 2000



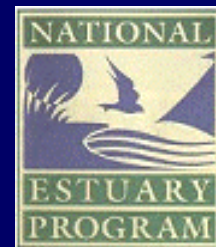
EPA Great Waters Program



CWAP: Coastal Research  
and Monitoring Strategy



NOAA National  
Status and Trends



National Estuary  
Program



U.S. Fish and Wildlife  
Service Coastal  
Program



National Marine  
Sanctuary Program

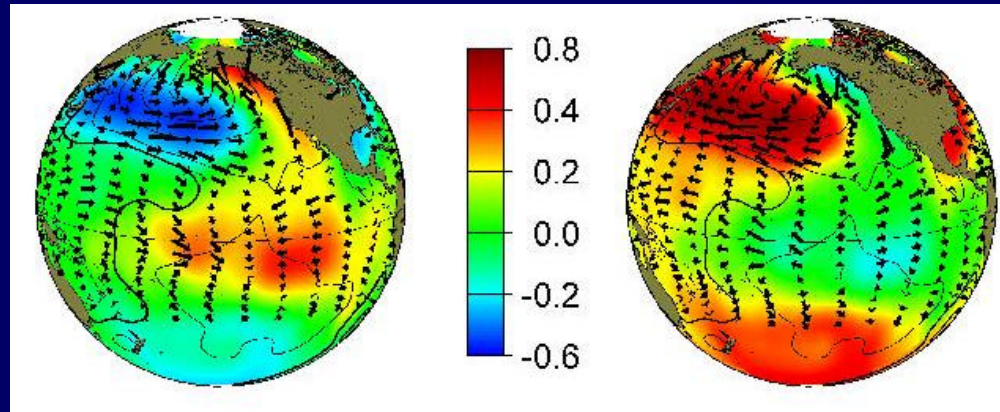


Coastal Zone  
Management Act



National Streamgauging  
Program

# Pacific Decadal Oscillation



Warm

Cool

Warm

