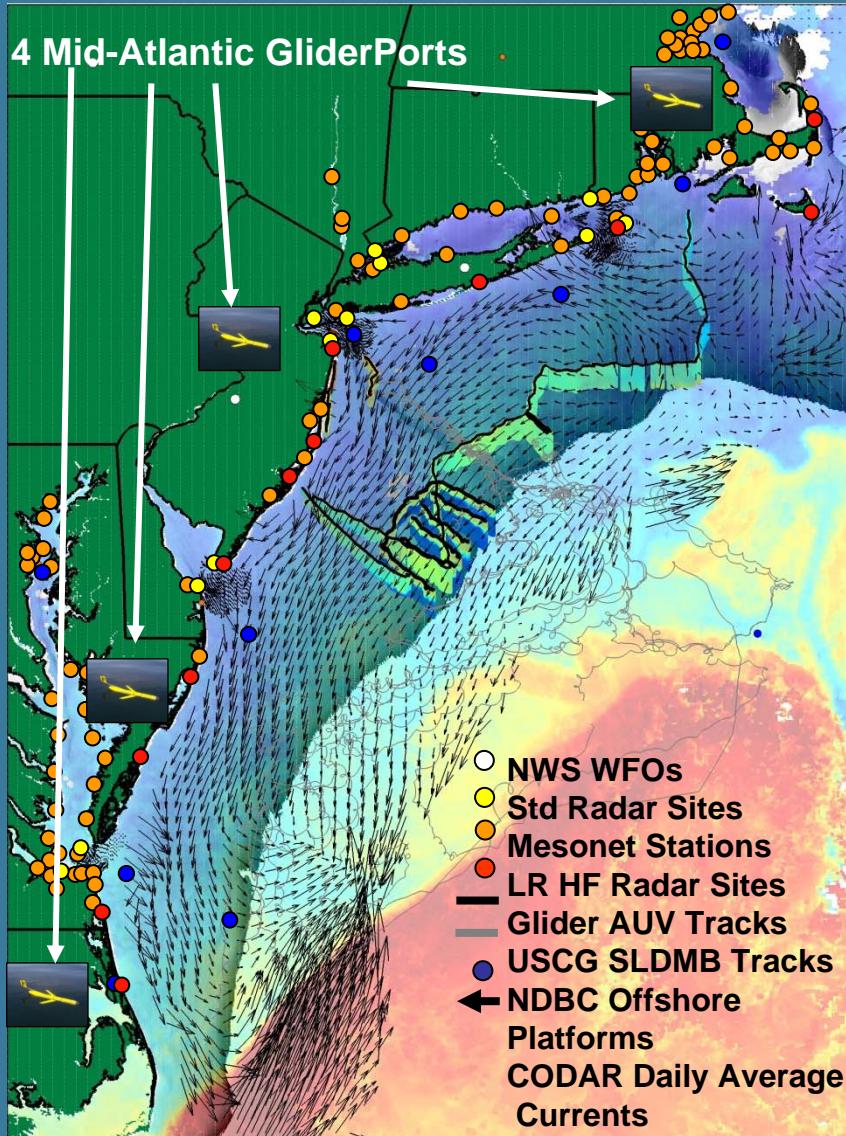


# Mid-Atlantic Regional Coastal Ocean Observing System



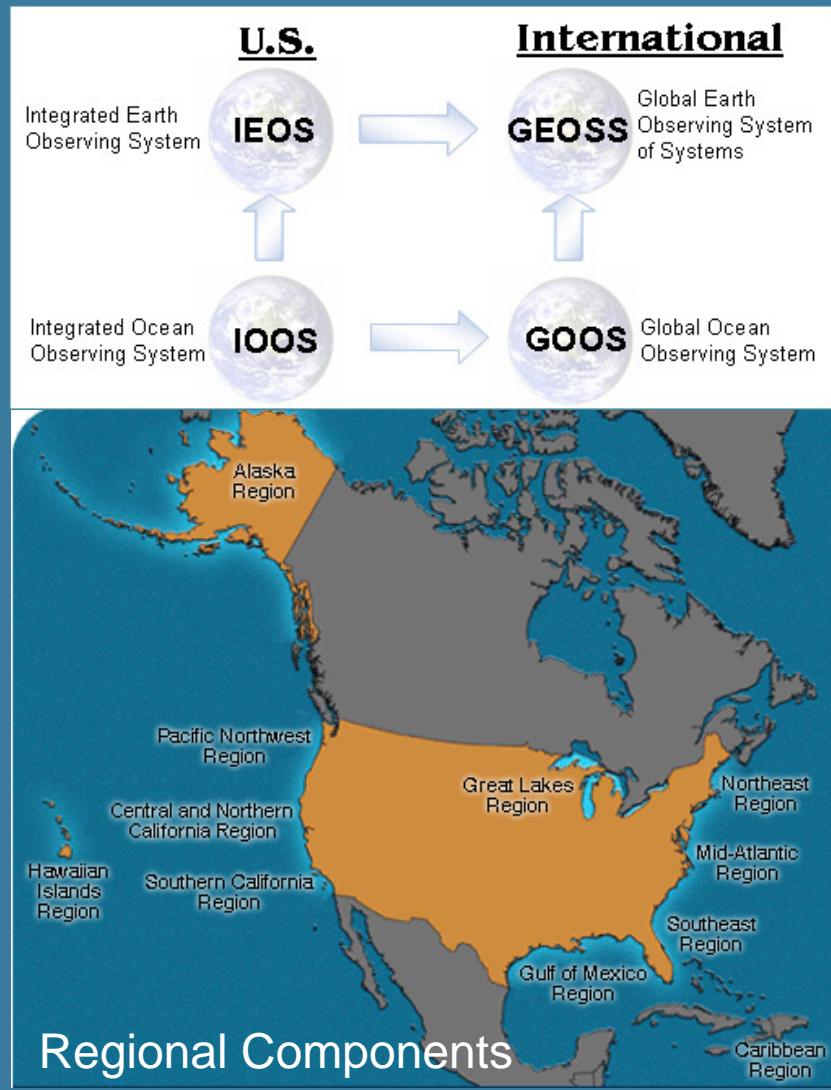
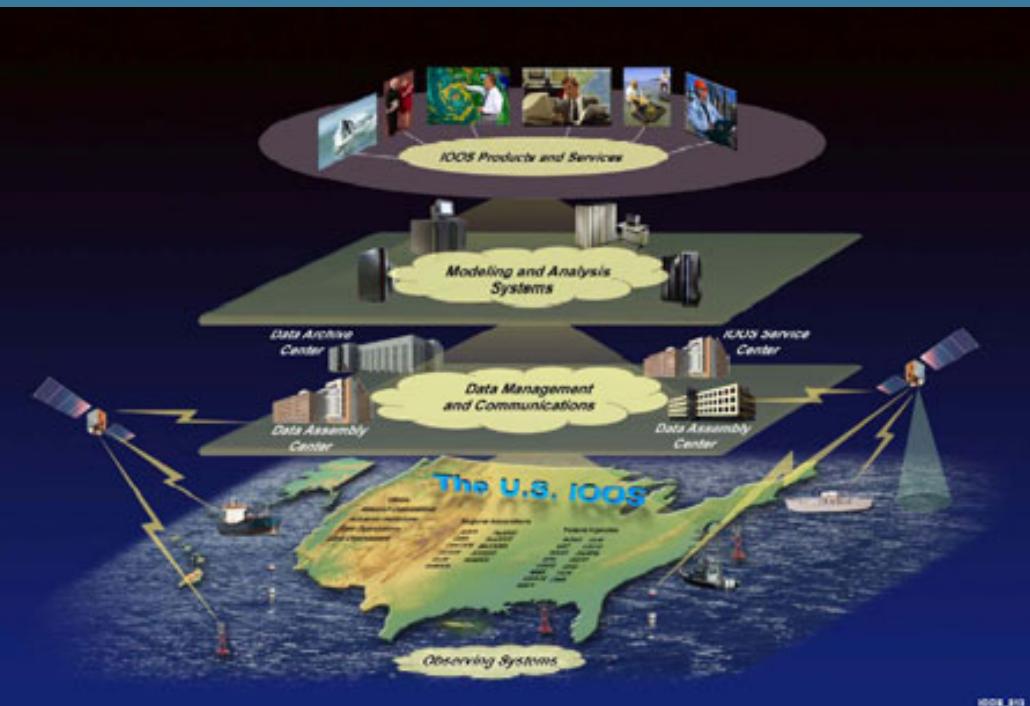
30 Co-PIs, 20 Institutions

Investigator	Affiliation	Investigator	Affiliation
A. Allen	U.S. Coast Guard	L. Atkinson	Old Dominion University
A. F. Blumberg	Stevens Institute of Technology	W. Boicourt	University of Maryland
W. Brown	University of Massachusetts	M. Bruno	Stevens Institute of Technology
D. Chapman	University of Delaware	A. Cope	NOAA Mount Holly WFO
A. Gangopadhyay	University of Massachusetts	T. Herrington	Stevens Institute of Technology
D. Holloway	OPeNDAP	E. Howlett	Applied Science Associates
D. King	University of Maryland	J. Kohut	Rutgers University
B. Lipphardt	University of Delaware	A. MacDonald	Monmouth University
J. McDonnell	Rutgers University	J. Moisan	NASA Wallops
J. O'Donnell	University of Connecticut	M. Oliver	Rutgers University
O. Schofield	Rutgers University	H. Seim	University of North Carolina
J. Titlow	WeatherFlow Inc.	D. Ullman	University of Rhode Island
J. Wilkin	Rutgers University	R. Wilson	SUNY, Stony Brook
W. Wittman	Public Service Electric & Gas	M. Yarosh	CIT
A. Voros	NY/NJ COAST	S. Glenn	Rutgers University

# U.S. Integrated Ocean Observing System (IOOS)

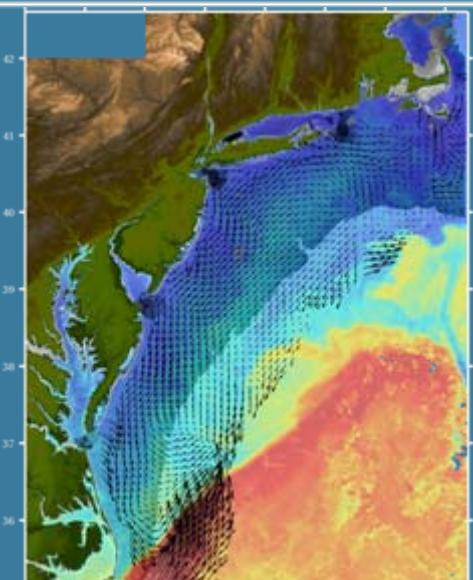
## US IOOS Components

- 1) International Component
- 2) National Component
  - a) 17 Federal Agencies
  - b) 11 Regional Associations

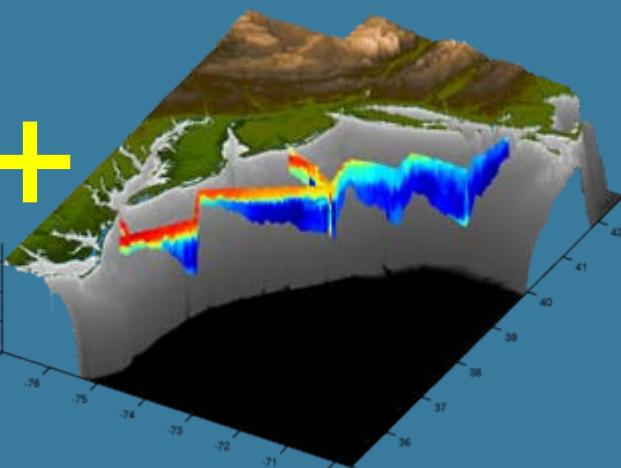


IOOS  
Observing, Data Management, Modeling

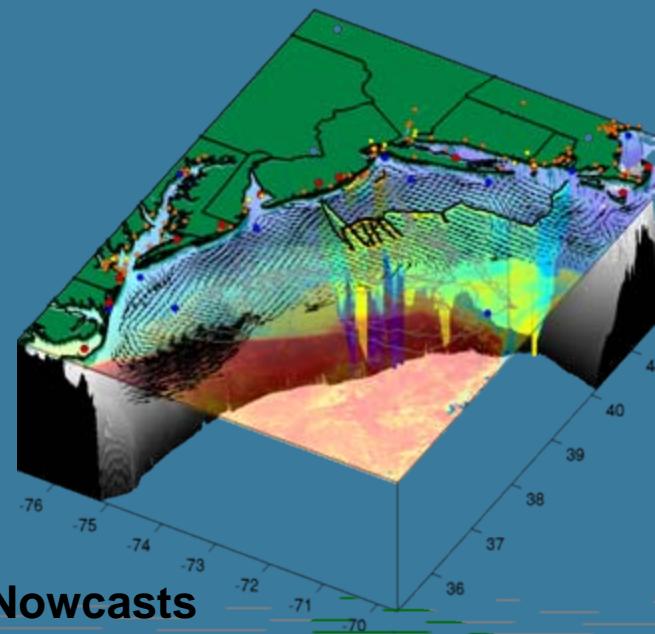
# Composite Data & Forecast Products



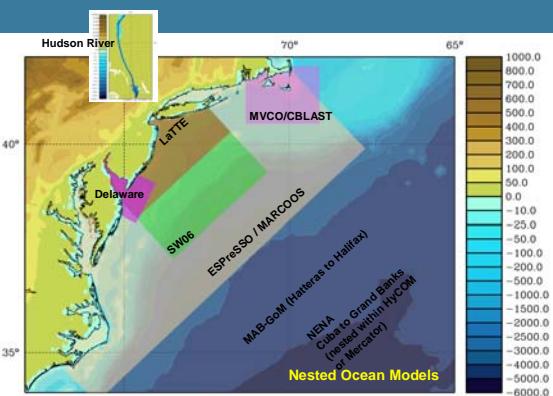
Remote Sensing



Gliders



3-D Nowcasts



Nested Models

**S4DVAR procedure**

Lagrange function  $L = J(\mathbf{x}) + \sum_{i=1}^N \lambda_i^T \left( \frac{d\mathbf{x}_i}{dt} - \mathbf{N}(\mathbf{x}_i) - \mathbf{F}_i \right)$        $\mathbf{F}_i = \mathbf{F}(i\Delta t)$        $\mathbf{x}_i = \mathbf{x}(i\Delta t)$

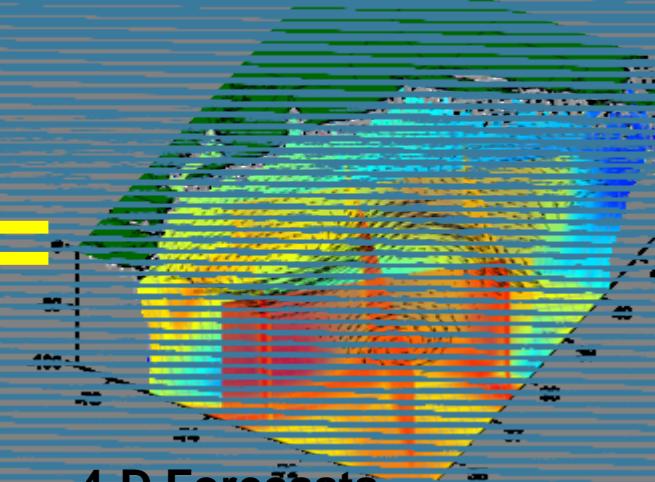
At extrema of  $L$ , we require:  $\frac{\partial L}{\partial \lambda_i} = 0 \Rightarrow \frac{d\mathbf{x}_i}{dt} - \mathbf{N}(\mathbf{x}_i) - \mathbf{F}_i = 0$       NLROMS

$$\frac{\partial L}{\partial \mathbf{x}_i} = 0 \Rightarrow -\frac{d\mathbf{x}_i}{dt} - \left( \frac{\partial \mathbf{N}}{\partial \mathbf{x}} \right)^T \lambda_i - \delta_{\mathbf{x}_i} \mathbf{H}^T \mathbf{O}^{-1} (\mathbf{H} \mathbf{x}_n - \mathbf{y}_n) = 0$$
      ADROMS
$$\frac{\partial L}{\partial \mathbf{x}(0)} = 0 \Rightarrow \mathbf{B}^{-1} (\mathbf{x}(0) - \mathbf{x}_s) - \lambda(0) = 0$$
      coupling of NL&ADROMS

**S4DVAR procedure:**

$$\frac{\partial L}{\partial \mathbf{x}(\tau)} = 0 \Rightarrow \lambda(\tau) = 0$$
      i.c. of ADROMS

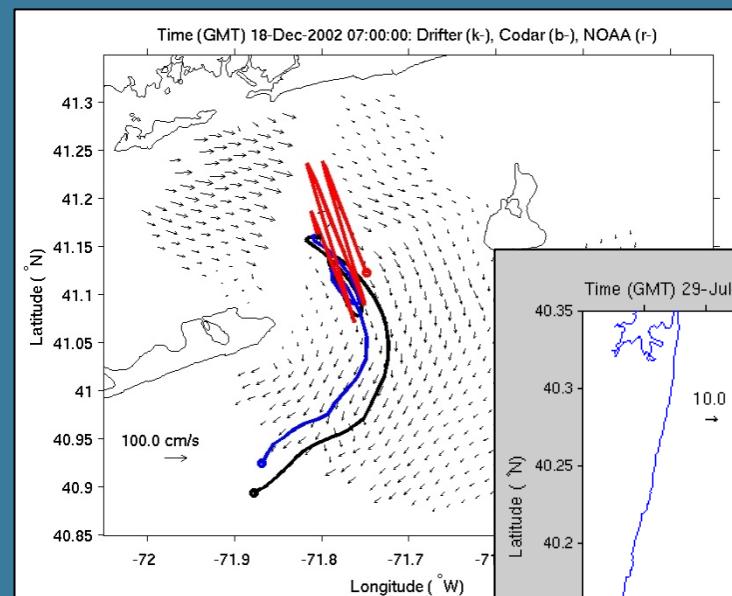
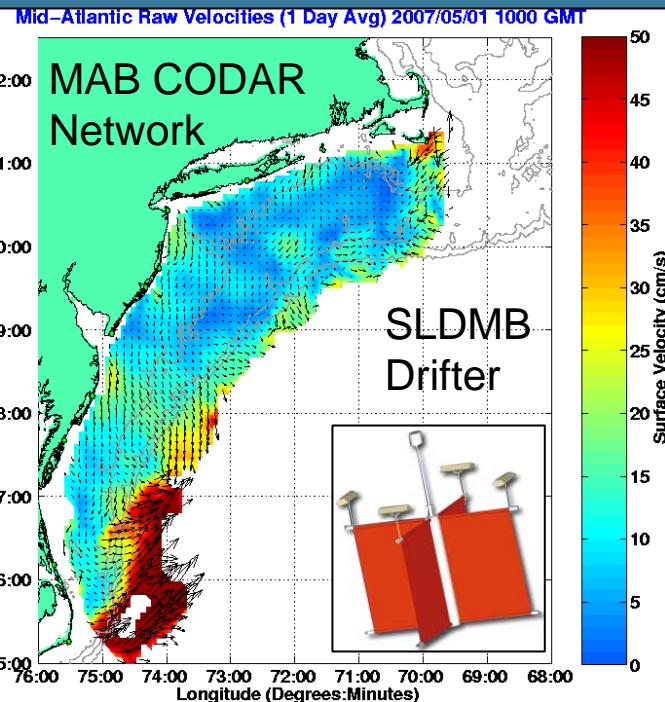
(1) Choose an  $\mathbf{x}(0) = \mathbf{x}_s$   
 (2) Integrate NLROMS  $t \in [0, \tau]$  and compute  $J$   
 (3) Integrate ADROMS  $t \in [\tau, 0]$  to get  $\lambda(0)$   
 (4) Compute  $\frac{\partial J}{\partial \mathbf{x}(0)} = \mathbf{B}^{-1} (\mathbf{x}(0) - \mathbf{x}_s) - \lambda(0)$   
 (5) Use a descent algorithm to determine a "down gradient" correction to  $\mathbf{x}(0)$  that will yield a smaller value of  $J$   
 (6) Back to (2) until converged



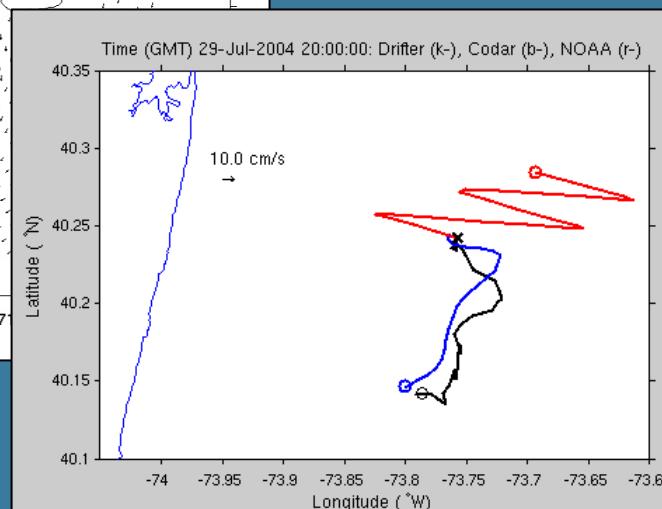
Data Assimilation

4-D Forecasts

# MARCOOS Theme 1: Maritime Safety – Search And Rescue

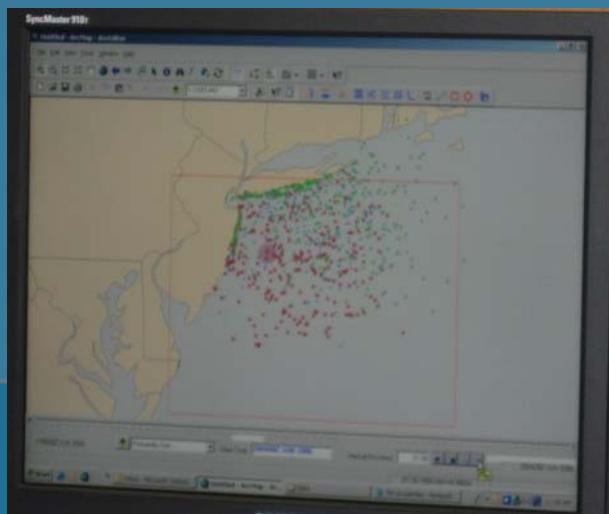


NOAA Coastal Site  
CODAR Currents  
SLDMB Drifter

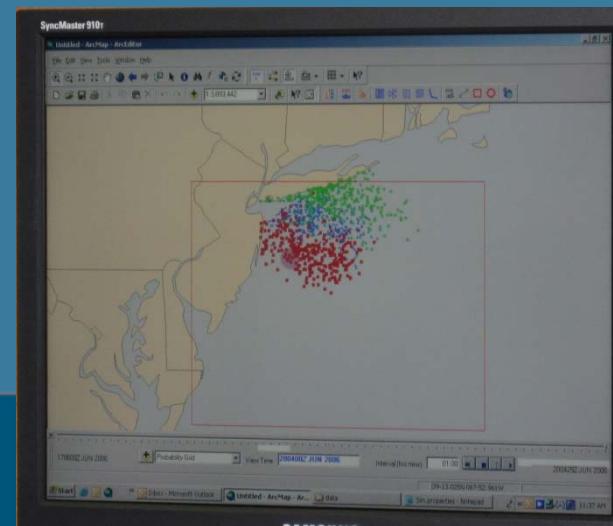


Drifter Test Results –  
CODAR Exceeds  
Present Methodology

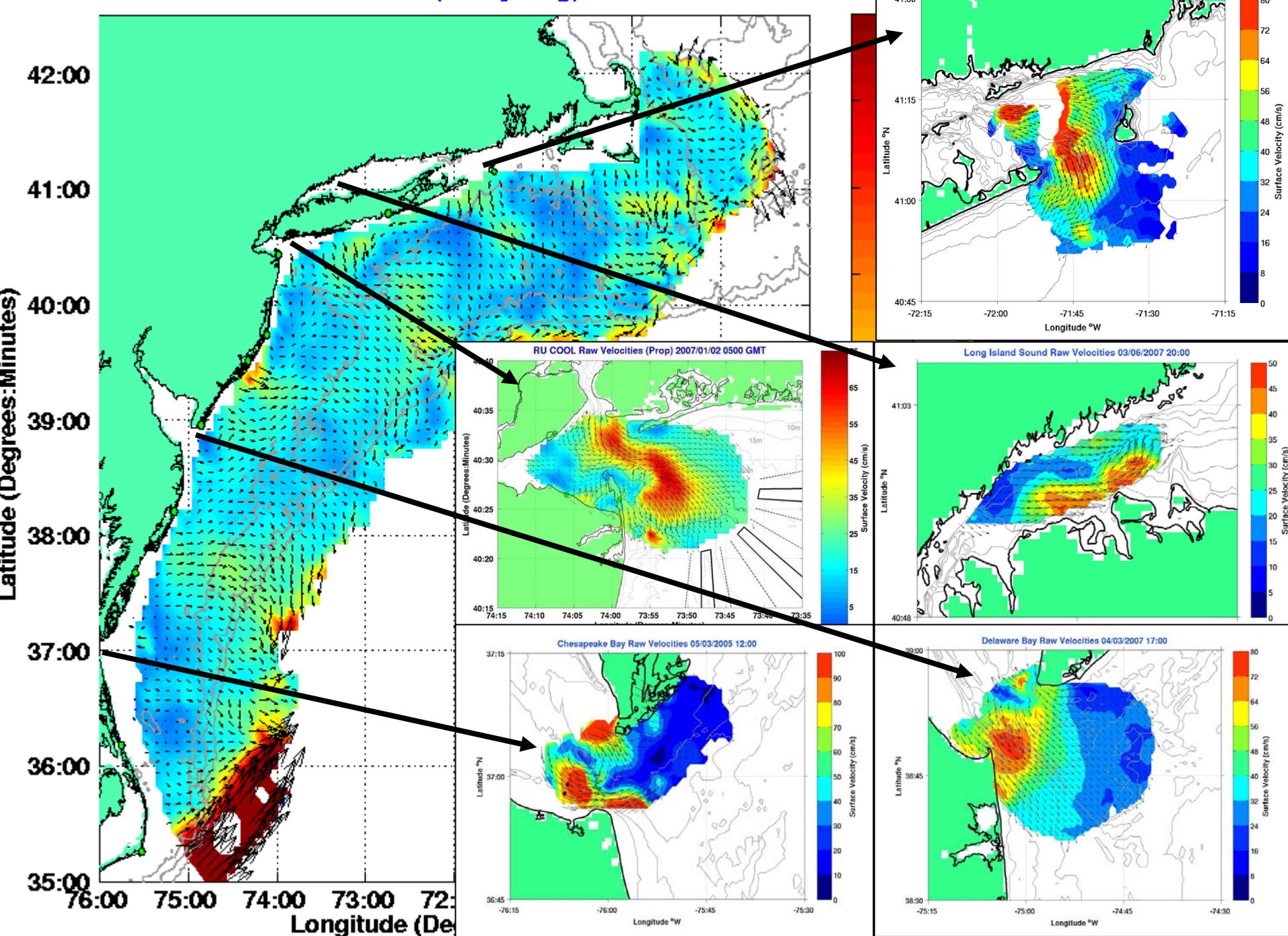
SAROPS  
Before  
CODAR –  
Large  
Random  
Search  
Area



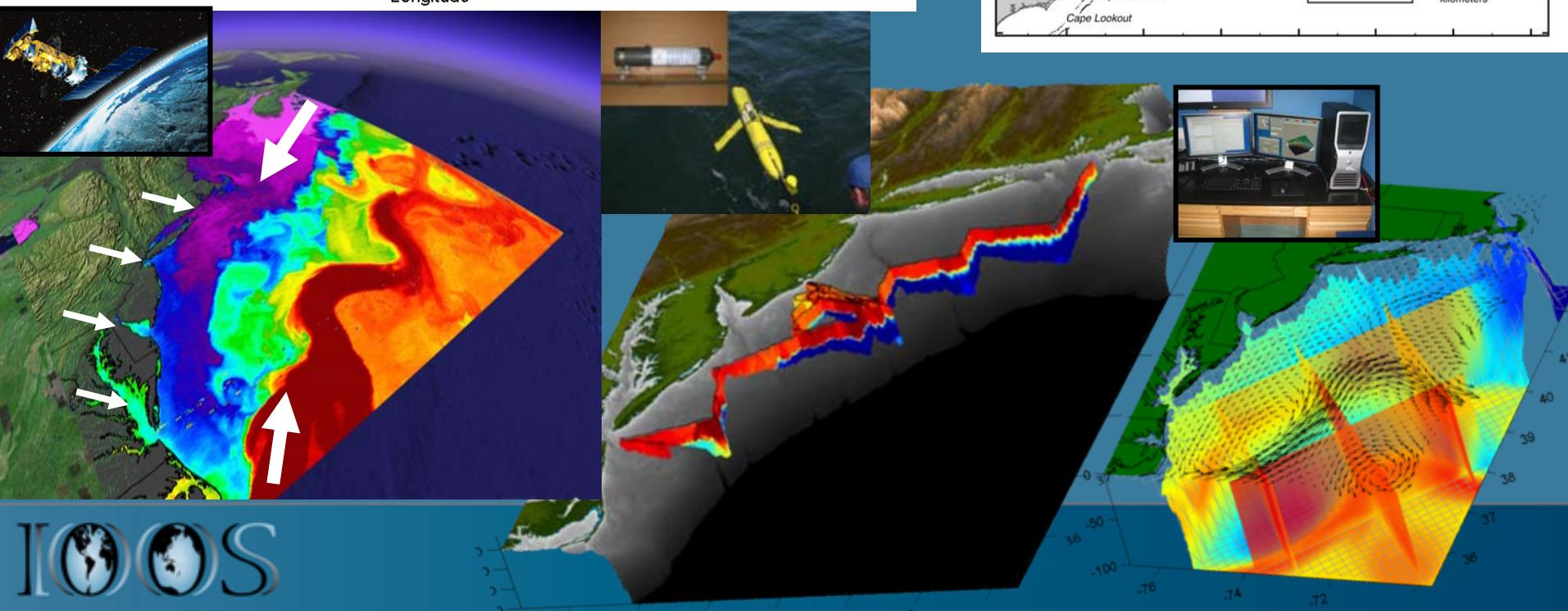
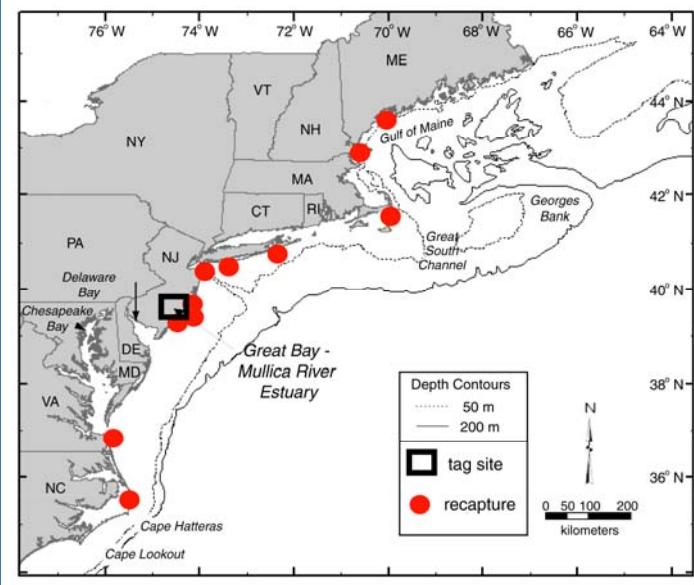
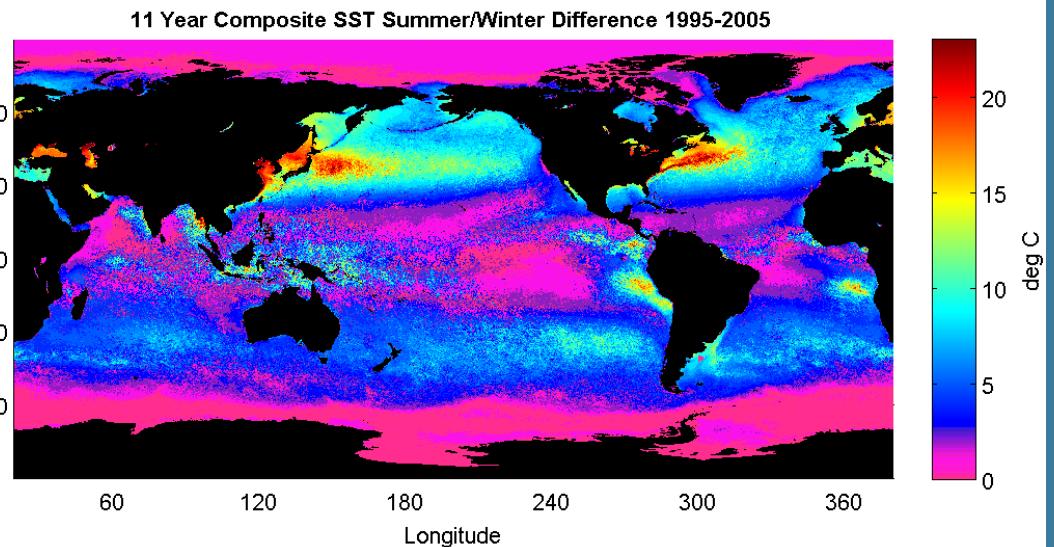
SAROPS  
After  
CODAR –  
Small  
Stratified  
Search  
Areas



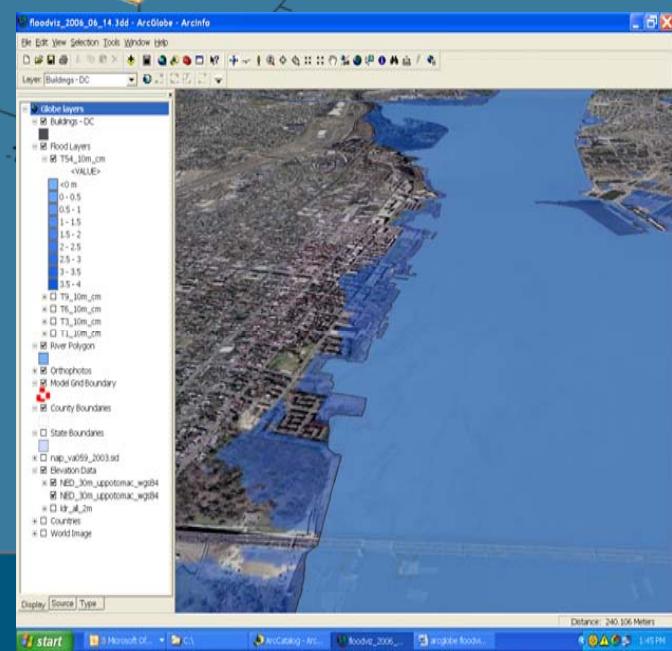
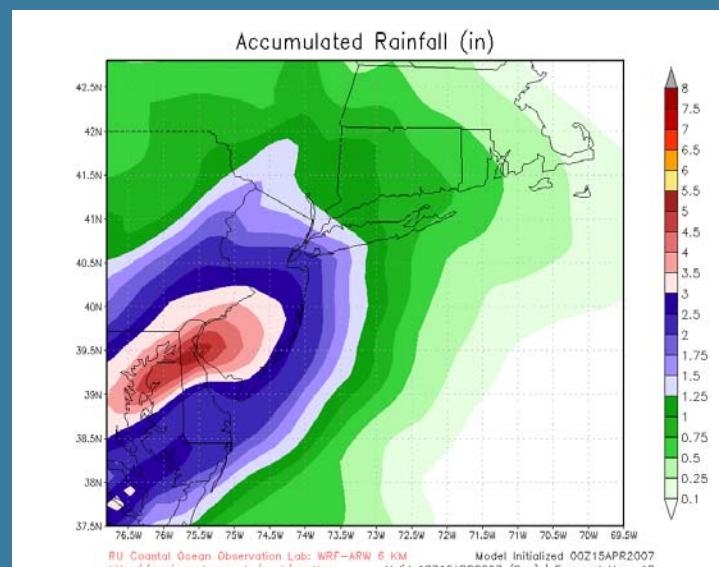
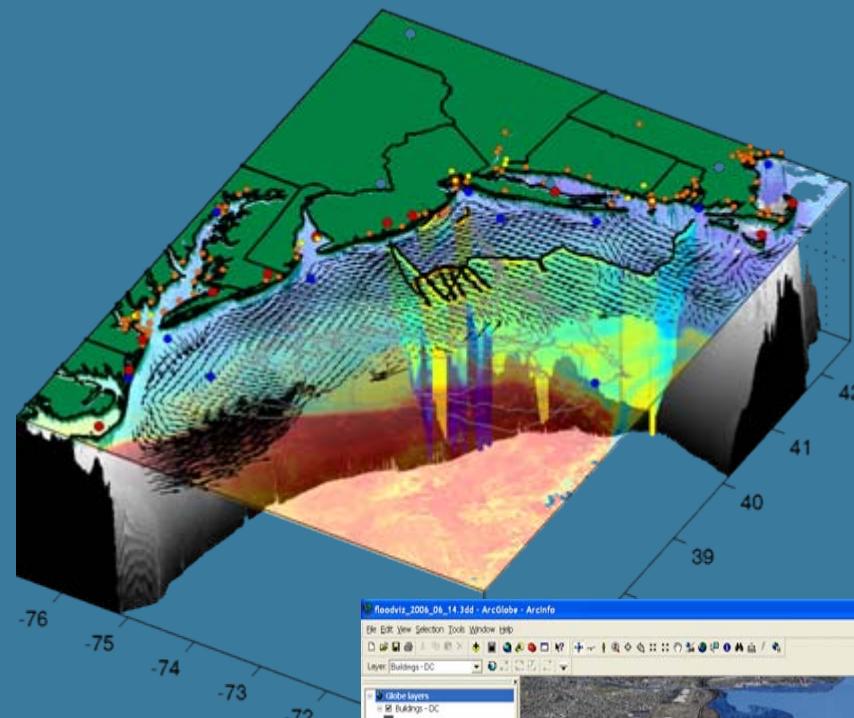
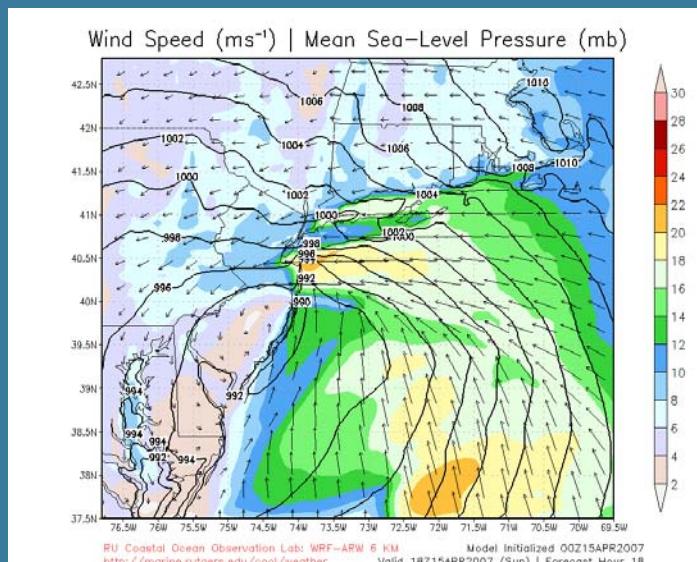
# Mid-Atlantic Raw Velocities (1 Day Avg) 2007/07/20 0500 GMT



# Regional Theme 2: Ecological Decision Support - Fisheries



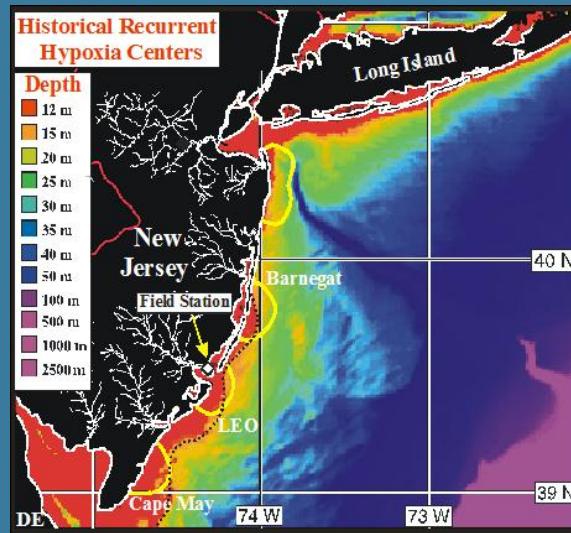
# MARCOOS Regional Support for Coastal Inundation



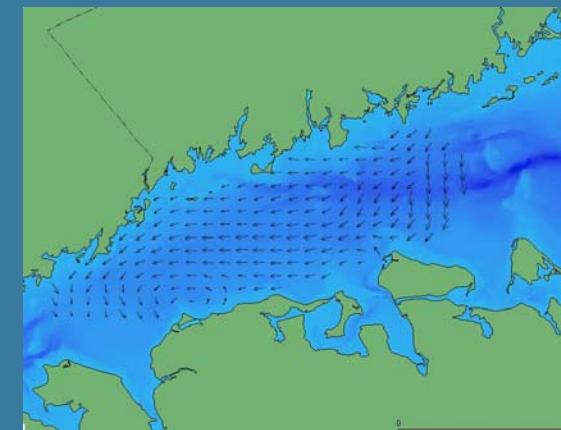
# MARCOOS Regional Support for Water Quality Projects



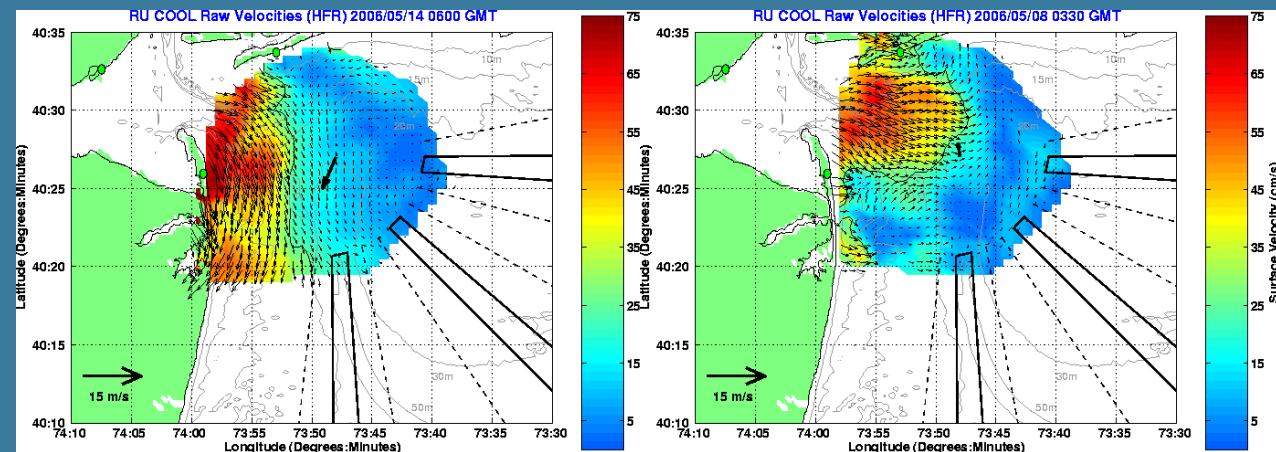
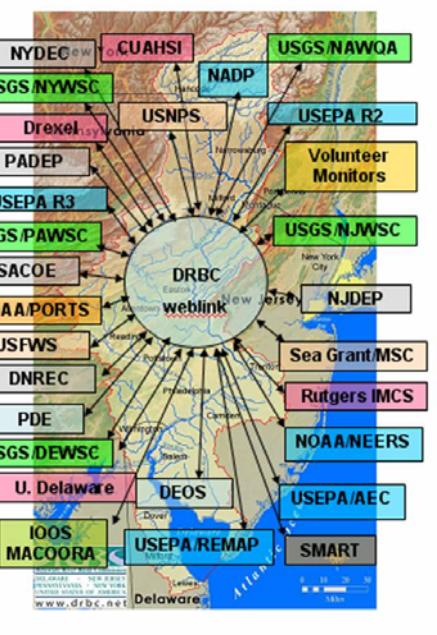
NERRS



NJ Coast Recurrent Hypoxia



LIS Water Quality



Monmouth County Health



Delaware River Basin NWQMN Pilot Study

# U.S. IOOS - Ecosystem Based Management

## North East Observing System (NEOS)

Large Marine Ecosystem #7  
Northeast U.S. Continental Shelf

Fisheries Survey & Argo Drifters

Met. Stations & QuikSCAT

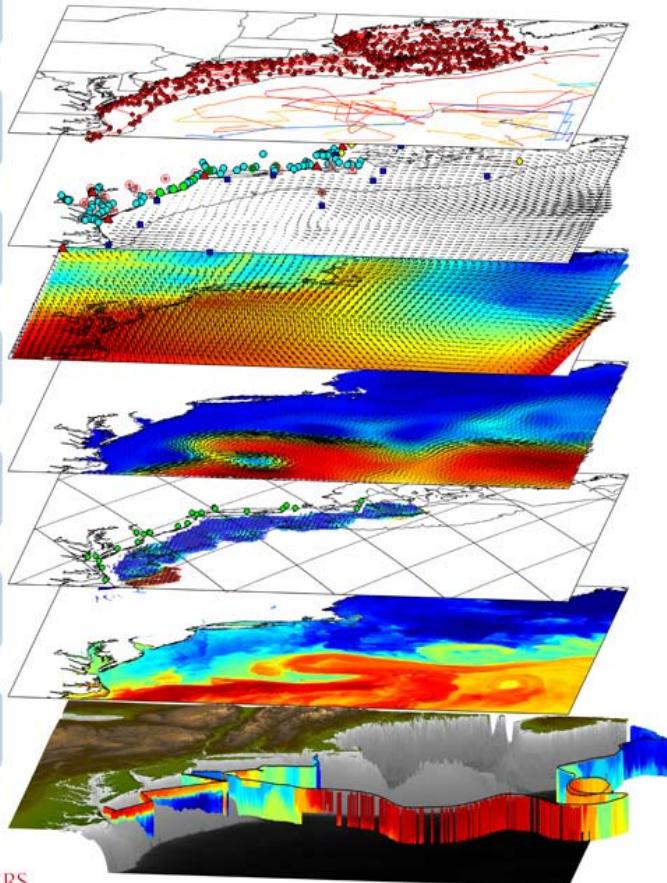
WRF Atmospheric Forecast

ROMS Ocean Forecast

HF Radar & Altimetry

Satellite Imagery

Autonomous Underwater Gliders



## Large Marine Ecosystems

Fisheries Surveys & Argo Drifters

Met. Stations & QuikSCAT

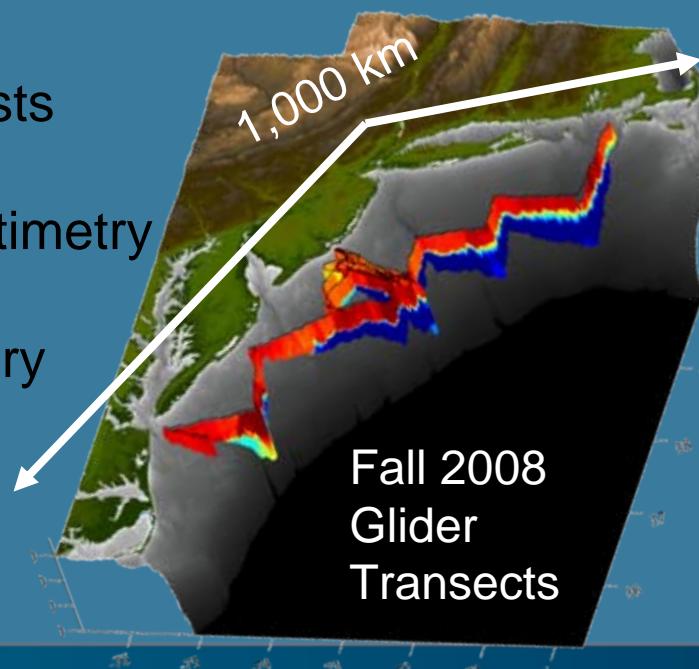
Atmospheric Forecasts

Ocean Forecasts

HF Radar & Altimetry

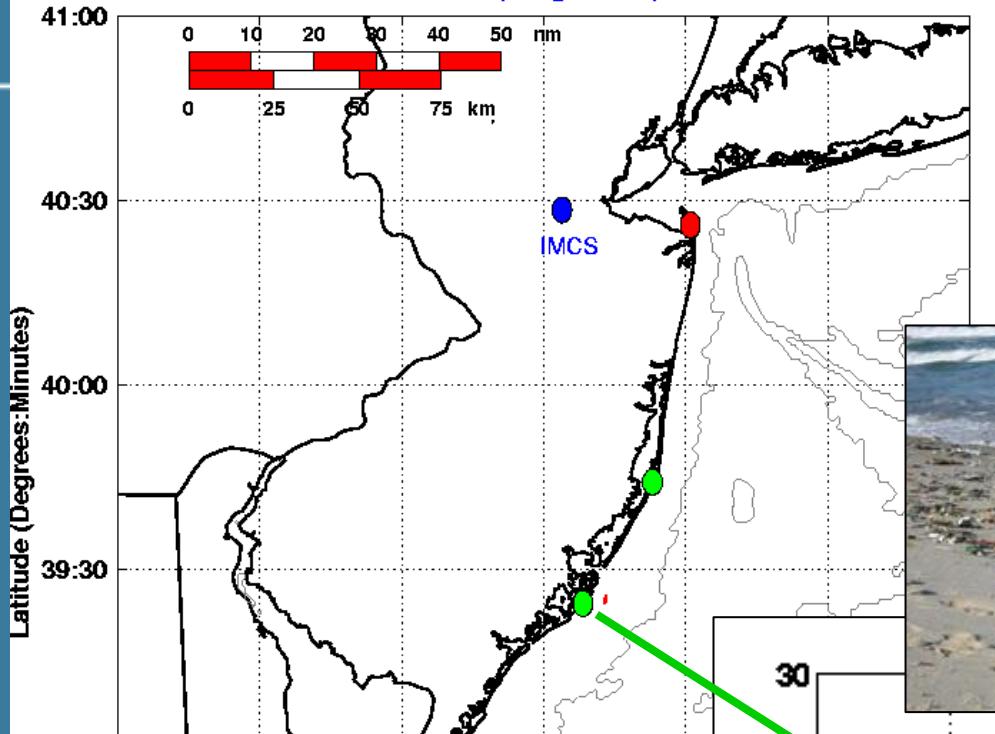
Satellite Imagery

Glider Fleets



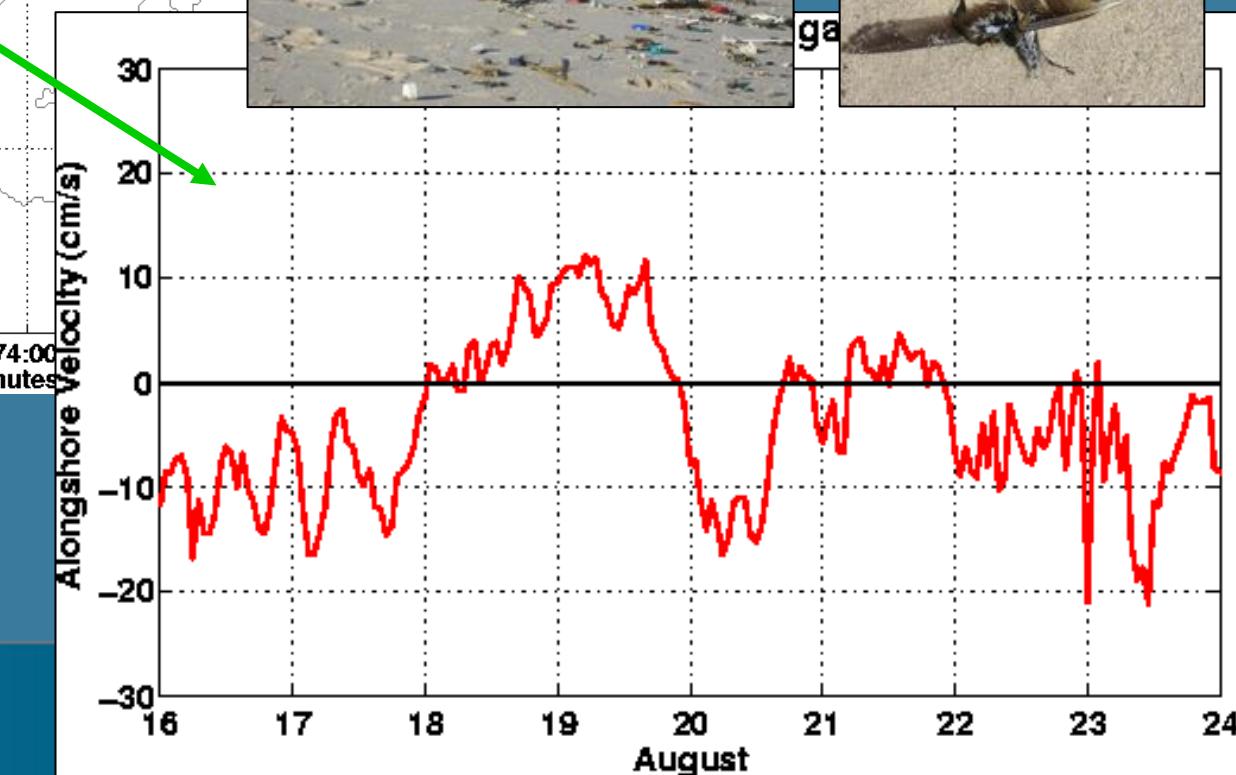
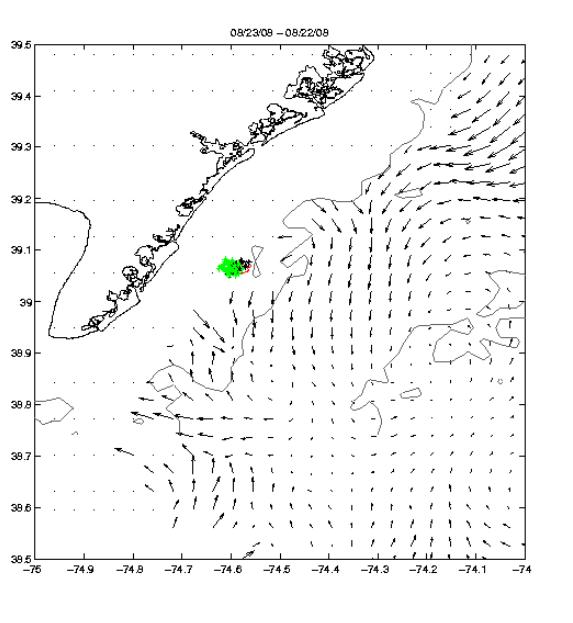
### RU COOL Raw Velocities (Single Site) 2008/08/29 1100 GMT

## Floatable Events

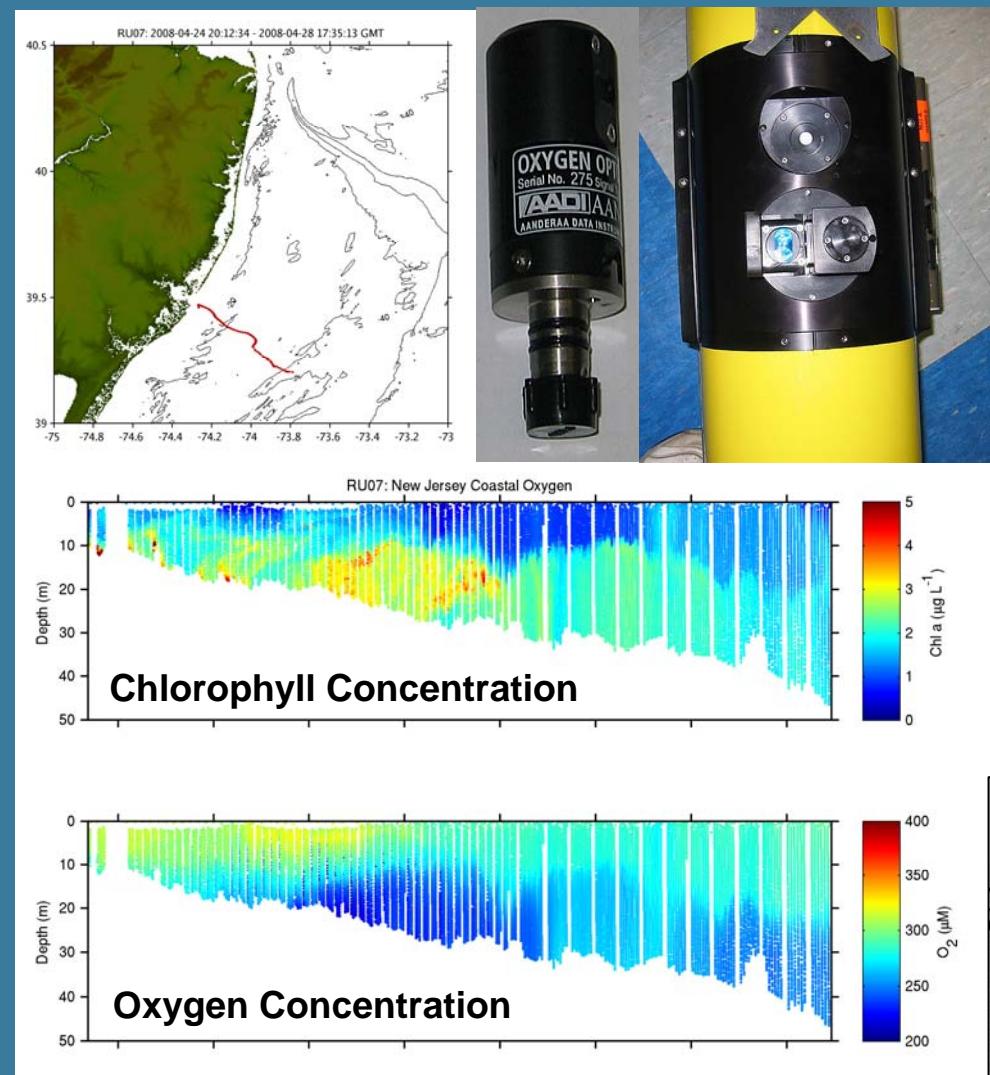


2007: Normandy Beach, NJ

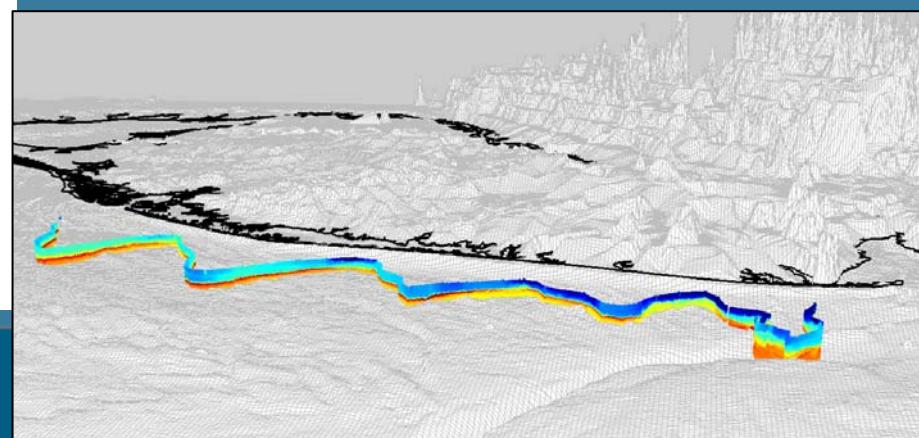
2008: Avalon, NJ



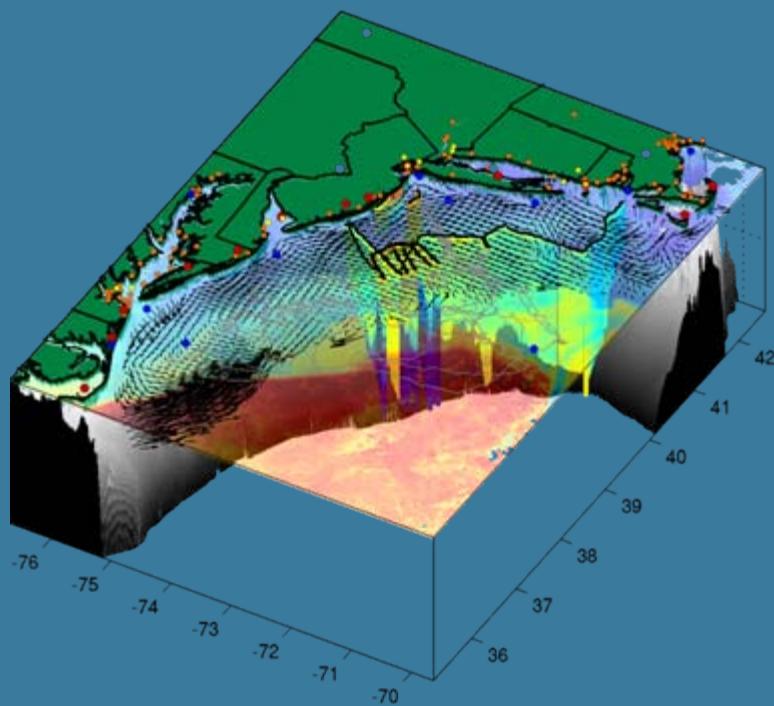
NOAA OE & NJ DEP: The production of CDOM & detritus tightly coupled to phytoplankton growth; therefore there is need to measure growth and metabolism.



Oxygen  
Phytoplankton health



# For More Information...



*Mid-Atlantic Regional Efforts:*  
<http://www.macoora.org/>

*Real-Time Data Links:*  
<http://rucool.marine.rutgers.edu>