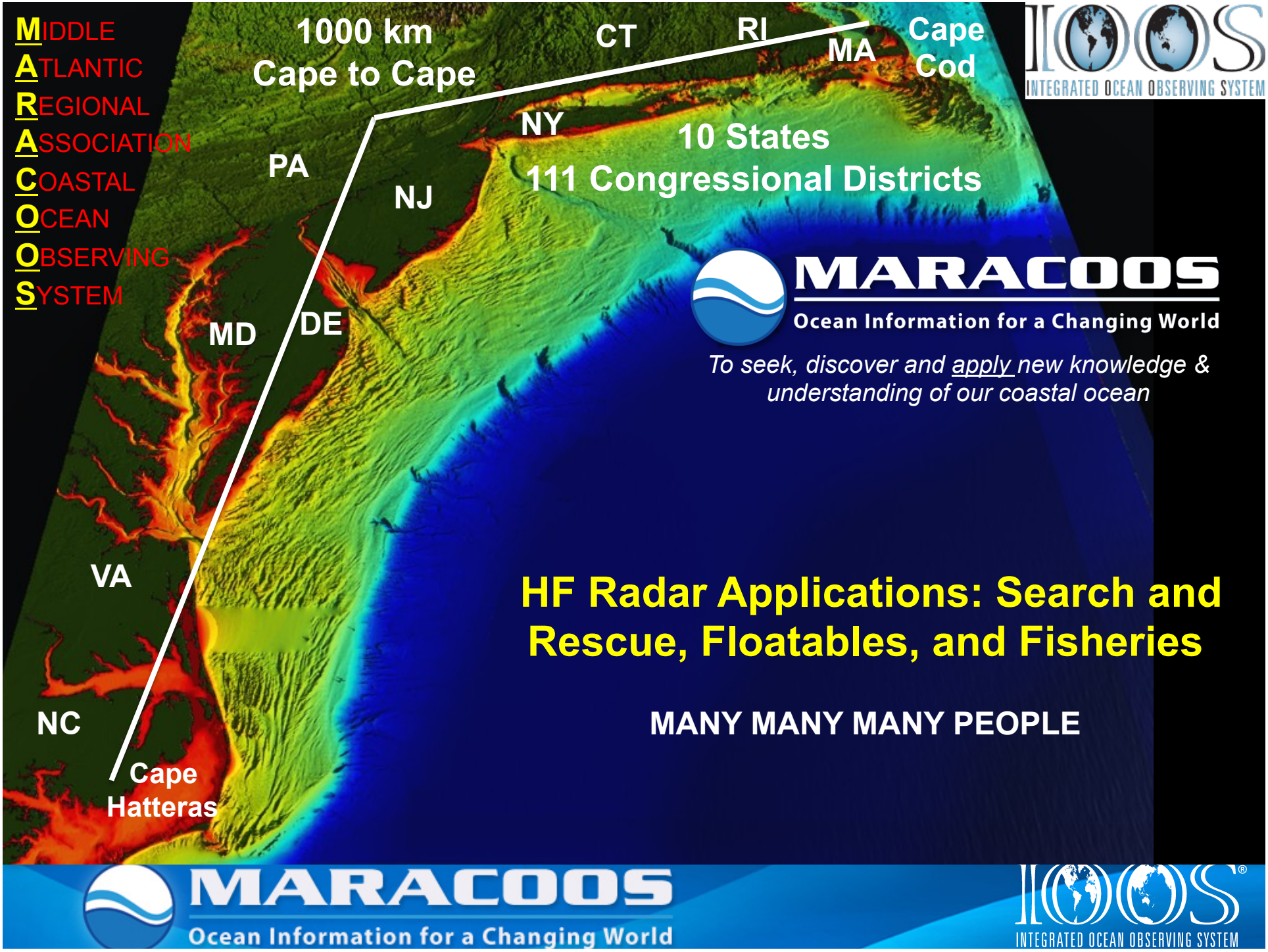
MIDDLE ATLANTIC REGIONAL ASSOCIATION COASTAL OCEAN OBSERVING SYSTEM
1000 km
Cape to Cape
CT
RI
MA
Cape Cod
NY
10 States
111 Congressional Districts
PA
NJ
MD
DE
VA
NC
Cape Hatteras
IOOS
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MARACOOS
Ocean Information for a Changing World
To seek, discover and apply new knowledge & understanding of our coastal ocean
HF Radar Applications: Search and Rescue, Floatables, and Fisheries
MANY MANY MANY PEOPLE
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U.S. Integrated Ocean Observing System

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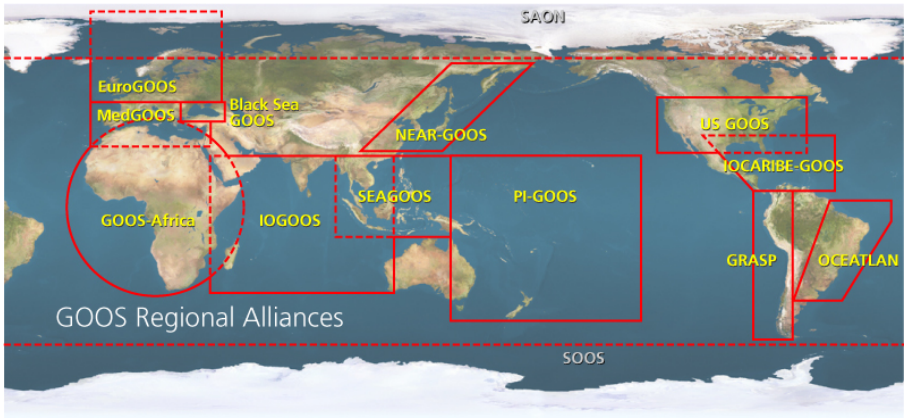
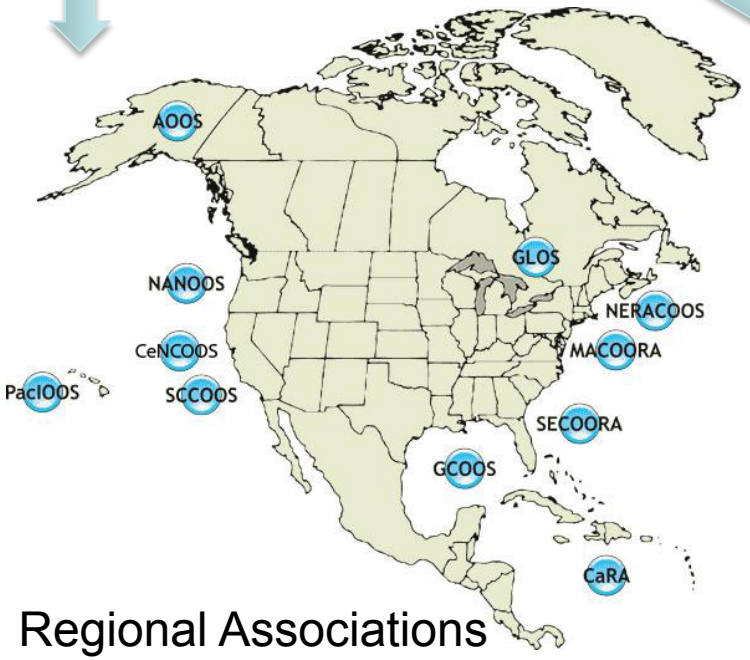
International Component



Global Ocean Observing System

Regional Component

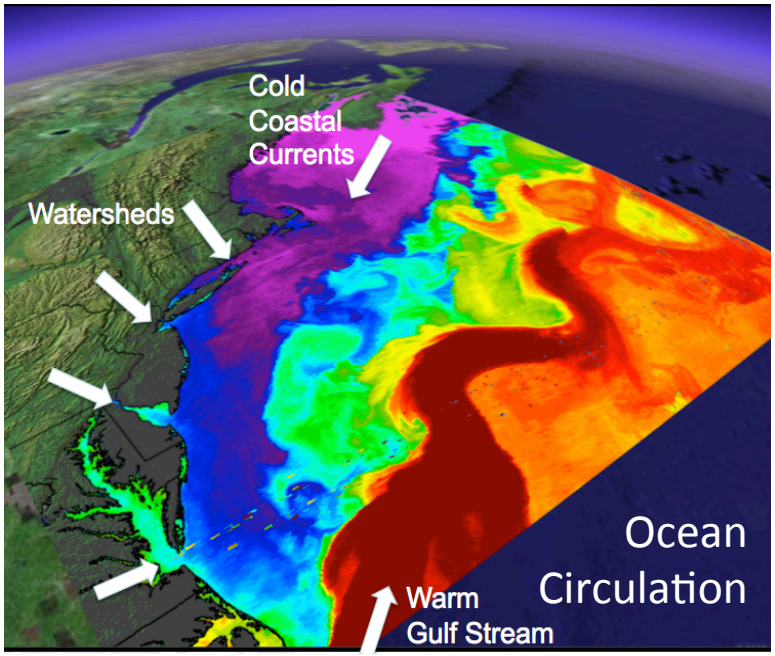
National Component

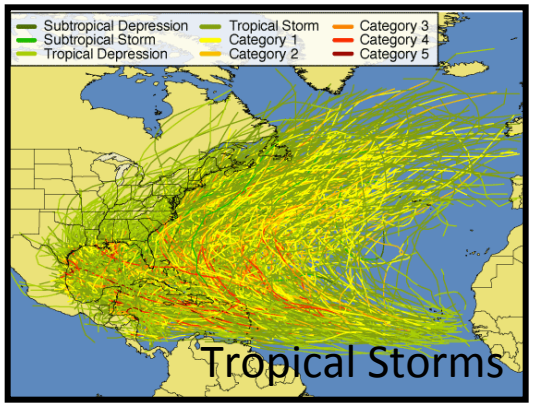


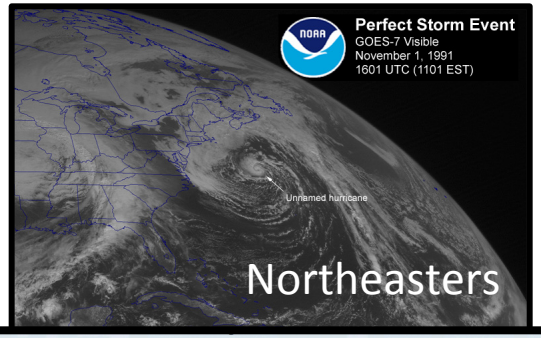
11 Regional Associations

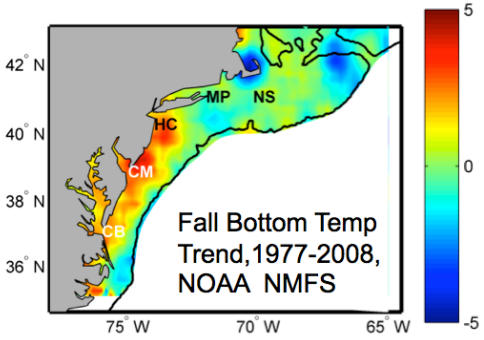
18 U.S. Federal Agencies

MIDDLE ATLANTIC REGIONAL DRIVERS

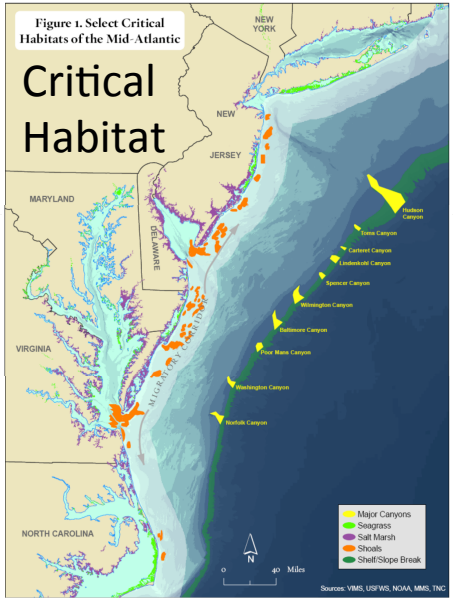


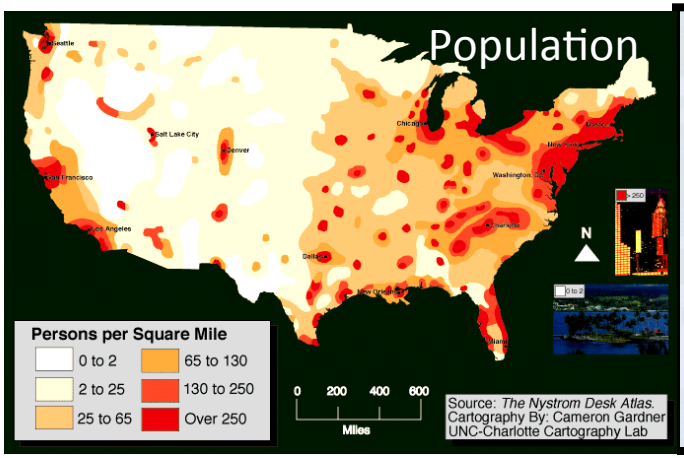


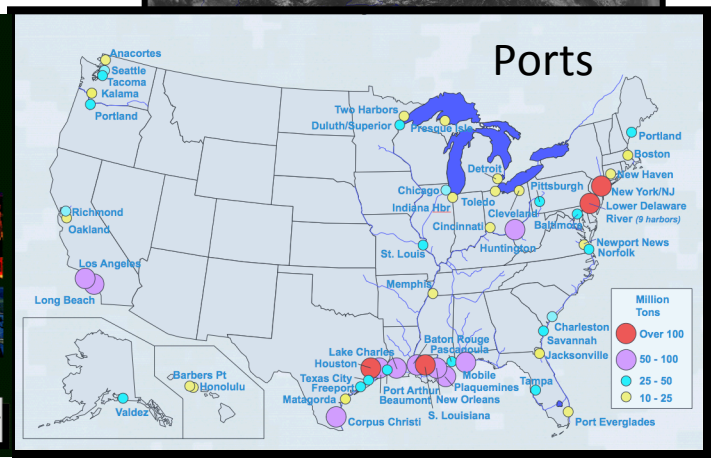


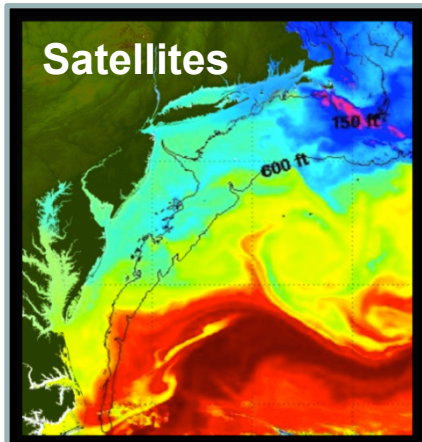


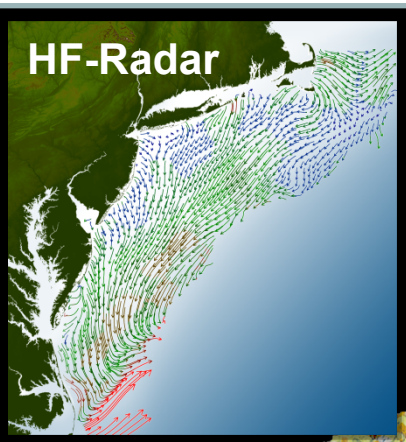
Climate Change

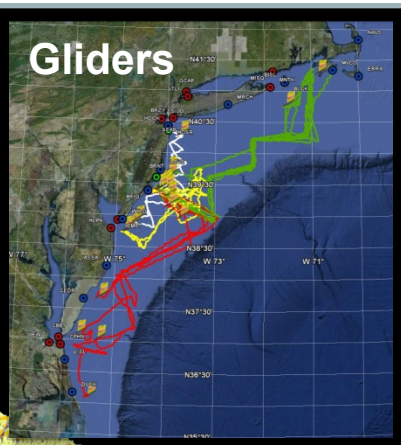


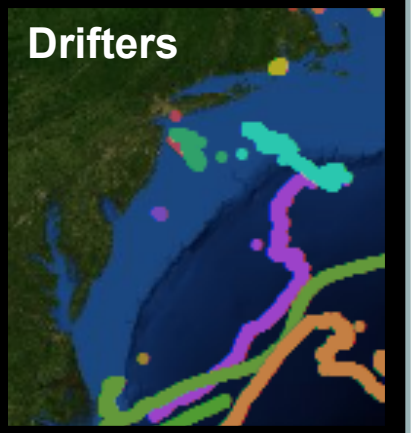












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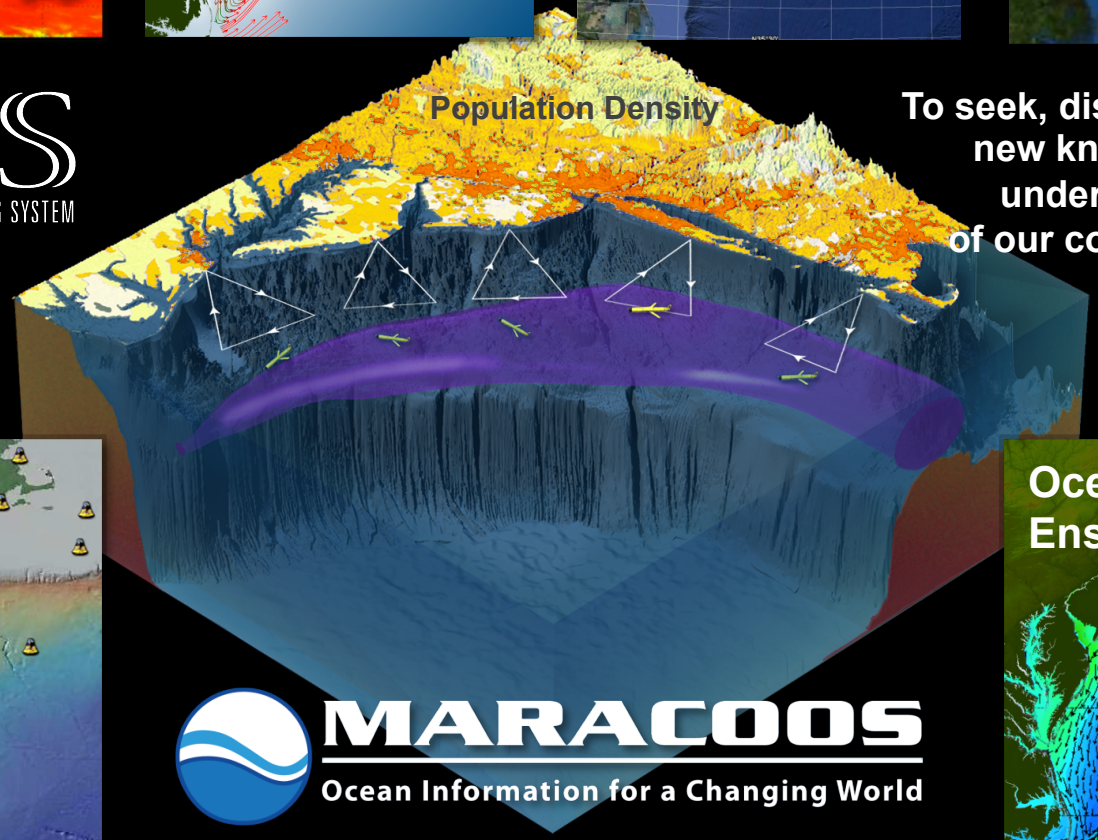
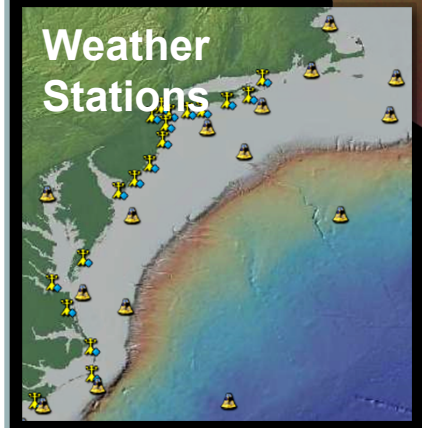


To seek, discover & apply new knowledge & understanding of our coastal ocean



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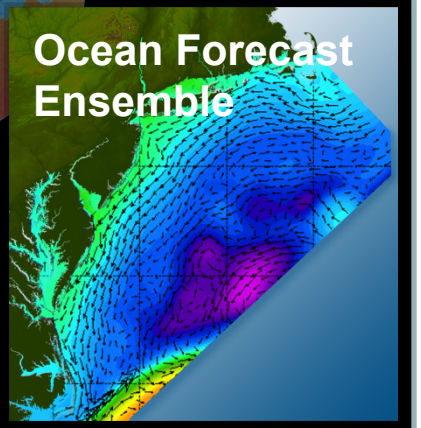

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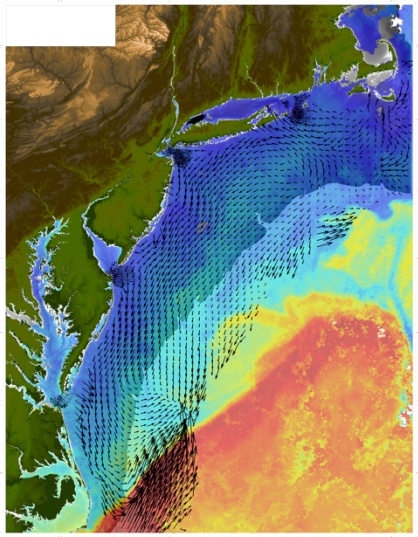
Composite Data & Forecast Products



Remote Sensing

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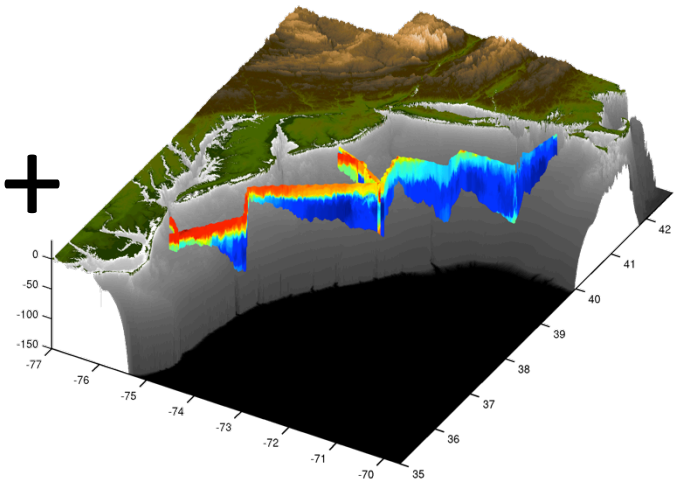

Gliders

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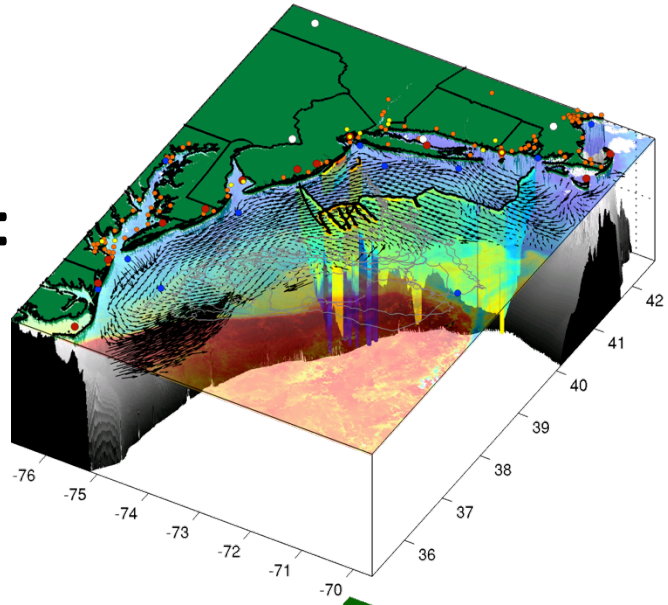
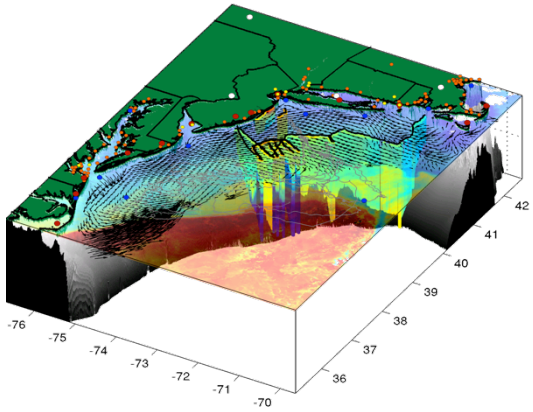


3-D Nowcasts



3-D Nowcasts

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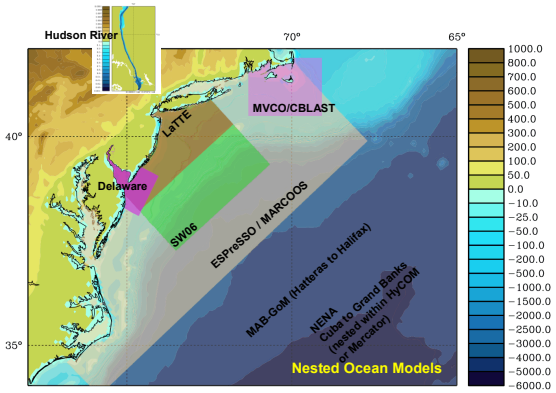

Nested Models

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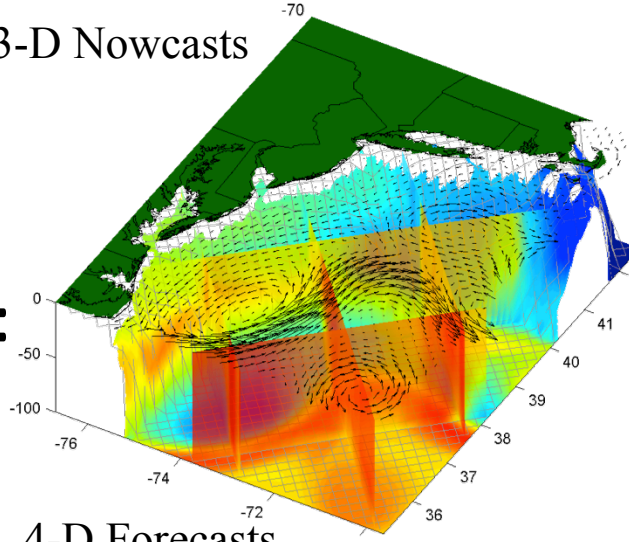
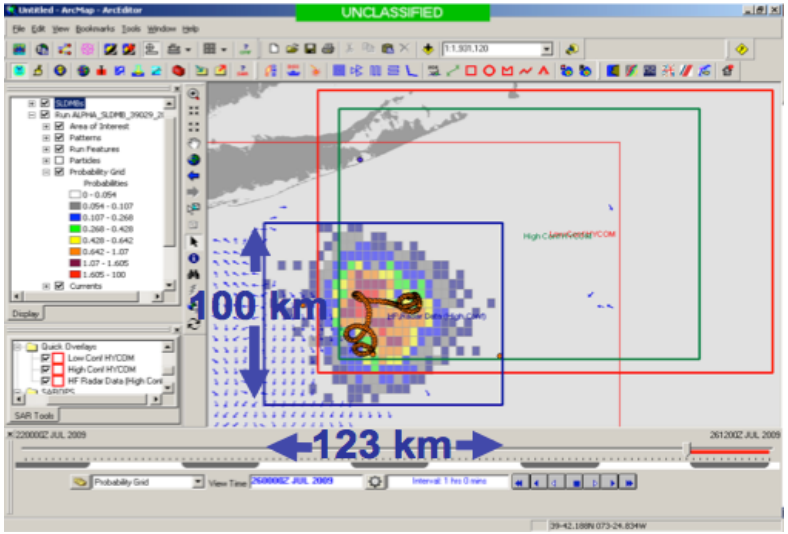


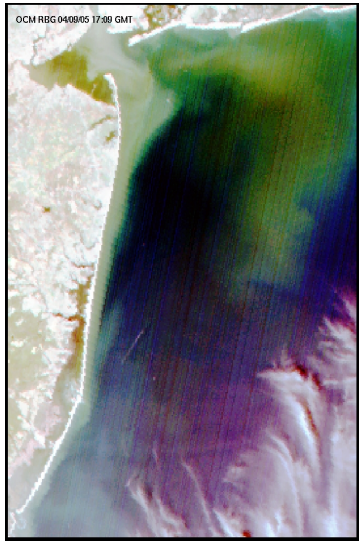
4-D Forecasts

MARACOOS REGIONAL THEMES & SUCCESS STORIES

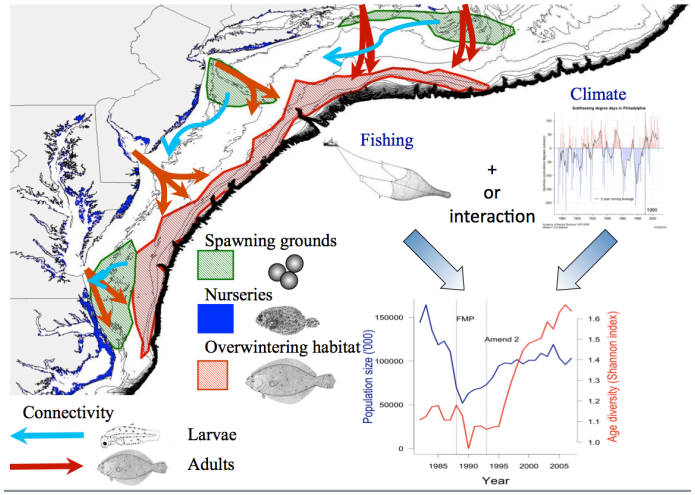
1) Maritime Operations – Safety at Sea



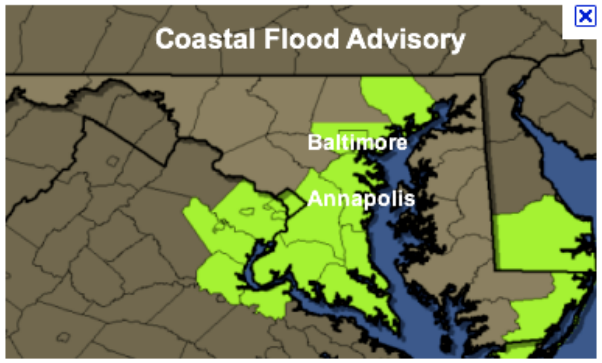
3) Water Quality – a) Floatables, b) Hypoxia, c) Nutrients



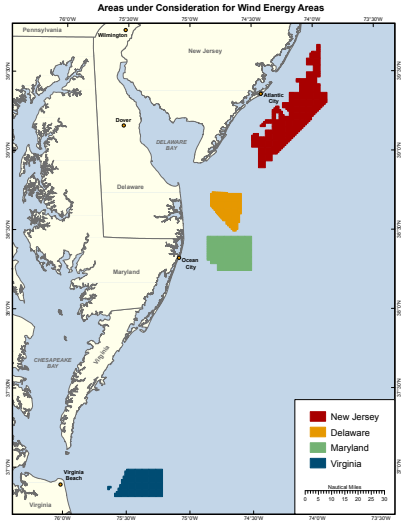
2) Ecosystem Decision Support - Fisheries



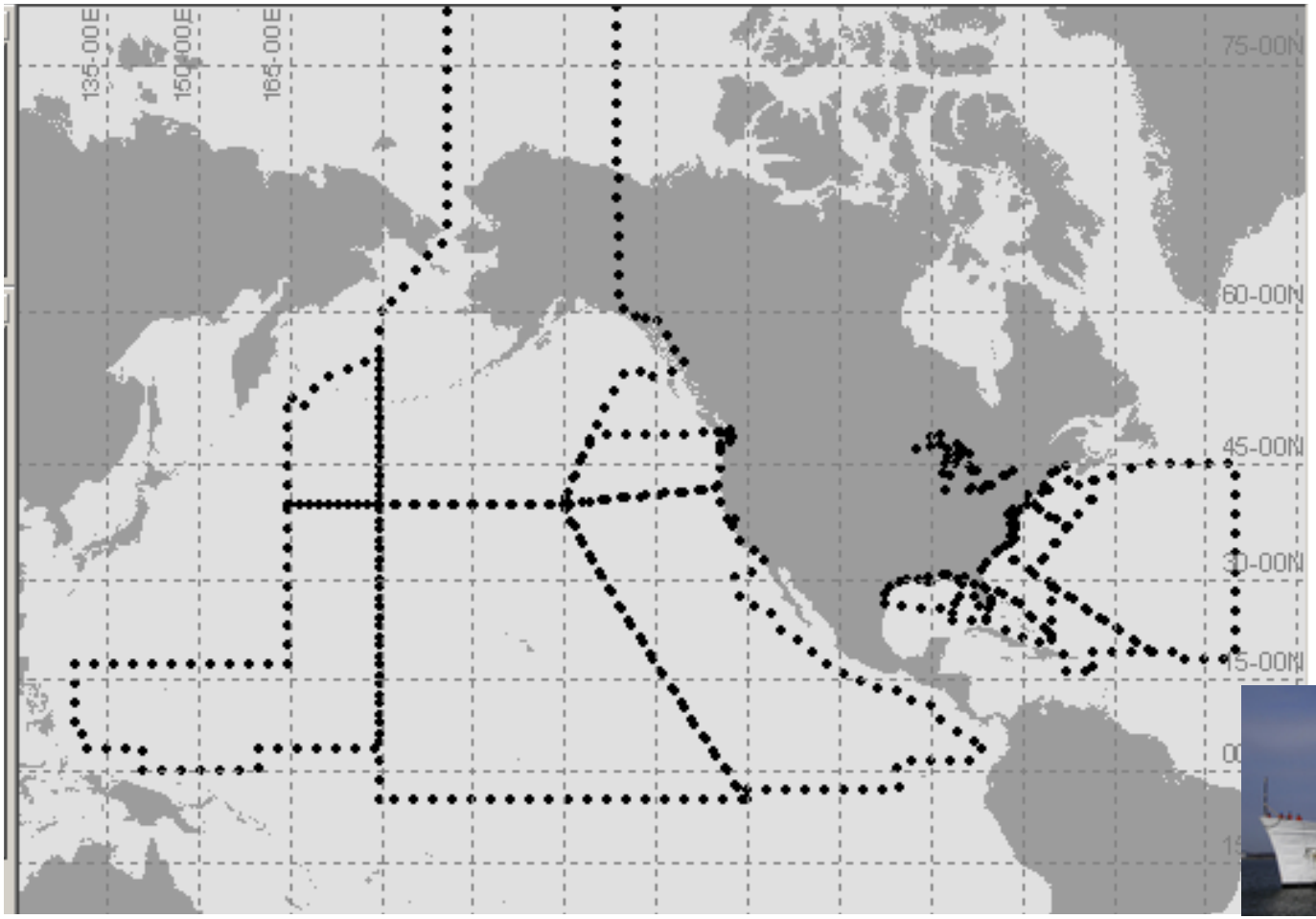
4) Coastal Inundation - Flooding



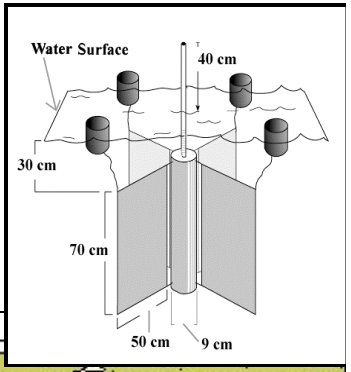
5) Energy – Offshore Wind

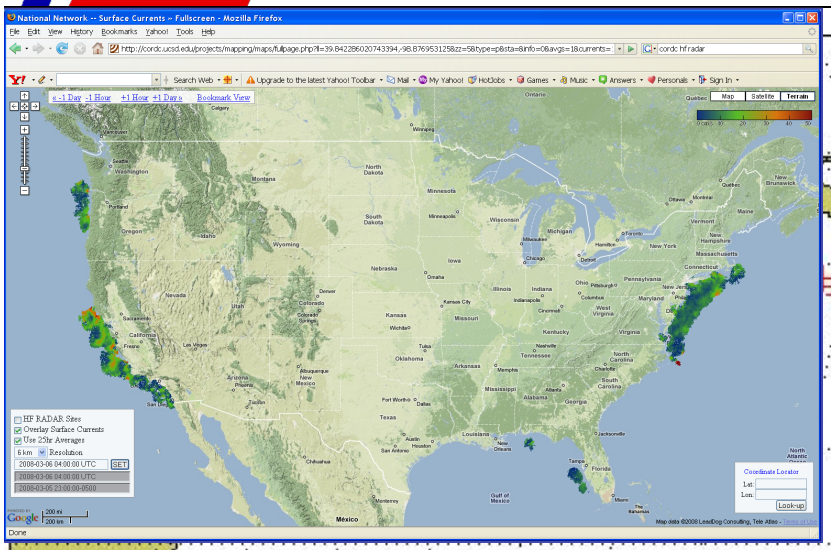


USCG Area of SAR Responsibility



SLDMB Deployments
1 Jan 2006 – 31 Dec 2007





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CG wide SAR Statistics

FY	Cases	Lives Saved
‘05	29,780	5,648
’06	28,323	5,290
’07	27,090	5,175

Search & Rescue Problem

- **Create a SAR case when alerted**

Search & Rescue Problem

- Create a SAR case when alerted
- **Gather information about case**

Search & Rescue Problem

- Create a SAR case when alerted
- Gather information about case
- **Get environmental data & uncertainties**

Search & Rescue Problem

- Create a SAR case when alerted
- Gather information about case
- Get environmental data & uncertainties
- **Use model to determine search area**

Search & Rescue Problem

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- Gather information about case
- Get environmental data & uncertainties
- Use model to determine search area
- **Estimate resource availability and capability**

Search & Rescue Problem

- Create a SAR case when alerted
- Gather information about case
- Get environmental data & uncertainties
- Use model to determine search area
- Estimate resource availability and capability
- **Plan, promulgate & perform the next search**

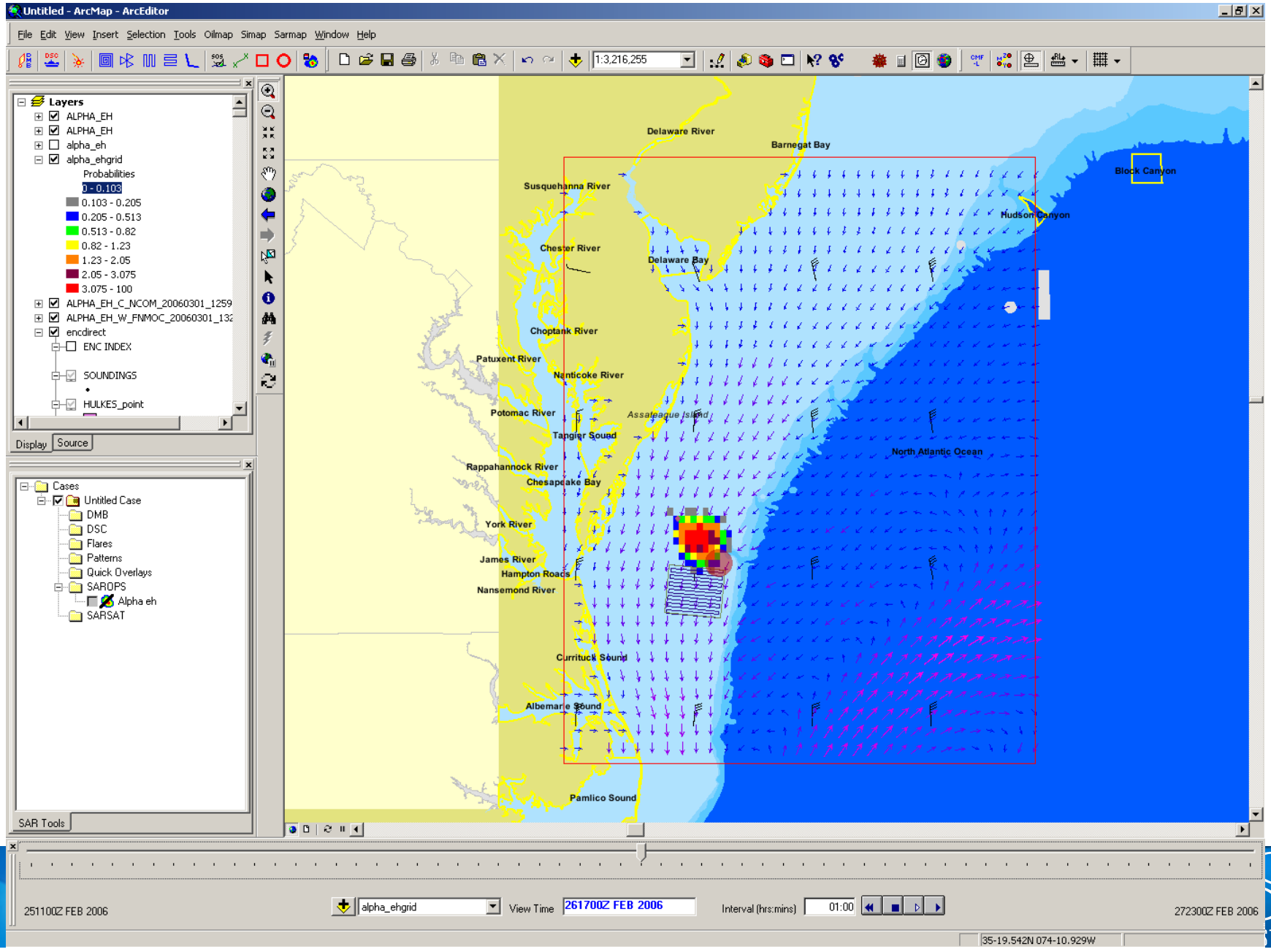
Search & Rescue Problem

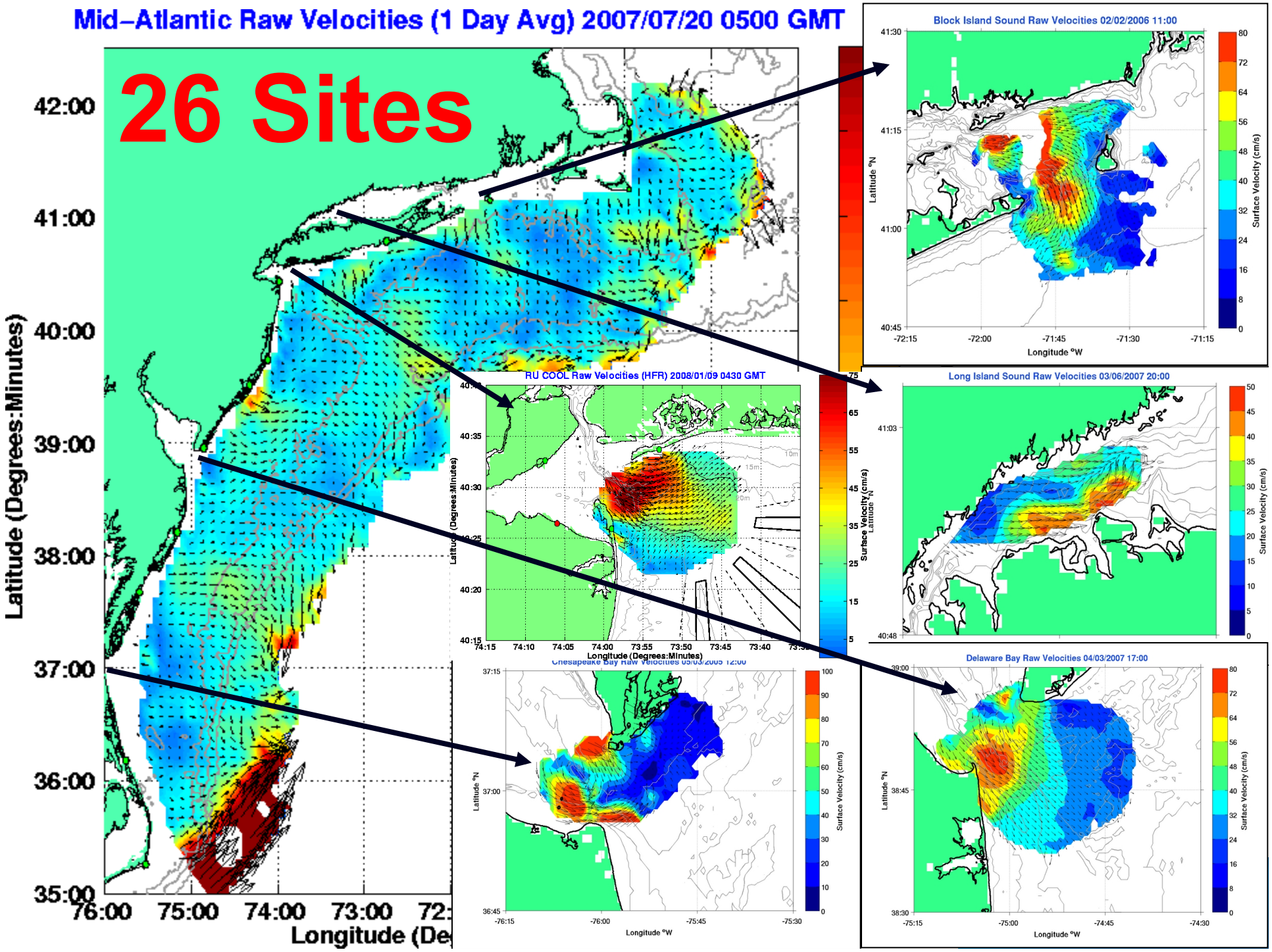
- Create a SAR case when alerted
- Gather information about case
- Get environmental data & uncertainties
- Use model to determine search area
- Estimate resource availability and capability
- Plan, promulgate & perform the next search
- **Evaluate the completed search**

Search & Rescue Problem

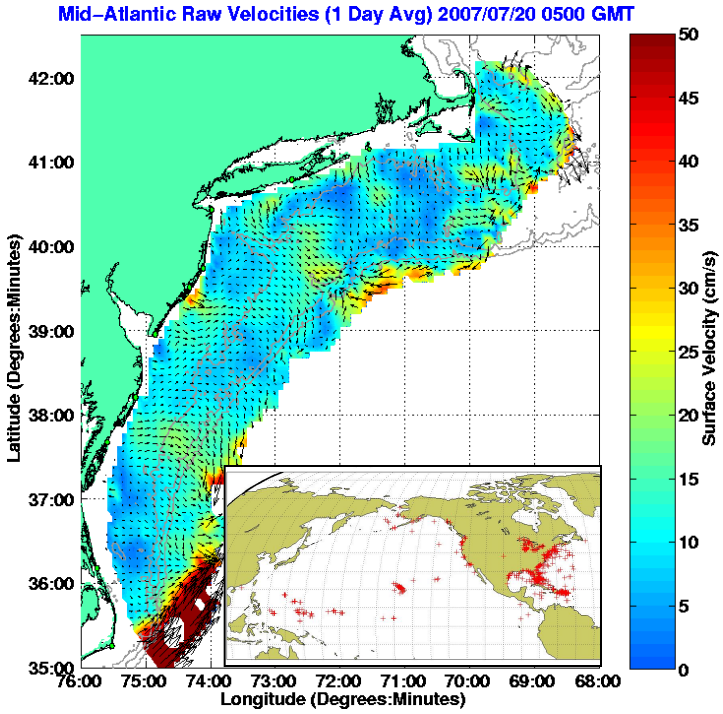
- Create a SAR case when alerted
- Gather information about case
- Get environmental data & uncertainties
- Use model to determine search area
- Estimate resource availability and capability
- Plan, promulgate & perform the next search
- Evaluate the completed search
- **Repeat above until survivors are found and rescued**

SAROPS Interface



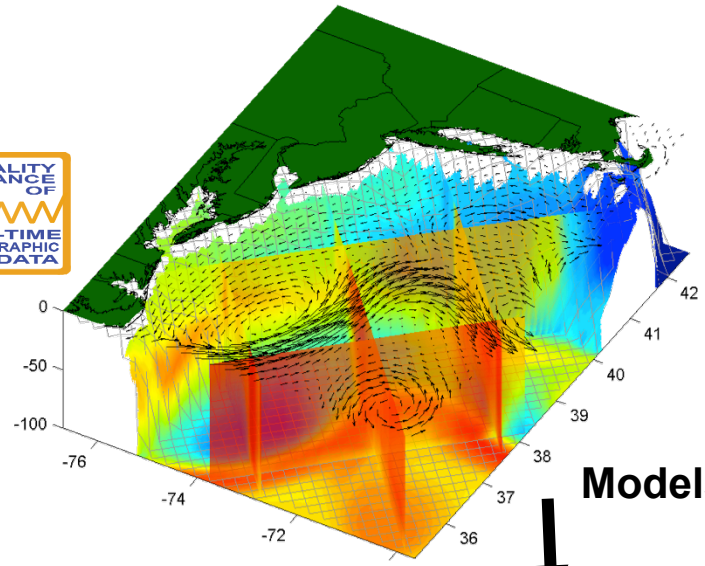

Mid–Atlantic Raw Velocities (1 Day Avg) 2007/07/20 0500 GMT
26 Sites
Latitude (Degrees:Minutes)
Longitude (De
Block Island Sound Raw Velocities 02/02/2006 11:00
Latitude °N
Longitude °W
Surface Velocity (cm/s)
RU COOL Raw Velocities (HFR) 2008/01/09 0430 GMT
Latitude (Degrees:Minutes)
Longitude (Degrees:Minutes)
Surface Velocity (cm/s)
Long Island Sound Raw Velocities 03/06/2007 20:00
Chesapeake Bay Raw Velocities 05/03/2005 12:00
Delaware Bay Raw Velocities 04/03/2007 17:00

US Coast Guard SAROPS Testbed

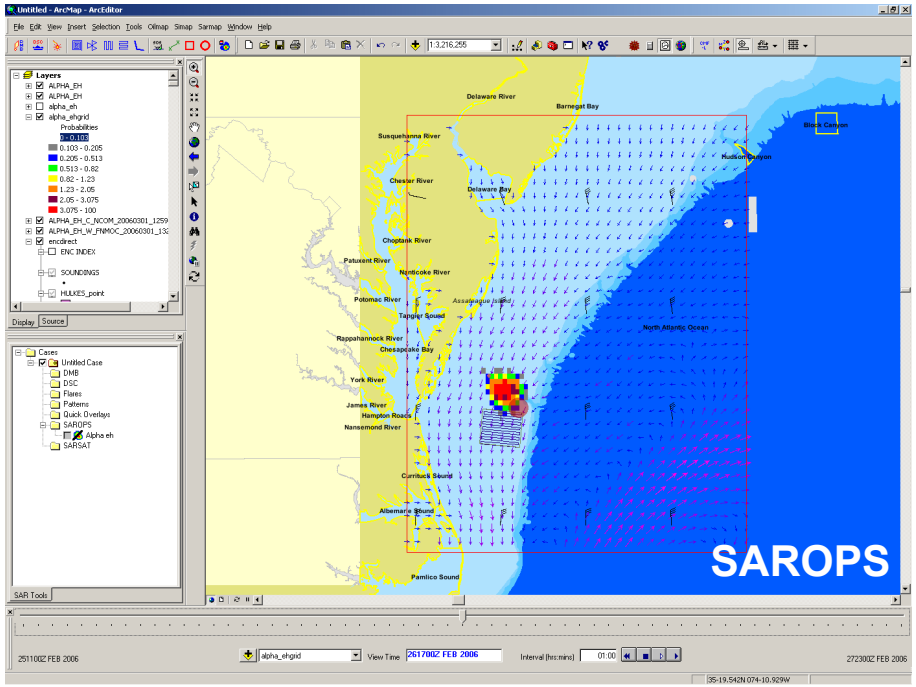


QAR TOD — QUALITY ASSURANCE OF REAL-TIME OCEANOGRAPHIC DATA

Rowg



Models



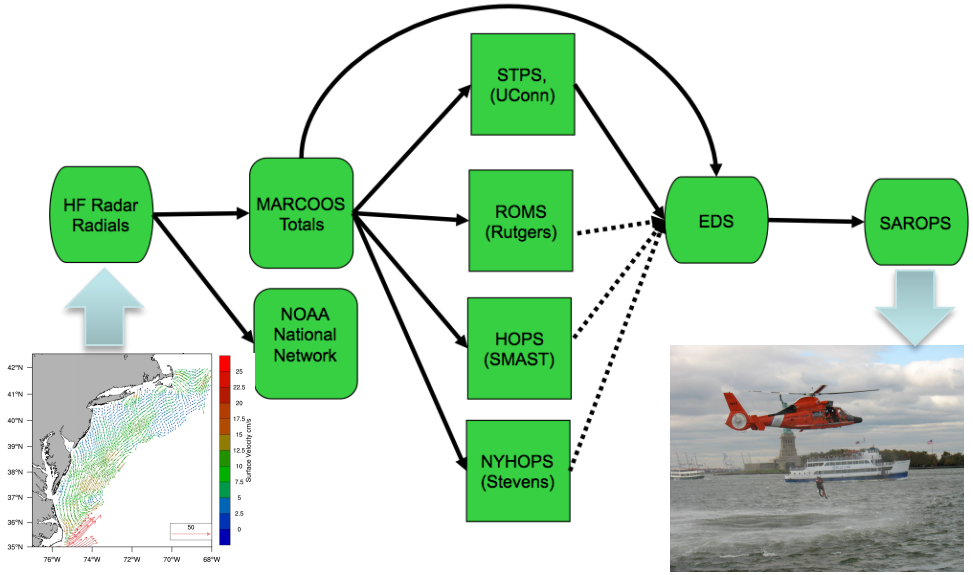
QA/QC Goals:

Ensure that data going to Coast Guard is within uncertainty estimates defined in SAROPS

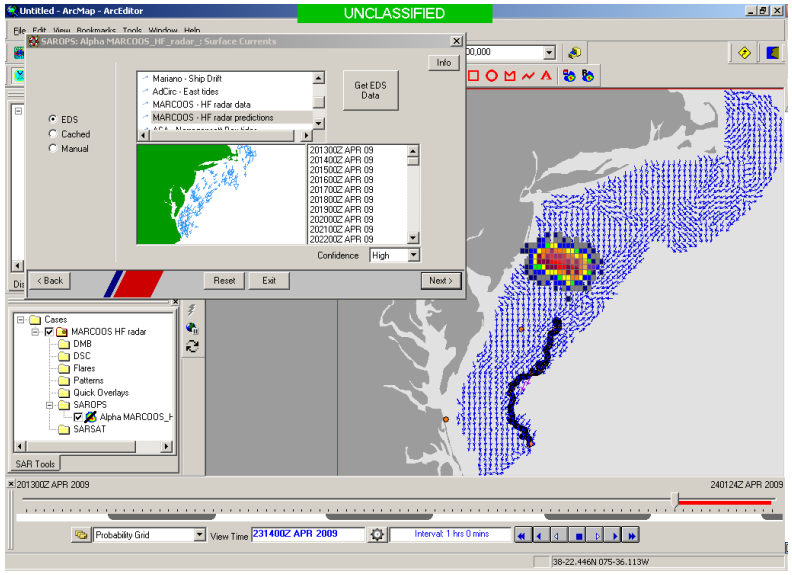
Standardize settings among 26 current sites.

Continue research on new algorithms/settings

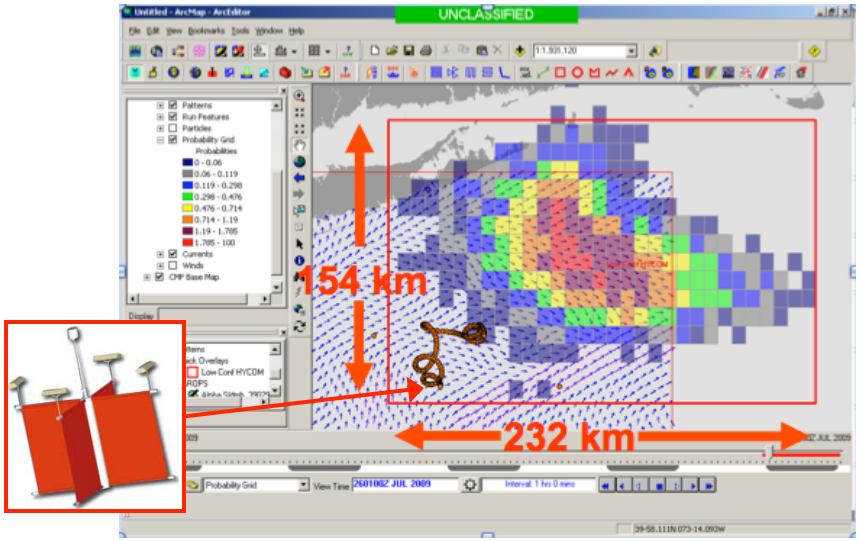
U.S. Coast Guard: Search And Rescue Optimal Planning System *SAROPS*



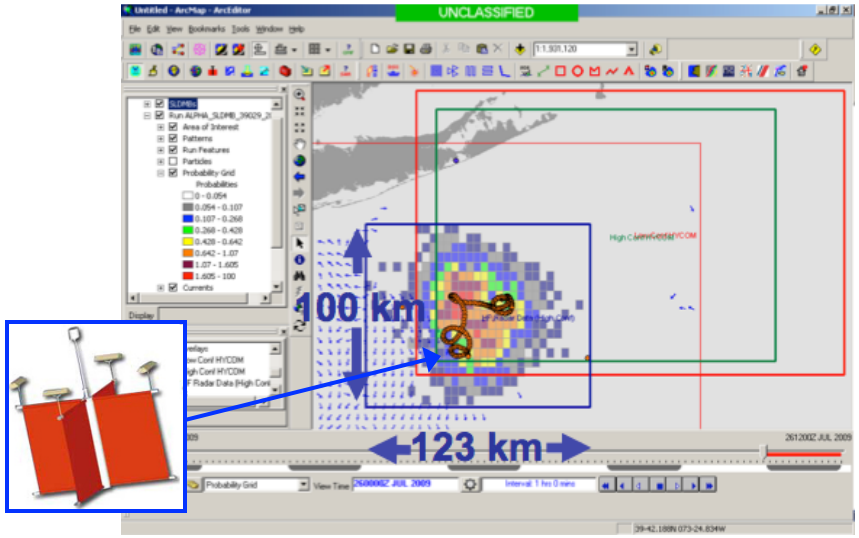
Mid-Atlantic Operational Data Flow to SAROPS



SAROPS User Interface

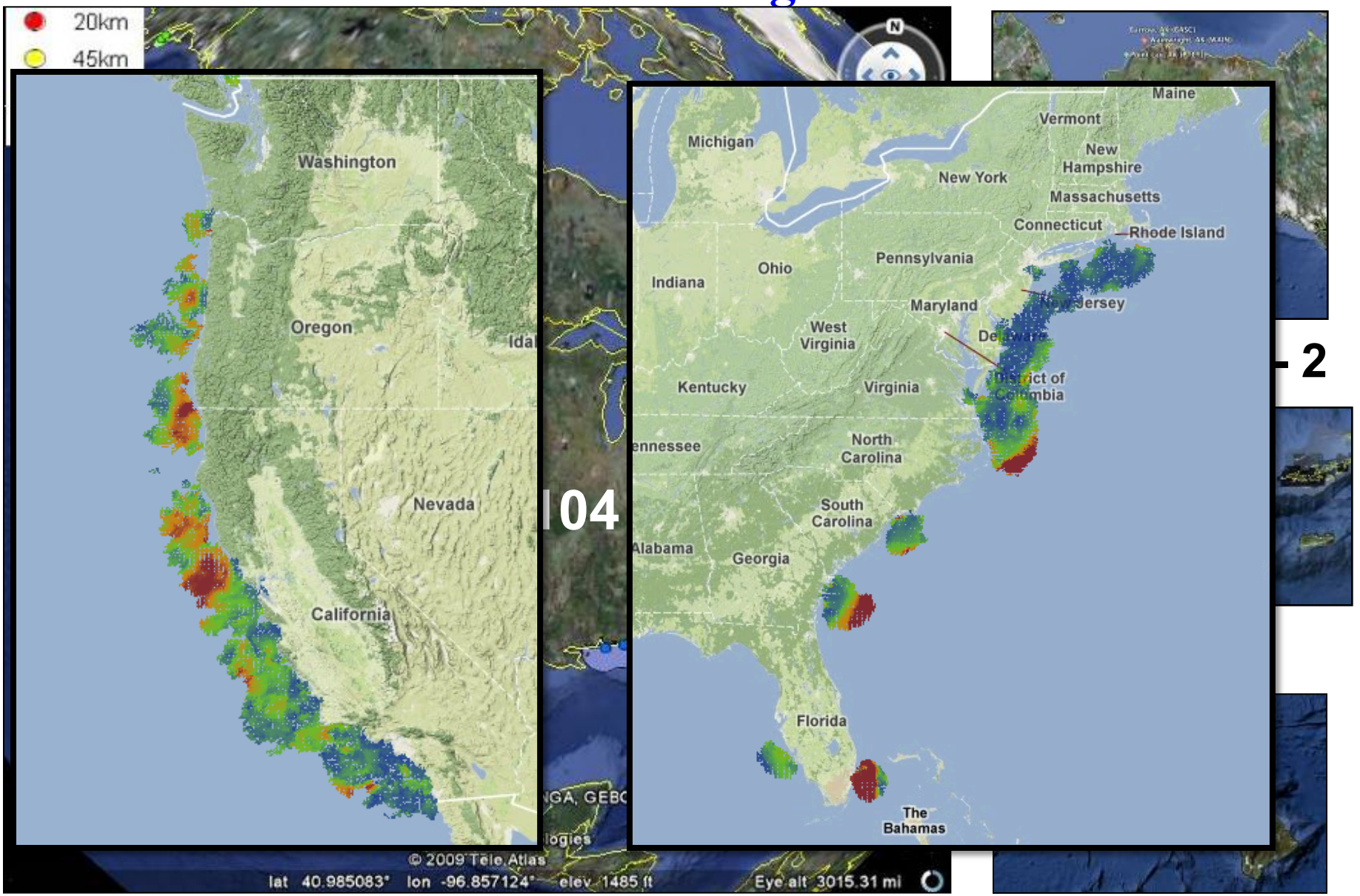


SAROPS 96-Hour Search Area: **HYCOM = 36,000 km²**



SAROPS 96-Hour Search Area: **HF Radar = 12,000 km²**

NOAA National Network: Existing Sites



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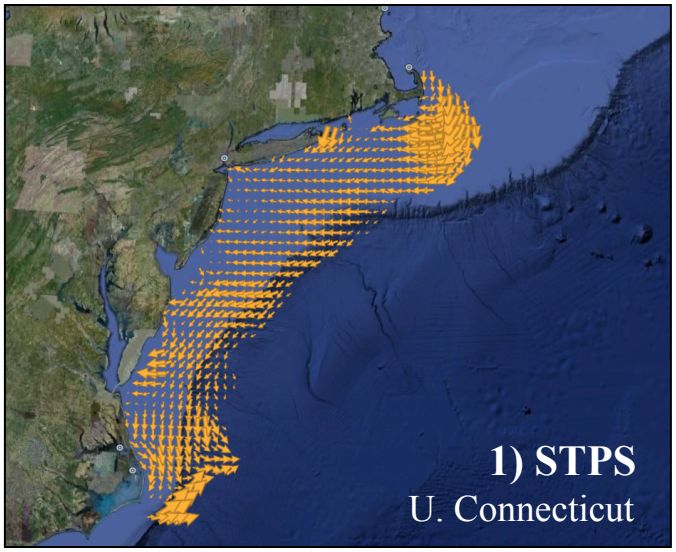
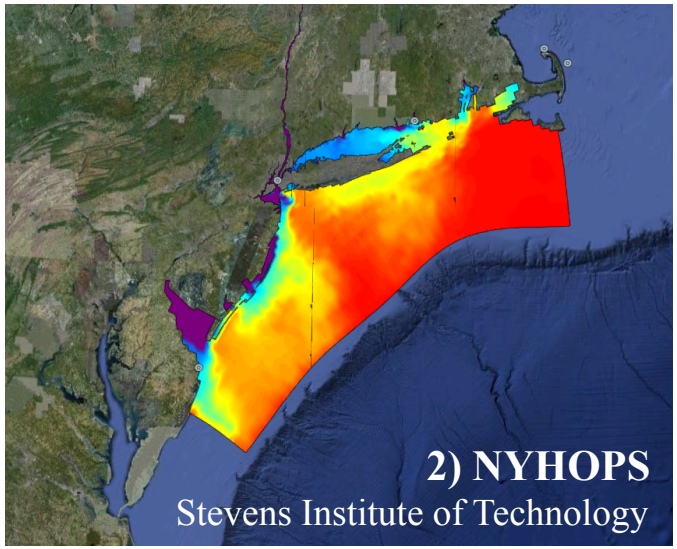
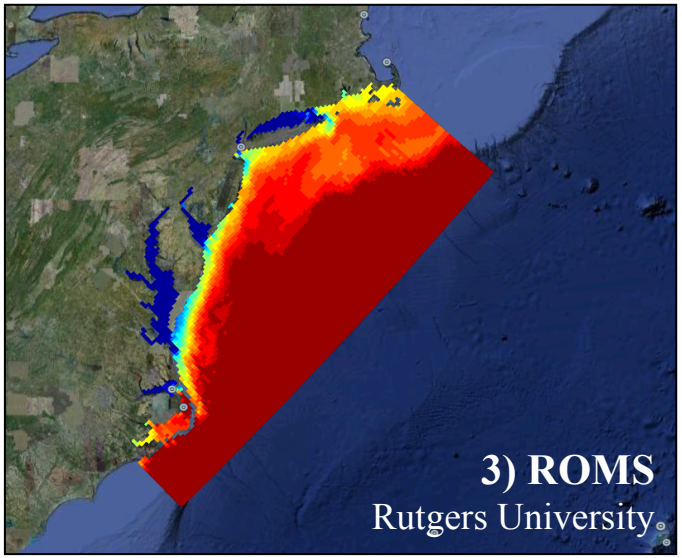
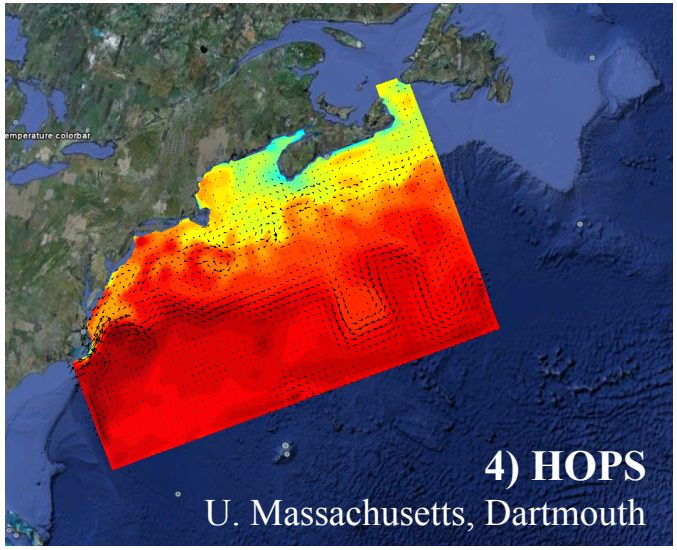
U.S. Coast Guard: Search And Rescue Optimal Planning System *SAROPS*

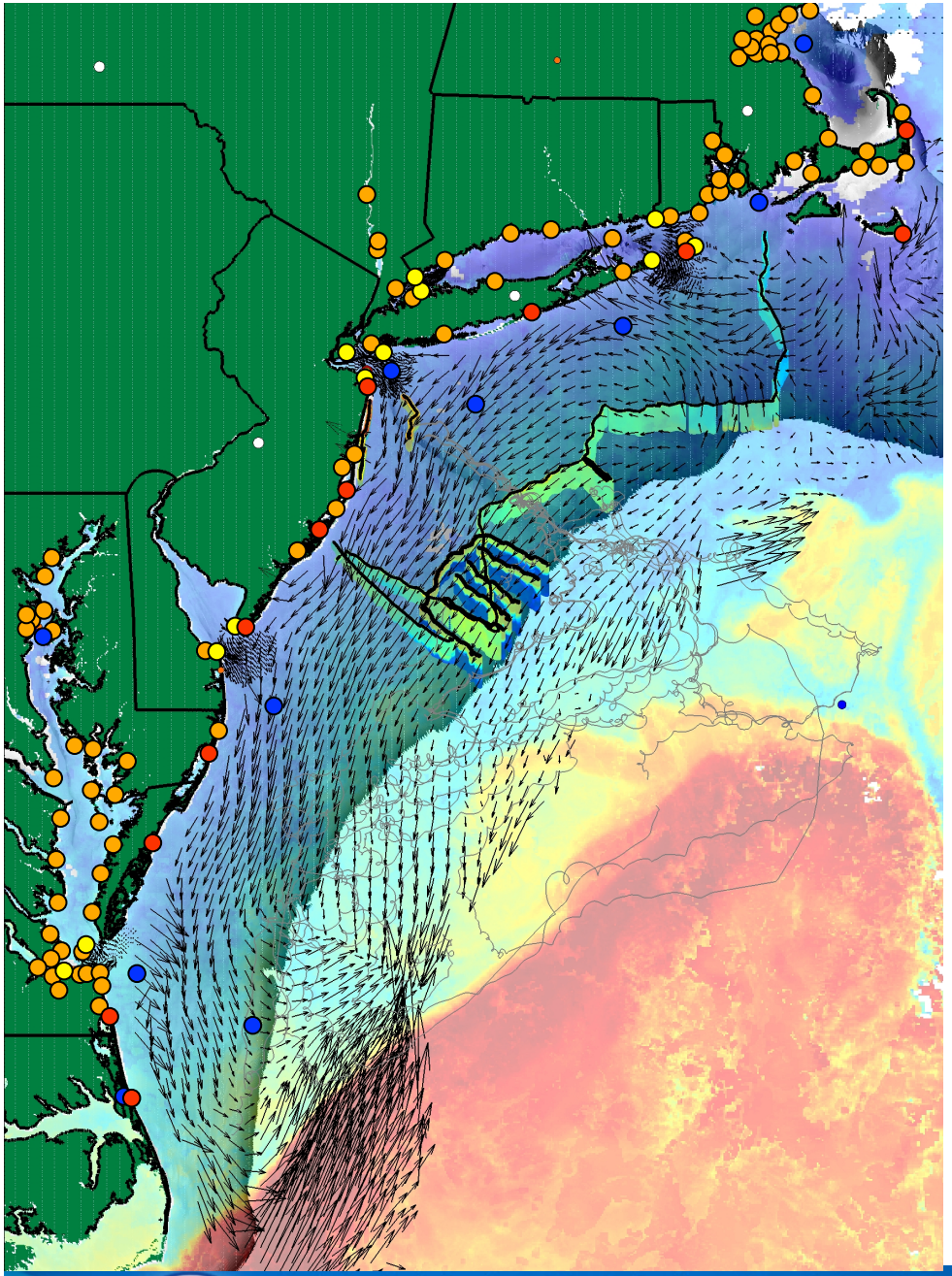
1 Statistical & 3 Dynamical Data-Assimilative Forecast Models









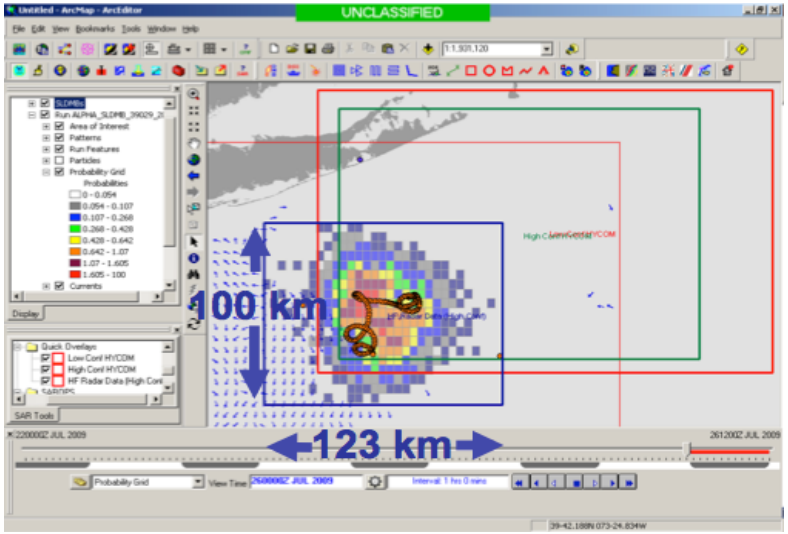


Summary: USCG SAR

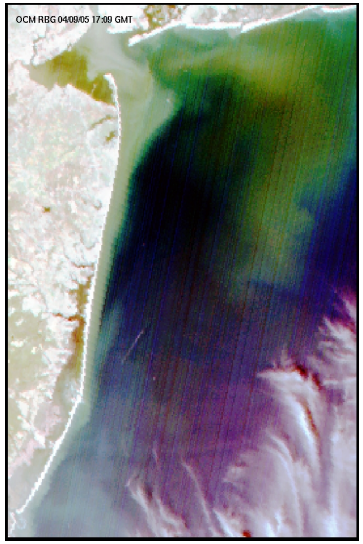
- MARCOOS is providing regional surface current observations to the Coast Guard through SAROPS
- IOOS will provide regional surface current forecasts to the Coast Guard through SAROPS
- QA/QC teams are continually testing new algorithms to further lower uncertainties of surface current and nearshore wave estimates.

MARACOOS REGIONAL THEMES & SUCCESS STORIES

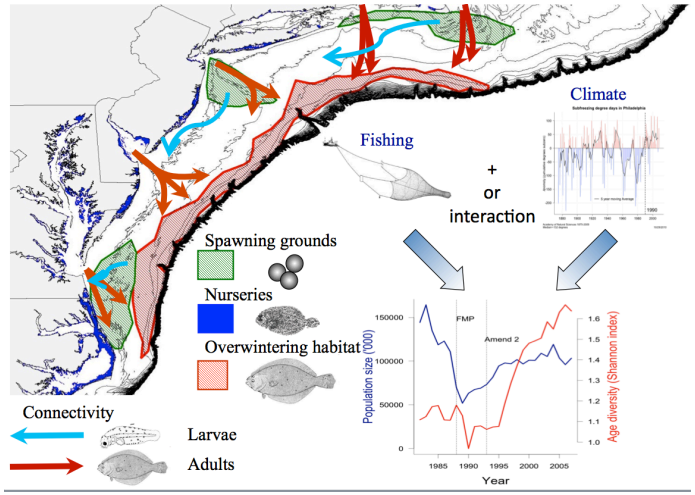
1) Maritime Operations – Safety at Sea



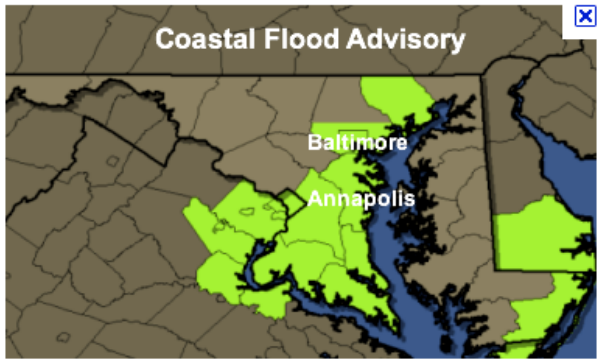
3) Water Quality – a) Floatables, b) Hypoxia, c) Nutrients



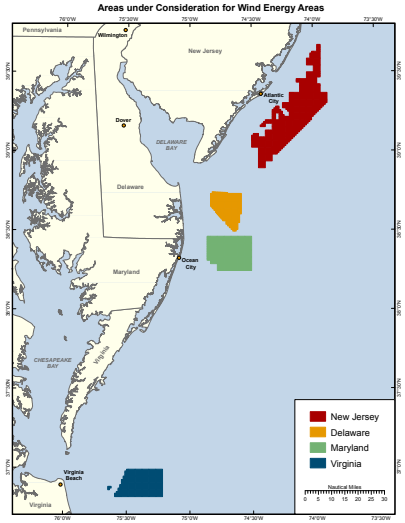
2) Ecosystem Decision Support - Fisheries

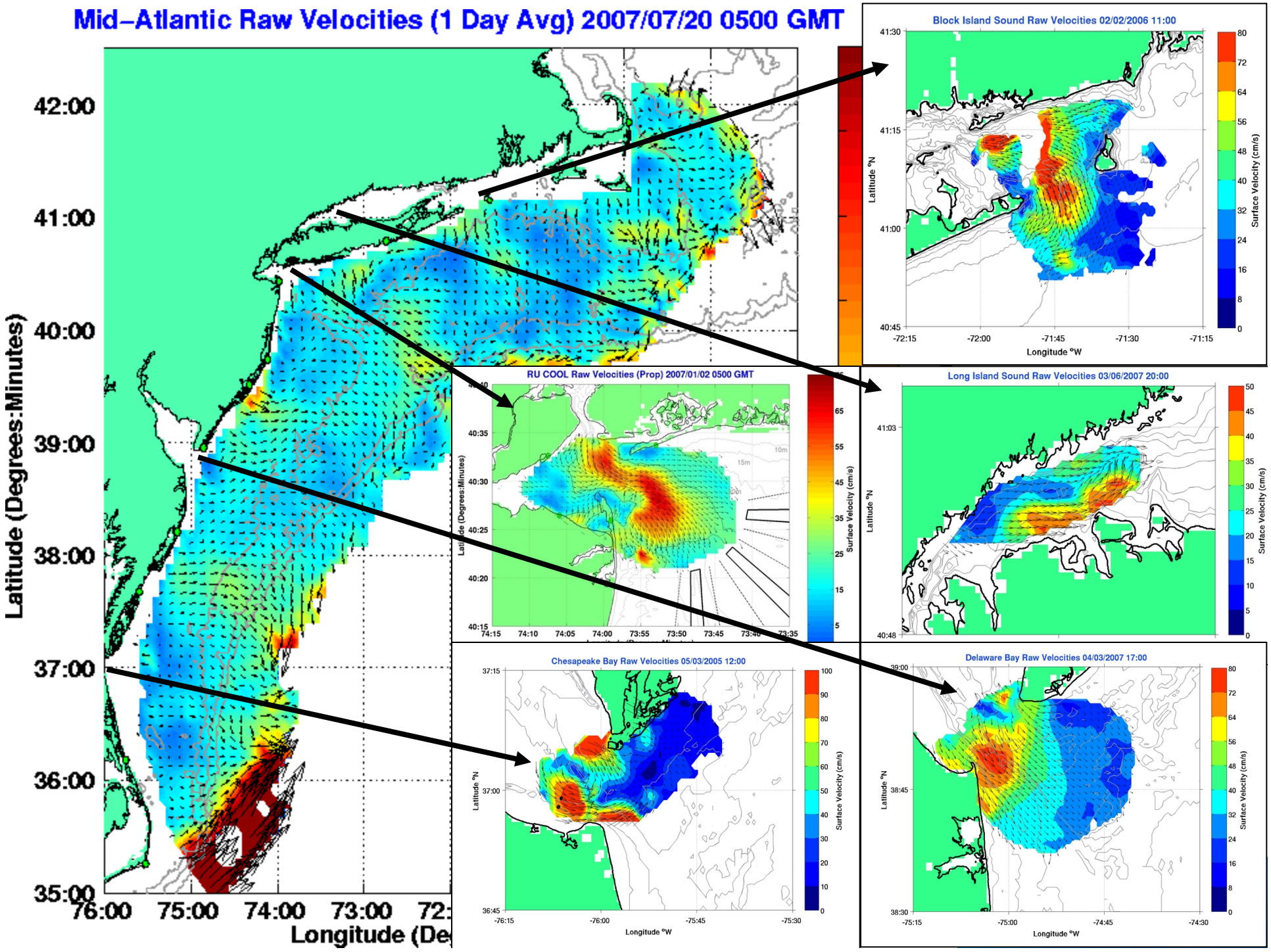


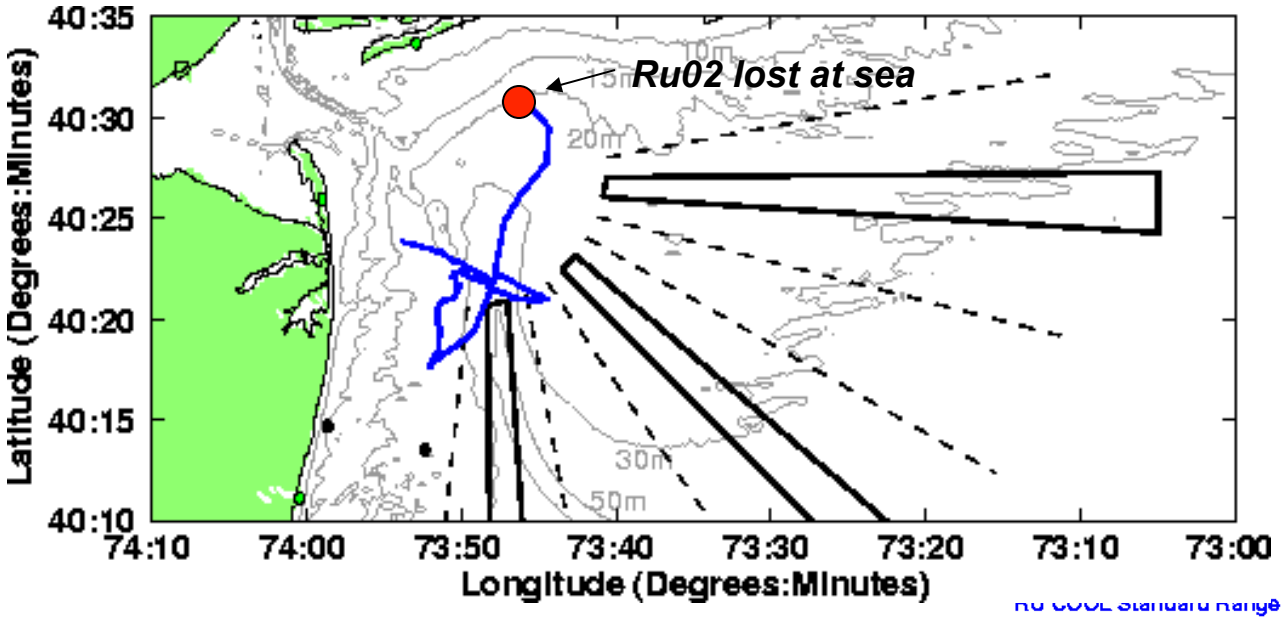
4) Coastal Inundation - Flooding

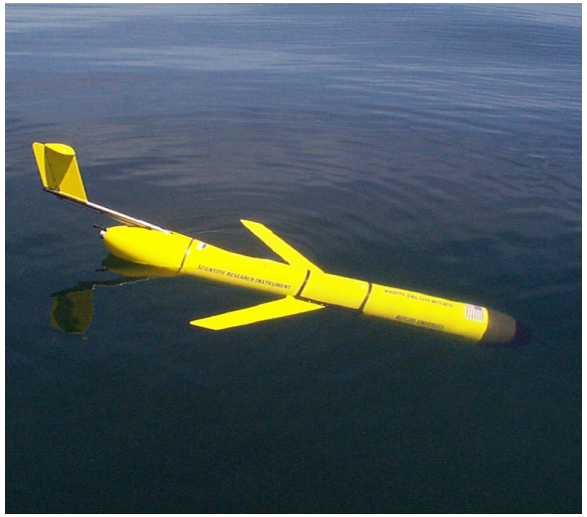


5) Energy – Offshore Wind



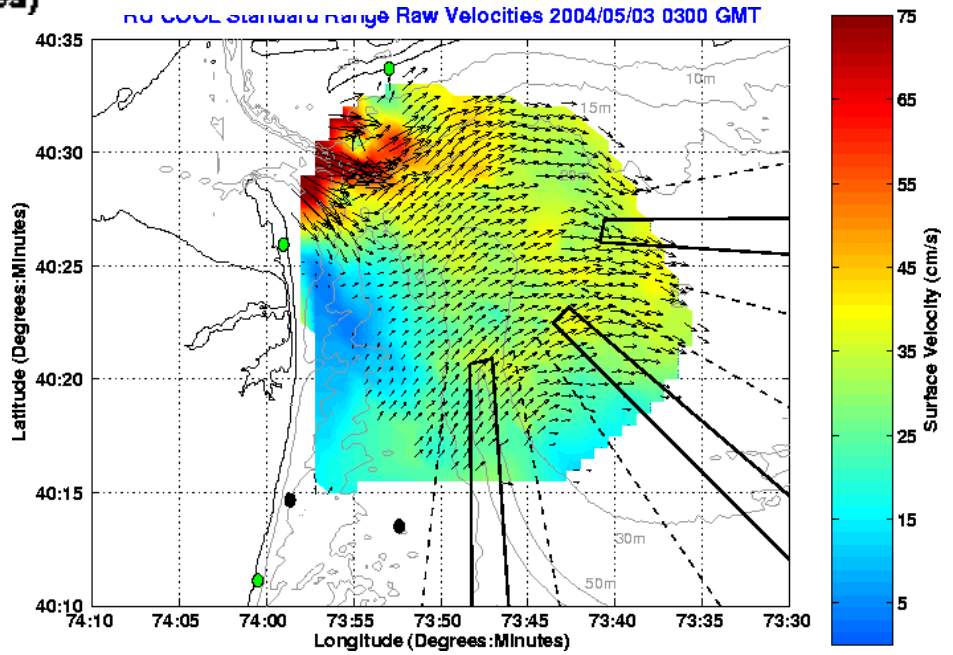

Mid–Atlantic Raw Velocities (1 Day Avg) 2007/07/20 0500 GMT
Latitude (Degrees:Minutes)
Longitude (De
42:00
41:00
40:00
39:00
38:00
37:00
36:00
35:00
76:00
75:00
74:00
73:00
Block Island Sound Raw Velocities 02/02/2006 11:00
Latitude °N
Longitude °W
Surface Velocity (cm/s)
RU COOL Raw Velocities (Prop) 2007/01/02 0500 GMT
Long Island Sound Raw Velocities 03/06/2007 20:00
Chesapeake Bay Raw Velocities 05/03/2005 12:00
Delaware Bay Raw Velocities 04/03/2007 17:00

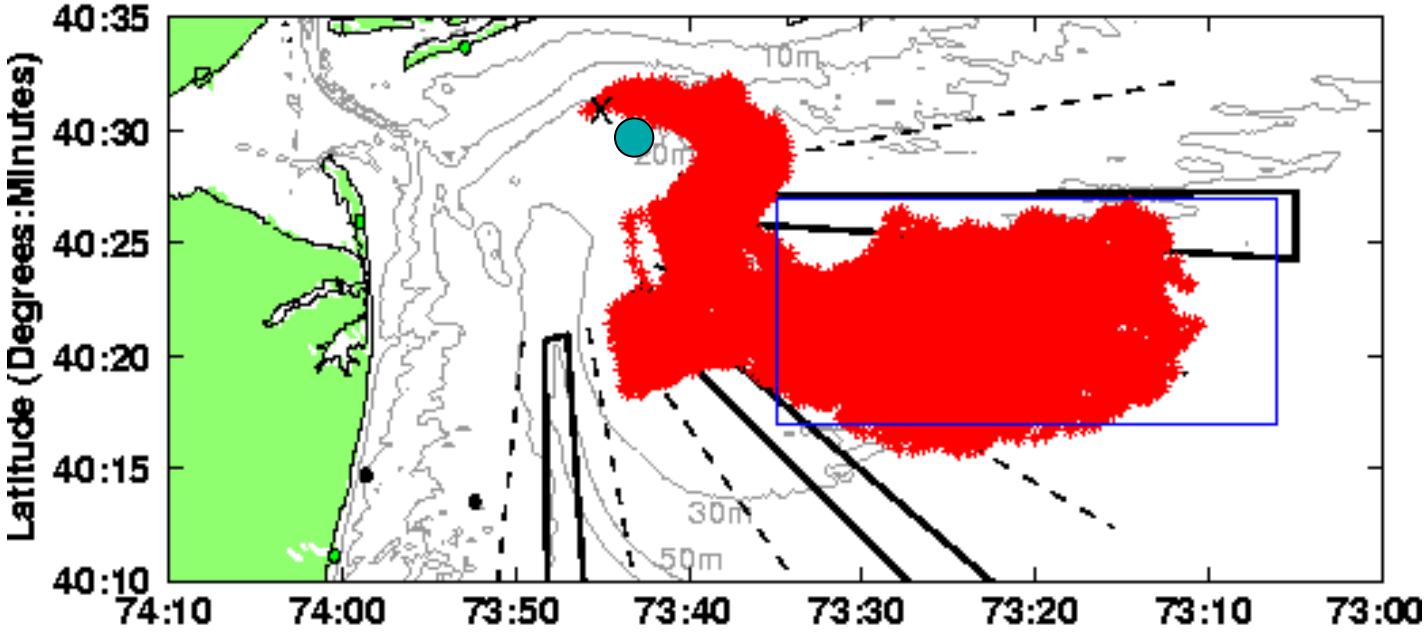




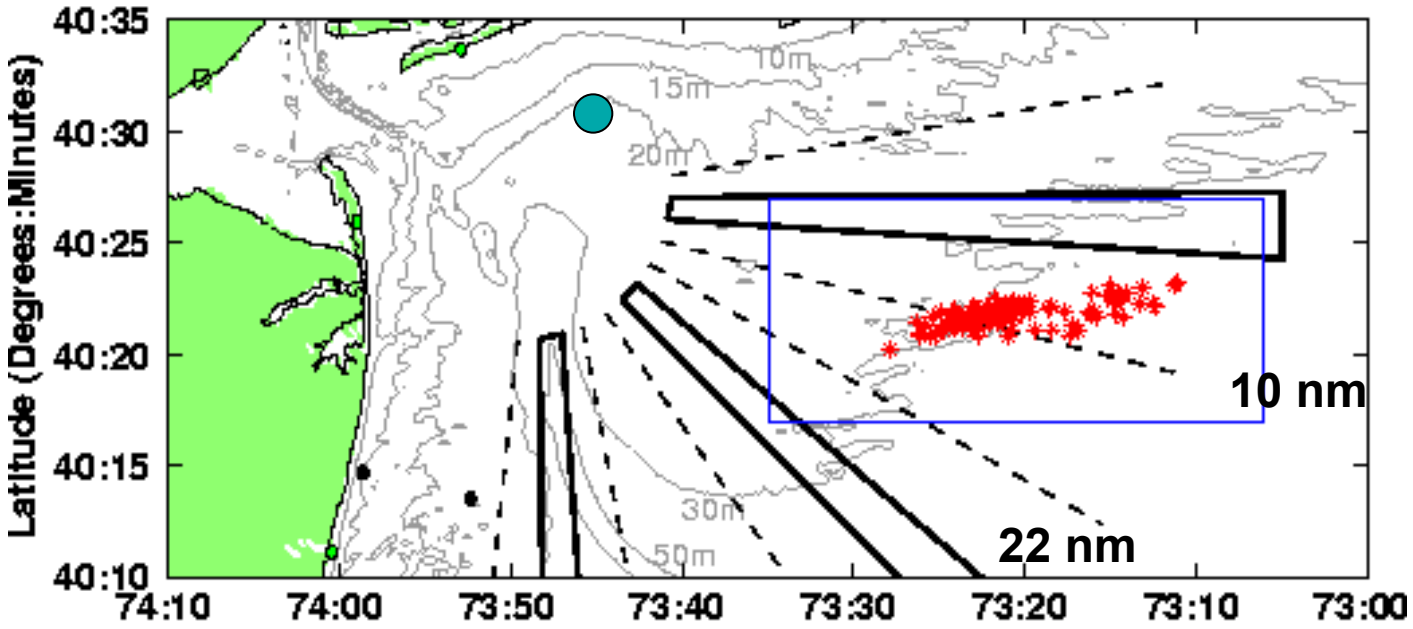
The wind switches to a more upwelling favorable direction and glider ru02 is retasked to head up toward the freshwater outflow.

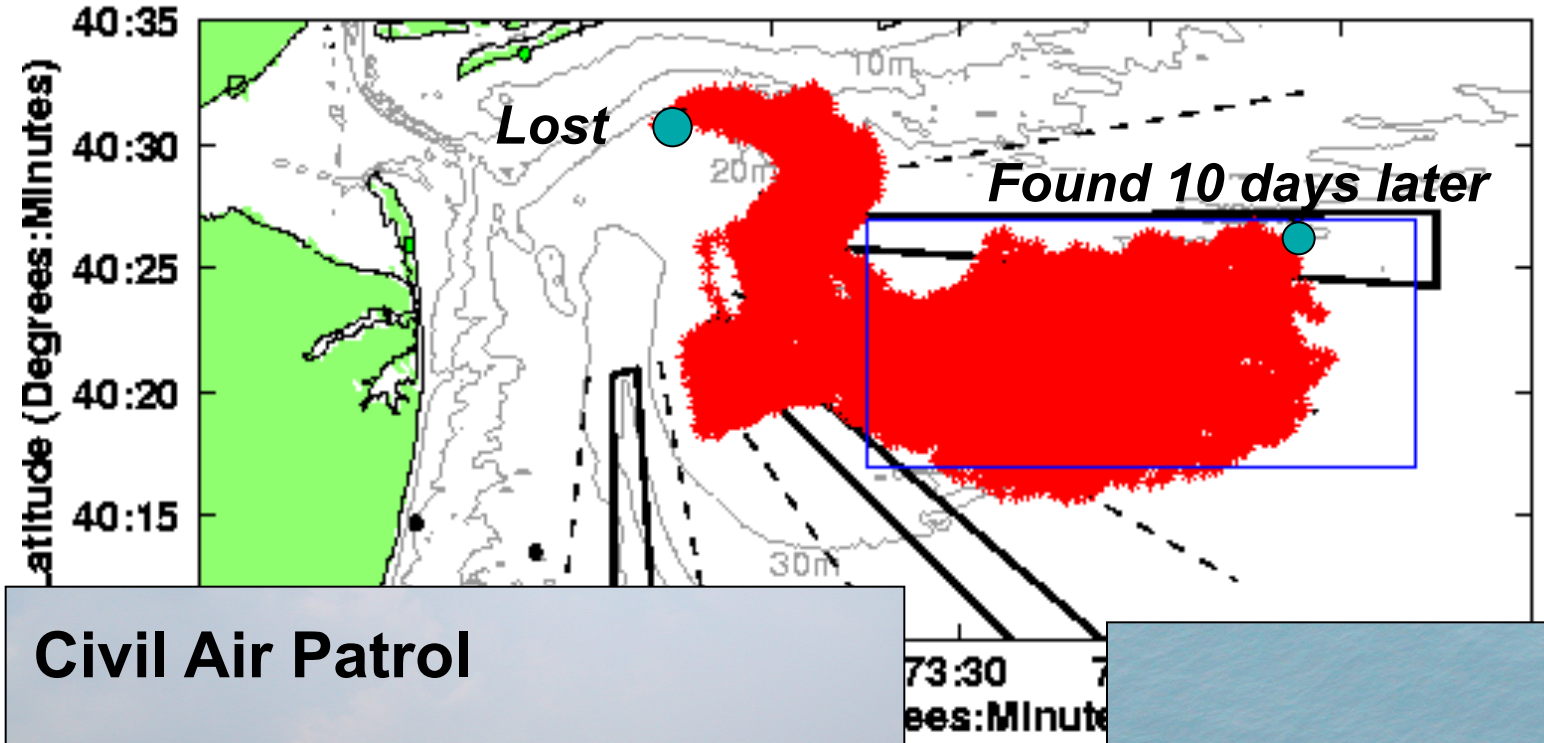
During the mission, the glider looses communication with mission control and begins to drift.



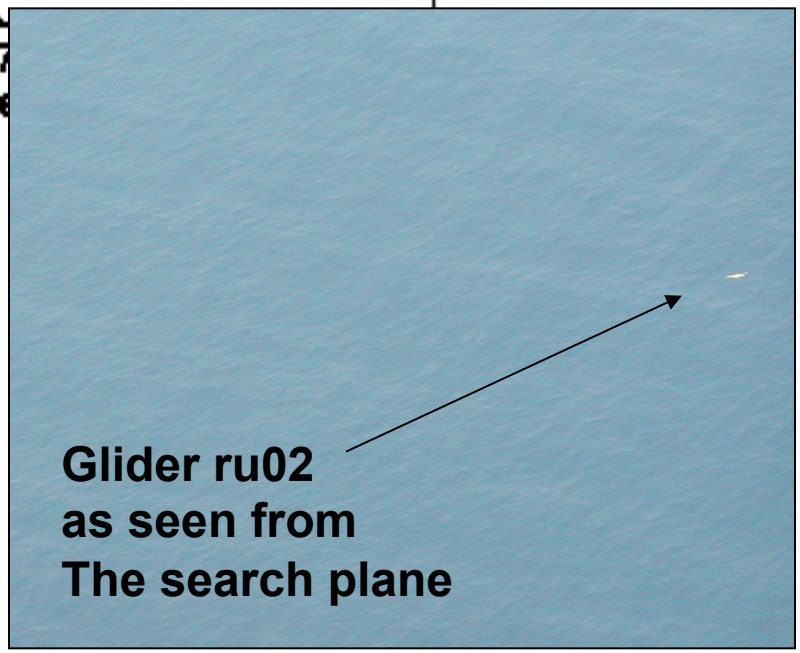


A search area is defined for the glider's probable location 10 days after communication is lost

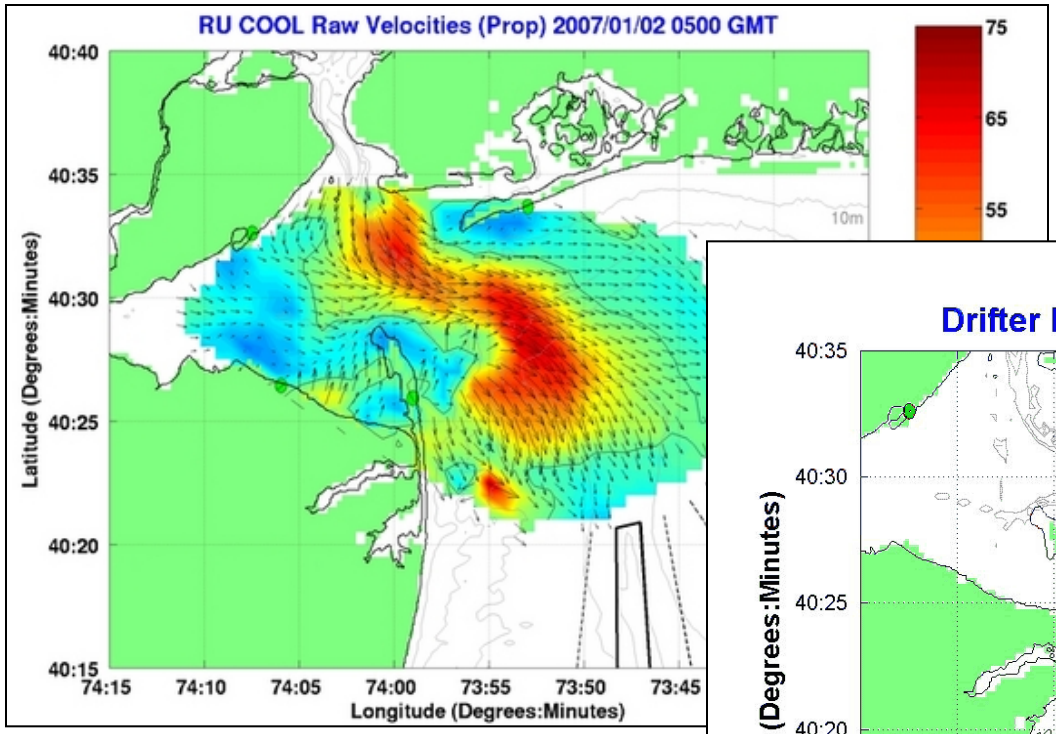


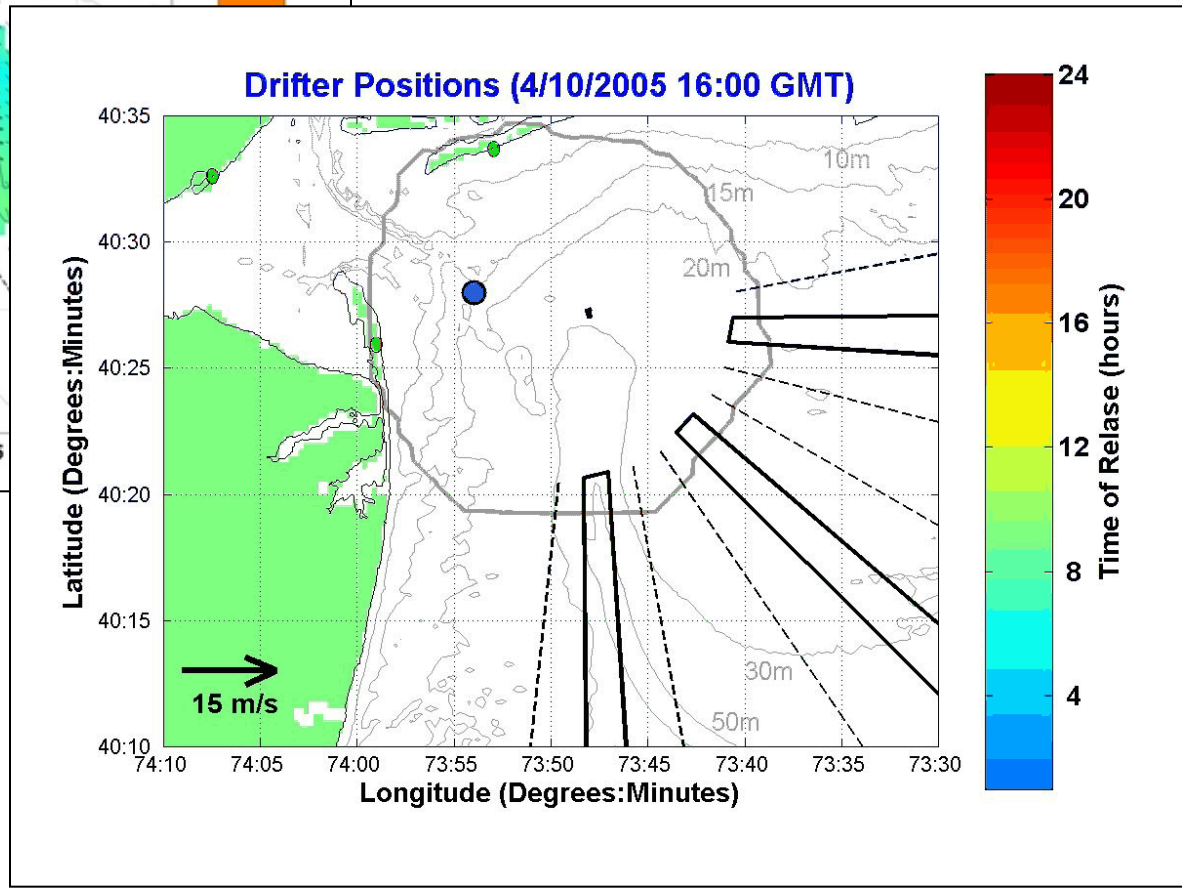

40:35
40:30
40:25
40:20
40:15
atitude (Degrees:Minutes)
10m
20m
30m
Lost
Found 10 days later
73:30
ees:Minute

Civil Air Patrol
Communication Plane
Search Plane


Glider ru02
as seen from
The search plane

Ocean Observing:
Tracking Particles Through the Coastal Ocean





Garbage gone from beaches; questions linger

Posted by the Philadelphia Inquirer on 09/12/07

Labor Day 2007 Beach Closure

"Worst beach pollution since the 1980's"

Aug 21-22: Over 1" of rainfall through the region

Aug. 24: Floatables reported at Union Beach, NJ

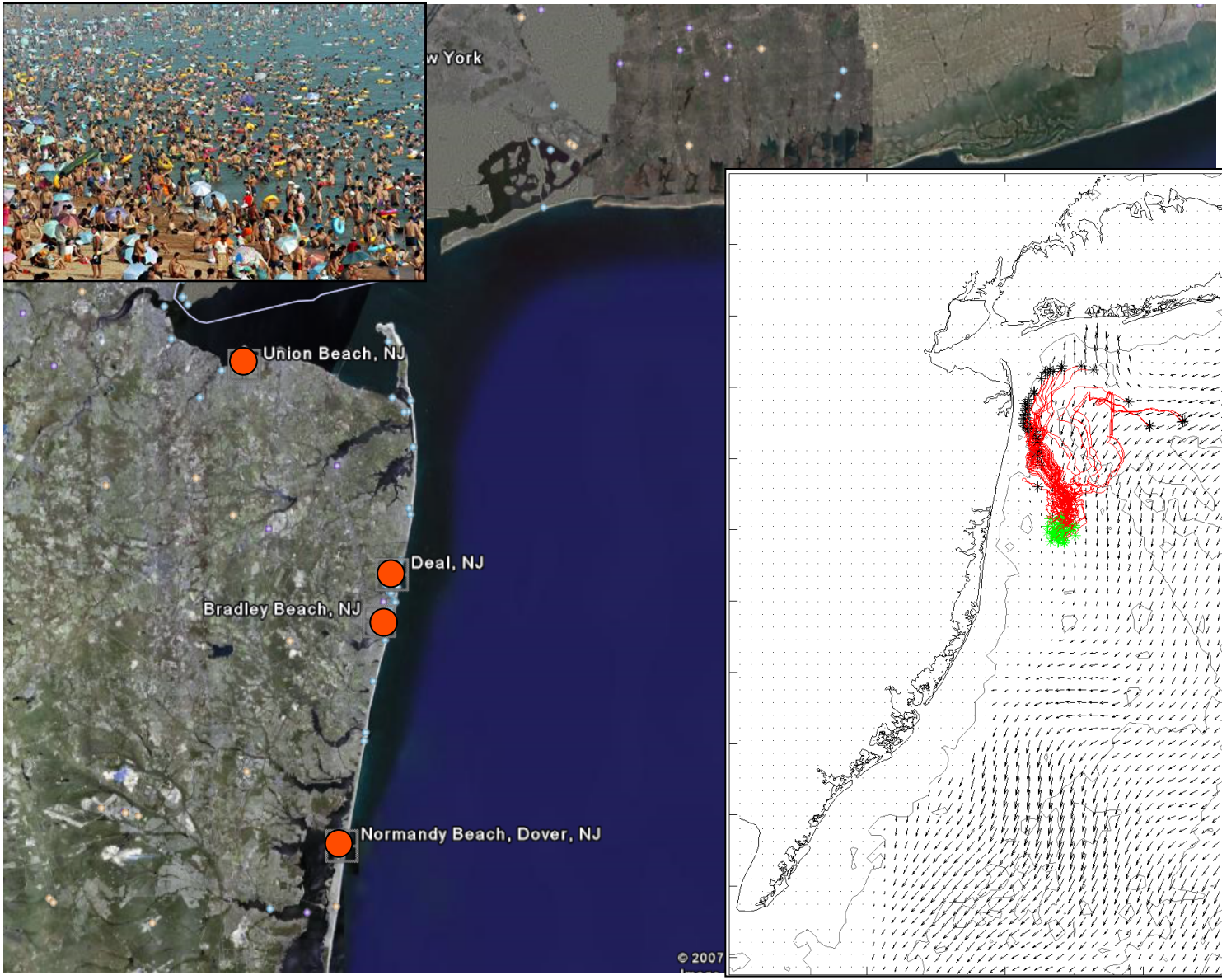
Aug. 27: Potato Sponges reported at Bradley Beach, NJ

Aug 29: Grease Balls reported at Deal, NJ

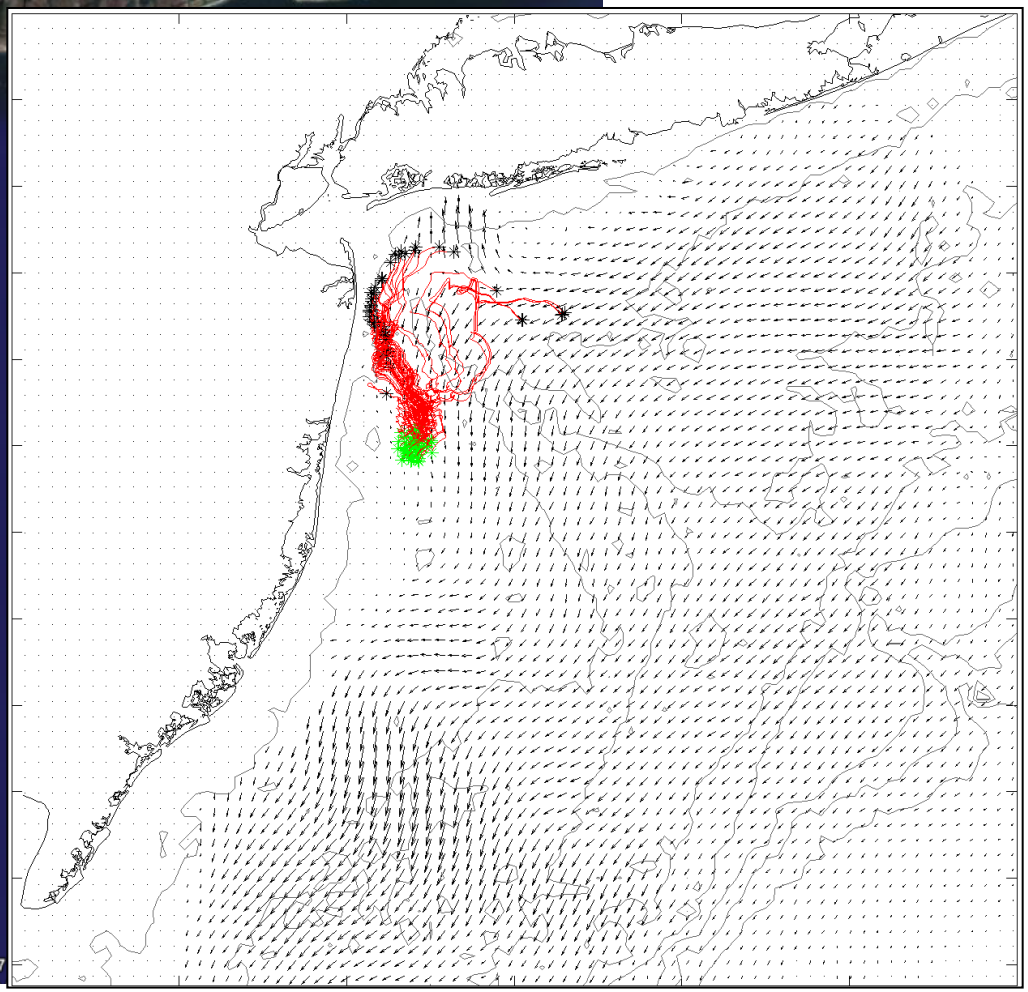
Sept. 1: Floatable/Medical Waste at Normandy Beach, NJ

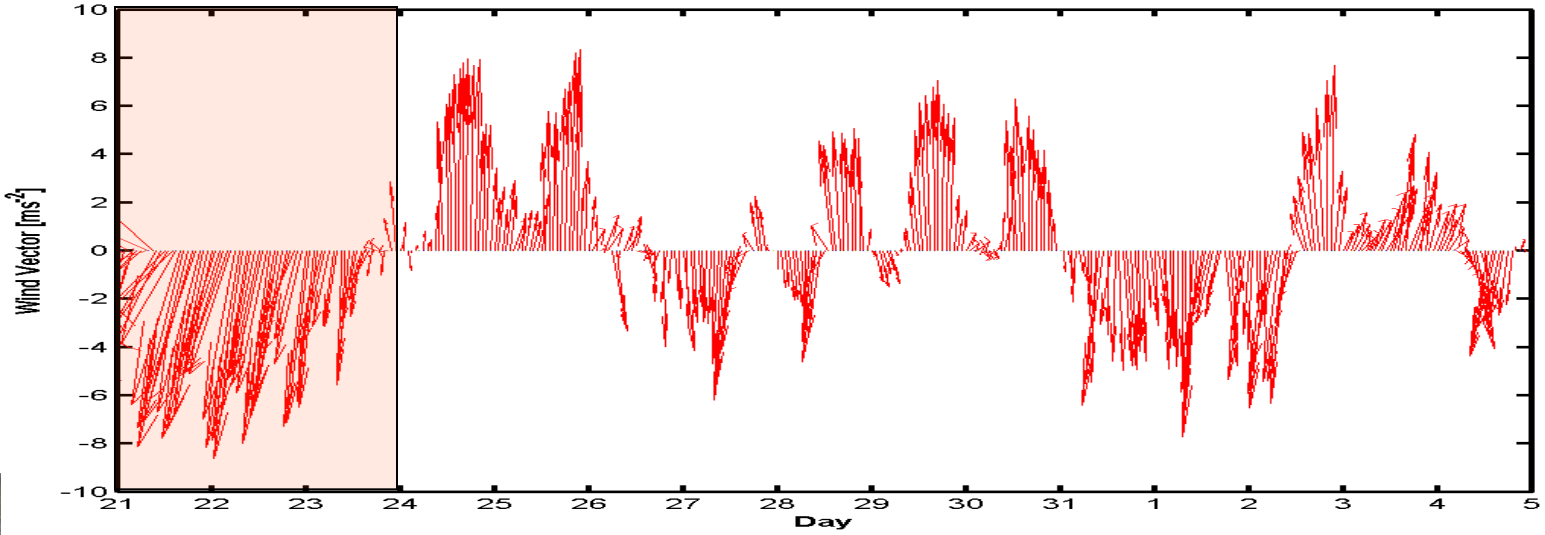
Garbage gone from beaches; questions linger

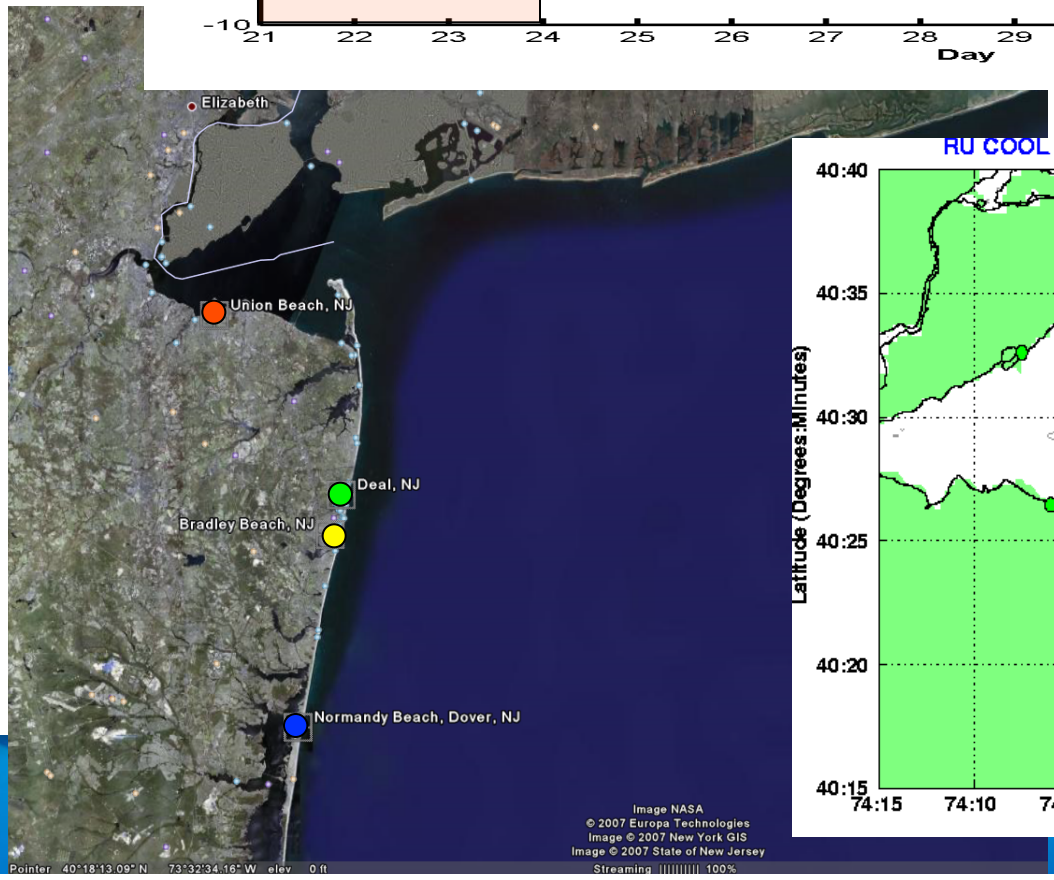
Posted by the Philadelphia Inquirer on 09/12/07

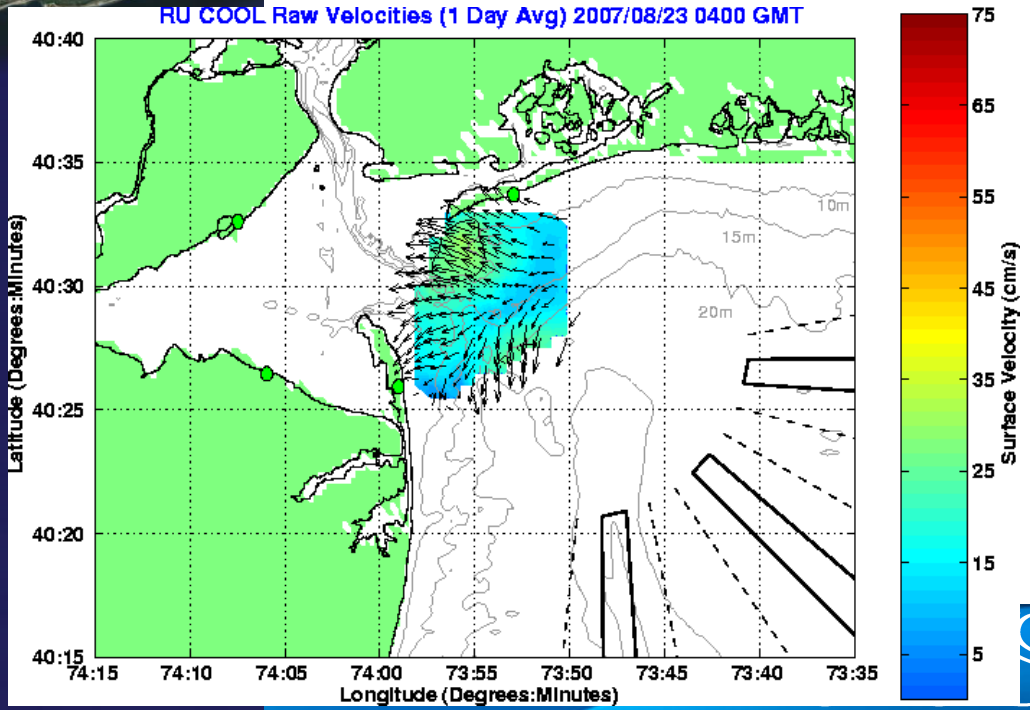


Labor Day 2007 Beach Closure

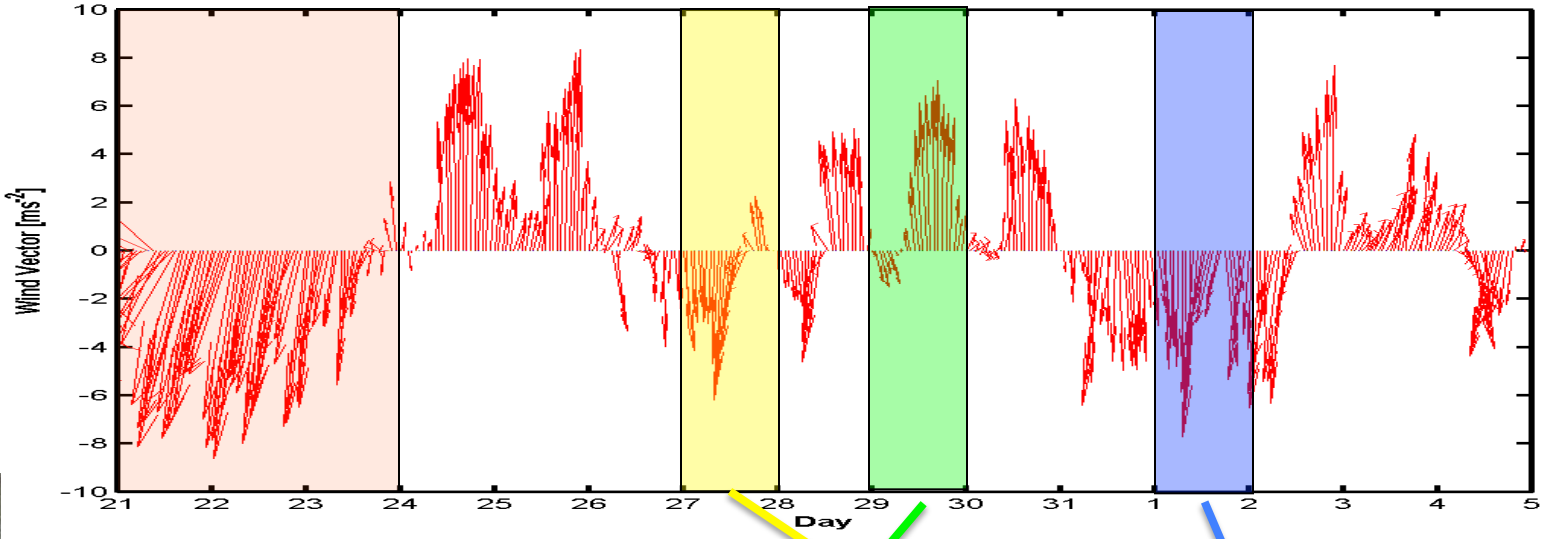


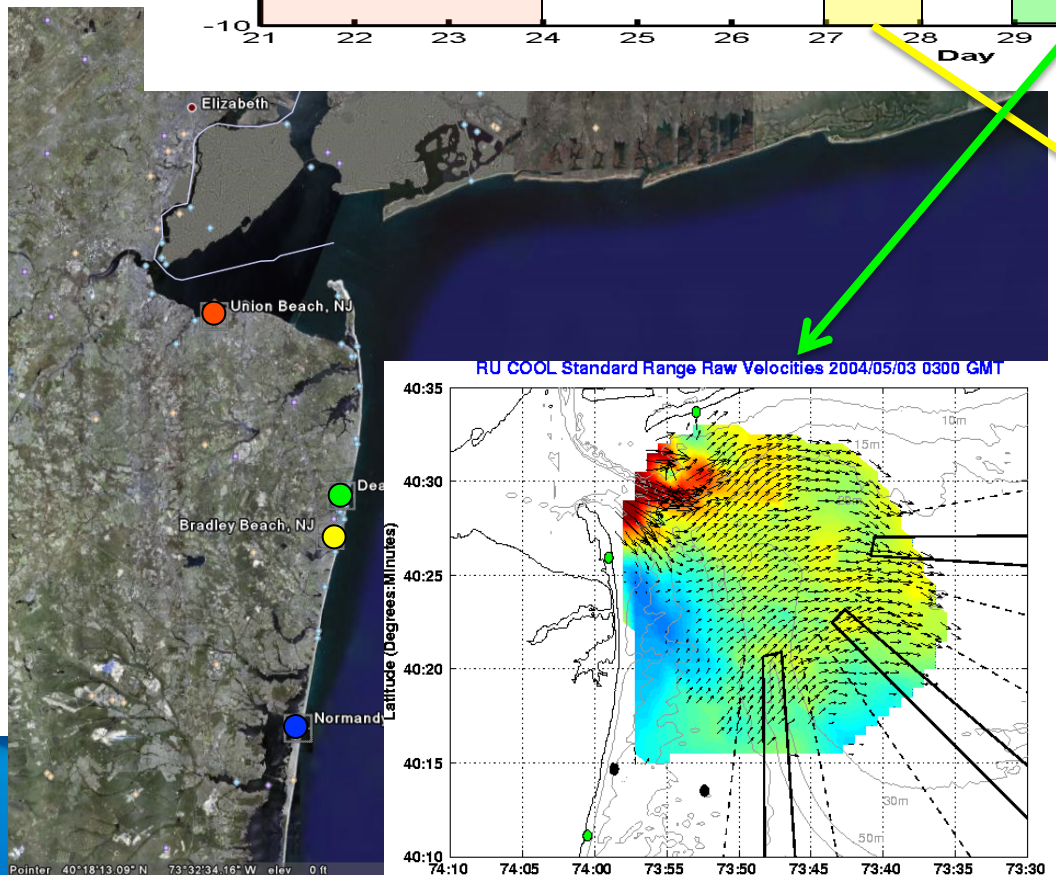




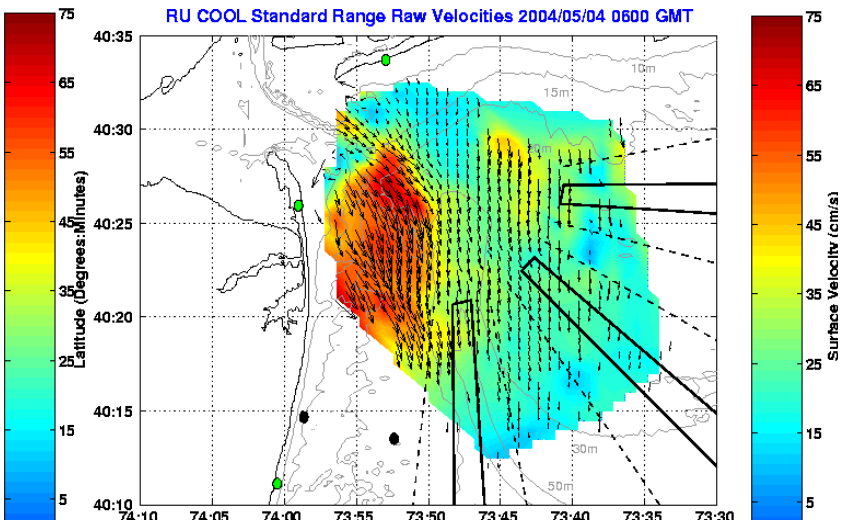


INTEGRATED OCEAN OBSERVING SYSTEM


Wind Vector [ms^{-2}]
10
8
6
4
2
0
-2
-4
-6
-8
-10
21
22
23
24
25
26
27
28
29
30
31
1
2
3
4
5
Day


Elizabeth
Union Beach, NJ
Bradley Beach, NJ
Normandy

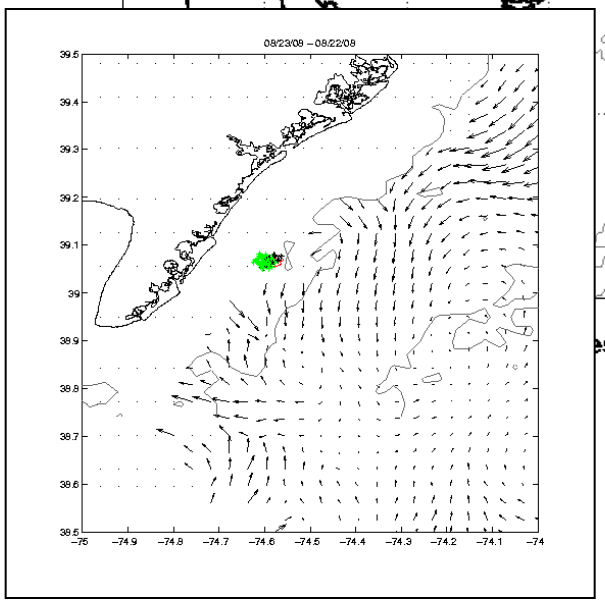
RU COOL Standard Range Raw Velocities 2004/05/03 0300 GMT
Latitude (Degrees:Minutes)
40:35
40:30
40:25
40:20
40:15
40:10
74:10
74:05
74:00
73:55
73:50
73:45
73:40
73:35
73:30
10m
15m
30m
50m

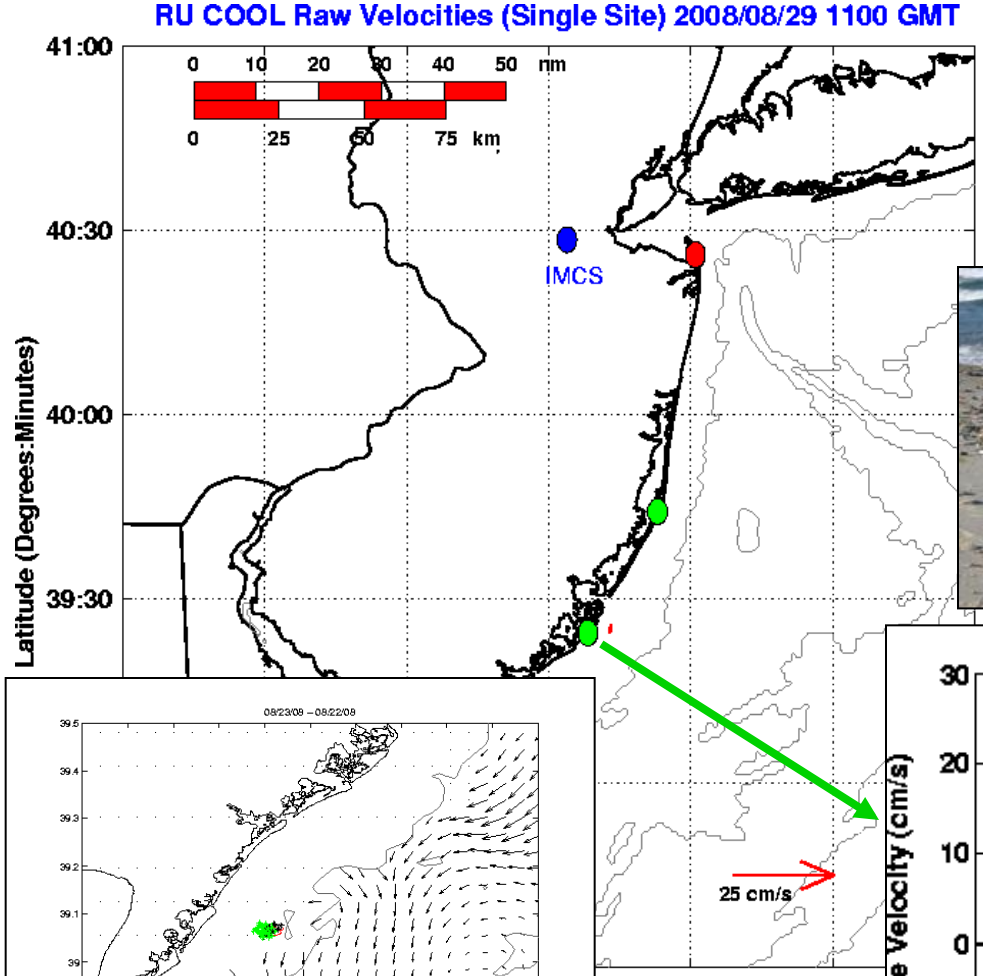

RU COOL Standard Range Raw Velocities 2004/05/04 0600 GMT
Latitude (Degrees:Minutes)
Surface Velocity (cm/s)
75
65
55
45
35
25
15
5
40:35
40:30
40:25
40:20
40:15
40:10
74:10
74:05
74:00
73:55
73:50
73:45
73:40
73:35
73:30
10m
15m
30m
50m

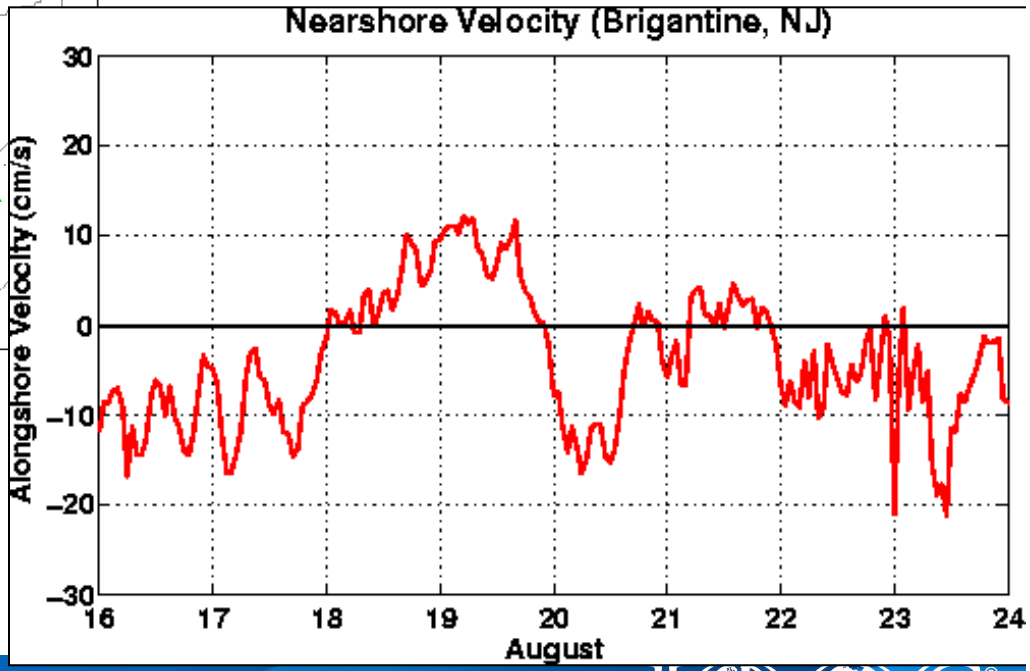
Floatable Events

2007: Normandy Beach, NJ

2008: Avalon, NJ







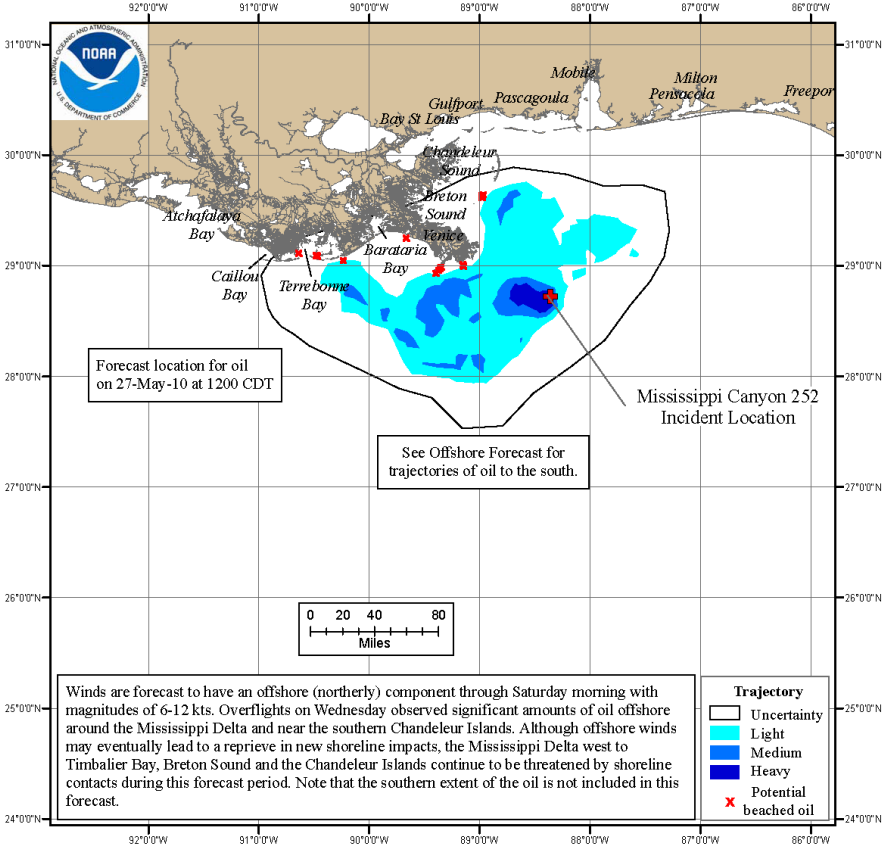
Oil Spill Status : NOAA Guidance

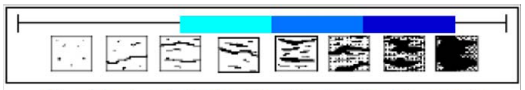
Nearshore Surface Oil Forecast Deepwater Horizon MC252

NOAA/NOS/OR&R **Nearshore**

Estimate for: 1200 CDT, Thursday, 5/27/10
Date Prepared: 2100 CDT, Wednesday, 5/26/10

This forecast is based on the NWS spot forecast from Wednesday, May 26 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, TAMU/TGLO, NAVO/NRL) and HFR measurements. The model was initialized from Tuesday evening satellite imagery analysis (NOAA/NESDIS) and Wednesday overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.





this scale bar shows the meaning of the distribution terms at the current time

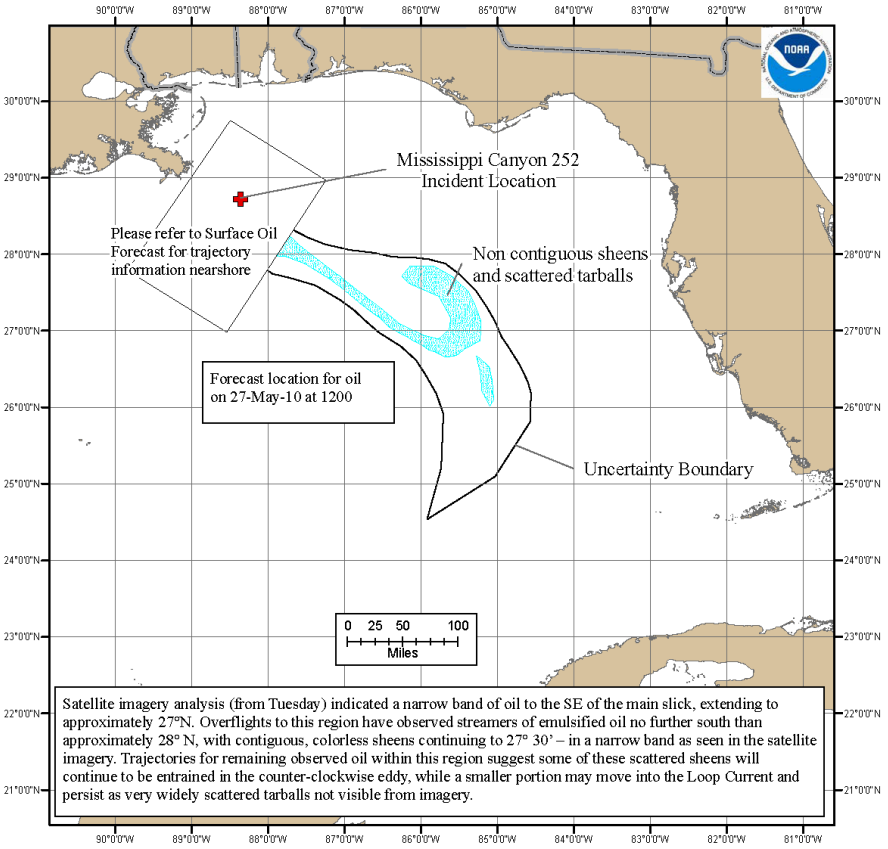
Next Forecast: May 27th PM

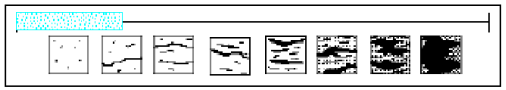
Offshore Surface Oil Forecast Deepwater Horizon MC252

NOAA/NOS/OR&R **Offshore**

Estimate for: 1200 CDT, Thursday 5/27/10
Date Prepared: 1800 CDT, Wednesday 5/26/10

Currents were obtained from four models: NOAA Gulf of Mexico, West Florida Shelf/USF, NRL IASNFS and NC State SABGOM. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from Tuesday morning satellite imagery analysis (NOAA/NESDIS) and observations from a Tuesday morning overflight. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).





this scale bar shows the meaning of the distribution terms at the current time

Next Forecast: May 27th PM

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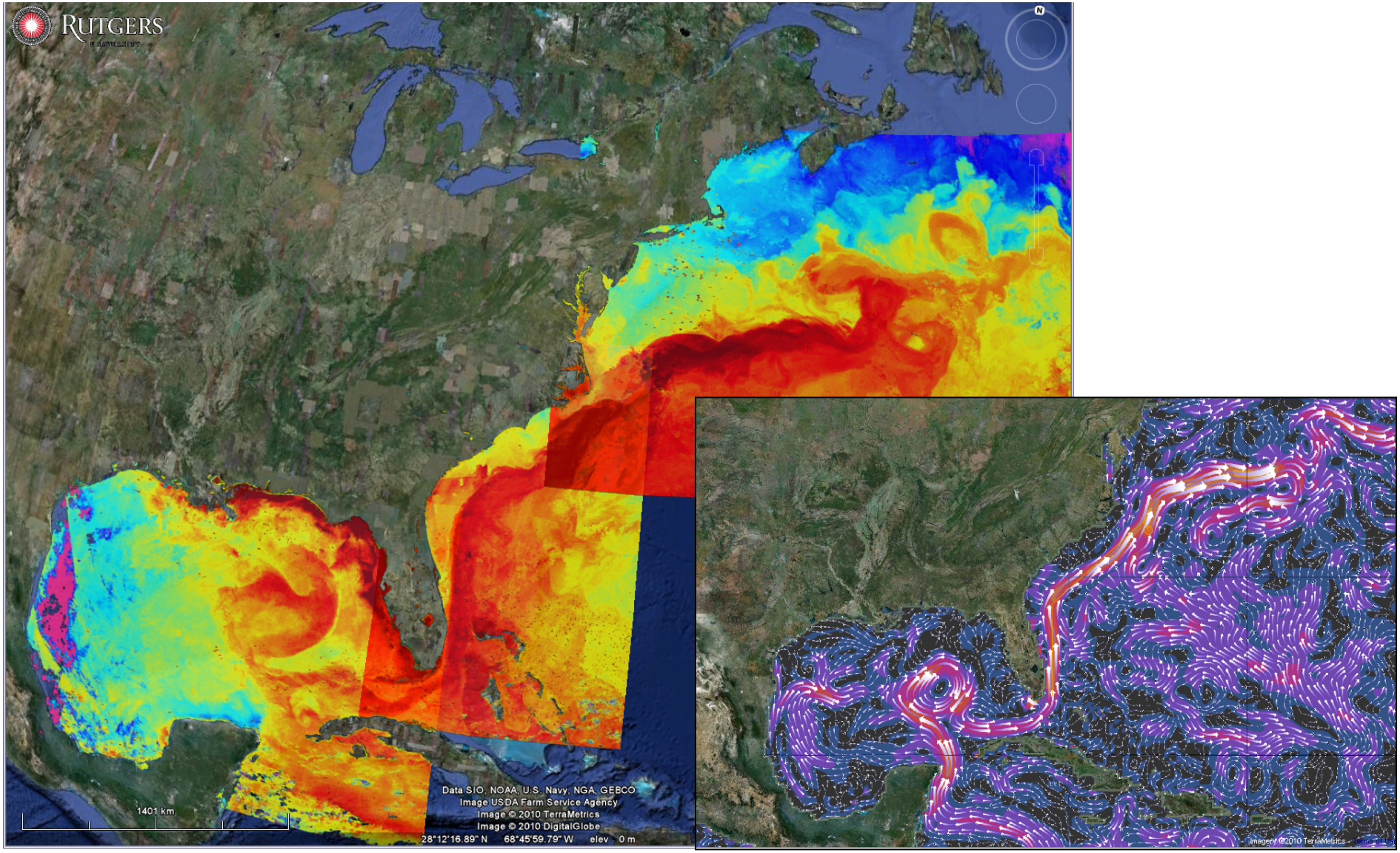
Ocean Connections: Gulf of Mexico to New Jersey



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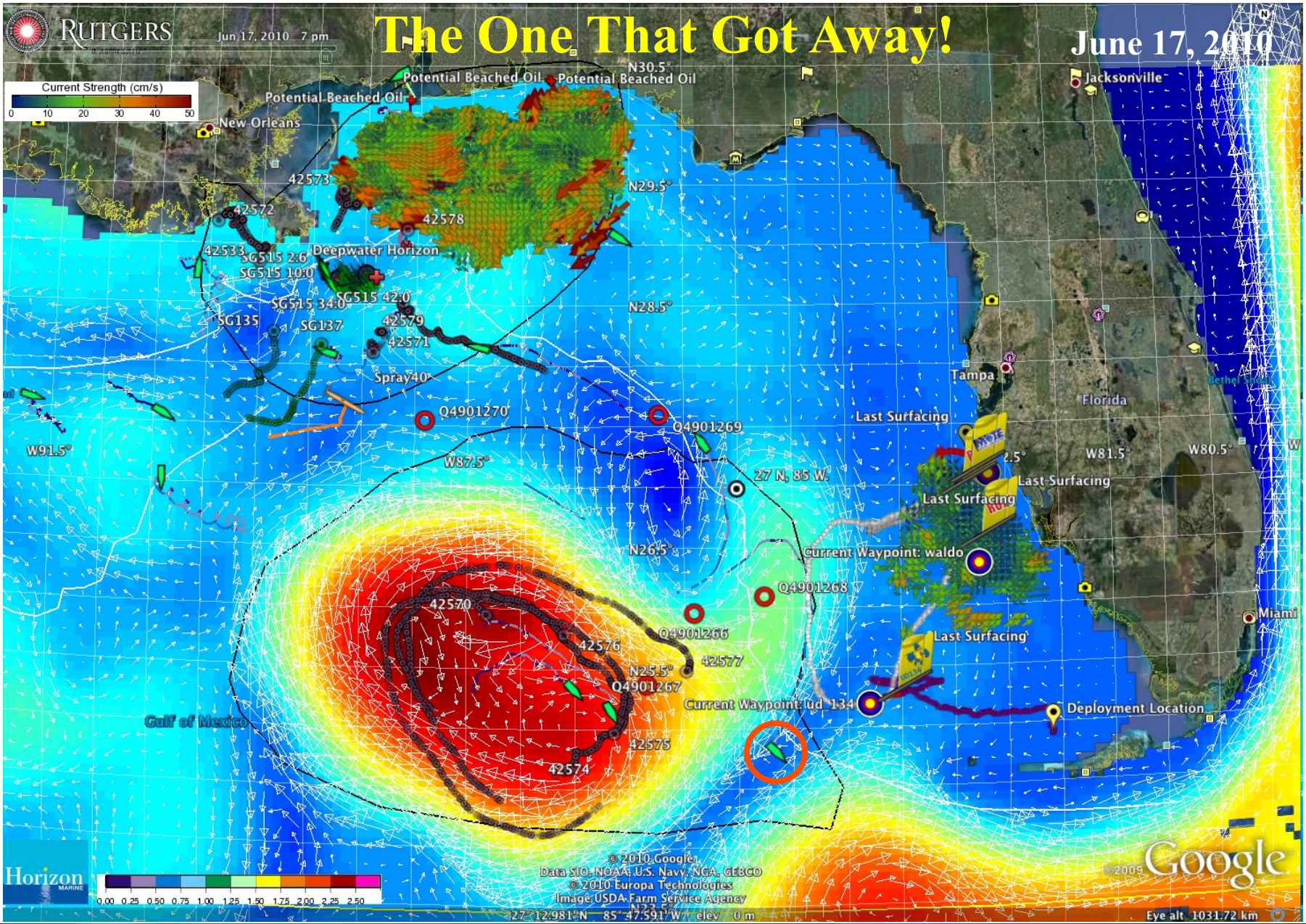

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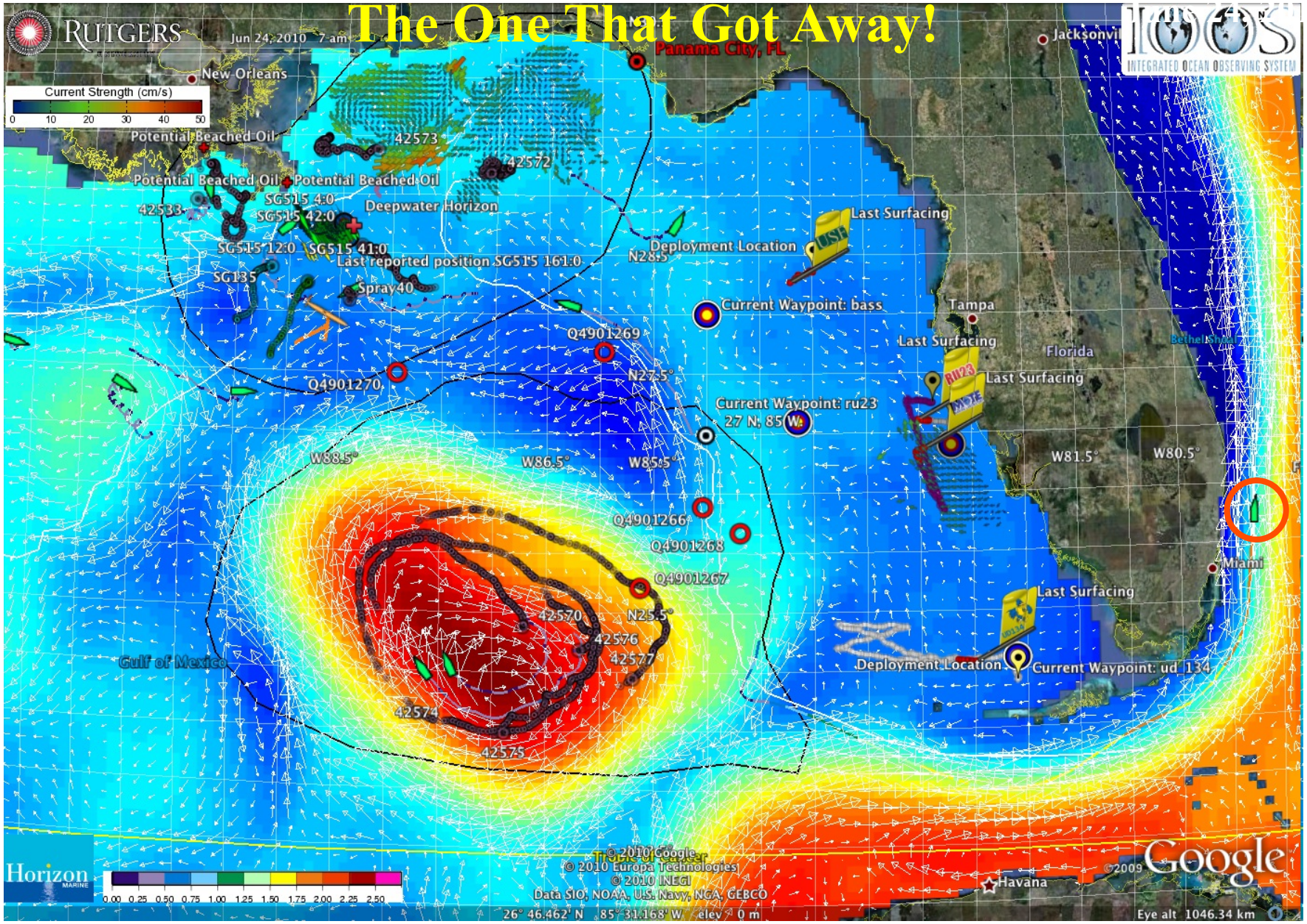
The One That Got Away!



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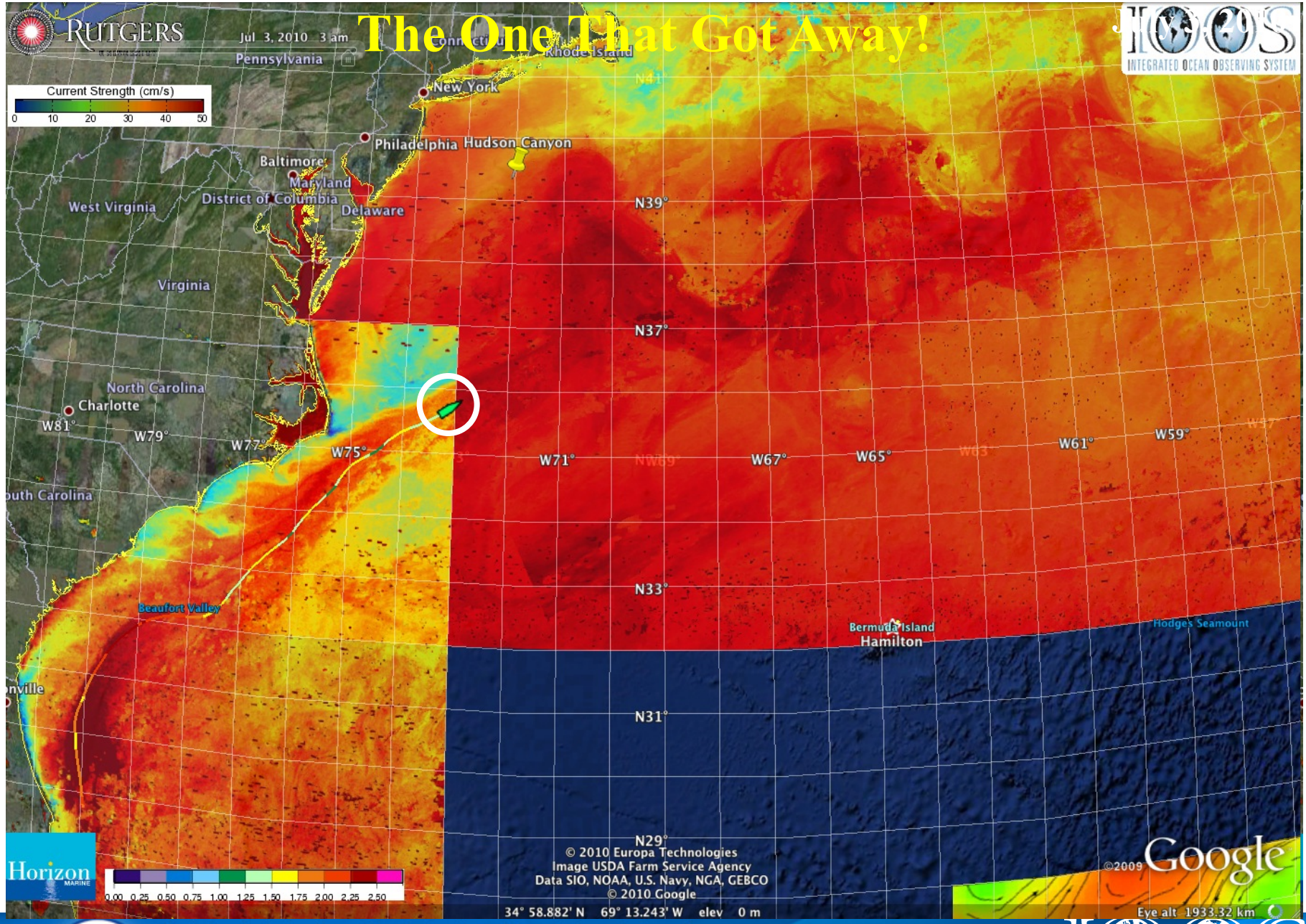
The One That Got Away!
RUTGERS
Jul 3, 2010 3 am
Current Strength (cm/s)
0 10 20 30 40 50
Pennsylvania
New York
Philadelphia
Hudson Canyon
Baltimore
Maryland
District of Columbia
Delaware
West Virginia
Virginia
North Carolina
Charlotte
W81°
W79°
W77°
W75°
W71°
W67°
W65°
W61°
W59°
N39°
N37°
N33°
N31°
N29°
Beaufort Valley
Bermuda Island
Hamilton
Hodges Seamount
Horizon MARINE
0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50
© 2010 Europa Technologies
Image USDA Farm Service Agency
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Google
34° 58.882' N 69° 13.243' W elev 0 m
©2009 Google
Eye alt 1933.32 km
IOOS
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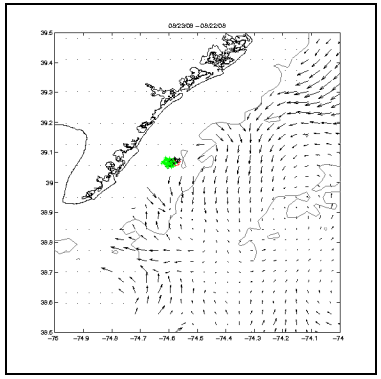
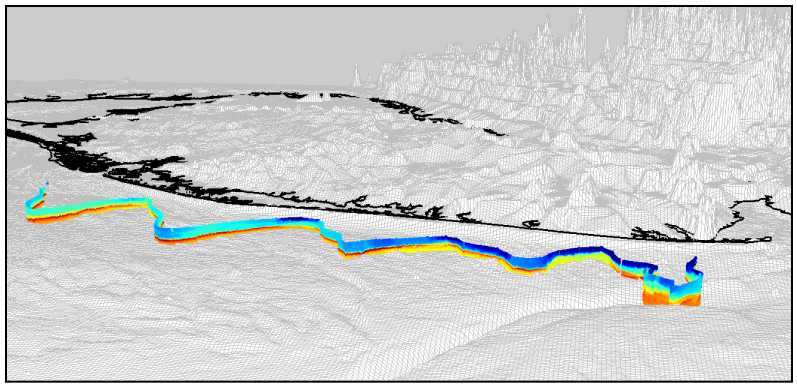
Local Predications: New Jersey Observations and Models

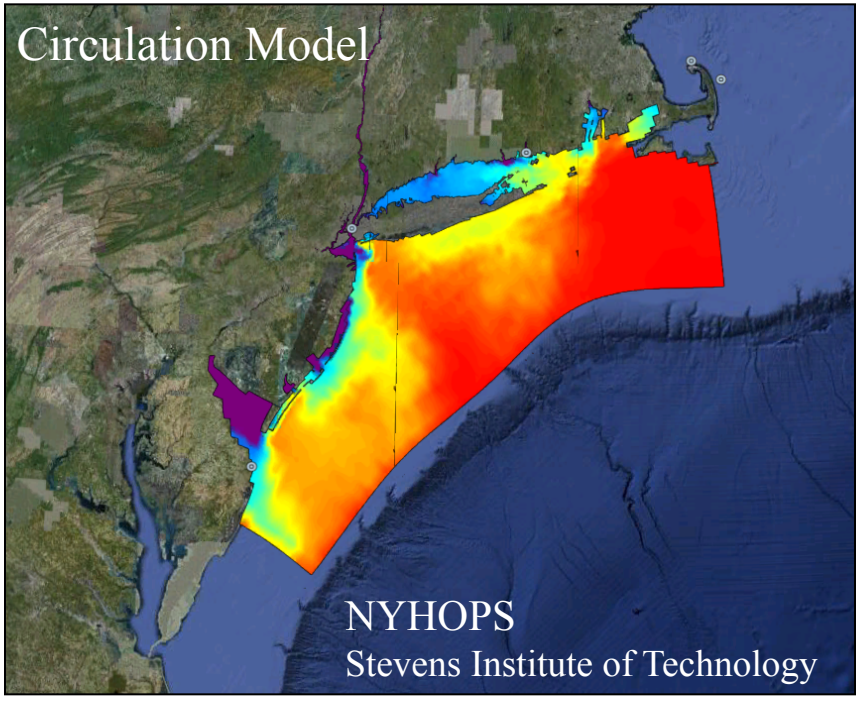


HF Radar



Gliders

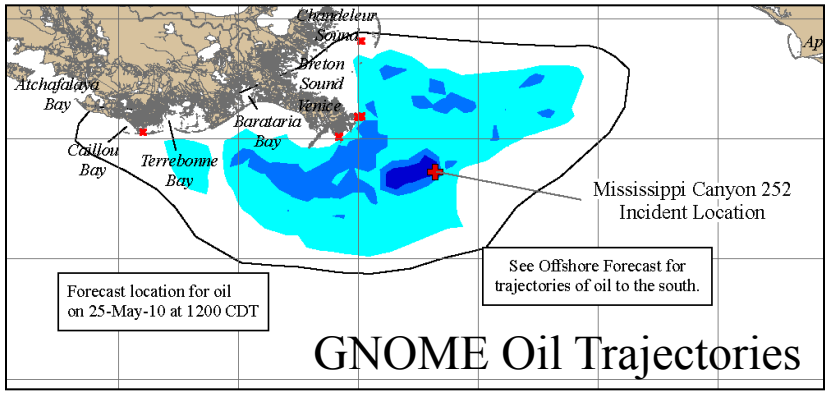
Observations focused on optimizing forecasts off the NJ Coast



RUTGERS

STEVENS Institute of Technology

Water Monitoring & Standards



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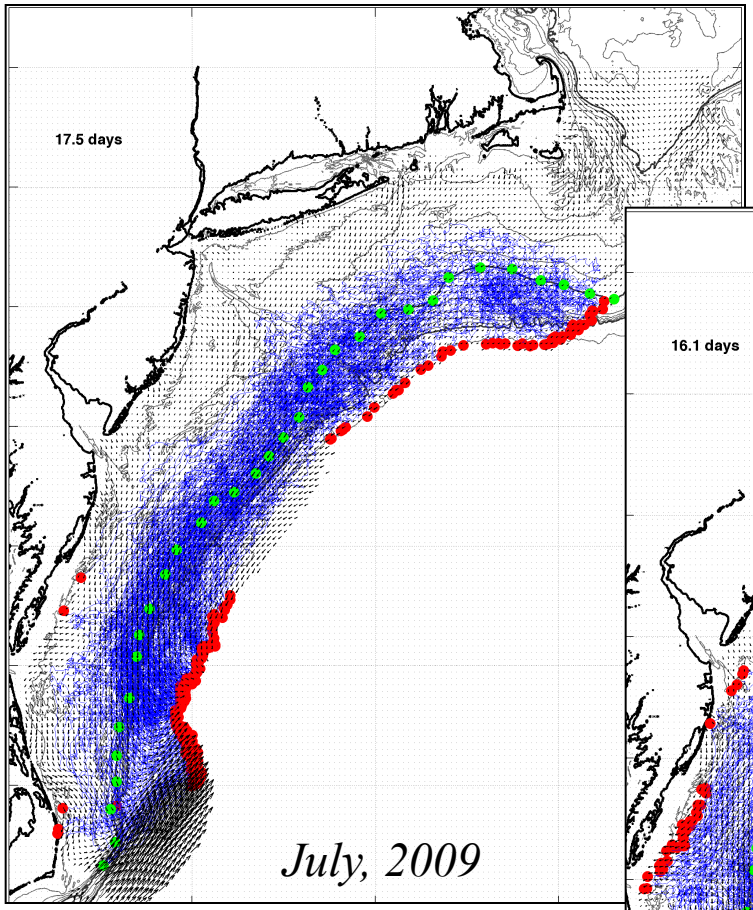
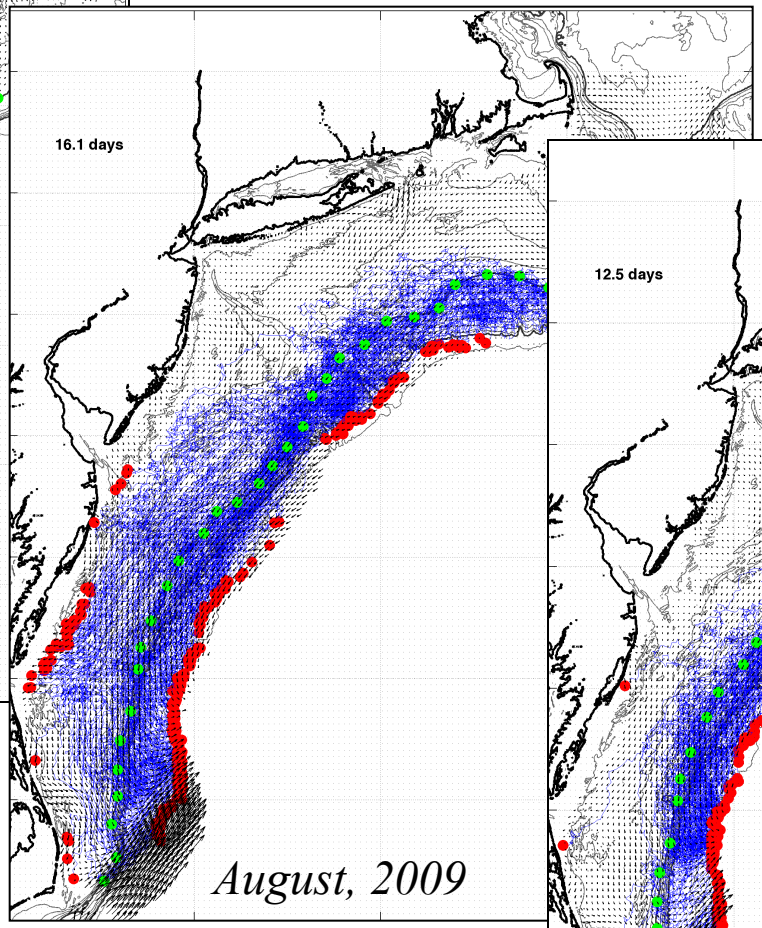
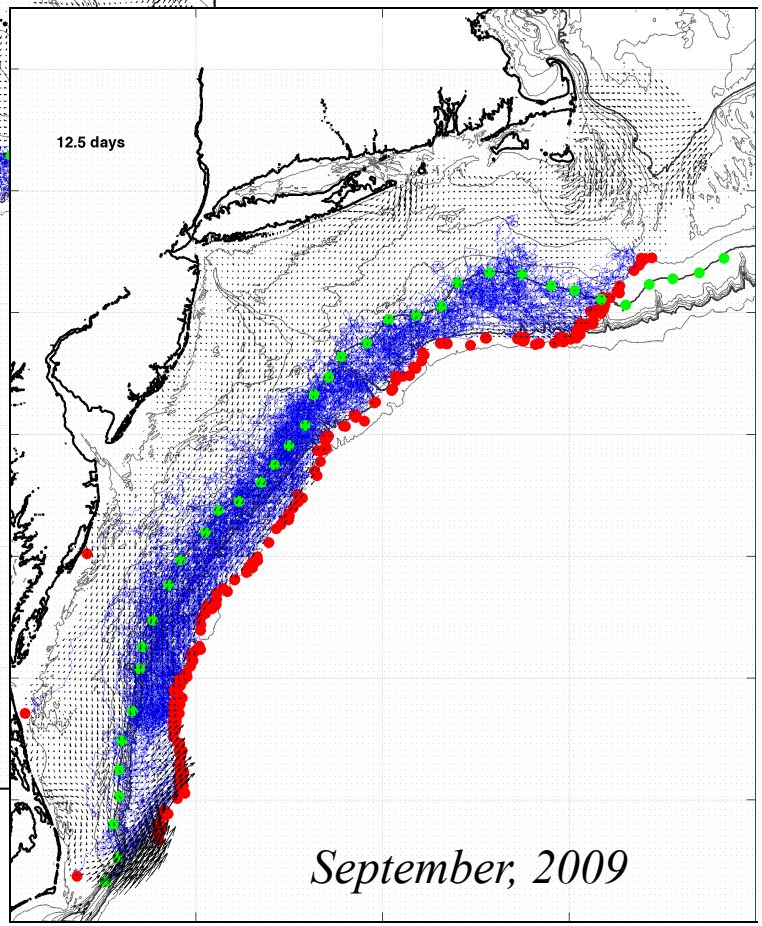
Surface Trajectories

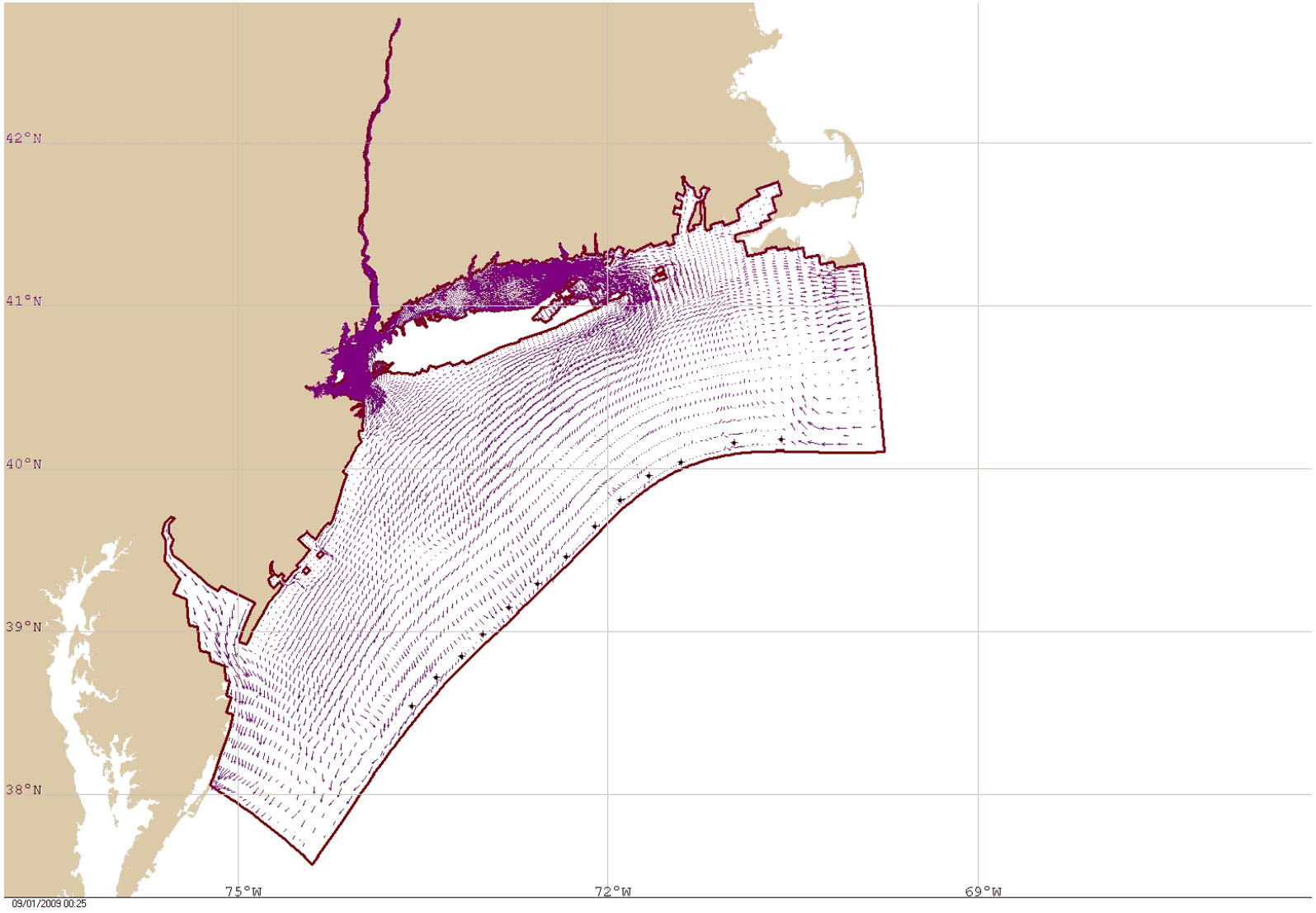






Modeled Particle Trajectories

Particles released September 1, 2009 to September 15, 2009

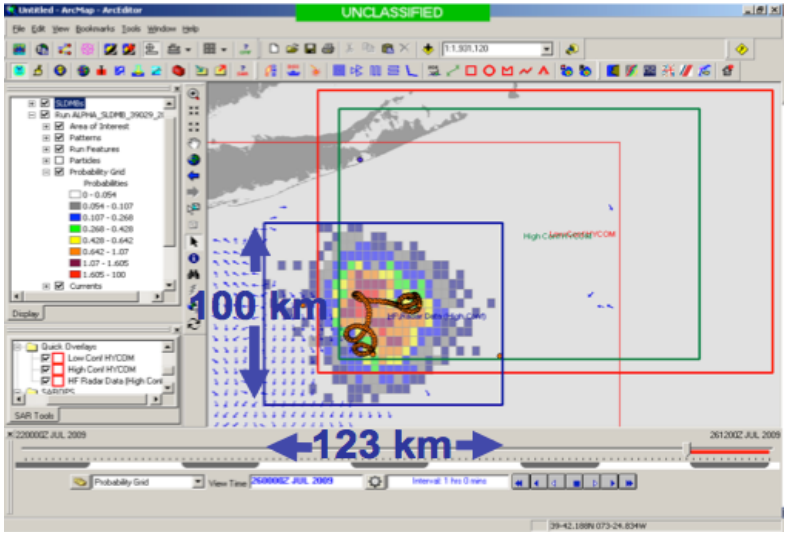


Summary: Floatables

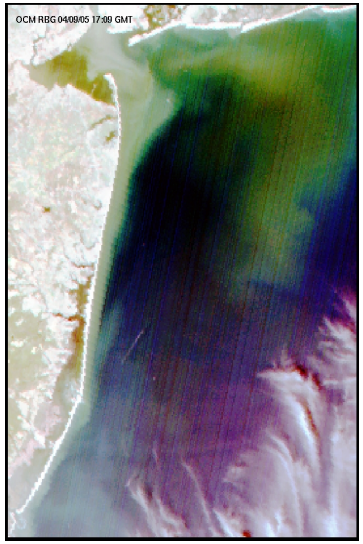
- Surface current maps provided by a nested HF radar network can support ocean observatory operations.
- Floatable events within the nearshore region have been tracked using these surface currents.
- Scenarios run with HF radar operations and assimilative circulation models guided decision making in response to catastrophic events.

MARACOOS REGIONAL THEMES & SUCCESS STORIES

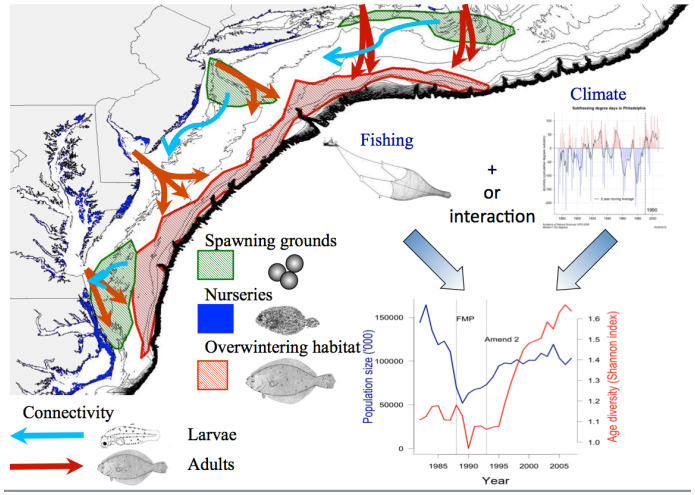
1) Maritime Operations – Safety at Sea



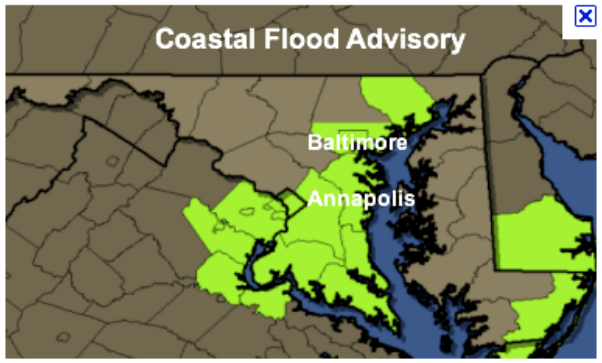
3) Water Quality – a) Floatables, b) Hypoxia, c) Nutrients



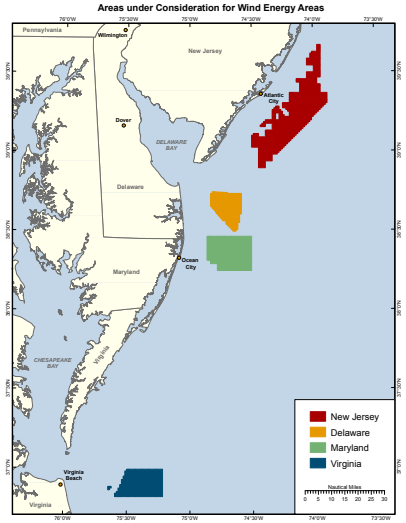
2) Ecosystem Decision Support - Fisheries



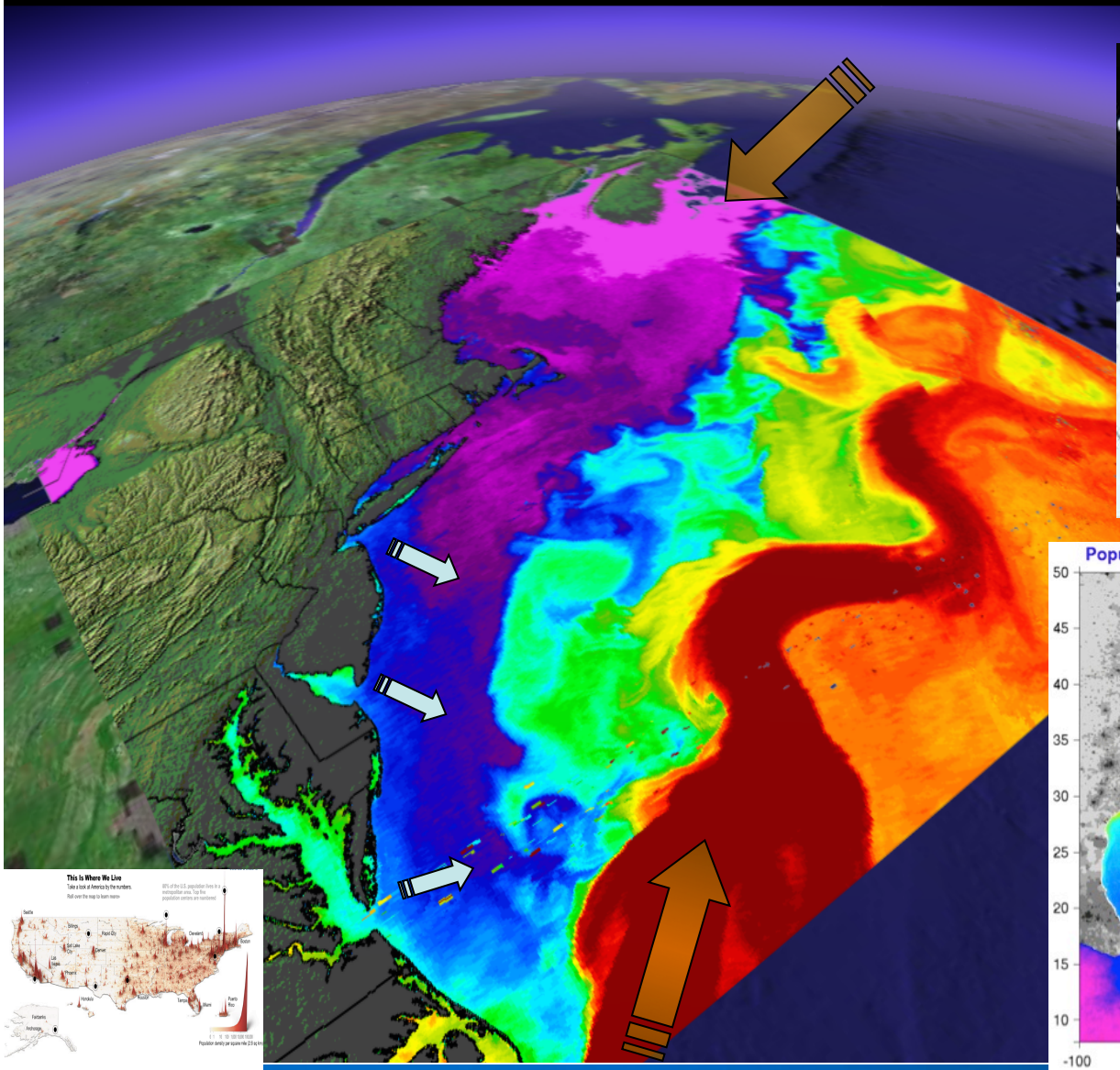
4) Coastal Inundation - Flooding

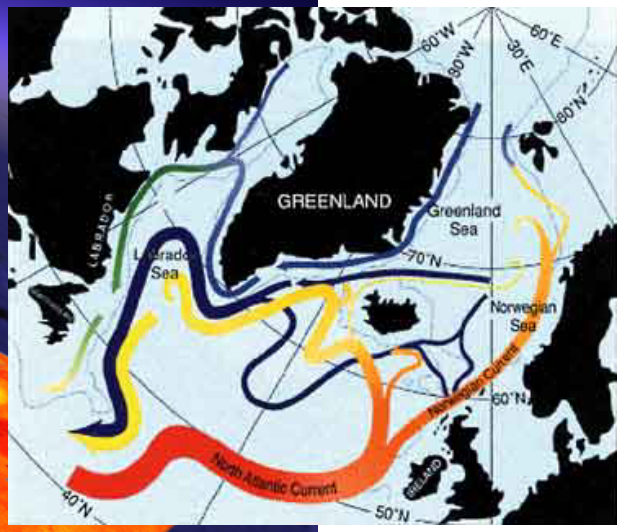


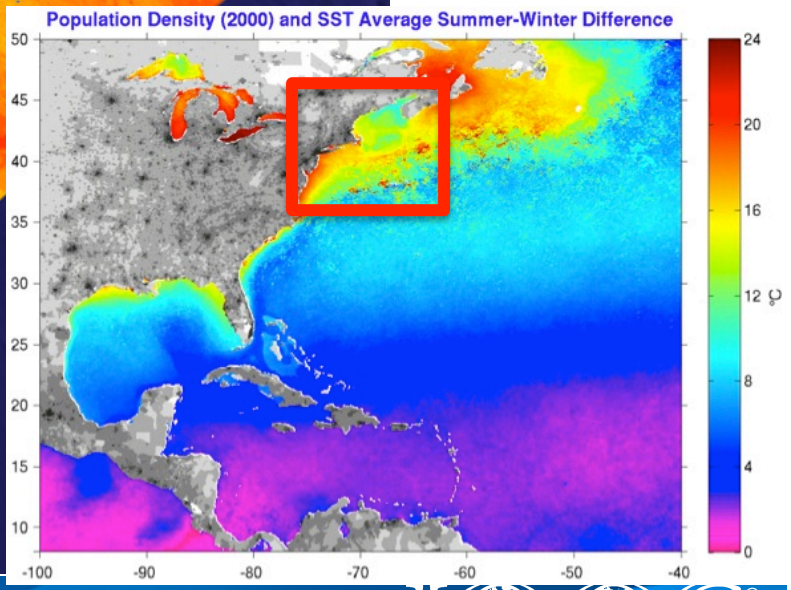
5) Energy – Offshore Wind



The Mid-Atlantic Bight



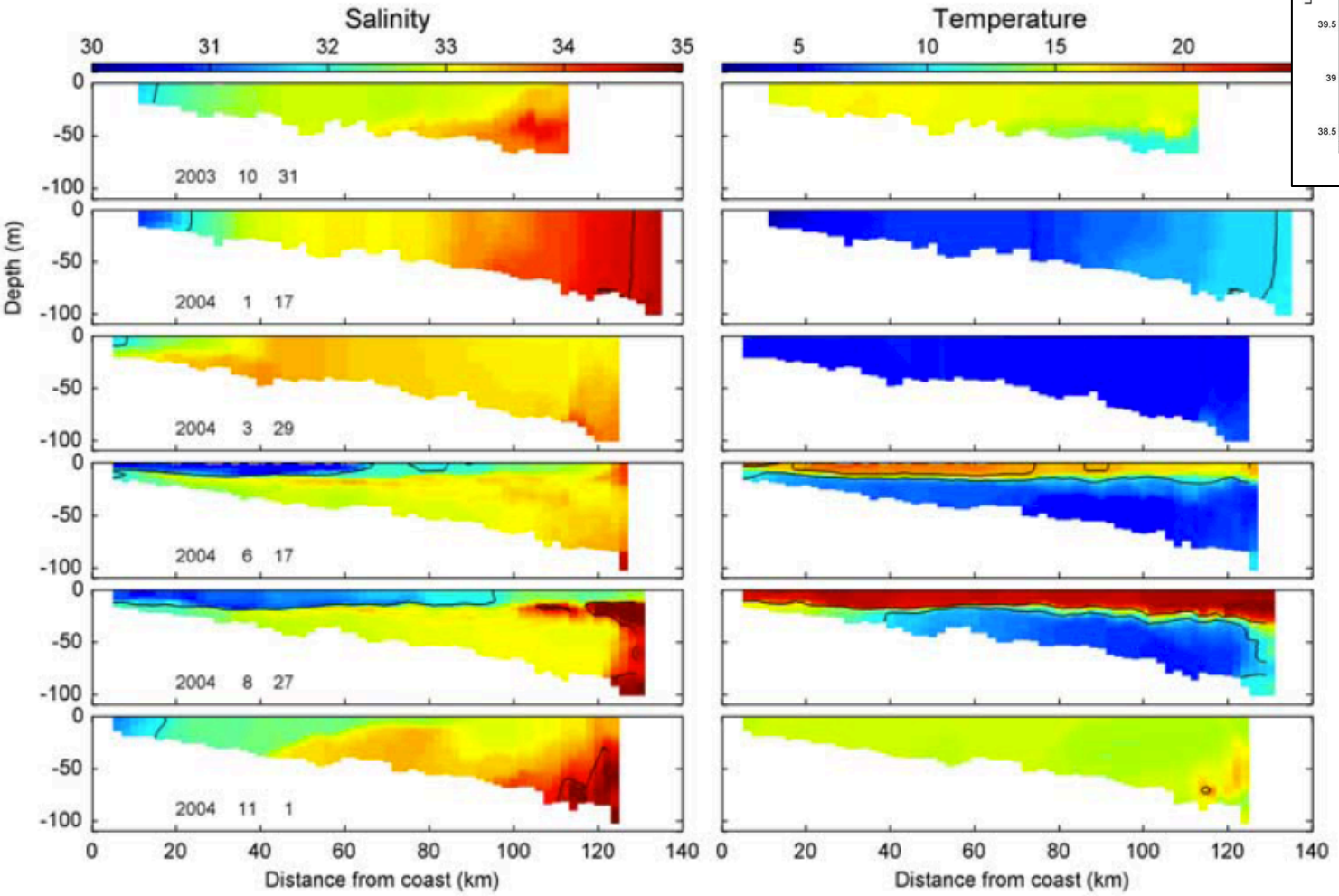


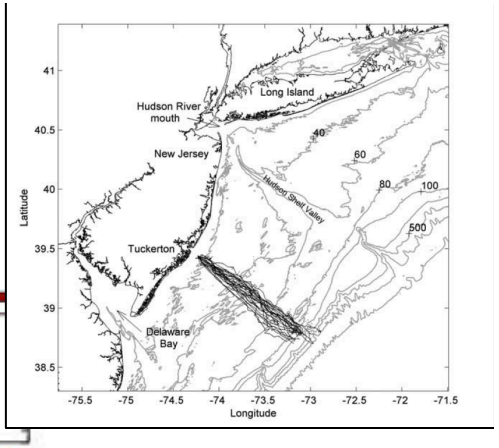


MARACOOS
Ocean Information for a Changing World

IOOS®
INTEGRATED OCEAN OBSERVING SYSTEM

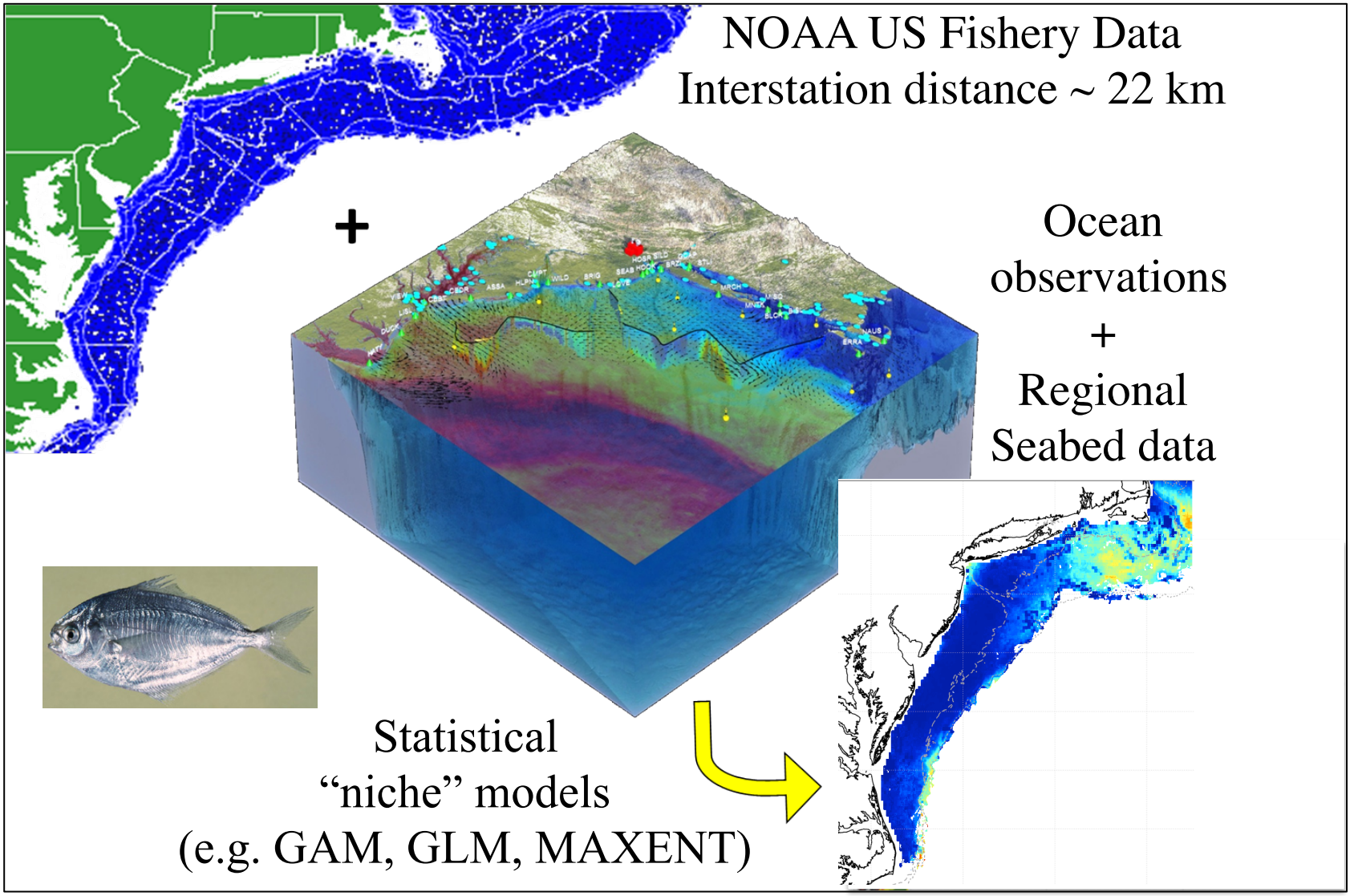
Seasonality





Castelao et al. 2008

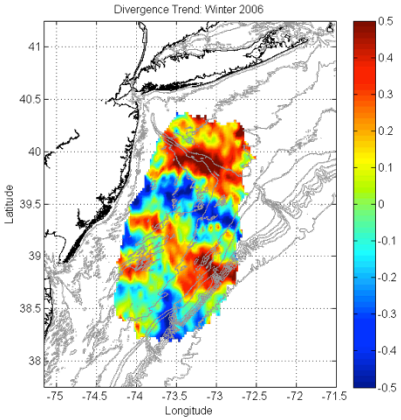
Approach: statistical species distribution models



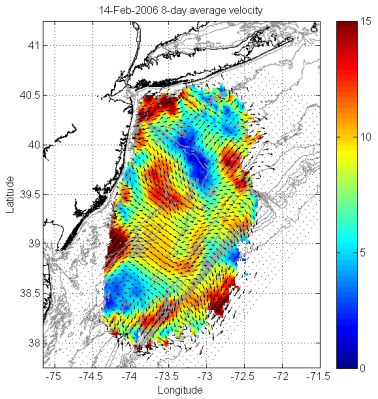
Environmental Data:

Remotely Sensed Pelagic
(IOOS HF radar - ocean currents)

- detided & filtered along-shore velocity
- detided & filtered cross-shore velocity
- variance in raw along-shore velocity
- variance in raw cross-shore velocity
- divergence
  - average
  - trend
- vorticity
  - average
  - trend

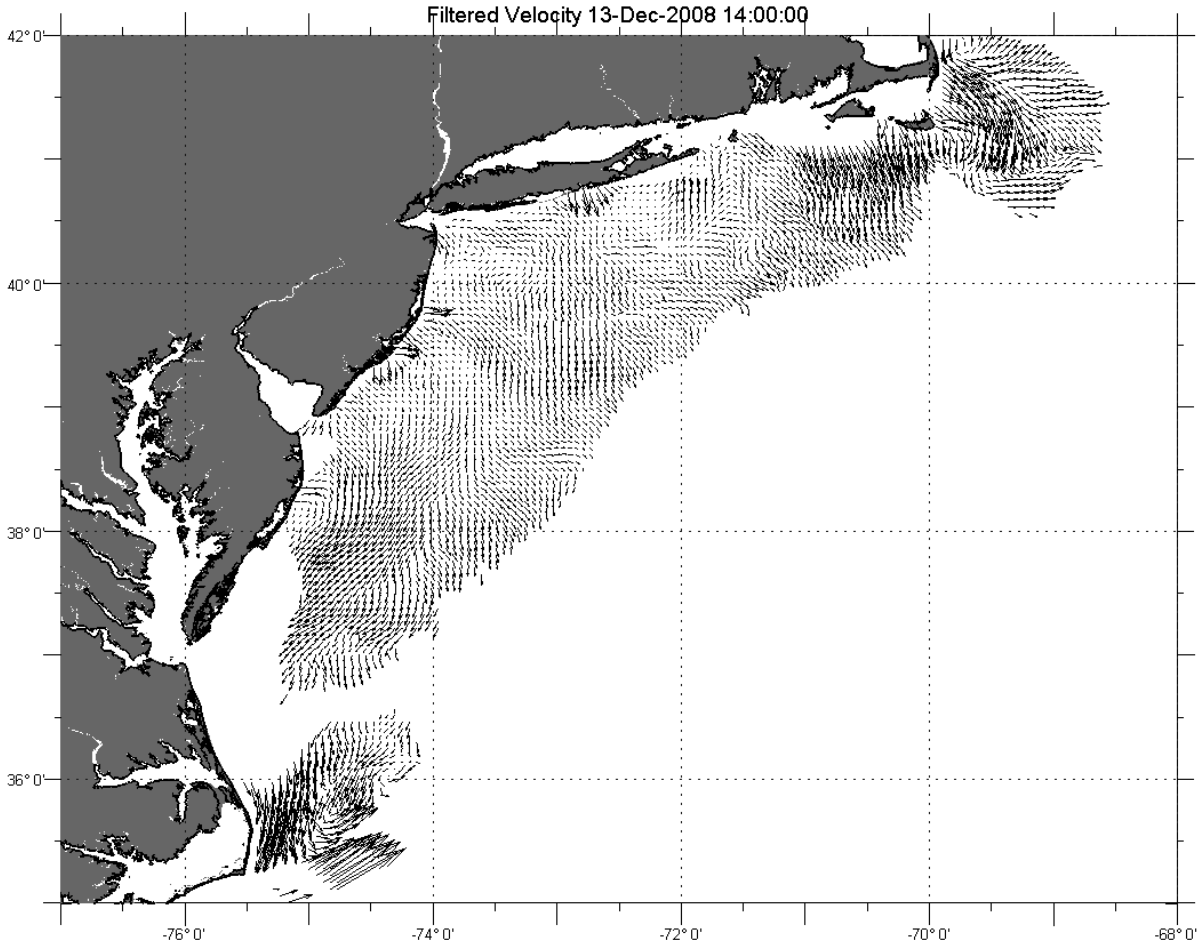


Divergence Trend

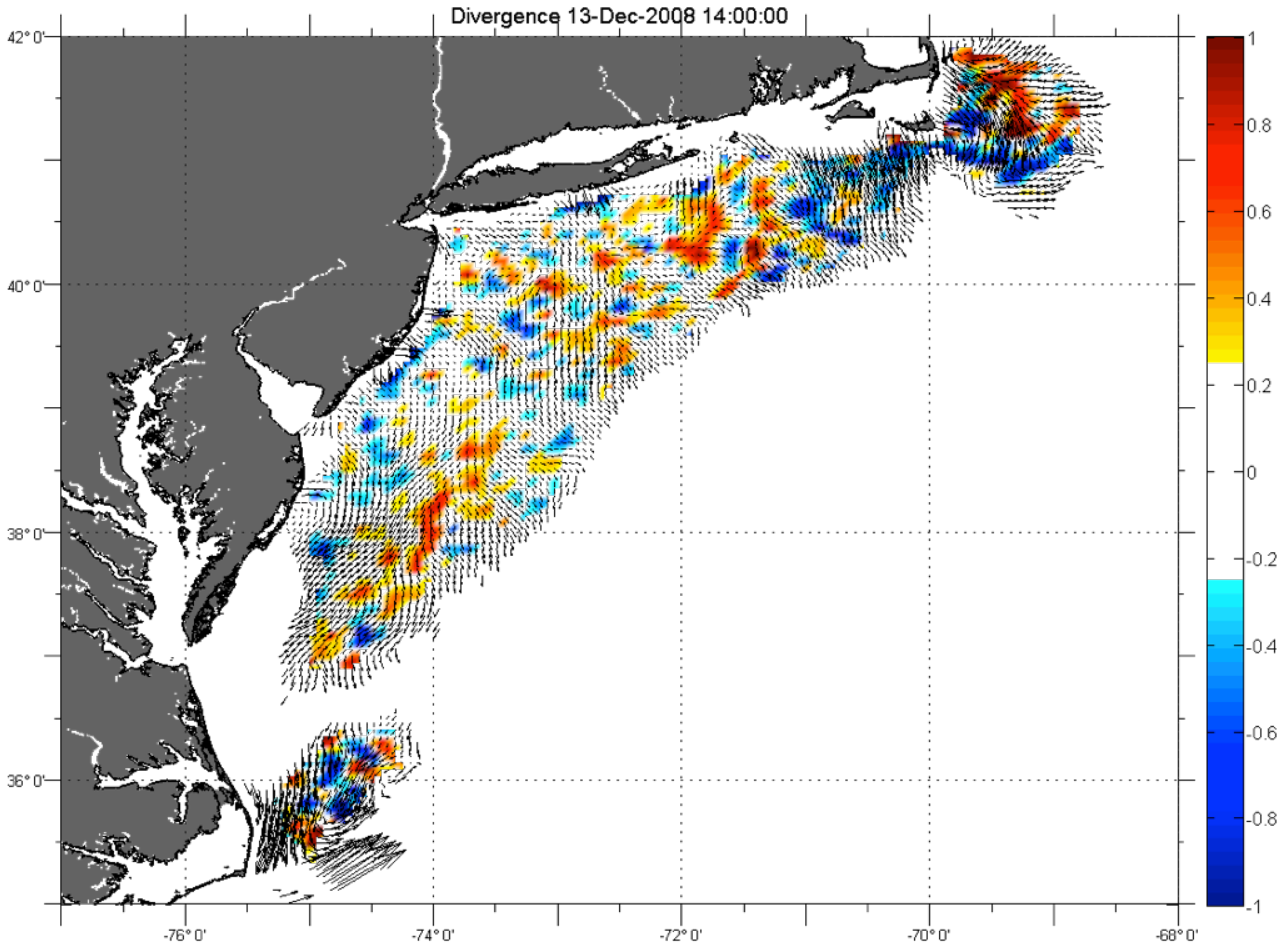


Current Velocity

Filtered Currents

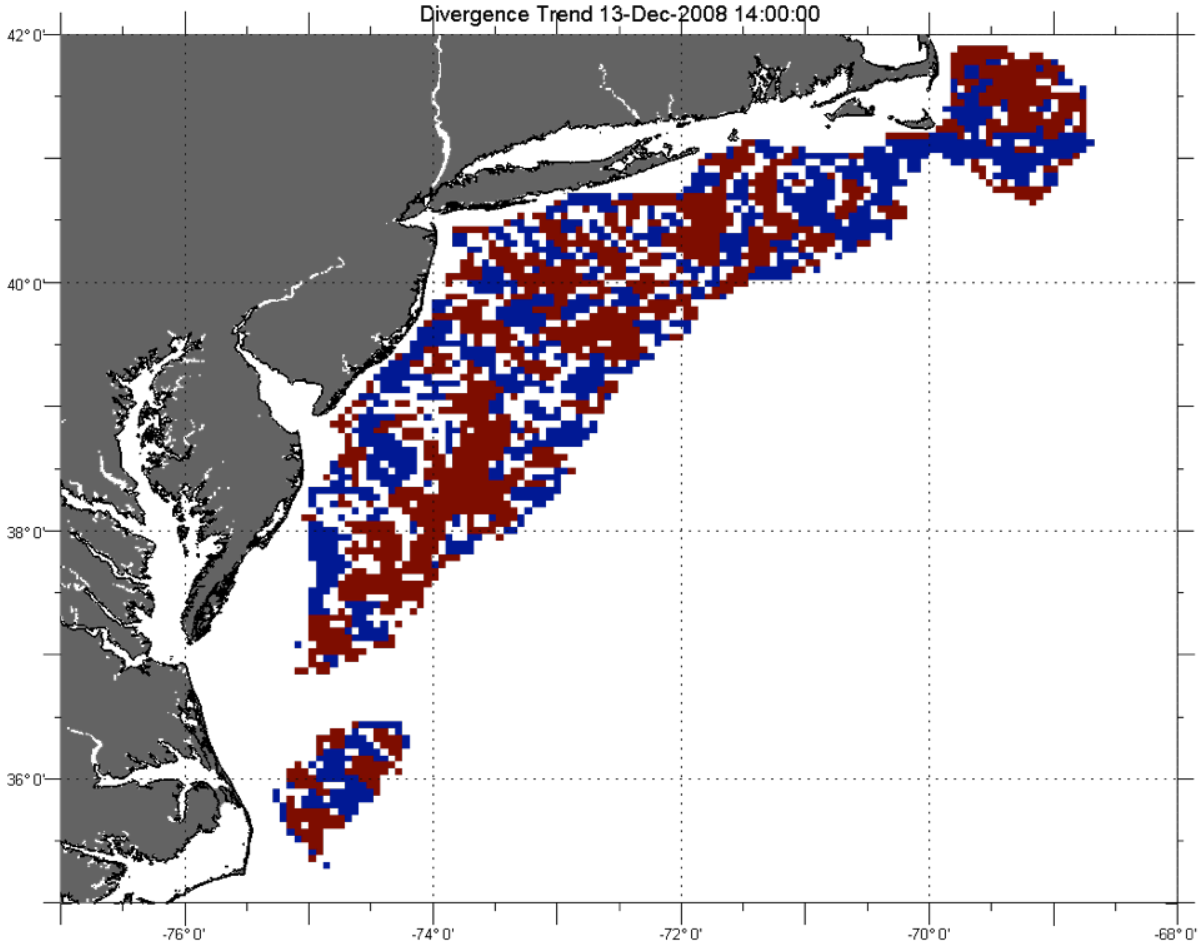


Surface Divergence



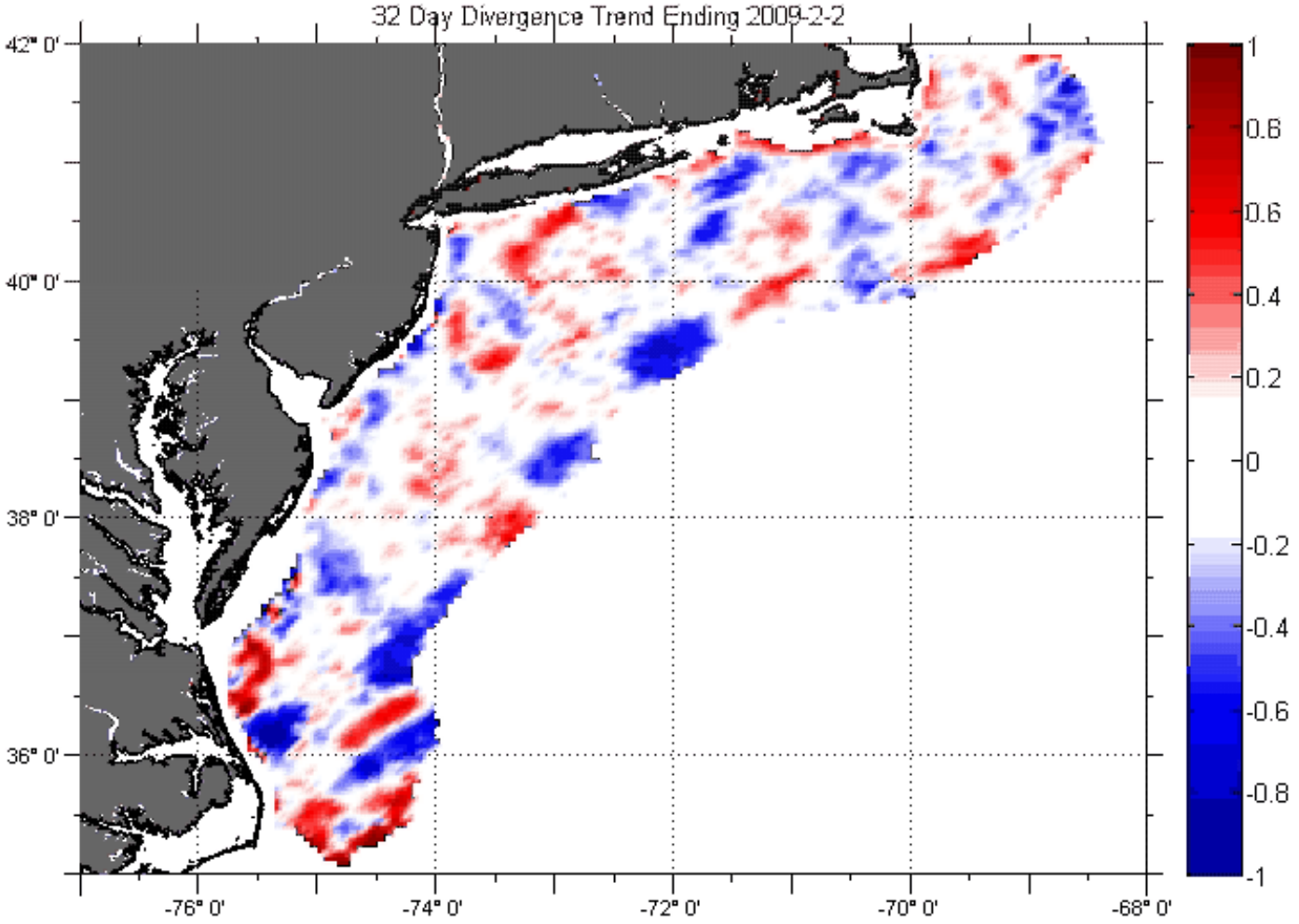
$$Divergence = \frac{du}{dx} + \frac{dv}{dy}$$

Divergence Trend



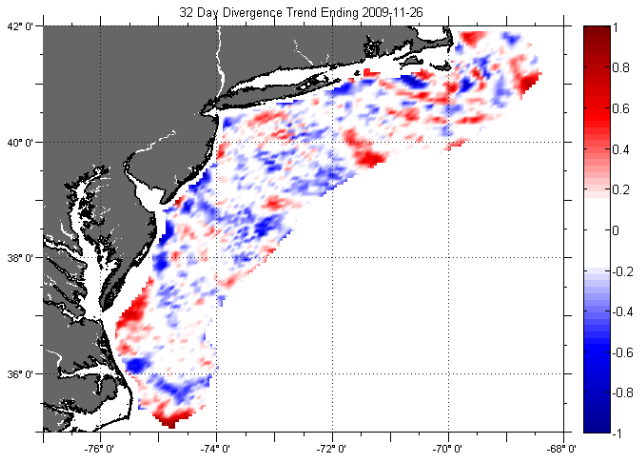
- Divergent: div > 0.1 m/day (→ +1, red)
- Convergent: div < -0.1 m/day (→ -1, blue)
- Neither: -0.1 < div < 0.1 (→ 0, white)

Seasonal Divergence Trends



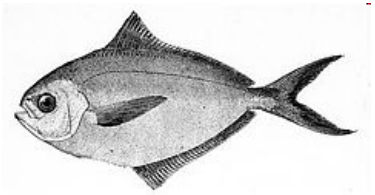
- Average instantaneous divergence trend values (+1,0,-1) at each point over entire season

Initial Statistical Model

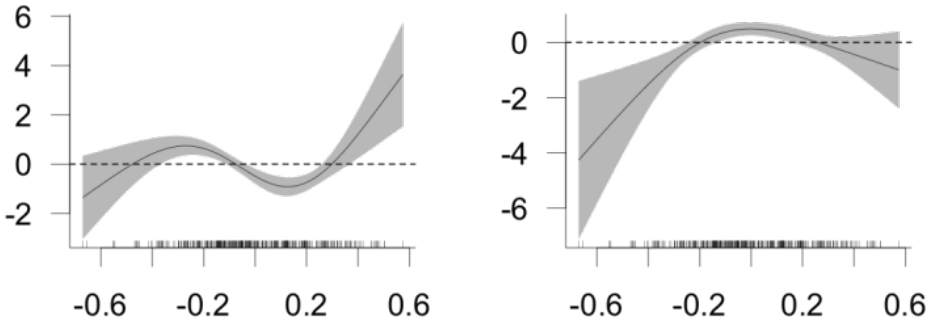


Upwelling

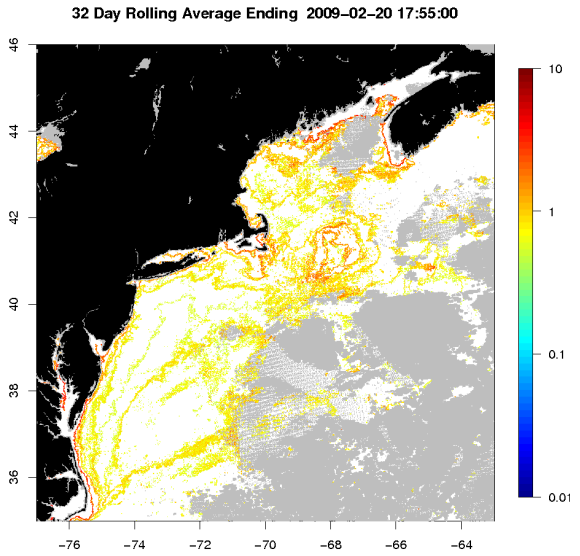
Downwelling



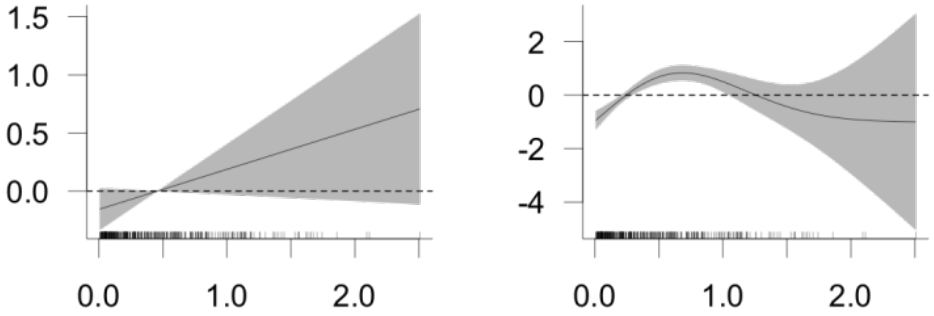
Divergence index



Downwelling Upwelling



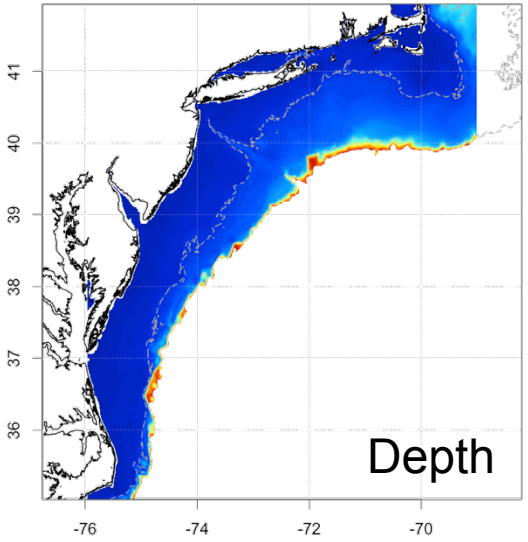
Frontal index

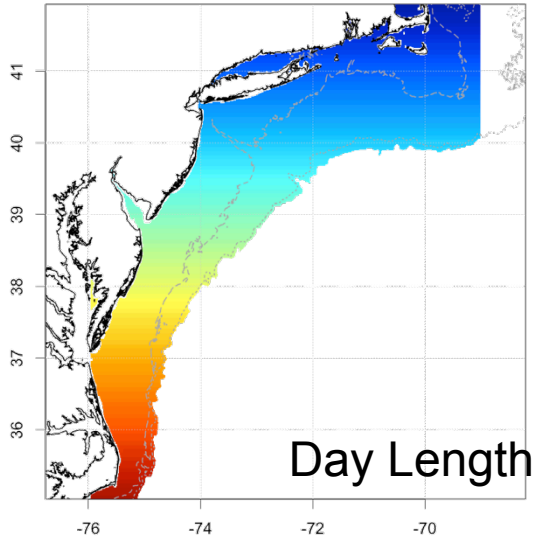


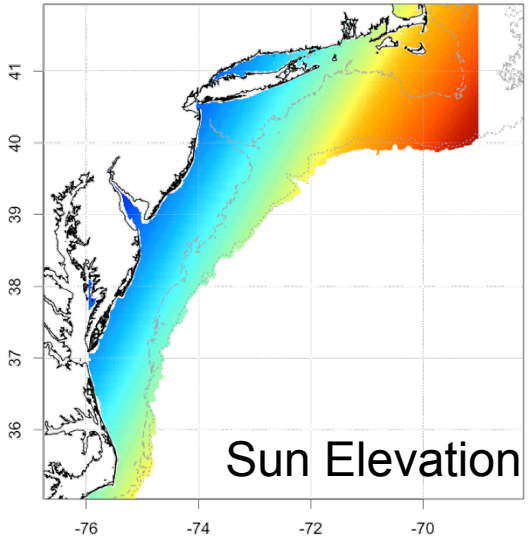
Distance: Far Close

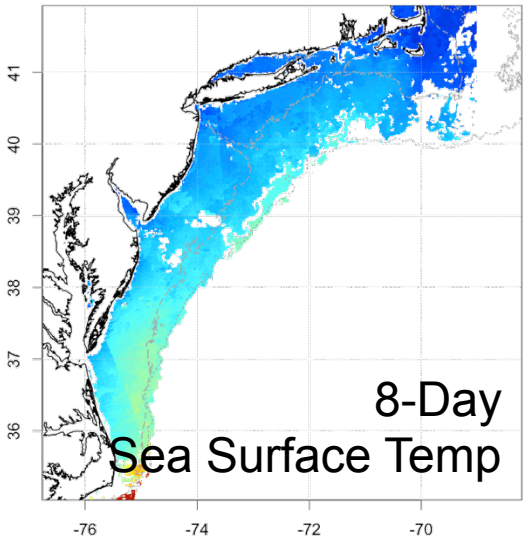
Strength: Weak Strong

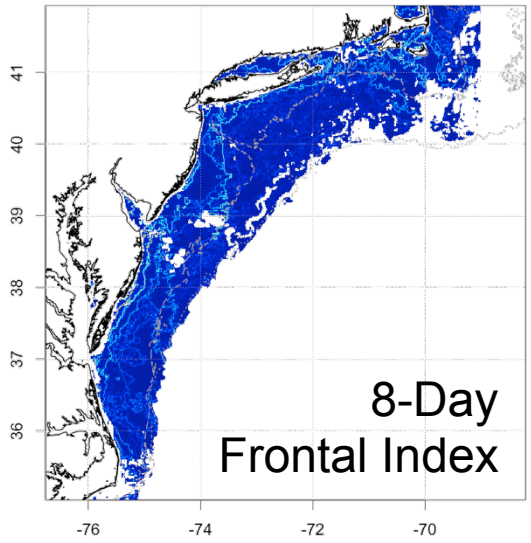
Butterfish Model Inputs

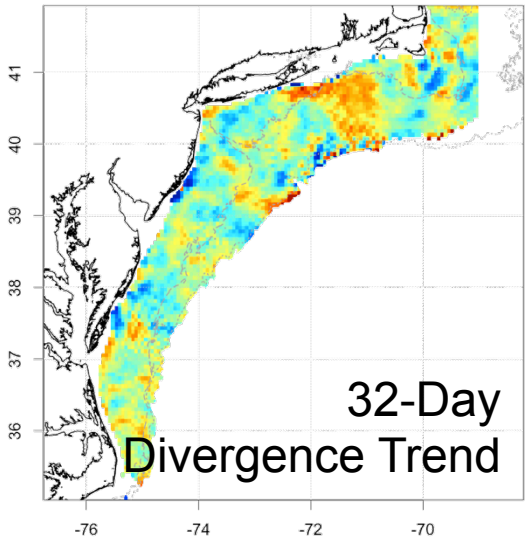




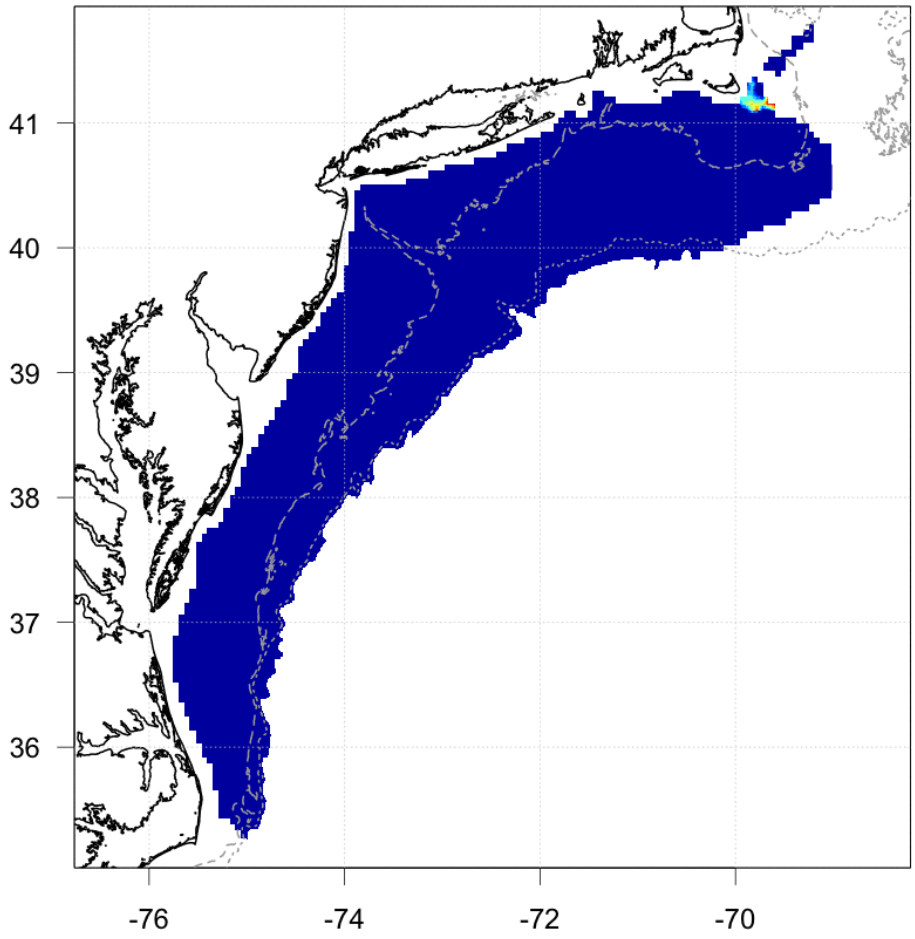




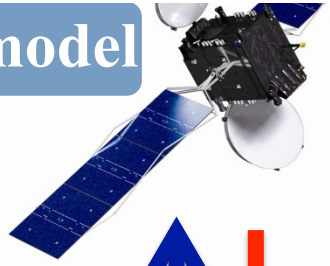


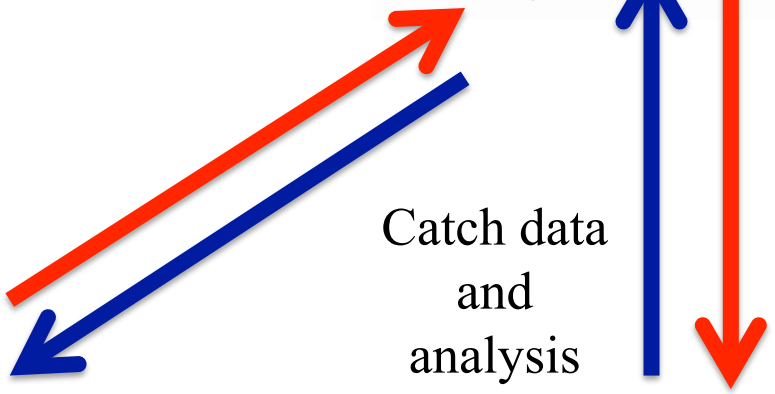


Test of prototype operational habitat model



Dynamic habitat
"nowcast"





Catch data
and
analysis

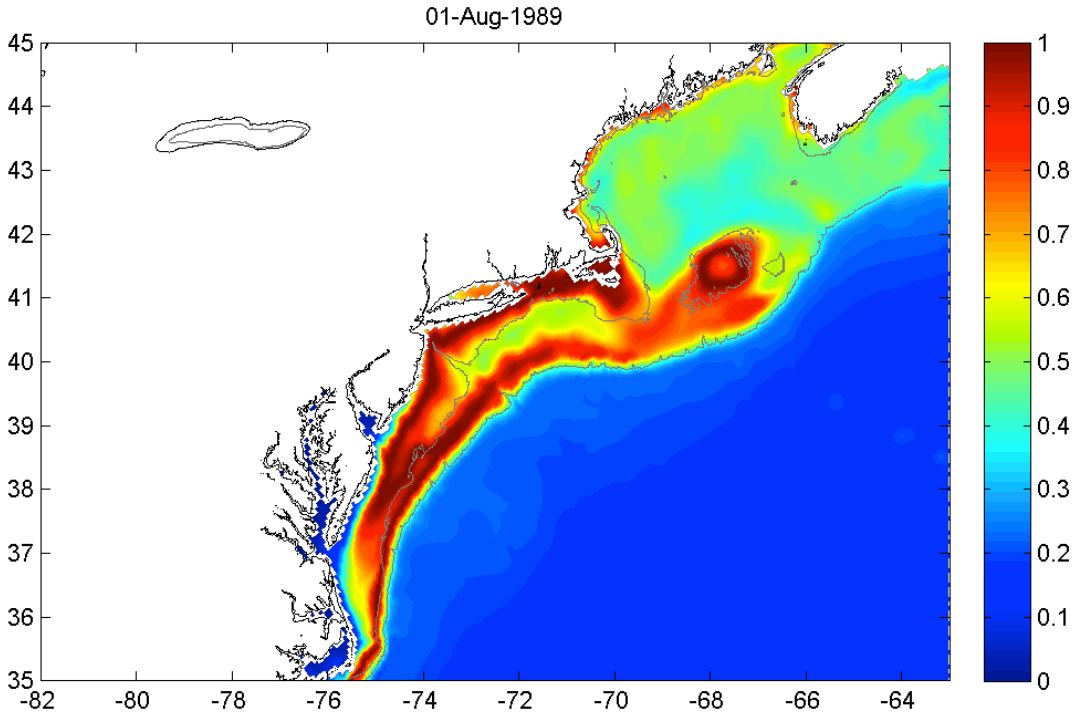
F/V Karen Elizabeth

Adaptive sampling
of "nowcast"

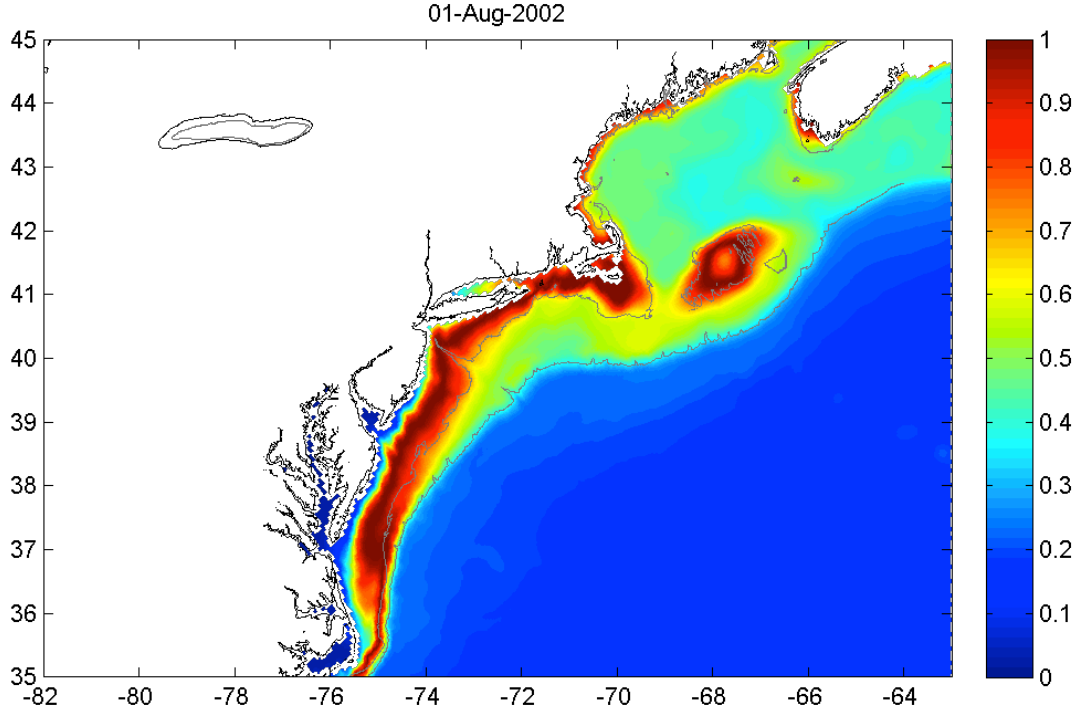
Mechanistic Habitat Model 3.0

Daily: 1958-2007

1989-1992



2002-2004



Index of thermal habitat quality

Summary: Fisheries

- Ocean observatories capture the dynamics of marine habitats
- Species in the MAB respond to dynamics of the surface ocean (i.e. Divergence) captured with an HF radar network.
- Mechanistic models linked to physical models **co-developed with scientists, managers, and the industry** may support fisheries assessment and management through.