Observing storm-induced sediment resuspension processes in the Mid-Atlantic Bight

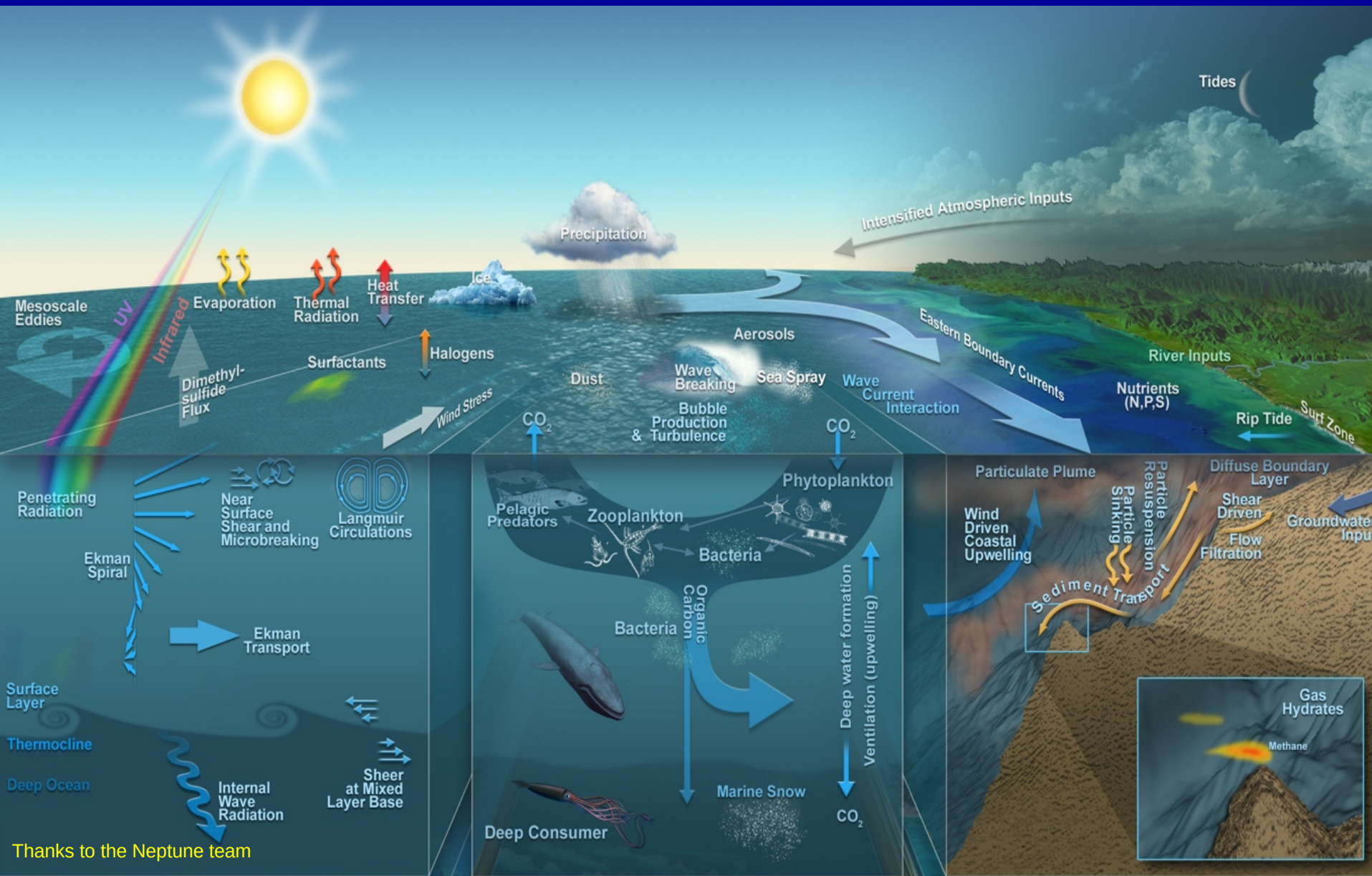
Scott Glenn, Oscar Schofield, Louis Bowers, John Kerfoot, Josh Kohut (Rutgers University)
Clayton Jones & Doug Webb (Webb Research)

Science web site
http://marine.rutgers.edu/cool

Operational web site
http://www.thecoolroom.org

Educational web site
http://www.coolclassroom.org

Aquatic systems are complex



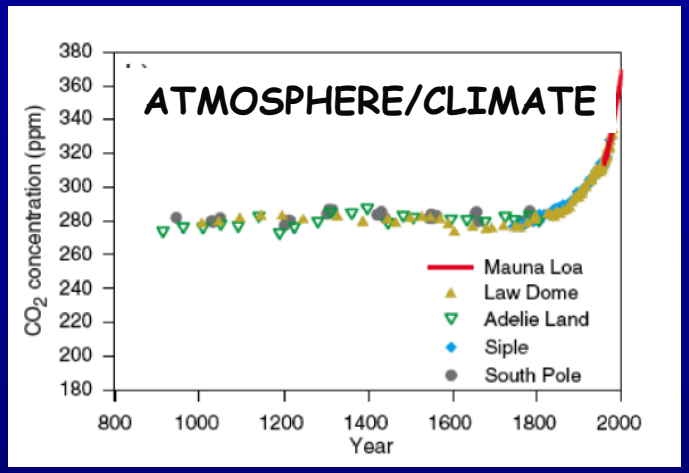
Thanks to the Neptune team

Marine systems are chronically under-sampled

Humans are changing the oceans and this will impact feedback on humanity in unknown ways.

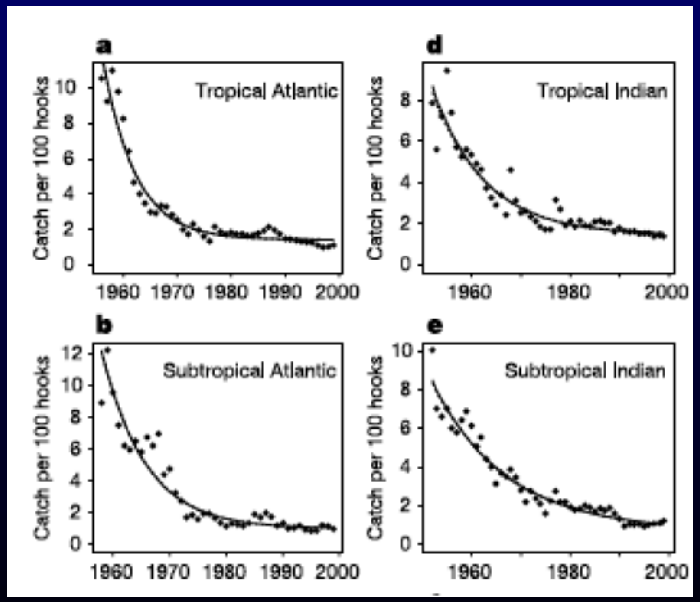
ALTERED NUTRIENT CYCLES AND EUTROPHICATION

Kirkpatrick and Crowley



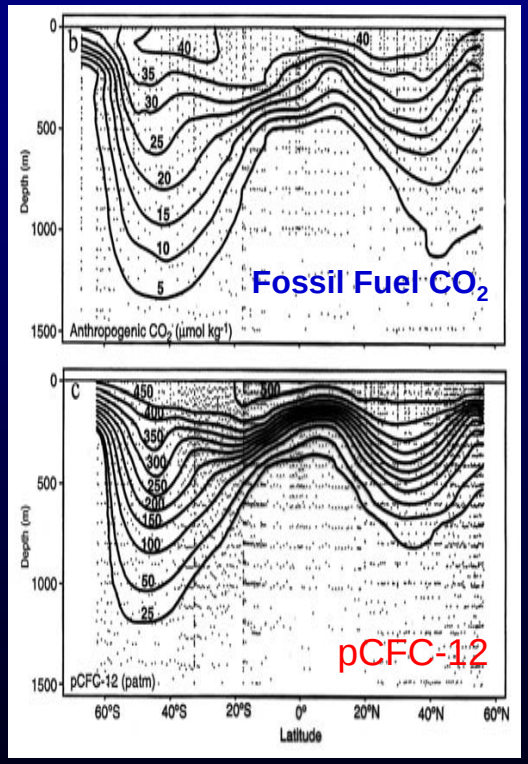
IPC TAR

OVERFISHING



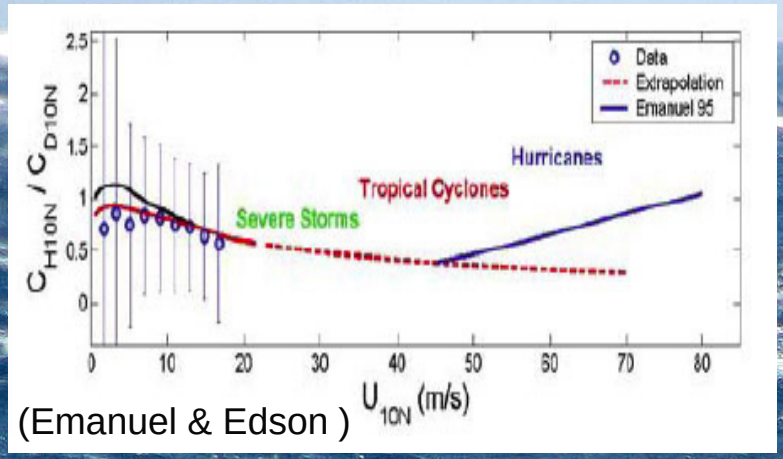
ALTERED CHEMISTRY DEEP IN OCEAN

Human fossil fuel
Has penetrated over 1000 m in the ocean



Sabine 2002

EXTREME EVENTS IN THE ATMOSPHERE and OCEAN ARE HARD TO SAMPLE



(Emanuel & Edson)

Heat

Wind Speed

Thanks to Edson and Pludemann

My ship on campus

CODAR Network

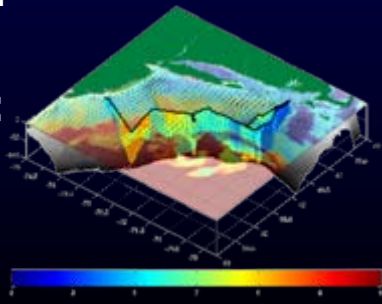
L-Band & X-Band Satellite Systems

Mission Planning

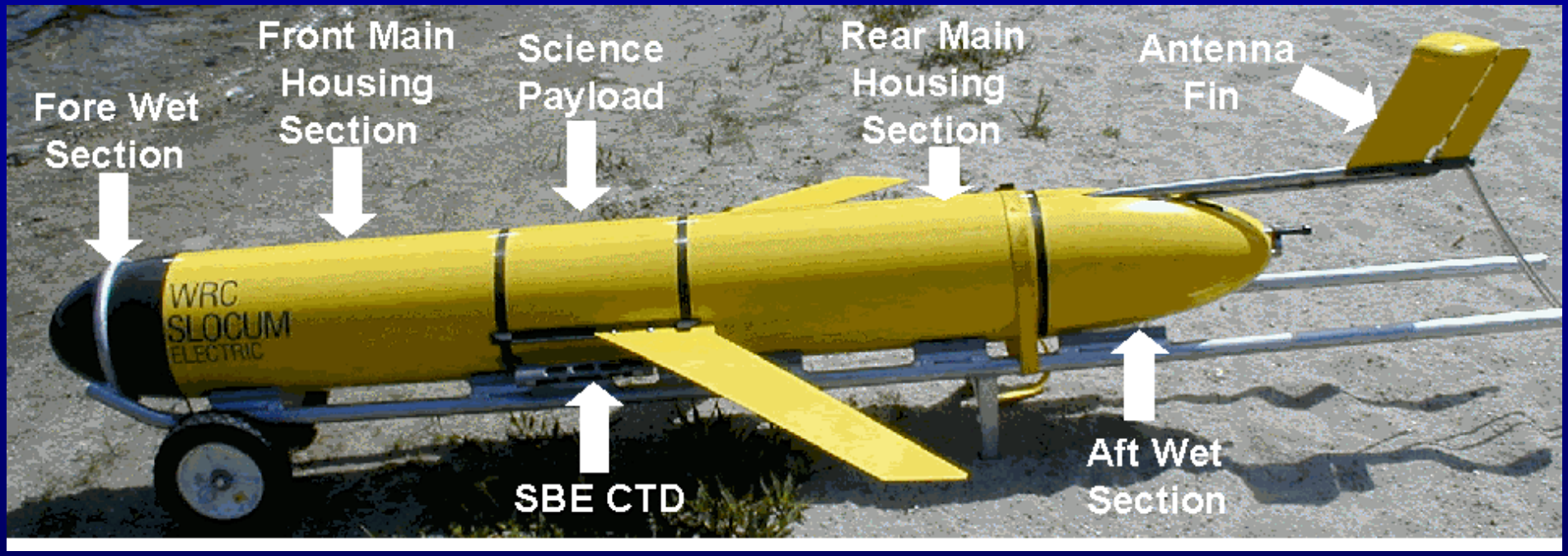
Operations & Communications Station

A "Stommel" View of the Ocean: WWW & Interactive 3-D

Glider Fleet



Slocum Coastal Glider



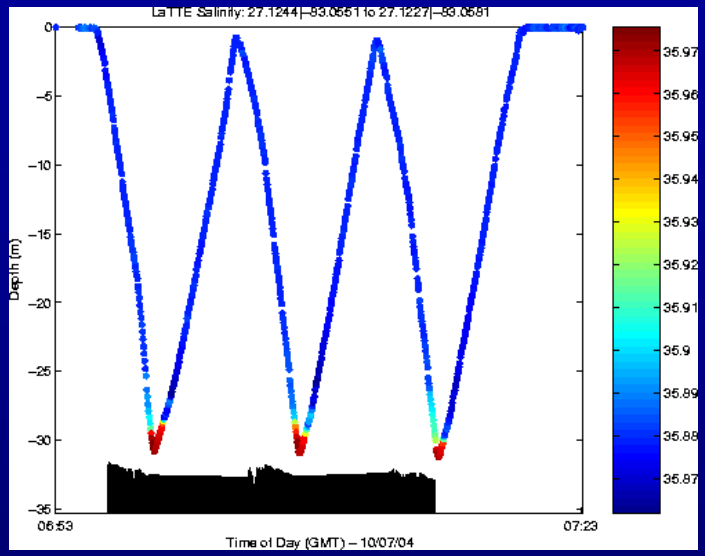
Glider Specs.

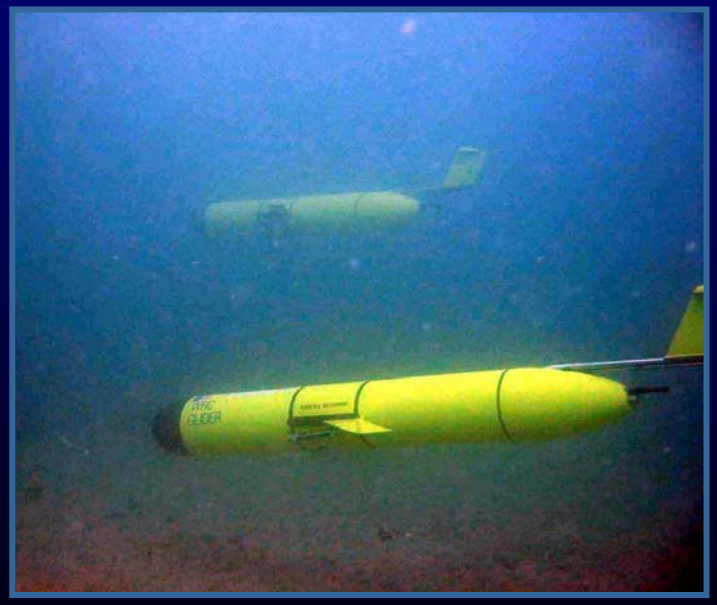
Length: 1.5 m Hull Diameter: 21.3 cm
Weight: 52 kg

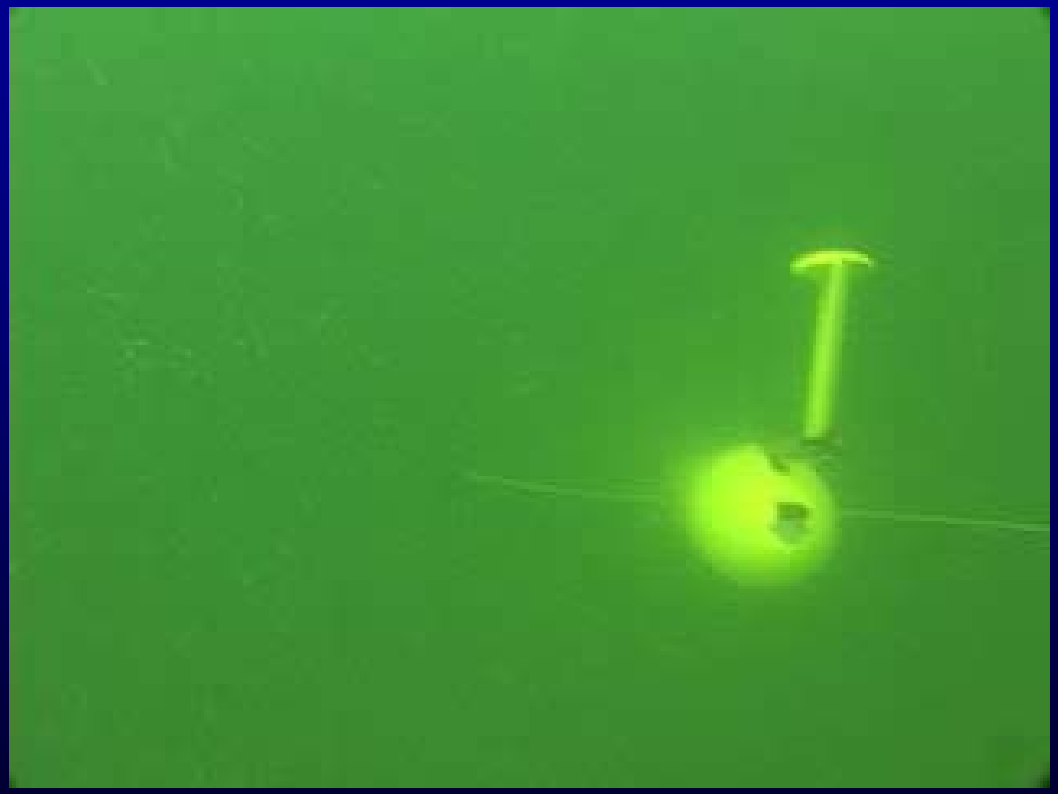
Science Bay Specs.

Length: 30 cm Diameter: 21.3 cm
Max. Payload Weight: 4 kg

The Glider “Flight”



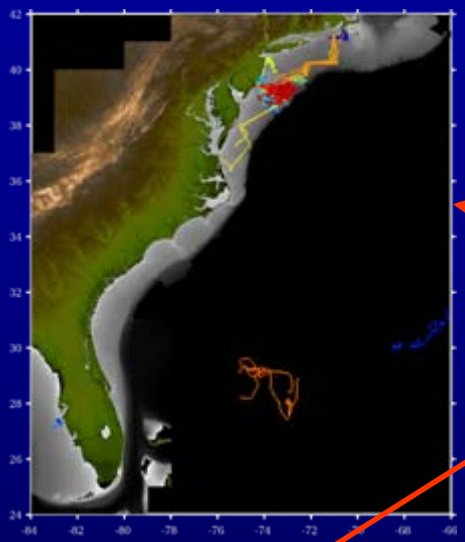


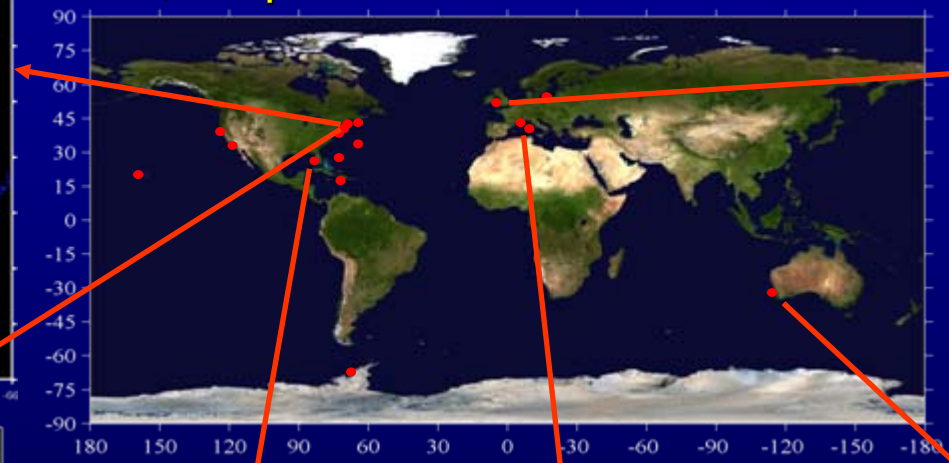


Rutgers Slocum Glider Fleet

129 deployments worldwide (2003 – present)

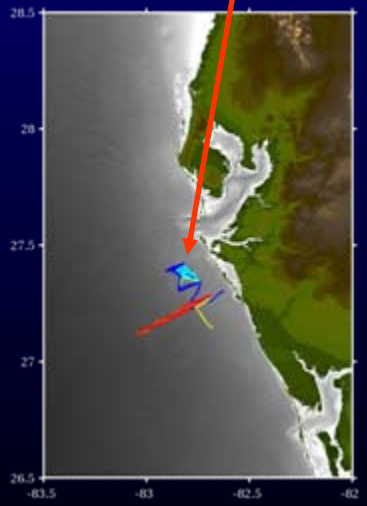
> 40,000 km flown (Earth's circ. ~ 40,000 km)
> 1900 days in water
~ 300,000 profiles



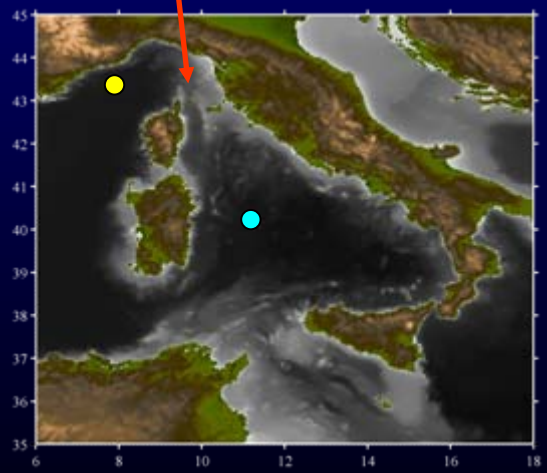


Liverpool Bay Coastal Observatory

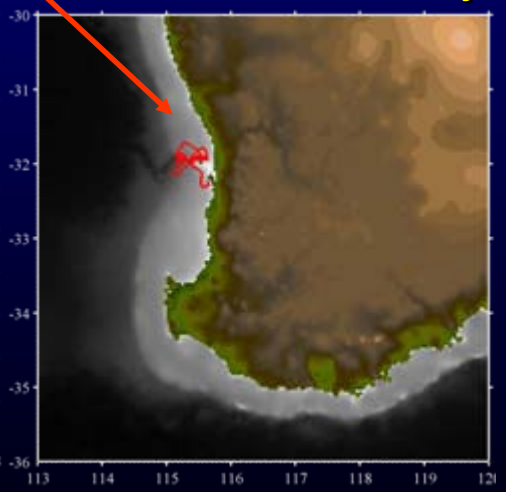
Mid-Atlantic Shelf



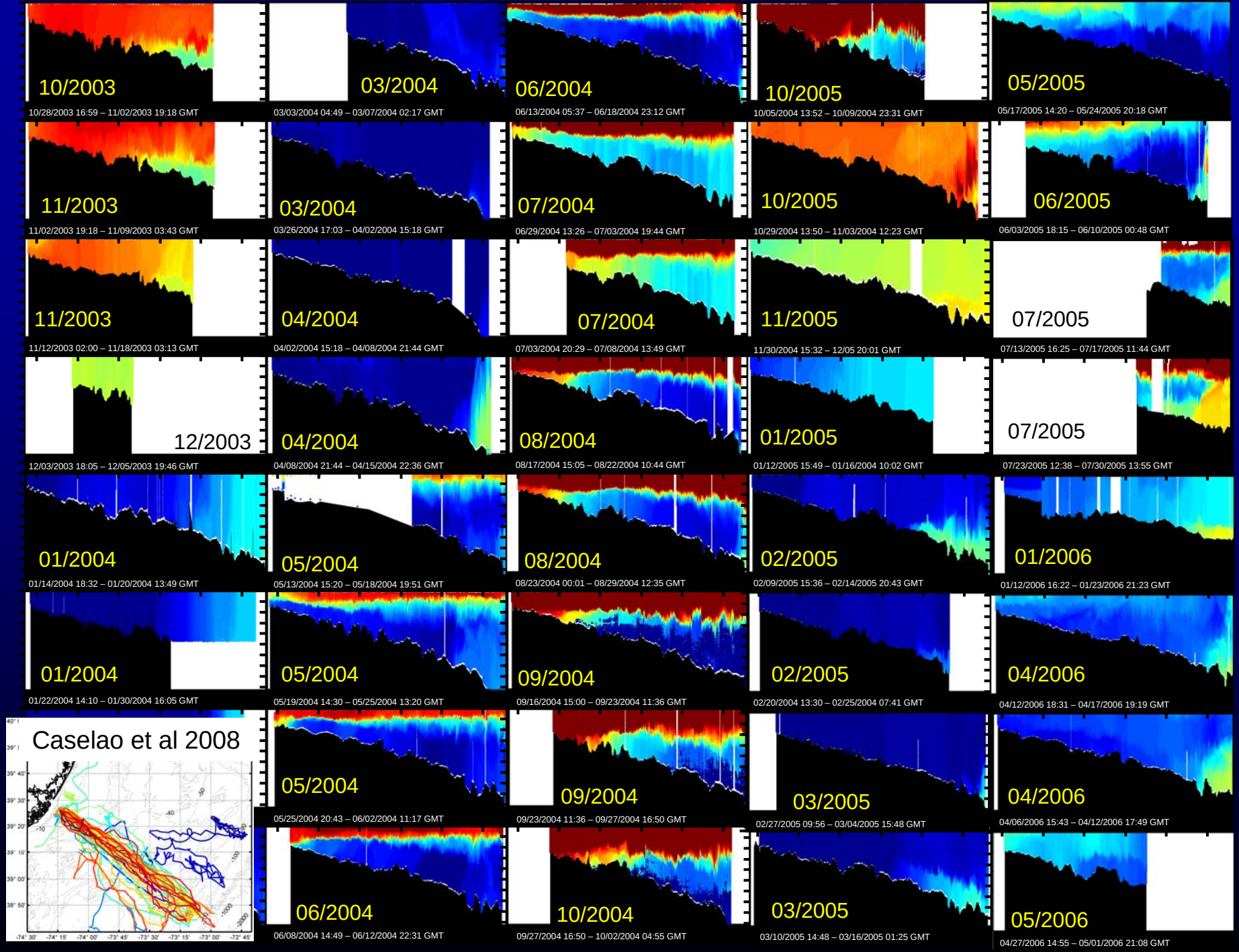
West Florida Shelf



Mediterranean Sea



Perth, Australia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10/28/2003 16:59 – 11/02/2003 19:18 GMT
03/2004
03/03/2004 04:49 – 03/07/2004 02:17 GMT
06/2004
06/13/2004 05:37 – 06/18/2004 23:12 GMT
10/2005
10/05/2004 13:52 – 10/09/2004 23:31 GMT
05/2005
05/17/2005 14:20 – 05/24/2005 20:18 GMT
11/2003
11/02/2003 19:18 – 11/09/2003 03:43 GMT
03/2004
03/26/2004 17:03 – 04/02/2004 15:18 GMT
07/2004
06/29/2004 13:26 – 07/03/2004 19:44 GMT
10/2005
10/29/2004 13:50 – 11/03/2004 12:23 GMT
06/2005
06/03/2005 18:15 – 06/10/2005 00:48 GMT
11/2003
11/12/2003 02:00 – 11/18/2003 03:13 GMT
04/2004
04/02/2004 15:18 – 04/08/2004 21:44 GMT
07/2004
07/03/2004 20:29 – 07/08/2004 13:49 GMT
11/2005
11/30/2004 15:32 – 12/05 20:01 GMT
07/2005
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12/2003
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01/2004
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05/13/2004 15:20 – 05/18/2004 19:51 GMT
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08/23/2004 00:01 – 08/29/2004 12:35 GMT
02/2005
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01/2006
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02/2005
02/20/2004 13:30 – 02/25/2004 07:41 GMT
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Caselao et al 2008
05/2004
05/25/2004 20:43 – 06/02/2004 11:17 GMT
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09/23/2004 11:36 – 09/27/2004 16:50 GMT
03/2005
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04/2006
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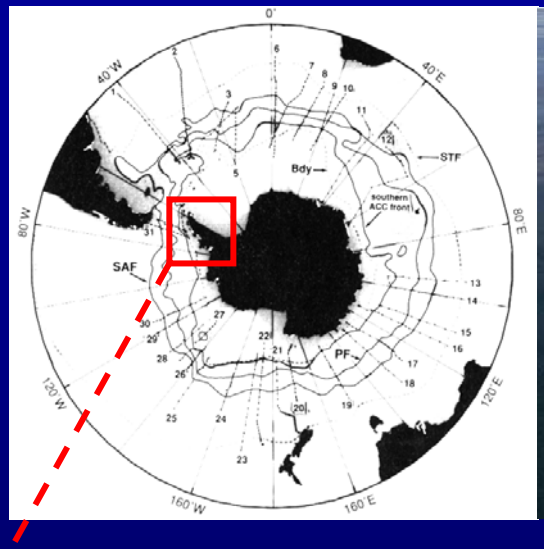
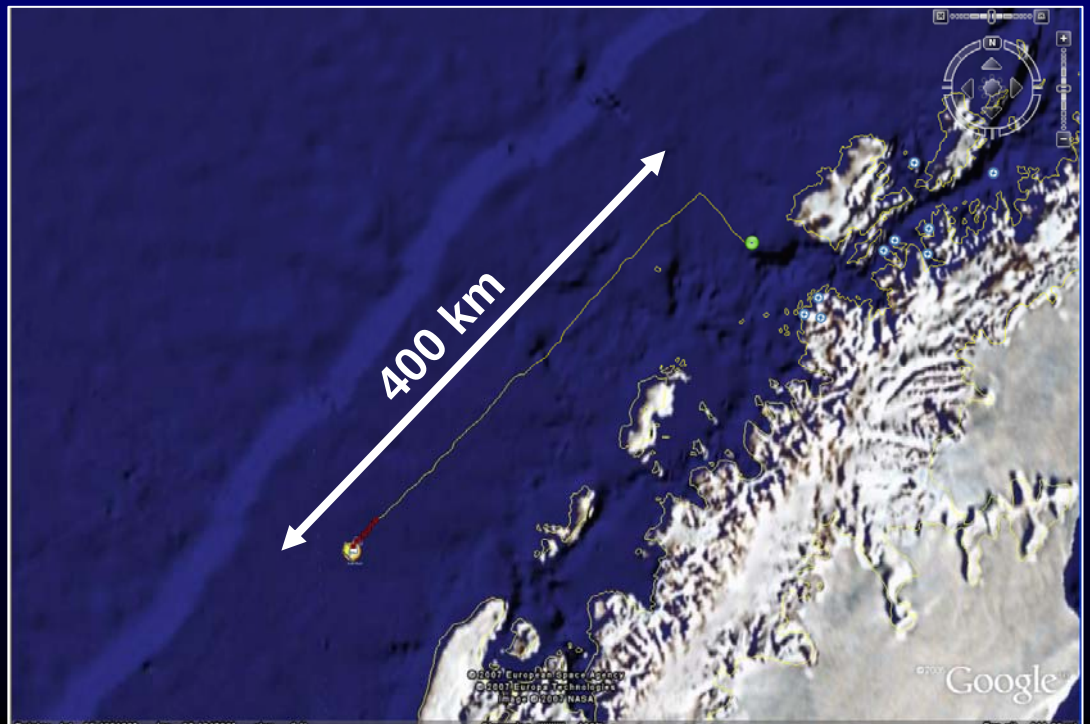
05/2006
04/27/2006 14:55 – 05/01/2006 21:08 GMT

22 January, 2007



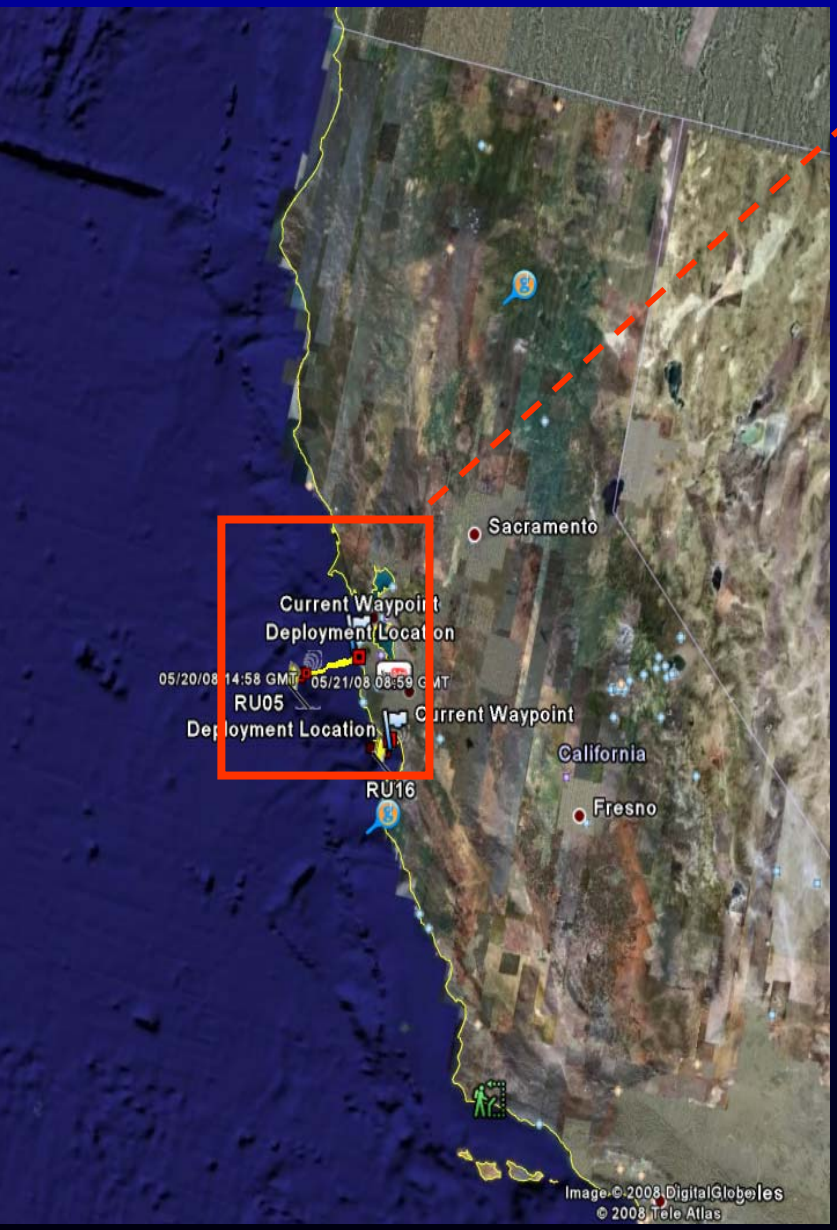


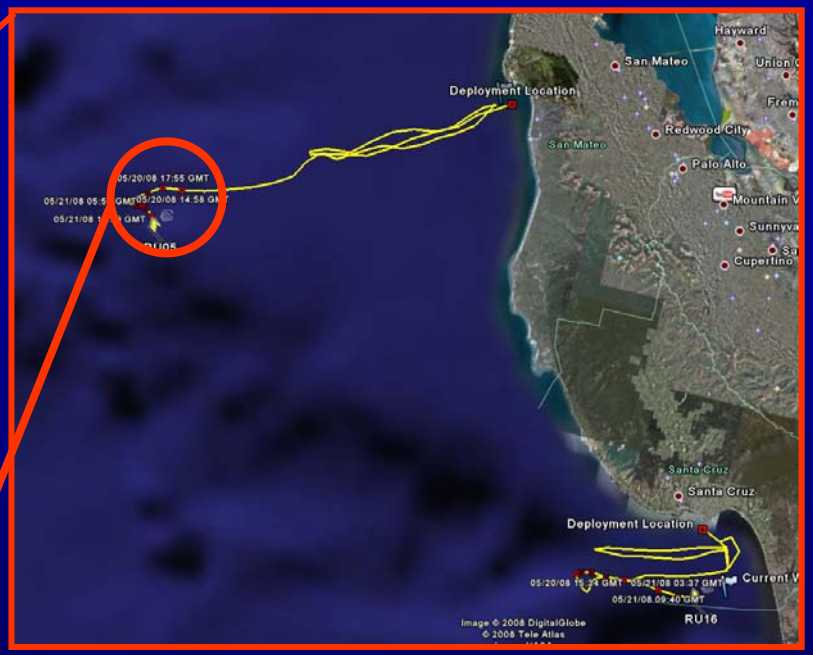
Jan 23, 2007

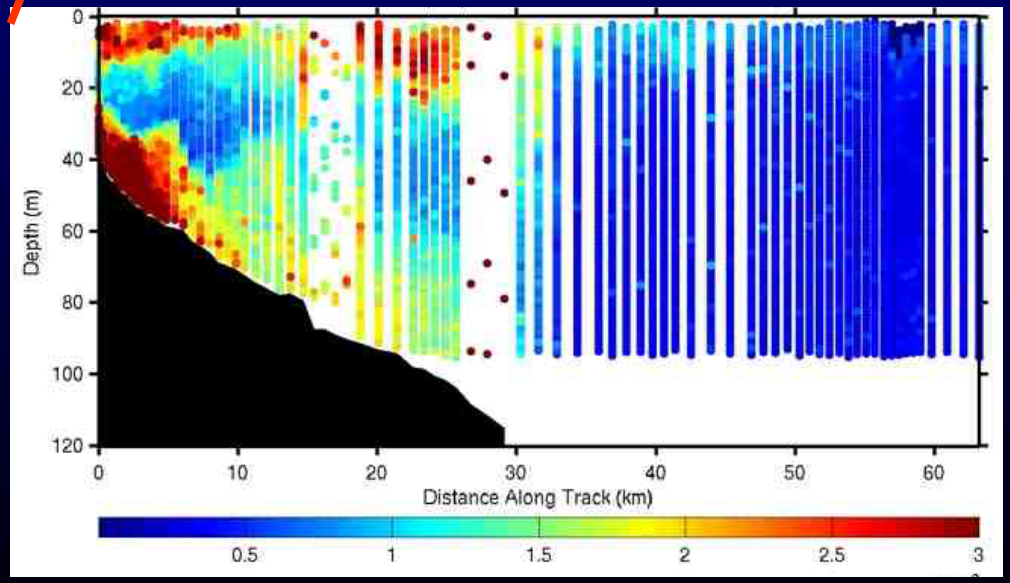
繁荣经济
振兴海业

Welcome Our Worshipful American Experts
谢谢款待!
"Innovating Ocean Science and Technology for a Healthy Planet"
Scott Glenn & Oscar Schofield
Coastal Ocean Observation Lab
Regional Ocean Prediction
Education and Outreach

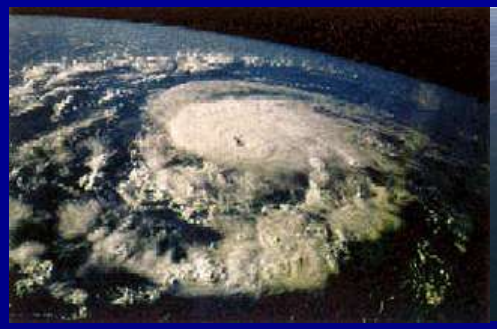
Where are the gliders now? May 21st 2008 @ 12:25 EDT

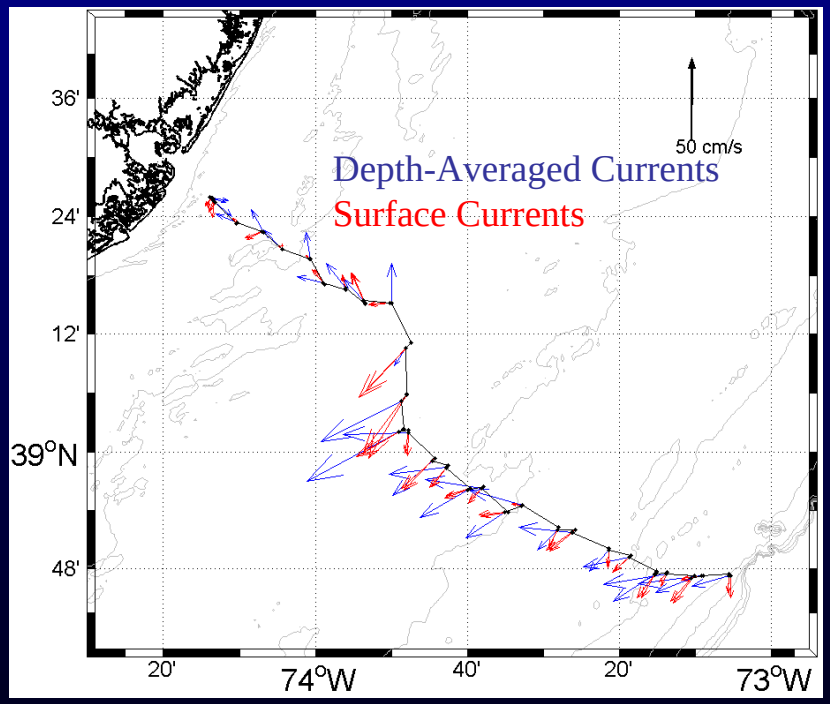


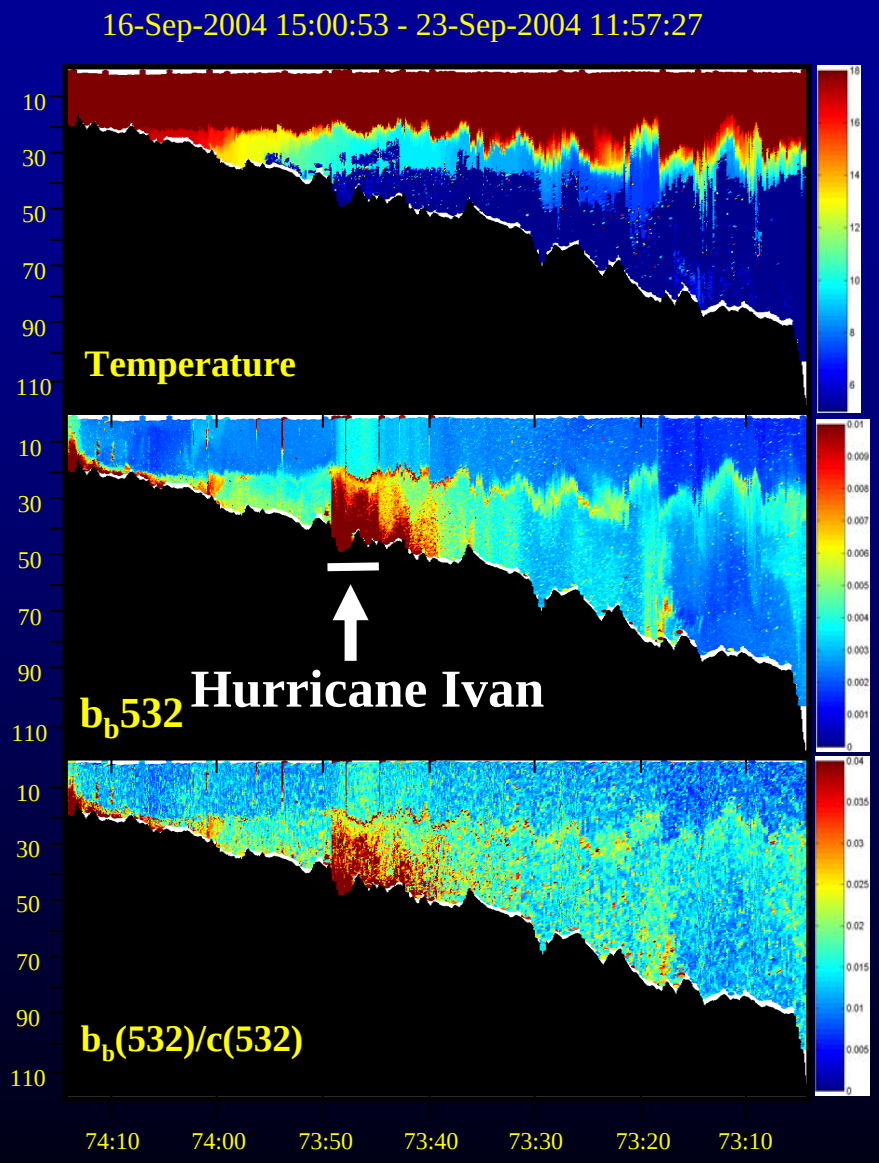


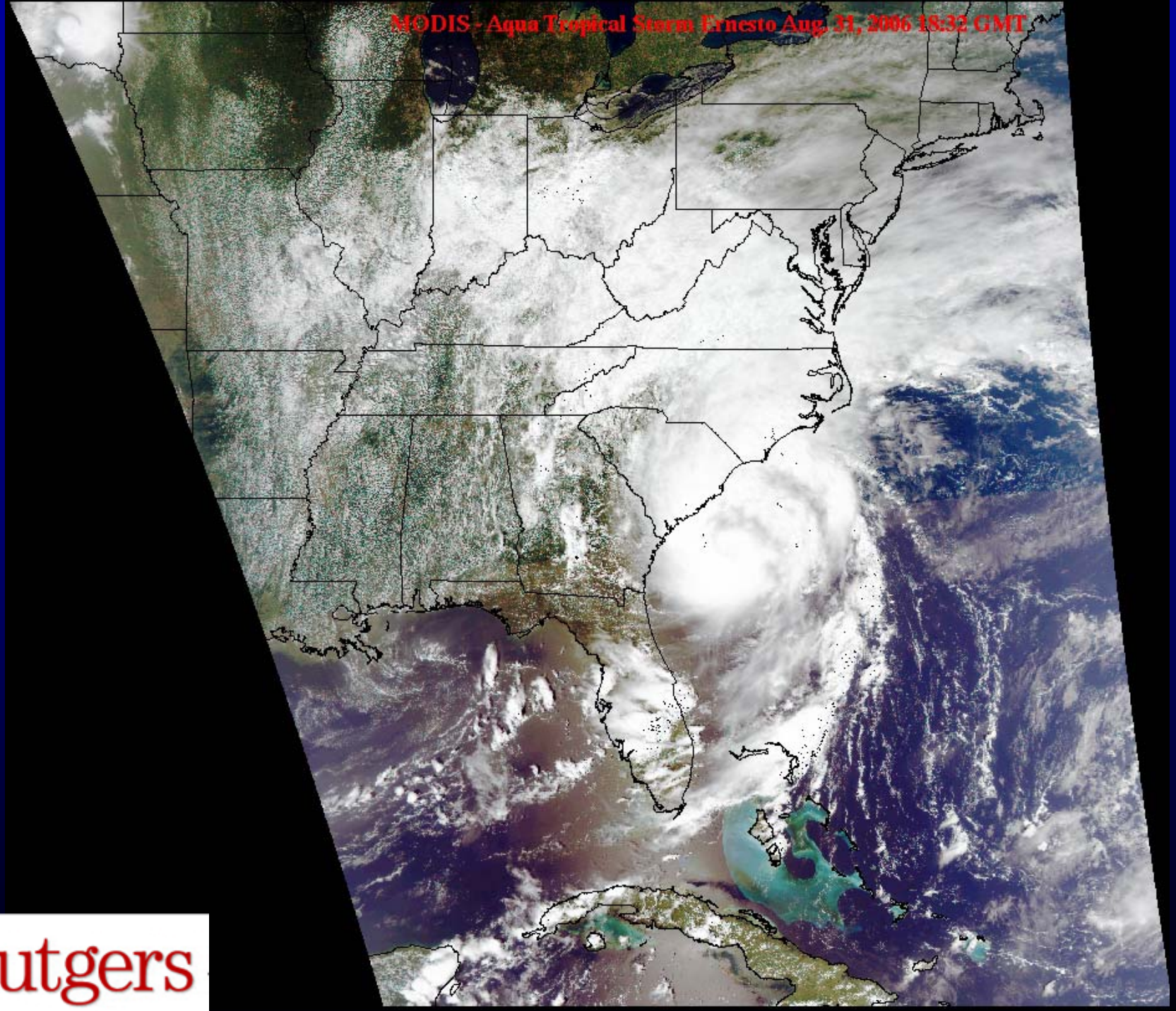


RIDER IN THE STORM



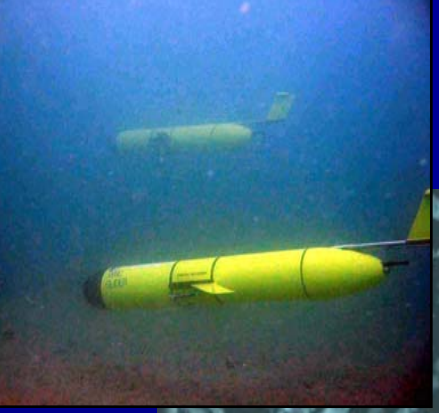


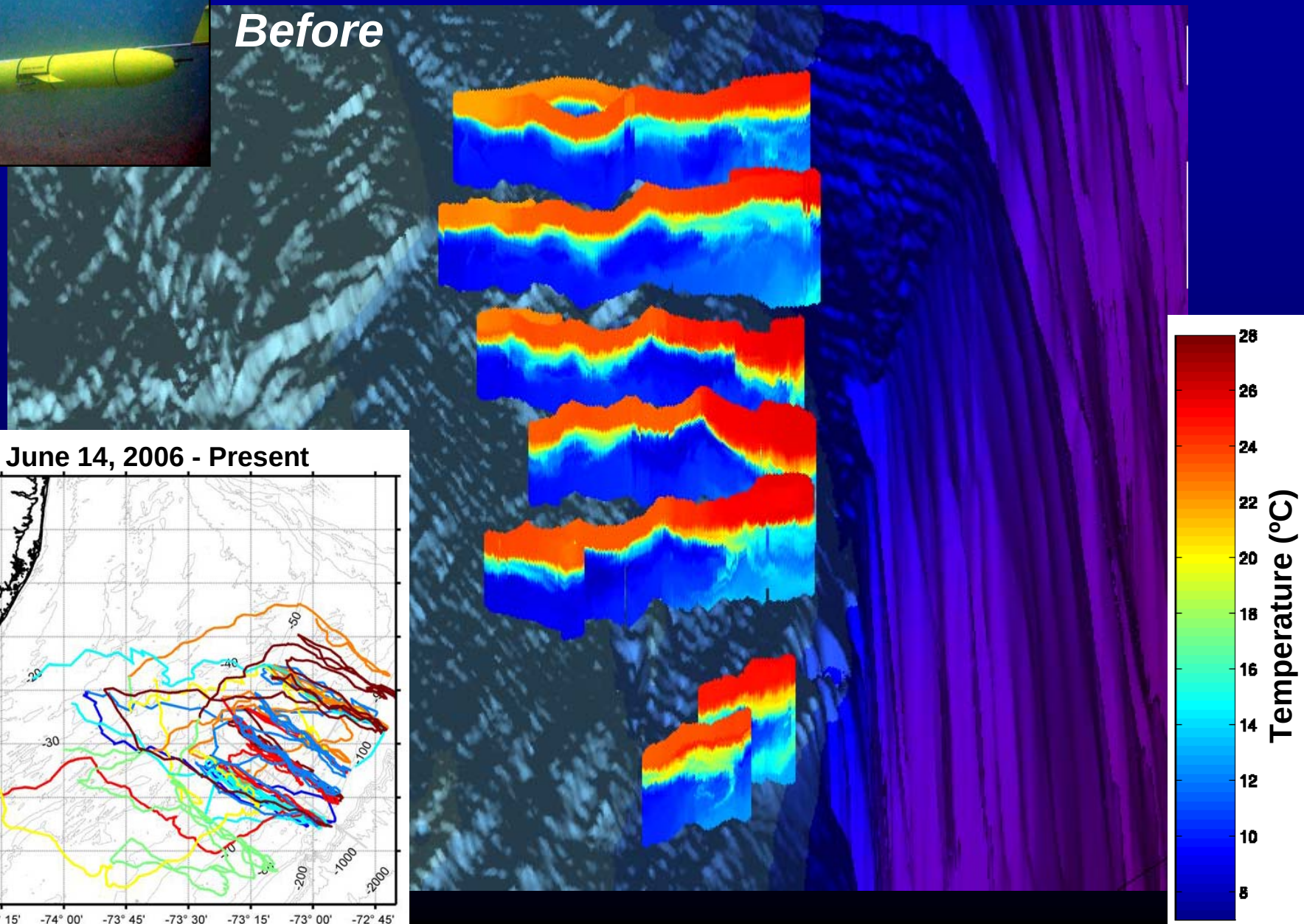


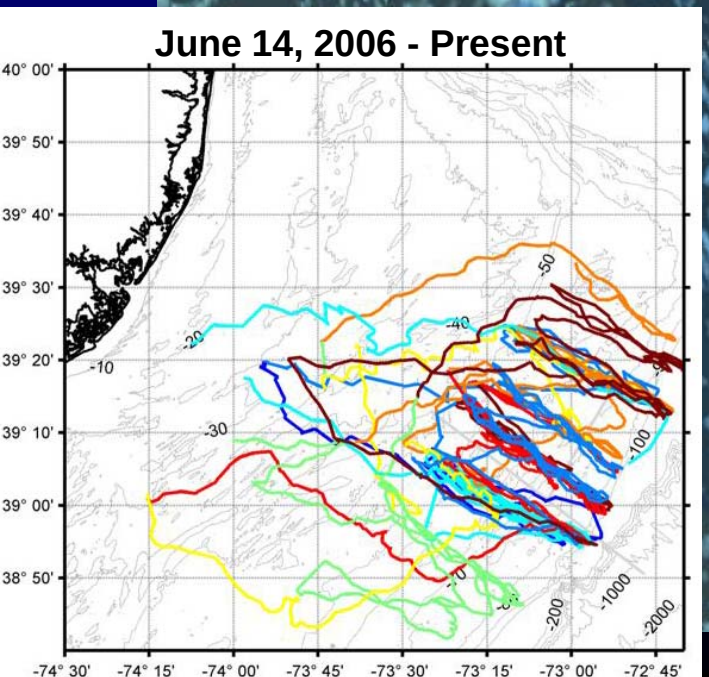


Rutgers

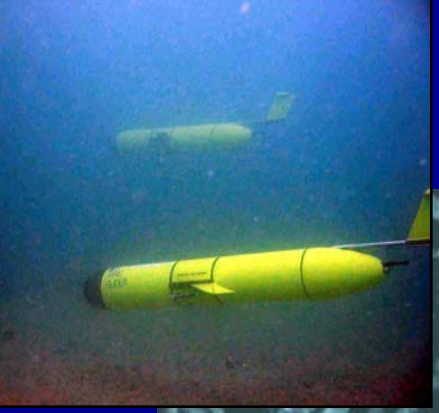
Tropical Storm Ernesto: Sub-Surface Impacts

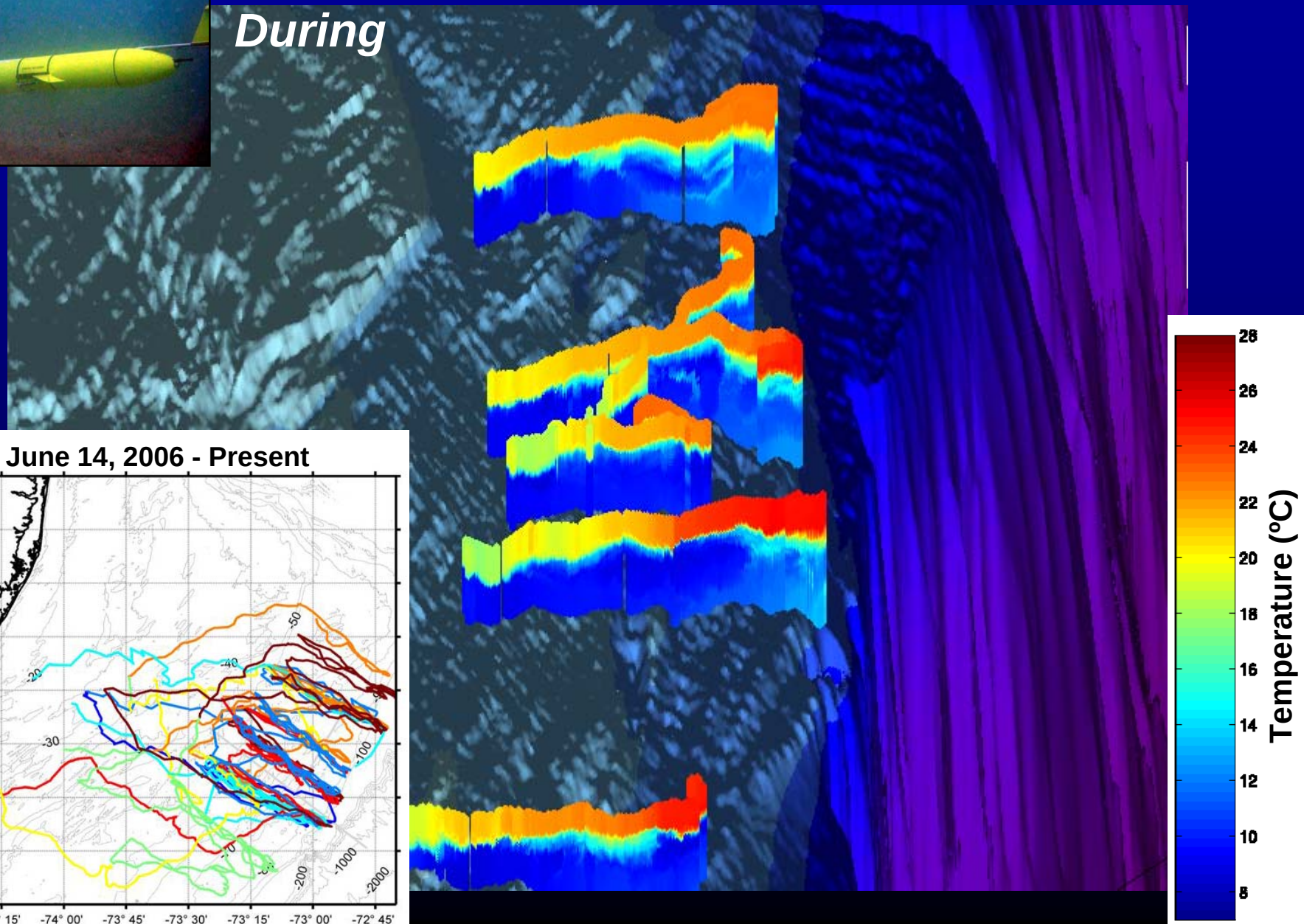


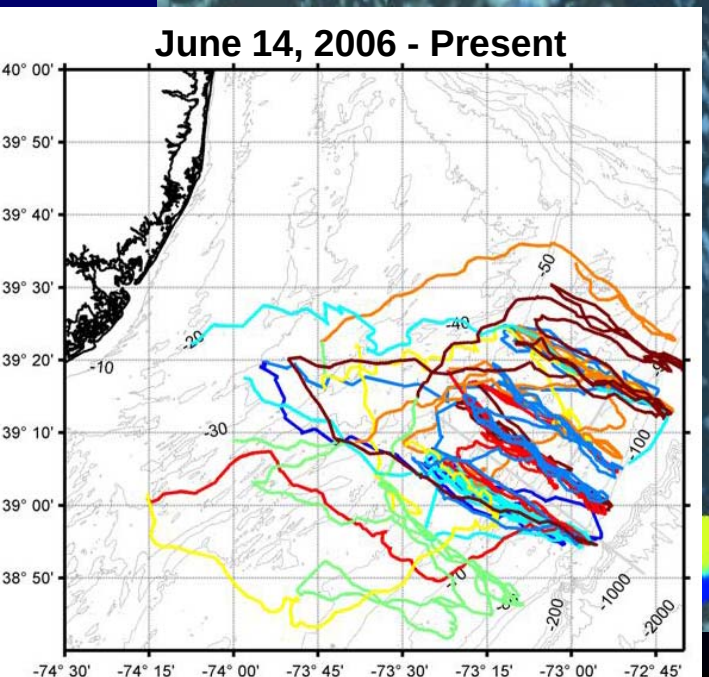




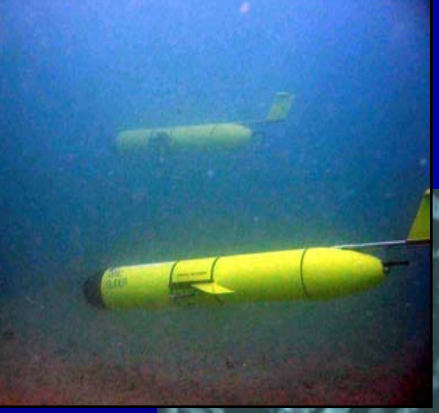
Tropical Storm Ernesto: Sub-Surface Impacts

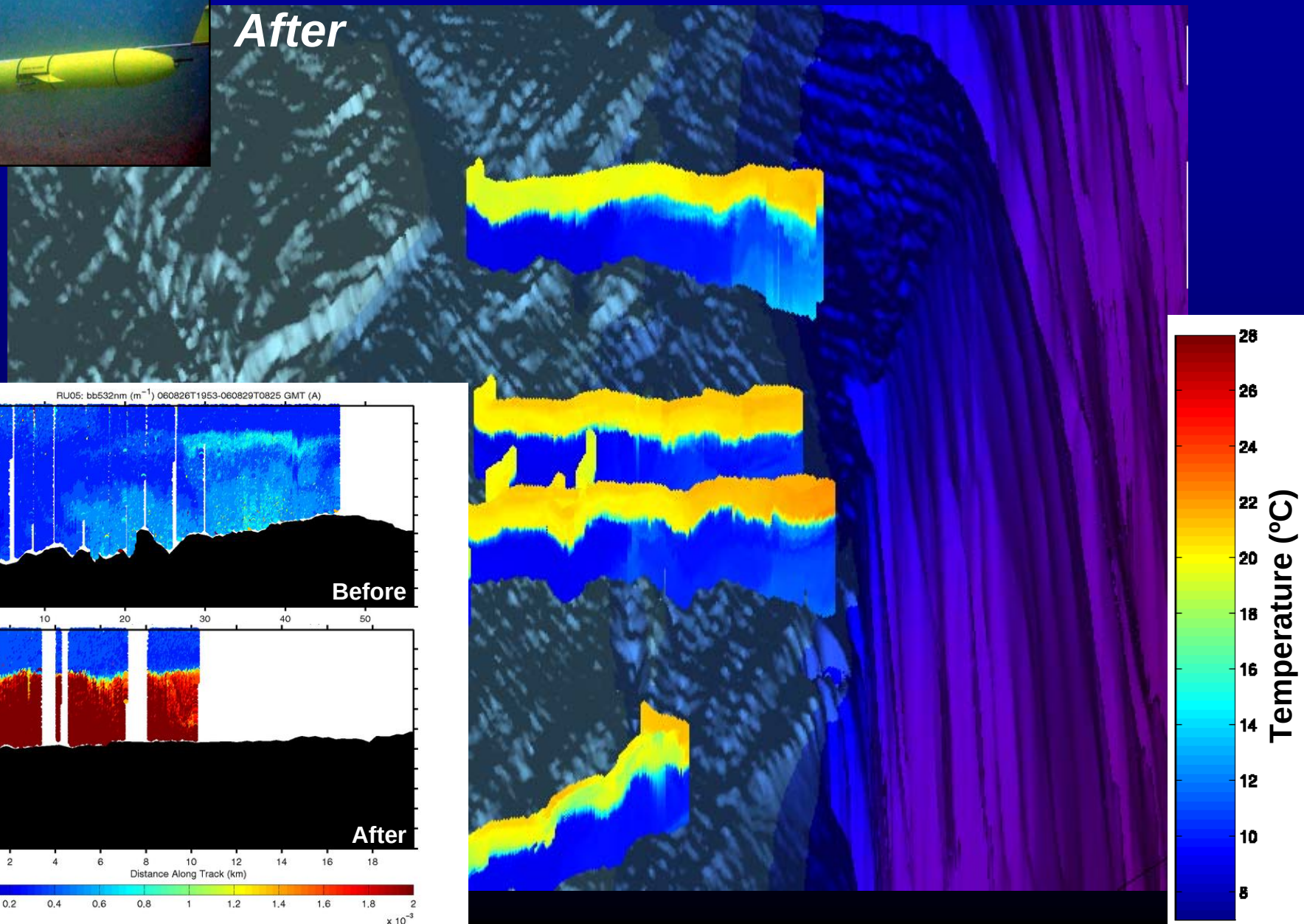


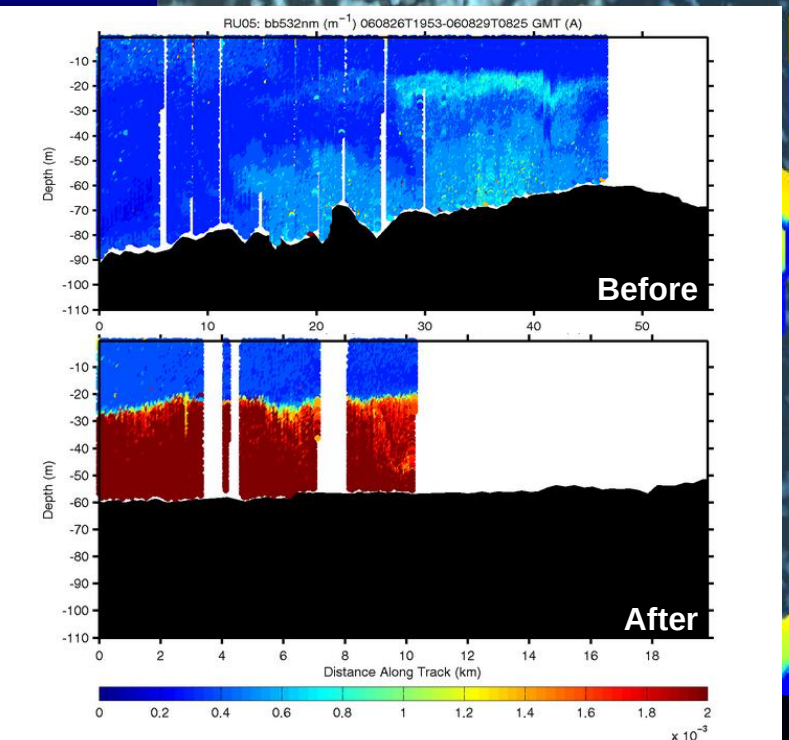




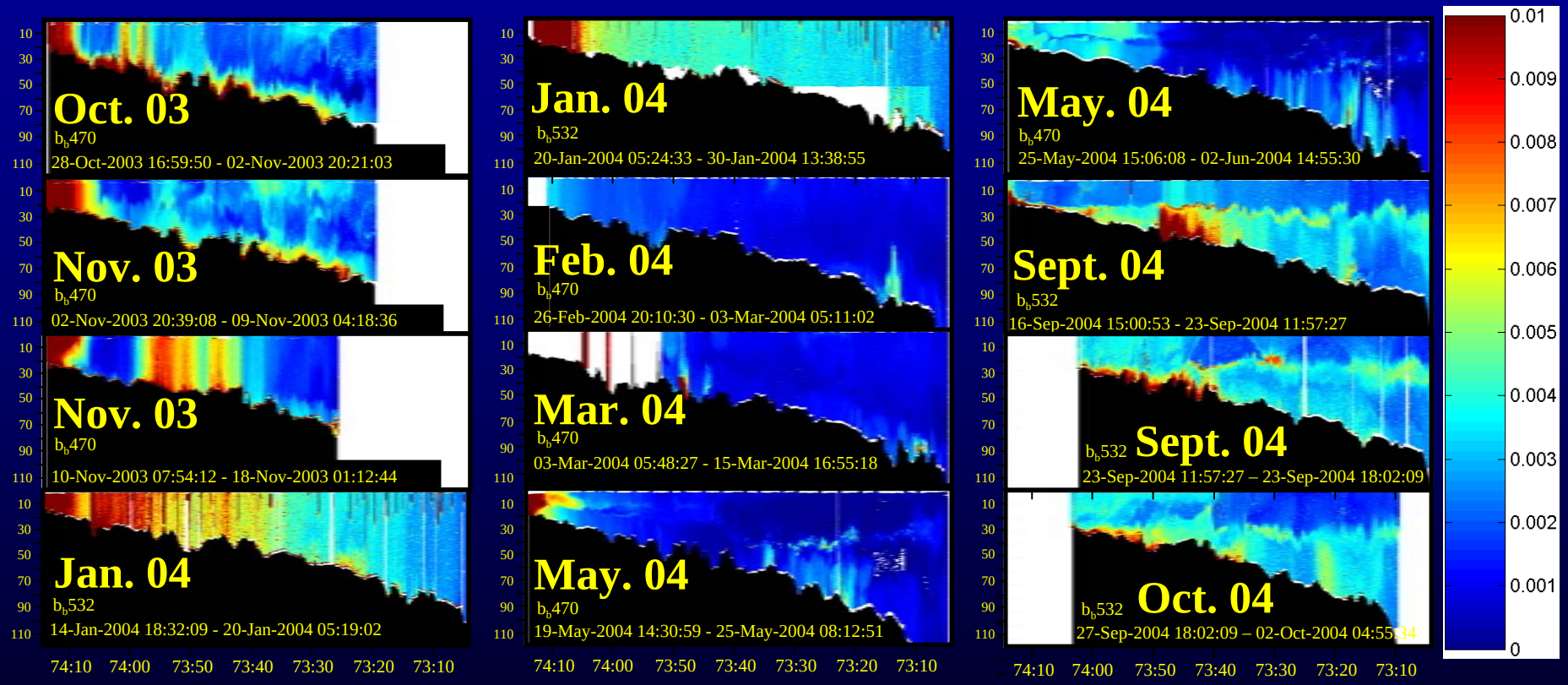
Tropical Storm Ernesto: Sub-Surface Impacts







NJSOS Endurance Line: Seasonal Cross-Shelf Optical Backscatter Transects



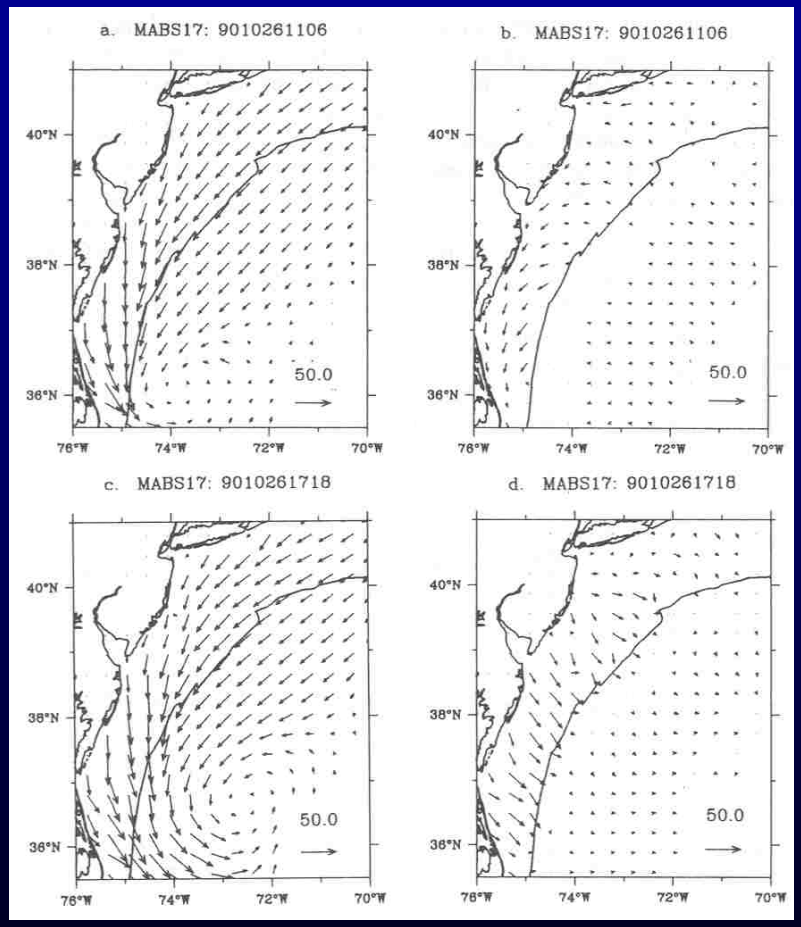
Schofield et al. 2007

Storm sediment transport on the MAB bight: 3-D models suggest net southward and offshore transport of material

Surface | Bottom

Flood tide

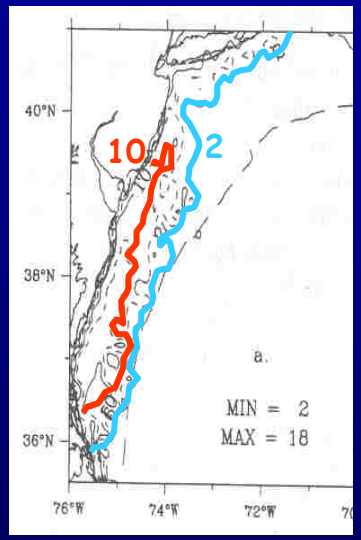
Ebb tide



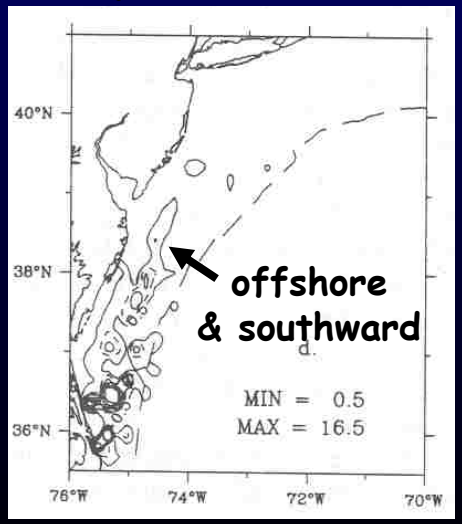
Southern alongshore & little or no cross-shore transport offshore

Southern alongshore & transport offshore

Wave stress



Deposition (mm)

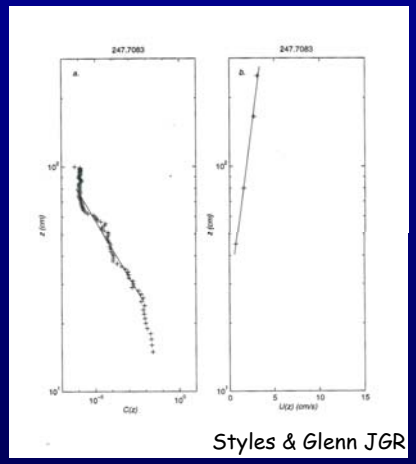


Keen and Glenn (JGR & JPO)

Storm sediment transport on the MAB bight: 1-D models & observation allow transport to calculated during storms, net transport is onshore!

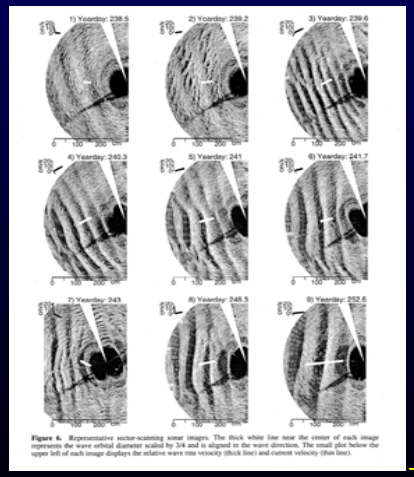
Models parameterized

1-D models of water column and bottom boundary layer



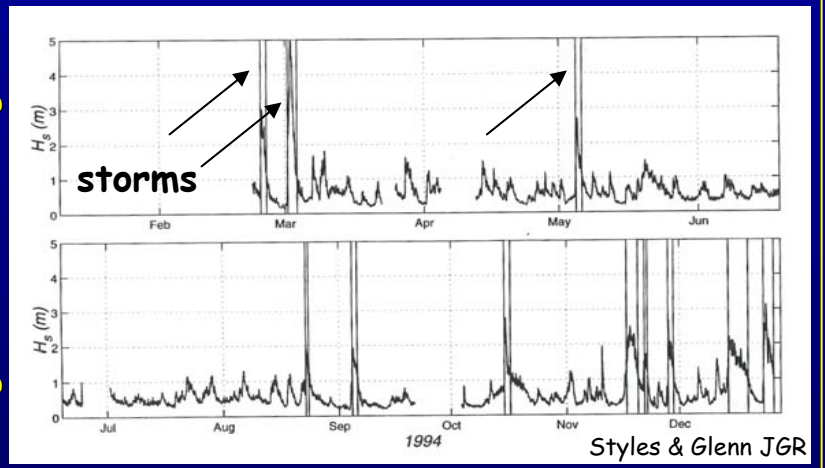
Styles & Glenn JGR

Bottom topography

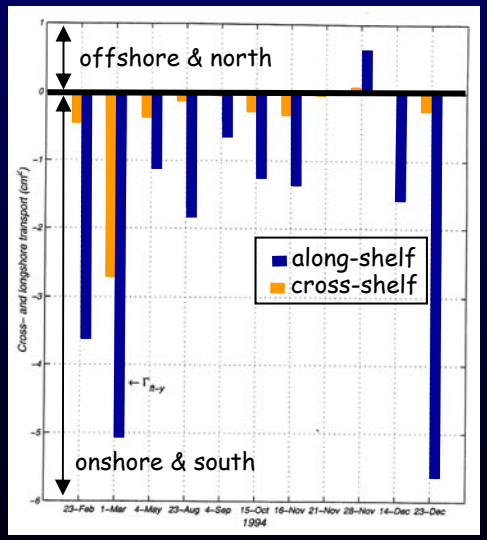


Traykovski JGR

Bottom time series collected



Styles & Glenn JGR



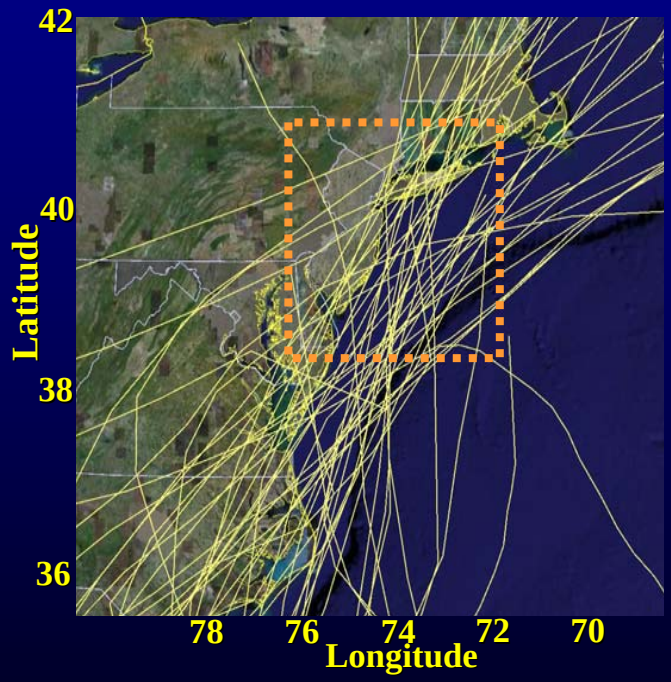
We are getting the <u>sign</u> of the cross shore transport wrong!

Not once but all storms!

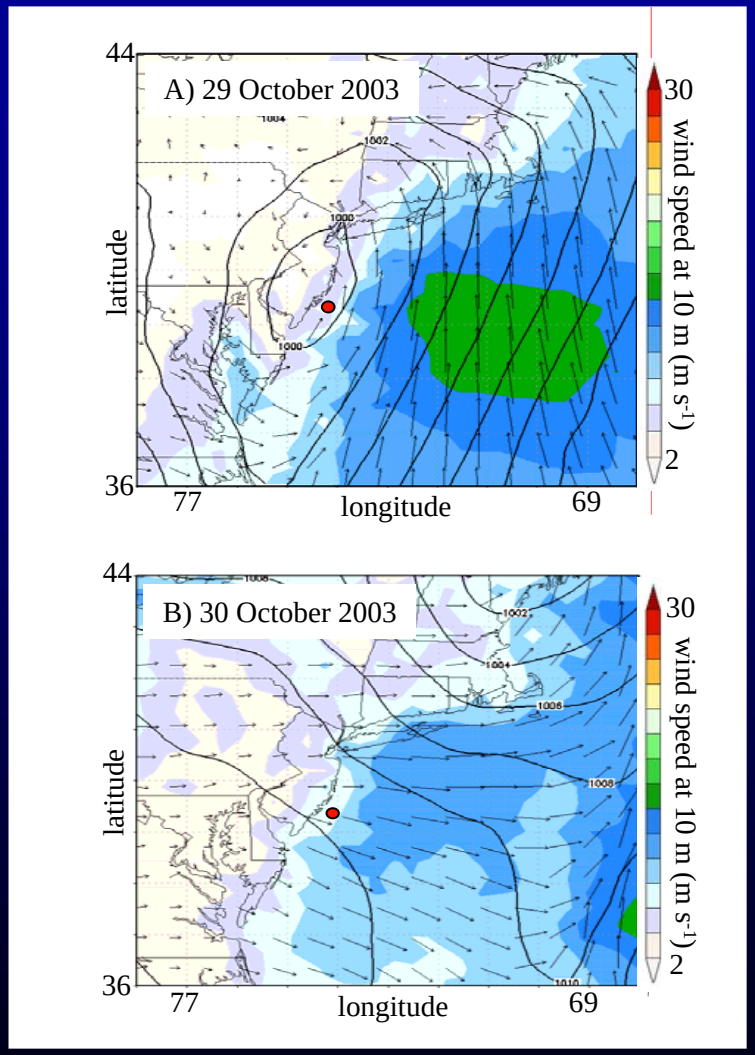
Styles & Glenn JGR

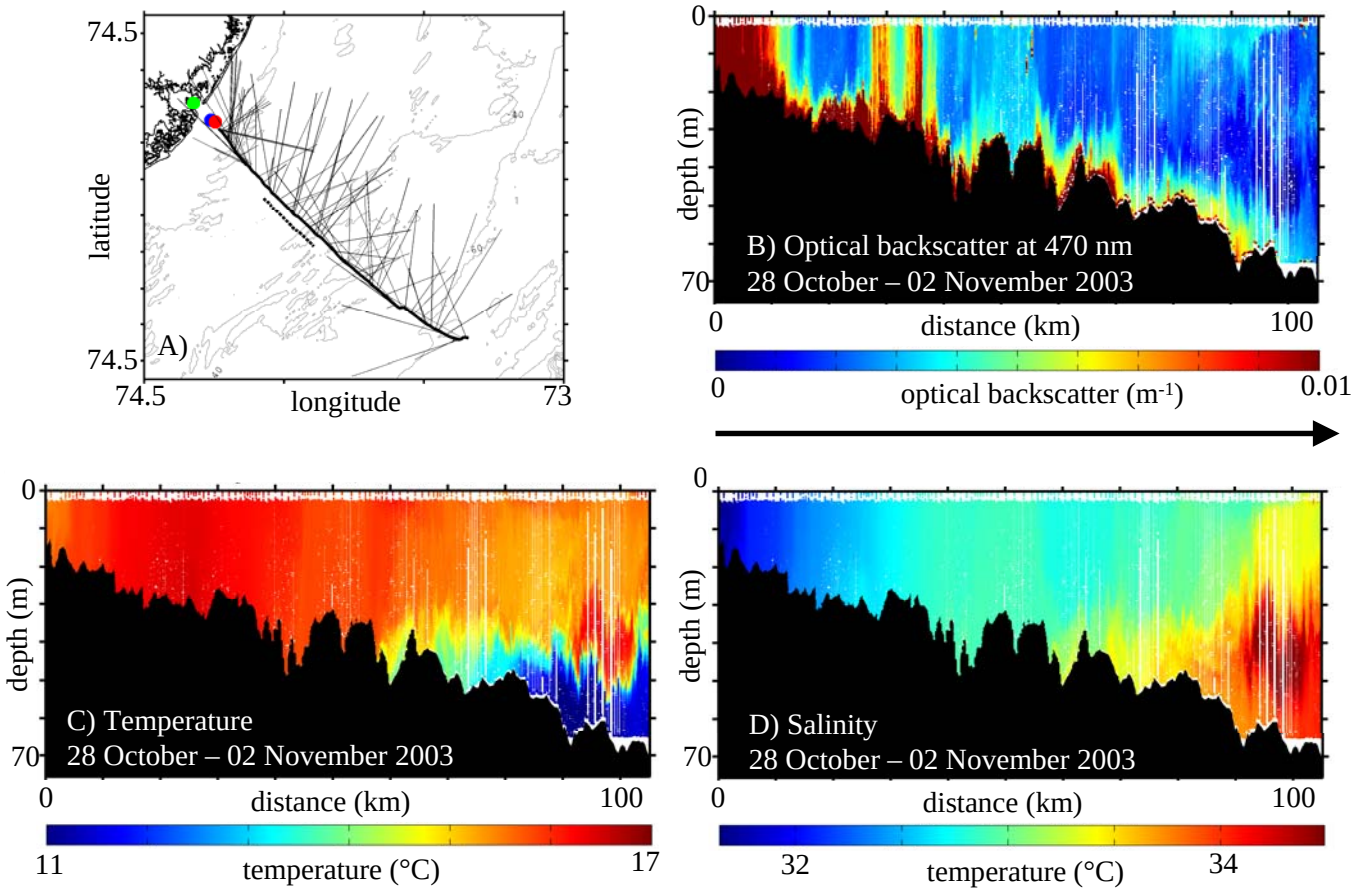
The Mid-Atlantic Bight frequently visited by large storms

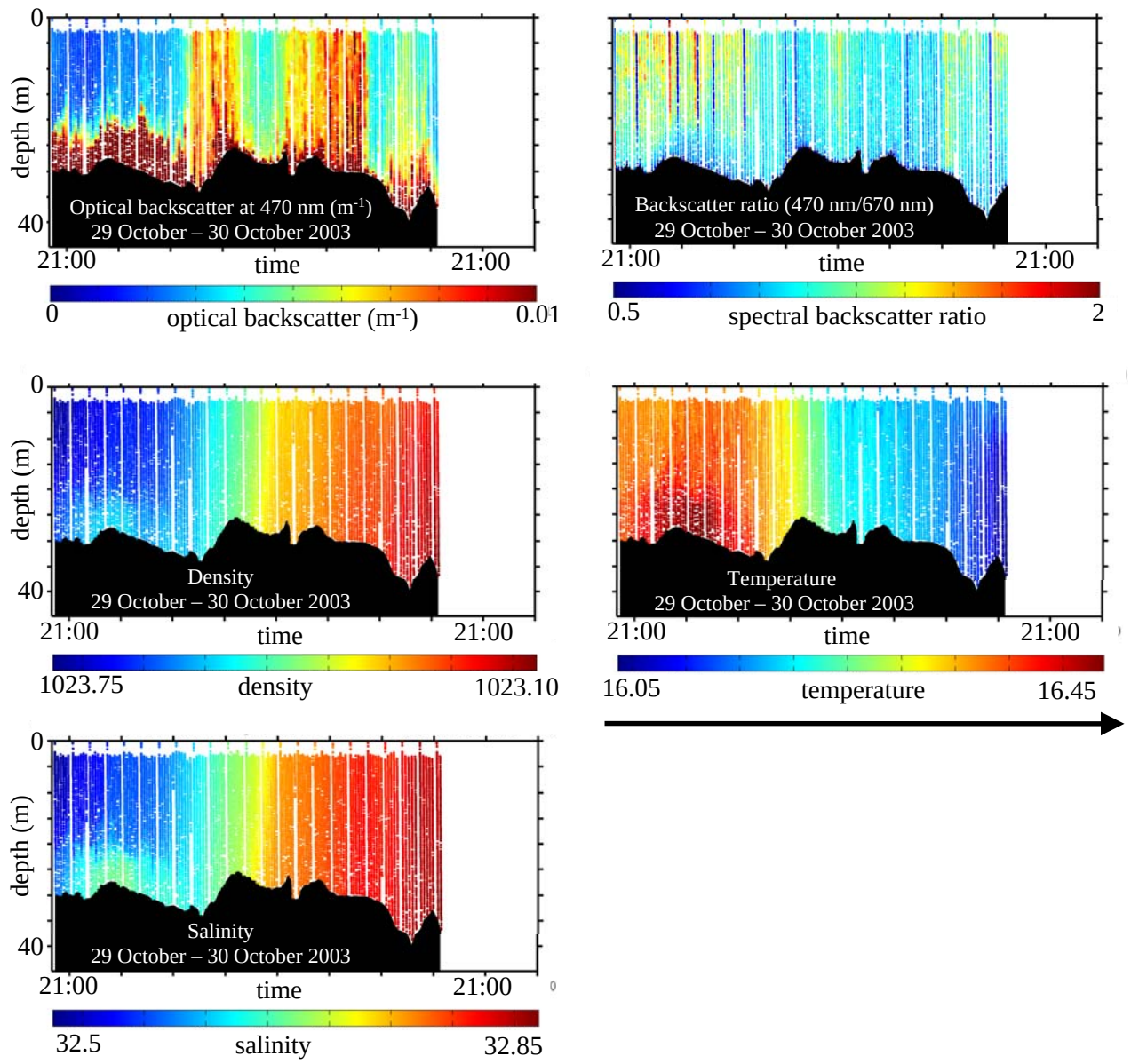
Below are the hurricane and tropical storm tracks of the last decade



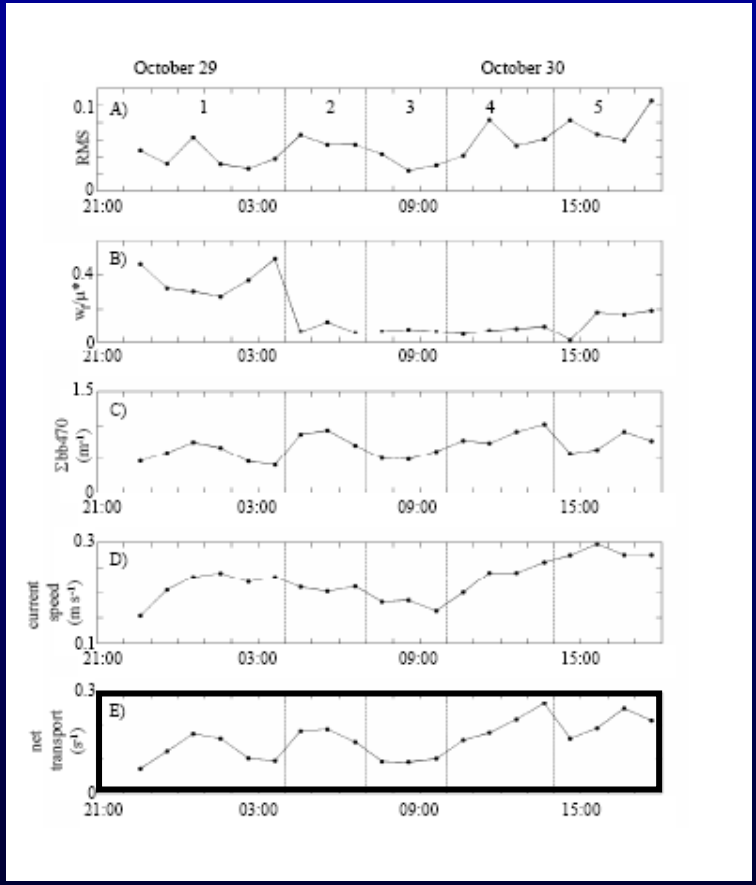
We will focus on a single storm event that impact our coastal waters in October 2003




74.5
latitude
74.5
A)
74.5
longitude
73
0
depth (m)
70
B) Optical backscatter at 470 nm
28 October – 02 November 2003
0
distance (km)
100
0
optical backscatter (m-1)
0.01
0
depth (m)
70
C) Temperature
28 October – 02 November 2003
0
distance (km)
100
11
temperature (°C)
17
0
depth (m)
70
D) Salinity
28 October – 02 November 2003
0
distance (km)
100
32
temperature (°C)
34


0
depth (m)
40
Optical backscatter at 470 nm (m-1)
29 October – 30 October 2003
21:00
time
21:00
0
optical backscatter (m-1)
0.01
Backscatter ratio (470 nm/670 nm)
29 October – 30 October 2003
21:00
time
21:00
0.5
spectral backscatter ratio
2
0
depth (m)
40
Density
29 October – 30 October 2003
21:00
time
21:00
1023.75
density
1023.10
Temperature
29 October – 30 October 2003
21:00
time
21:00
16.05
temperature
16.45
0
depth (m)
40
Salinity
29 October – 30 October 2003
21:00
time
21:00
32.5
salinity
32.85

Why water quality should care?



CONCLUSIONS:

We can now sample during extreme events using robots. These extreme events represent the largest signal for many important water quality parameters

This will help scientists to understand these processes while simultaneously providing water quality information in real-time to those charged with managing our aquatic resources

This dual use will allow for close working relationships between the managers and scientists. This will allow BOTH groups to learn from each other.

This is a great thing!