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Florida Bay Innerbasin Study

Transport and Exchange of Florida Bay Interior Waters

Florida Bay & Everglades National Park

The Problem

- Florida Bay is located downstream of the Everglades discharge that has been altered over the past century due to South Florida land uses practices.
- The salinity of Florida Bay has undergone dramatic changes.
- Salinity values reached their most extreme, up to 70, in the late 1980s, concurrent with ecological changes in Florida Bay including degradation of water quality and a mass sea-grass die-off.

Florida Bay Science Program

Question

- How and at what rate do storms, changing fresh water flows, sea level rise and local evaporation-precipitation patterns influence circulation and salinity patterns within Florida Bay and exchanges between the bay and adjacent waters ?

Proposed Research Objectives

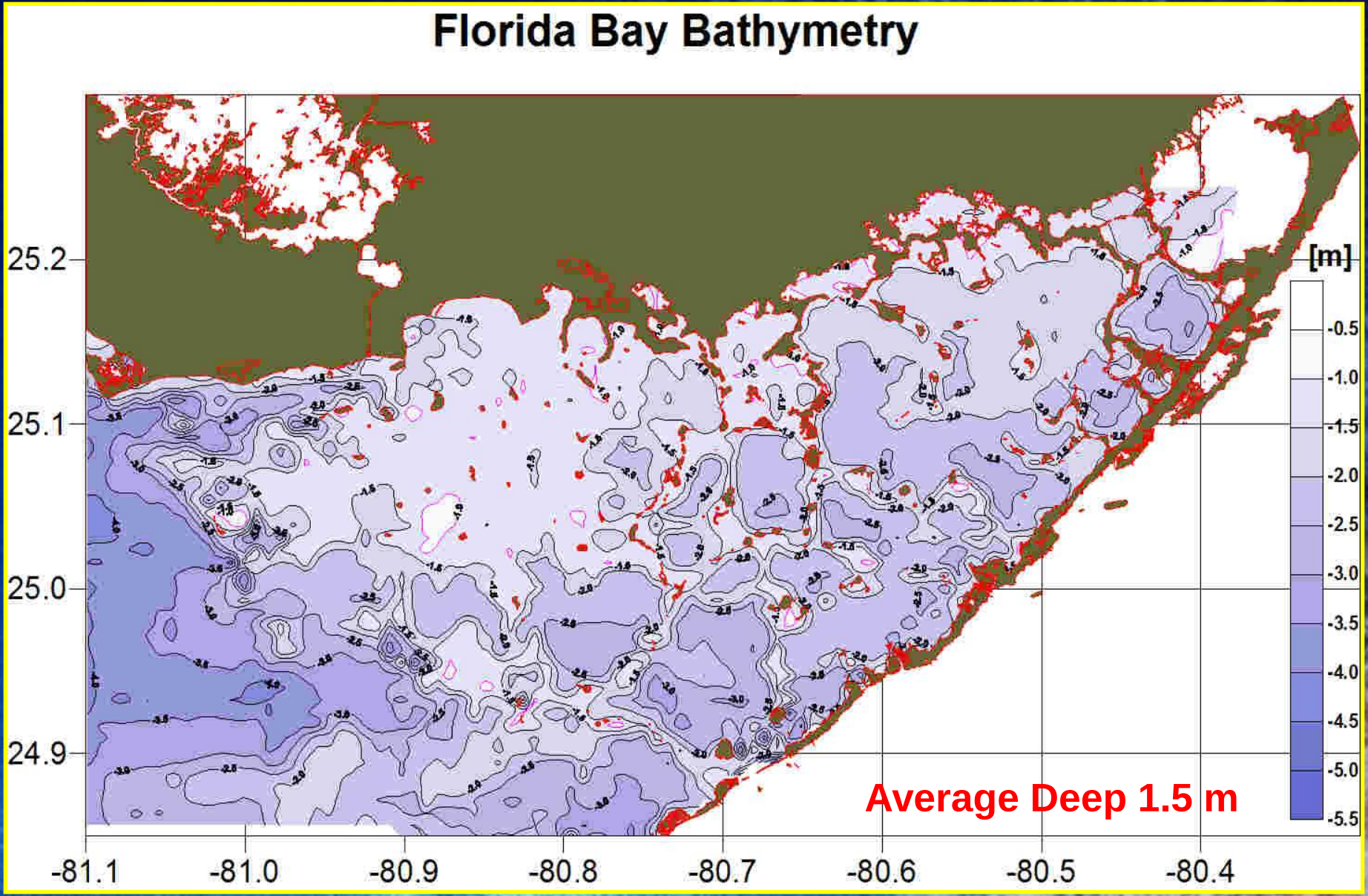
- Multi-institutional study to resolve the volume and salt transports in Florida Bay.
- Compute volume transport, salt balances and resident times in the Bay.

Florida Bay

CAPE SABLE
West Lake
Coot Bay
Bear Lake
Buttonwood Canal
Flamingo
Snake Bight
Snake Bight Channel
Garfield Bight
Porpoise Pt
Rankin Bight
Santini Bight
Terrapin Bay
Crocodile Pt
Palm Lake
Madeira Bay
Joe Bay
Little Madeira Bay
Alligator Bay
Davis Cove
Trout Cove
Long Sound
Little Blackwater Sound
Blackwater Sound
Buttonwood Sound
Joe Kemp Key
Tin Can Channel
Bradley Key
East Cape Canal
Middle Ground
Murray Key
Oyster Keys
Catfish Key
Conchie Channel
Murray-Clive Channel
Clive Key
Frank Key
Palm Key
Cormorant Key
Curlew Key
Buoy Key
Camp Key
Umbrella Key
Rankin Key
Otter Key
Mosquito Pt
Derelict Key
Dump Keys
Roscoe Key
Buttonwood Keys
End Key
Whipray Basin
Jim Foot Key
Pelican Keys
Dildo Key Bank
Dildo Key
Johnson Key
First National Bank
Carl Ross Key
Sandy Key
Man of War Channel
Man of War Key
Cluett Key
Everglades National Park Boundary
Iron Pipe Channel
Oxfoot Bank
Rabbit Key Basin
Rabbit Keys
Rabbit Key Pass
FLORIDA BAY
Schooner Bank
Ninemile Bank
Twin Key Bank
Twin Keys
Barnes Key
Upper Arsnicker Keys
Lower Arsnicker Keys
Buchanan Keys
Peterson Keys
Arsenic Bank
Pontoon Bank
Sprigger Bank
Tripod Bank
FLORIDA KEYS NATIONAL MARINE SANCTUARY
Intracoastal Waterway
Anne's Beach
Fiesta Key
Lower Matecumbe Key
Lignumvitae Key State Aquatic Preserve
Lignumvitae Key
Indian Key
Teatable Key
Upper Matecumbe Key
Shell Key
Islamorada
Windley Key
Snake Creek
Plantation Key
Plantation
Tavernier Creek
Tavernier
Tavernier Key
Rodriguez Key
Key Largo
Everglades National Park Boundary
East Key
West Key
Crane Keys
Crab Keys
Pollock Keys
Spy Key
Panhandle Key
Gopher Keys
Corinne Key
Whipray Keys
Coon Key
Dead Terrapin Key
Topsy Key
Sid Key
Calusa Keys
Bob Allen Keys
Captain Key
Jimmy Channel
Low Key
Stake Key
Manatee Keys
Bottle Key
Russell Key
Bob Keys
Black Betsy Keys
Triplet Keys
Brush Keys
Twisty Mile
Club Key
Samphire Keys
Big Key
Terrapin Pt
Crocodile Dragover
Pass Key
Lake Key
Park Key
Eagle Key
Tern Keys
Nest Keys
Deer Key
Snipe Pt
Duck Key
The Boggies
Boggy Key
Porjoe Key
Whaleback Key
Shell Key
Swash Keys
FLORIDA KEYS NATIONAL MARINE SANCTUARY
ATLANTIC OCEAN
North
0 1 5 10 Kilometers
0 1 5 10 Miles

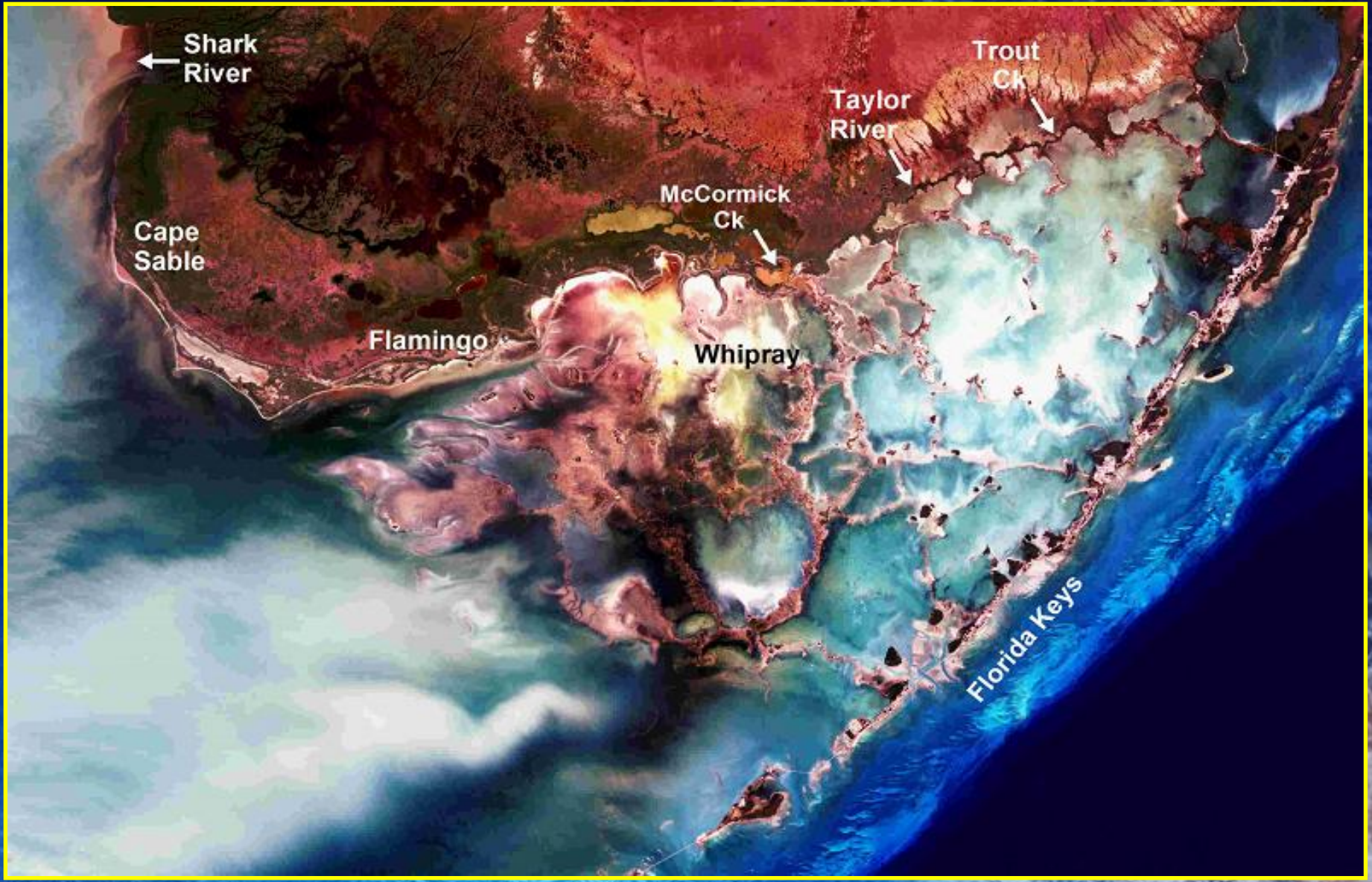
Florida Bay Regions

Florida Bay Bathymetry



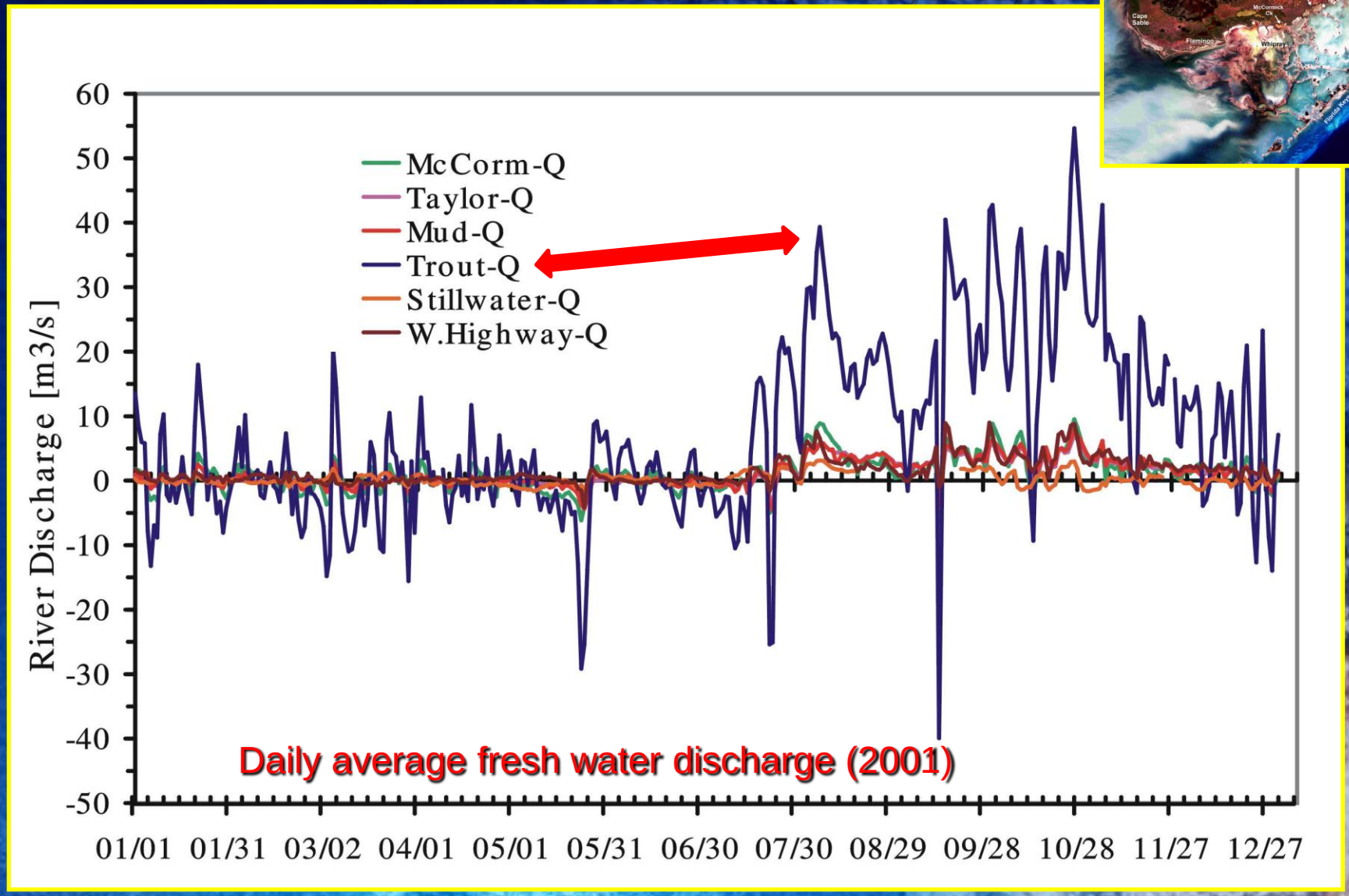
Mud Banks

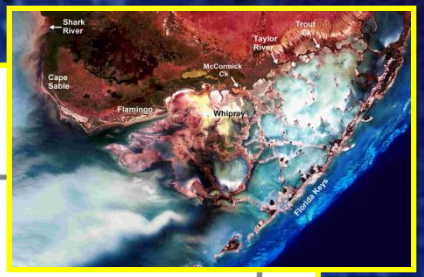
Fresh Water Inputs



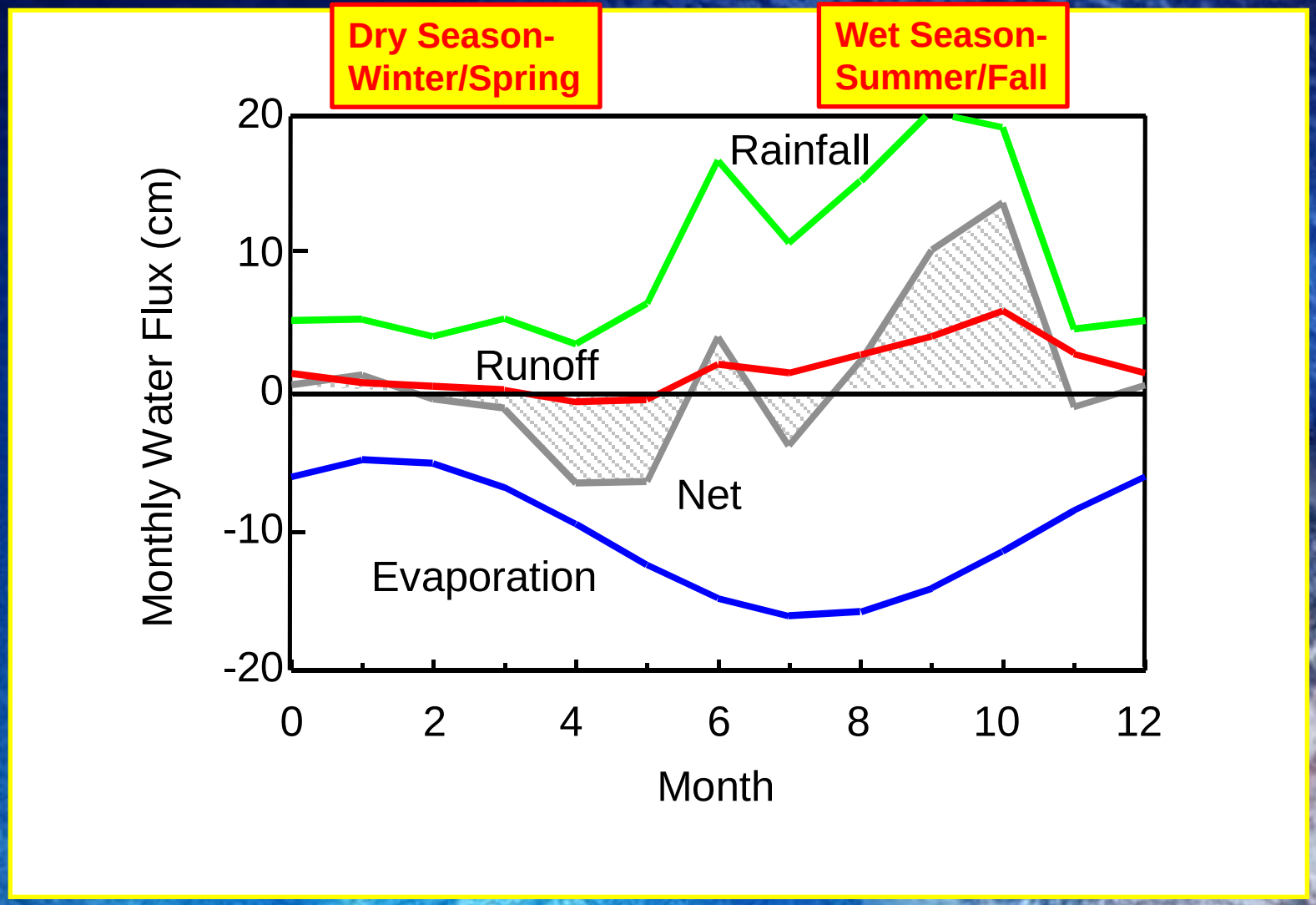
Daily average fresh water discharge to Florida Bay for 2001.

Data provided by U.S. Geological Survey, South Florida Ecosystem Program, Information Access Site (USGS, 2005).

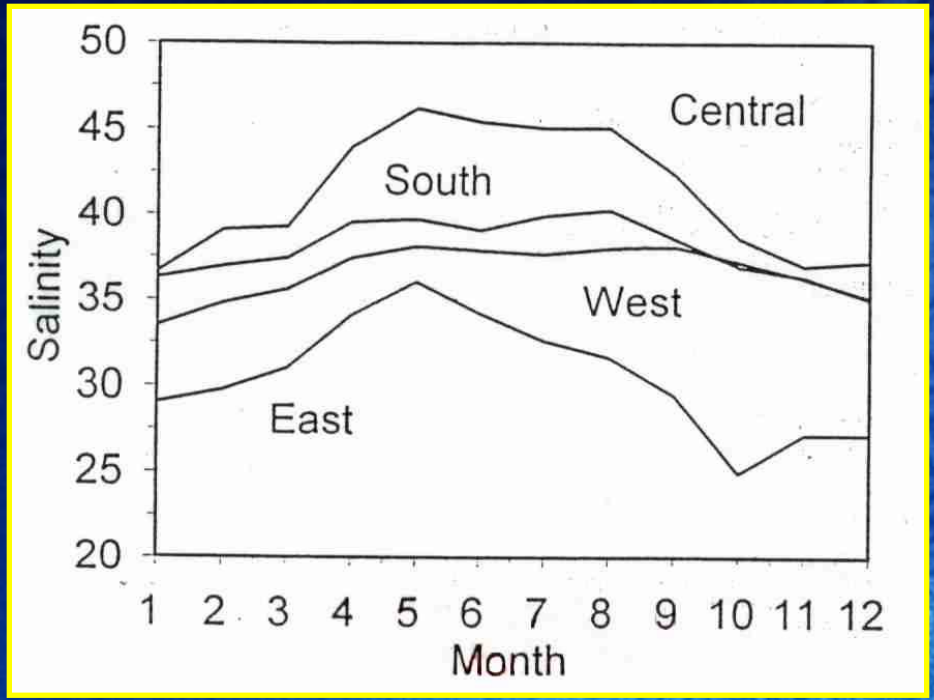




Monthly average fresh water fluxes to Fla. Bay from long-term (25 years) measurements. (Nuttle *et al.*, 2000).

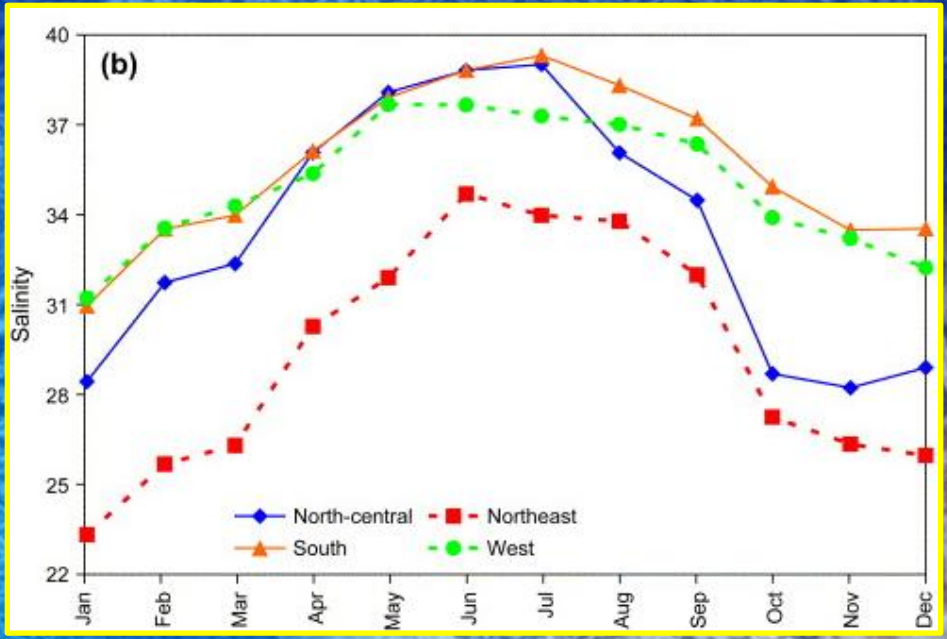


Seasonal cycle of monthly average salinity for the four regions of Florida Bay



from Nuttle et al., 2000

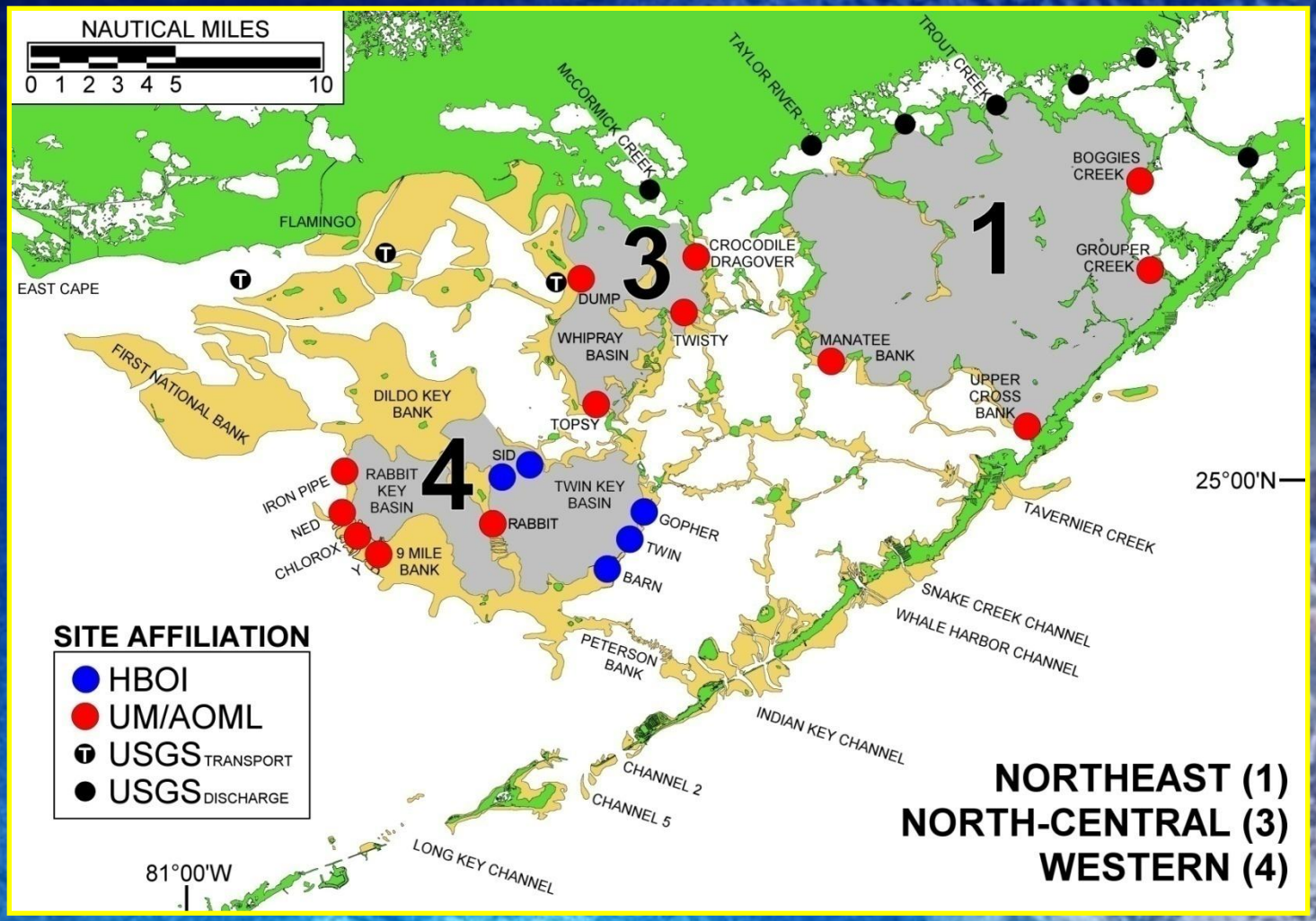
31 year data



from Kelble et al., 2006

7 year data

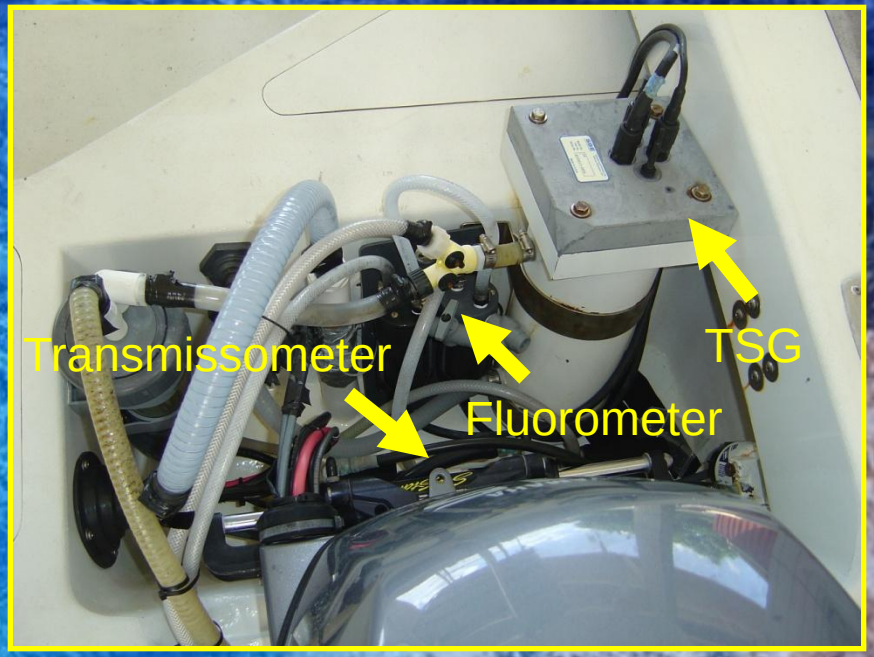
Moored instrumentation sites from recent studies of the inner basin circulation and exchange processes in northeast, north-central, and western basin sub-regions of Florida Bay. Also shown are USGS transport and river discharge measurement stations.



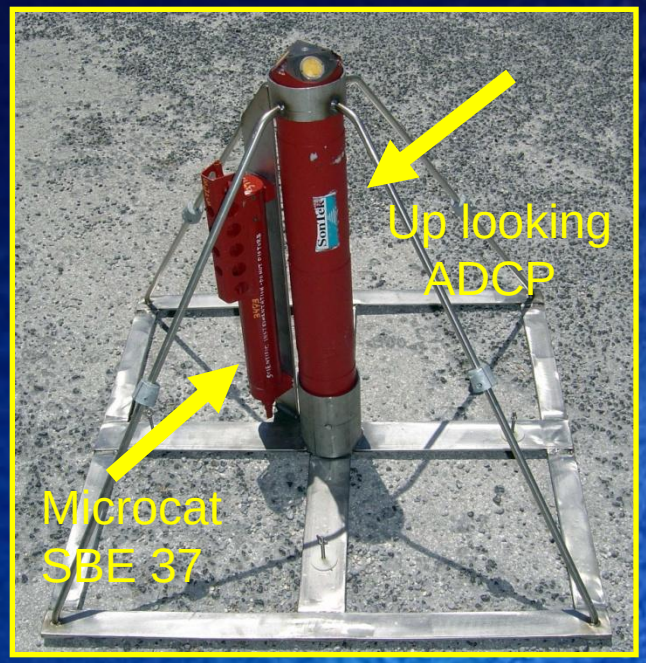
The Boat

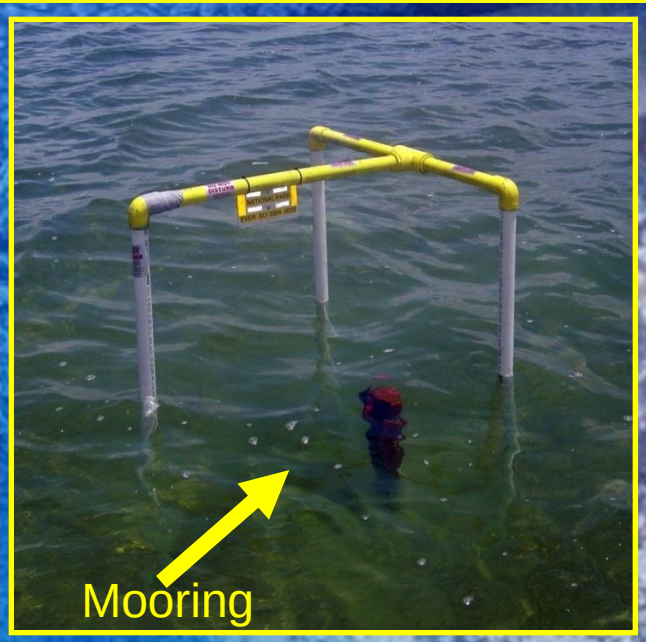
R/V Virginia K

Instruments (The Boat)



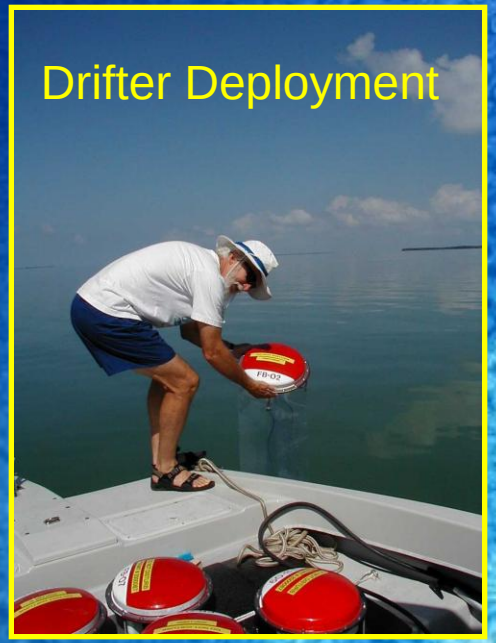
Instruments (The Moorings)





Instruments (The Drifters)

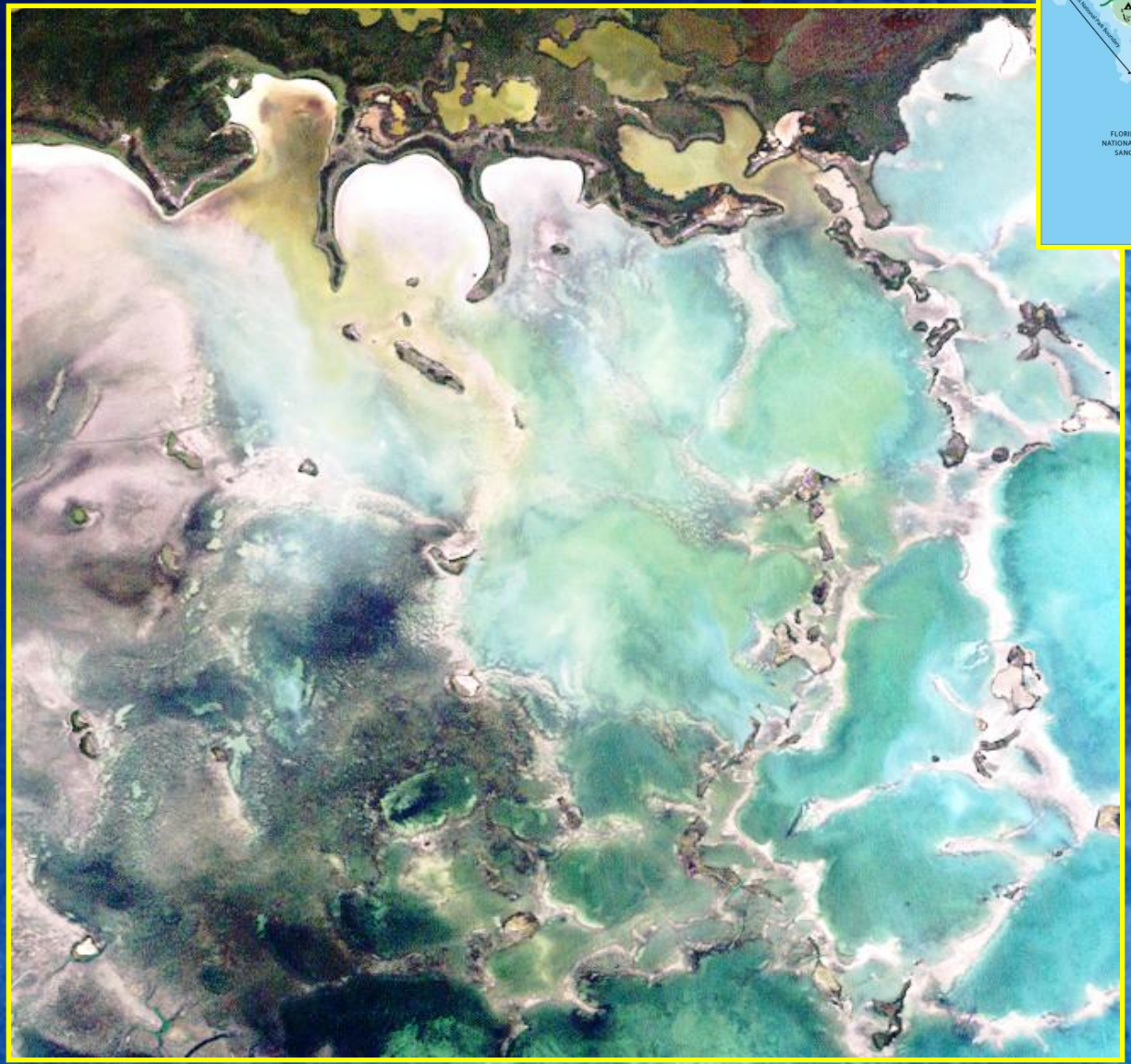
Shallow Water Drifter



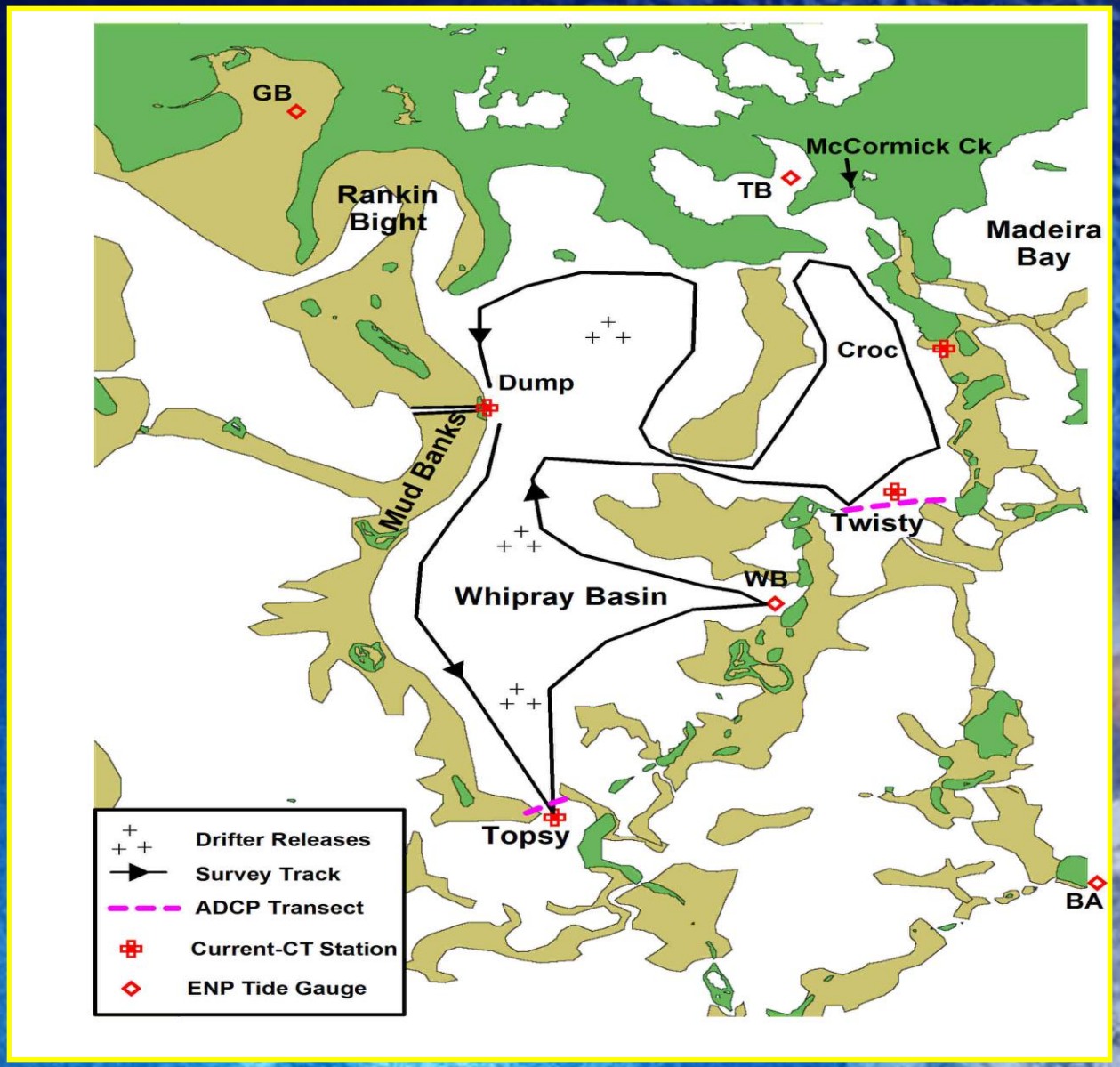
Drifter Deployment

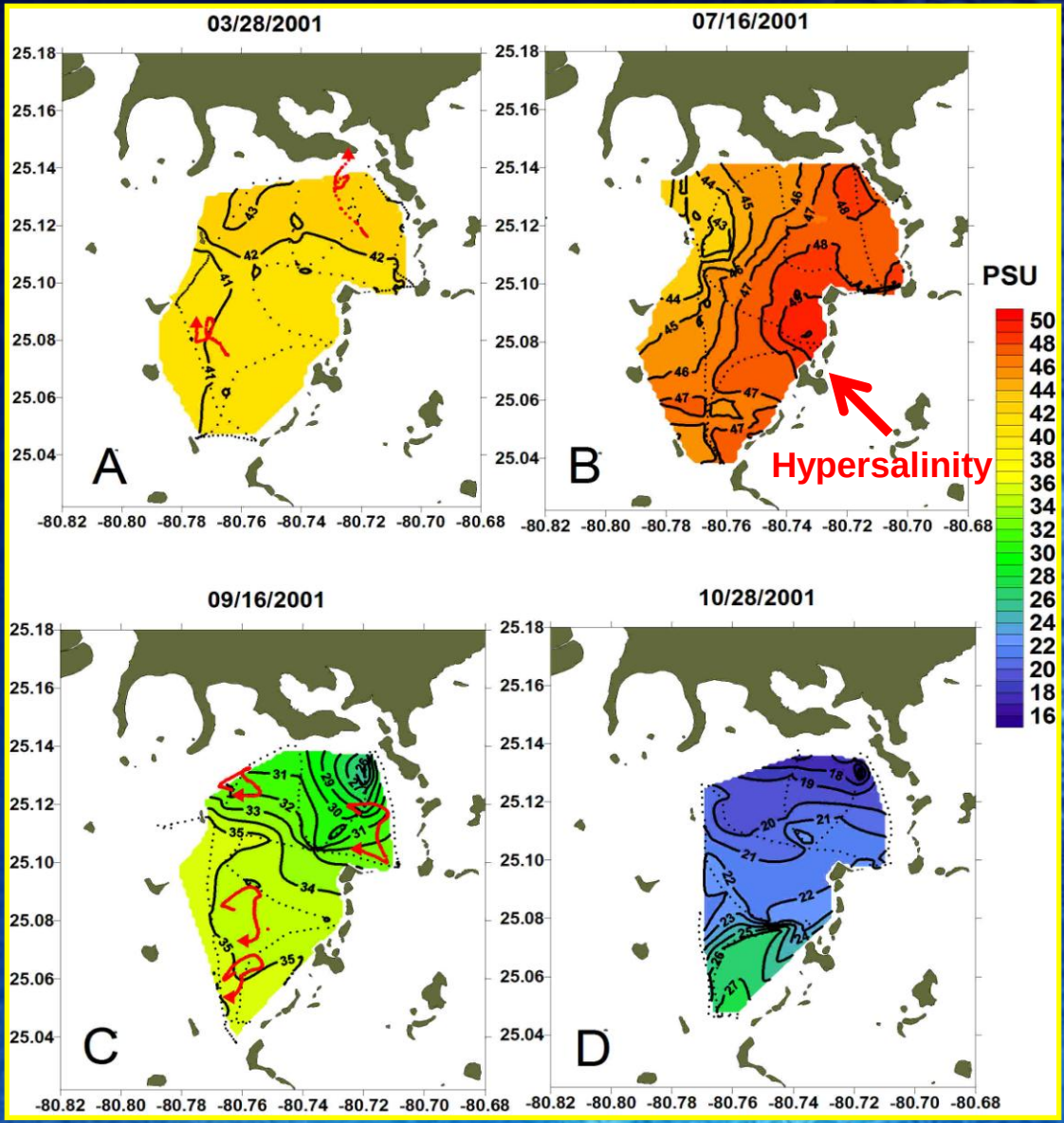
Drifter Recovery

Central Basin Florida Bay



Location of Central Basin Measurement Stations





Central Basin Surface Salinity

from high-resolution surveys of the *R/V Virginia K* using continuous underway measurement for:

A) Mar. 28 dry season;

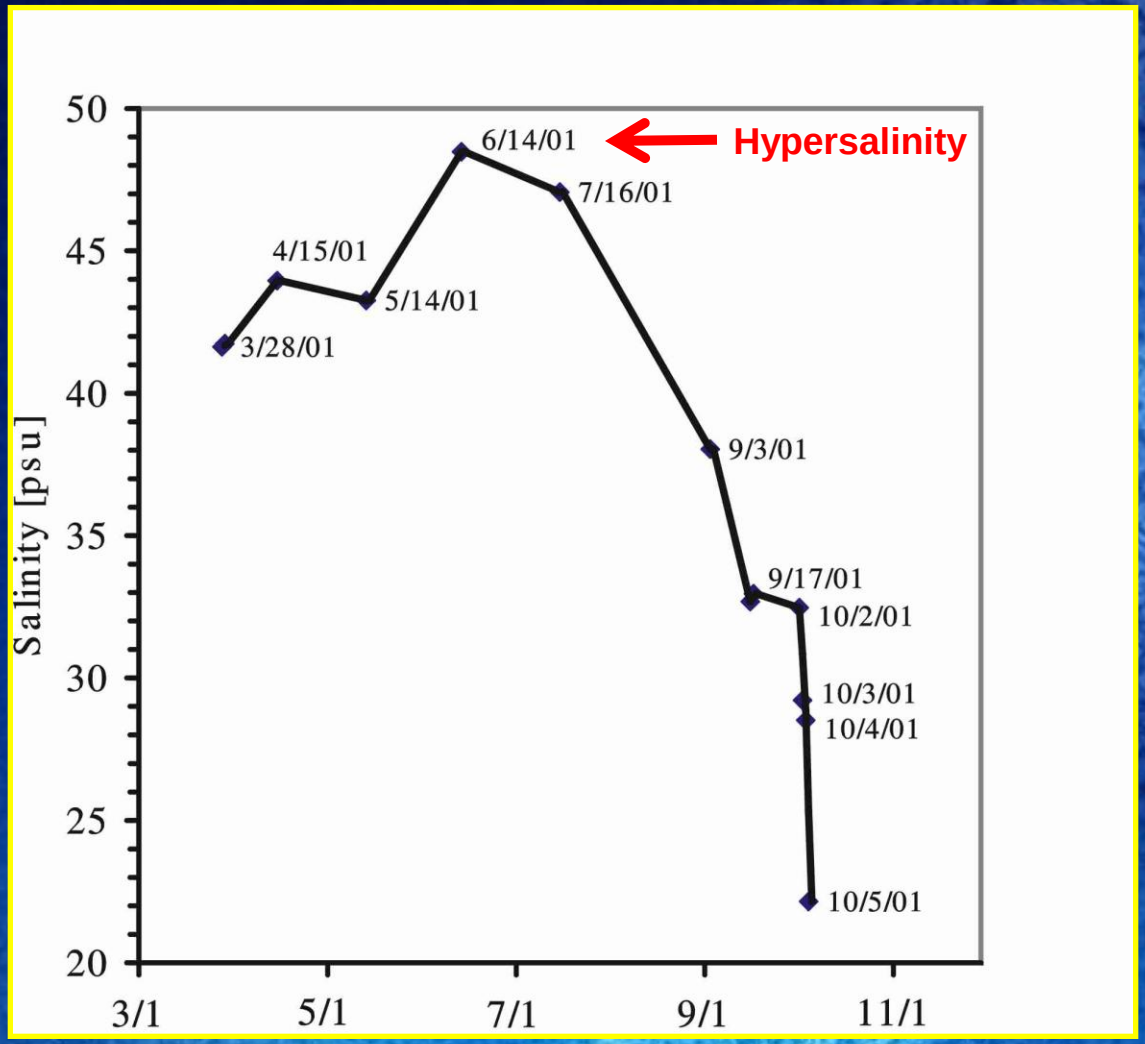
B) Jul. 16 near the end of the dry season;

C) Sept. 16 wet season; and

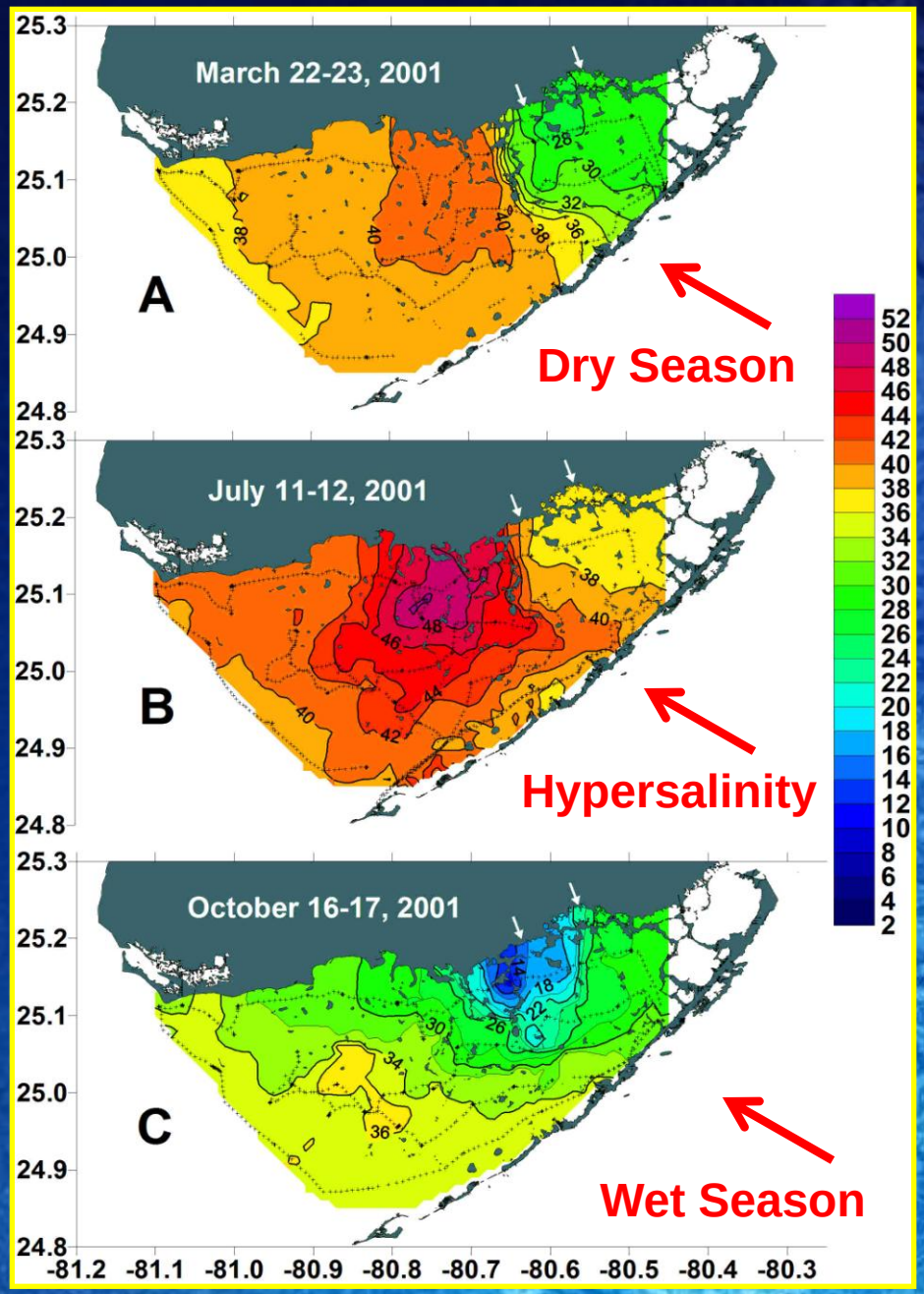
D) Oct. 28 near the end of wet season 2001.

Vessel track shown with dotted line.

Surface drifter trajectories shown with red arrows.



Time series of the Central Basin average salinity during dry and wet seasons of 2001 from *R/V Virginia K* spatial surveys.



Florida Bay Surface Salinity

from 2001 monthly surveys of the *R/V Virginia K* using continuous underway measurement for:

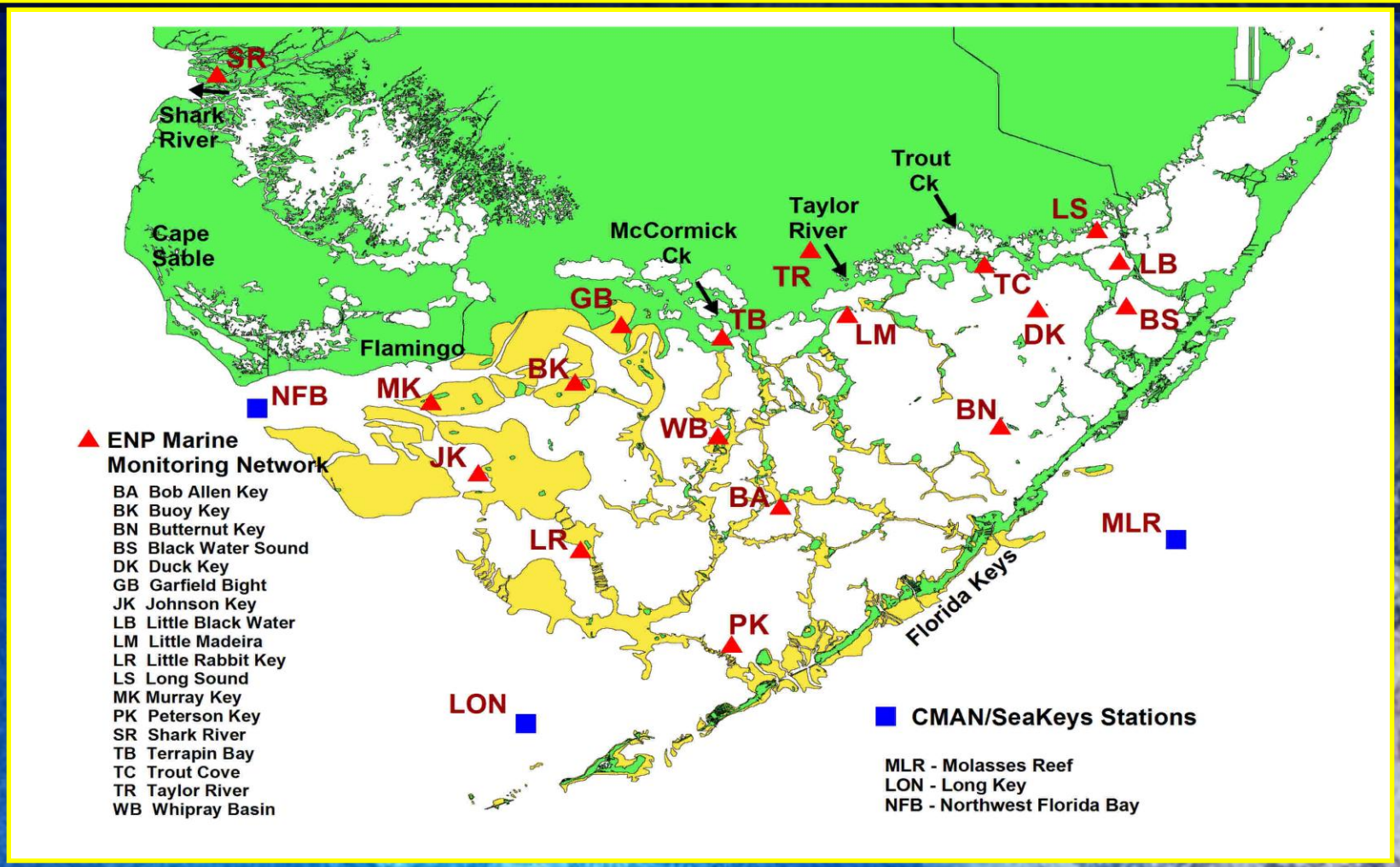
A) March 22-23 dry season;

B) July 11-12 near the end of the dry season

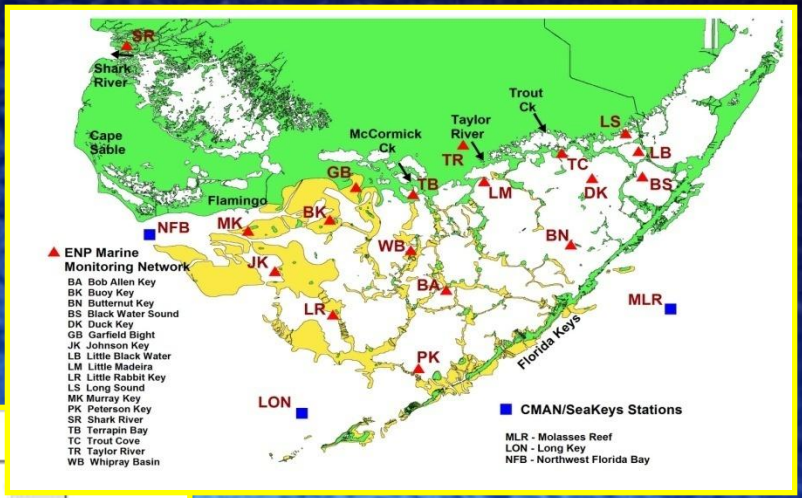
C) October 16-17 wet season.

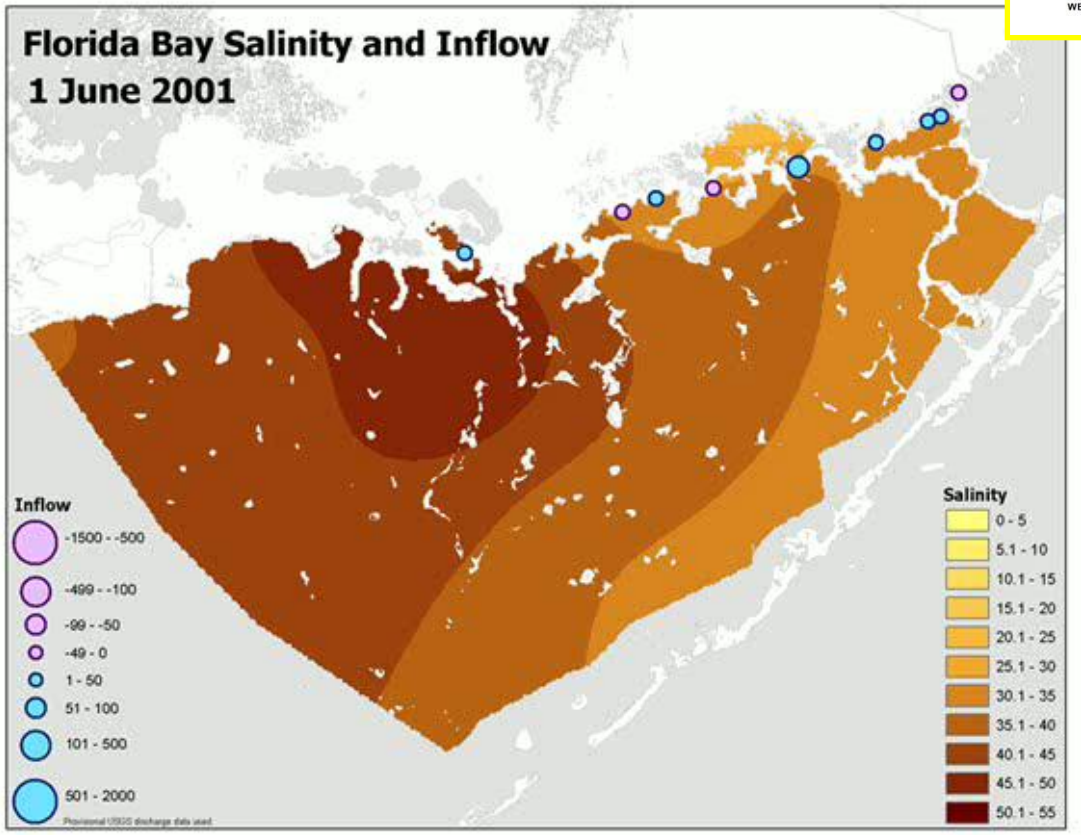
Vessel track shown with dotted line.

Location of ENP marine monitoring stations in Florida Bay (triangles), CMAN/SeaKeys wind stations (squares), and the location of fresh water discharge points (arrows) superimposed on the bays bank/basin configuration (yellow/white) and mangrove islands (green).



Florida Bay Hypersalinity Event (2001)





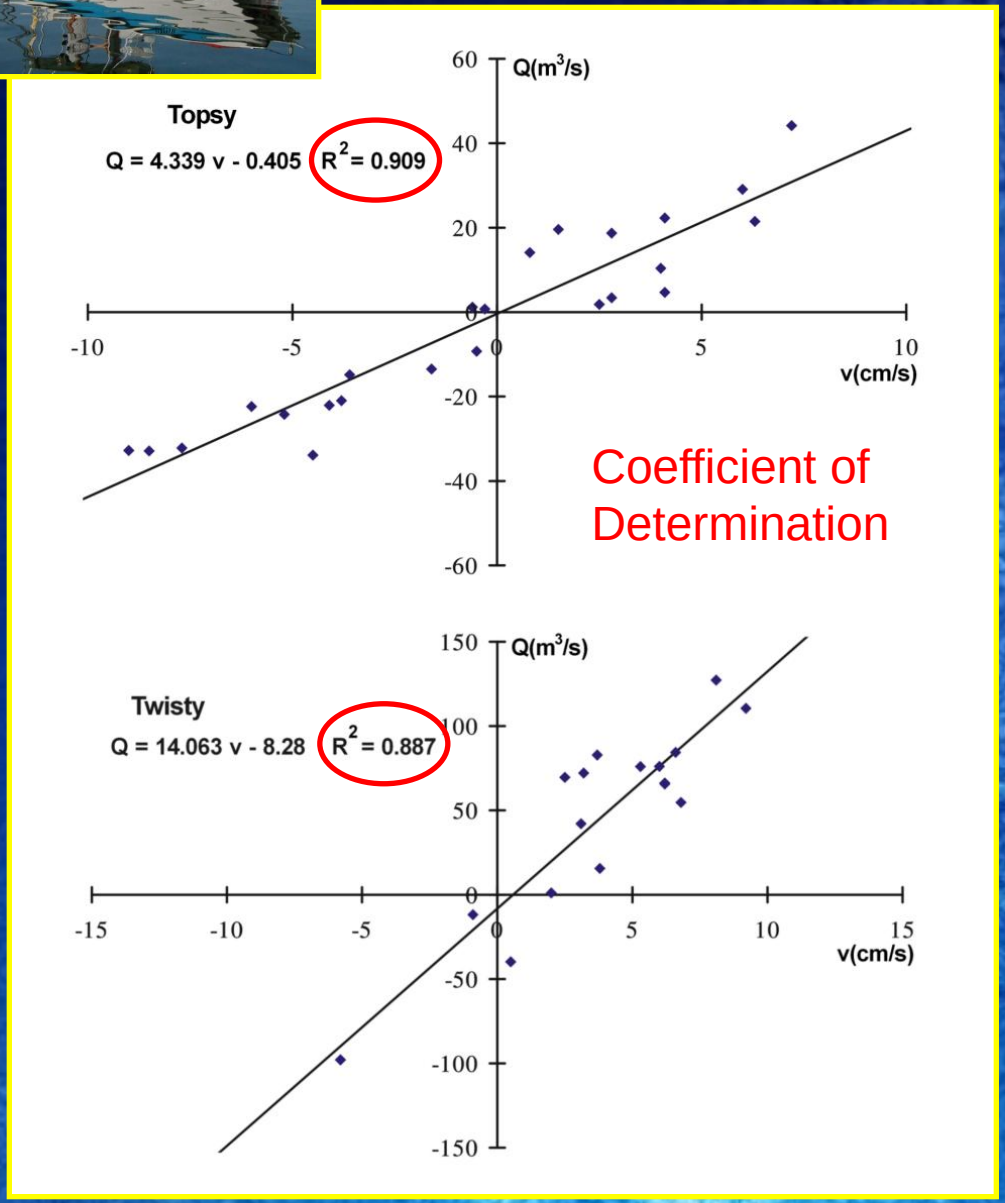
Daily Salinity Fields

Gridded and Contoured

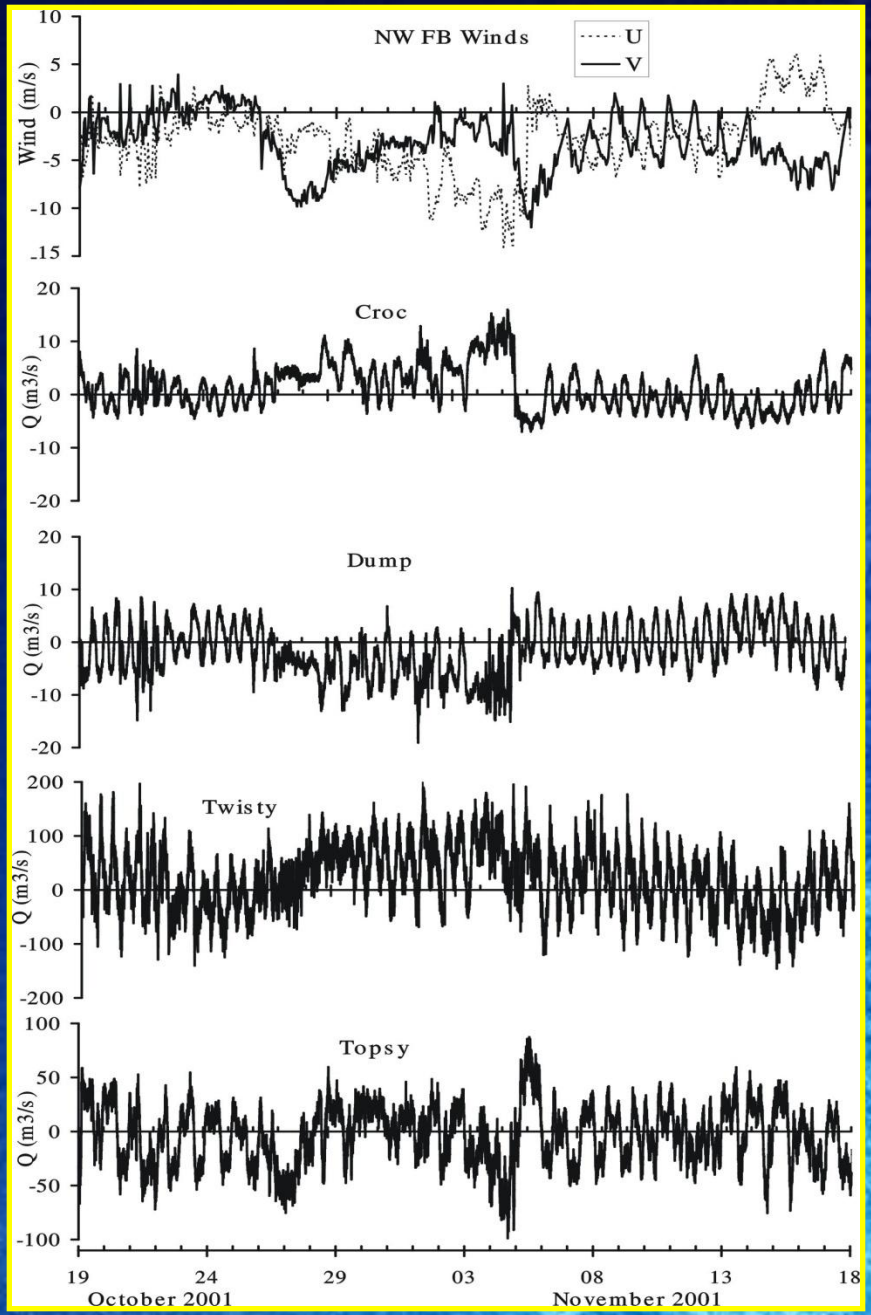
Derived from the E.N.P. monitoring array.

Fresh Water inflow from the U.S. Geological Survey are shown with circles.

Moorings Current - Transport



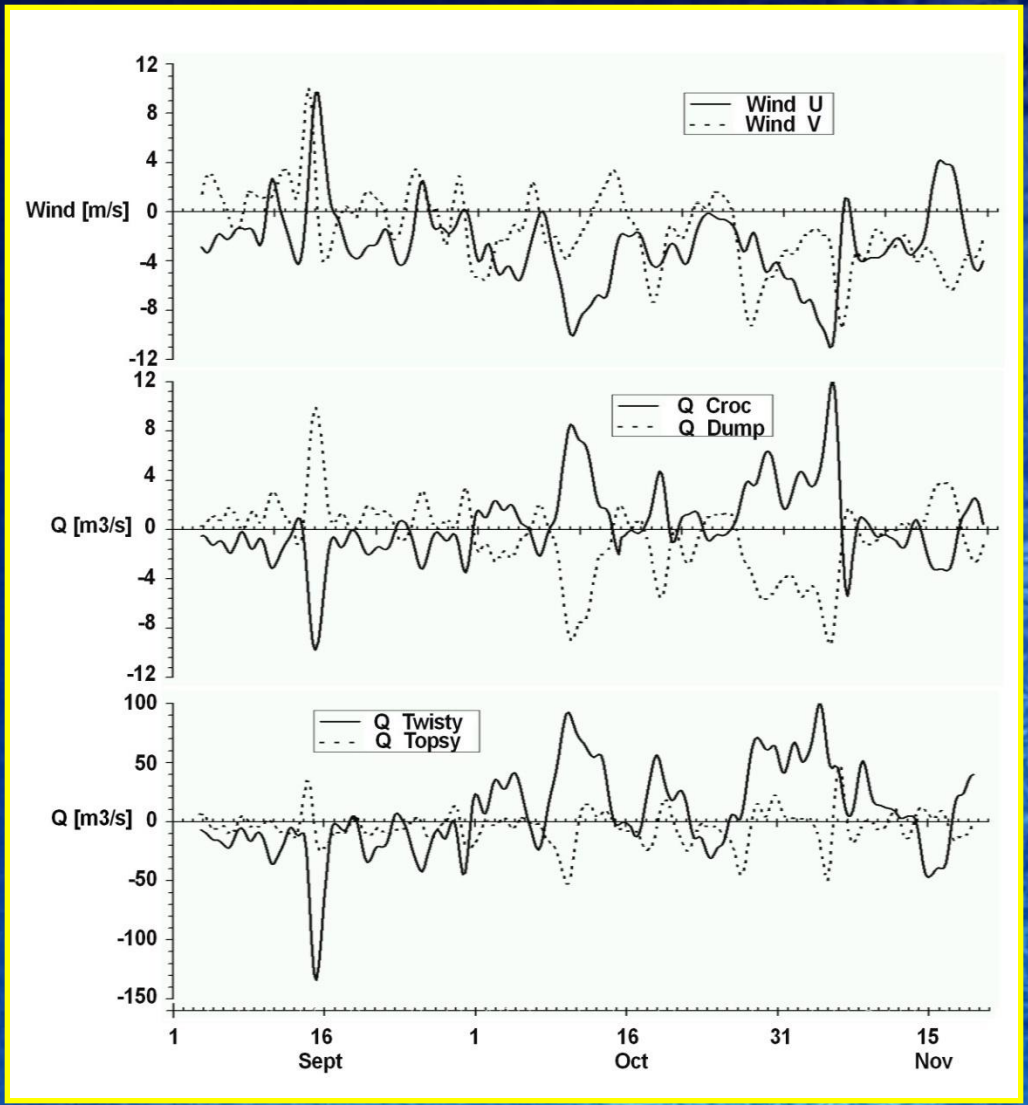
Linear regression of along-channel currents against volume transport measured with shipboard ADCP transects across the current meter sites at Topsy (top) and Twisty (bottom) transects during the wet season of 2001.



Channel Volume Transports

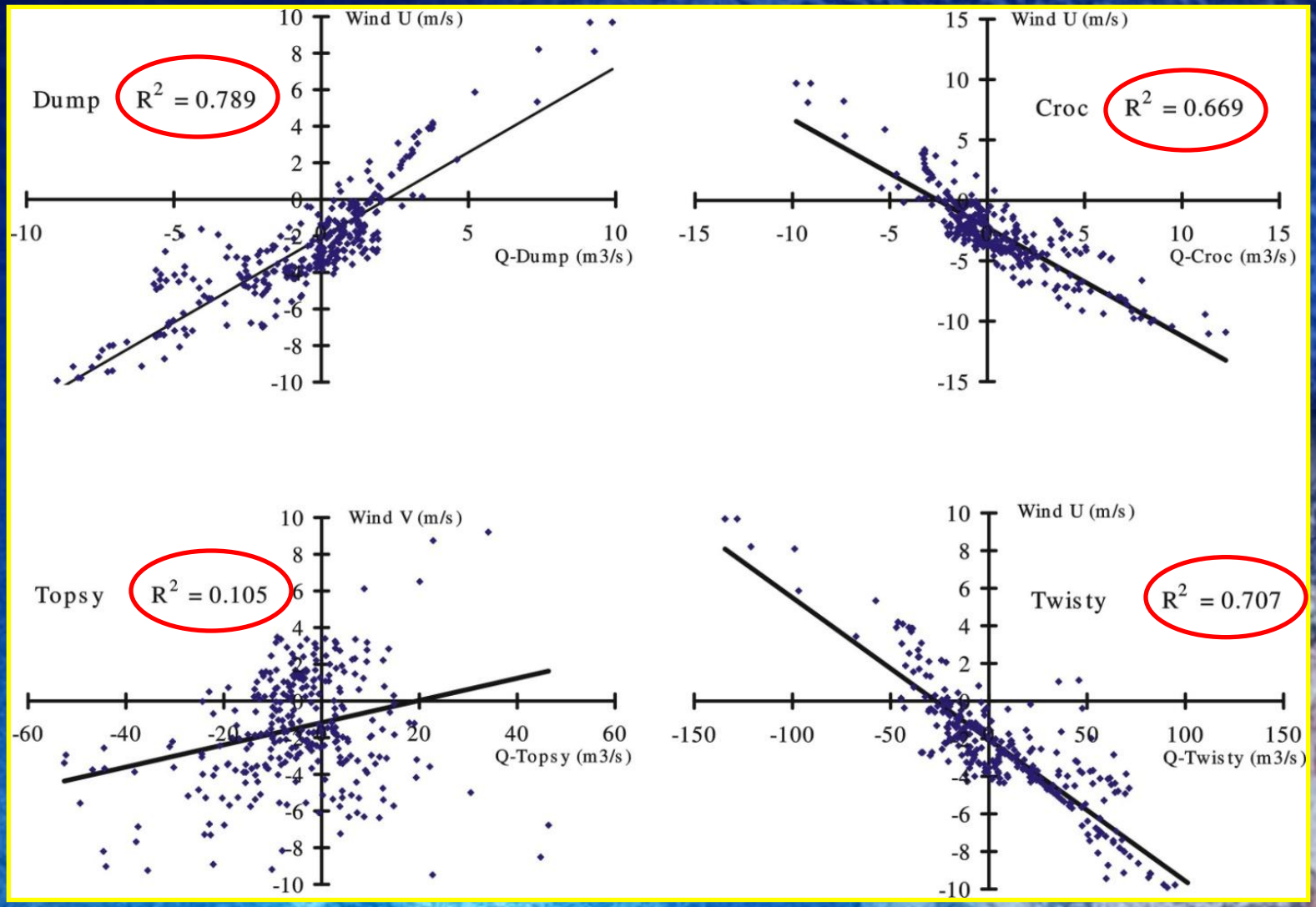
Wet Season

3 hour low-pass filtered volume transports derived for the major flow channels to the Central Basin for a one month period from the 2.5 month total record of the wet season 2001.
Positive values are inflows and negative are outflows. Also shown are east-west and north-south wind components from the NWFB SeaKeys site.



40 hour low-pass filtered NWFB wind components and volume transports through CB flow channels during wet season 2001. Positive values are inflows and negative are outflows.

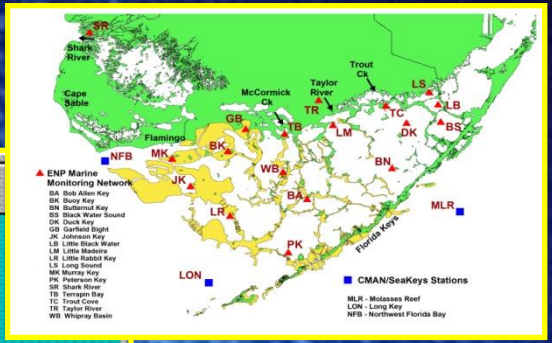
Linear regression between subtidal time series of east-west wind and transports through Central Basin flow channels during the wet season 2001.

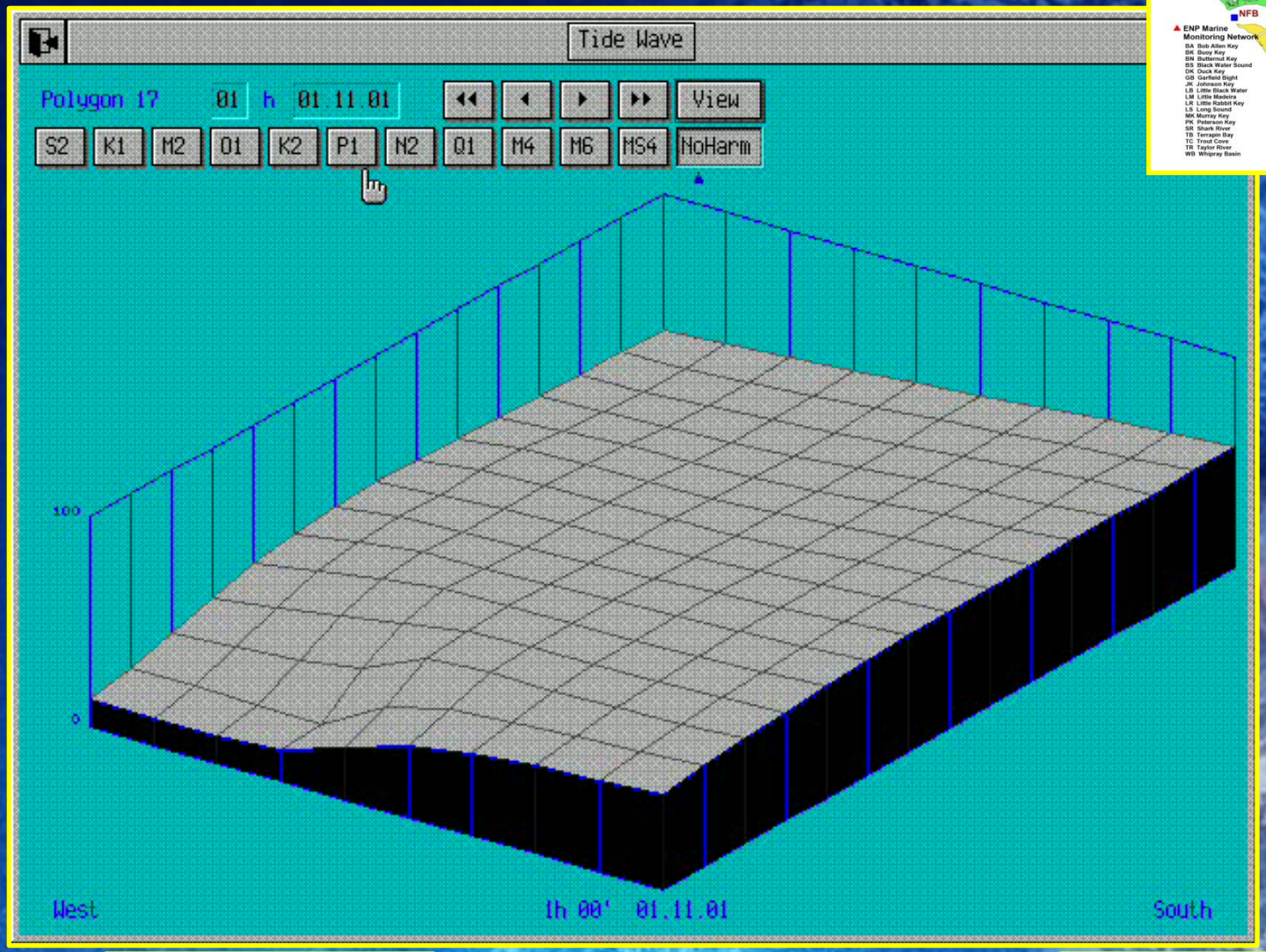


Florida Bay Sea Level Anomaly Movie

Average weather conditions

NE Basin





Hourly Sea Level Fields

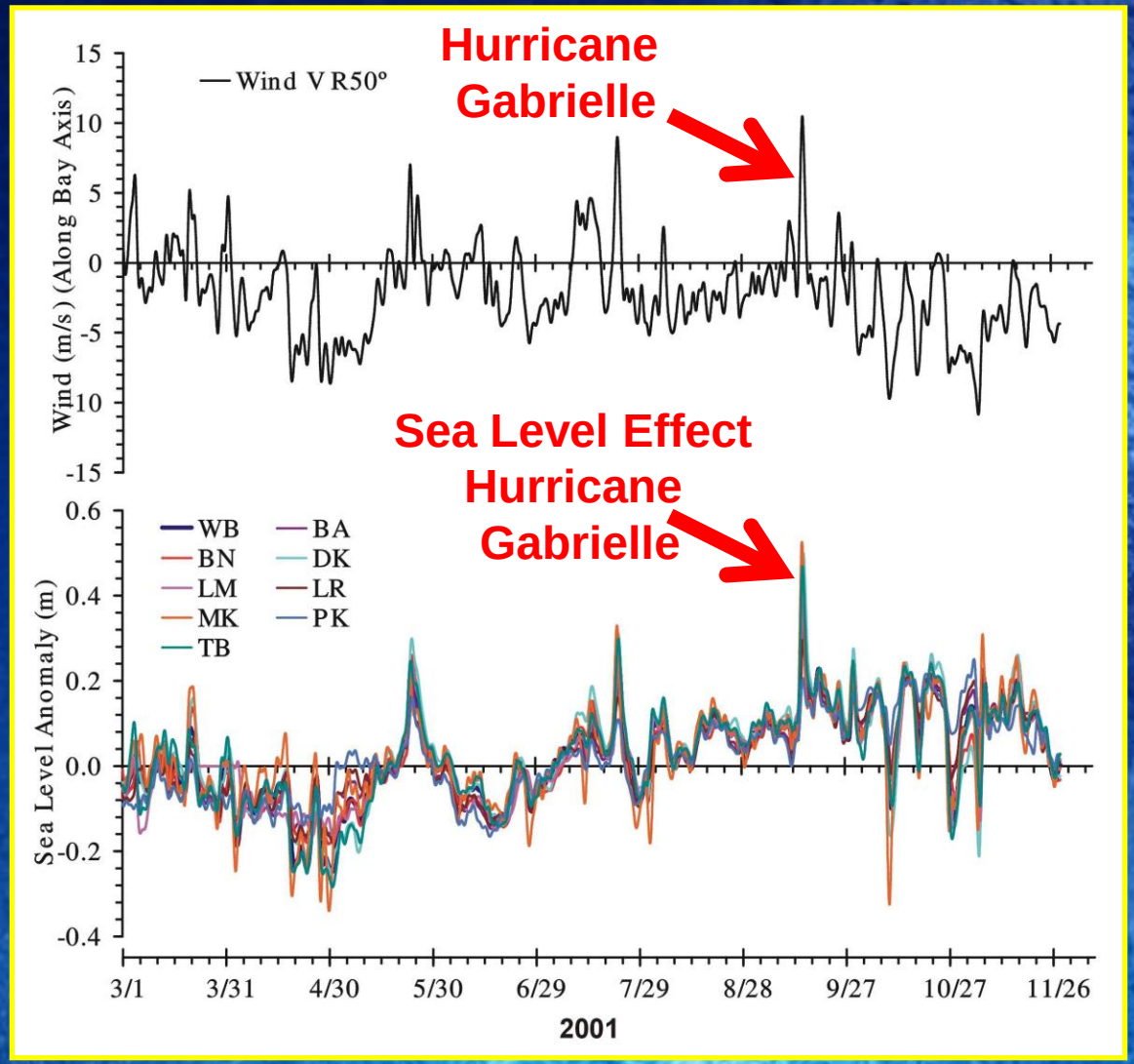
Gridded and Contoured

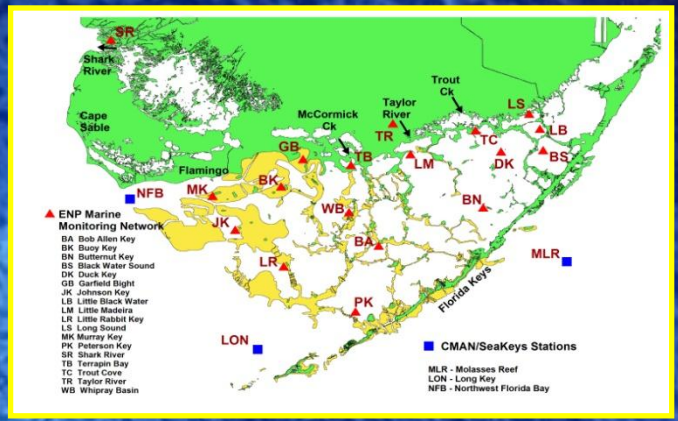
Tide constants Derived from the E.N.P. monitoring array.

Gulf of Mexico

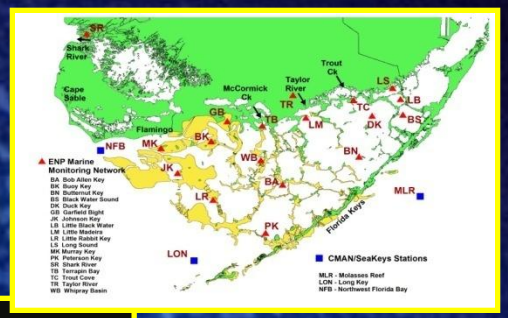
Florida Keys

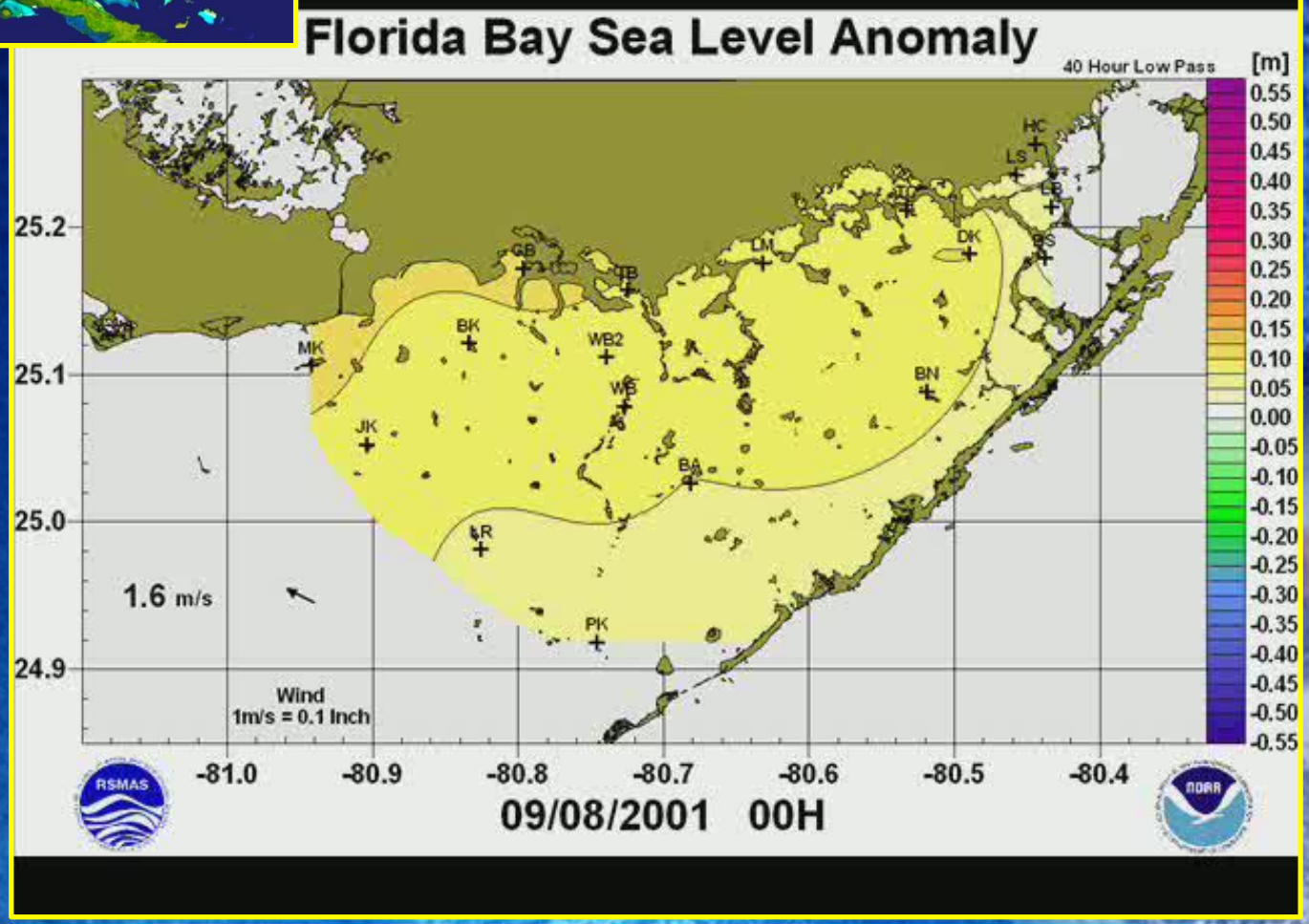
Subtidal sea level time series from selected stations of the ENP monitoring array and winds for the NWFB SeaKeys station, rotated 50º into along-bay axis and cross-bay axis components (along-axis winds + toward 50º and cross-axis winds + toward 140º. Sea level stations were selected to provide coverage of the entire bay.





Sea Level Anomaly Movie Hurricane Gabrielle (2001)





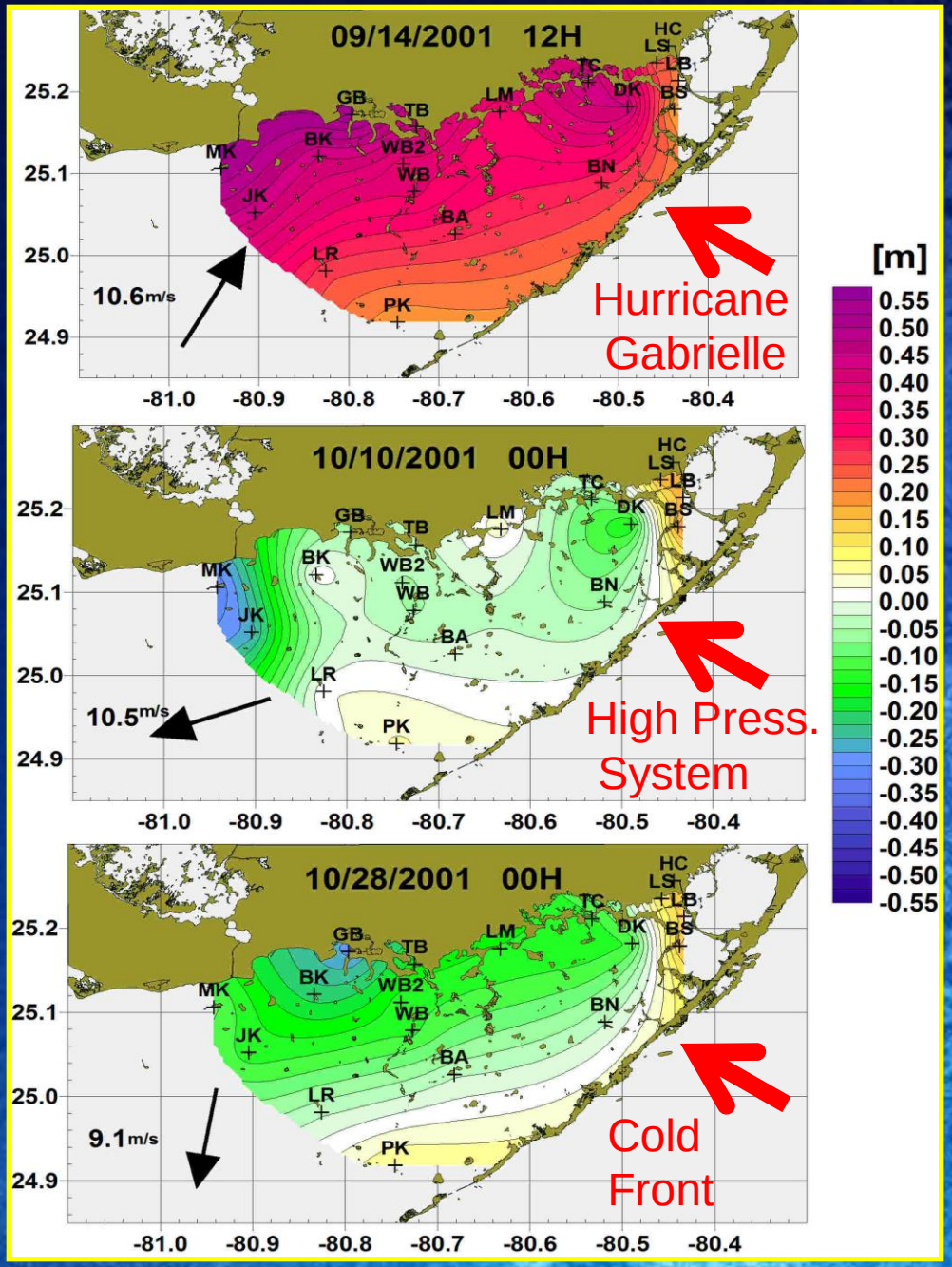
Gridded and Contoured Sea Level Fields

Derived from the ENP monitoring array for fall 2001 wind events.

Winds from the NWFB SeaKeys station are shown with black arrows.

Gridded and Contoured Sea Level Fields

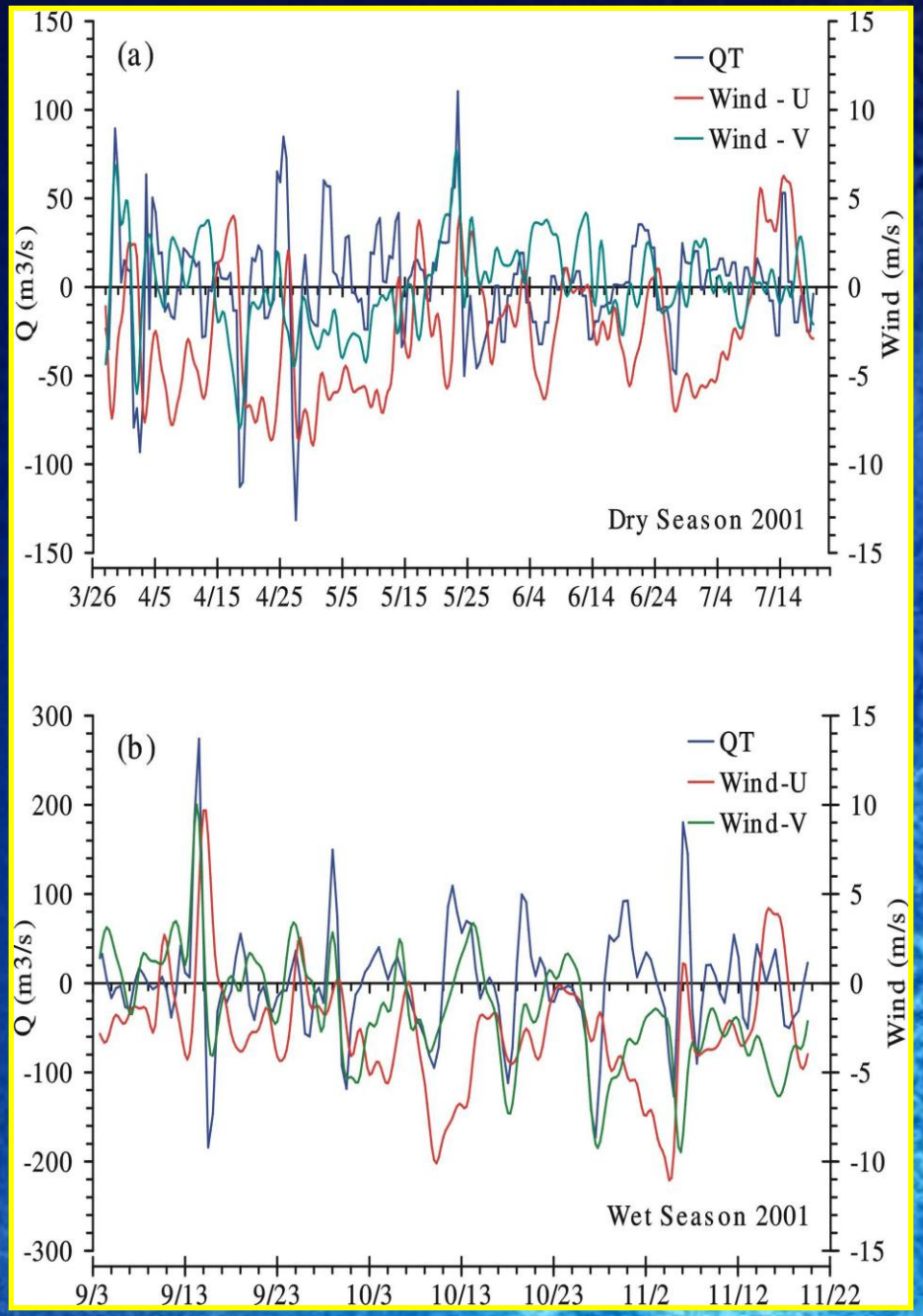
Wind Events and Sea Level in Fl. Bay (2001)



Gridded and Contoured Sea Level Fields

Derived from the ENP monitoring array for fall 2001 wind events.

Winds from the NWFB SeaKeys station are shown with black arrows.

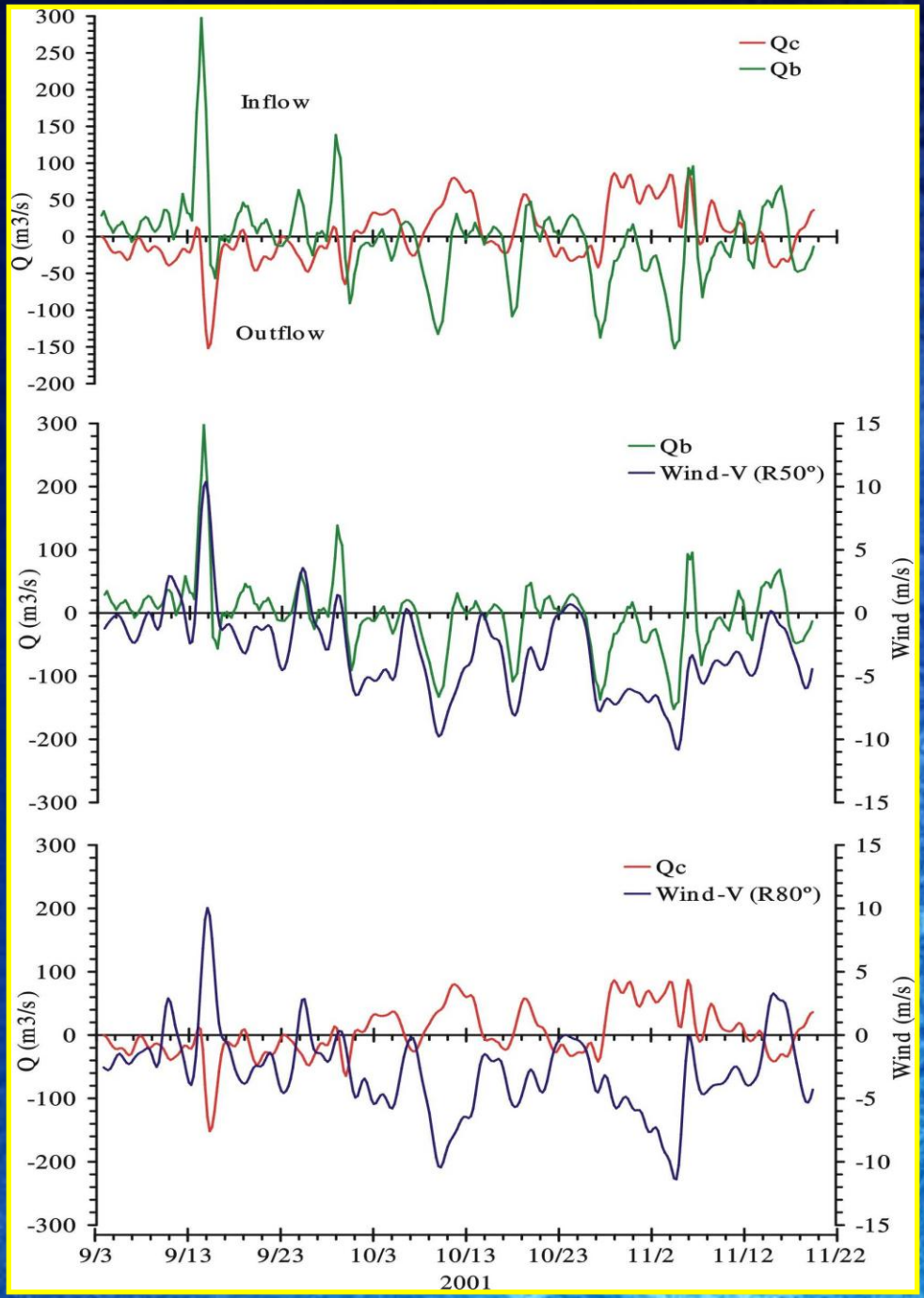


Subtidal time series of the Total Volume Transport (Q_T)

into (+) and out of (-) Central Basin derived from gridded sea level fields,

shown with east-west (U) and north-south (V) winds

for dry (a) and wet (b) seasons of 2001.



$$Q_T = Q_c + Q_b$$

Wet season 2001 subtidal time series of the:
Total channel flow (Q_c) and Total bank flow (Q_b) (top panel);

Total bank flow plotted with along-axis winds (middle panel); and

Total channel flow plotted with winds rotated 80deg (bottom panel).

Seasonal and annual means of Total Transport (Q_T) from Central Basin sea level monitoring data, total measured channel transport (Q_c) and residual bank transport (Q_b) from

$$Q_b = Q_T - Q_c$$ in m^3/s for 2001.

[Mean volume of Central Basin is 56.55×10^6 (m^3).]

Transport	Dry Season	Wet Season	Annual Mean
Q_T	0.8	-0.1	0.4
Q_c	-10.48	3.2	-3.6
Q_b	11.2	-3.3	3.9
Basin Renewal Time (months)	2.1	6.8	6.1

Physical data for the Central Basin and values for annual water balance model during wet and dry seasons of 2001.

Mean depth (m)	Surface area (km^2)	Mean volume x 10^6 (m^3)
0.65	86.9	56.55

Seasonal and Annual Water Balance Model in m^3/s

$$Q_T = Q_w + Q_g + r + P + E$$

Wind transport | Ground water inflow | River discharge | Precipitation | Evaporation | Total Transport

	Q_w	$+ Q_g$	$+ r$	$+ P$	$+ E$	=	Q_T
Dry	0.8	1.65	-0.5	3.07	-4.25	=	0.77
Wet	-0.07	-4.67	3.5	4.81	-3.64	=	-0.07
Annual average	0.36	-1.51	1.5	3.94	-3.94	=	0.35

Conversion: 1 m^3/s = 2.98 cm/mo.

Salt balance model for estimating the fractional rate of **volume exchange (Q'_i)/mo** and **water renewal time (T)** for the Central Basin during dry and wet seasons 2001. (Lee et al., 2006)

$$Q'_i = Q_i / Vol;$$

$$R = r + P - E; \quad R' = R/Vol; \quad Vol = \text{Central Basin mean volume.}$$

$$Q'_i = (\partial S_{WB}/\partial t + S_o R')/(S_i - S_o)$$

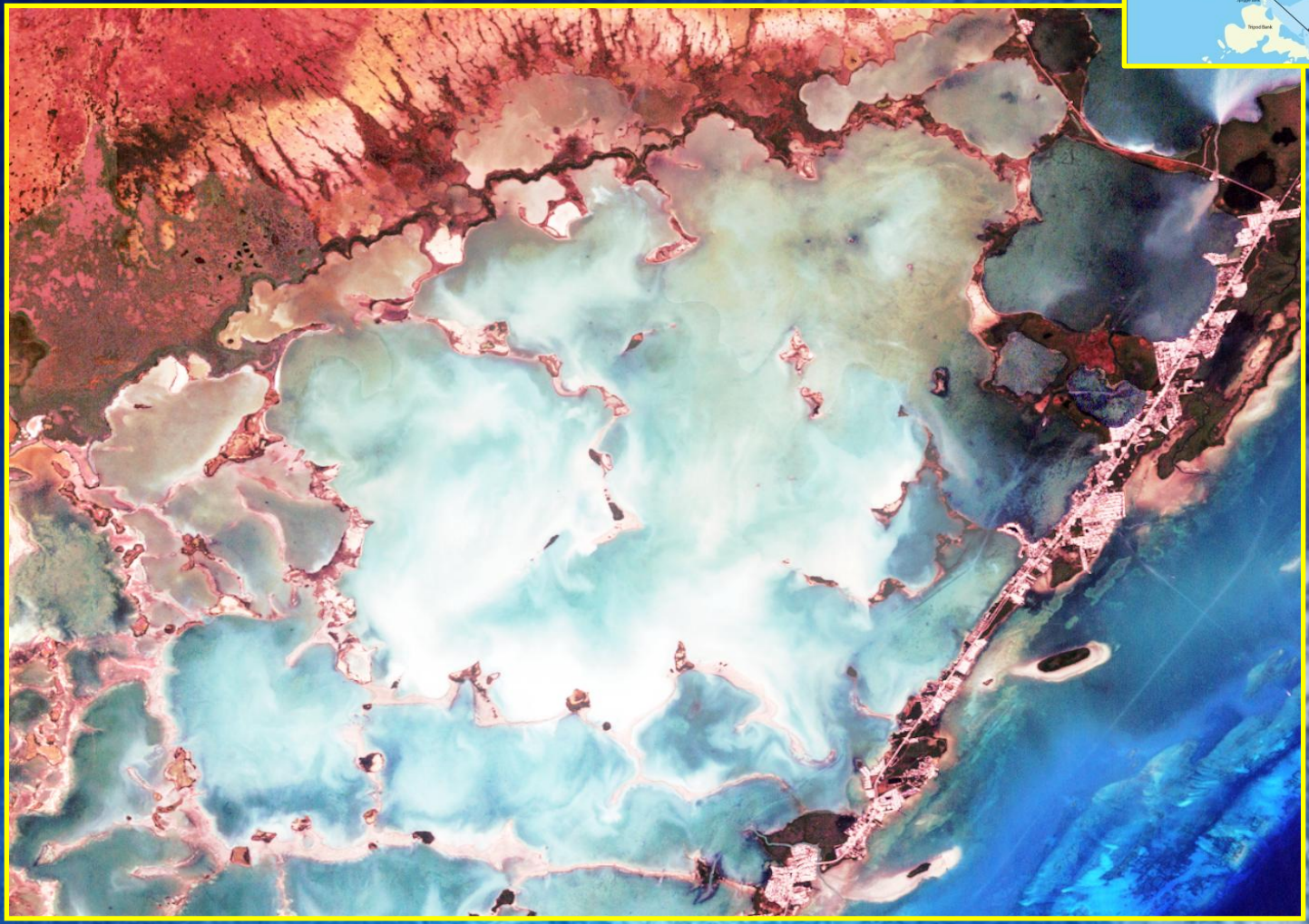
Q_i = Water Inflow;

S_i and S_o = Ave. S of the inflow and outflow waters in Central Basin

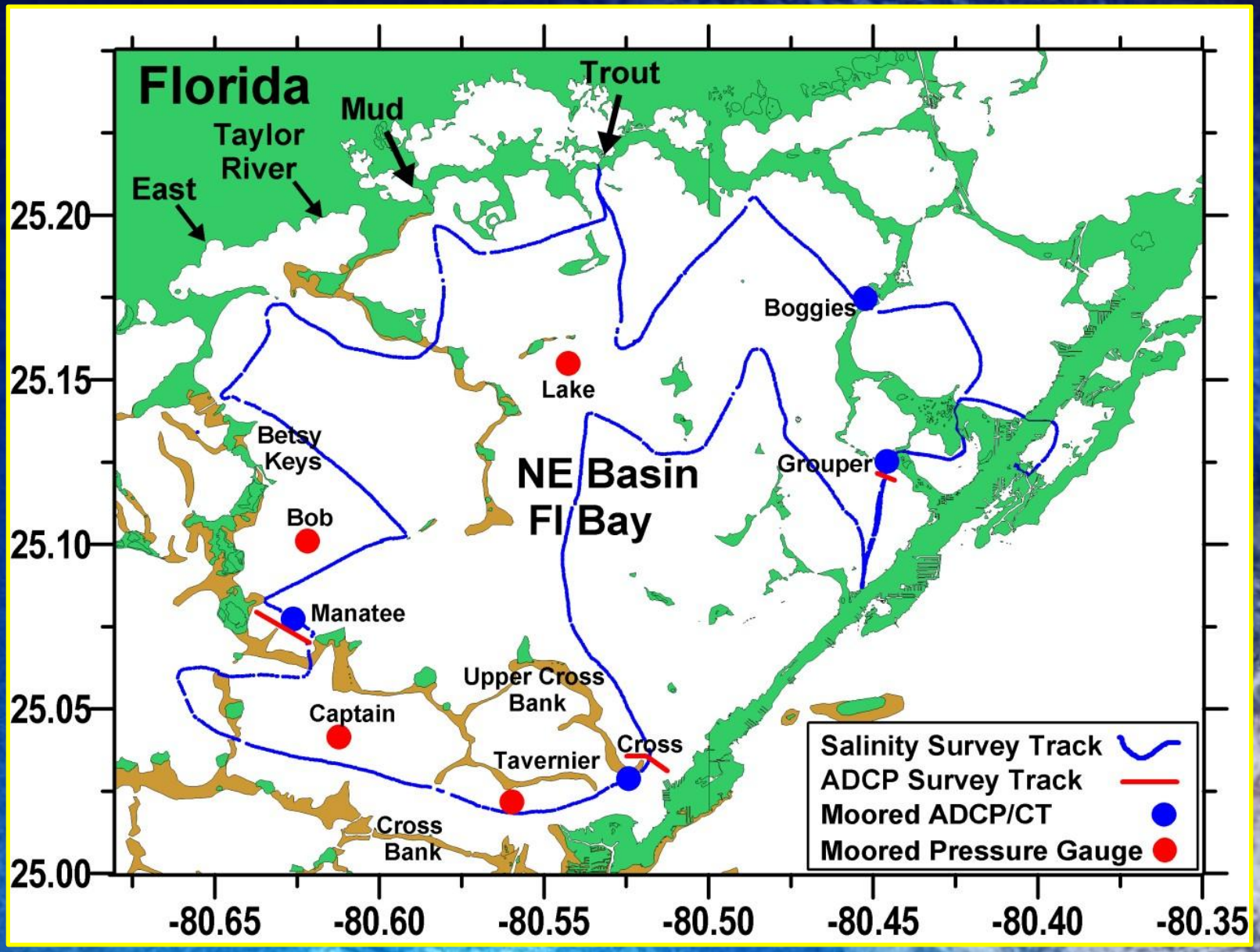
R = Net supply of fresh water; r = River discharge; P = Precipitation; E = Evaporation

	Rate S Change	Fresh Water Supply	Average S Inflow	Average S Outflow	Rate Volume Exchange	Water Renewal Time
Season	$\partial S_{WB}/\partial t$ (mo^{-1})	R' (mo^{-1})	S_i	S_o	Q'_i (mo^{-1})	T (mo)
Dry	2.6	-0.078	42.7-41.7	44.69	0.44 to 0.3	2.3 to 3.4
Wet	-5.8	0.22	28.38	32.65	-0.32	3.1

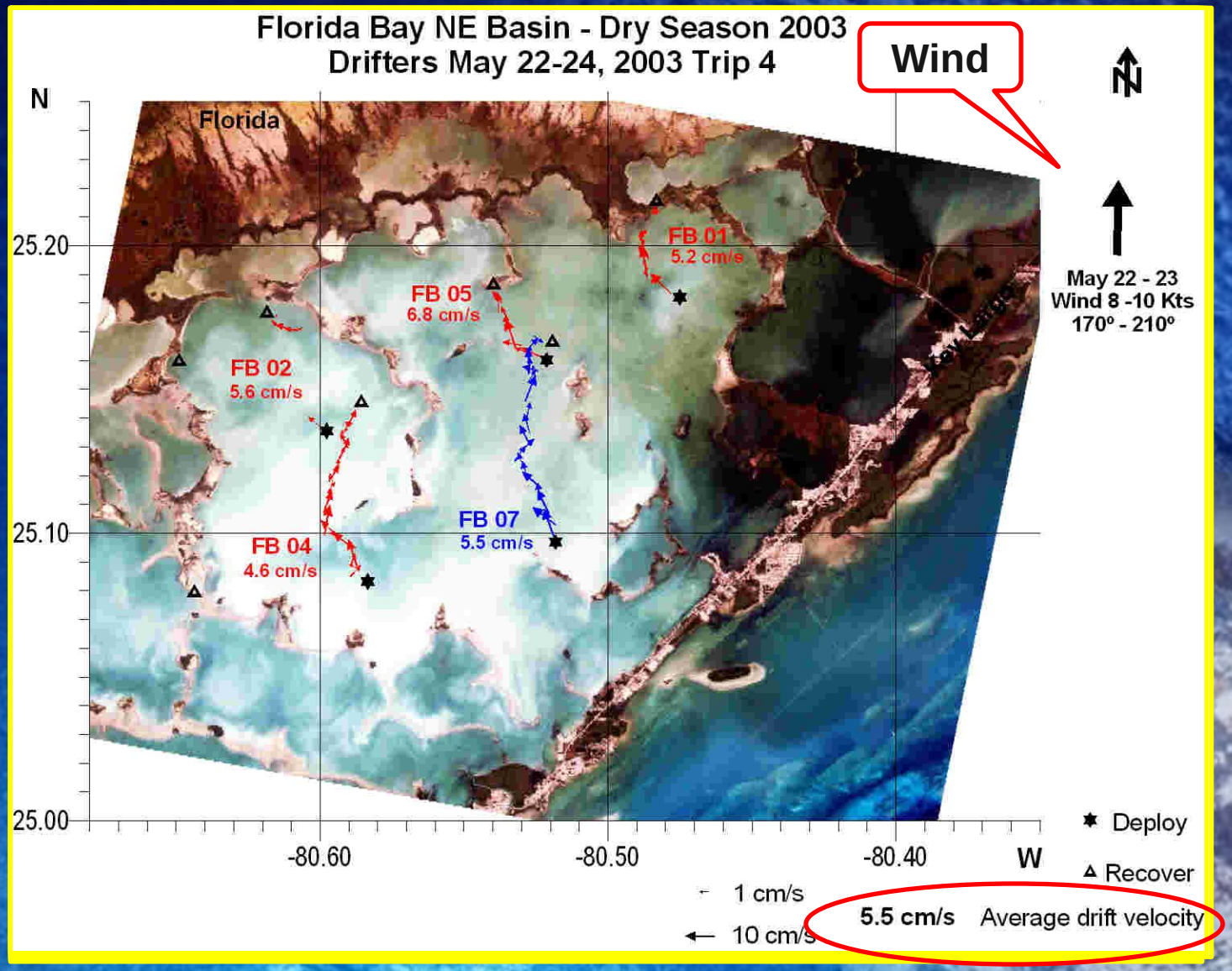
NE Basin
Florida Bay



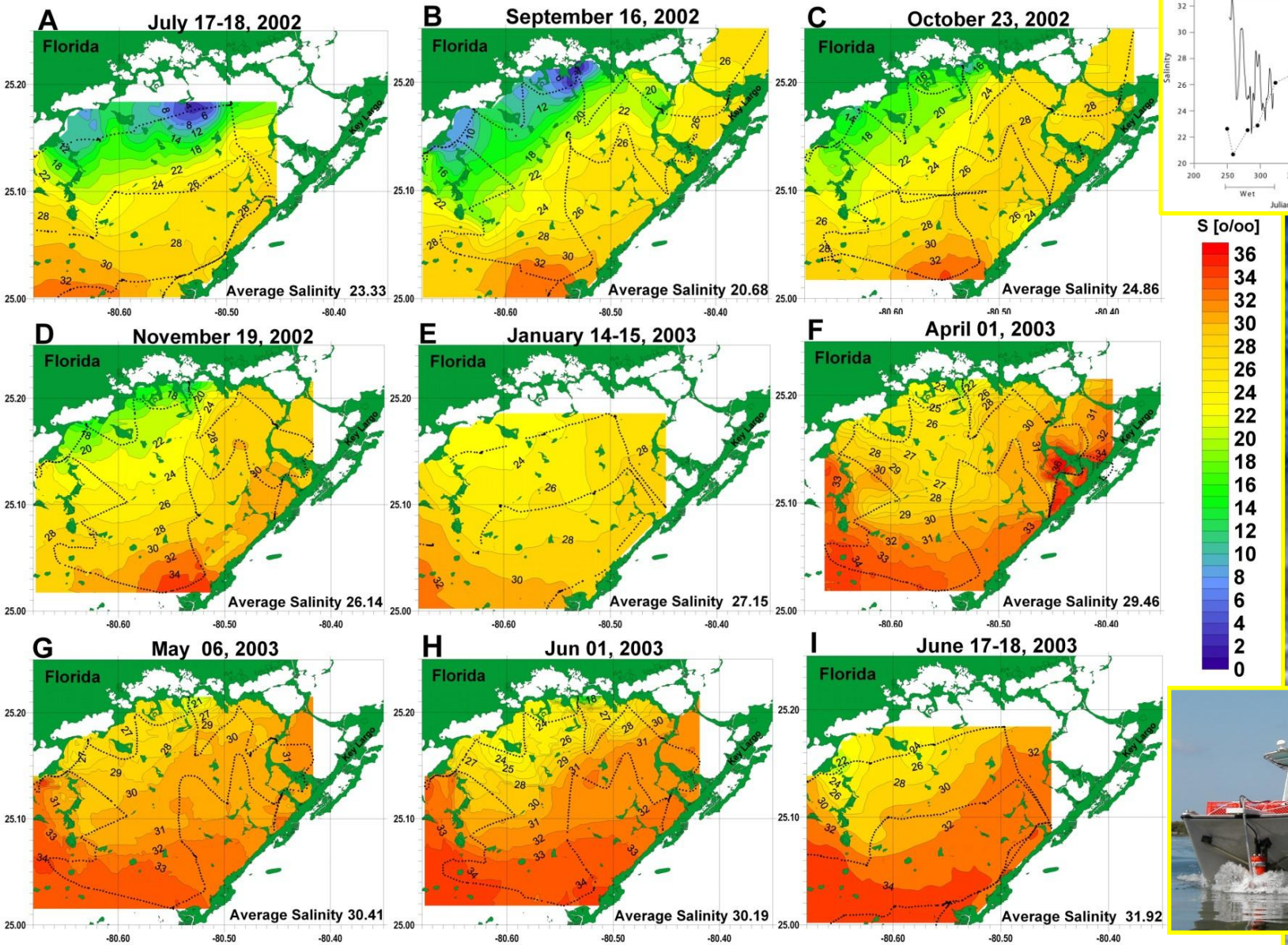
Location of NE Basin Measurement Stations

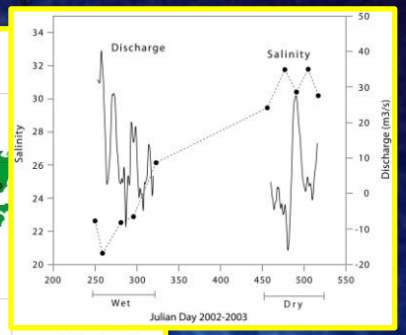


Drifters Deployment



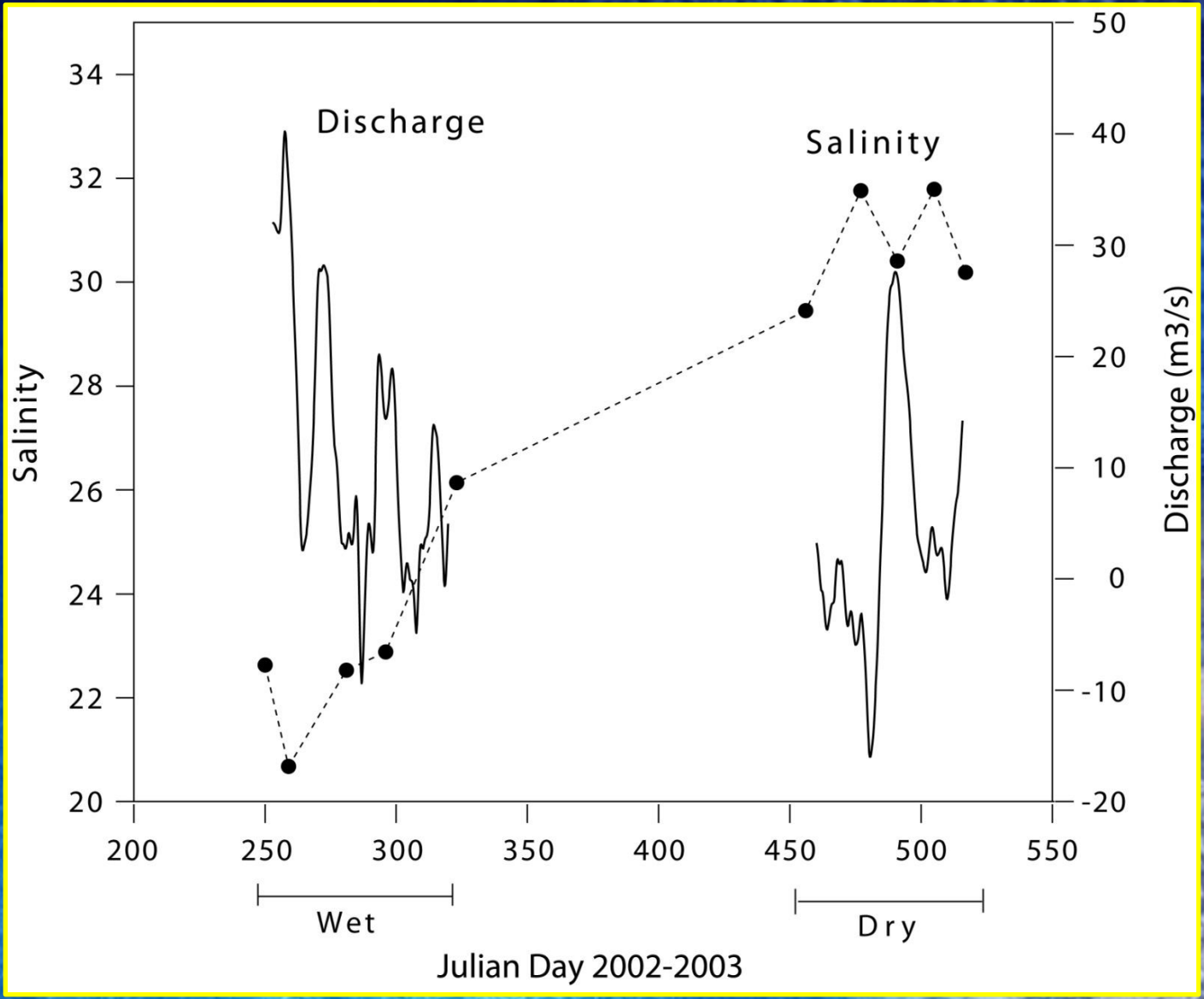
Salinity Surveys (NE Basin & Florida Bay 2002 -2003)



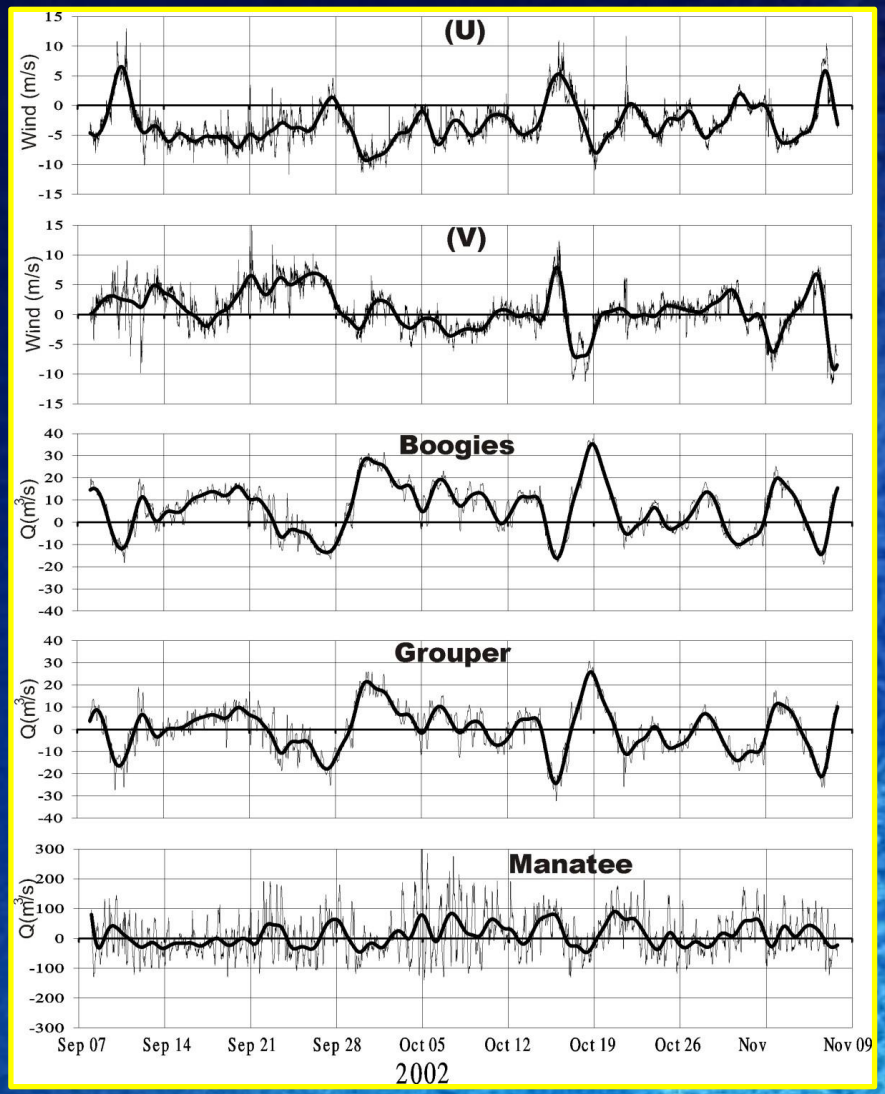


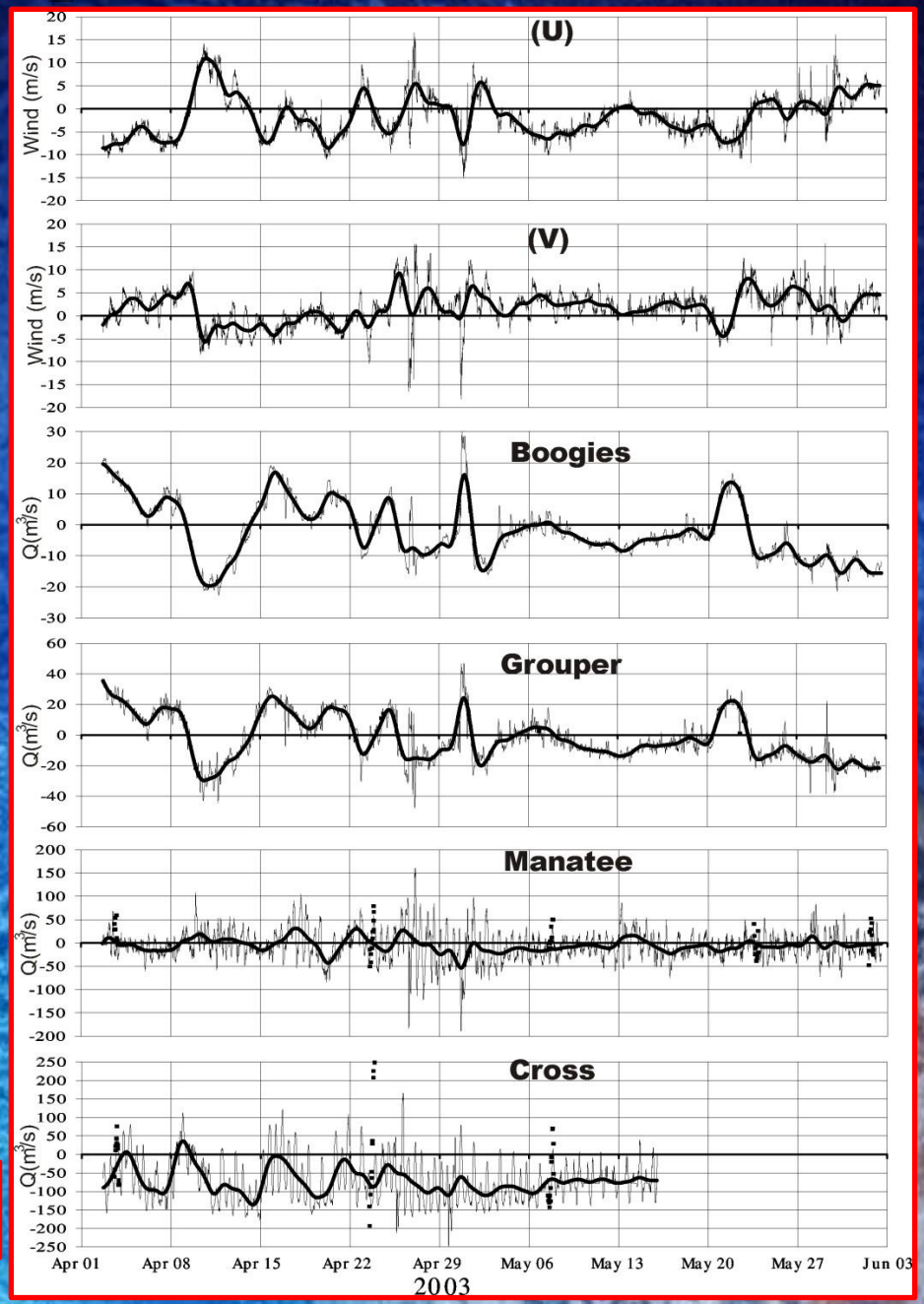
Salinity and Fresh Water Discharge

(NE Basin 2002 - 2003)



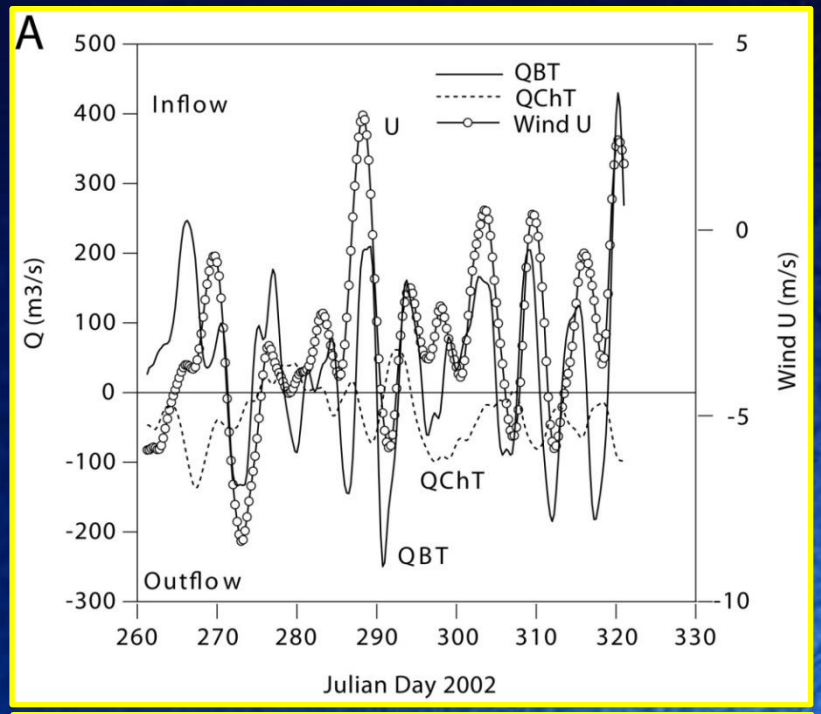
Channels Transport and Wind

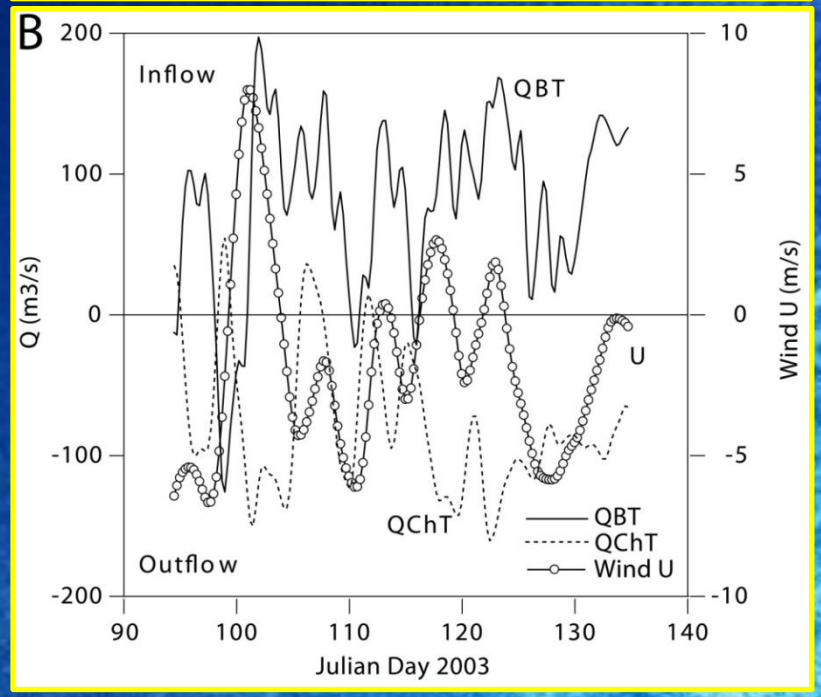




Wet Season

Dry Season





Subtidal time series of the Total Bank Transport (QBT) and Total Channel Transport (QChT)

into (+) and out of (-) NE Basin derived from sea level fields.

(U) east-west and
(V) north-south winds.

(A) wet 2002
(B) dry seasons 2003.

Seasonal and annual means of Total Transport (Q_T) from NE Basin volume anomalies data, total measured channel transport (Q_c) and residual bank transport (Q_b) from

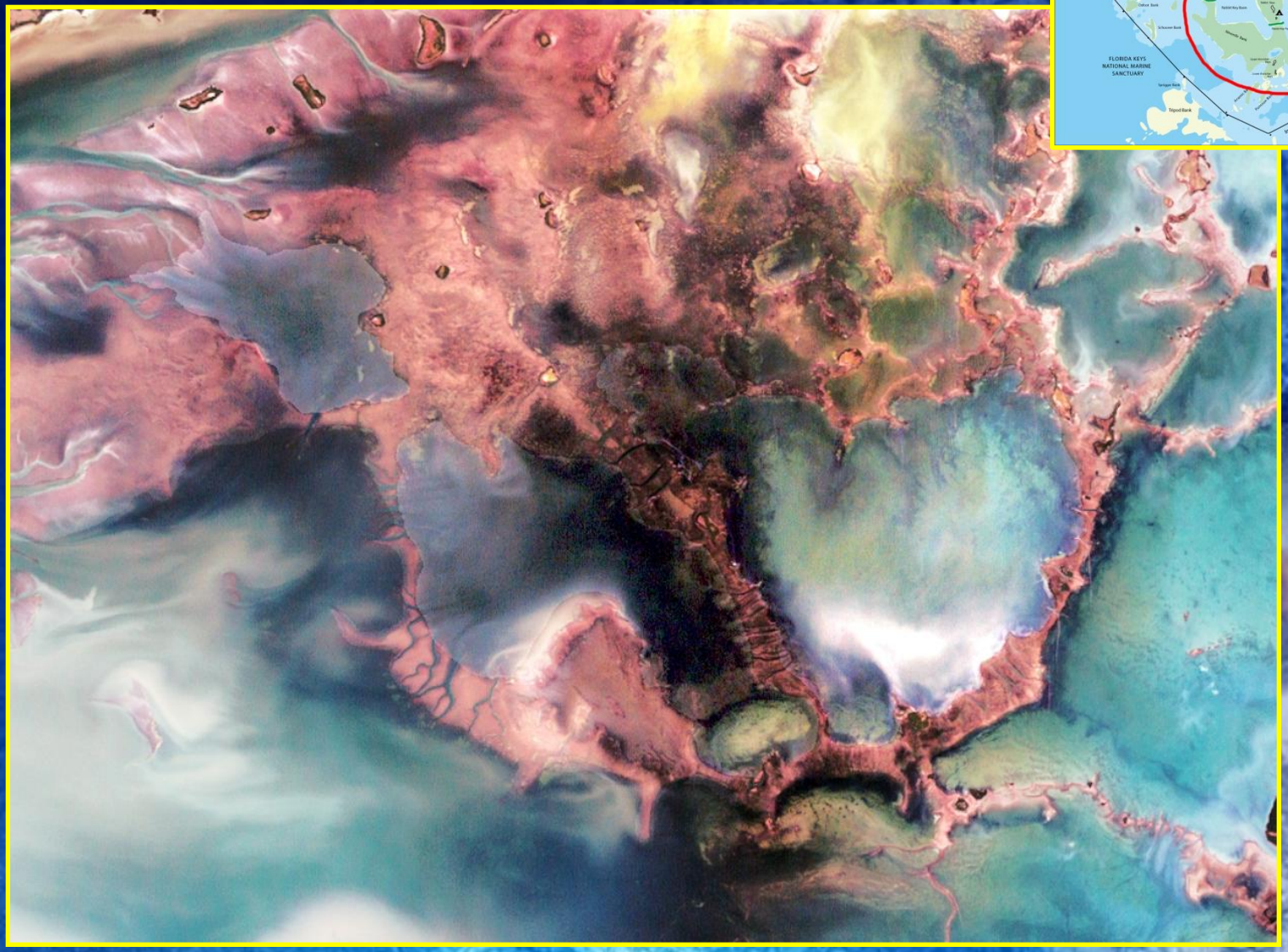
$$Q_b = Q_T - Q_c \text{ in } m^3/s$$

for 2002.

[Mean volume of NE Basin is 4.41×10^8 (m^3).]

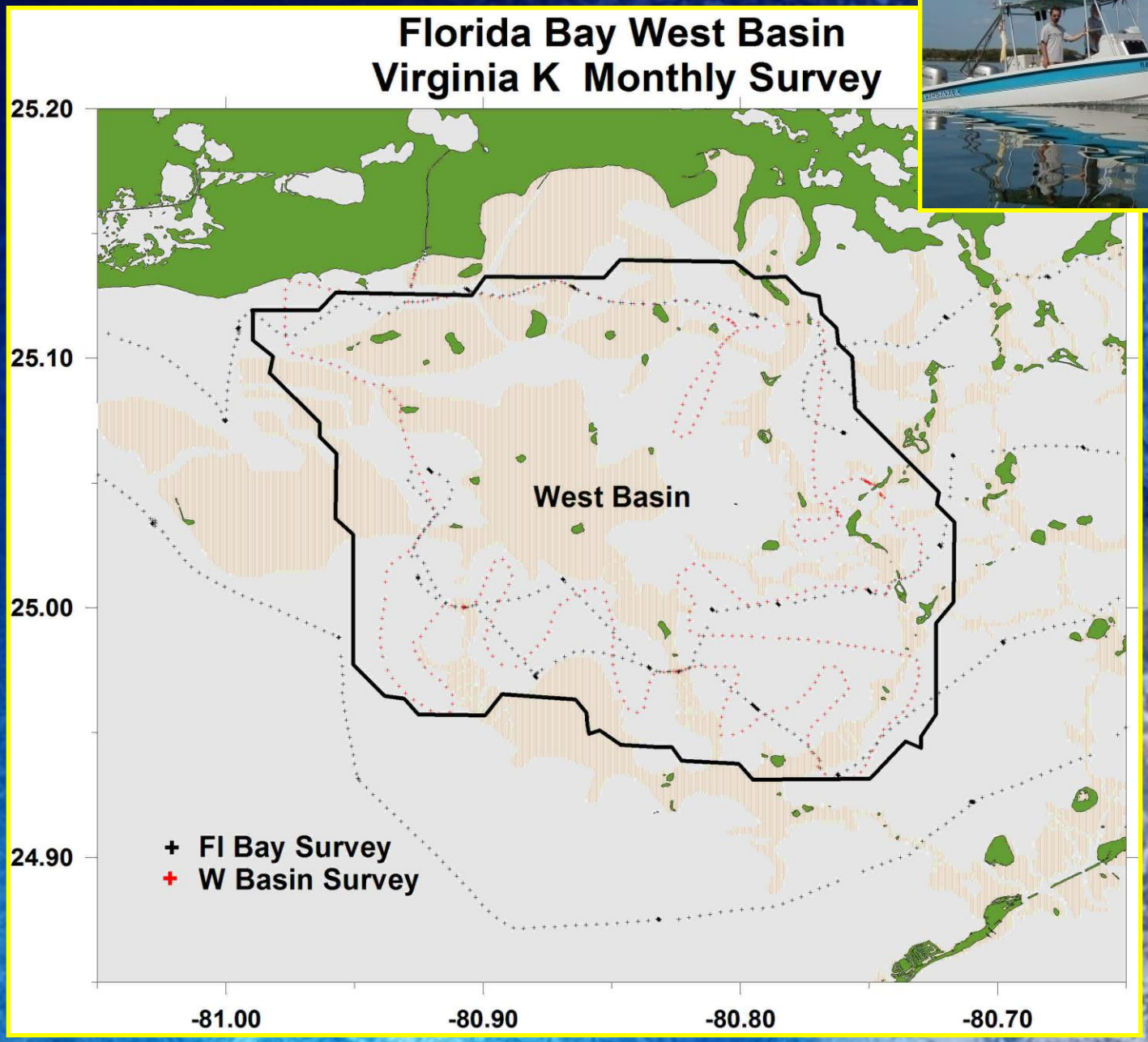
Transport (m3/s)	Wet Season	Dry Season	Annual Mean
Q_T	5.3	1.8	3.6
Q_c	-32.7	-77.8	-55.2
Q_b	38.8	79.6	58.8
Basin Renewal Time (months)	4.8	2.2	3.0

West Basin Florida Bay



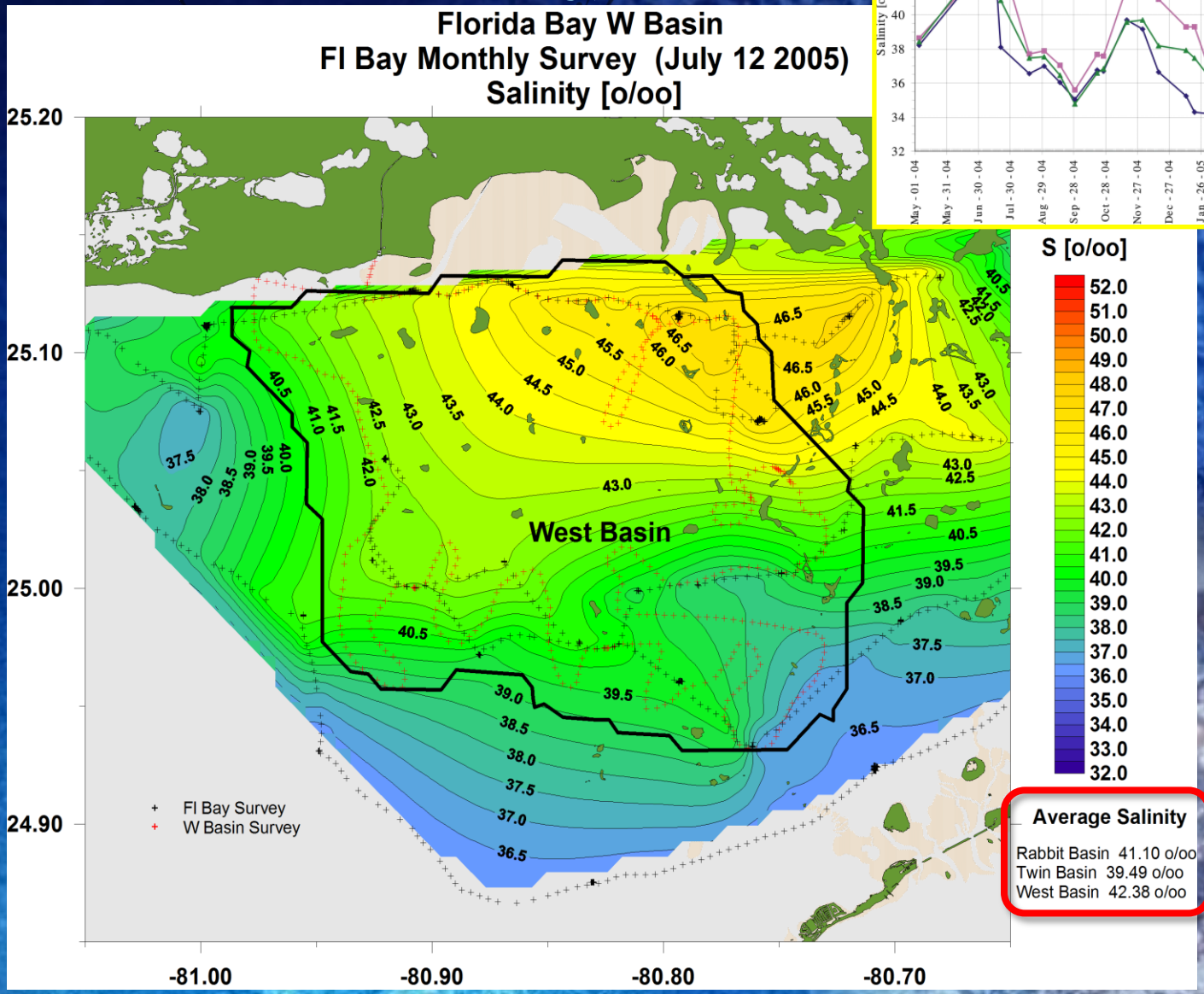
West Basin Florida Bay Mooring Array

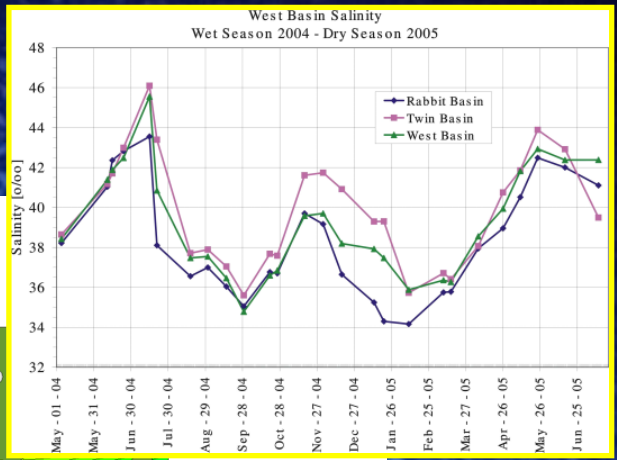
Virginia K W Basin and Monthly Survey



Salinity Surveys

(W Basin - Fl. Bay)

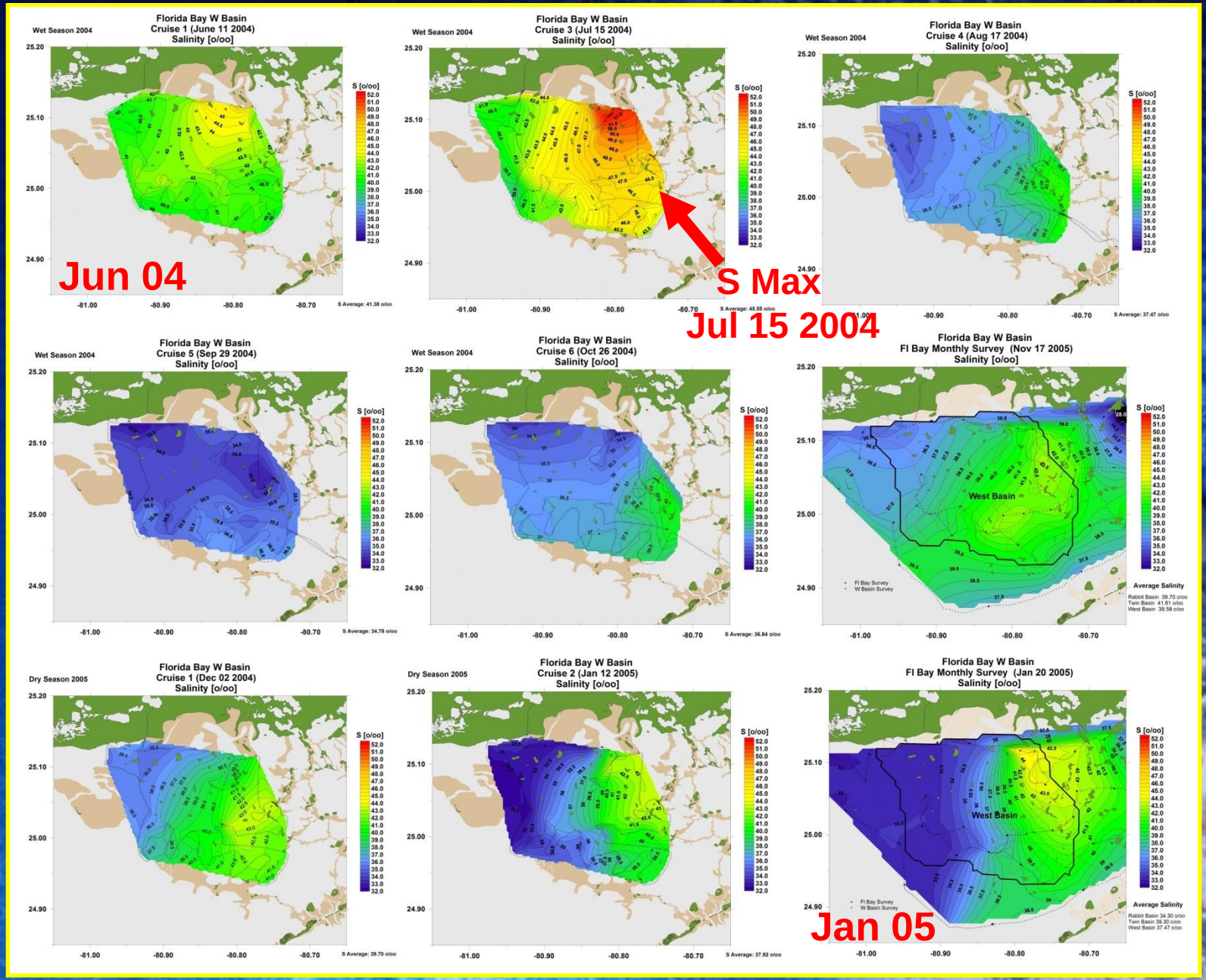




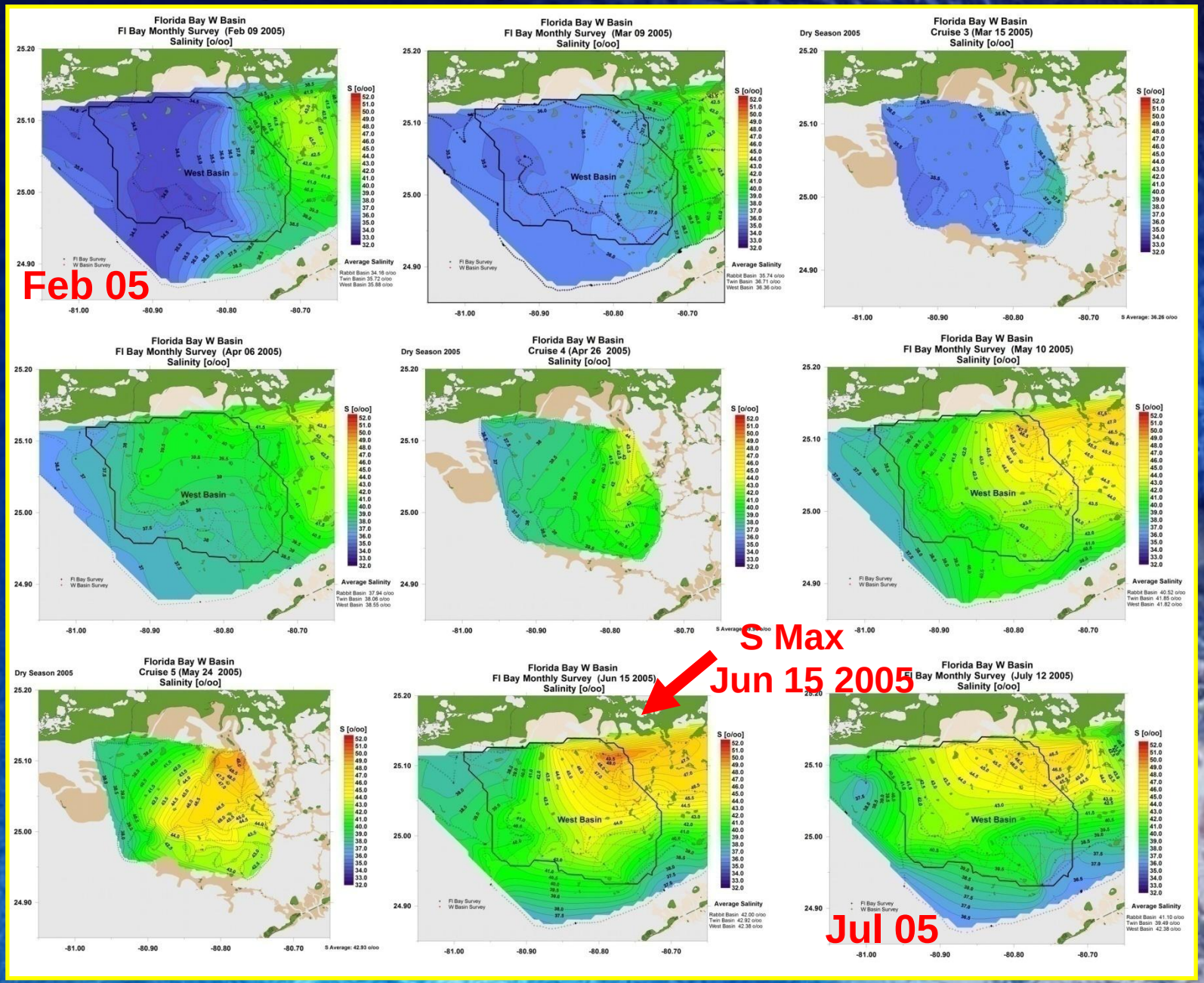
Average Salinity

Rabbit Basin 41.10 o/oo
Twin Basin 39.49 o/oo
West Basin 42.38 o/oo

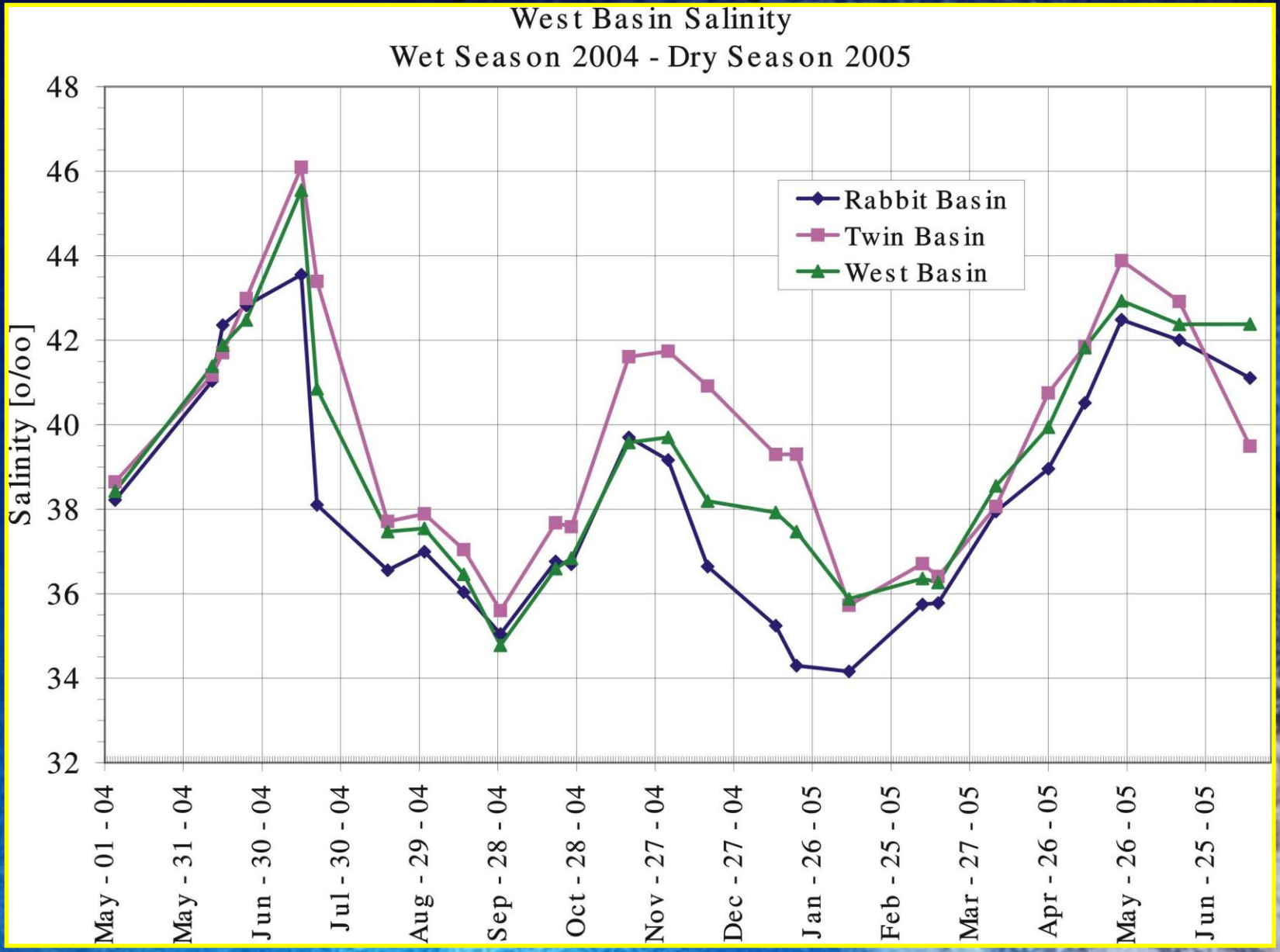
Salinity Survey (W Basin & Florida Bay)



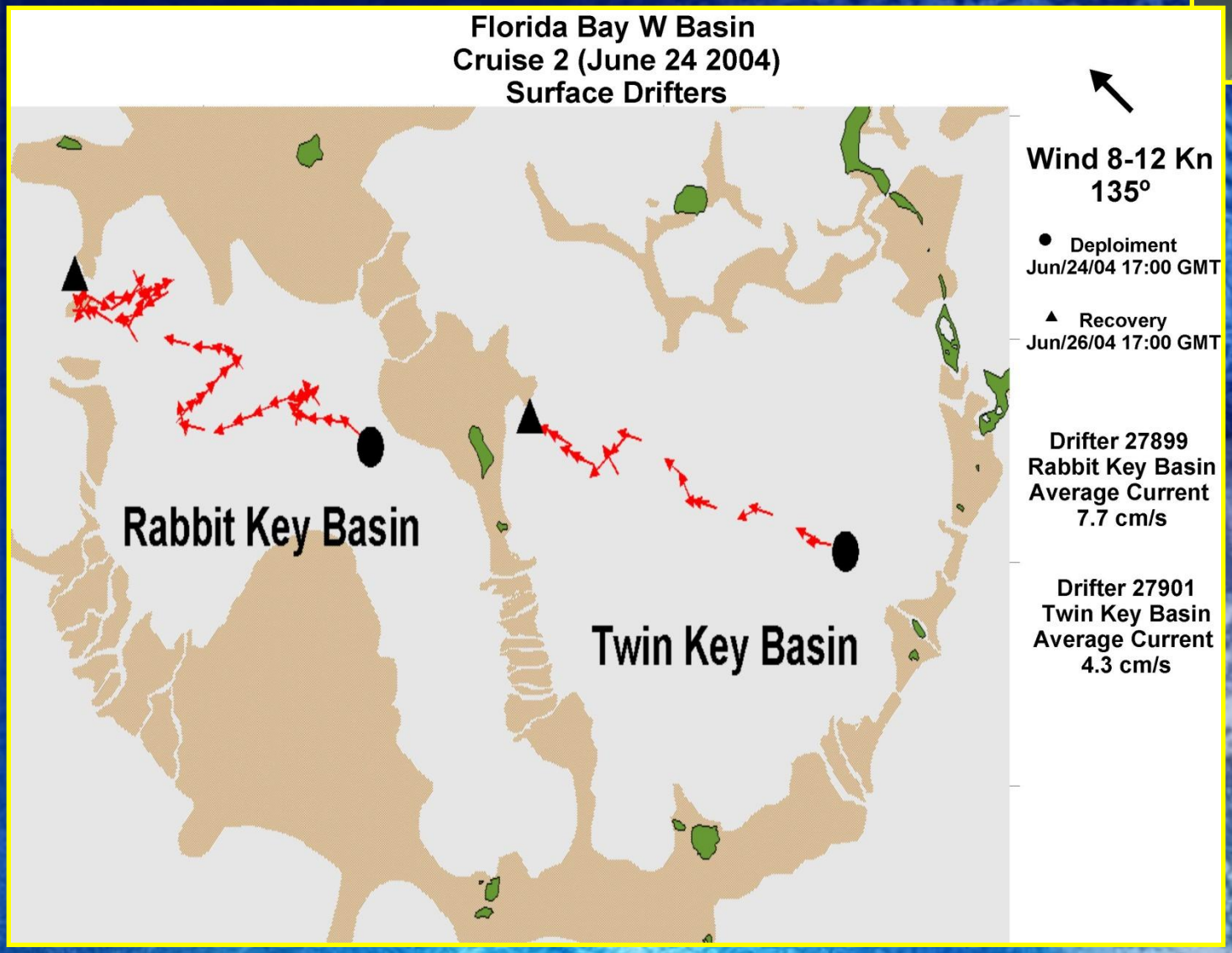
Salinity Surveys (W Basin & Florida Bay)



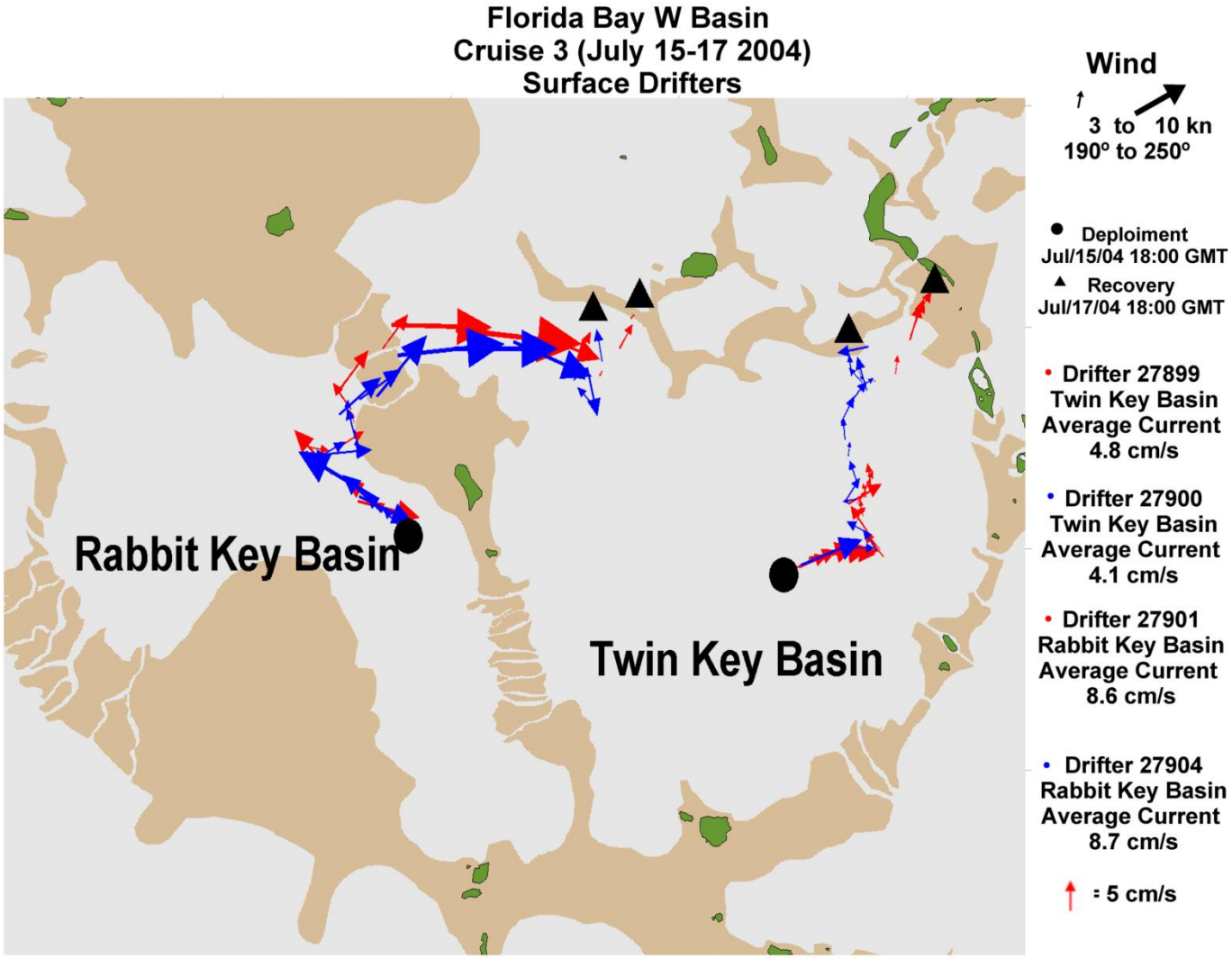
Salinity Surveys (W Basin)



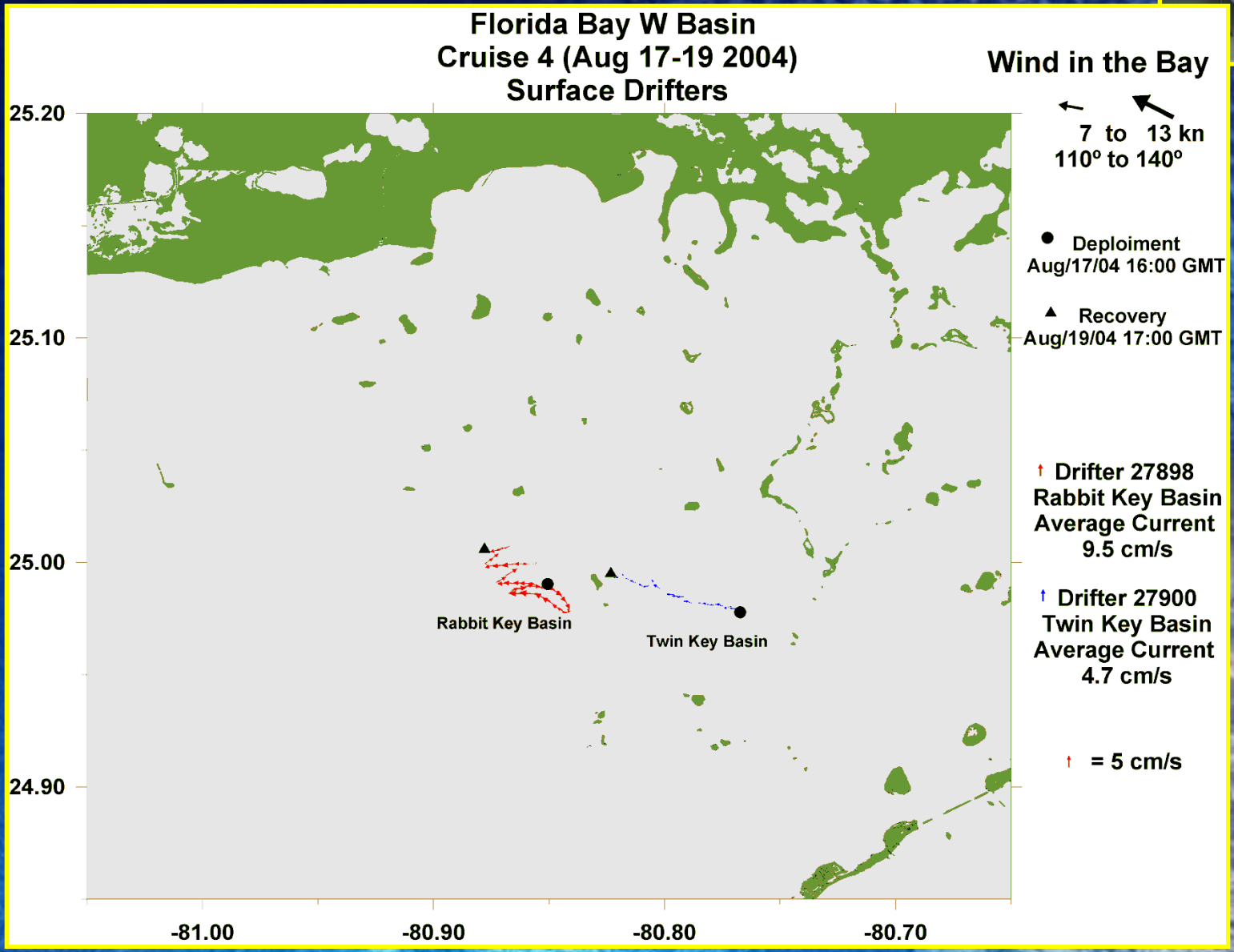
Drifter Deployments



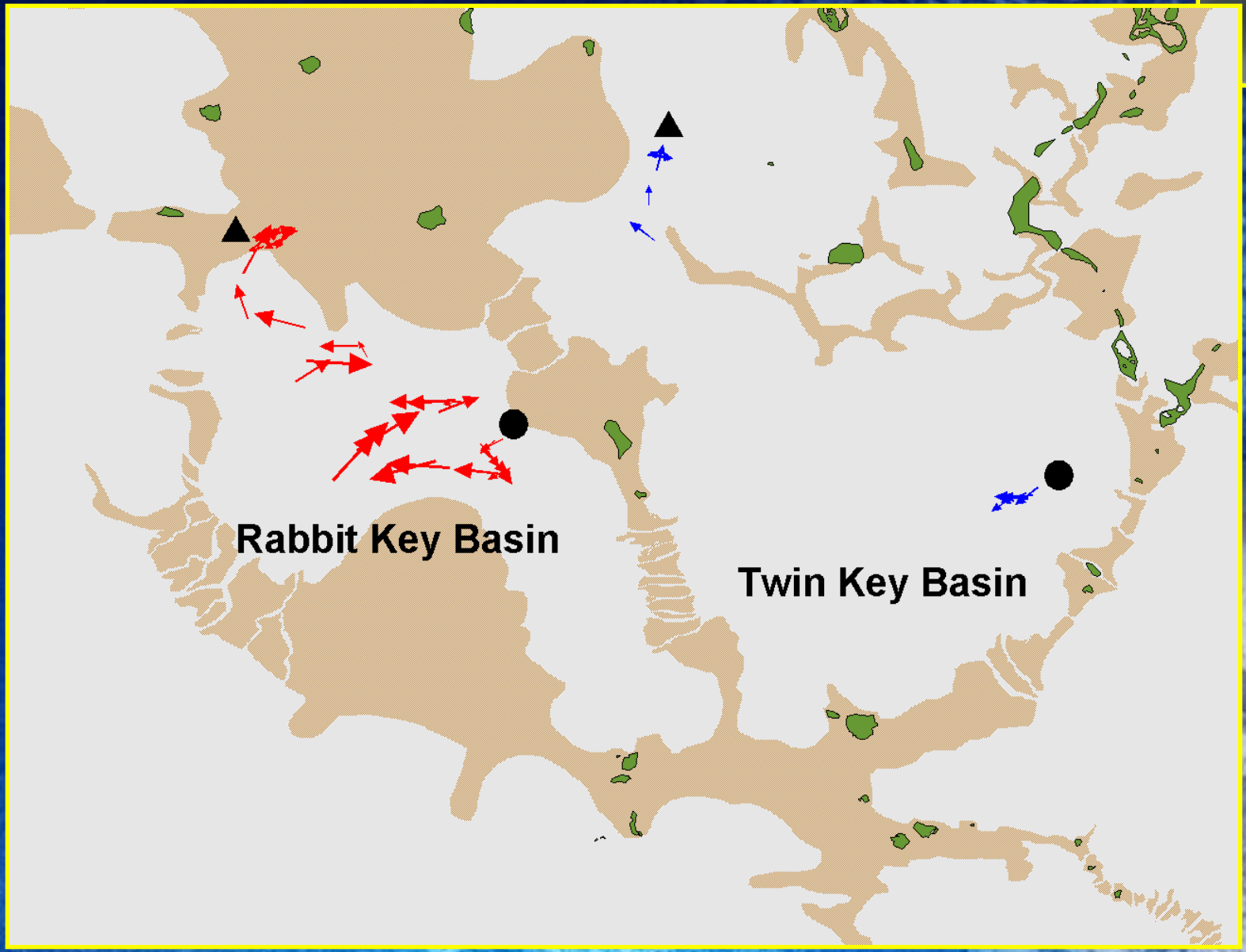
Drifter Deployments



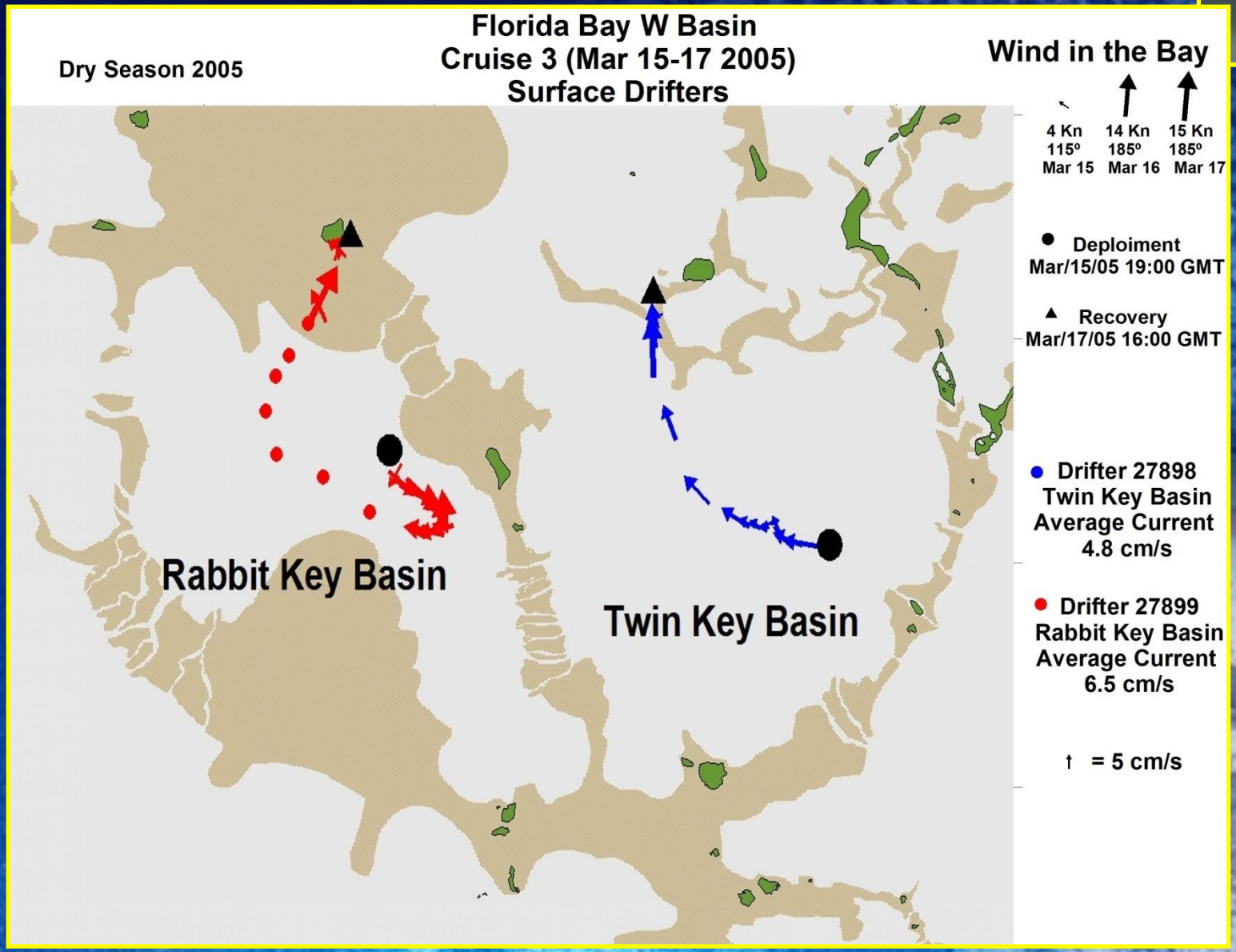
Drifter Deployments



Drifter Deployments

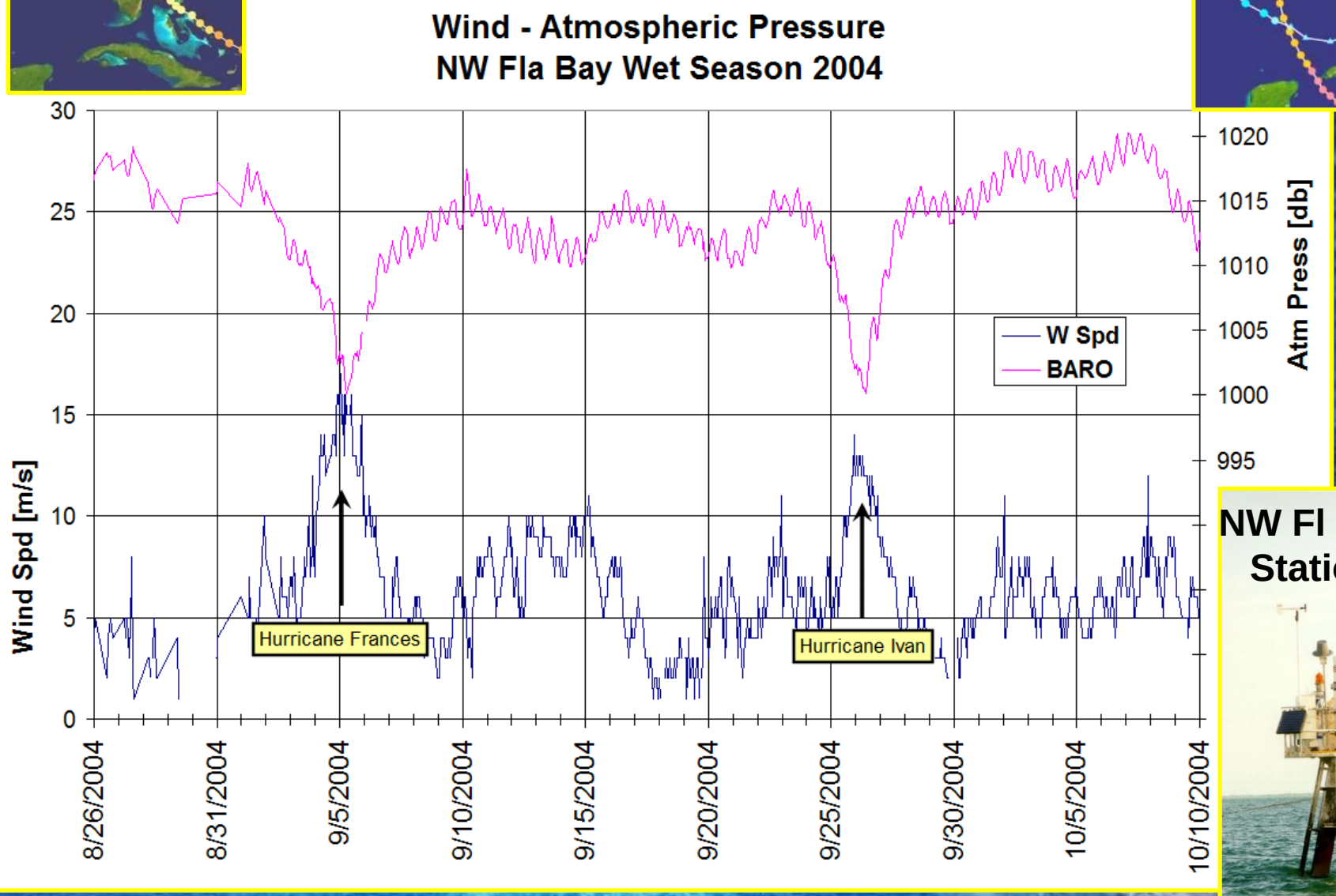


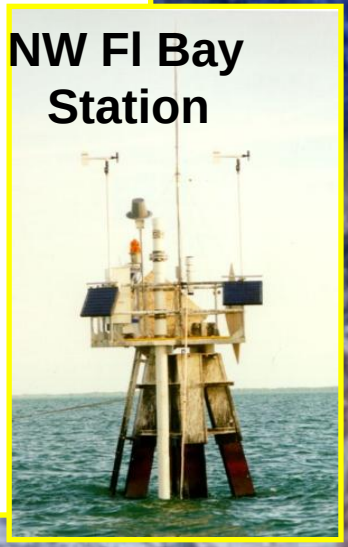
Drifter Deployments



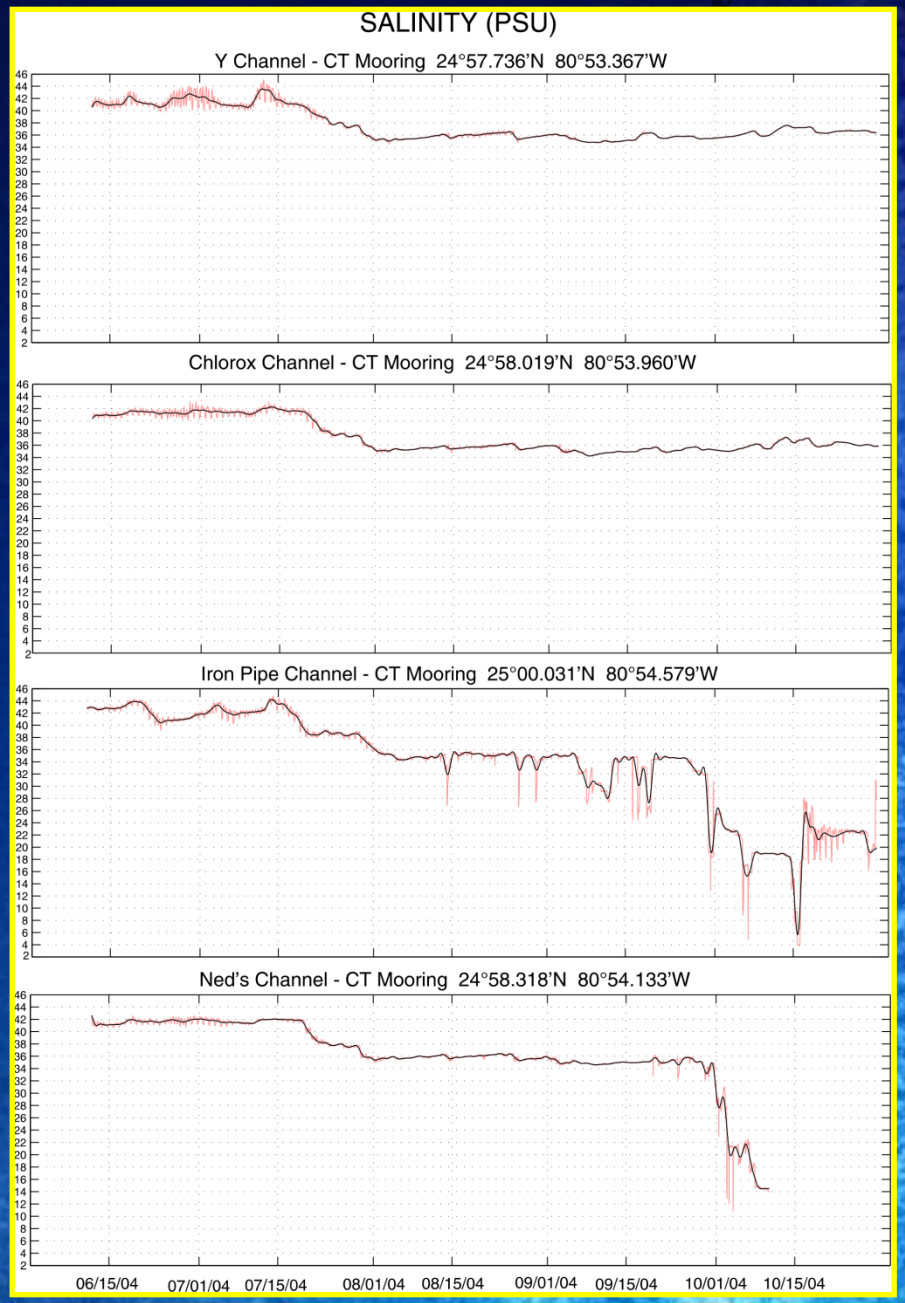
Moorings
Wet Season
Jun Dec 2004

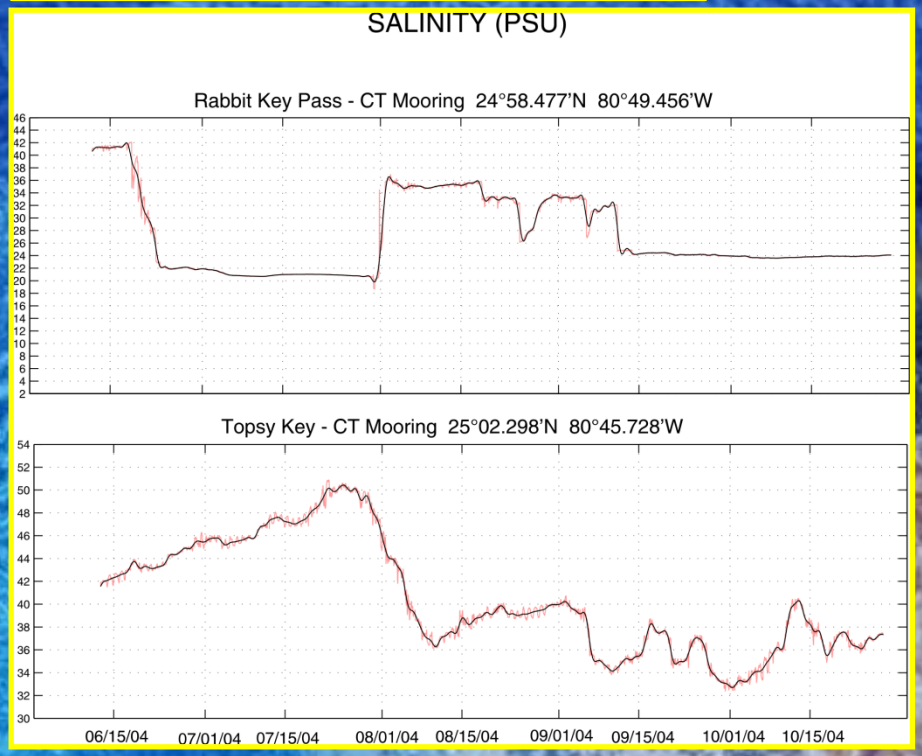
Hurricanes Frances & Ivan



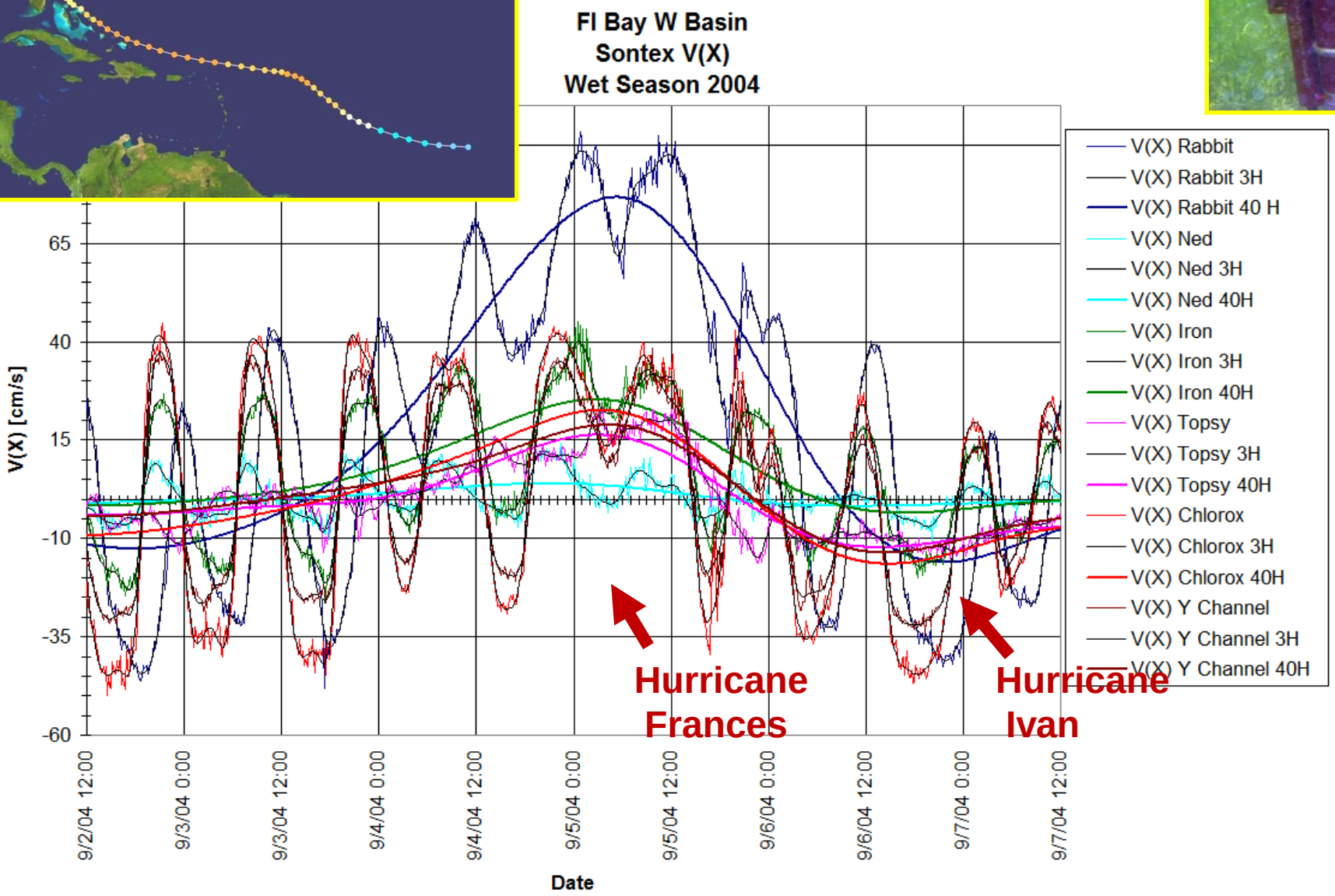


Salinity Time Series





Moorings

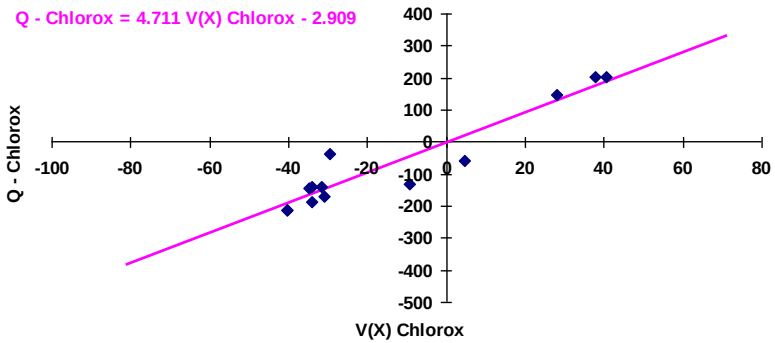

Fl Bay W Basin
Sontex V(X)
Wet Season 2004
V(X) [cm/s]
65
40
15
-10
-35
-60
9/2/04 12:00
9/3/04 0:00
9/3/04 12:00
9/4/04 0:00
9/4/04 12:00
9/5/04 0:00
9/5/04 12:00
9/6/04 0:00
9/6/04 12:00
9/7/04 0:00
9/7/04 12:00
Date
V(X) Rabbit
V(X) Rabbit 3H
V(X) Rabbit 40 H
V(X) Ned
V(X) Ned 3H
V(X) Ned 40H
V(X) Iron
V(X) Iron 3H
V(X) Iron 40H
V(X) Topsy
V(X) Topsy 3H
V(X) Topsy 40H
V(X) Chlorox
V(X) Chlorox 3H
V(X) Chlorox 40H
V(X) Y Channel
V(X) Y Channel 3H
V(X) Y Channel 40H
Hurricane Frances
Hurricane Ivan

Moorings Current - Transport

Florida Bay West Basin Wet Season 2004

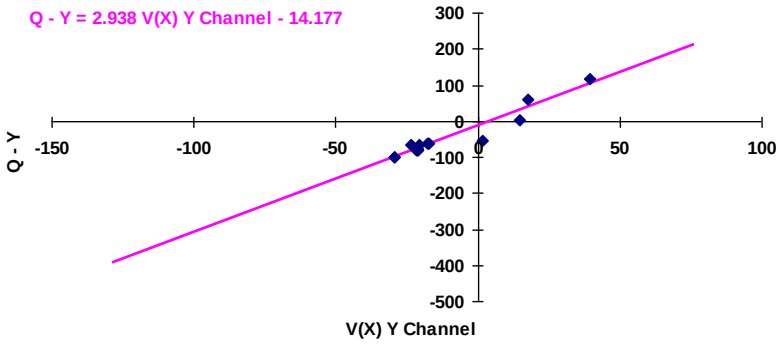
Linear Regression: Analysis associated with a model of the form Y = mX + c + error

Chlorox Channel



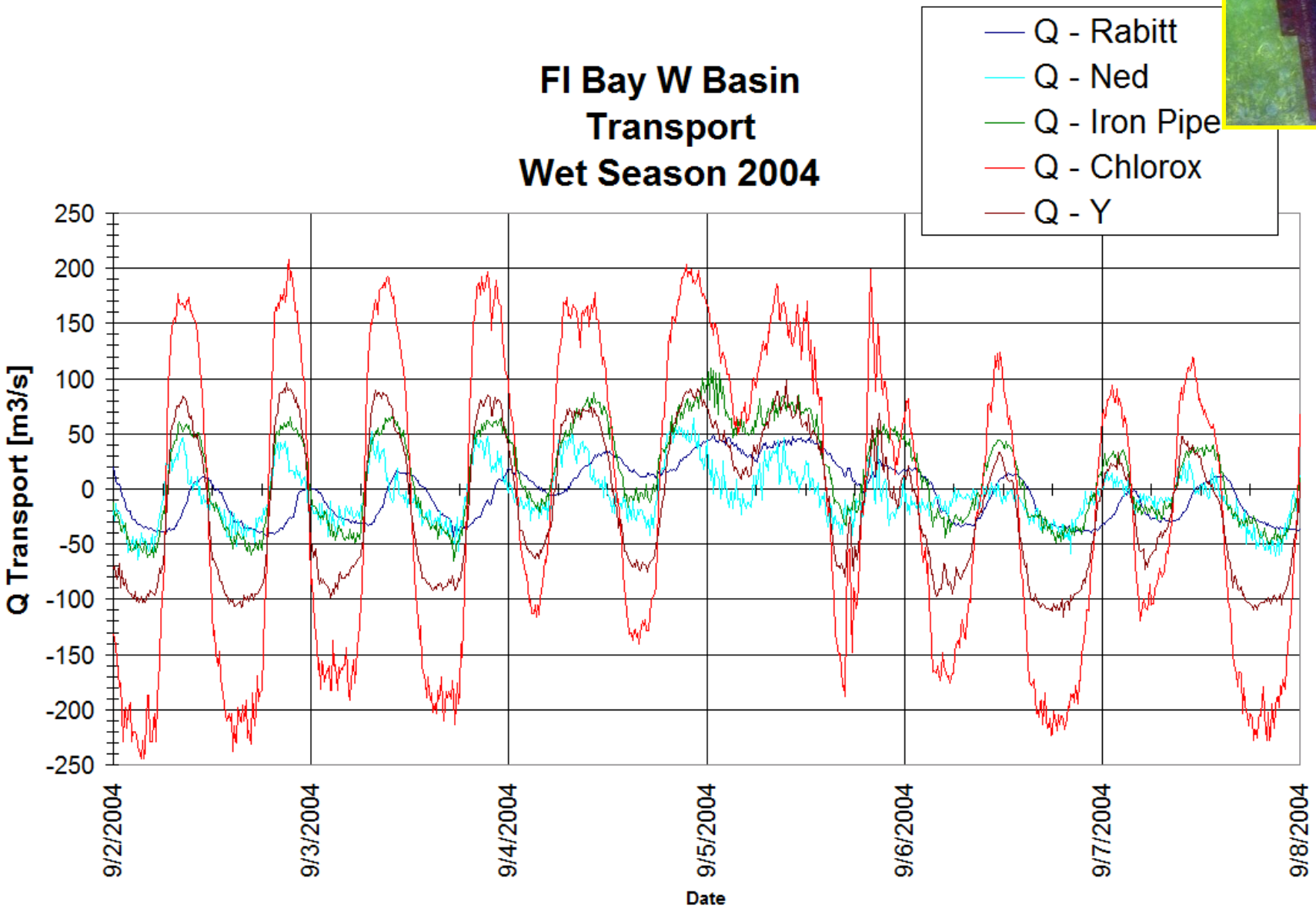
Summary			Confidence Ints.			
			Level	0.95	R^2	0.89159
	Estimate	SE	Lower	Upper	s	53.1038
Slope	4.71107	0.5195	3.55358	5.86856		
Constant	-2.90879	16.378	-39.402	33.5846		

Y Channel



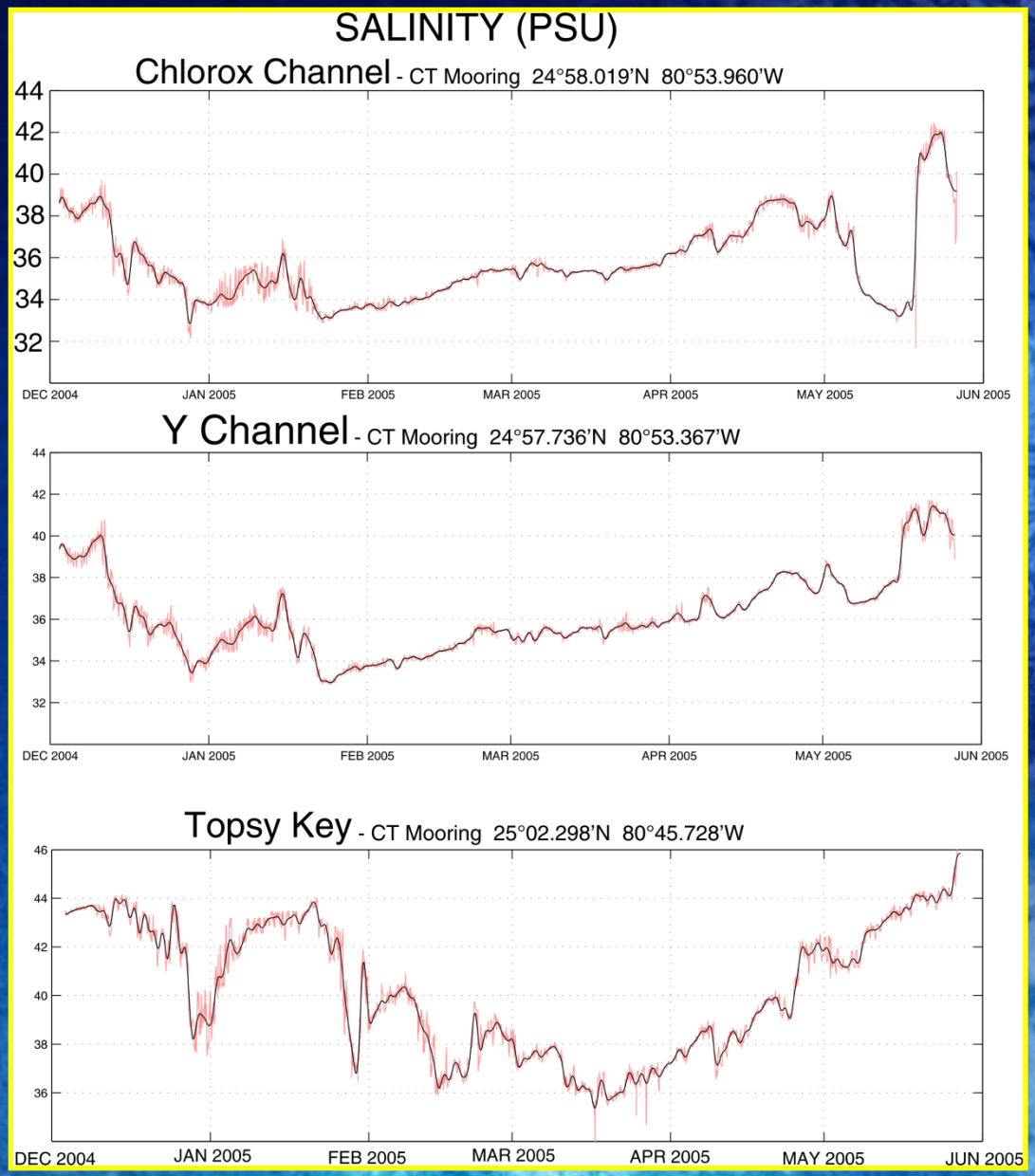
Summary			Confidence Ints.			
			Level	0.95	R^2	0.92209
	Estimate	SE	Lower	Upper	s	19.2568
Slope	2.9379	0.2701	2.33617	3.53963		
Constant	-14.1771	5.9872	-27.517	-0.8369		

Moorings Transport

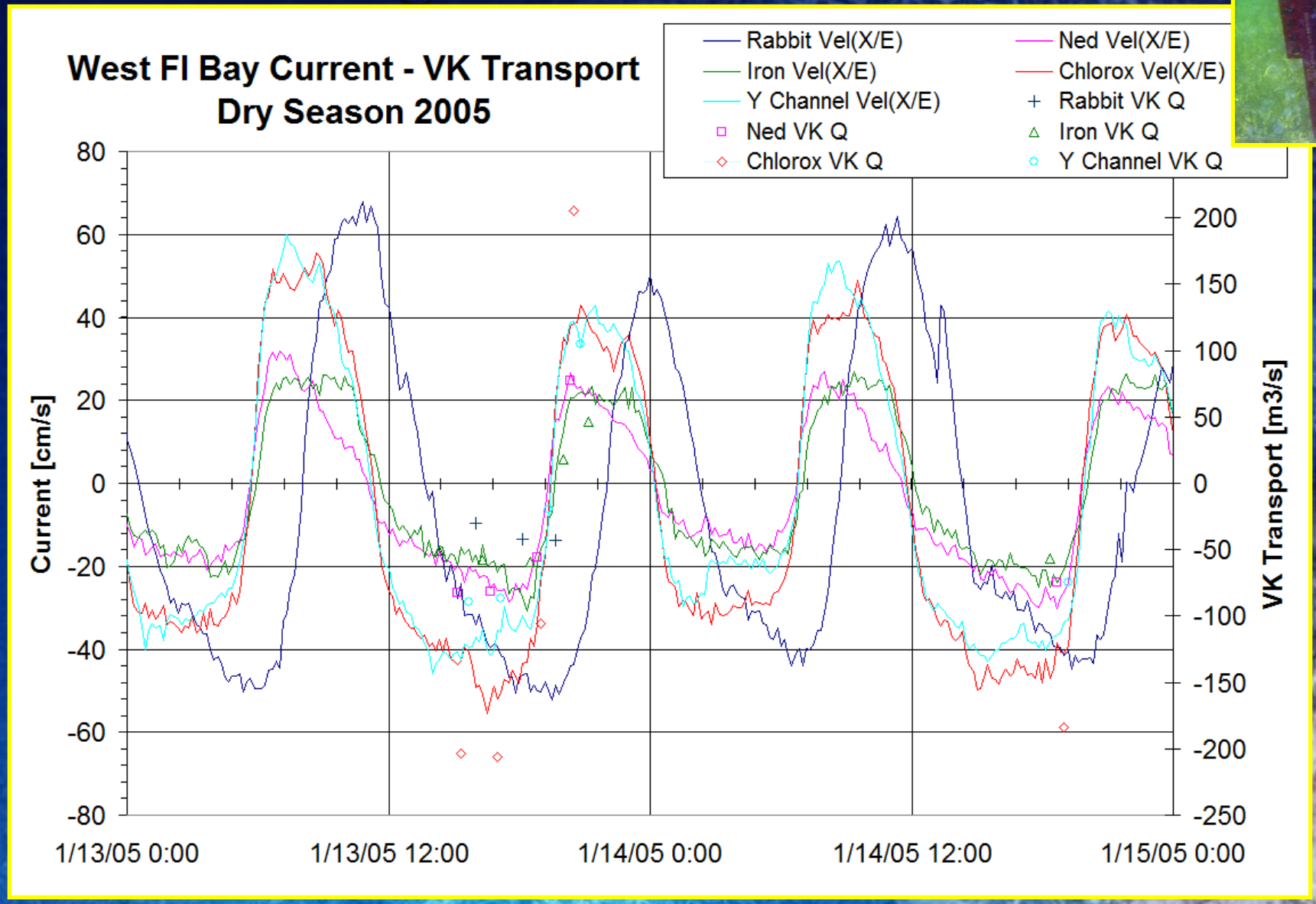


Moorings
Dry Season
Dec 2004 – Jun 2005

Salinity Time Series



Moorings Current



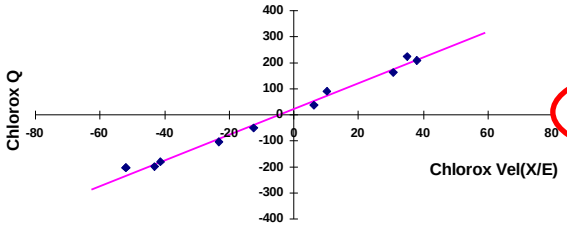
Moorings Current - Transport

Florida Bay West Basin Wet Season 2004

Linear Regression: Analysis associated with a model of the form Y = mX + c + error

Clorox

Summary			Confidence Ints.			
			Level	0.95	R^2	0.988736
	Estimate	SE	Lower	Upper	s	19.04195
Slope	4.927823	0.18596	4.49899	5.35665		
Constant	20.35956	6.09239	6.31047	34.4086		

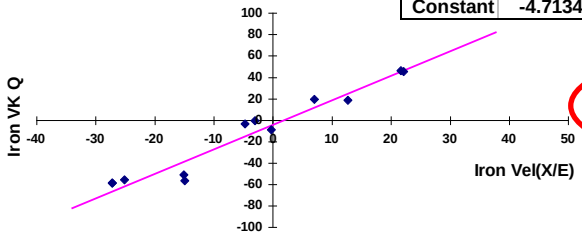


$R^2 = 0.988$

Chlorox Q = 4.928 Chlorox Vel(X/E) + 20.36

Iron

Summary			Confidence Ints.			
			Level	0.95	R^2	0.942029
	Estimate	SE	Lower	Upper	s	10.27025
Slope	2.284709	0.18892	1.85734	2.71208		
Constant	-4.713415	3.12863	-11.791	2.36404		

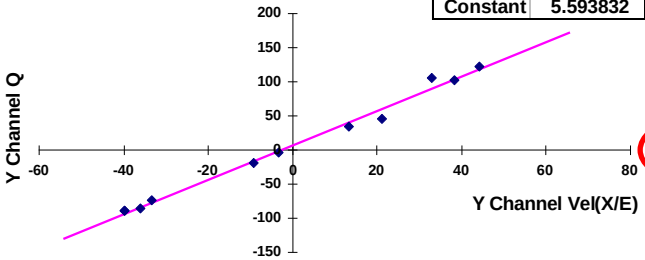


$R^2 = 0.942$

Iron VK Q = 2.285 Iron Vel(X/E) - 4.713

Y Channel

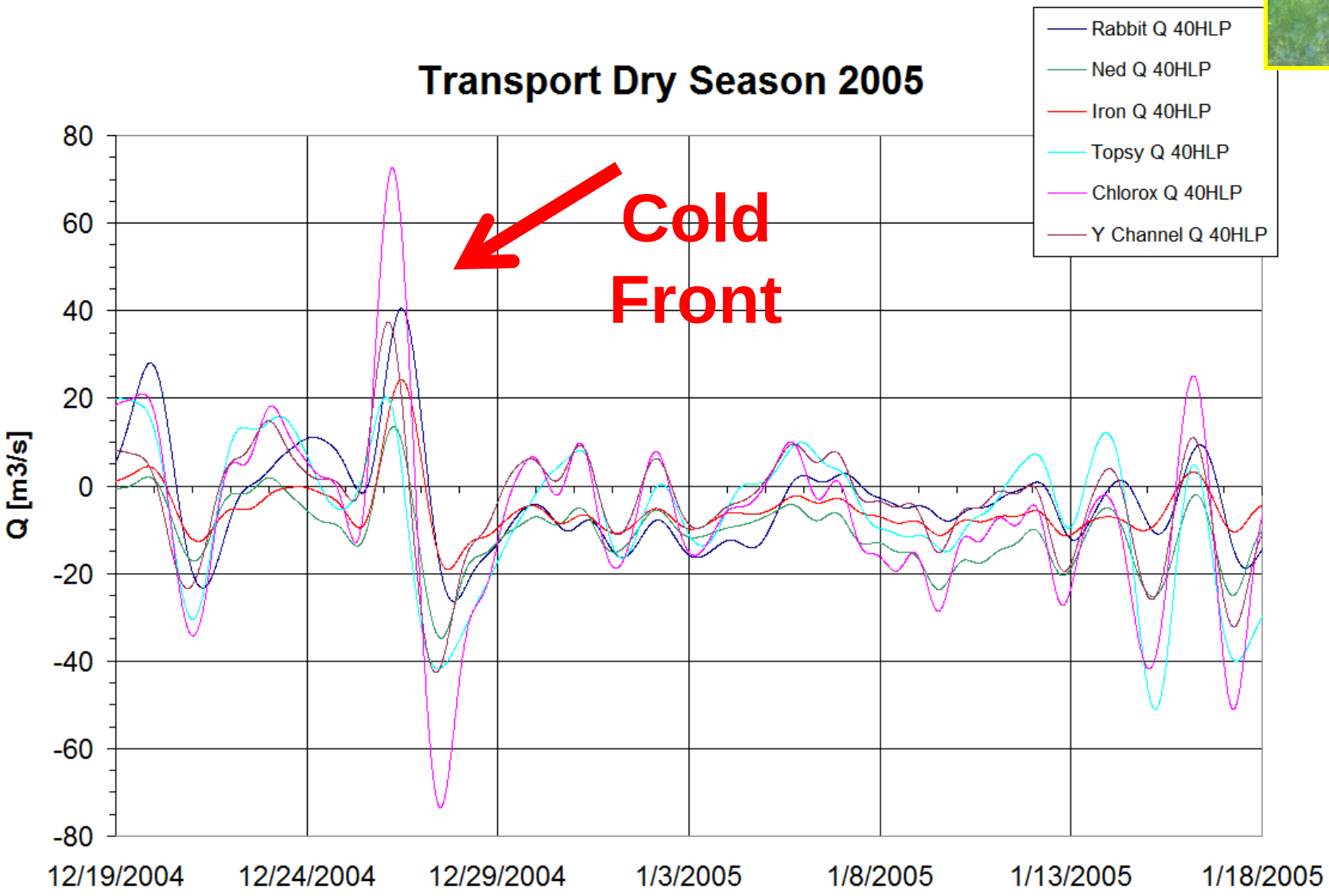
Summary			Confidence Ints.			
			Level	0.95	R^2	0.991015
	Estimate	SE	Lower	Upper	s	8.144103
Slope	2.53462	0.08533	2.33786	2.73138		
Constant	5.593832	2.58791	-0.3739	11.5616		



$R^2 = 0.991$

Y Channel Q = 2.535 Y Channel Vel(X/E) + 5.594

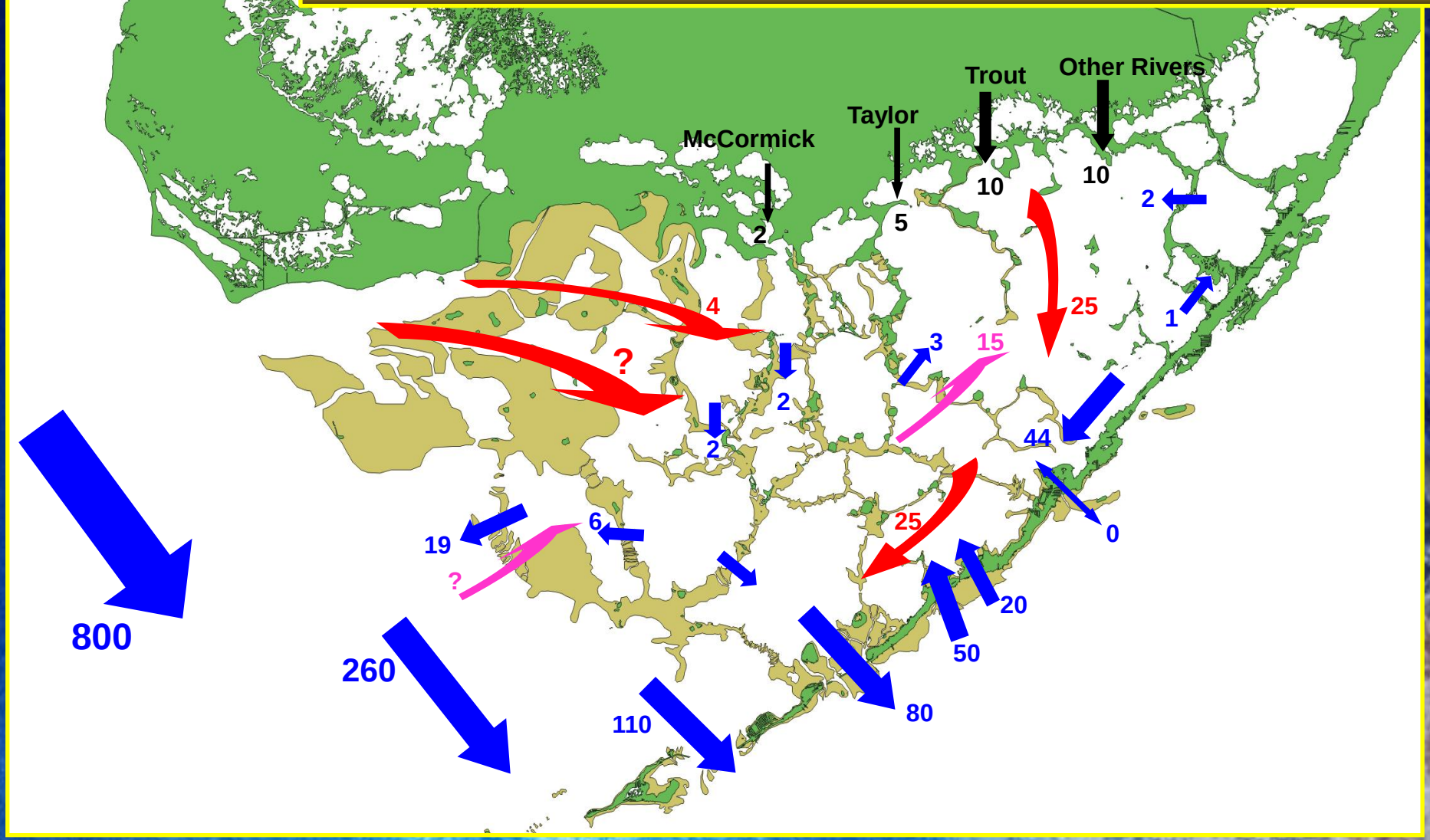
Moorings Transport



Florida Bay Transports

Annual Mean Volume Transports in Florida Bay and Keys (blue arrows).
Estimated Mean Flow Pathways (red arrows).
River Discharge (black arrows).
Estimated Bank Flow (pink arrows).

Transports in m3/s .



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South Florida Coastal Oceanographic Database

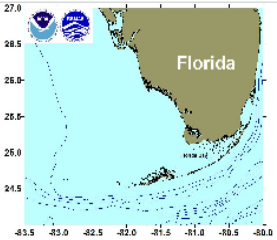
- South Florida Program
- Fl Bay Inner Basin Transport and Exchange
- NCORE
- SEFCAR/OPRC

Related Projects

NOAA's South Florida Ecosystem Research and Monitoring Program

Related Links

Publications



South Florida Coastal Oceanographic Database

Principal Investigators:
Dr. Libby Johns, Dr.Thomas N. Lee, Dr. Peter Ortner
Participating Institutions:
University of Miami / RSMAS, NOAA / AOML / CIMAS
Project Dates: April 1989 to present

Tom Lee, Nelson Melo & Liz Williams

This database is currently under construction. Data contained herein may or may not be quality controlled or in a finalized form. The data served on this site should be considered as PRELIMINARY DATA ONLY!

These data are intended for general scientific interest. NOAA/AOML and the UM/RSMAS cannot be held liable for the use of these data in any other manner. For further information contact Nelson Melo at 305-361-4329.

Data Base Description

The creation and maintenance of the South Florida Coastal Oceanographic Database (SFCOD) is undertaken as part of the collaborative South Florida Program between NOAA/AOML CIMAS and UM/RSMAS. The purpose is to organize historical and ongoing data being collected from the South Florida coastal region into a user friendly web accessed data base to enhance and encourage research efforts to better describe, understand and model the oceanographic processes, their interactions and influence on water quality and living marine resources. The Data Base is organized by projects, which are searchable by data types: moored time series, shipboard, drifters, satellite imagery and linked to relevant atmospheric and other coastal data sets such as coastal sea level and river discharge. To date SFCOD covers the 17 year period from April 1989 to April 2006, but is an ongoing process an updated following each new mooring deployment period.

http://www.aoml.noaa.gov/sfros/database/

Conclusions

In the Central Basin 2001:

- **Dry Season - eastward winds produce mean through-flow of 11 m^3/s and basin renewal times of 2-3 mo.**
- **Wet Season – westward winds cause mean through-flow of 3 m^3/s and basin renewal times of 6-7 mo.**
- **Flushing time for complete water renewal ~= 6-12 mo.**

In the NE Basin 2002-2003:

- **Dry Season - eastward winds produce mean through-flow of 31 m^3/s and basin renewal times of 5.5 mo.**
- **Wet Season – westward winds cause mean through-flow of 13 m^3/s and basin renewal times of 12 mo.**
- **Flushing time for complete water renewal ~= 6-12 mo.**

****

- **Water renewal and residence times in Florida Bay are primarily controlled by local wind forcing.**
- **Hypersalinity development in north-central Florida Bay results from reduced fresh water inputs during the dry season coupled with poor exchange with surrounding regions.**
- **Hypersalinity development in Fl. Bay could be regulated by redirection of a portion of Everglades flow to Whipray Basin via McCormick Creek during the dry season.**

Publications

BULLETIN OF MARINE SCIENCE, 79(2): 301–327, 2006

ON FLORIDA BAY HYPERSALINITY AND WATER EXCHANGE

Thomas N. Lee, Elizabeth Johns, Nelson Melo,
Ryan H. Smith, Peter Ortner, and Dewitt Smith

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Available online at www.sciencedirect.com

ScienceDirect

Estuarine, Coastal and Shelf Science 71 (2007) 318–334

ESTUARINE COASTAL AND SHELF SCIENCE

www.elsevier.com/locate/ecss

Salinity patterns of Florida Bay

Christopher R. Kelble [a,*], Elizabeth M. Johns [b], William K. Nuttle [c],
Thomas N. Lee [d], Ryan H. Smith [b], Peter B. Ortner [b]

On Water Renewal and Salinity Variability in the

Northeast Subregion of Florida Bay

Thomas N. Lee, Nelson Melo, Elizabeth Johns, Chris Kelble

Ryan H. Smith and Peter Ortner

Submitted to BMS

Florida Bay Sea Level Response to Local Wind Forcing

Nelson Melo, Thomas N. Lee, Mariana B. Framiñan, Elizabeth M. Johns and Ryan H. Smith, DeWitt Smith

Submitted to BMS

For the Future ?

A possible synthesis document:

Florida Bay Transport and Salinity Patterns

With all results of the Florida Bay Inner-basin studies, the transports in the Keys and the results of 10 year studies in the region.

Authors: All of us.

Future Efforts

- Integration of the field data with circulation and salinity models.
- Develop a web of real time stations to monitor the Bay System and feed the models.

Quick view of the:

SOUTH FLORIDA REGIONAL OBSERVING SYSTEM (SF-ROS)

Libby Johns
Ryan Smith
Nelson Melo
Chris Kelble
Ulises Rivero
Grant, Andy, Pedro, Robert, Kyle, …

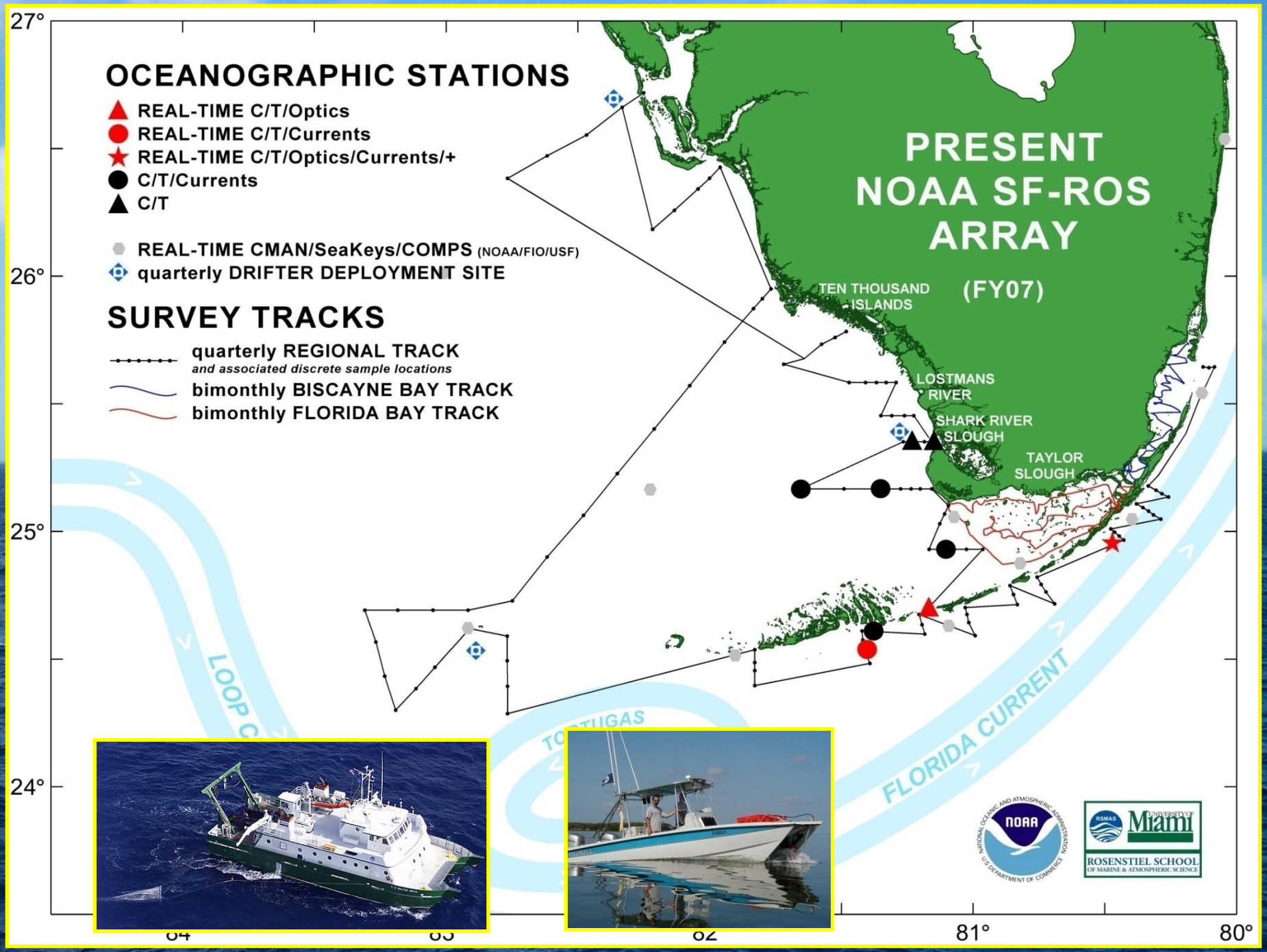
PRESENT NOAA SF-ROS ARRAY (FY07)

OCEANOGRAPHIC STATIONS

- REAL-TIME C/T/Optics
- REAL-TIME C/T/Currents
- REAL-TIME C/T/Optics/Currents/+
- C/T/Currents
- C/T
- REAL-TIME CMAN/SeaKeys/COMPS (NOAA/FIO/USF)
- quarterly DRIFTER DEPLOYMENT SITE

SURVEY TRACKS

- quarterly REGIONAL TRACK
  and associated discrete sample locations
- bimonthly BISCAYNE BAY TRACK
- bimonthly FLORIDA BAY TRACK



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  - Archived Data
  - Related Research
- » Outreach
- » Partnerships
- » What's New
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...a National Oceanic and Atmospheric Administration effort dedicated to providing quality science to the Comprehensive Everglades Restoration Plan...

www.aoml.noaa.gov/sfp

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Research » Archived Data

Select the desired year and type of survey map from the below drop down menus and click "Get Map!".

Bi-Monthly Surveys of South Florida Coastal Waters

2003 salinity Get Map!

[Standard CTD Station Locations - December 1995 - April 2001]
[Standard CTD Station Locations - May 2001 - Present]

Monthly Hydrographic Surveys of Biscayne Bay and Florida Bay

Florida Bay

2003 salinity Get Map! [Table listing all survey cruise dates]

Biscayne Bay

2003 salinity Get Map!

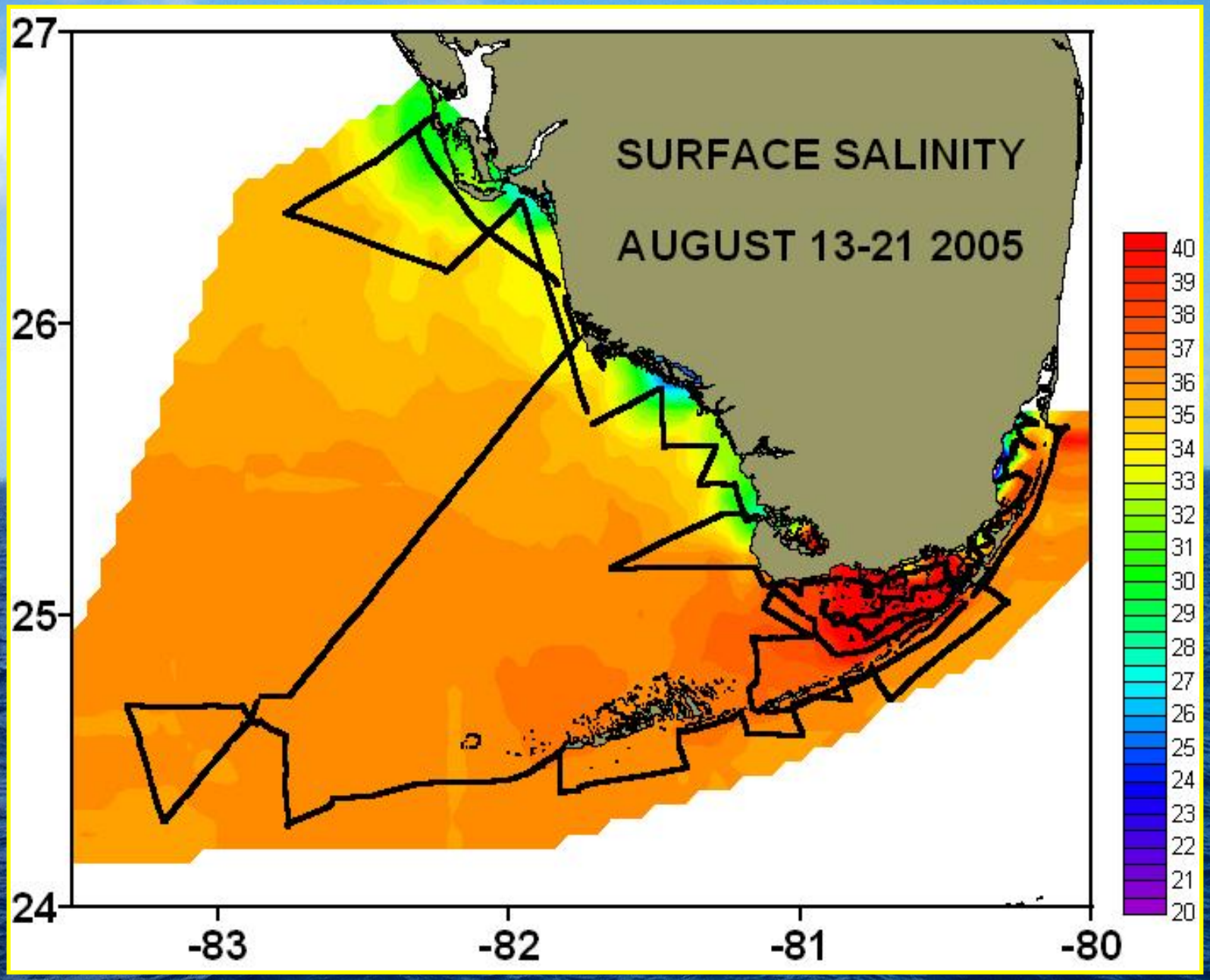
Satellite-Tracked Surface Drifter Trajectories

SEAKEYS Reports

[Historical C-Man Data Reports]

http://www.aoml.noaa.gov/sfp/data_archives.shtml

Internet


SURFACE SALINITY
AUGUST 13-21 2005
27
26
25
24
-83
-82
-81
-80
40
39
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REAL-TIME INSTRUMENTATION

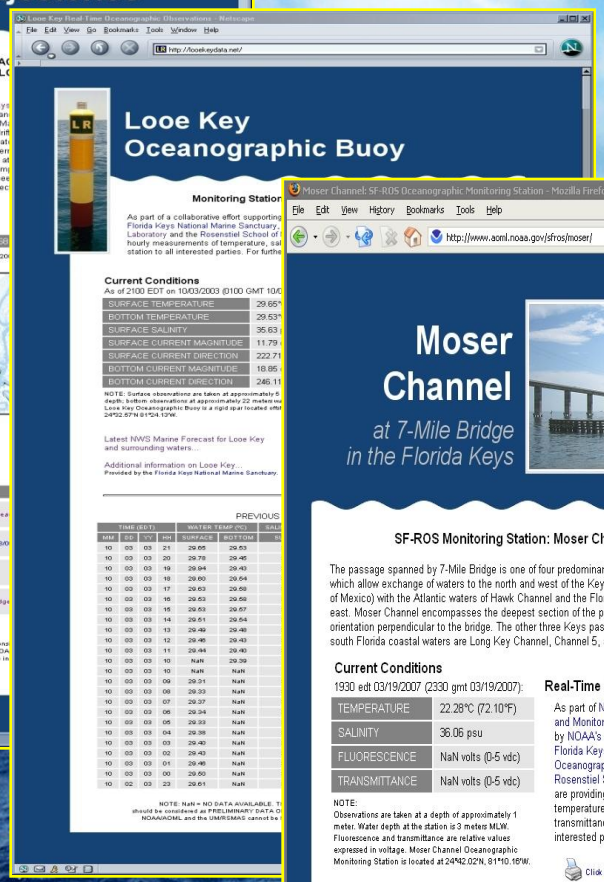
Looe Reef

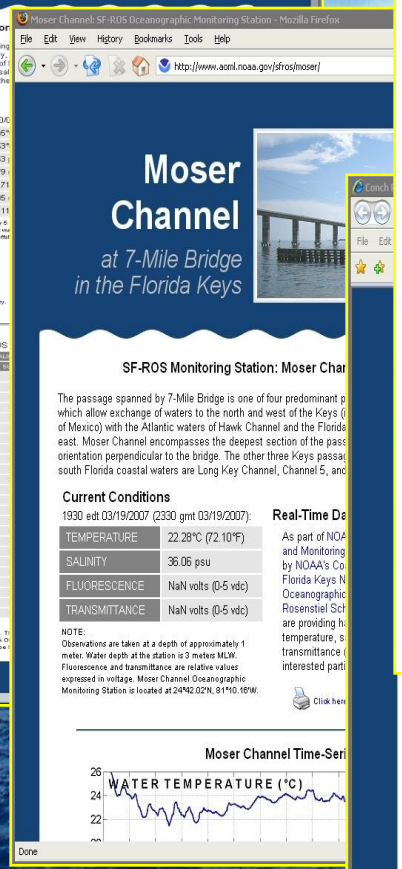
Moser Channel

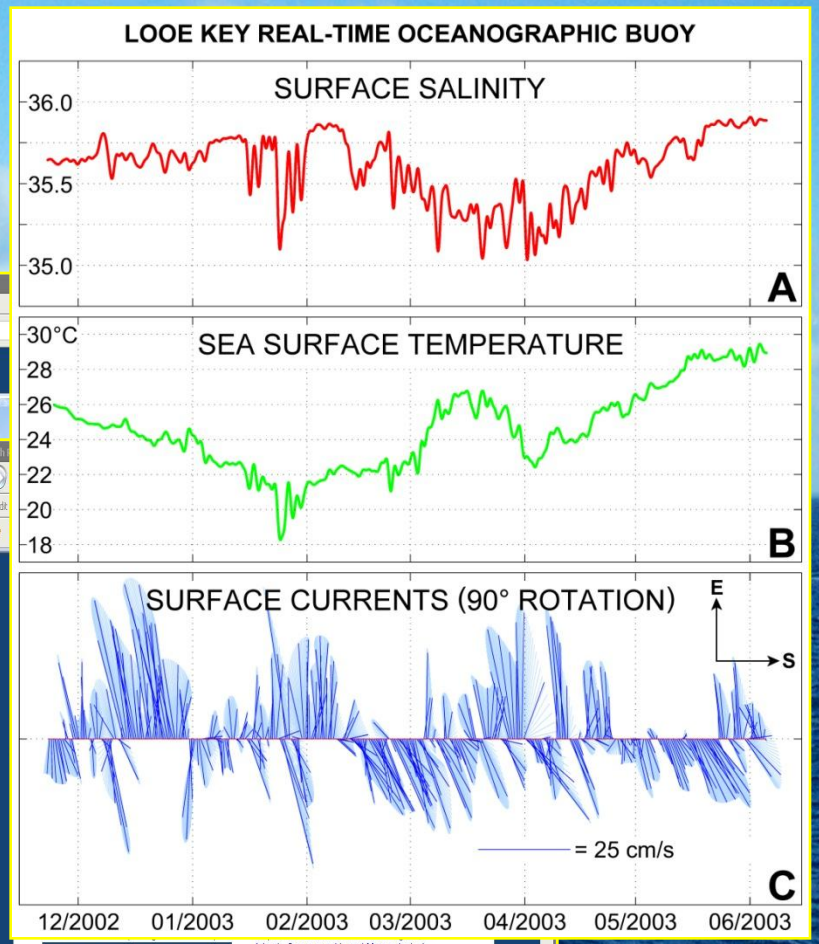
Aquarius

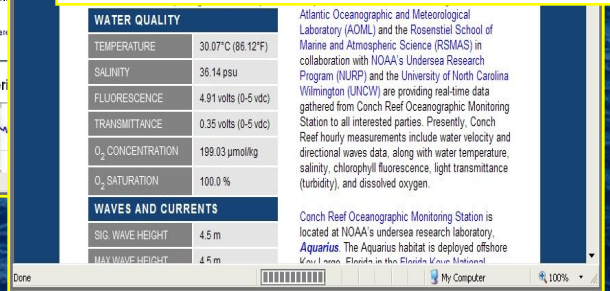
REAL-TIME CURRENTS AND WATER QUALITY MONITORING *in the Florida Keys National Marine Sanctuary (FKNMS)*

Data

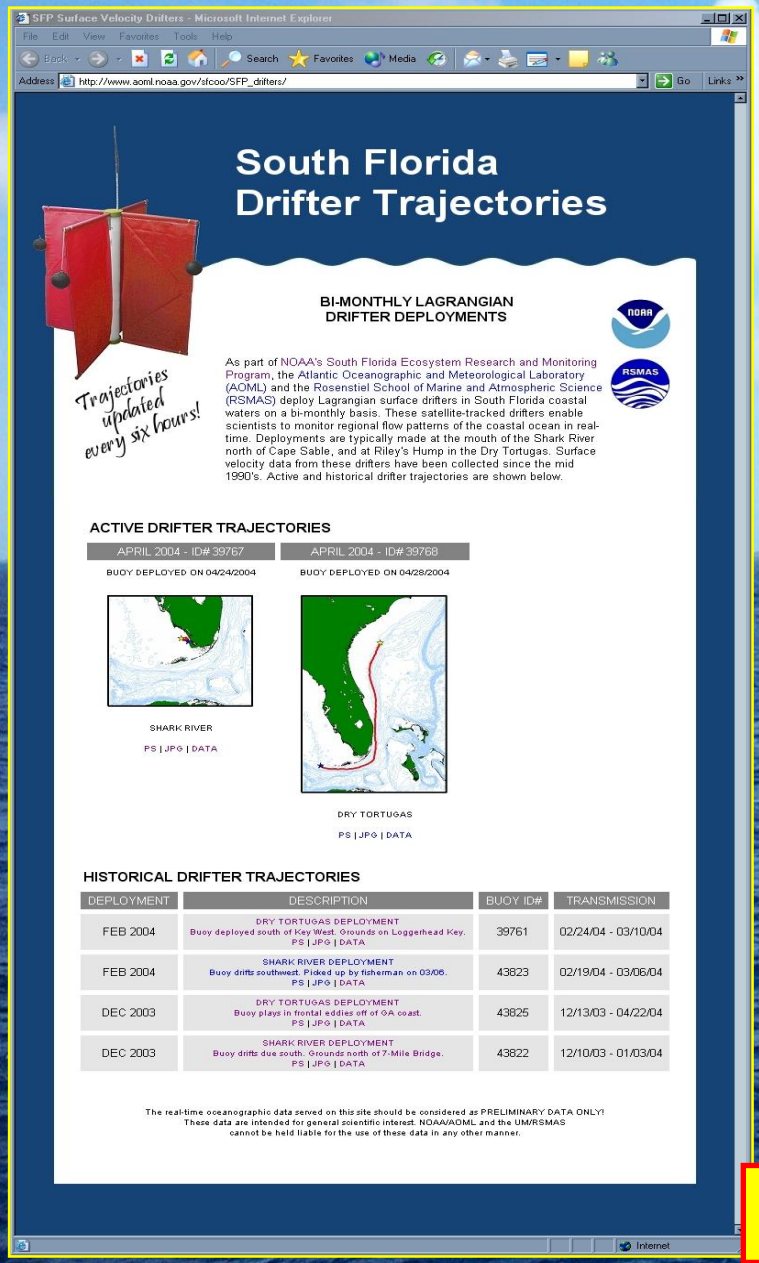


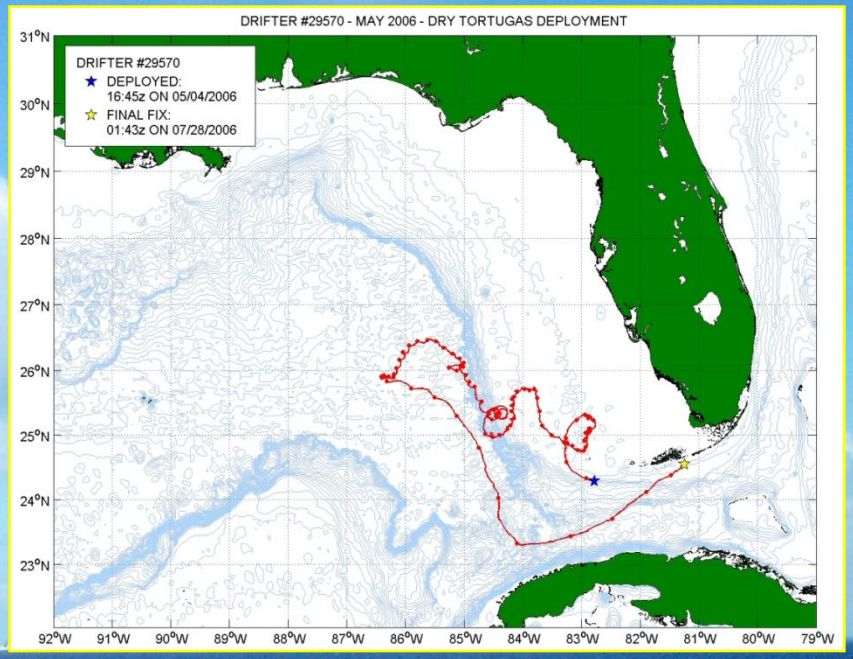


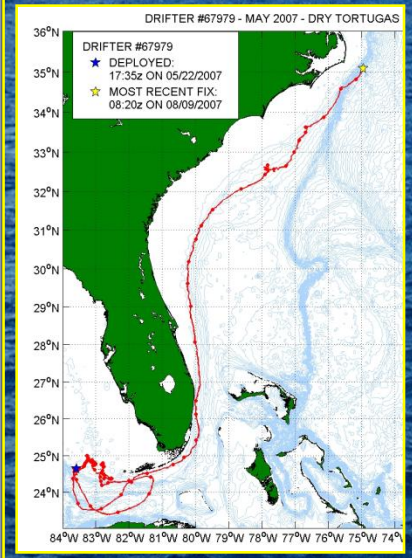


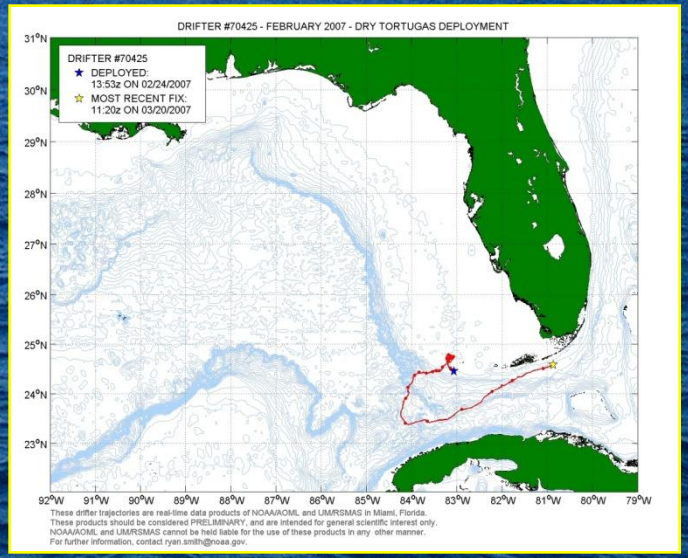


Drifter Trajectories



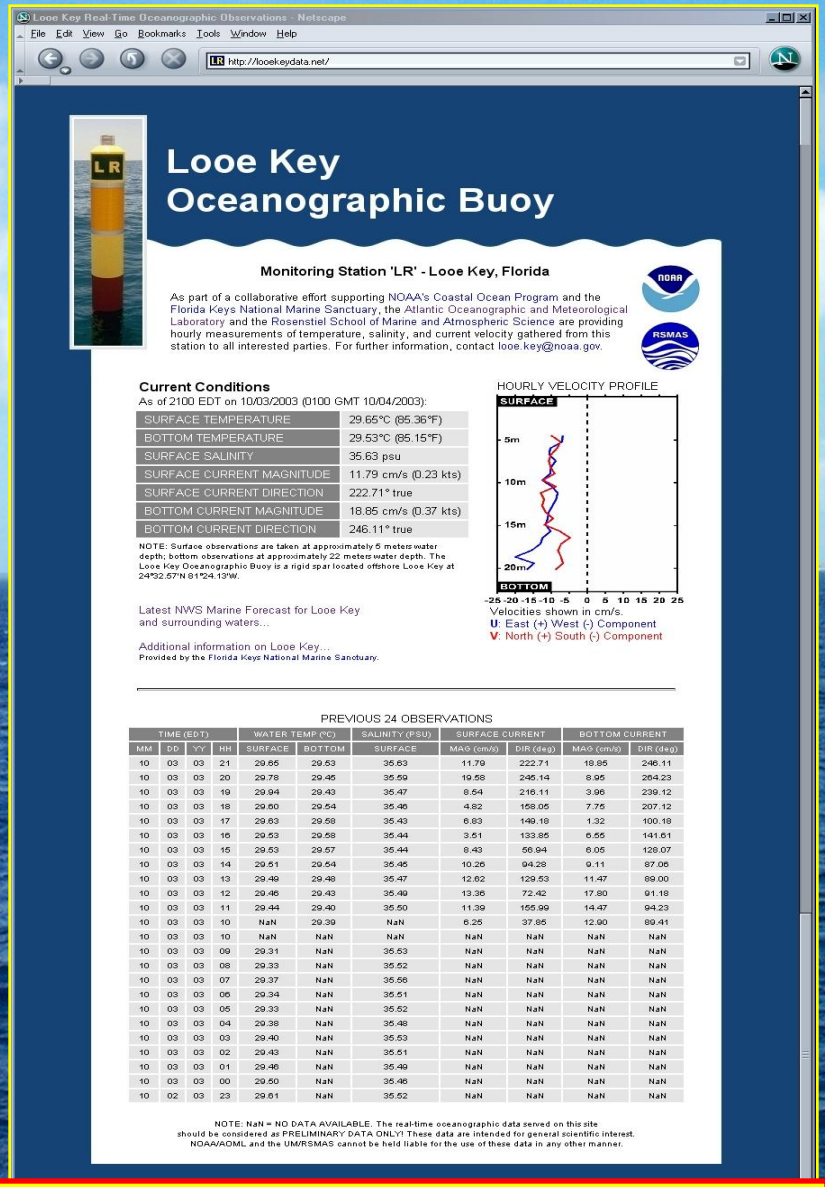






http://www.aoml.noaa.gov/sfros/drifters

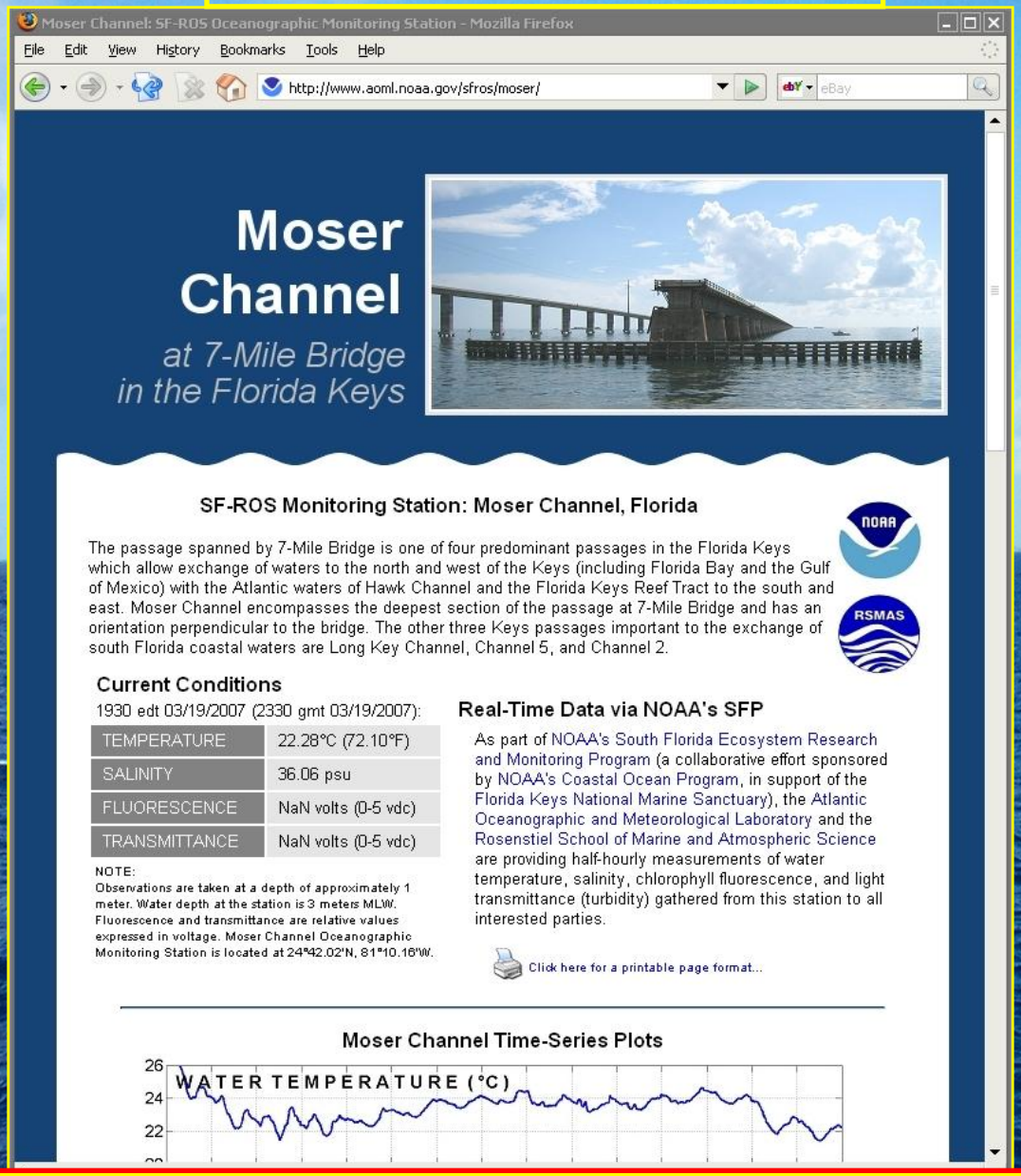
Real Time Stations



TIME (EDT)				WATER TEMP (°C)		SALINITY (PSU)	SURFACE CURRENT		BOTTOM CURRENT	
MM	DD	YY	HH	SURFACE	BOTTOM	SURFACE	MAG (cm/s)	DIR (deg)	MAG (cm/s)	DIR (deg)
10	03	03	21	29.65	29.53	35.63	11.79	222.71	18.85	246.11
10	03	03	20	29.78	29.45	35.59	19.58	245.14	8.95	264.23
10	03	03	19	29.94	29.43	35.47	8.54	216.11	3.96	239.12
10	03	03	18	29.60	29.54	35.46	4.82	158.05	7.75	207.12
10	03	03	17	29.63	29.58	35.43	6.83	149.18	1.32	100.18
10	03	03	16	29.53	29.58	35.44	3.51	133.85	6.55	141.61
10	03	03	15	29.53	29.57	35.44	8.43	56.94	6.05	126.07
10	03	03	14	29.51	29.54	35.45	10.26	94.28	9.11	87.06
10	03	03	13	29.49	29.48	35.47	12.62	129.53	11.47	89.00
10	03	03	12	29.46	29.43	35.49	13.36	72.42	17.80	91.18
10	03	03	11	29.44	29.40	35.50	11.39	155.99	14.47	94.23
10	03	03	10	NaN	29.39	NaN	6.25	37.85	12.90	89.41
10	03	03	10	NaN	NaN	NaN	NaN	NaN	NaN	NaN
10	03	03	09	29.31	NaN	35.53	NaN	NaN	NaN	NaN
10	03	03	08	29.33	NaN	35.52	NaN	NaN	NaN	NaN
10	03	03	07	29.37	NaN	35.56	NaN	NaN	NaN	NaN
10	03	03	06	29.34	NaN	35.51	NaN	NaN	NaN	NaN
10	03	03	05	29.33	NaN	35.52	NaN	NaN	NaN	NaN
10	03	03	04	29.38	NaN	35.48	NaN	NaN	NaN	NaN
10	03	03	03	29.40	NaN	35.53	NaN	NaN	NaN	NaN
10	03	03	02	29.43	NaN	35.51	NaN	NaN	NaN	NaN
10	03	03	01	29.46	NaN	35.49	NaN	NaN	NaN	NaN
10	03	03	00	29.50	NaN	35.46	NaN	NaN	NaN	NaN
10	02	03	23	29.61	NaN	35.52	NaN	NaN	NaN	NaN

http://looekeydata.net/

Real Time Stations



http://www.aoml.noaa.gov/sfros/moser/

Real Time Stations

Conch Reef: SF-ROS Oceanographic Monitoring Station - Windows Internet Explorer

http://www.aoml.noaa.gov/sfros/conch

File Edit View Favorites Tools Help

Conch Reef: SF-ROS Oceanographic Monitoring Station

Conch Reef Oceanographic Station *at Aquarius*

SF-ROS Monitoring Station: Conch Reef, Florida

Current Conditions
1530 edt 01/30/2007 (1930 gmt 01/30/2007):

WATER QUALITY	
TEMPERATURE	30.07°C (86.12°F)
SALINITY	36.14 psu
FLUORESCENCE	4.91 volts (0-5 vdc)
TRANSMITTANCE	0.35 volts (0-5 vdc)
O_2 CONCENTRATION	199.03 µmol/kg
O_2 SATURATION	100.0 %
WAVES AND CURRENTS	
SIG. WAVE HEIGHT	4.5 m
MAX WAVE HEIGHT	4.5 m

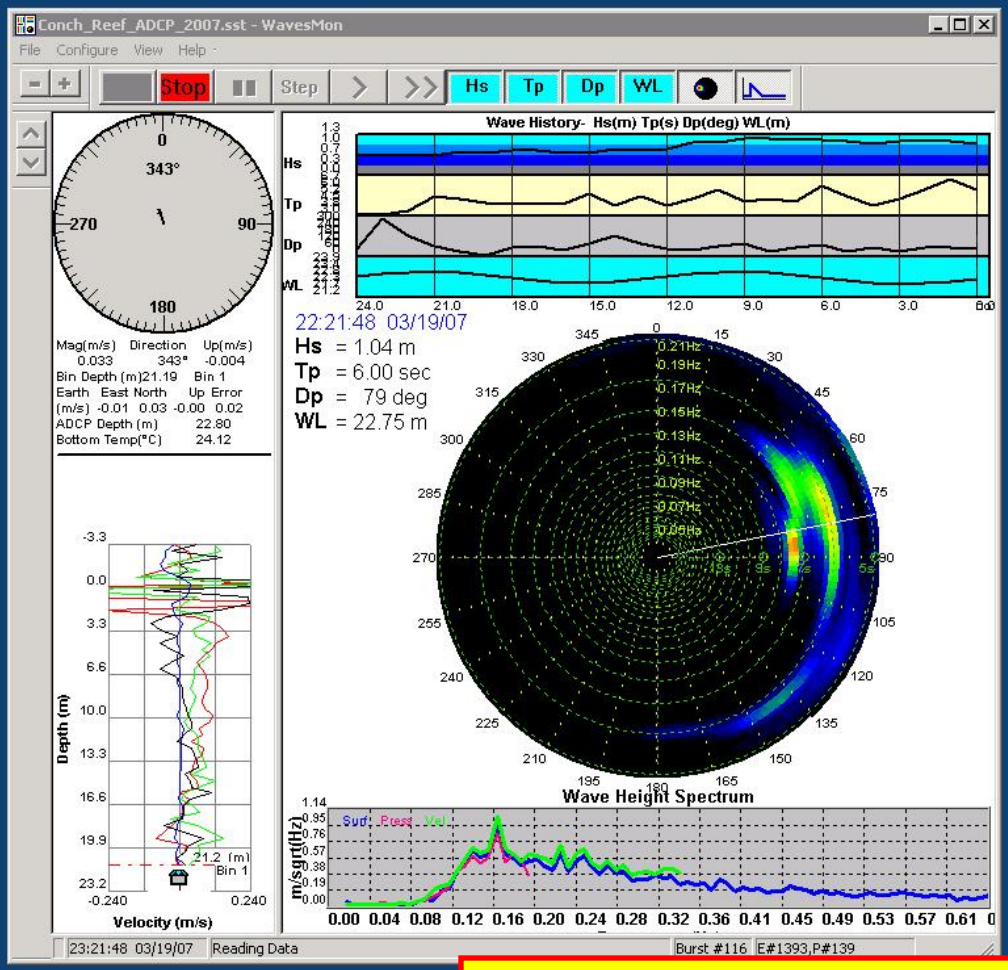
Real-Time Collaboration...
As part of NOAA's South Florida Program, the Atlantic Oceanographic and Meteorological Laboratory (AOML) and the Rosenstiel School of Marine and Atmospheric Science (RSMAS) in collaboration with NOAA's Undersea Research Program (NURP) and the University of North Carolina Wilmington (UNCW) are providing real-time data gathered from Conch Reef Oceanographic Monitoring Station to all interested parties. Presently, Conch Reef hourly measurements include water velocity and directional waves data, along with water temperature, salinity, chlorophyll fluorescence, light transmittance (turbidity), and dissolved oxygen.

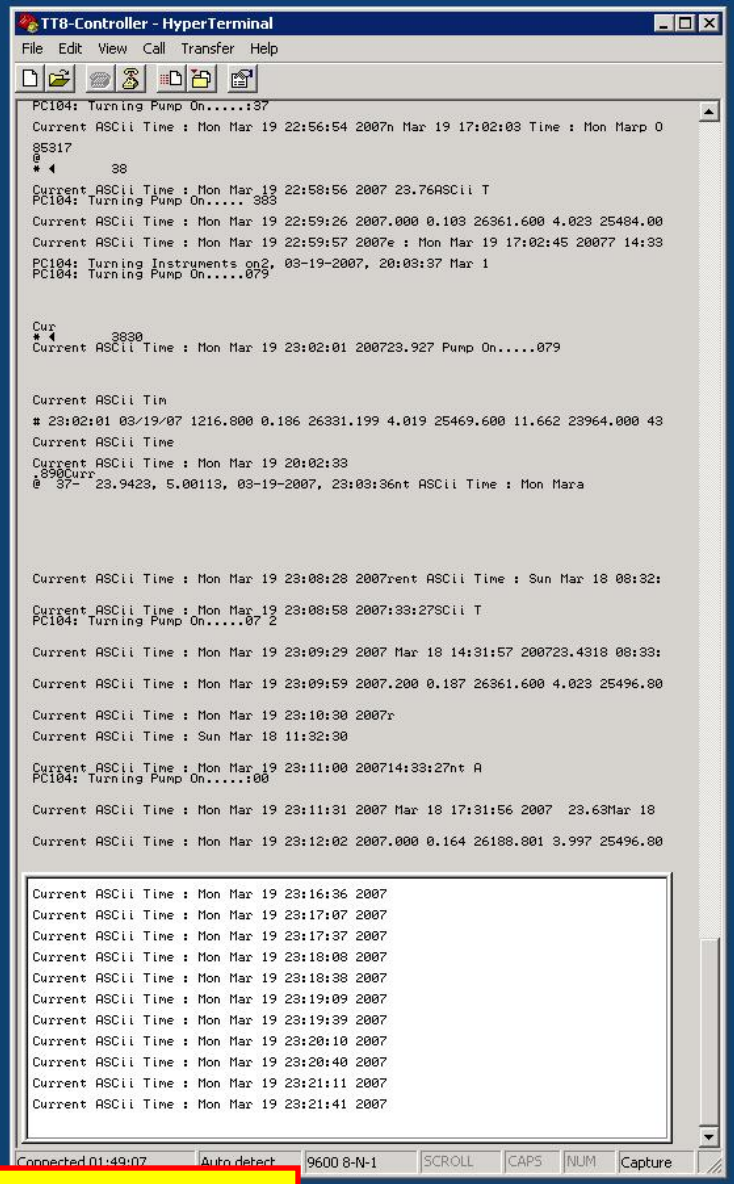
Conch Reef Oceanographic Monitoring Station is located at NOAA's undersea research laboratory, ***Aquarius***. The Aquarius habitat is deployed offshore Key Largo, Florida in the Florida Keys National

Done My Computer 100%

http://www.aoml.noaa.gov/sfros/conch/

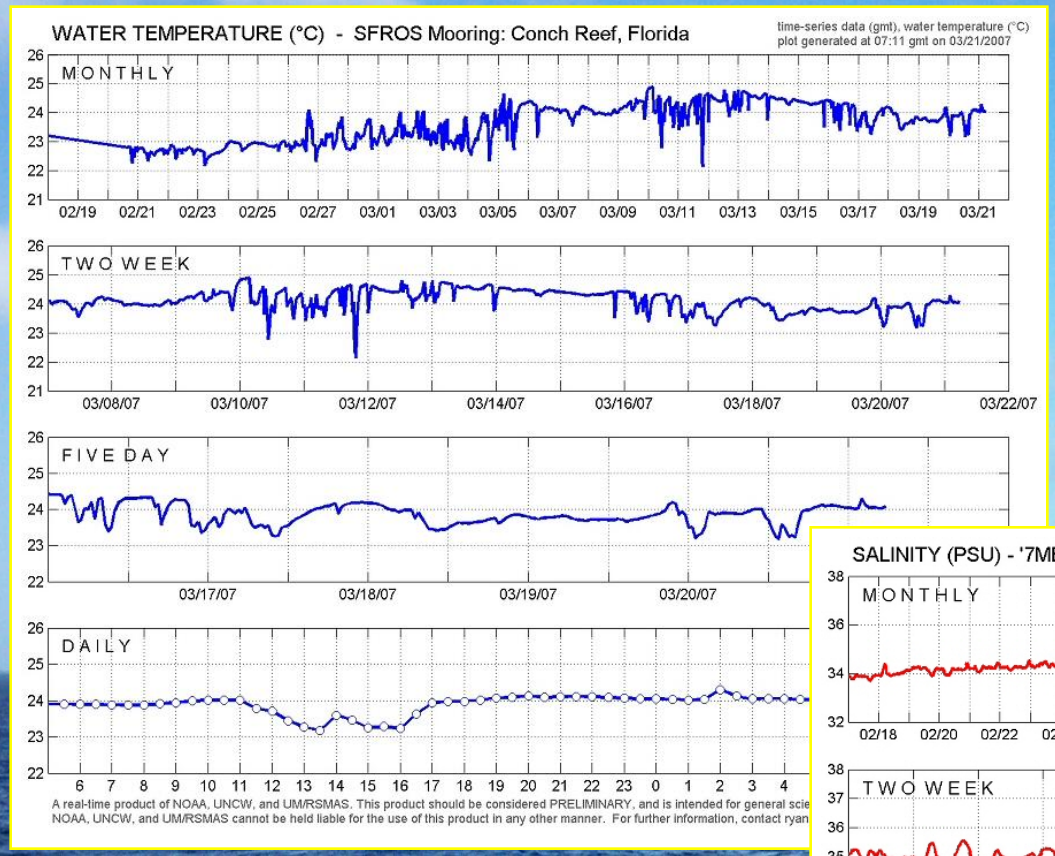
Conch Reef / Aquarius
REAL-TIME CURRENTS plus
LSB computer control module
216.89.225.170

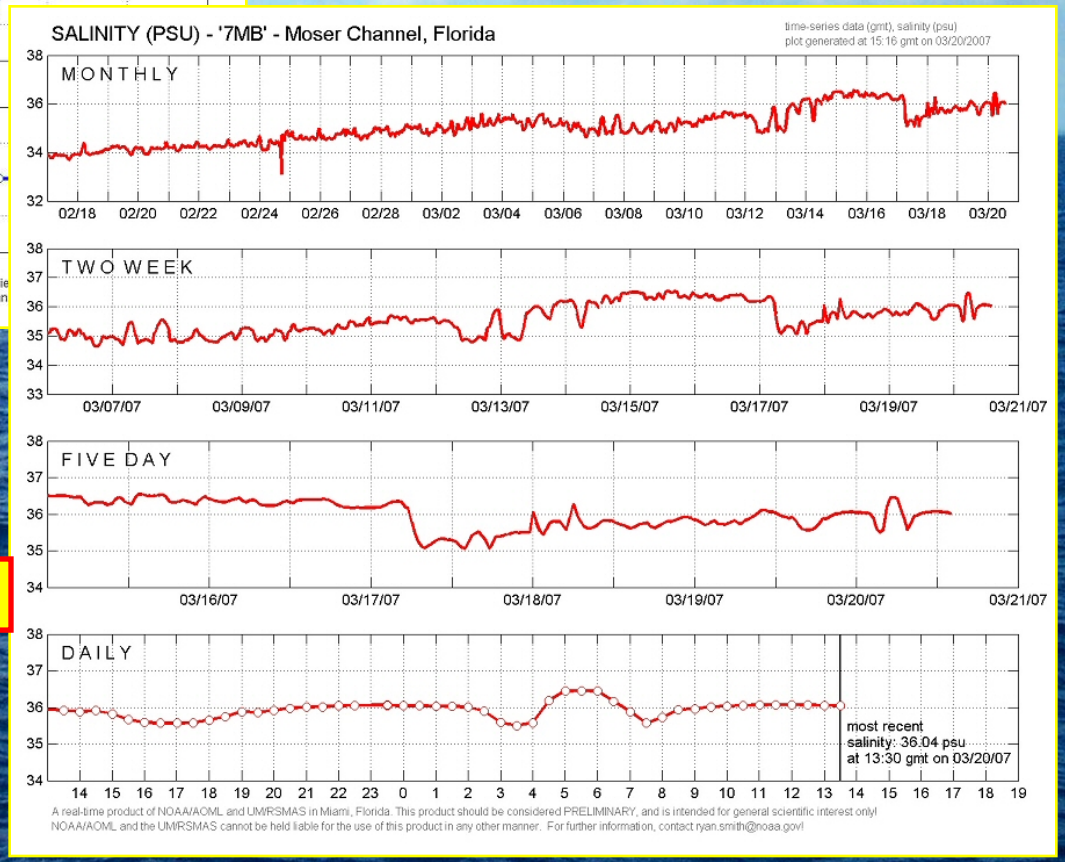




http://www.aoml.noaa.gov/sfros/conch/

Real Time DATA





http://www.aoml.noaa.gov/sfros/conch

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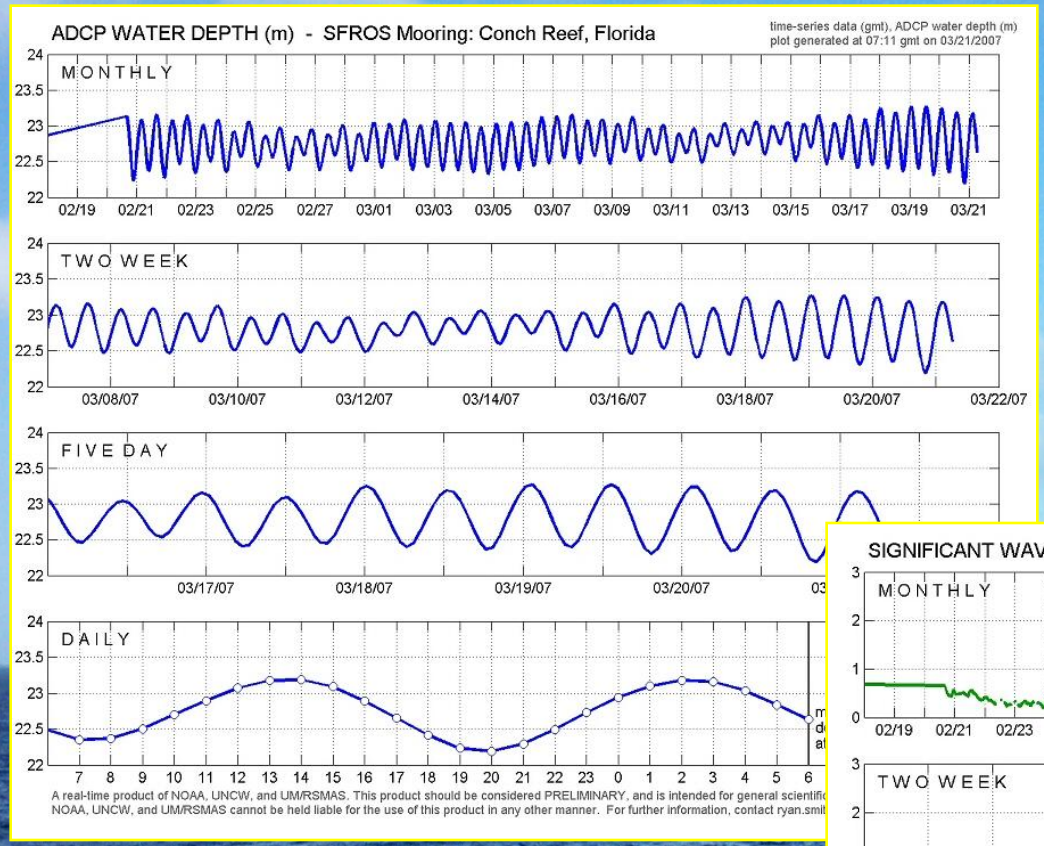

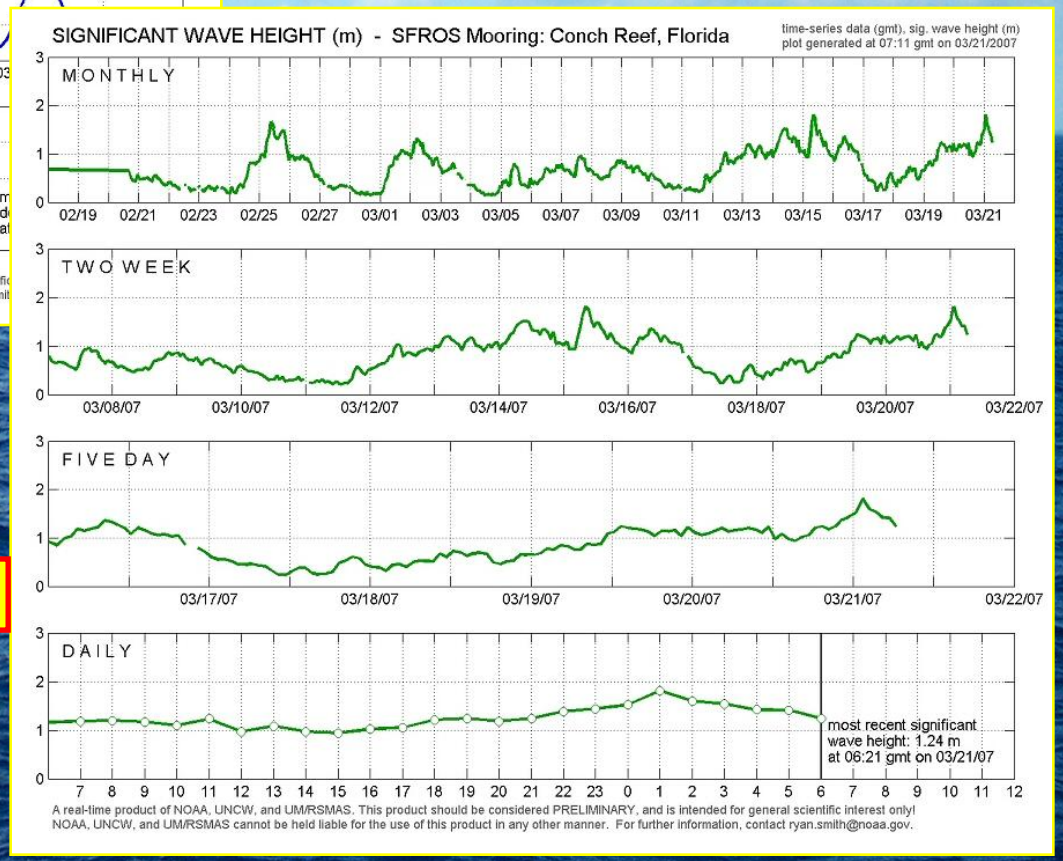

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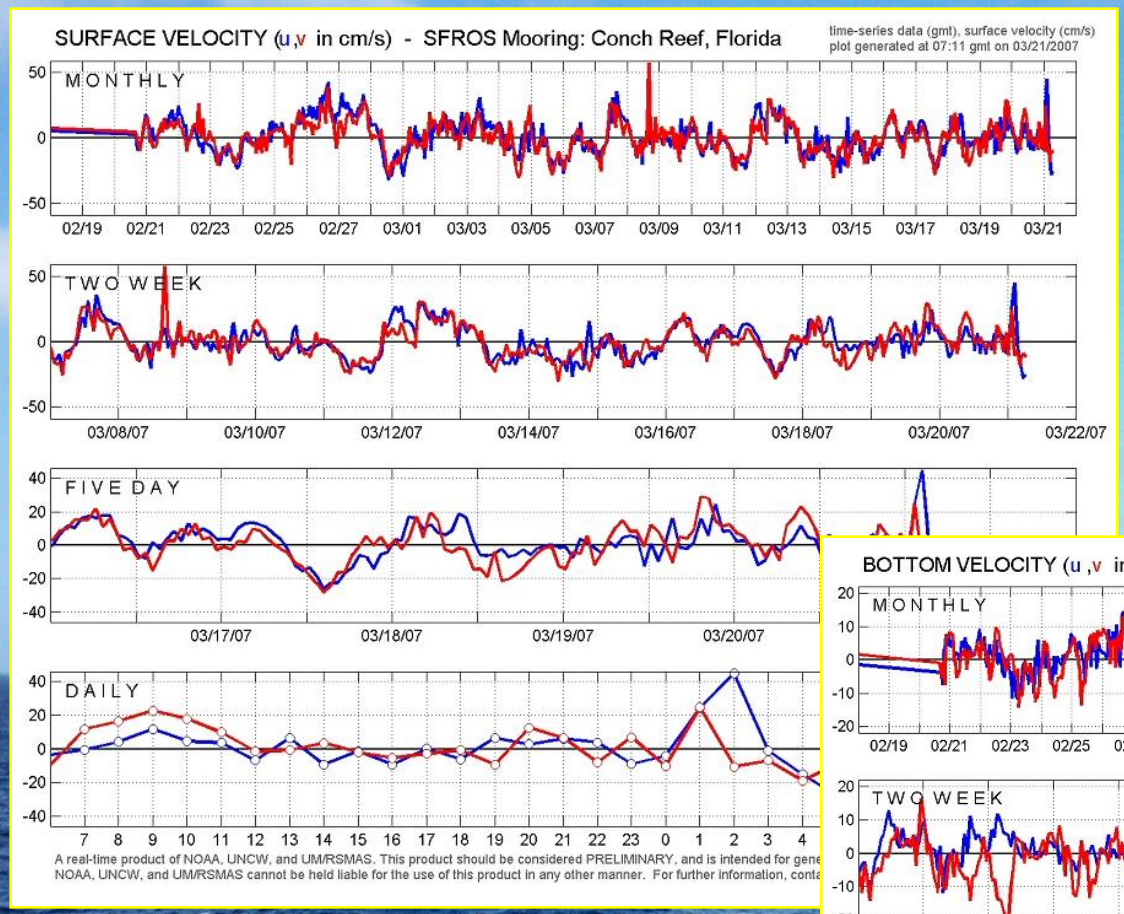

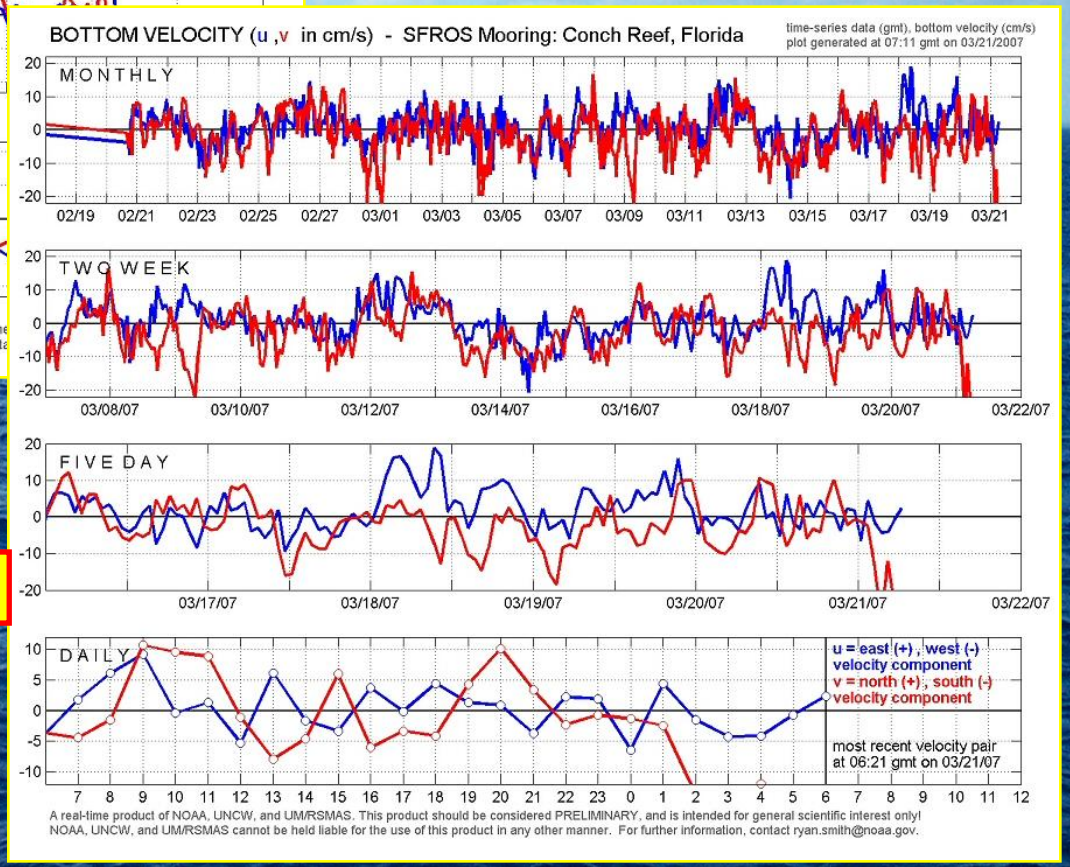

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Thanks !