

Evaluation of the effects of Boundary Conditions and Atmospheric Forcing in the SoFLA-HYCOM domain

Villy Kourafalou and Ge Peng
UM/RSMAS

In Collaboration with

Pat Hogan, Ole Martin Smedstad and Alan Walcraft (*NRLSSC*)
Julie Pullen (*NRLMRY*)



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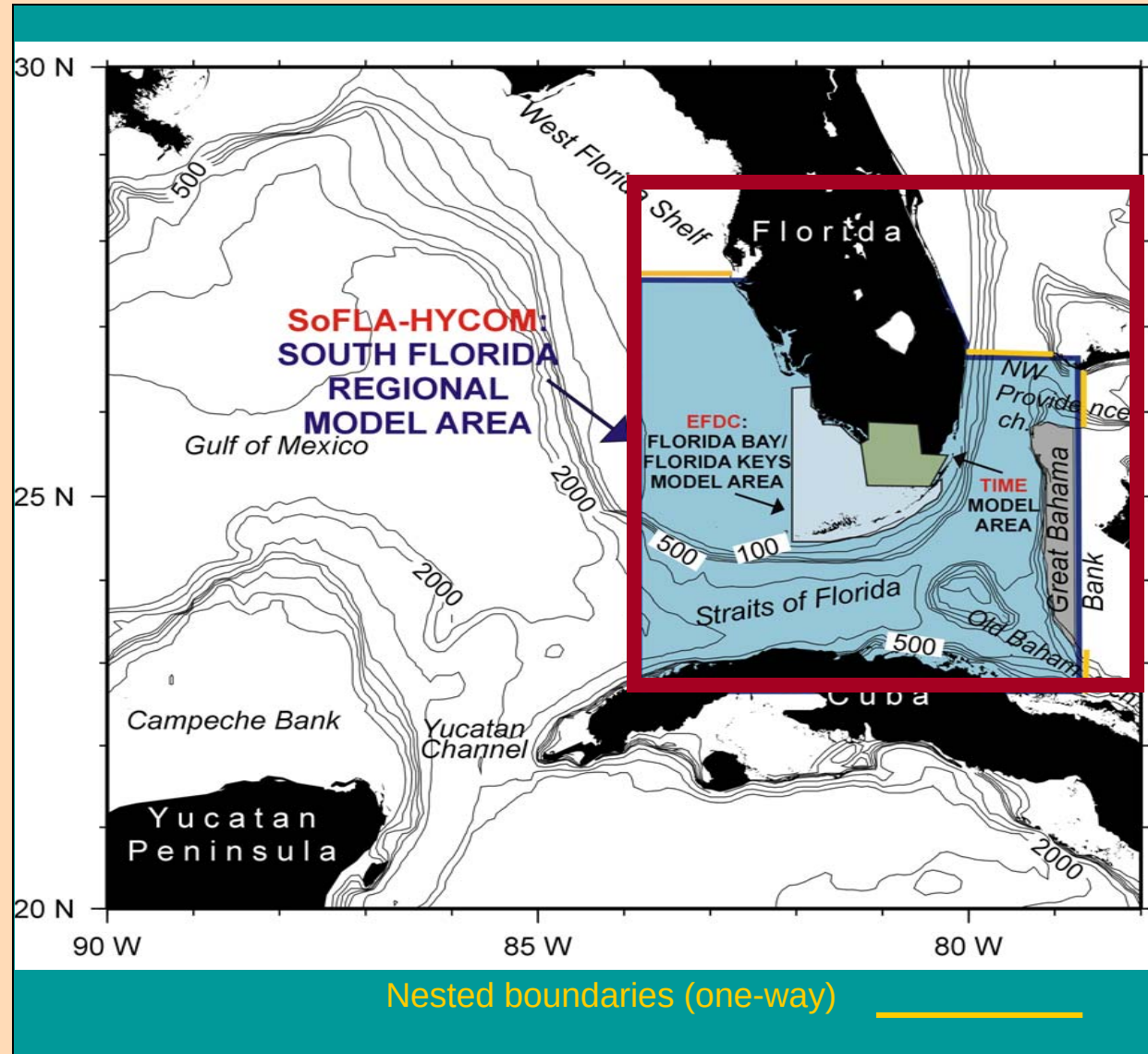
Regional model for South Florida seas: **SoFLA-HYCOM**

(South Florida Hybrid Coordinate Ocean Model)

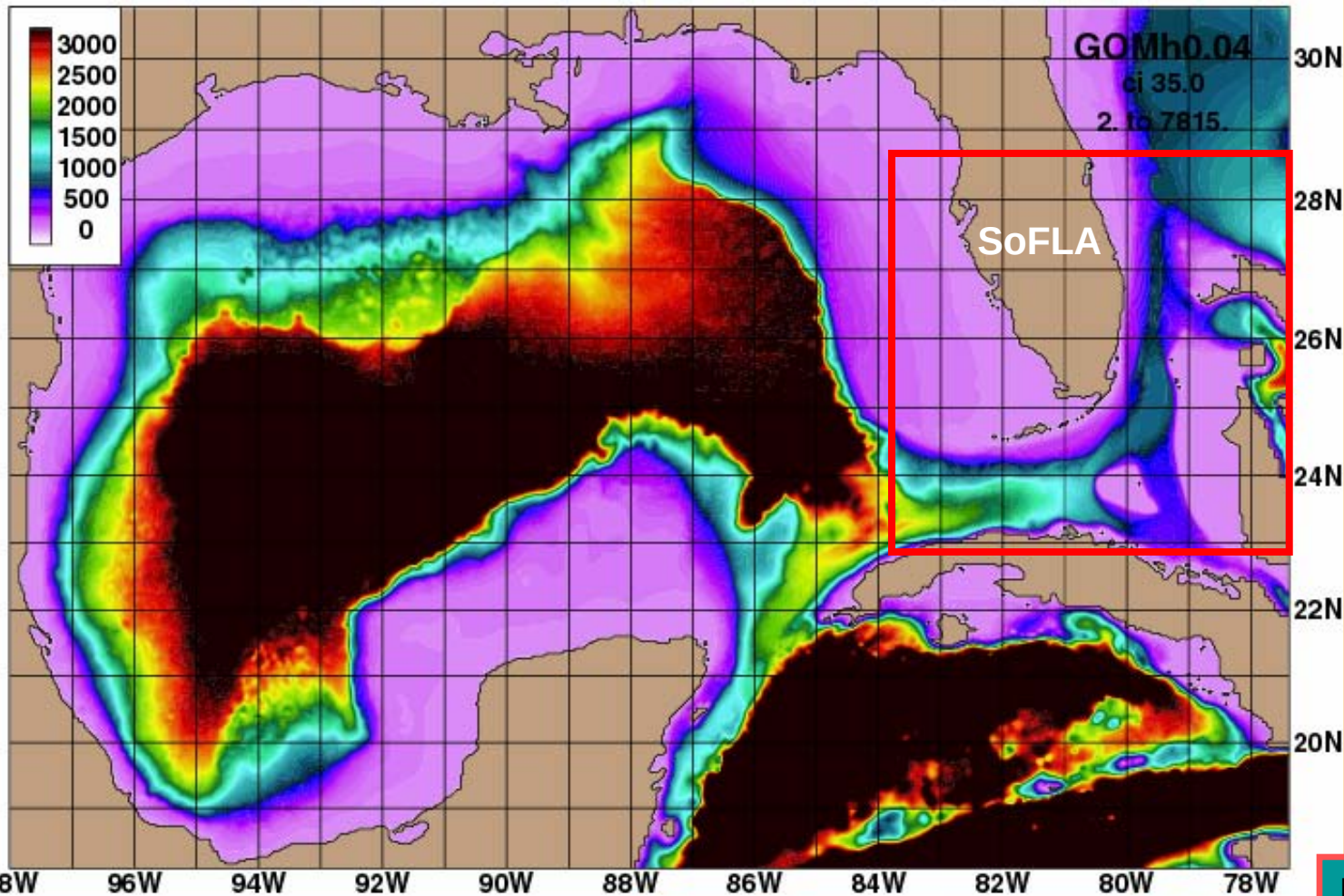
➤ A multi-nested modeling approach in support of the Comprehensive Everglades Restoration Project (funded by NOAA)

➤ Evaluation of nested simulation strategies in terms of boundary conditions, data assimilation and forcing (funded by ONR-NOPP)

➤ Coupled to a biological Lagrangian model of larval transport to study connectivity and coral reef fish recruitment in the Florida Keys (funded by NSF)



GOM-HYCOM: GOMh0.04 Bathymetry



GOMh0.04 1/25° resolution: Idm=517 jdm=349 kdm=20;
98°W-77.36°W; 18.90°N-30.71°N; 2 m minimum water depth

FLAh0.04

HYCOM 2.1.35

1/25° resolution:

Idm=161

jdm=163

kdm=20

83.76°W-77.36°W

22.78°N-28.61°N

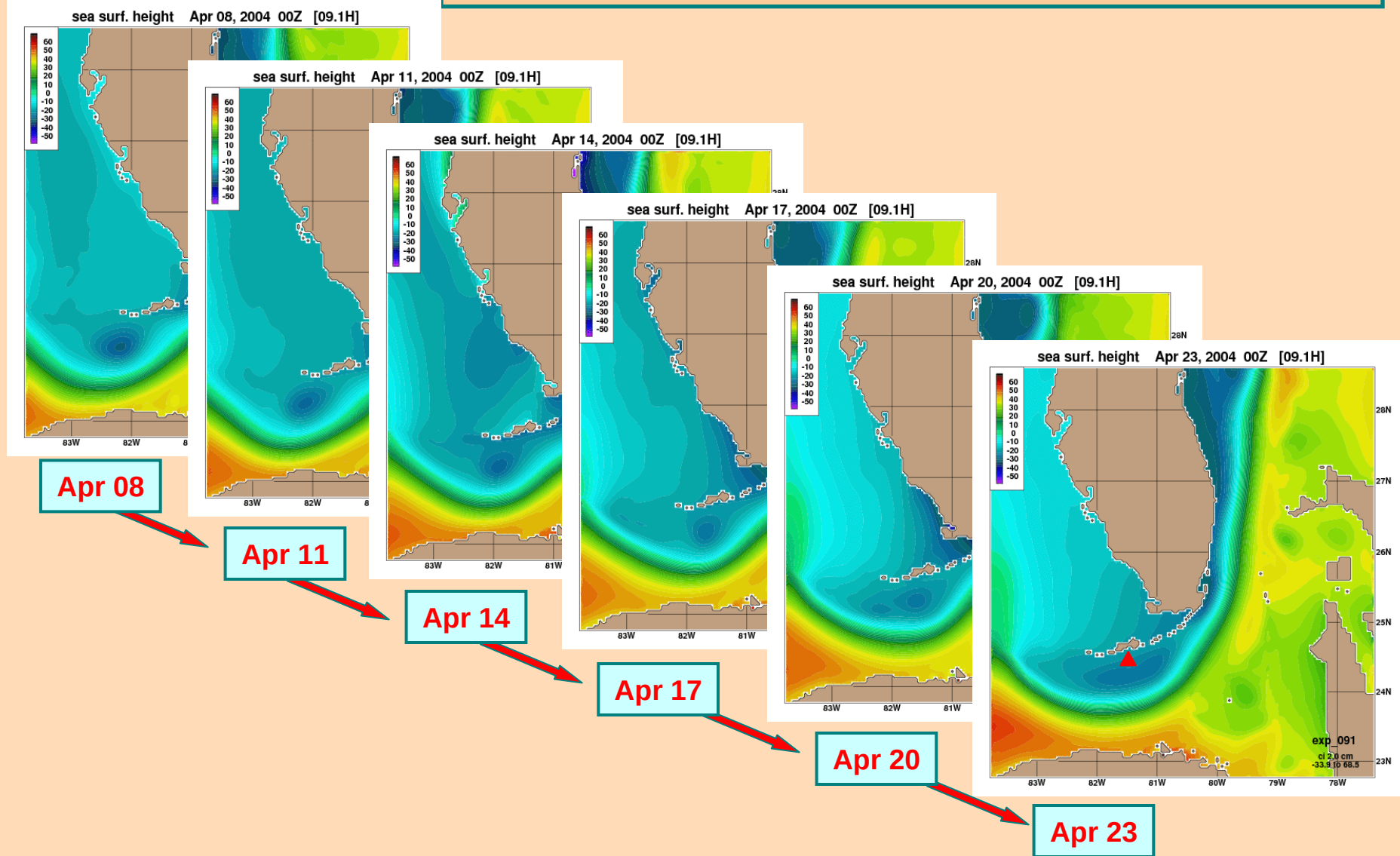
2 m minimum
water depth

FLAh0.04 shares
the same grid with
GOMh0.04 within
the SoFLA domain

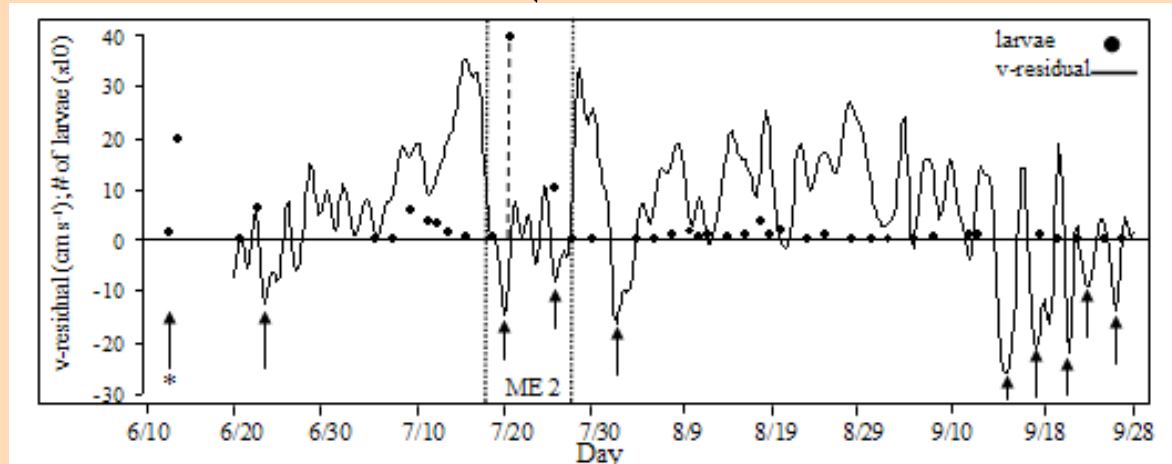
SoFLA-HYCOM: FLAh0.04 Run Numbers and Attributes

RunID	Layers	Rivers	Forcing	Nesting BC	Date
01.1	20	Same as free GOMh0.04	fnmoc-1.0	Free GOMh0.04	2004
06.4	20	Merging 01.1 with FLAe06.4: Rivers_X5	fnmoc-1.0	Free GOMh0.04	2004
09.1	20	Rivers_X9	fnmoc-1.0	Free GOMh0.04	2004, 2005
09.2	20	Rivers_X9X5	fnmoc-1.0	Free GOMh0.04	April and May, 2004
29.1	20	Rivers_X9	fnmoc-1.0	NCODA GOMh0.04	2004, 2005
39.1	20	Rivers_X9	fnmoc-1.0	ATLd0.08	2004
07.1	20	Rivers_X9	coamps 27km	Free GOMh0.04	Jan-Sep, 2004?
27.1	20	Rivers_X9	coamps 27km	NCODA GOMh0.04	2004, 2005
04.1	20	Rivers_X9	Fnmoc-0.50	Free GOMh0.04	2004
02.1	26	Same as free GOMh0.04	Fnmoc-1.0	Free GOMh0.04	Jan, 2004
01.5	26	Rivers_X9	coamps 27km	Free GOMh0.04	2004,2005
02.5	26	Rivers_X9	coamps 27km	NCODA GOMh0.04	2004,2005
03.5	26	Rivers_X9	coamps 27km	ATLd0.08	2004,2005

Simulation of coastal to offshore interactions during an eddy passage April 2004

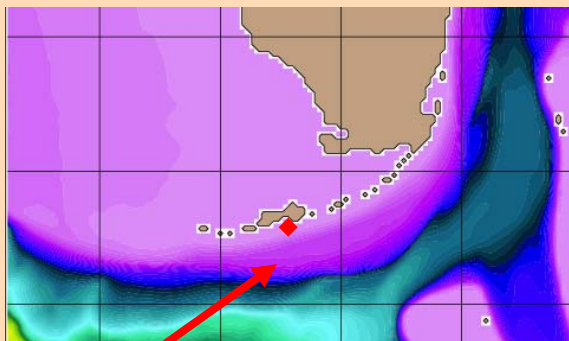


Alongshore current and larval counts during an eddy passage (2001 data)

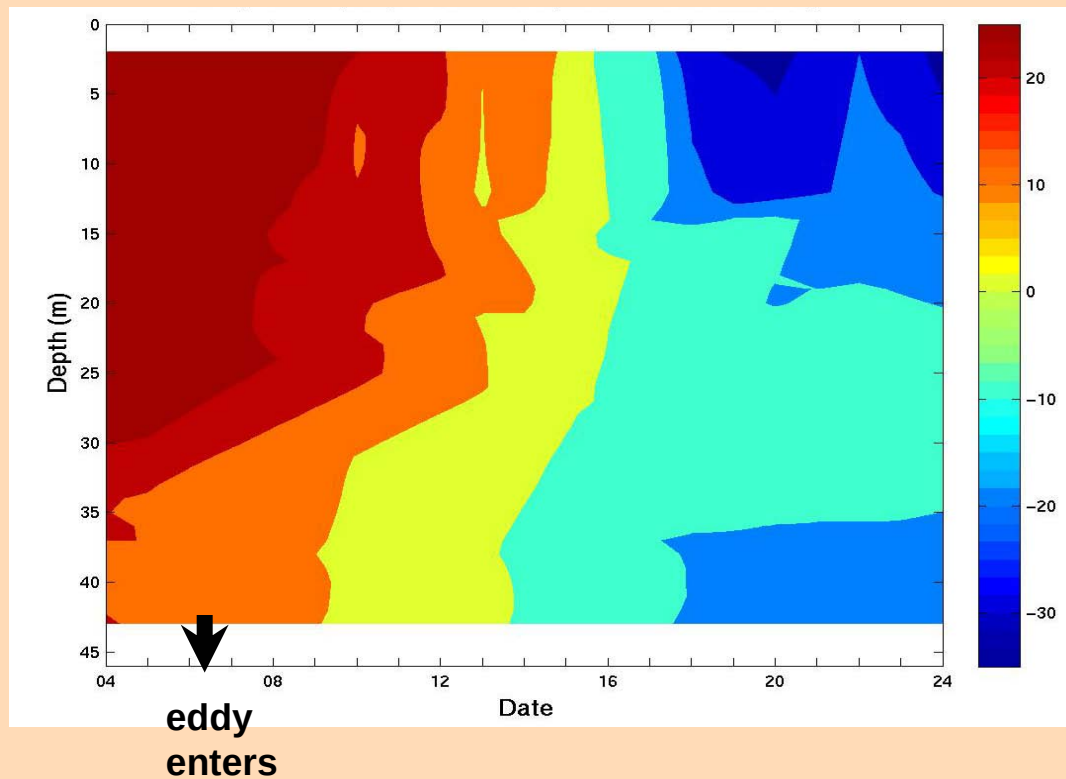


Sponaugle et al., 2005

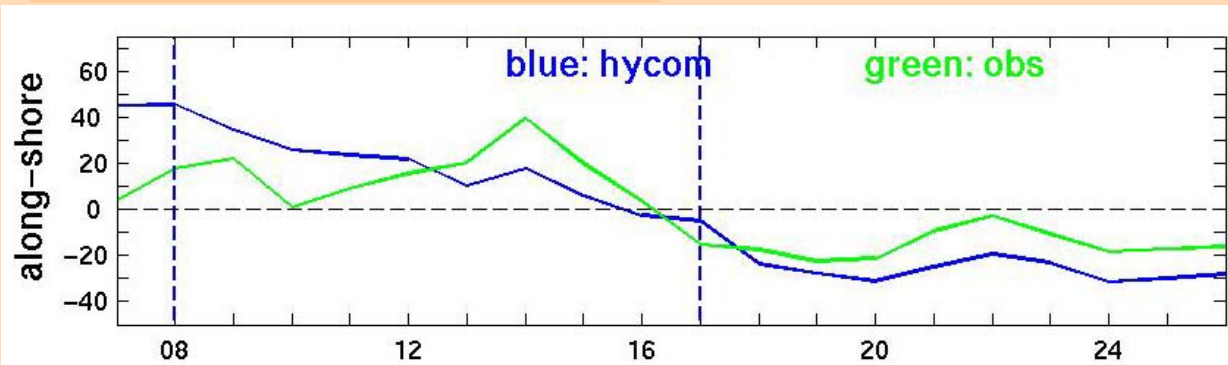
Along-Shore Current reversal at Looe Key during the eddy passage



81.4W, 24.65N



Model to Data comparison



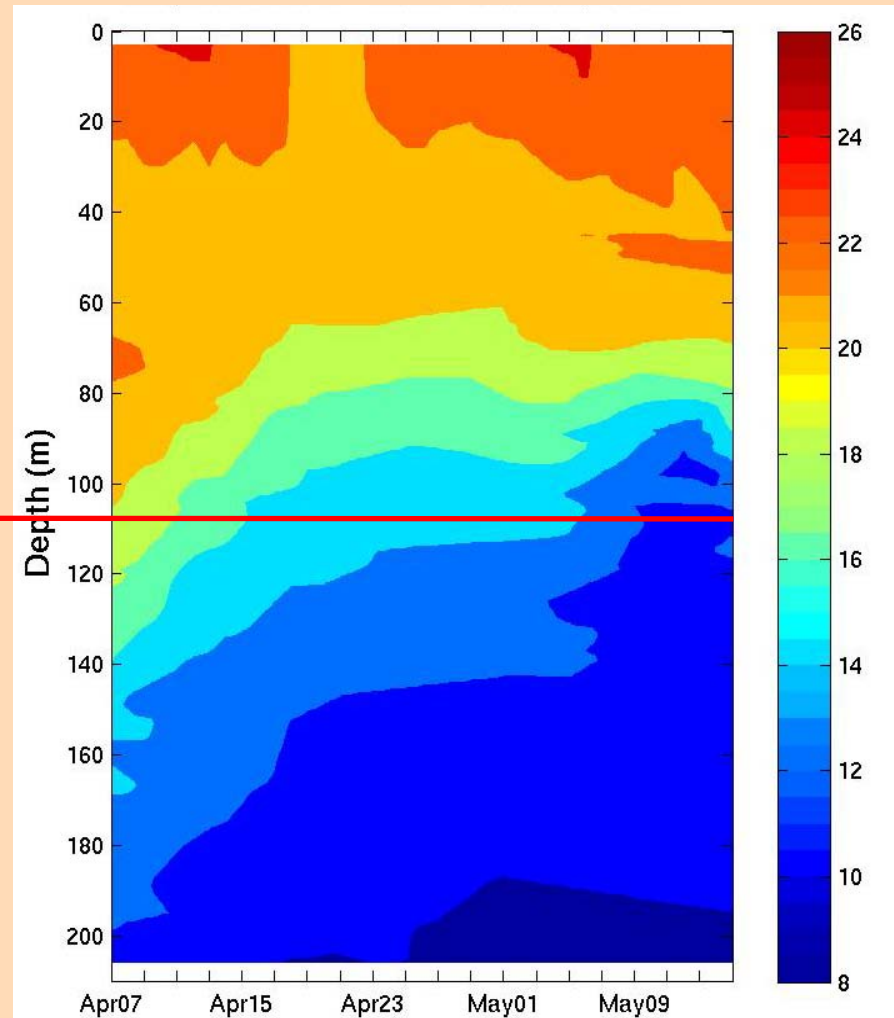
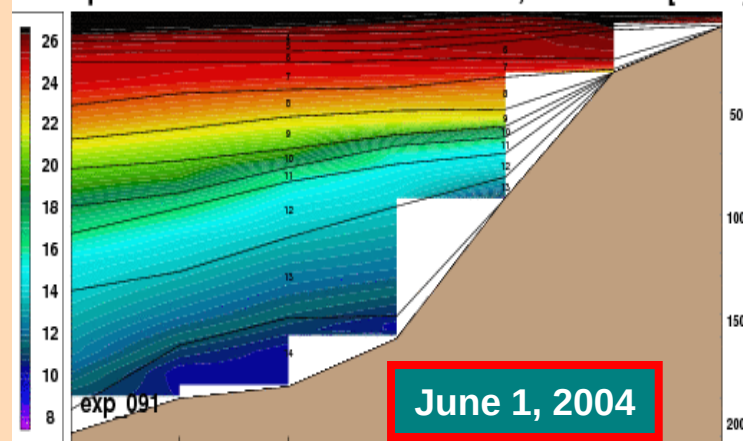
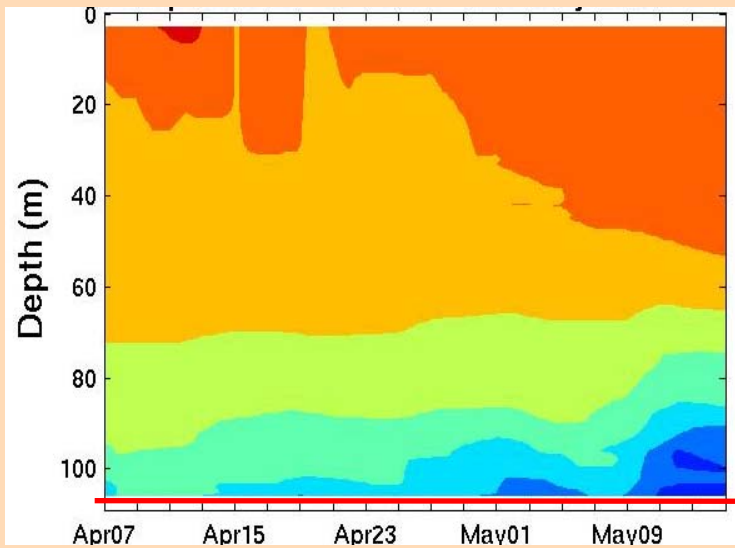
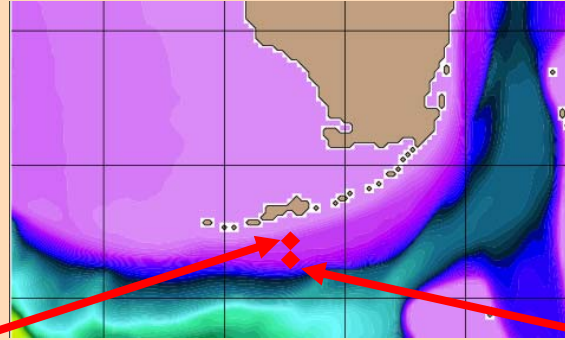
April 2004

•40 HLP data (rot. 73 deg.)
prepared by
Ryan Smith, NOAA/AOML

Eddy “signal” at different depths:
Temperature cross-sections at
Looe Key

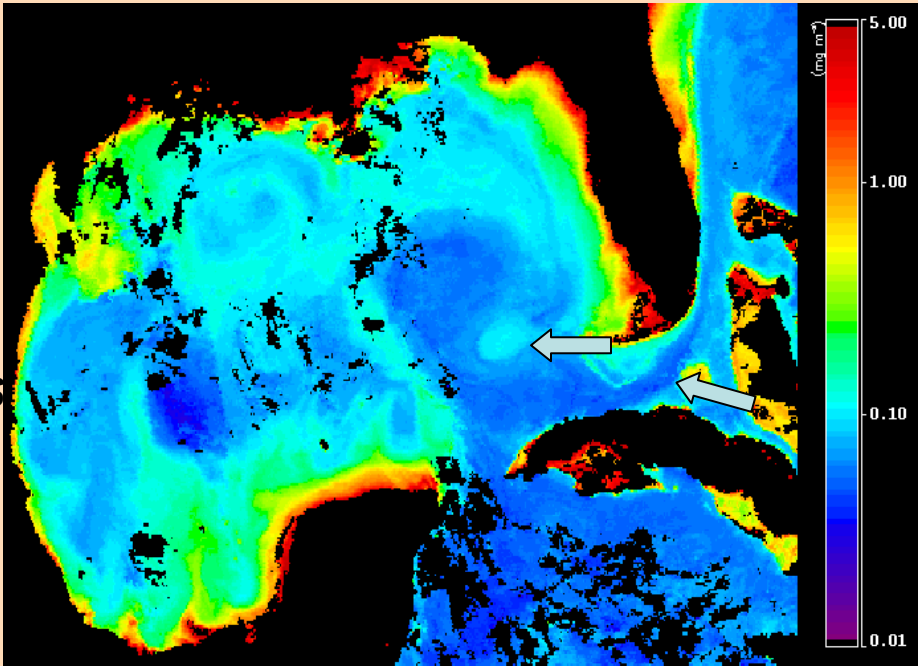
81.4W, 24.5N

81.4W, 24.35N



Assimilation effects through Boundary Conditions

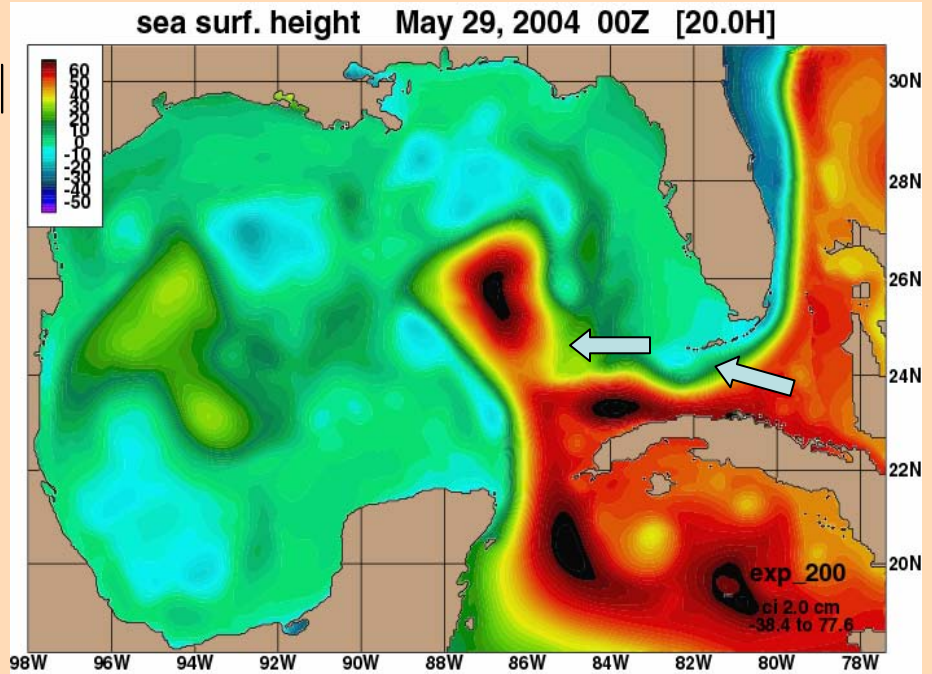
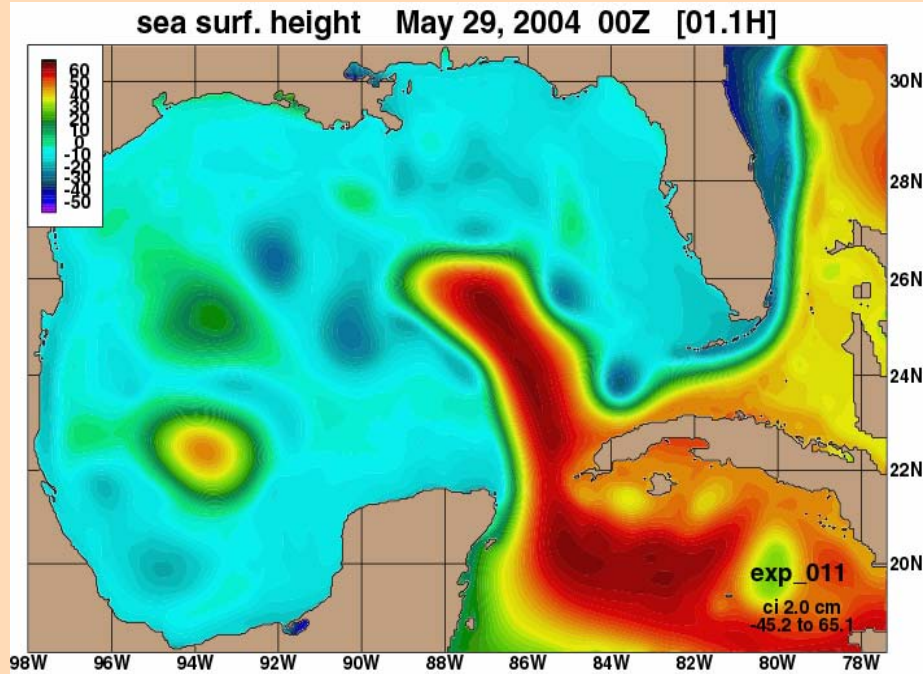
7-days, 5/24-31/2004,
Aqua-chla
Provided by
Viva Banzon, RSMAS
Satellite group



Noticeable
improvement
on positions of
Loop Current
and eddies

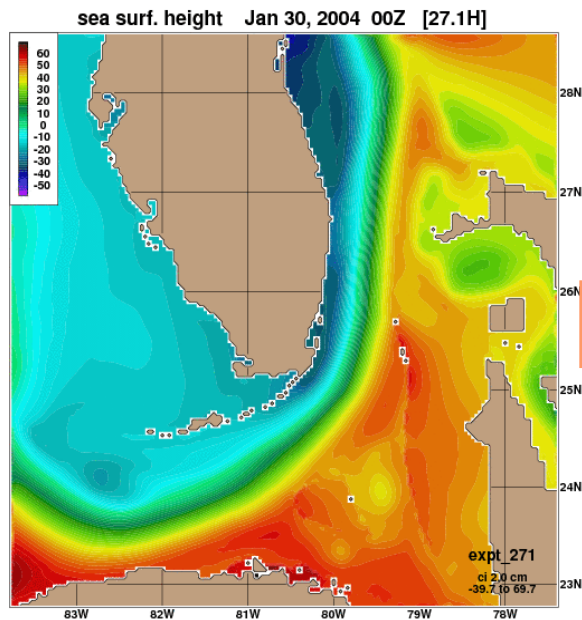
Free: Pat Hogan

NCODA: O-M. Smedstadt

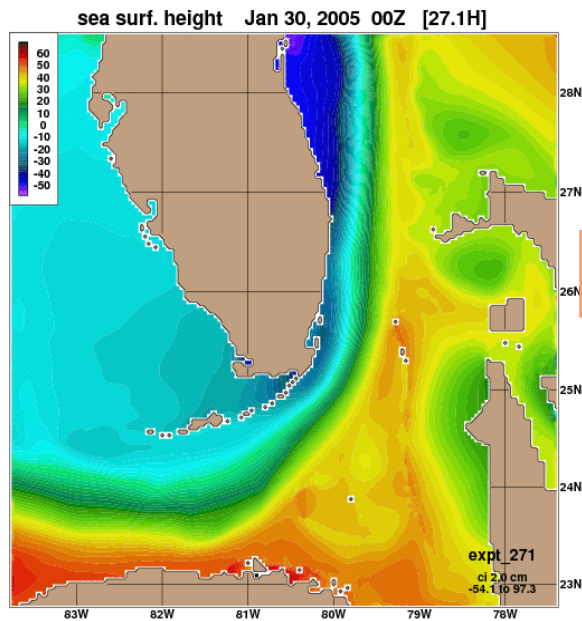
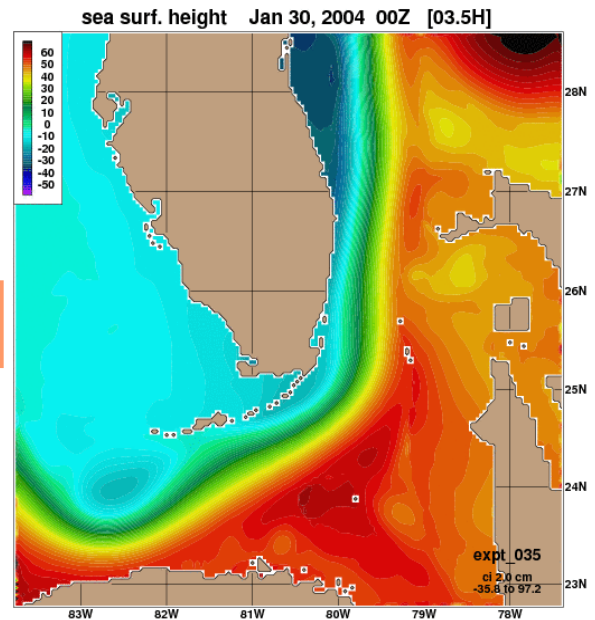


NCODA GOMh0.04 Nesting

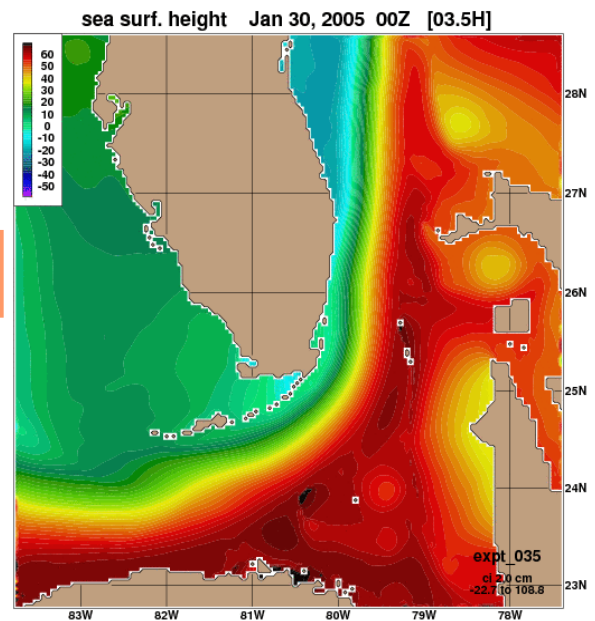
OI NATL0.08 Nesting



Jan 30, 2004

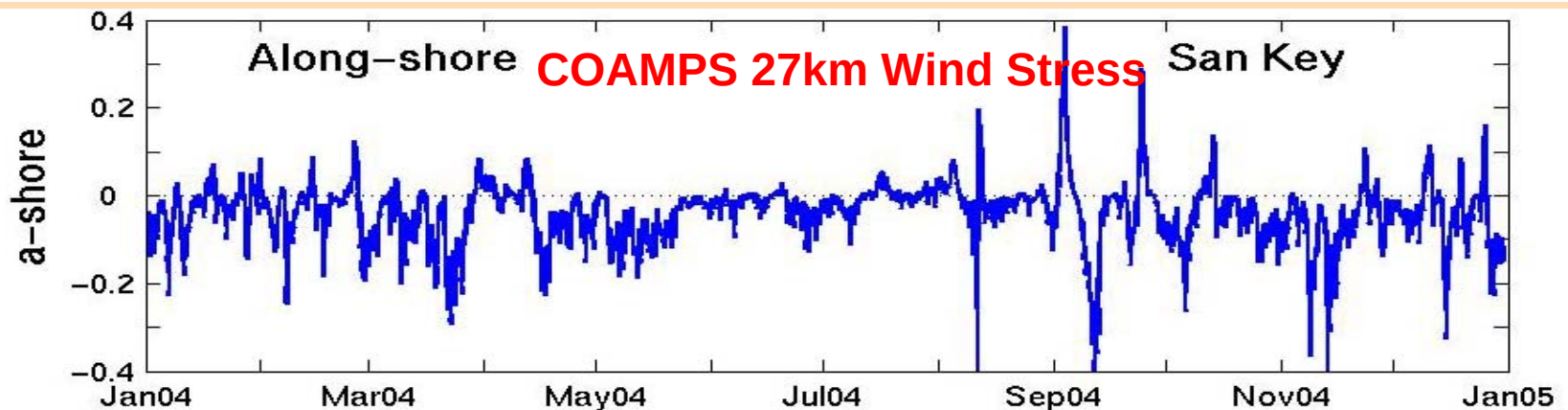
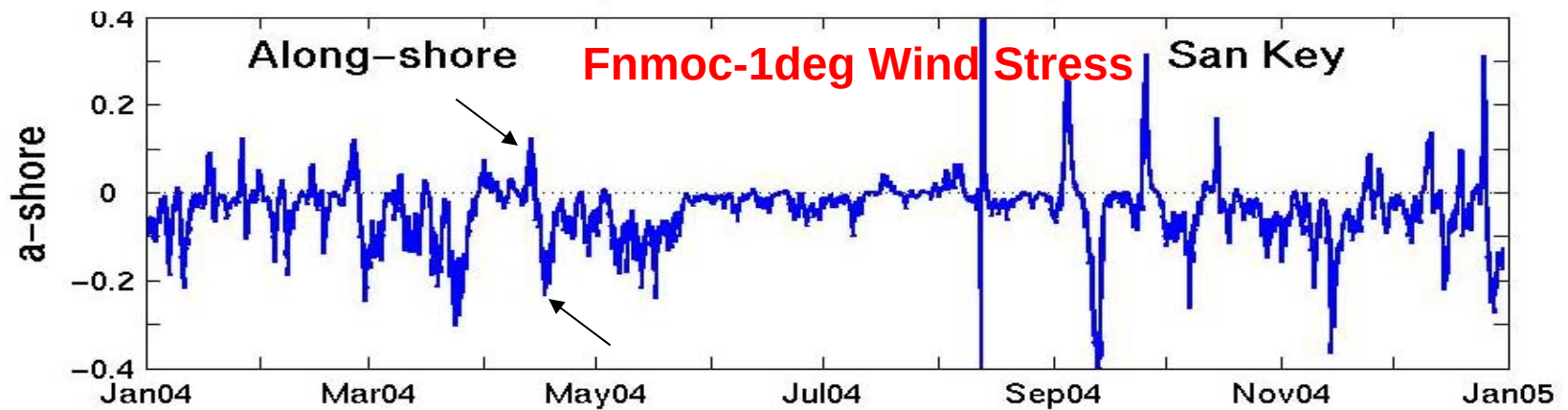
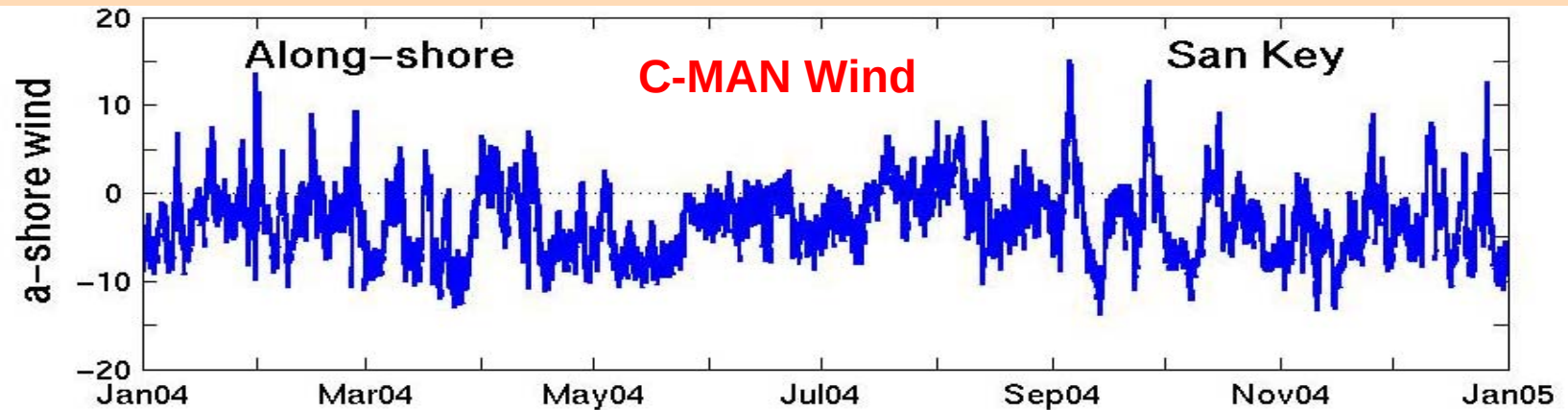


Jan 30, 2005



**Impact of
Atmospheric Forcing Resolution**
(NCODA BC's)

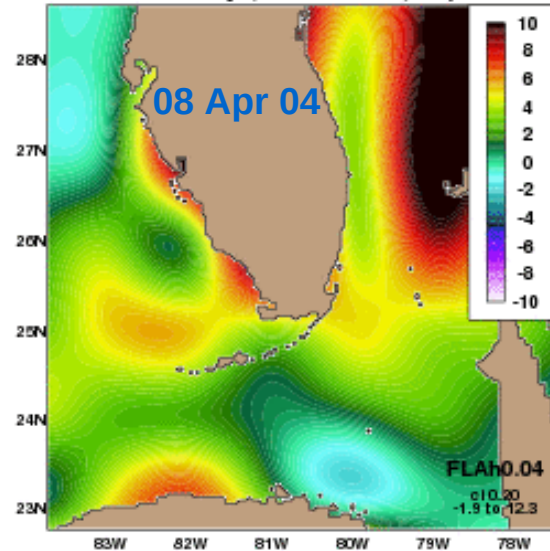
Winds & Stress: Sand Key 81.88W 24.46N 2004 $\text{rot}=73^\circ$



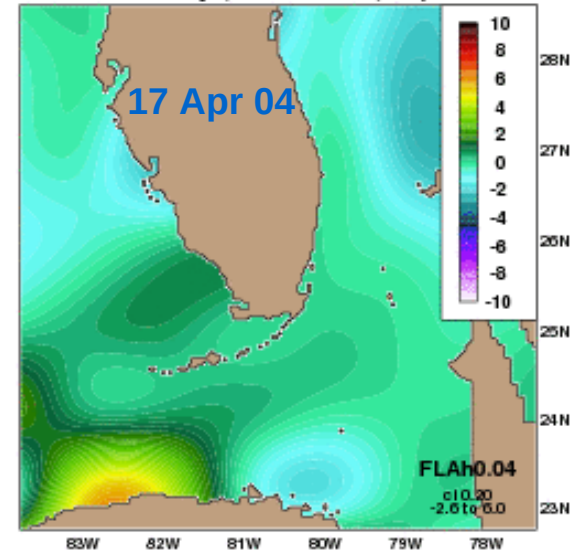
SoFLA-HYCOM: FLAh0.04 **Tau-y**

fnmoc 1-degree

fnmoc_1.00 tauy (0.01 N/m**2), Apr 08, 2004

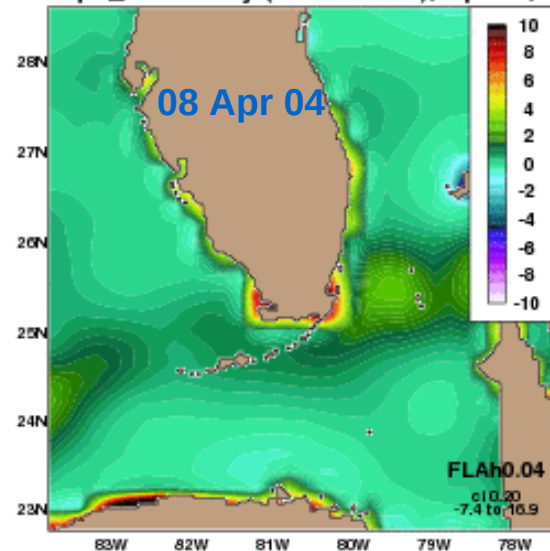


fnmoc_1.00 tauy (0.01 N/m**2), Apr 17, 2004

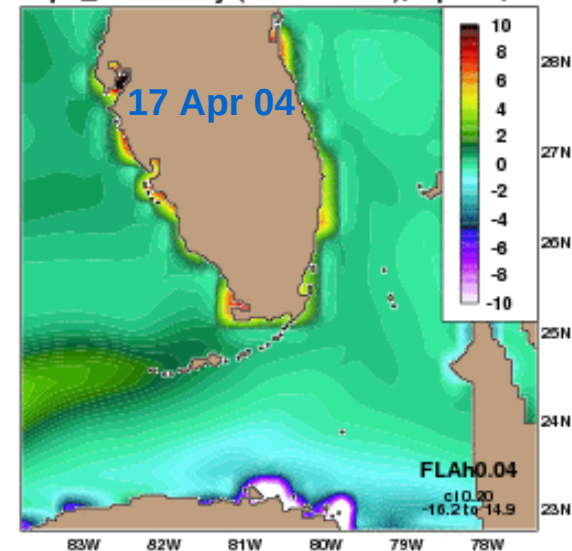


Coamps 27 km

coamps_27km tauy (0.01 N/m**2), Apr 08, 2004



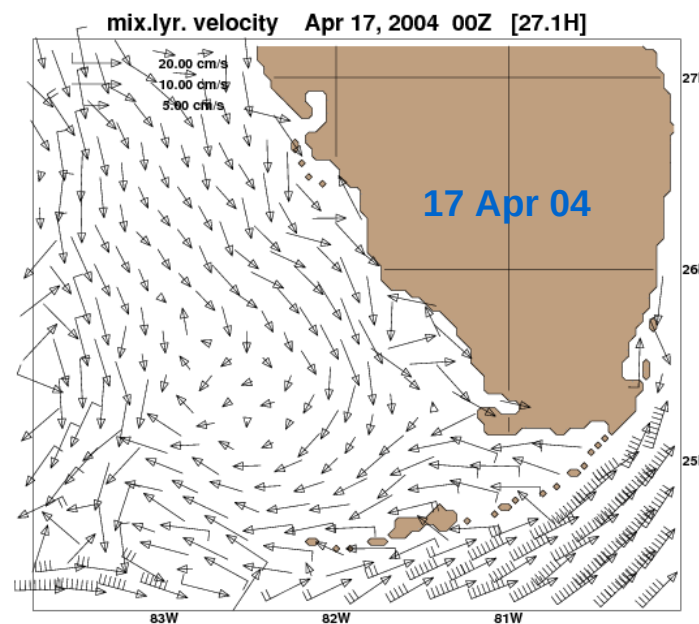
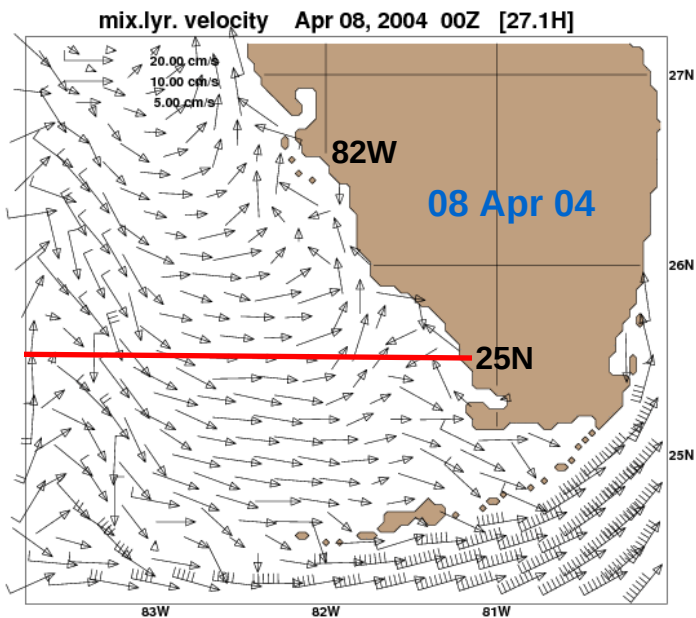
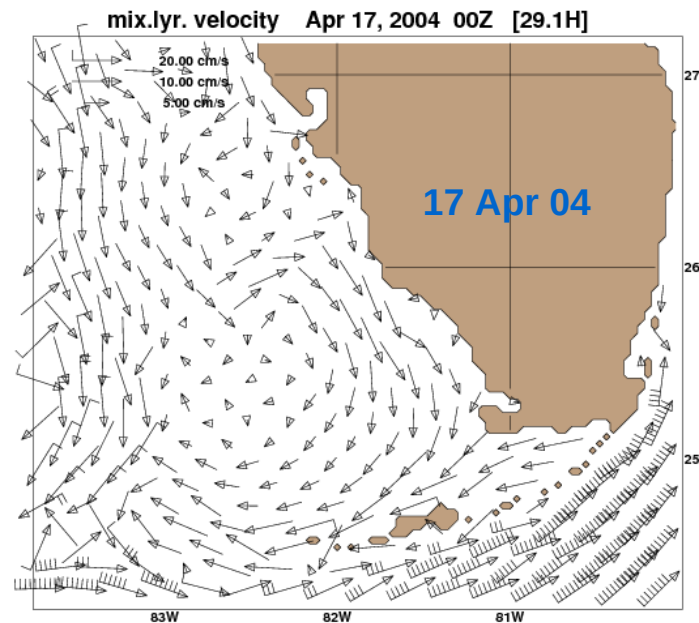
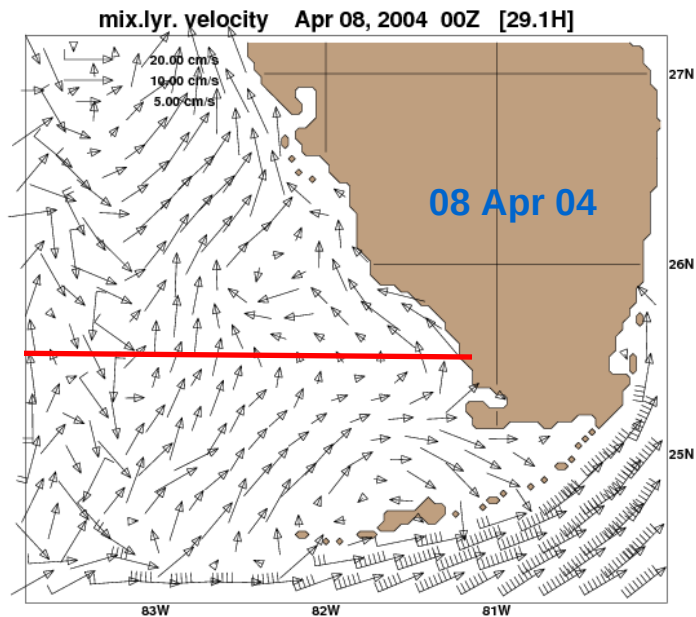
coamps_27km tauy (0.01 N/m**2), Apr 17, 2004



fnmoc 1-degree

SoFLA-HYCOM:
FLAh0.04 SVEL
West FL Shelf

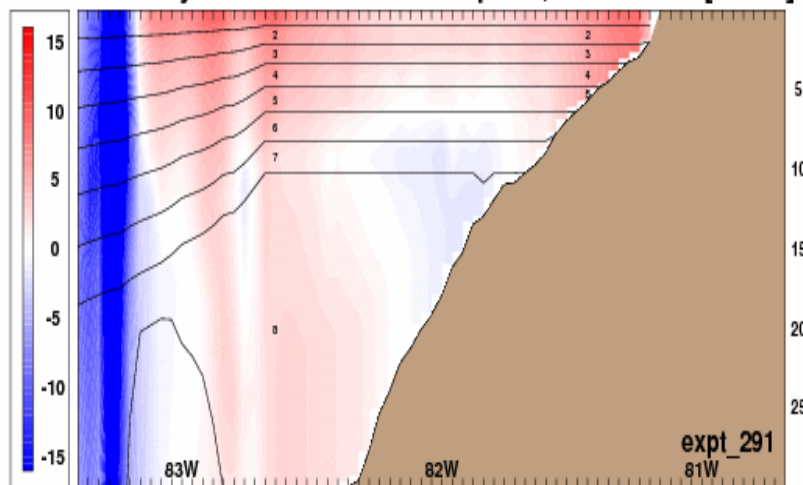
Coamps 27 km



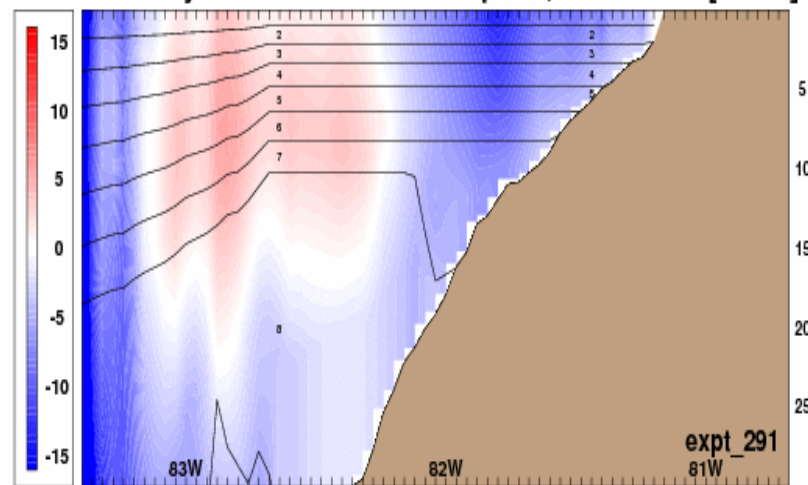
SoFLA-HYCOM: FLAh0.04 25°N v-Comp

fnmoc 1degree

v-velocity zonal sec. 25.48n Apr 08, 2004 00Z [29.1H]

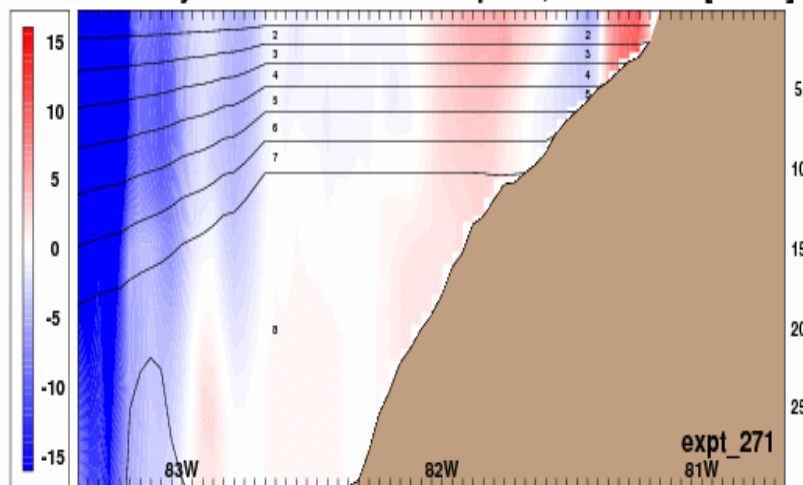


v-velocity zonal sec. 25.48n Apr 17, 2004 00Z [29.1H]

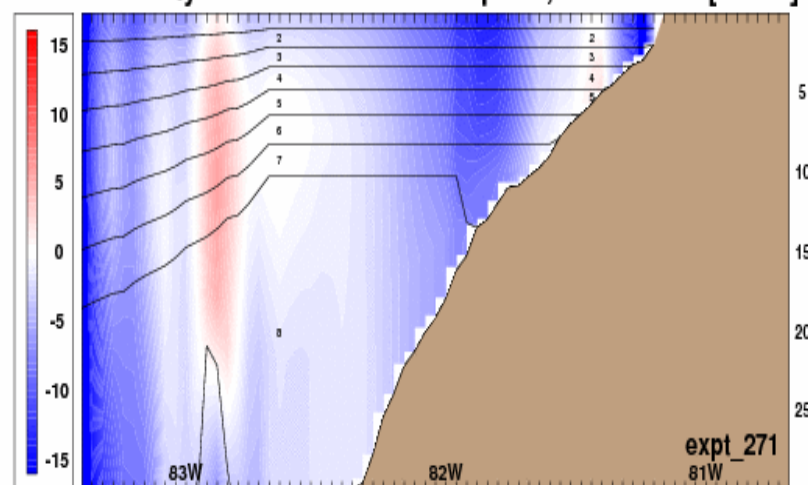


Coamps 27km

v-velocity zonal sec. 25.48n Apr 08, 2004 00Z [27.1H]



v-velocity zonal sec. 25.48n Apr 17, 2004 00Z [27.1H]

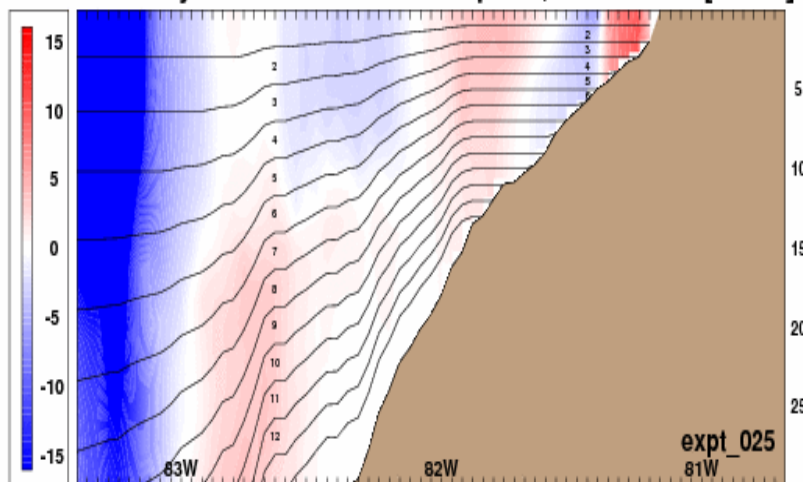


**Impact of
Vertical Model Resolution**
(coamps 27 km atmospheric forcing)

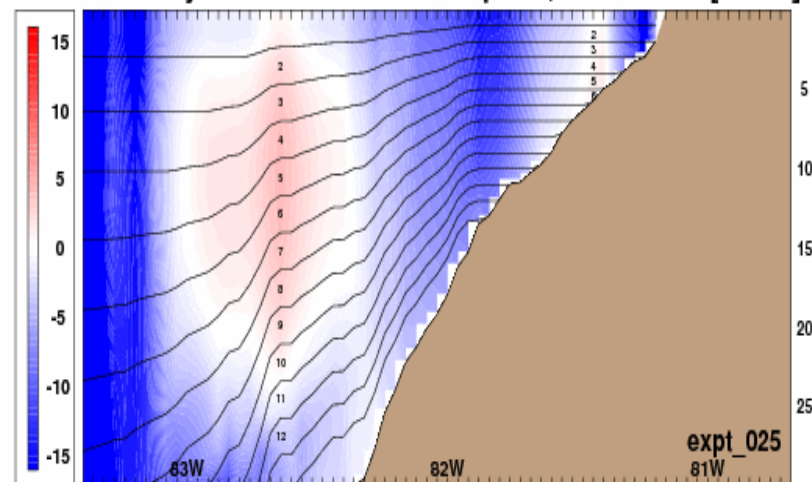
SoFLA-HYCOM: FLAh0.04 25°N v-Comp

k26

v-velocity zonal sec. 25.48n Apr 08, 2004 00Z [02.5H]

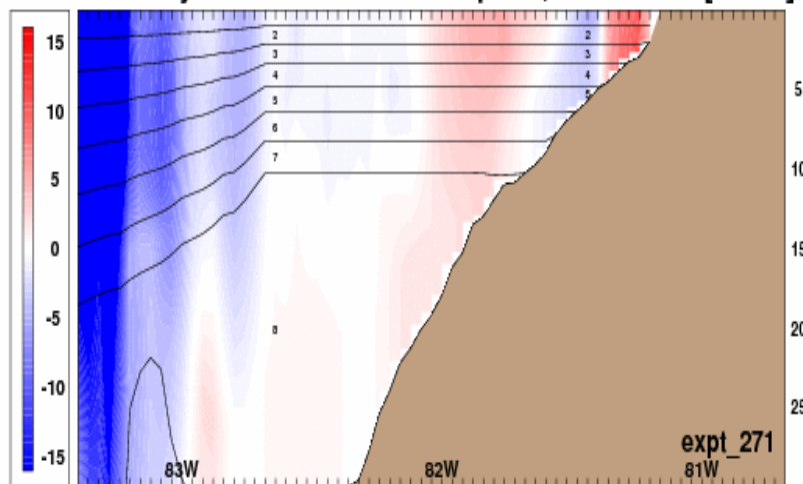


v-velocity zonal sec. 25.48n Apr 17, 2004 00Z [02.5H]

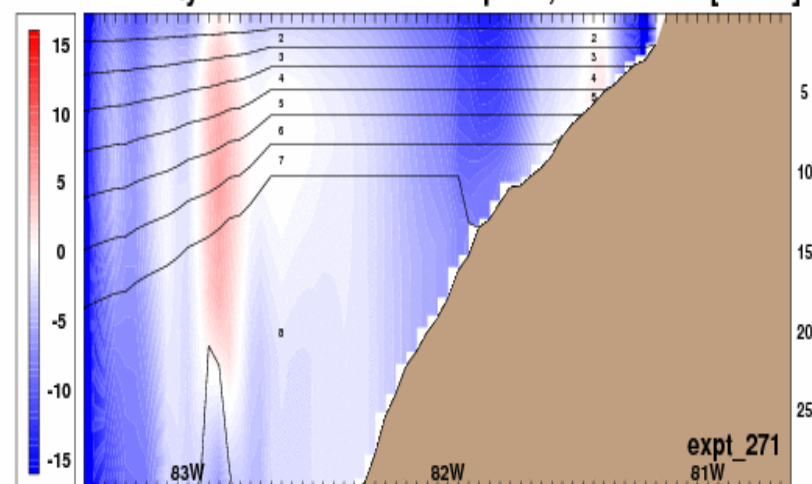


k20

v-velocity zonal sec. 25.48n Apr 08, 2004 00Z [27.1H]



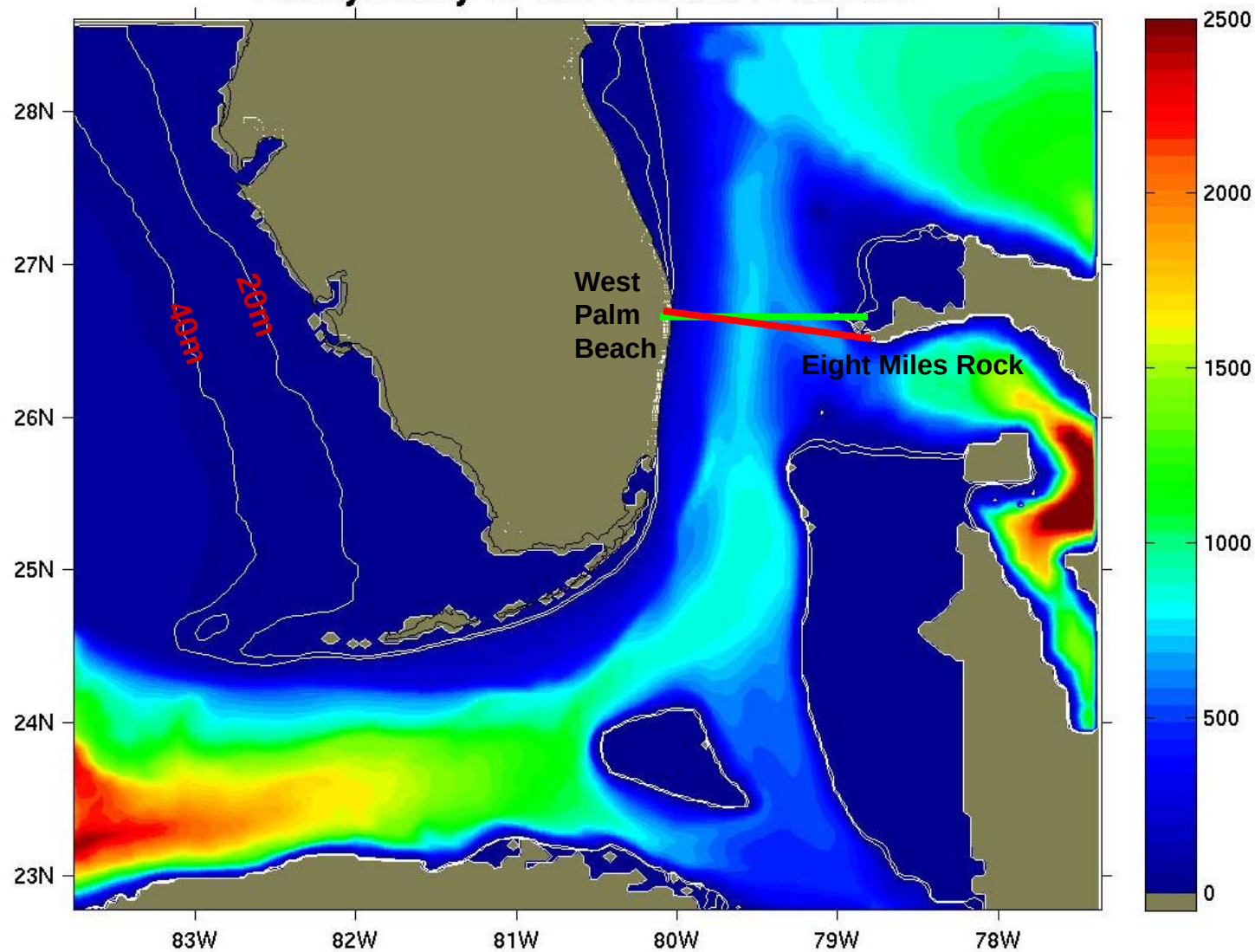
v-velocity zonal sec. 25.48n Apr 17, 2004 00Z [27.1H]



Florida Current Transport

Locations of the Cable and Model Sections

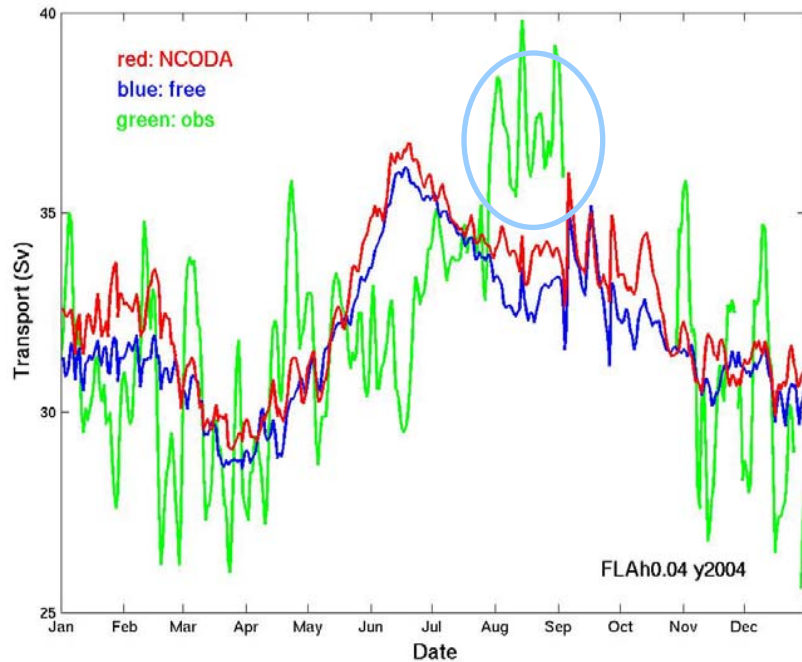
Bathymetry in SoFLAh0.04 Domain



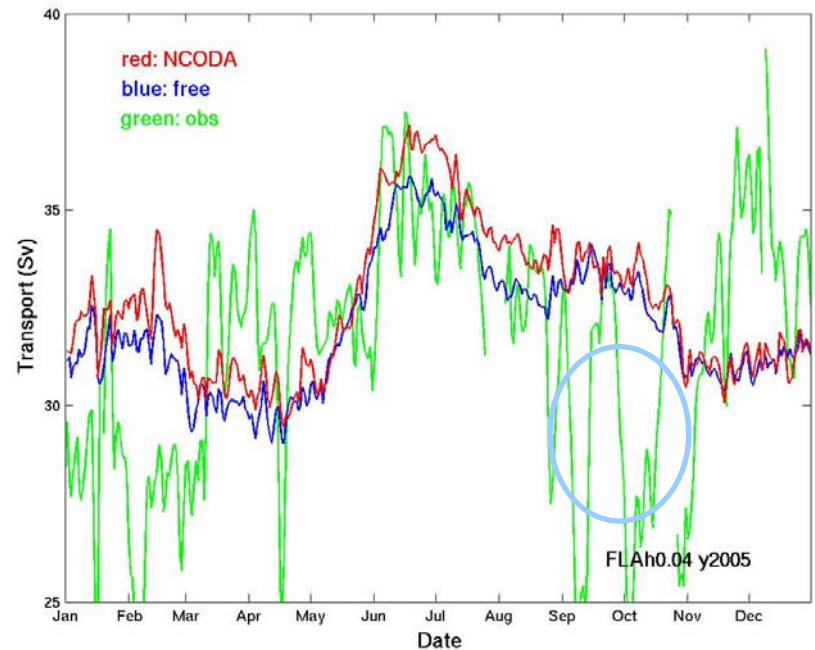
Cable

SoFLAh0.04

SOFLA-HYCOM: FC Transport at 26.7N



Daily Mean 2004



Daily Mean 2005

Statistic Characteristics: SoFLAh0.04

Florida Current Transport: 2004 and 2005

	Free	NCODA	Cable	Free	NCODA	Cable
Mean	31.85	32.46	31.81	32.02	32.62	31.38
STD	1.89	1.96	3.00	1.66	1.88	3.37

Year 2004

Year 2005

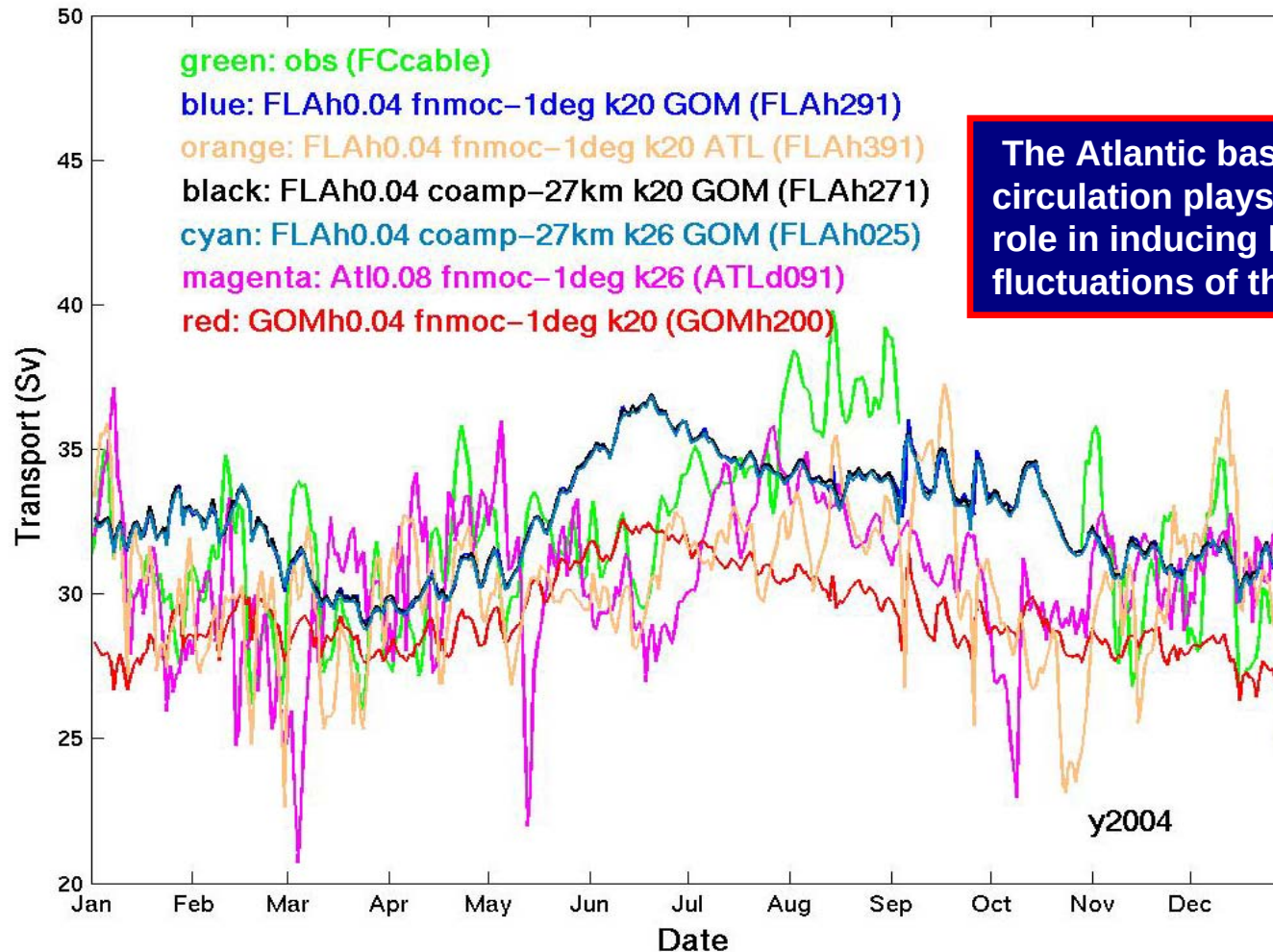
Missing Cable data:

2004: 9/04-10/28; 12/26-12/28

2005: 7/26-8/03; 10/25-10/26; 12/08

Model data for those days are removed
before computing the means and stds.

Cable Data and HYCOM: FC Transport at 26.7N Year 2004

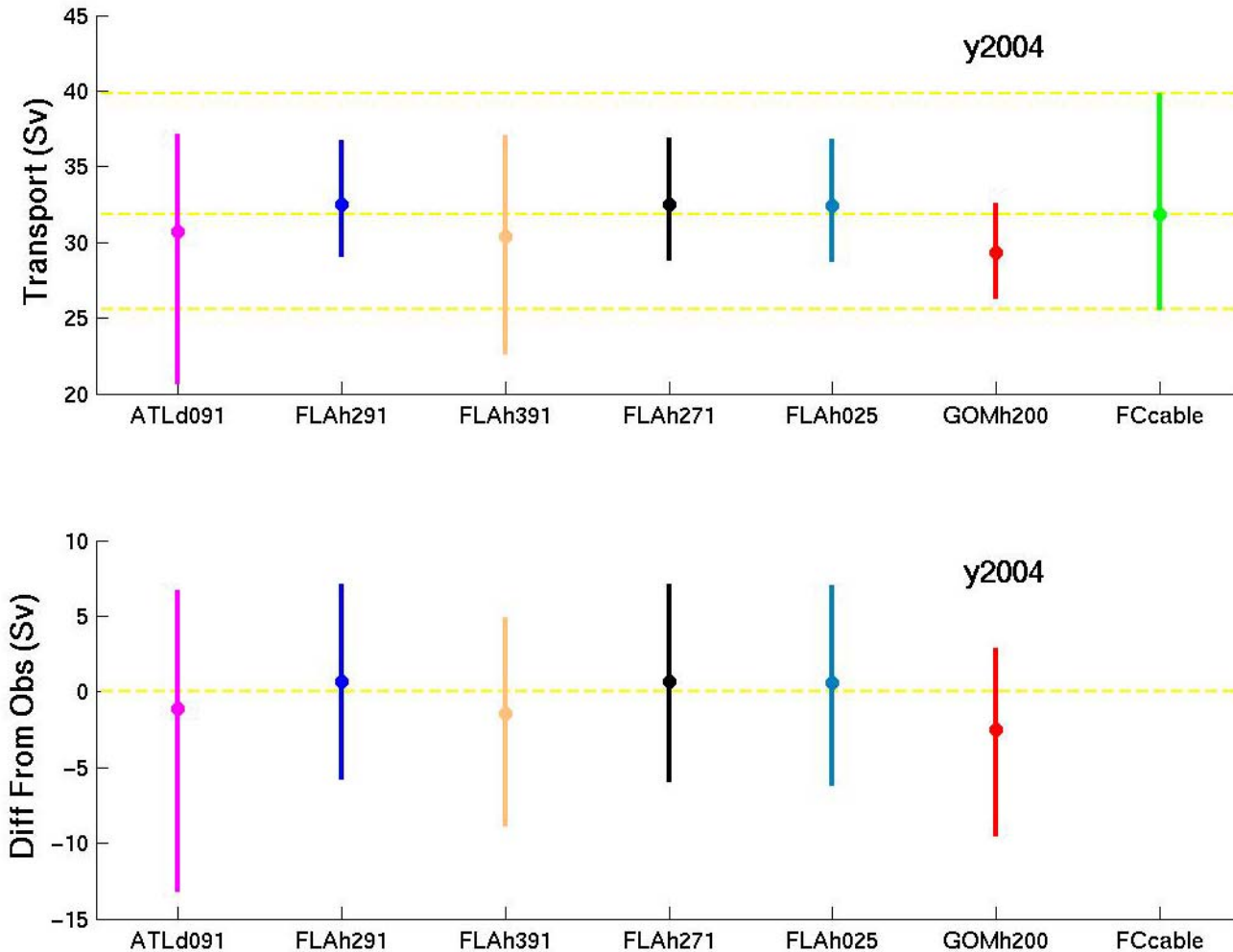


The Atlantic basin-wide circulation plays an important role in inducing larger fluctuations of the FC transport

FC transport at 27°N is not sensitive to the current changes in resolution of the local atmospheric forcing or the adopted increase in vertical layers

FC transport of ATLd091 and archive files of GOMh200 were provided by Ole Martin Smedstad, NRLSSC.

Cable and HYCOM: FC Transport at 26.7N Statistics



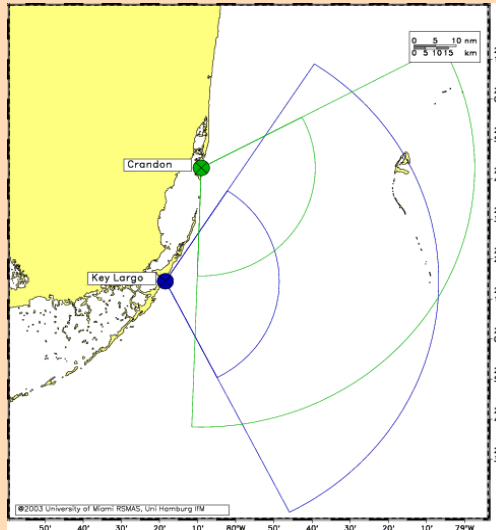
The dots denote the means and the bars denote the range of values: from the minimum to maximum.

Future Work

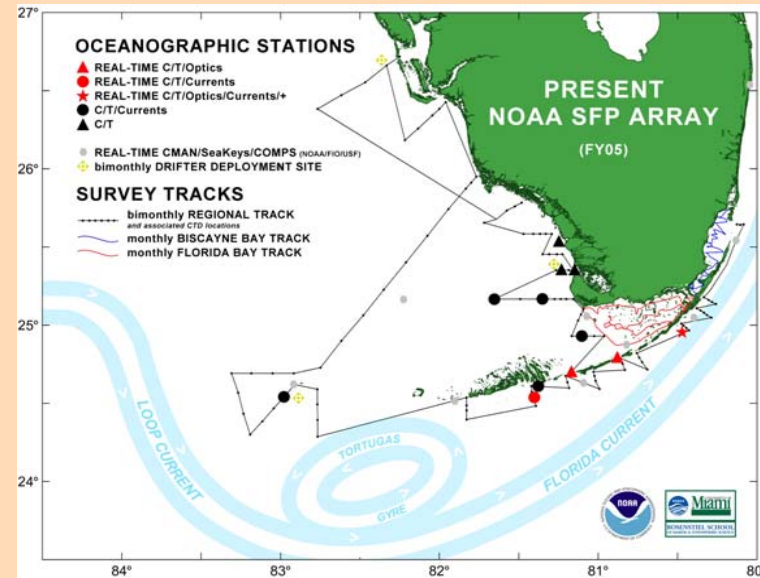
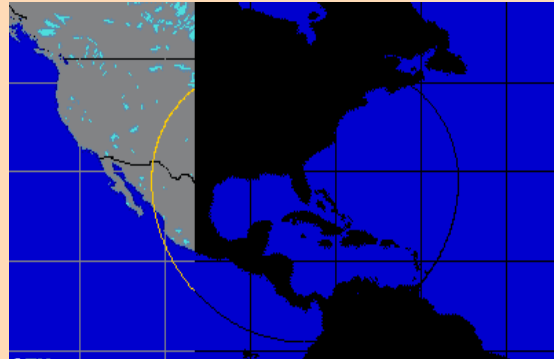
- **Simulation nested in GoM with NAT BC's**
- **Tides**
- **Comparison to in-situ data**
- **Simulations in support of nested FKEYS and coupled BOLTS models**

Local Observational Data Coverage in the SoFLA Domain

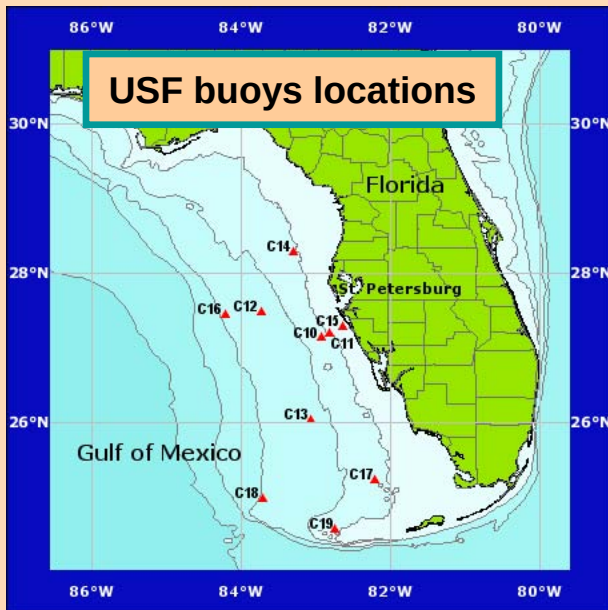
WERA coverage



CSTAR coverage



USF buoys locations



- ▲ : moorings
- : c-man stations
- DT: Dry Tortugas
- LK: Looe Key
- san: Sand Key
- smk: Sombrero Key
- SR: Sharker River
- CR: Caloosahatchee River
- : Cable

