

Present and future (NCODA) assimilation in the near real-time Atlantic system

*O. M. Smedstad
Planning Systems Inc.*

*J. A. Cummings, H. E. Hurlburt and A. J. Wallcraft
Naval Research Laboratory*

*W. C. Thacker, H. Kang
NOAA*

*E. P. Chassignet
University of Miami*

<http://hycom.rsmas.miami.edu>

*HYCOM NOPP GODAE Meeting
27-29 October 2004
RSMAS, Miami, FL*

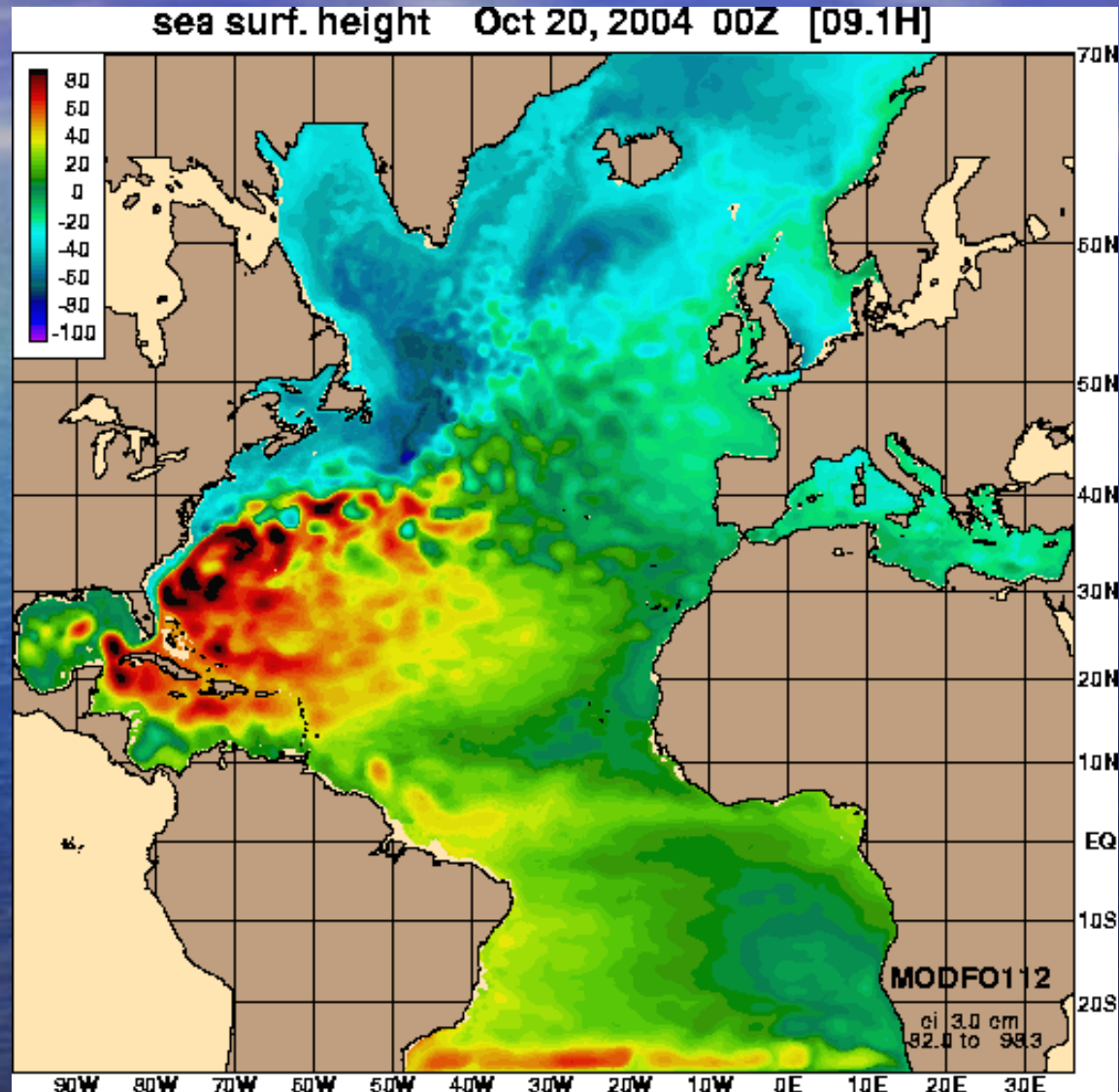
Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE OCT 2004		2. REPORT TYPE		3. DATES COVERED 00-00-2004 to 00-00-2004	
4. TITLE AND SUBTITLE Present and future (NCODA) assimilation in the near real-time Atlantic system				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory,Stennis Space Center,MS,39529				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 21	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Present system

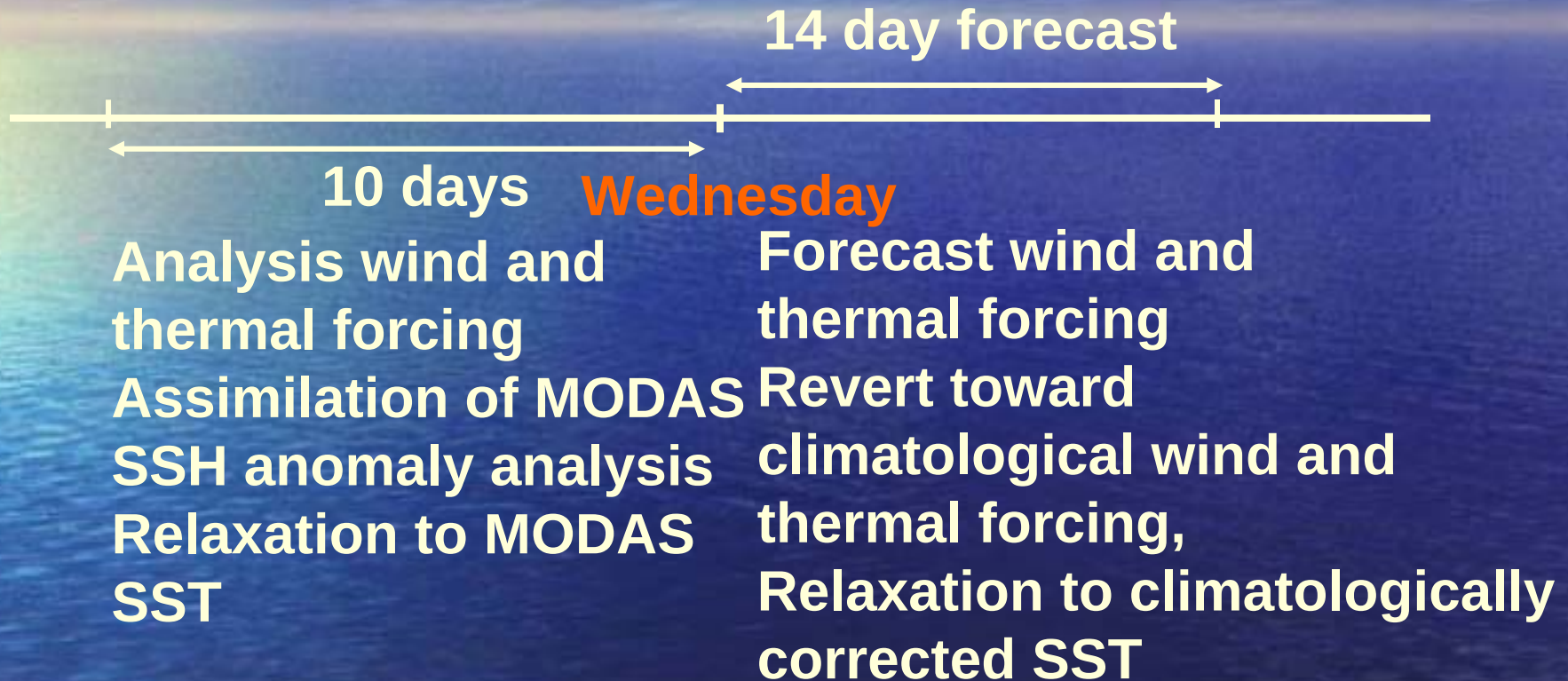
- **Running in near real-time**
 - . Assimilates the satellite altimeter analysis from the MODAS operational system at the Naval Oceanography Office (NAVOCEANO)
 - . Mean SSH from the 1/12° MICOM (ECMWF)
 - . Vertical projection via the Cooper and Haines technique (1996, JGR)
 - . FNMOC/NOGAPS atmospheric forcing
 - . Relaxation to the MODAS SST analysis
- **Automated scripts run the system from the preprocessing of the forcing fields to the post processing of the results**
- **Participating in the MERSEA model inter-comparison**

1/12° ATLANTIC HYCOM SSH

20 October, 2004



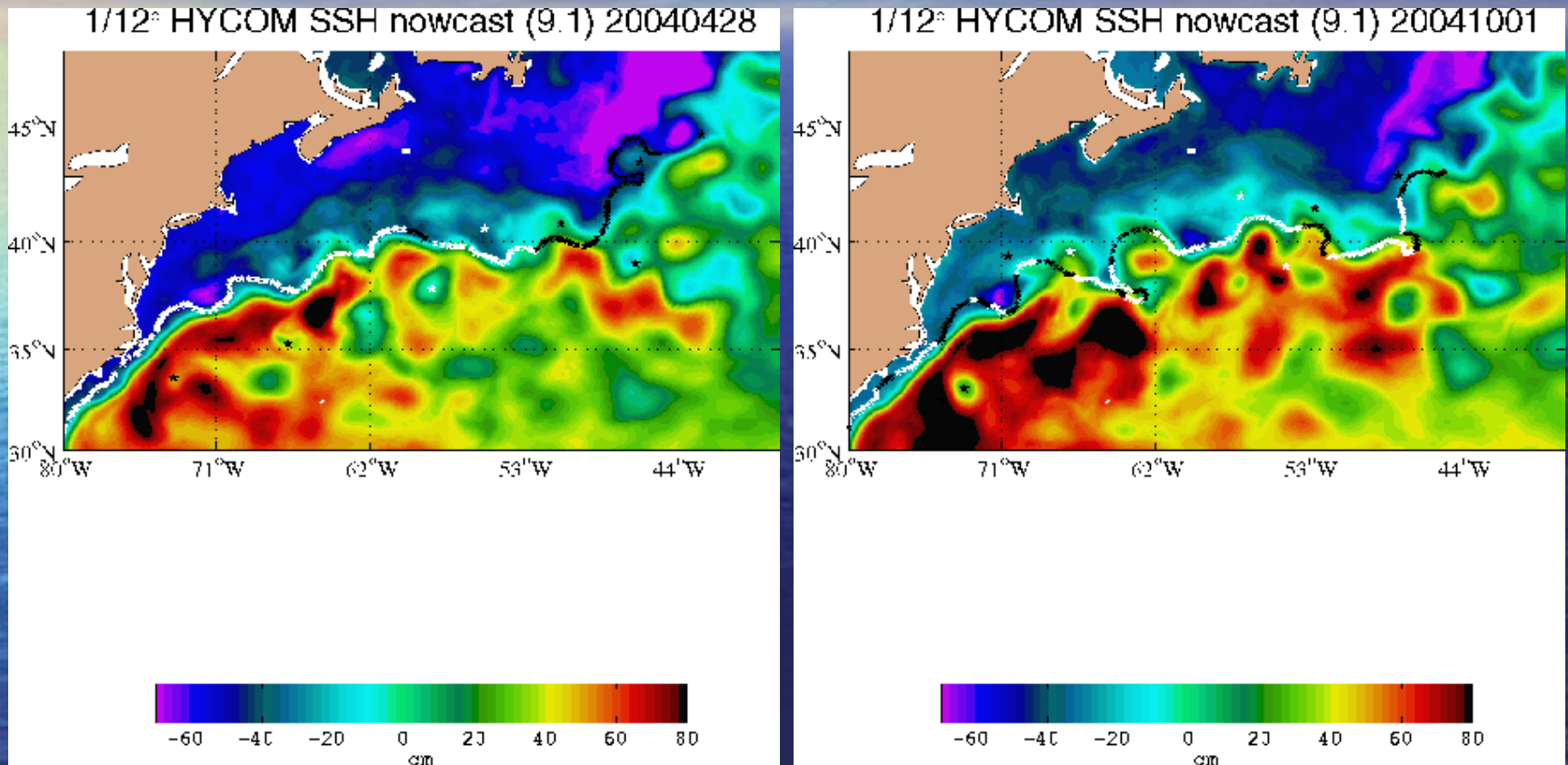
Near real-time system



<http://hycom.rsmas.miami.edu>

1/12° Atlantic HYCOM

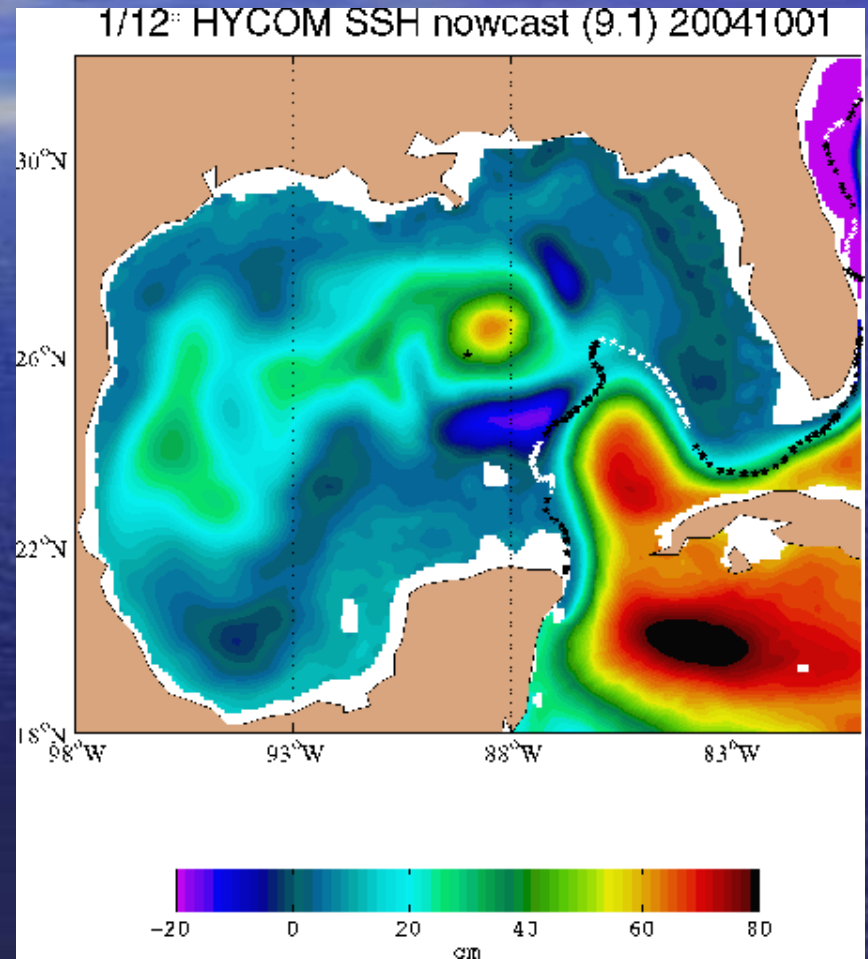
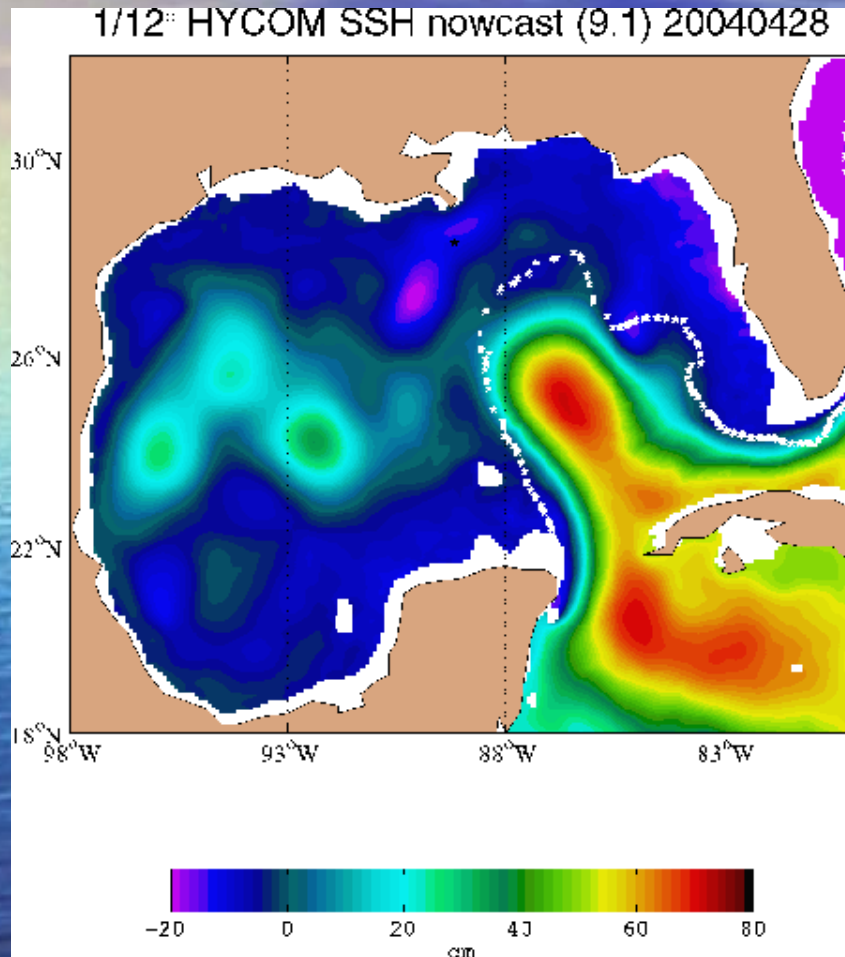
SSH in Gulf Stream region



White/black line is the frontal analysis of MCSST observations performed at NAVOCEANO. Black line represents data more than four days old.

1/12° Atlantic HYCOM

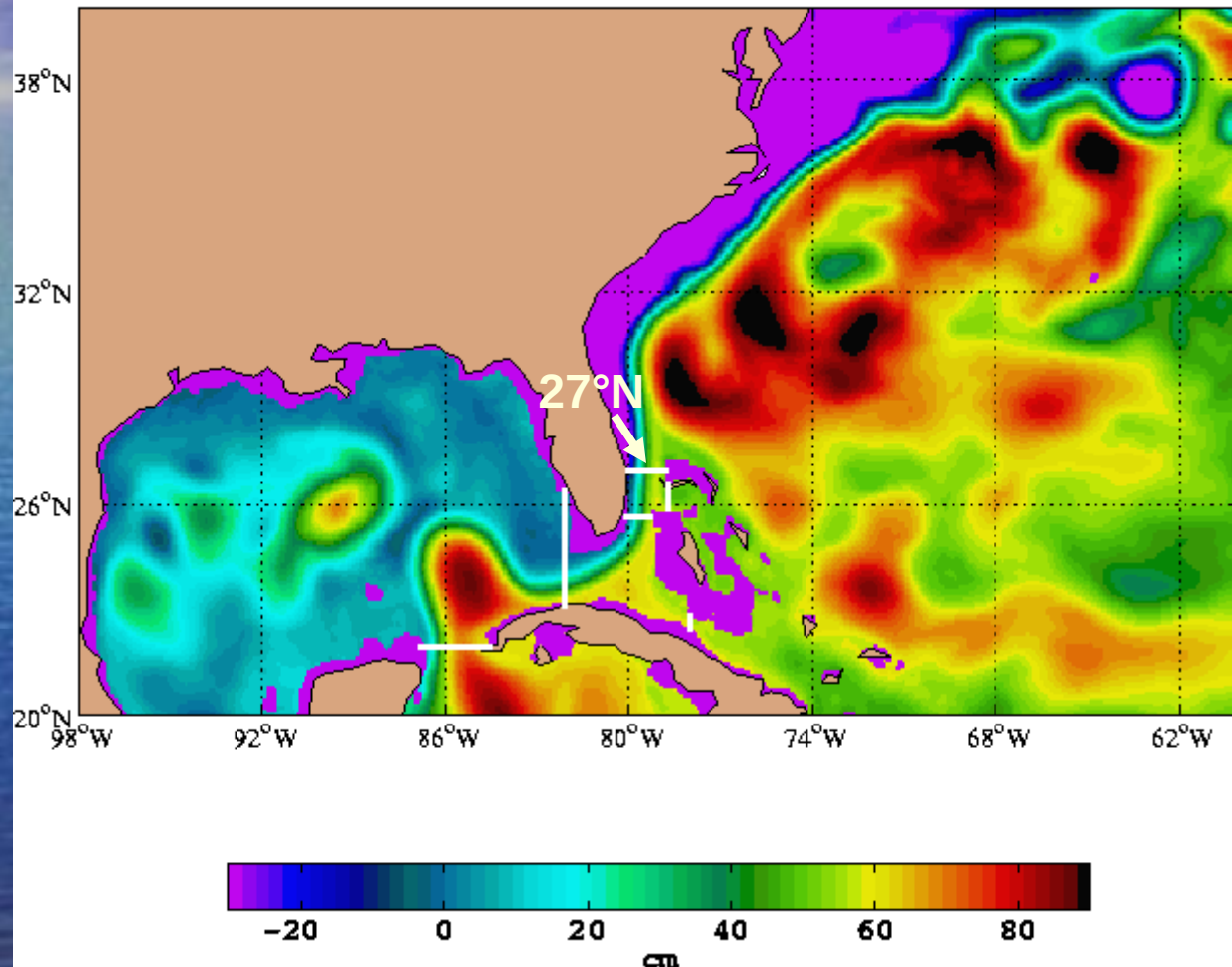
SSH in Gulf of Mexico region



White/black line is the frontal analysis of MCSST observations performed at NAVOCEANO. Black line represents data more than four days old.

Transport sections

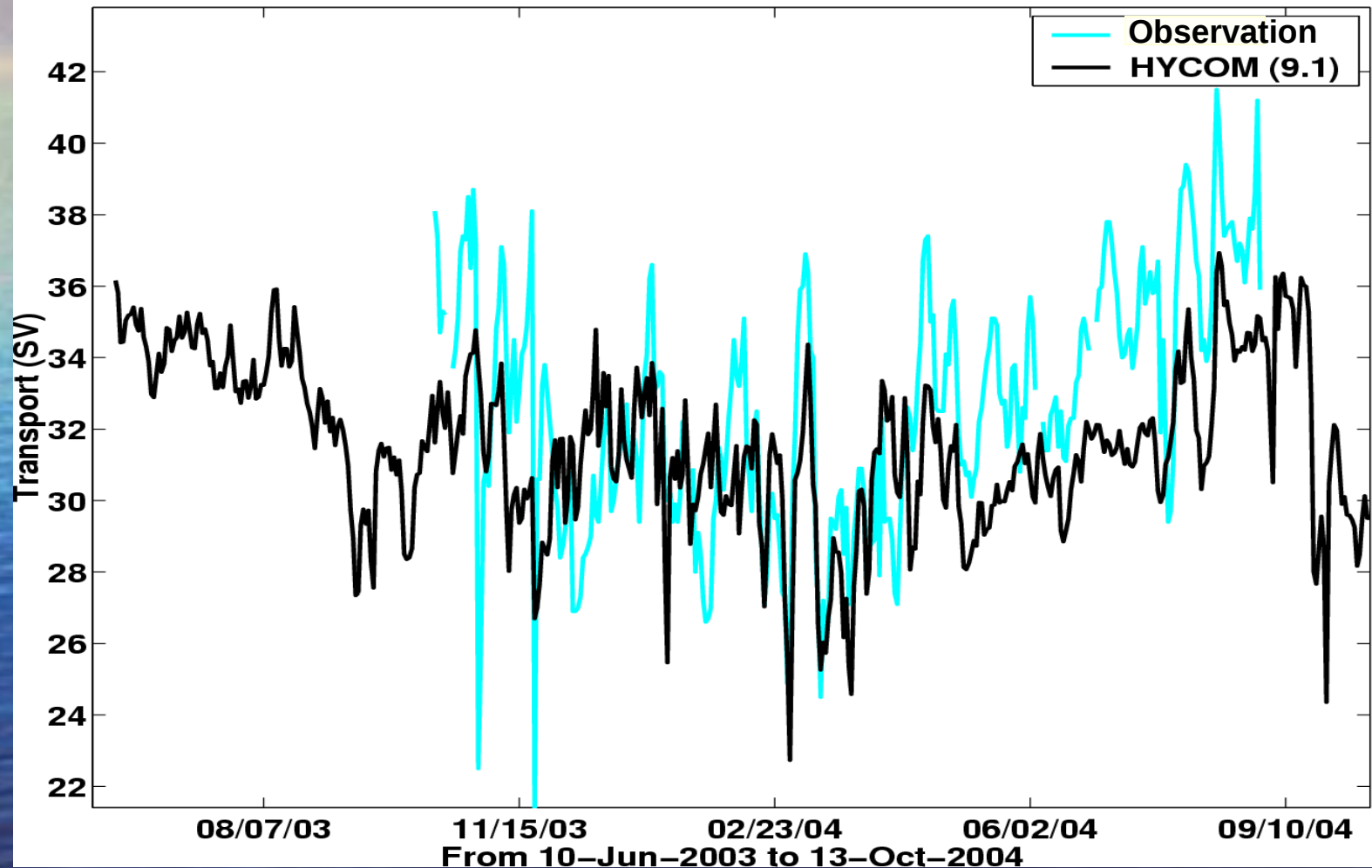
1/12° HYCOM SSH nowcast 20041020



Florida Current transport at 27°N

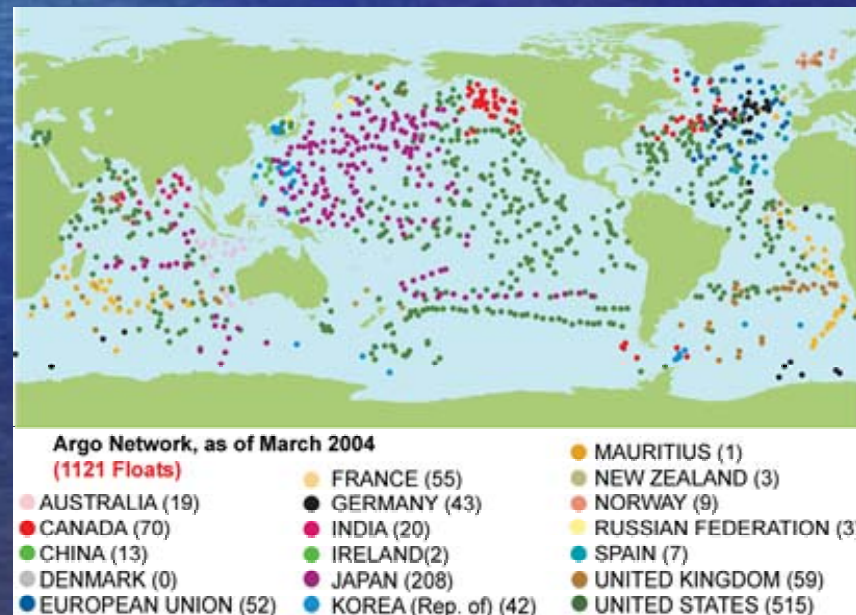
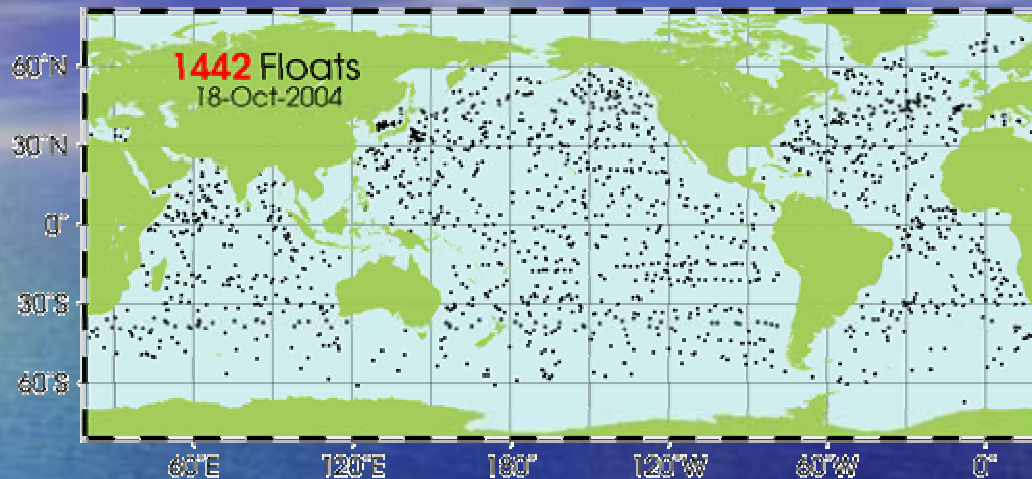
HYCOM ATLd0.08–9.1–nowcast: STACS (80.08W–78.72W, 26.95N–26.95N)

Layer 1–26 Mean: 31.60 Min: 22.73 Max: 36.93 Std: 2.31 Corr: 0.60

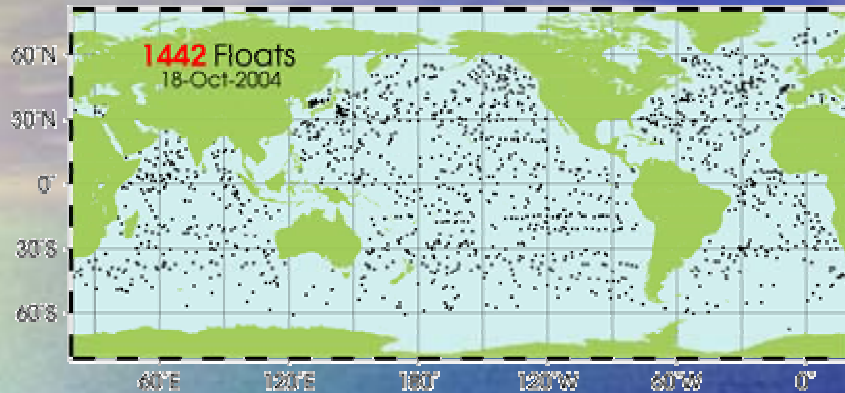


ARGO profiles

<http://www.argo.ucsd.edu/>



ARGO profiles

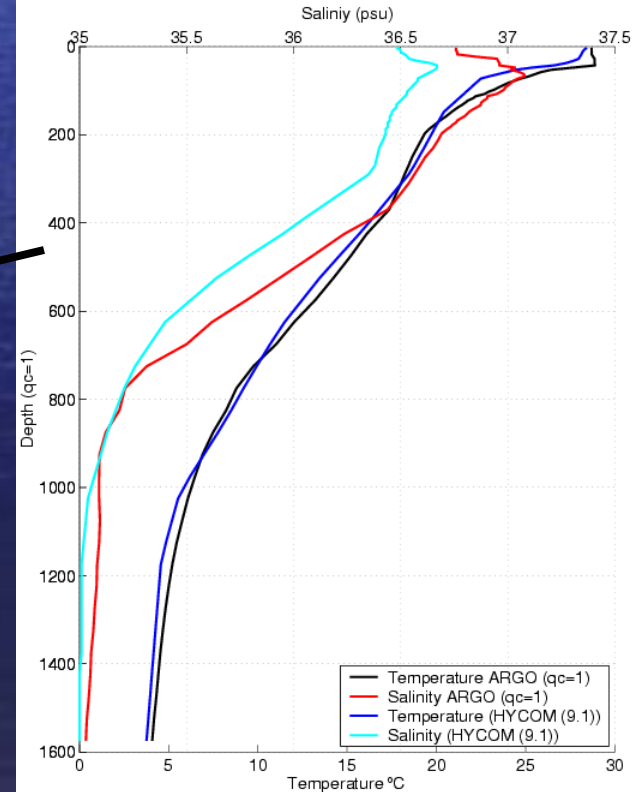
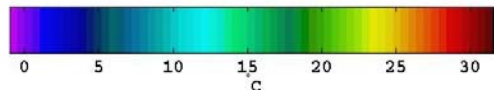
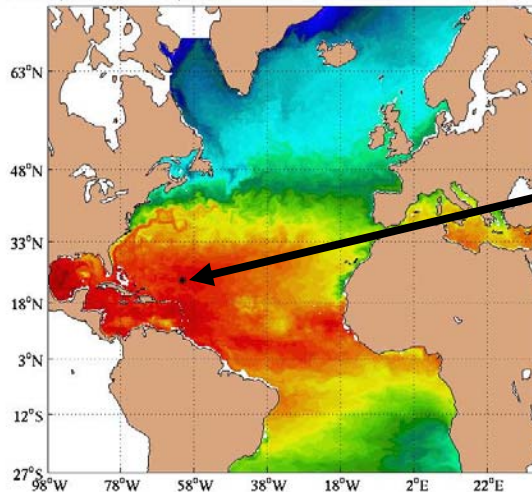


<http://www.argo.ucsd.edu/>

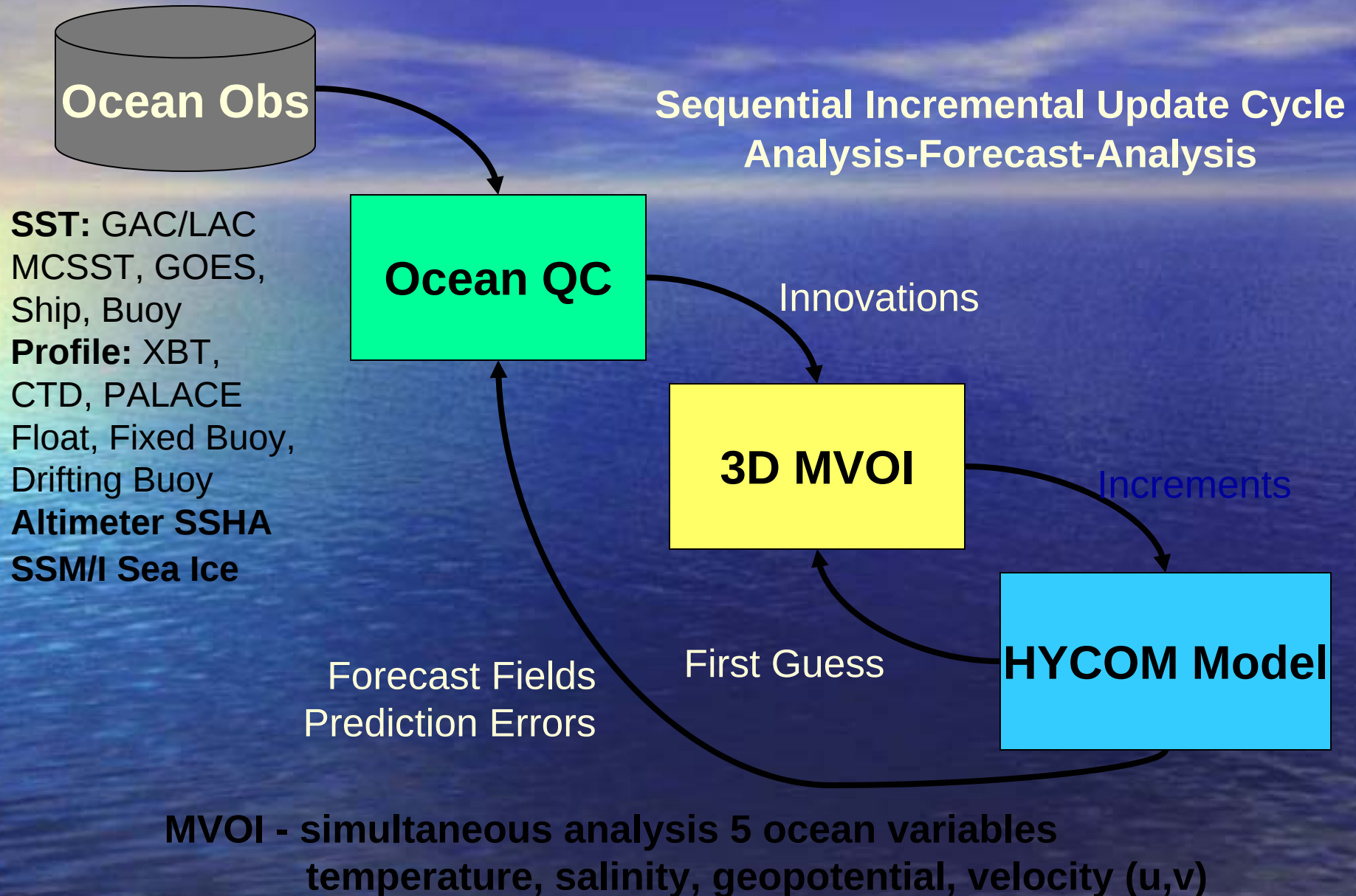
11 September 2004
23.635°N, 61.148°W

ARGO/HYCOM(9.1) (4900559) Date: 20040911 LAT: 23.635 Lon: -61.146

1/12° HYCOM SST 20040921 nowcast (9.1)
ARGO positions for platform 4900559 from 20040911 to 20040921



NRL Coupled Ocean Data Assimilation (NCODA)

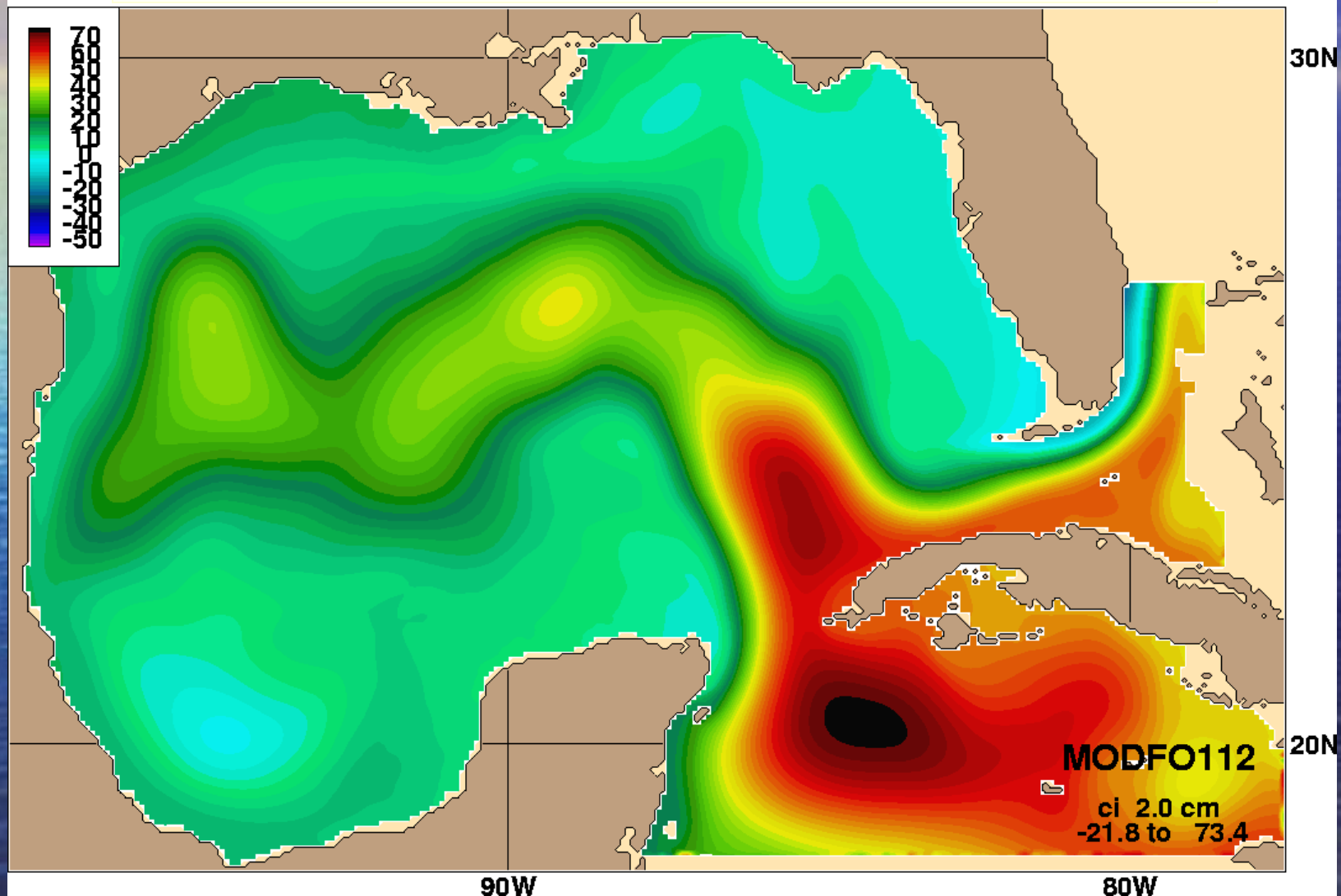


GULF OF MEXICO MODEL CONFIGURATION

- Horizontal grid: $1/12^\circ$ (258 x 175 grid points, 6.5 km spacing on average)
- 18°N to 31°N
- 20 vertical coordinates
- Bathymetry: 5m coastline
- Surface forcing from FNMOC/NOGAPS
- Monthly river runoff
- Nested Boundary:
relaxation to the $1/12^\circ$ Atlantic HYCOM T and S, U and V along open boundary, (free running in these experiments)

1/12° GOM HYCOM MEAN SSH

September 1999 - June 2000



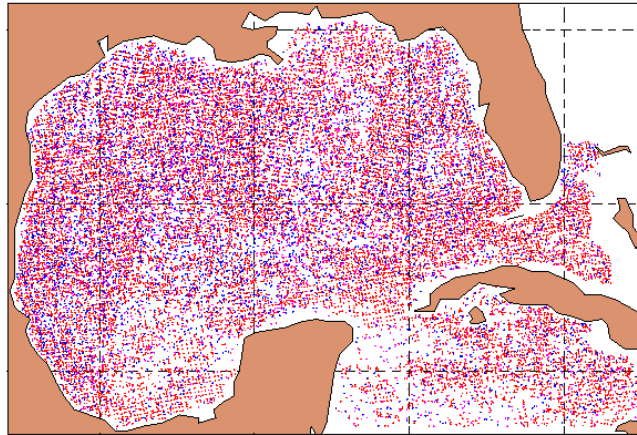
Update HYCOM restart file

- NCODA 3D MVOI analysis on z-grid
 - total field and increments from the first guess (model forecast)
- Use total field and convert from z-space to HYCOM space when updating the restart file, (expt_08.3)
- Use the increments to update T, S (and ρ) in the restart file. Let hybgen move the interfaces, (expt_08.4)
- A new analysis once a week in these experiments

NCODA observations, 17 May 2000

Satellite SST

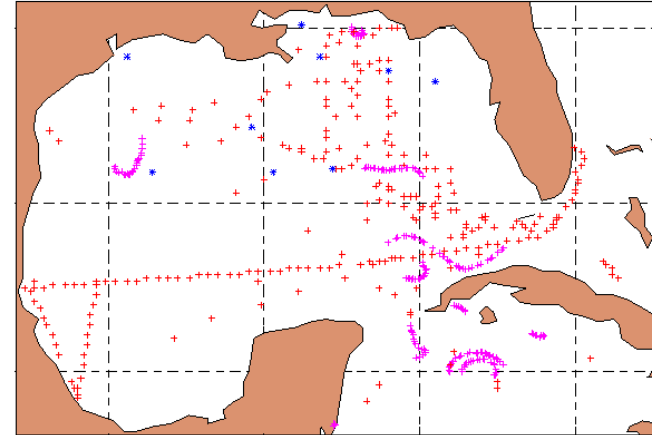
Satellite SST 17 May 00 00Z 9 km grid



GAC Day GAC Night GAC Rlx Day GOES Day GOES Night LAC Day LAC Night

In situ SST

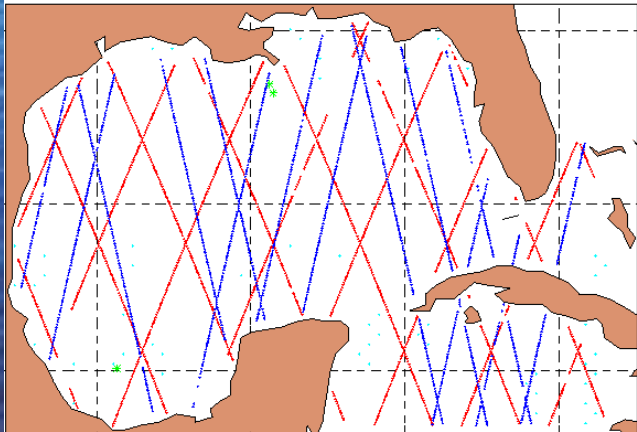
In Situ SST 17 May 00 00Z 9 km grid



Sfc Ship Fixed Buoy Drift Buoy Sea Ice SST Climate CMAN SST Analyzed SST

Satellite altimetry

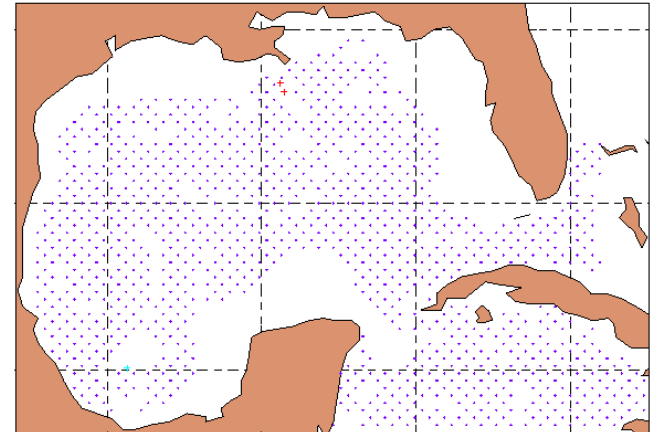
SSH Observations 17 May 00 00Z 9 km grid



Topex ERS2 GFO Jason Envisat In situ Suppl

Profile "observations"

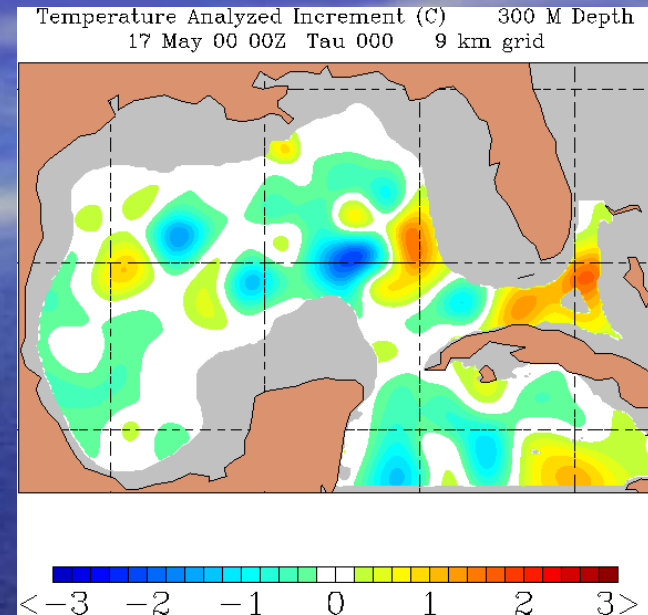
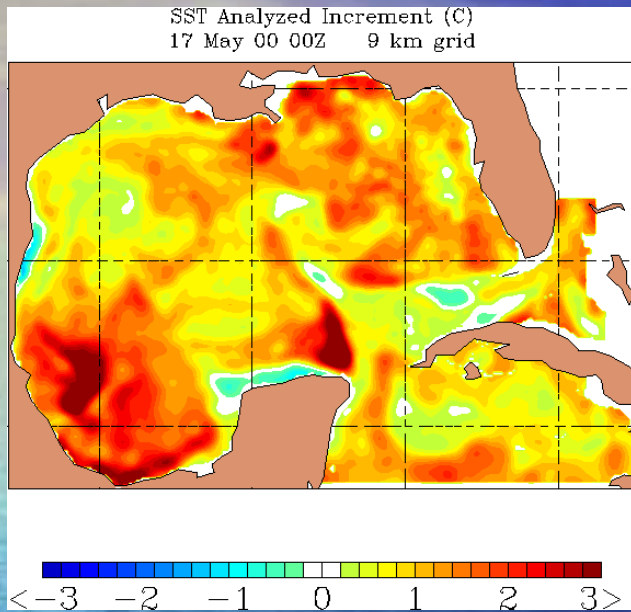
Profile Observations 17 May 00 00Z 9 km grid



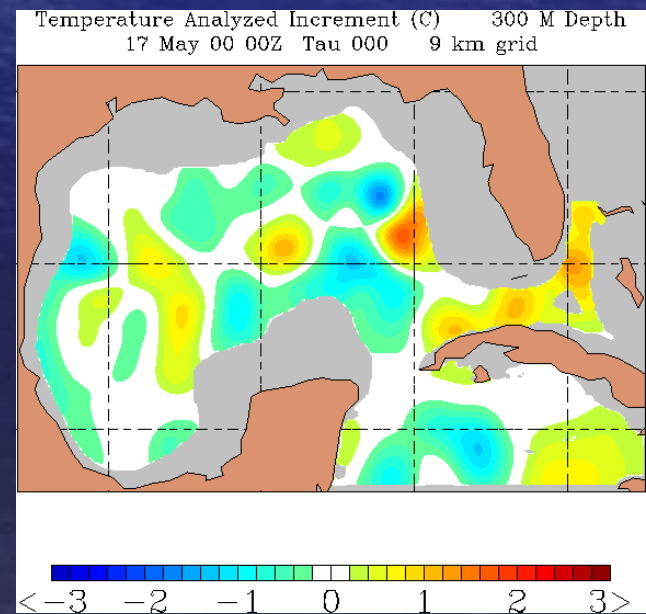
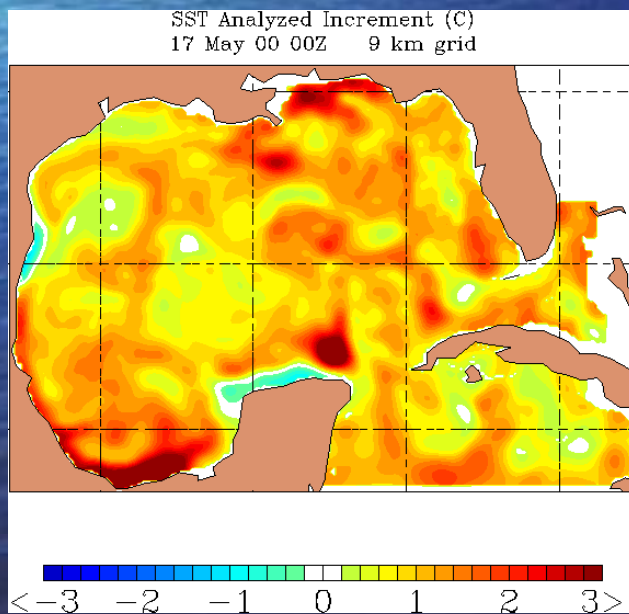
XBT TESAC PALACE Float Fixed Buoy Drifting Buoy MODAS Syn MODAS Suppl DIRECT Syn

NCODA increments 17 May 2000

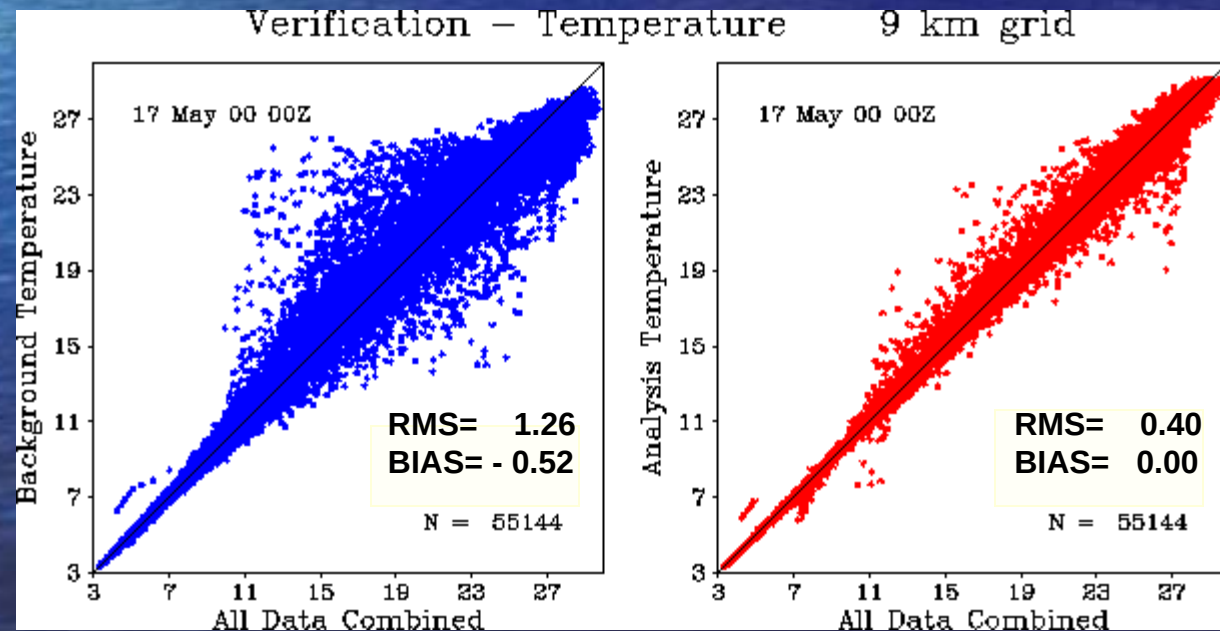
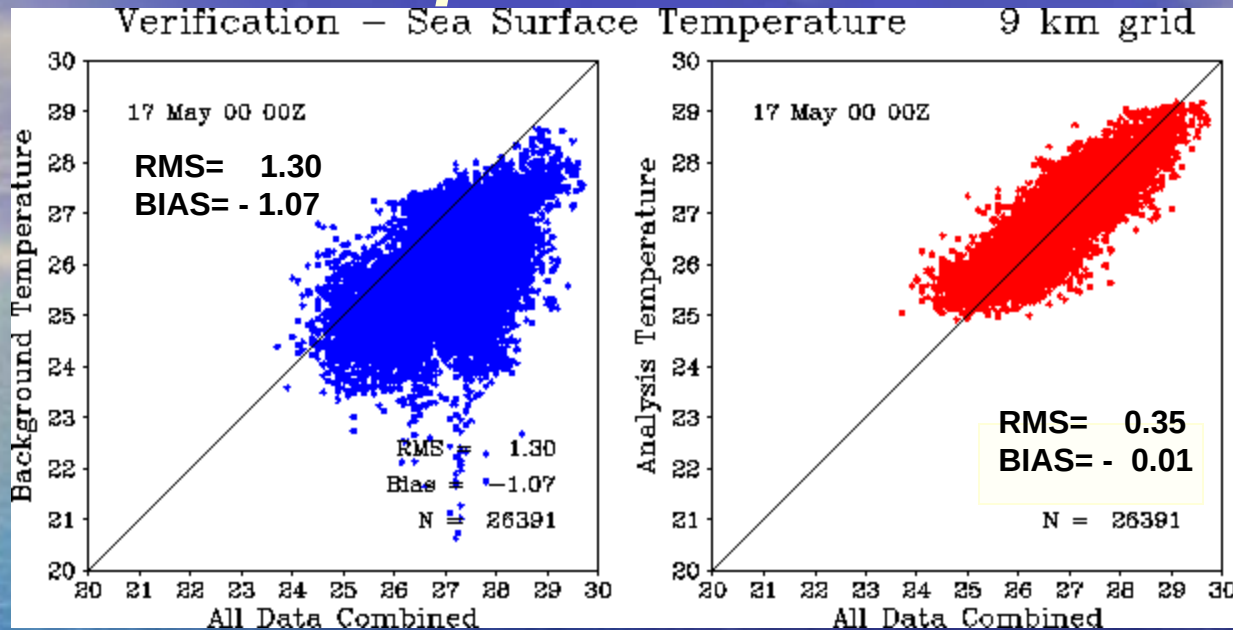
(08.3)



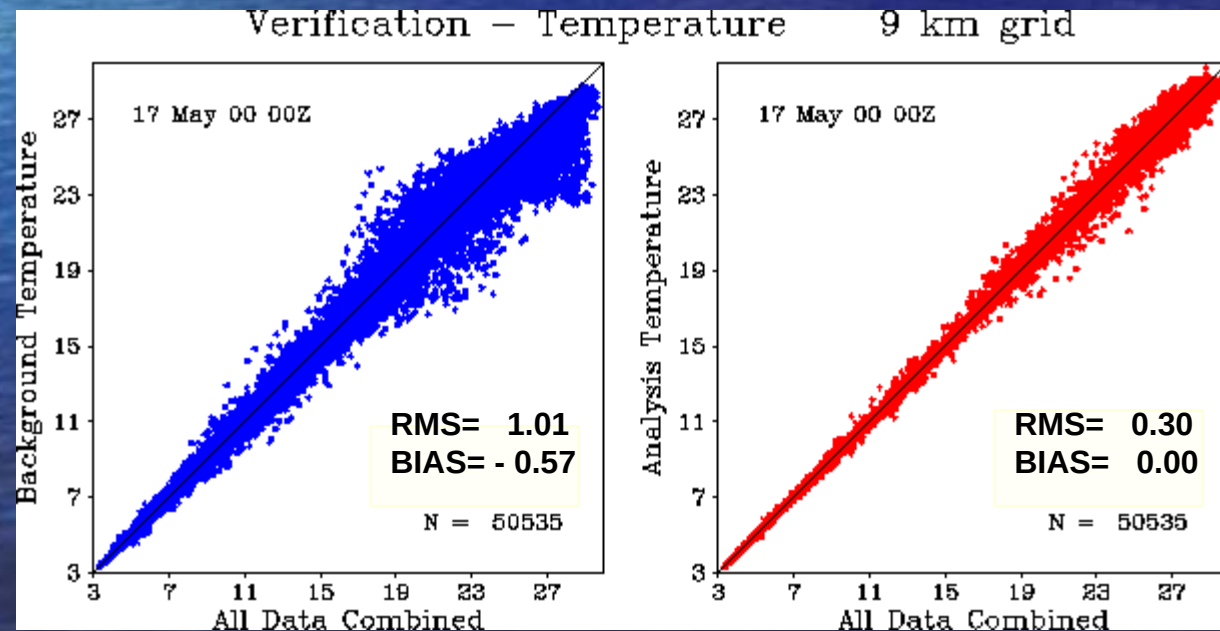
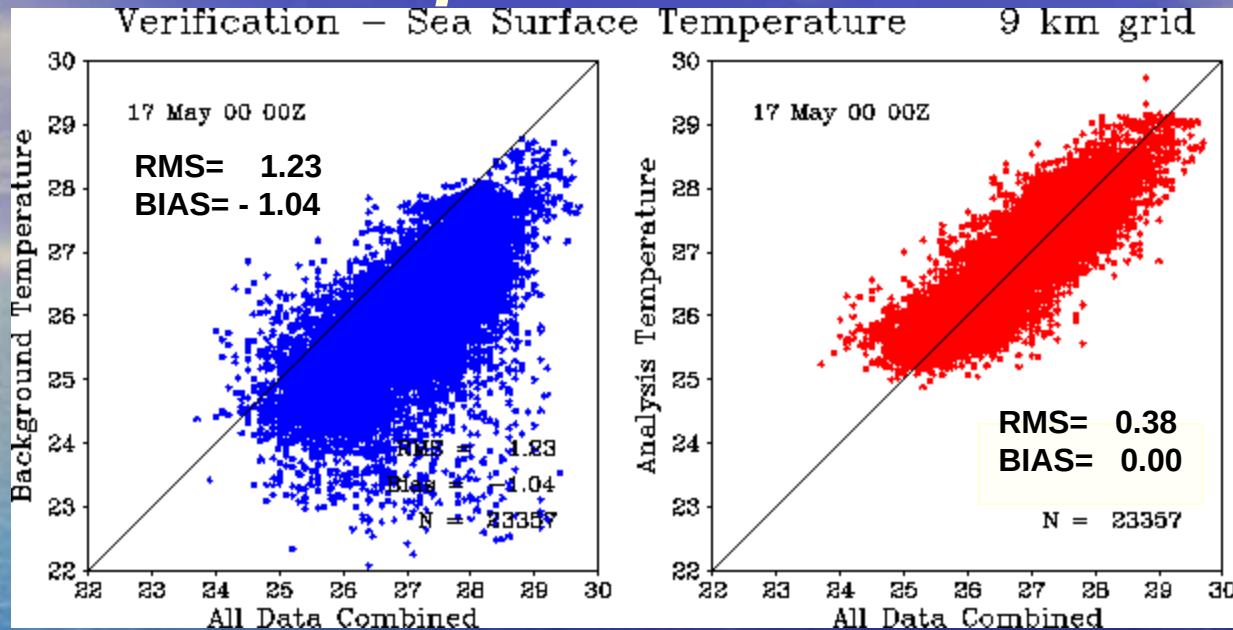
(08.4)



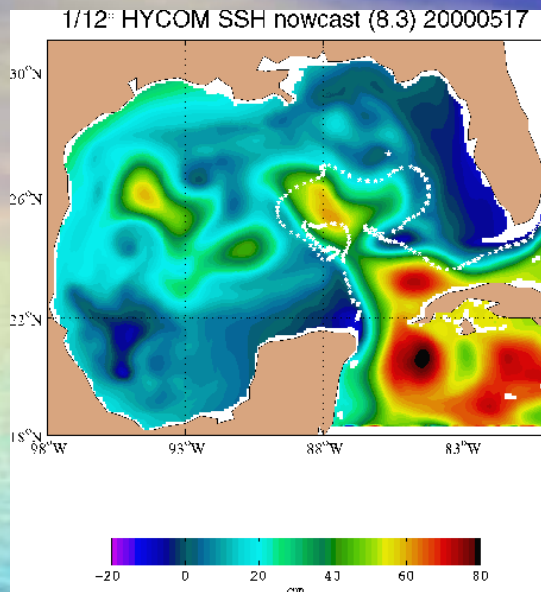
NCODA Temperature verification (08.3)



NCODA Temperature verification (08.4)

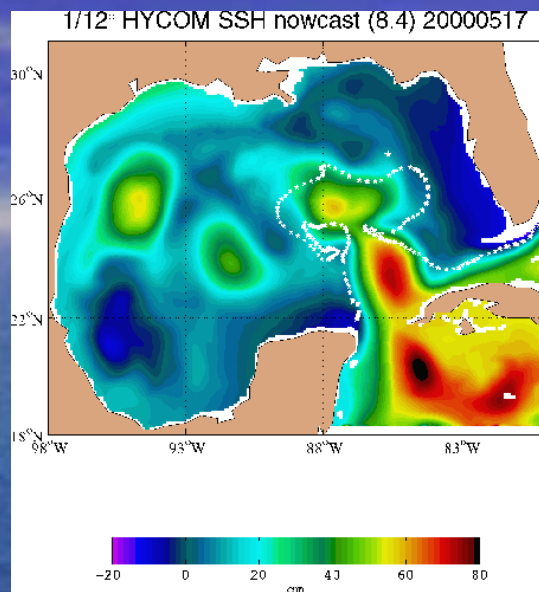


NCODA (08.3)

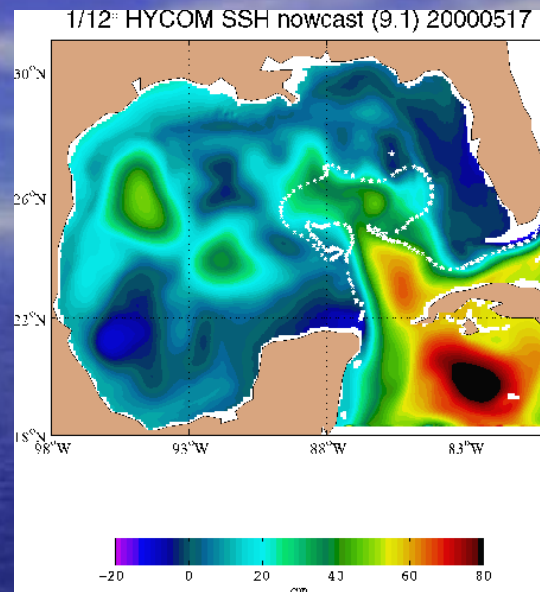


NCODA (08.4)

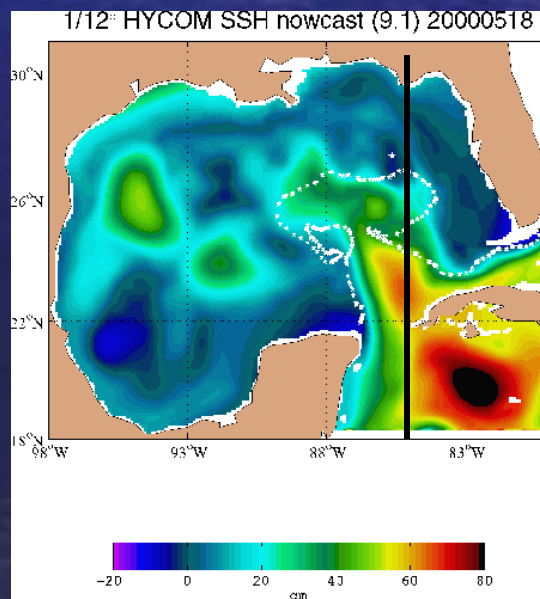
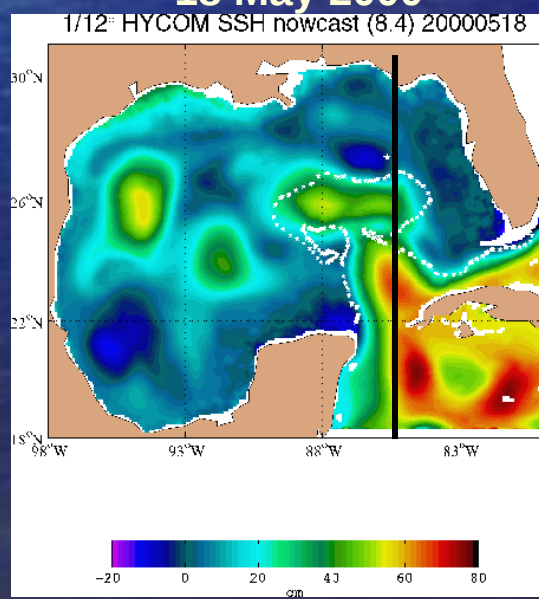
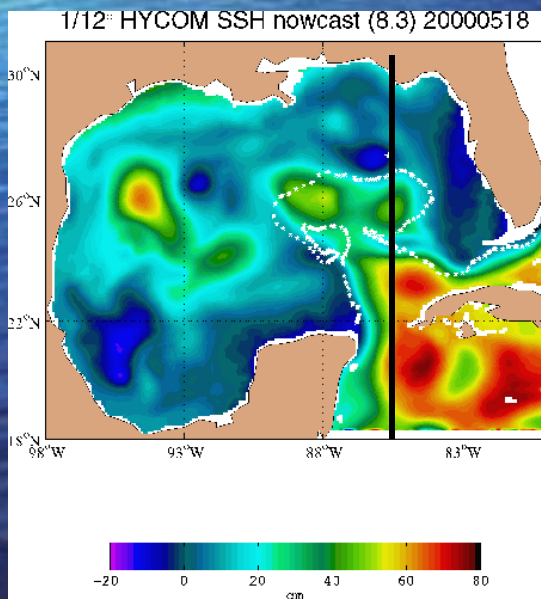
17 May 2000



Present assimilation



18 May 2000



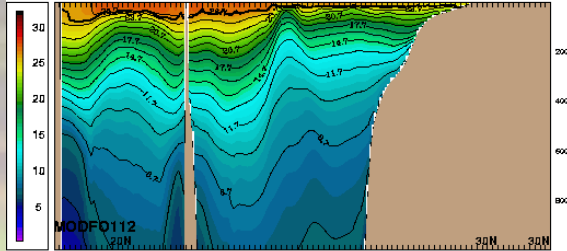
NCODA (08.3)

NCODA (08.4)

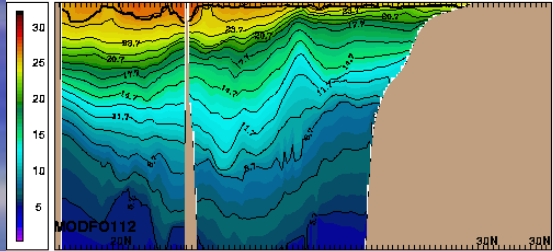
Present assimilation

17 May 2000

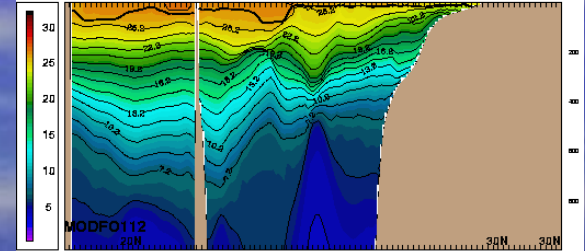
temperature merid.sec. 84.88w May 17, 2000 00Z [08.3H]



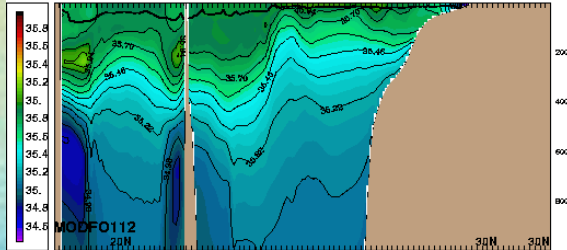
temperature merid.sec. 84.88w May 17, 2000 00Z [08.4H]



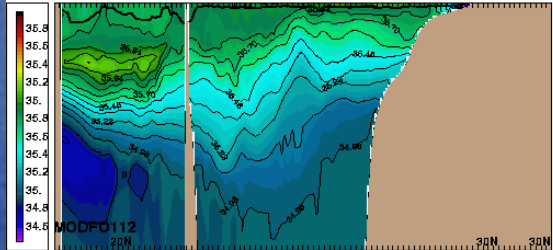
temperature merid.sec. 84.88w May 17, 2000 00Z [09.1H]



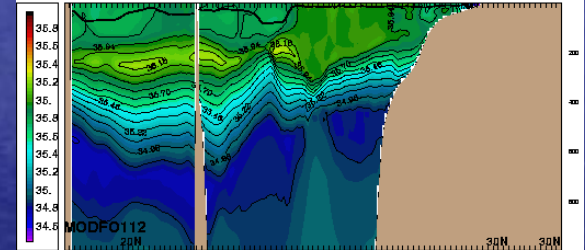
salinity merid.sec. 84.88w May 17, 2000 00Z [08.3H]



salinity merid.sec. 84.88w May 17, 2000 00Z [08.4H]

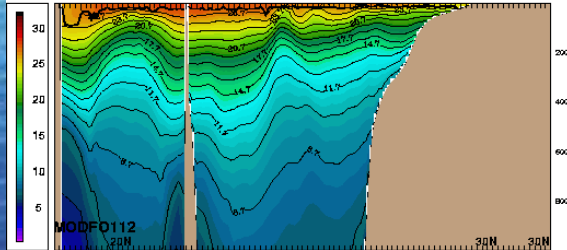


salinity merid.sec. 84.88w May 17, 2000 00Z [09.1H]

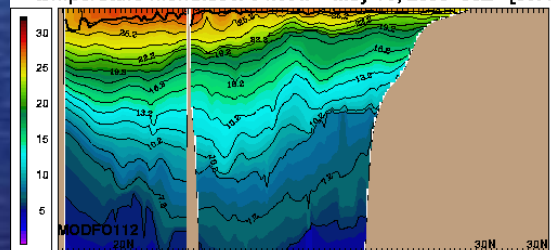


18 May 2000

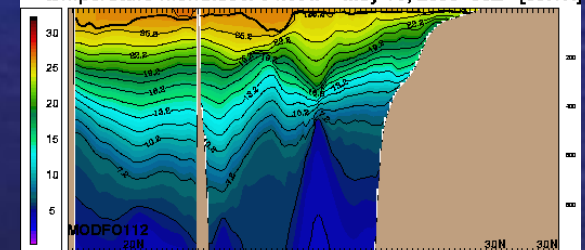
temperature merid.sec. 84.88w May 18, 2000 00Z [08.3H]



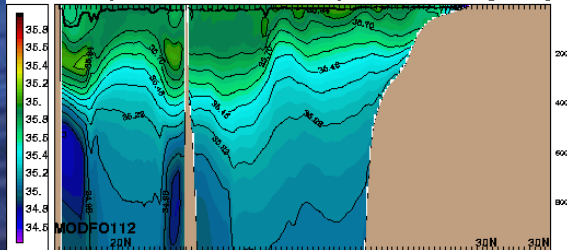
temperature merid.sec. 84.88w May 18, 2000 00Z [08.4H]



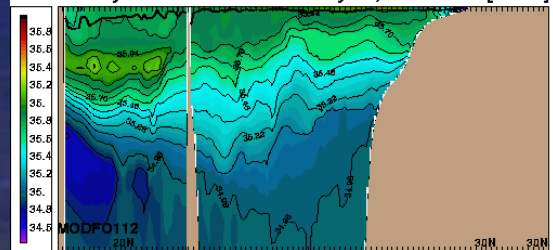
temperature merid.sec. 84.88w May 18, 2000 00Z [09.1H]



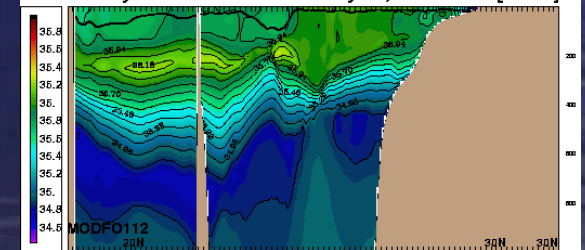
salinity merid.sec. 84.88w May 18, 2000 00Z [08.3H]



salinity merid.sec. 84.88w May 18, 2000 00Z [08.4H]



salinity merid.sec. 84.88w May 18, 2000 00Z [09.1H]



Future

- New spin up of the Atlantic model
 - 5m coastline
 - σ_2^*
- Upgrade assimilation
 - NCODA