

# ***Implementation of the NRL Coupled Ocean Data Assimilation (NCODA) system in HYCOM***

***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>**

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# Report Documentation Page

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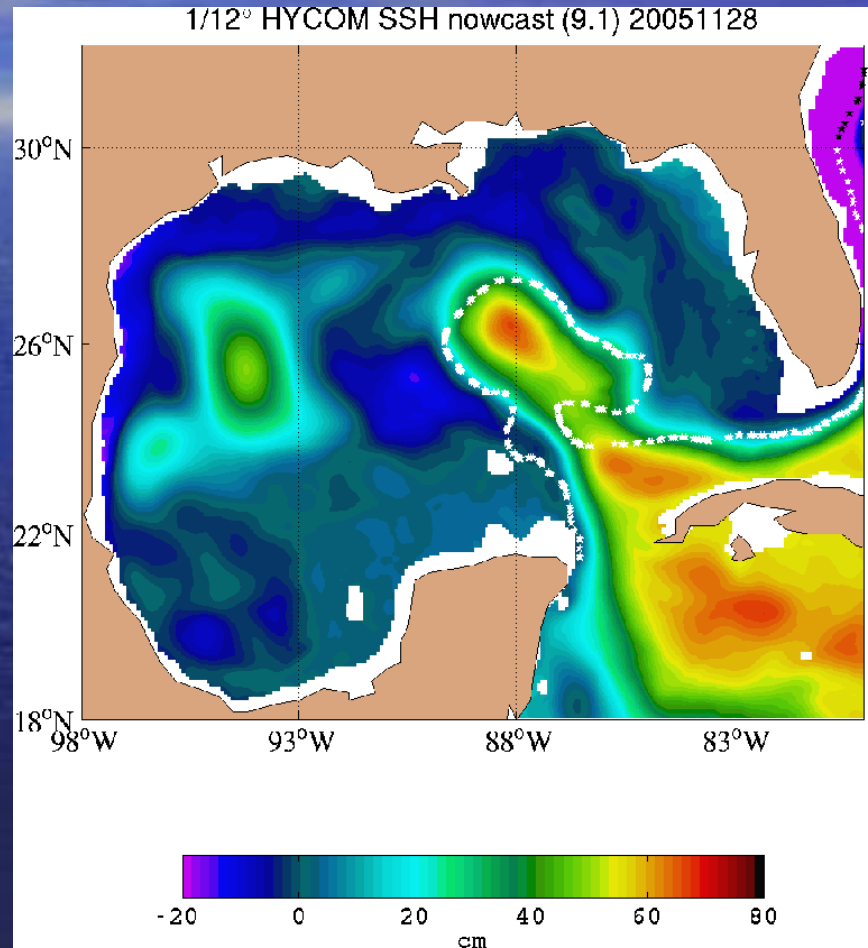
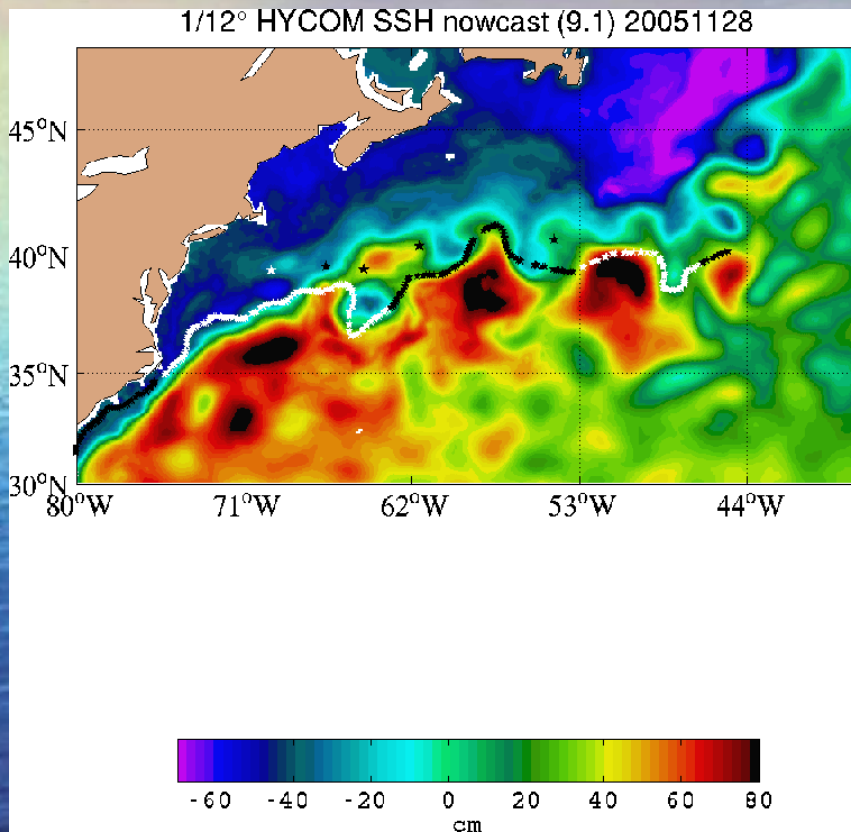
## *Present system*

- 1/12° Atlantic (28°S to 70°N)
- Running in near real-time (on Wednesday)
  - . 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
- 10 day hindcast, 14 day forecast
- 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

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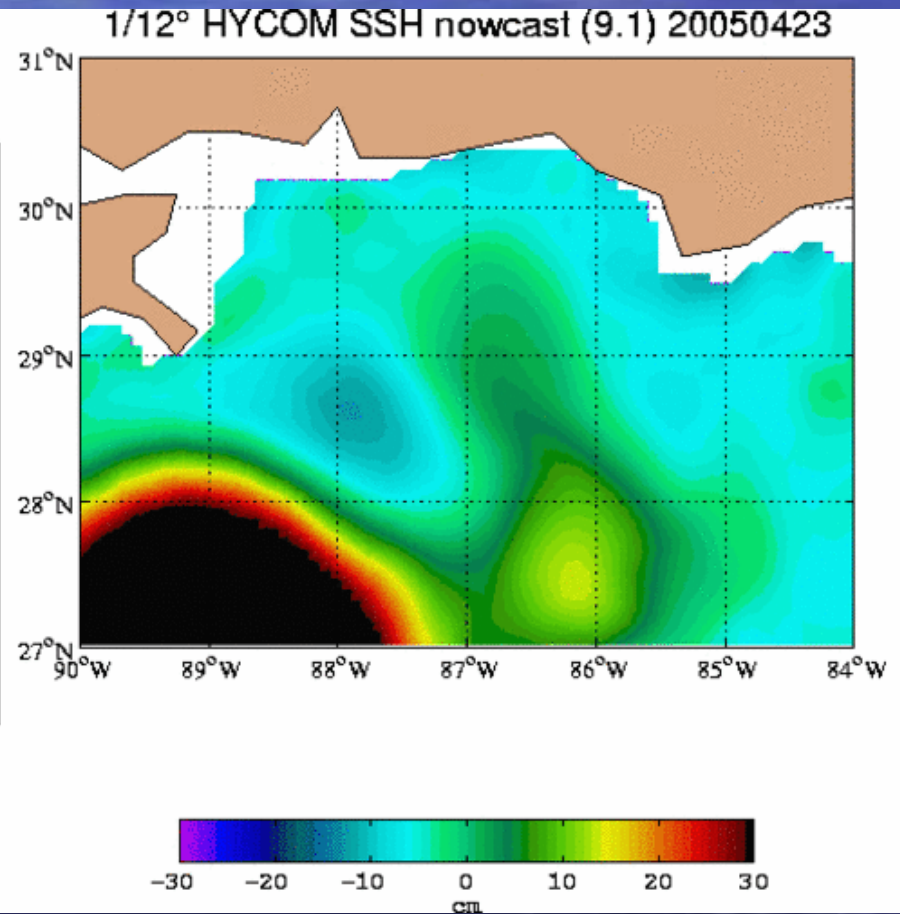
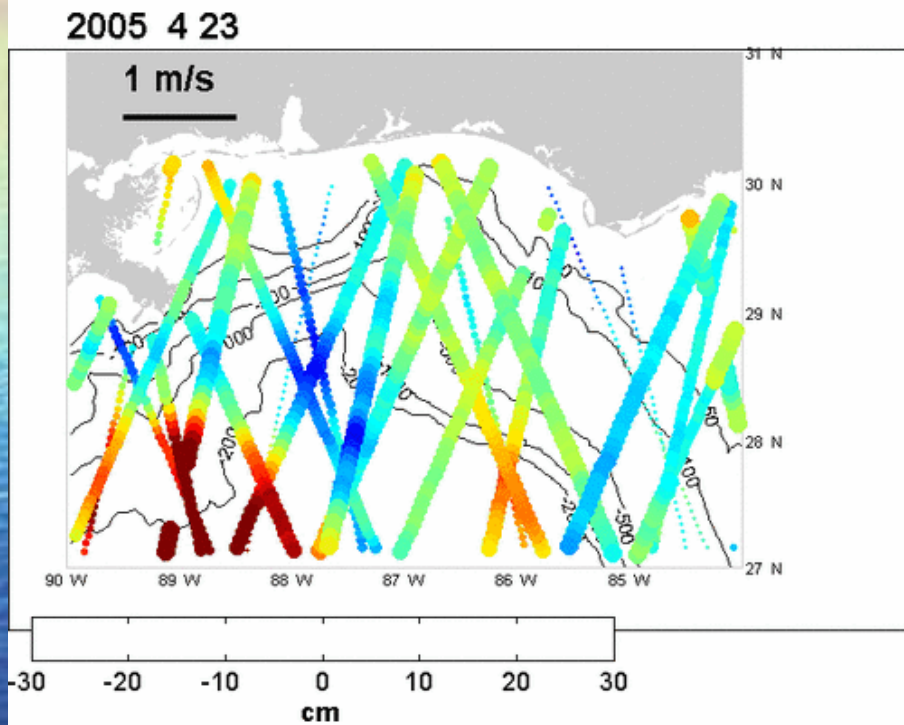
# 1/12° Atlantic HYCOM

SSH in Gulf Stream region, 23 November, 2005



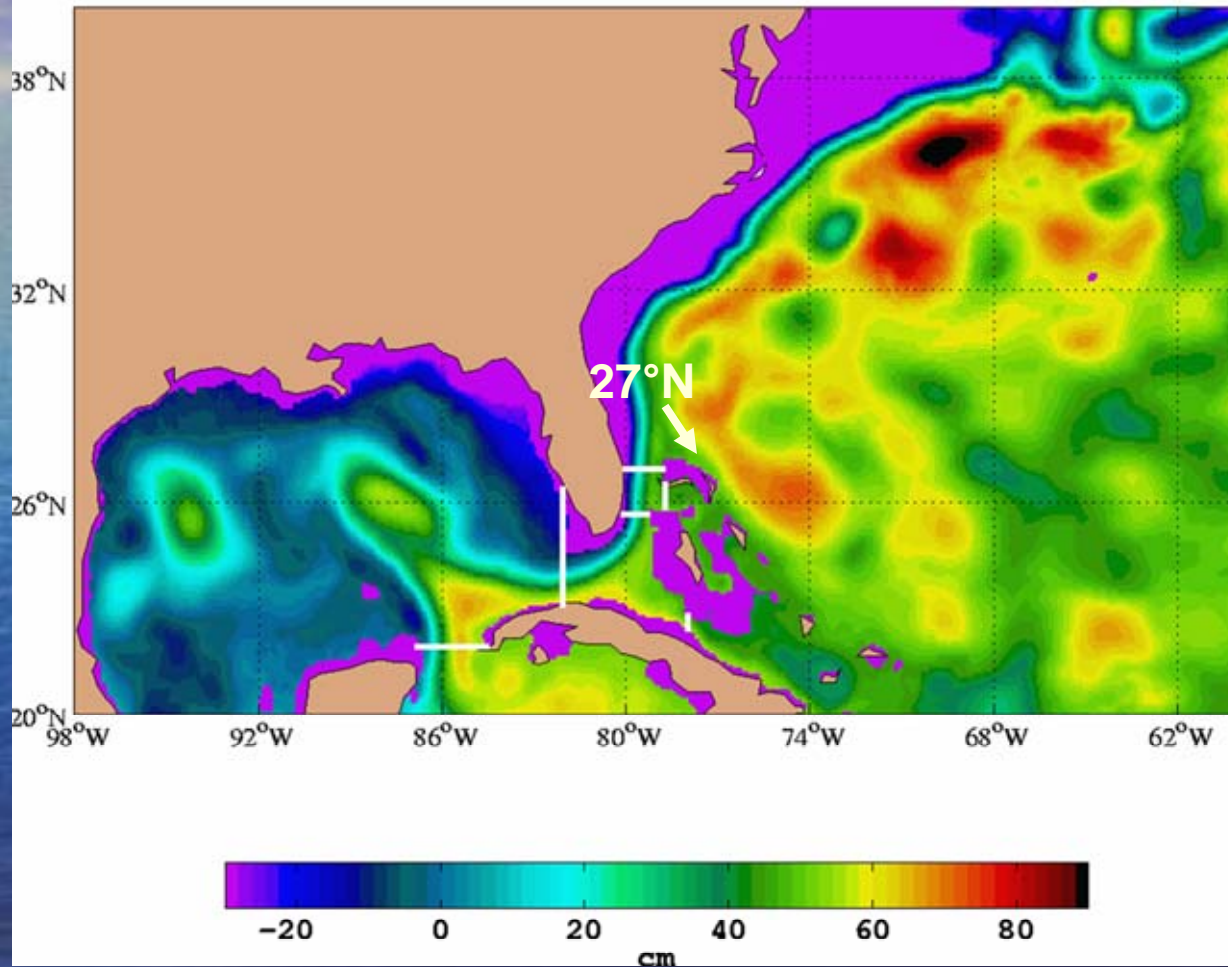
White/black line is the frontal analysis of MCSST observations performed at NAVOCEANO. Black line represents data more than four days old.

# 1/12° Atlantic HYCOM SSH in Gulf of Mexico region (SEED)

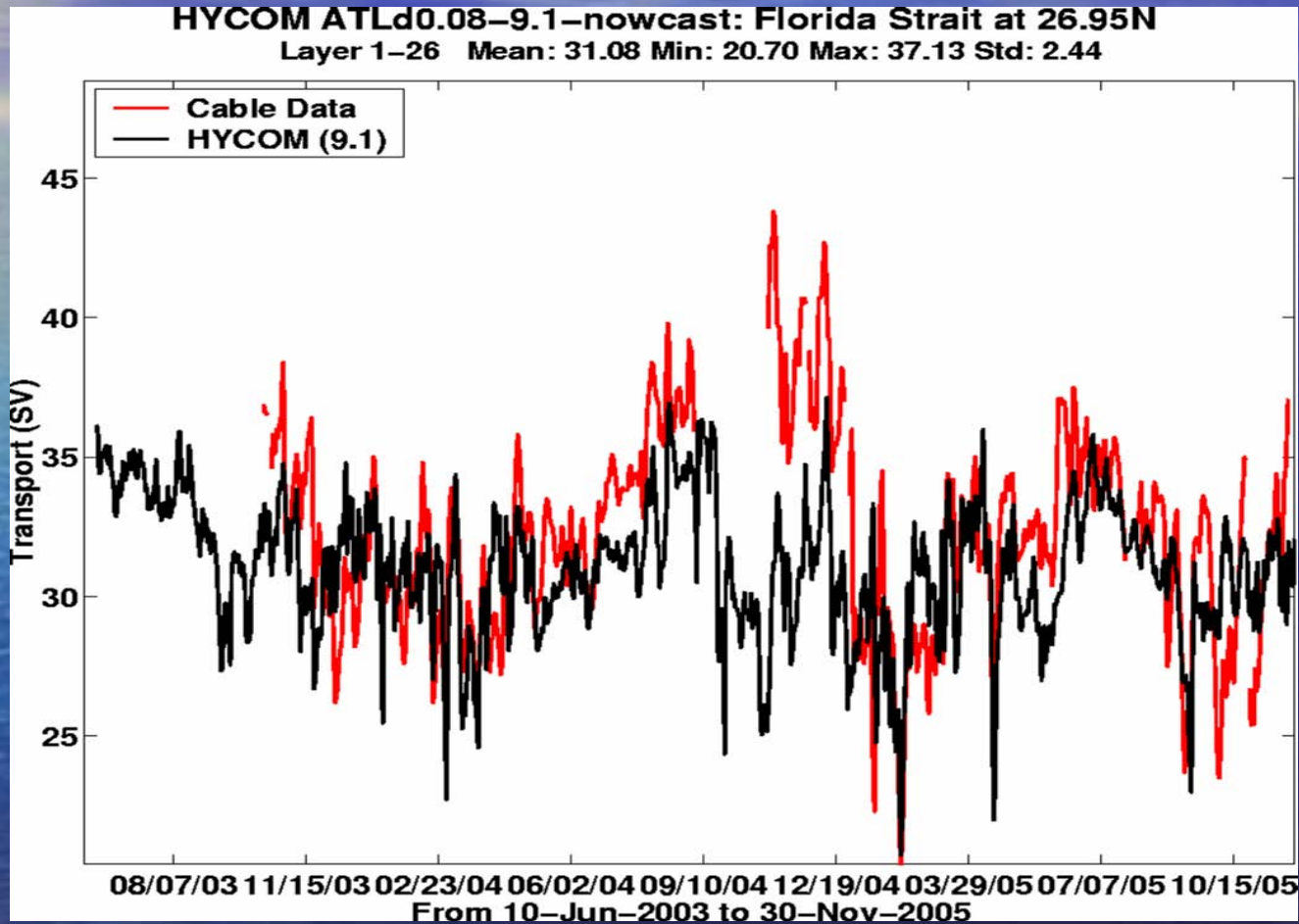


# *Transport sections*

1/12° HYCOM SSH nowcast 20051123



# Florida Current transport at 27°N



Cable data: <http://www.aoml.noaa.gov/phod/floridacurrent/>

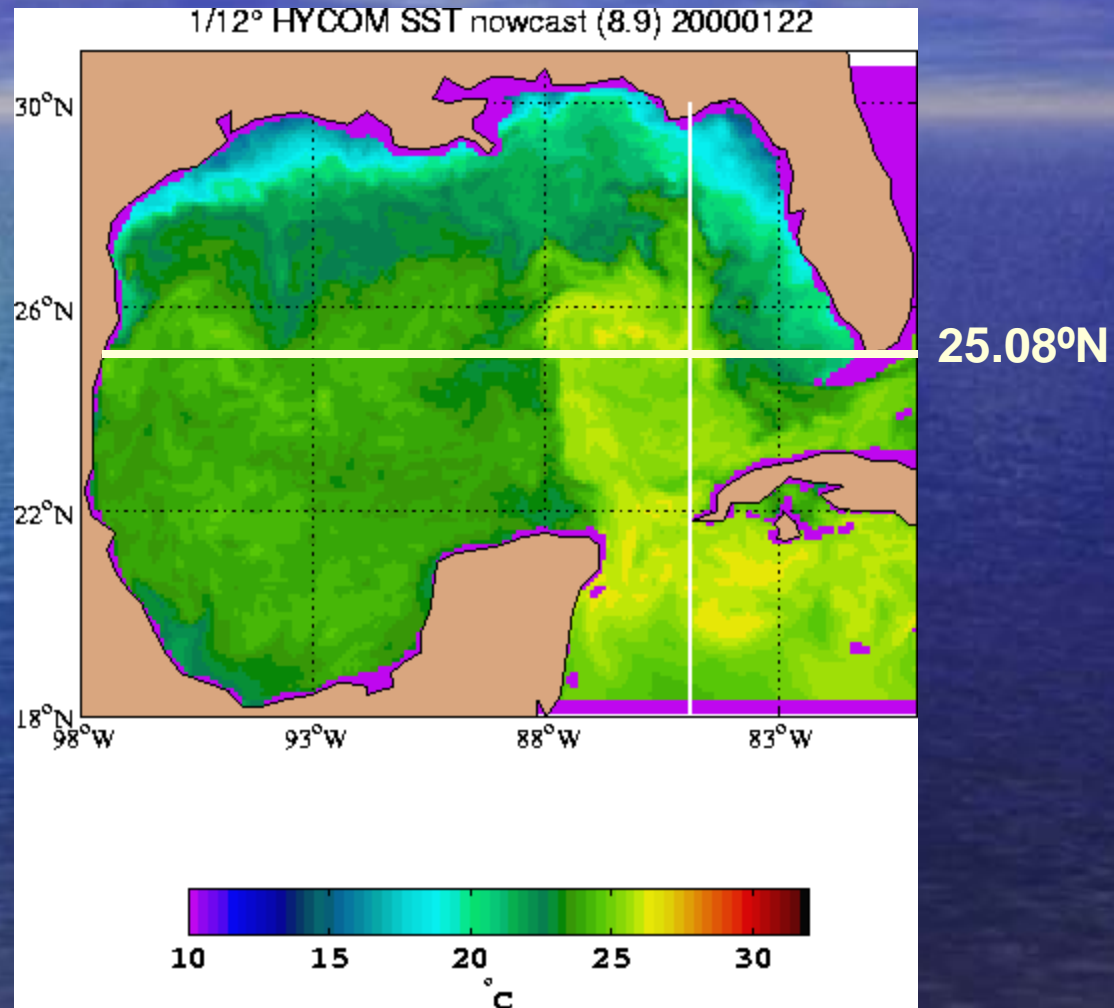
# ***GULF OF MEXICO MODEL CONFIGURATION***

- Horizontal grid:  $1/12^\circ$  (258 x 175 grid points, 6.5 km spacing on average)
- $18^\circ\text{N}$  to  $31^\circ\text{N}$
- 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, S, U and V along open boundary, (no assimilation in these experiments)

## ***HYCOM/NCODA coupling***

- **HYCOM to 3D z-grid**
- **NCODA analysis**
- **Use the NCODA analysis of T, S to create a new restart file. Let hybgen move the interfaces**  
**or**
- **Use the NCODA analysis of T, S and layer pressure to create a new restart file.**
- **A new analysis every day in these experiments**

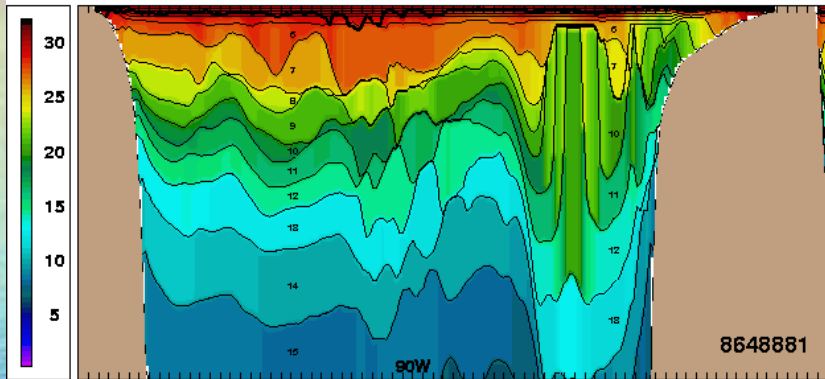
# Sections in the Gulf of Mexico



# T and $\rho$ section along 25.08°N, 31 August 1999

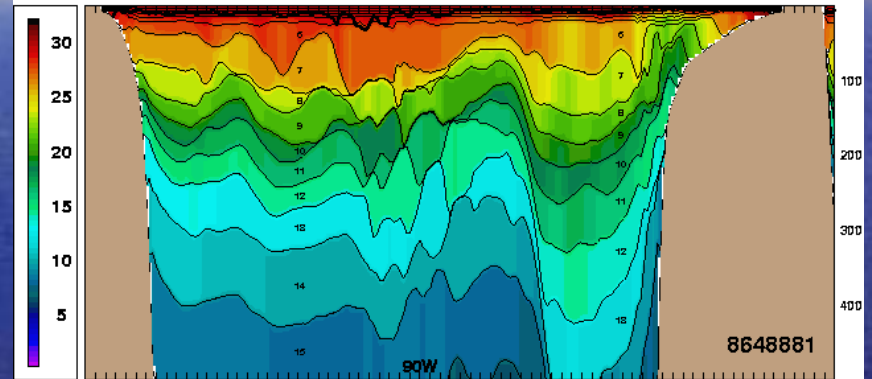
T and S updating

temperature zonal sec. 25.08n Aug 31, 1999 00Z [08.4H]

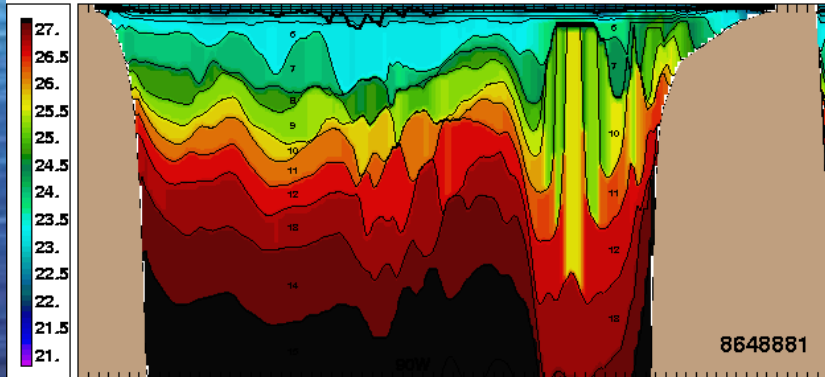


T and S updating, new hybgen

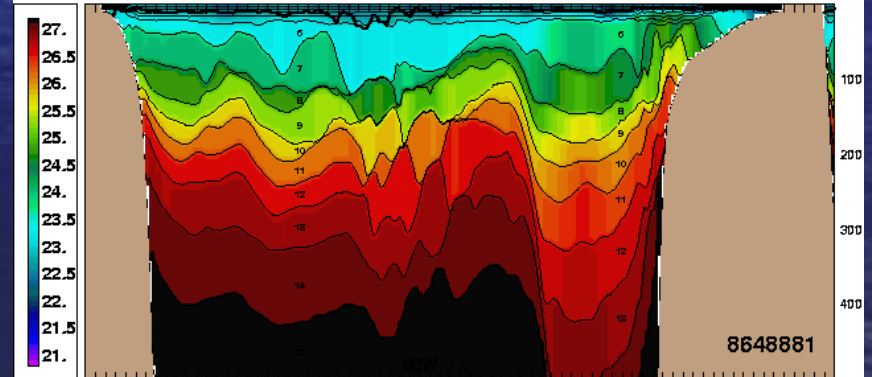
temperature zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]



density zonal sec. 25.08n Aug 31, 1999 00Z [08.4H]



density zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]

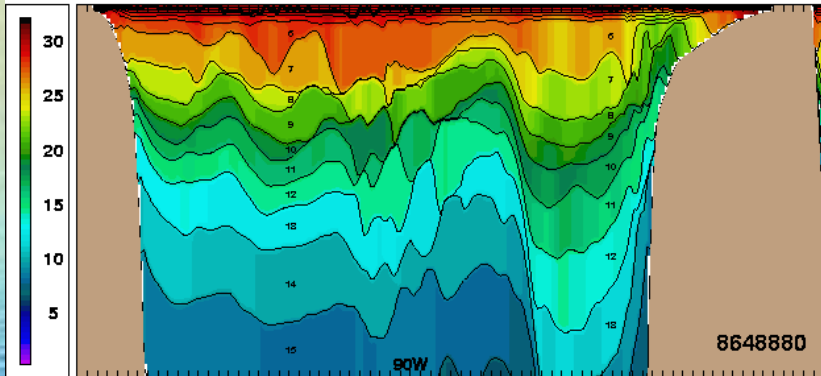


# T and $\rho$ section along 25.08°N, 31 August 1999

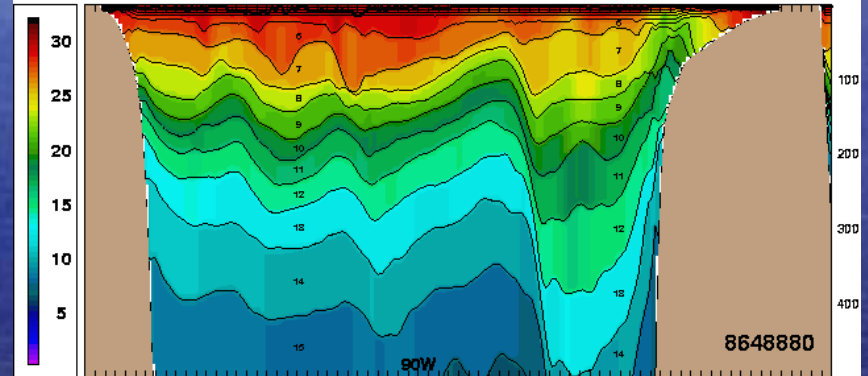
T and S updating, new hybgen

T, S and dp updating

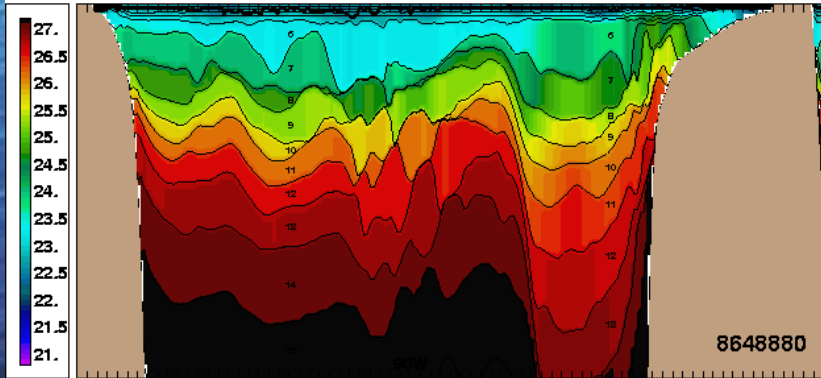
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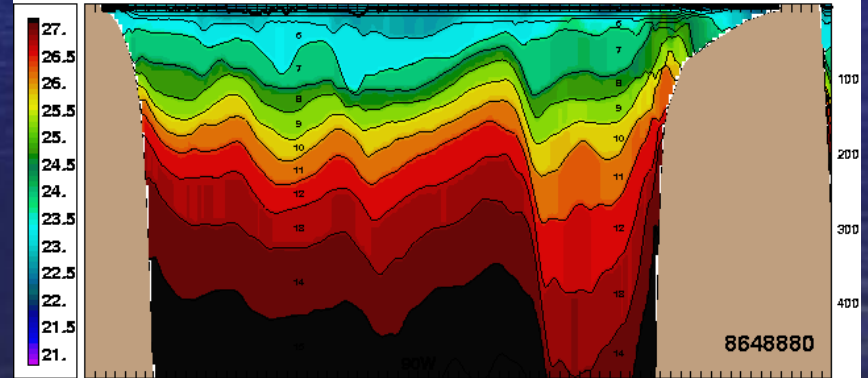
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density zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]

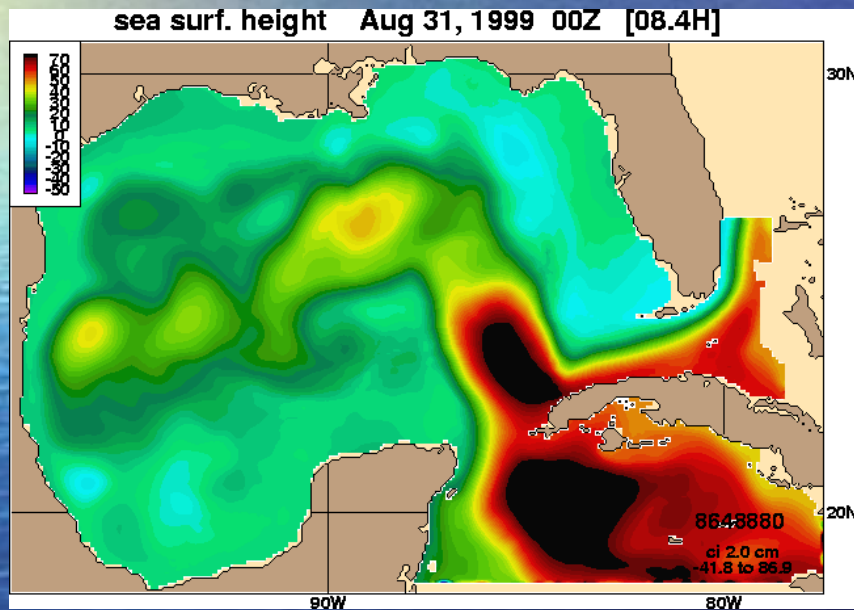


density zonal sec. 25.08n Aug 31, 1999 00Z [08.5H]

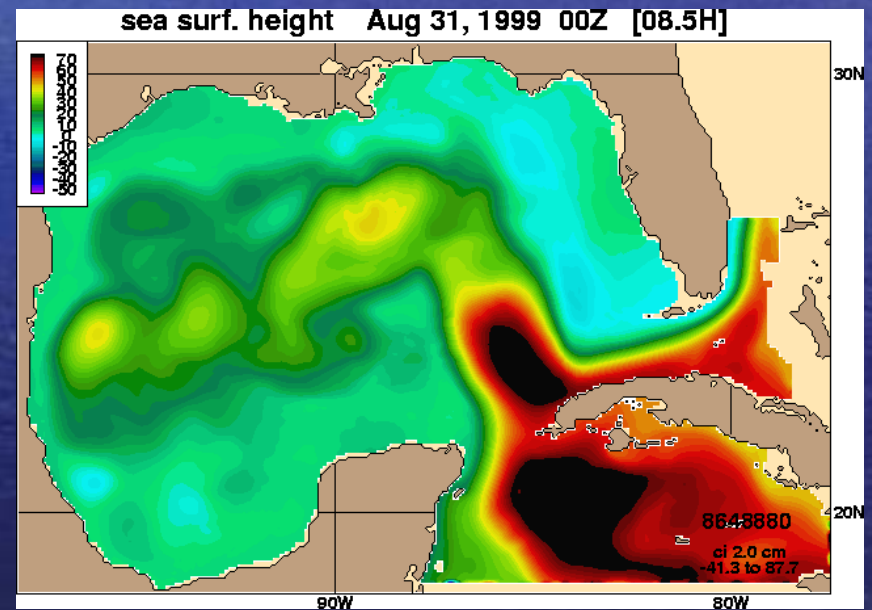


# SSH, 31 August 1999

T and S updating

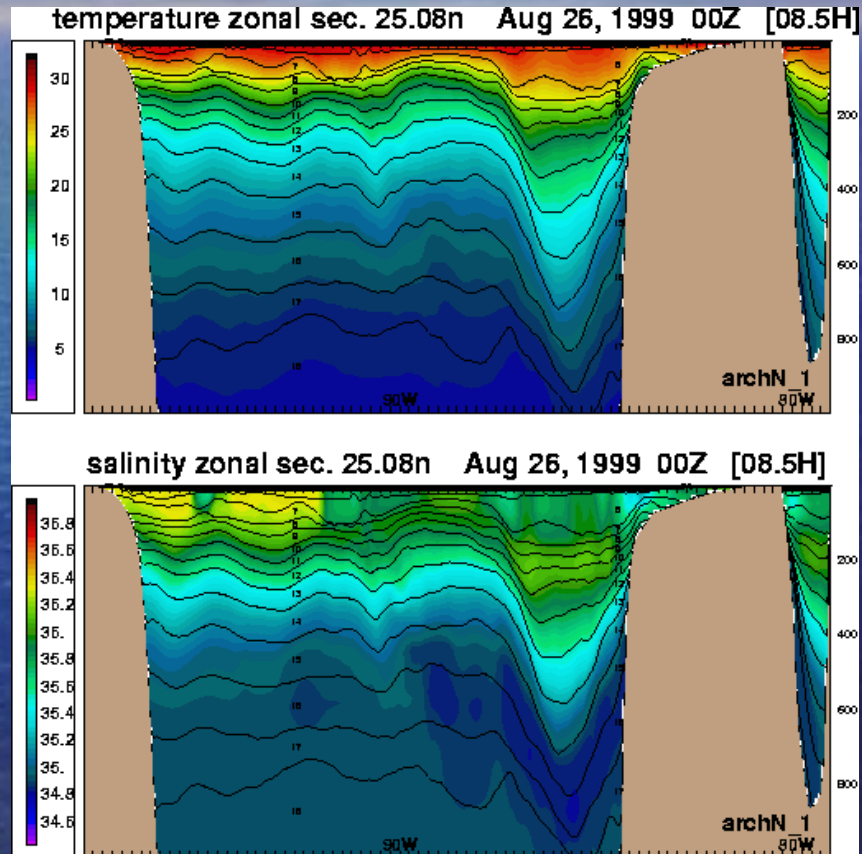


T, S and dp updating

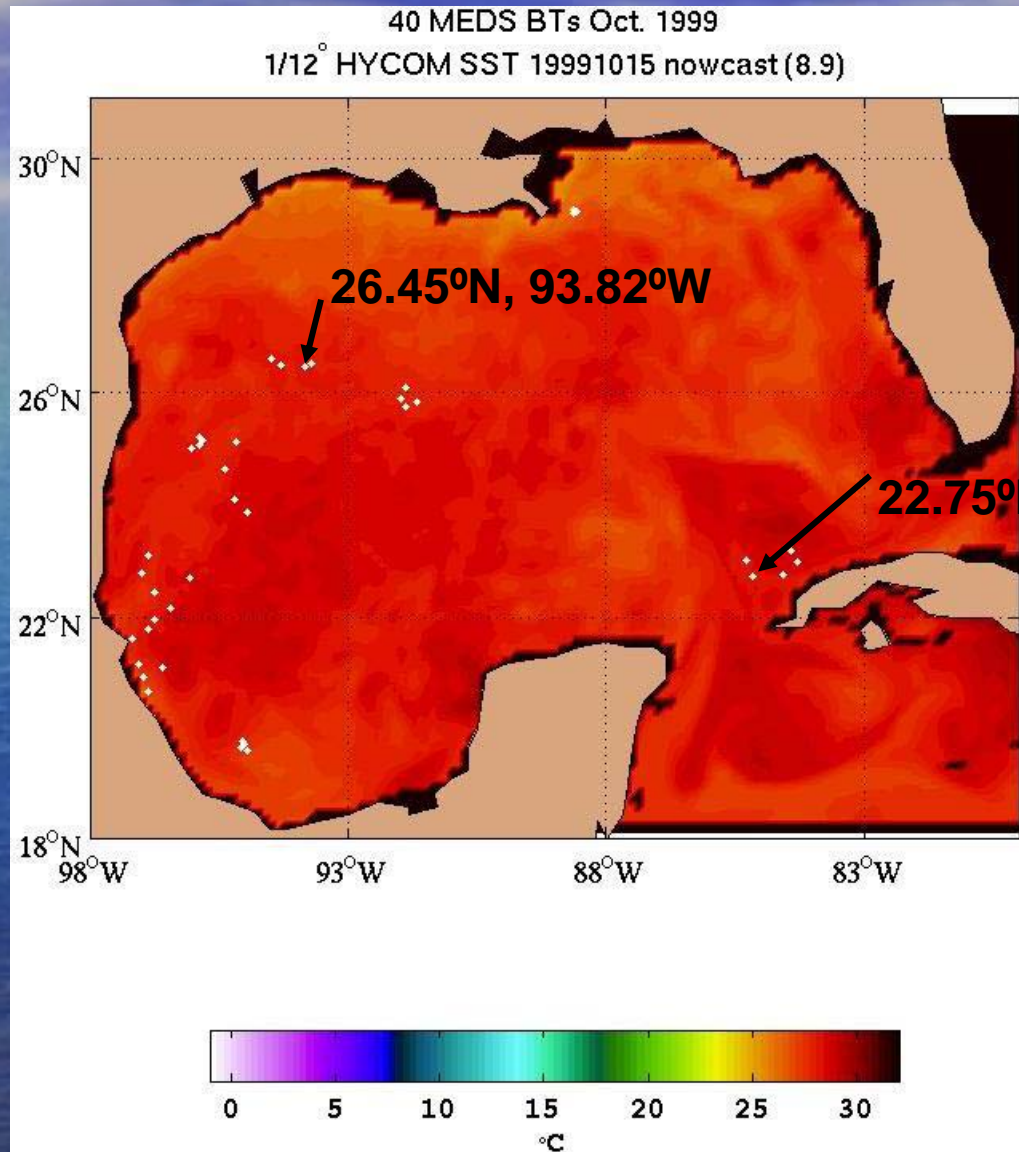


# T and S section along 25.08°N, 31 August 1999

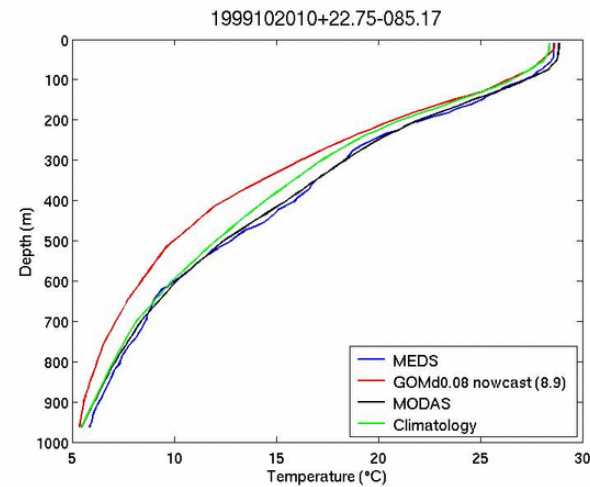
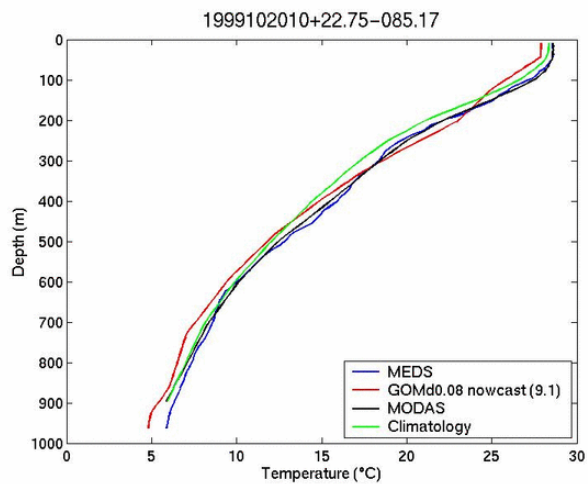
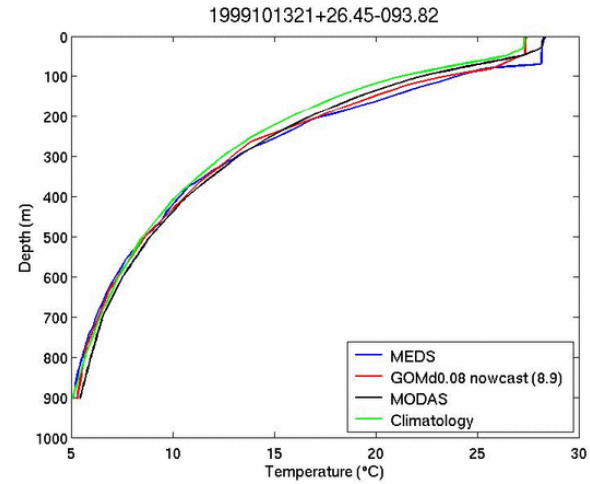
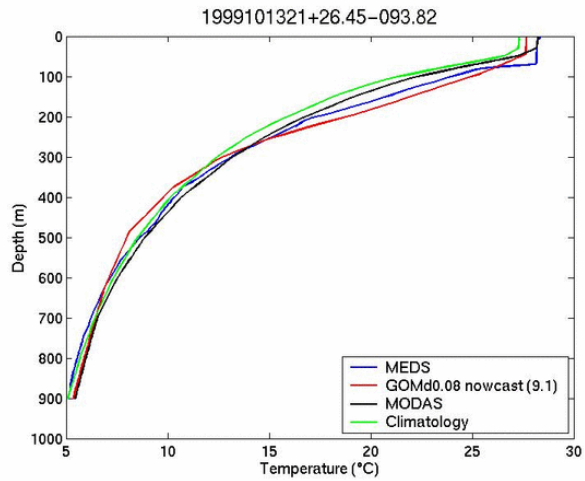
## T, S and dp updating



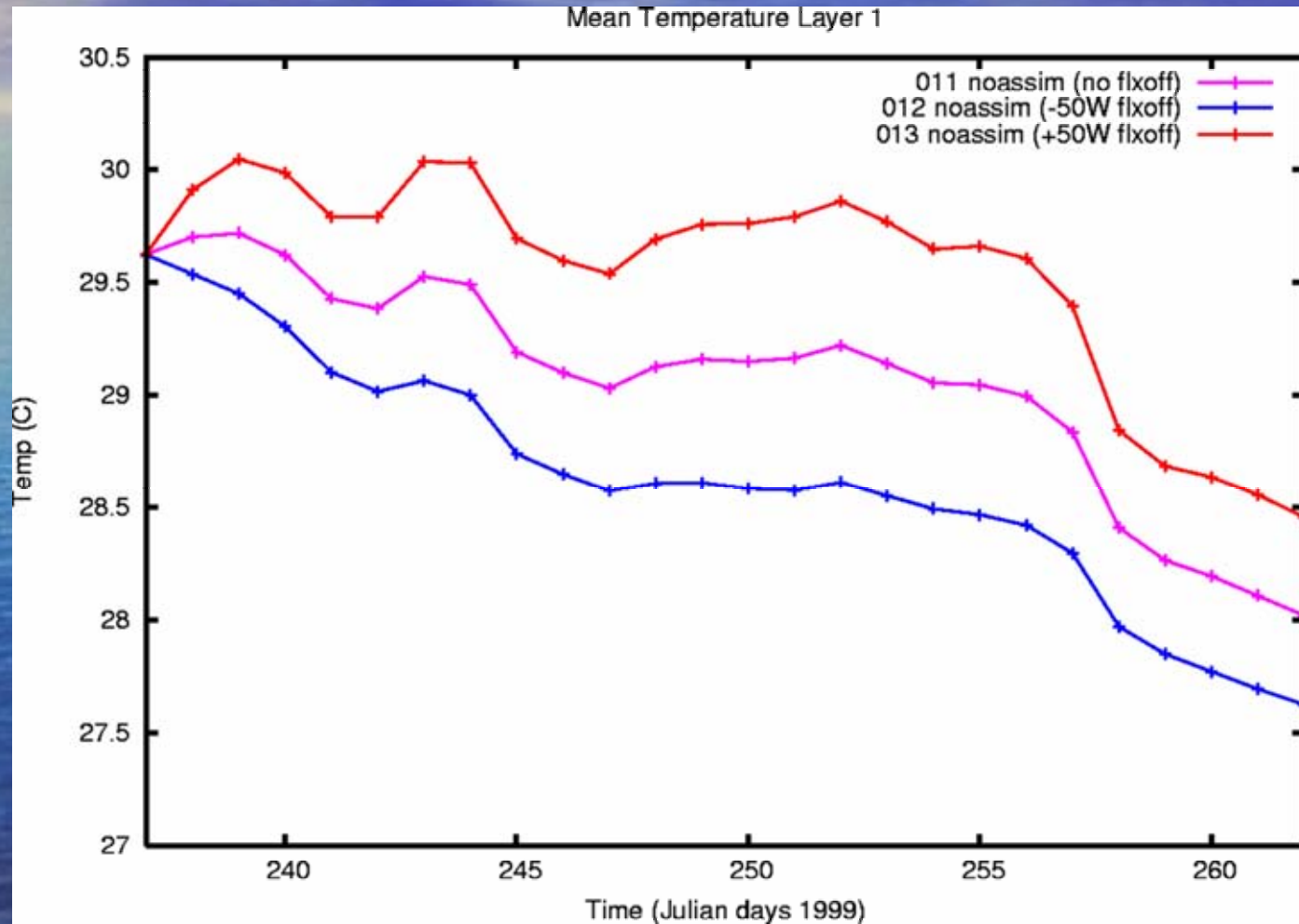
# BT positions October 1999



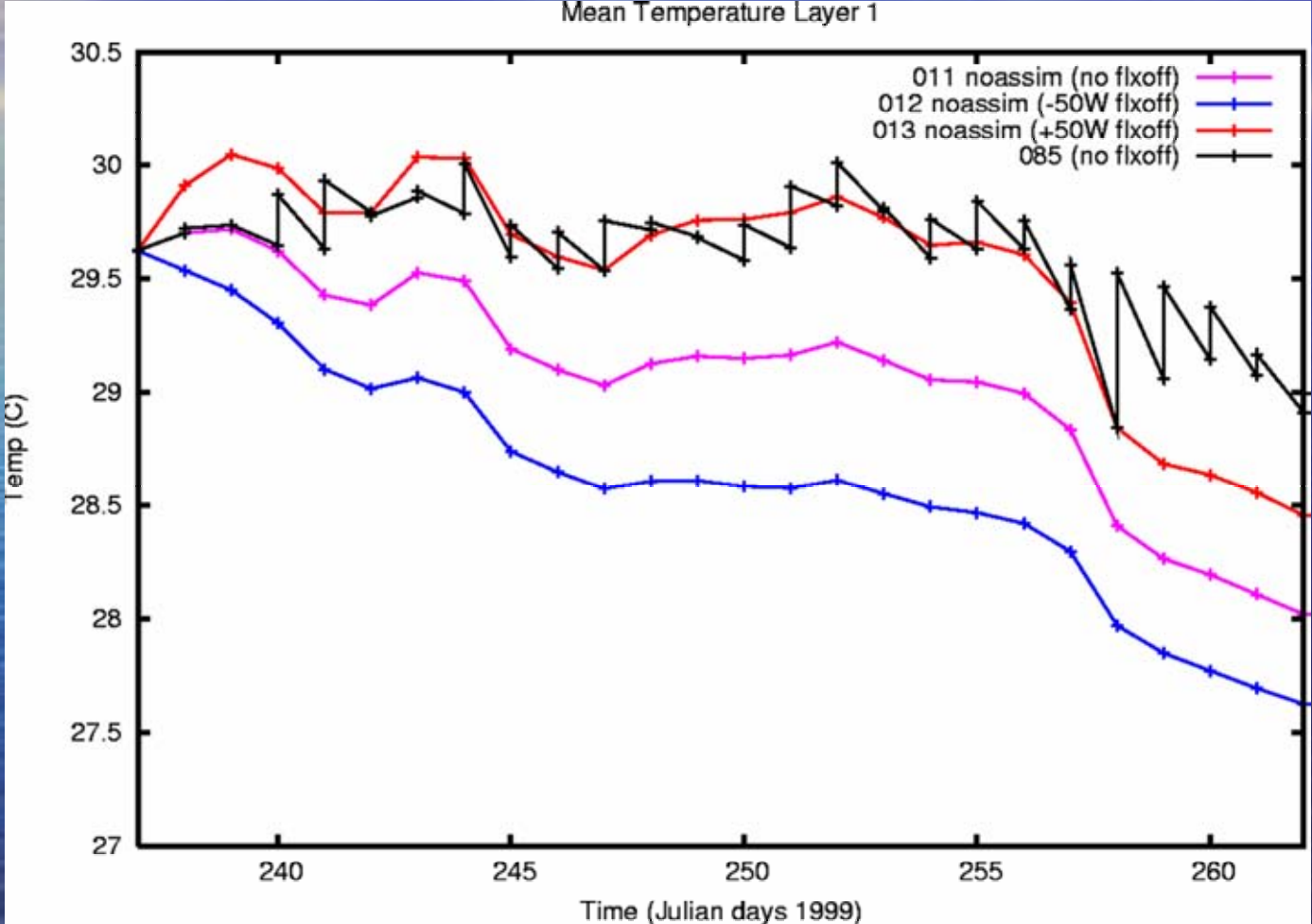
# BT comparison October 1999



# Mean Temperature Layer 1

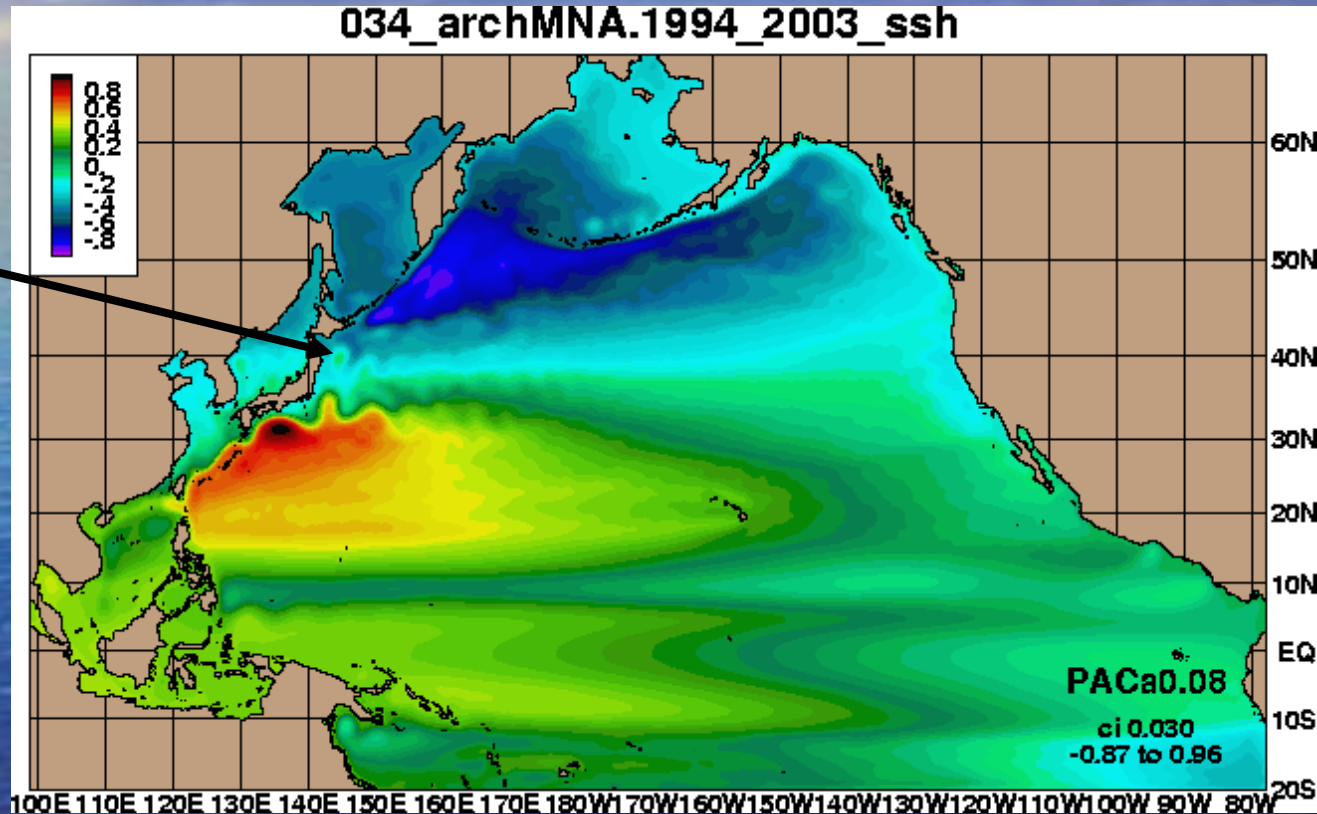


# Mean Temperature Layer 1



# 1/12° PACIFIC HYCOM

Mean SSH 1994 – 2003

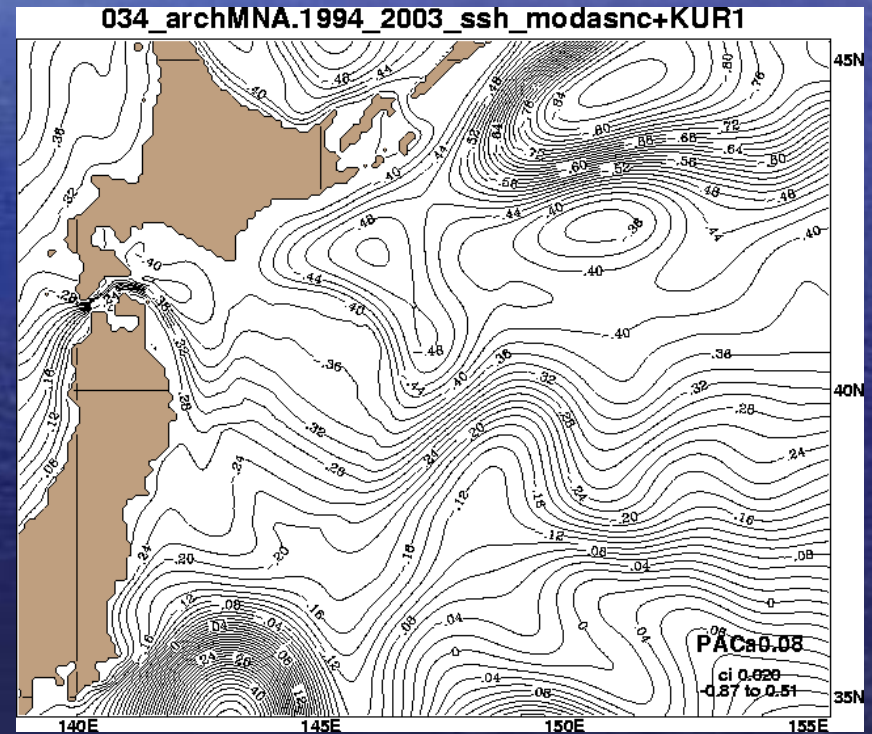
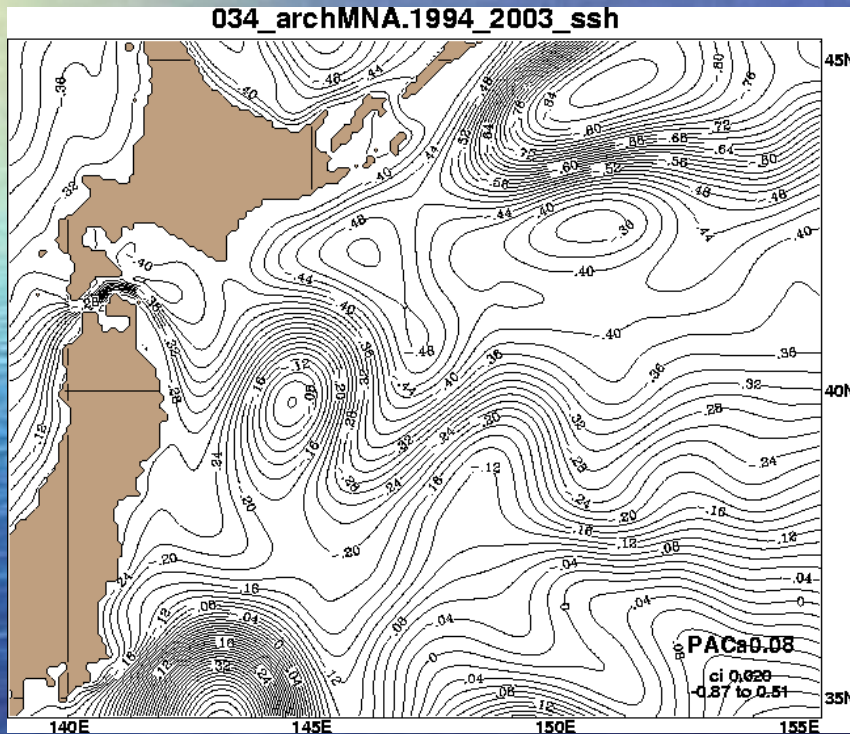


# 1/12° PACIFIC HYCOM

Mean SSH 1994 – 2003

ORIGINAL

RUBBER SHEETED



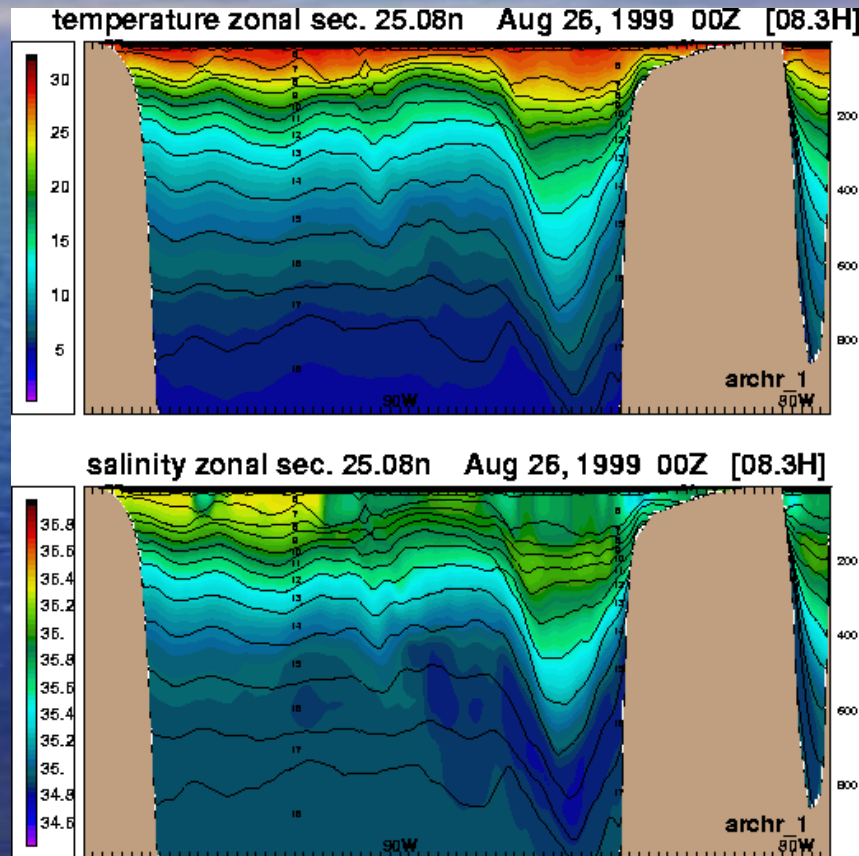
## *Future*

- NCODA in 1/12° Pacific HYCOM
- NCODA in 1/12° Atlantic HYCOM
- 1/12° Global HYCOM assimilation

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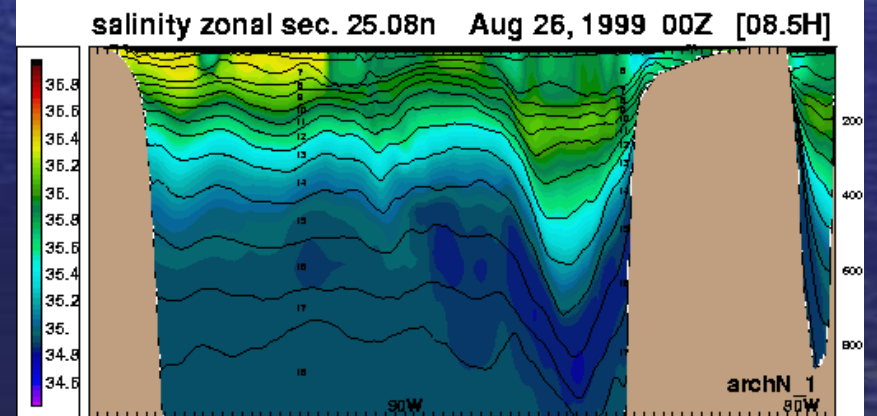
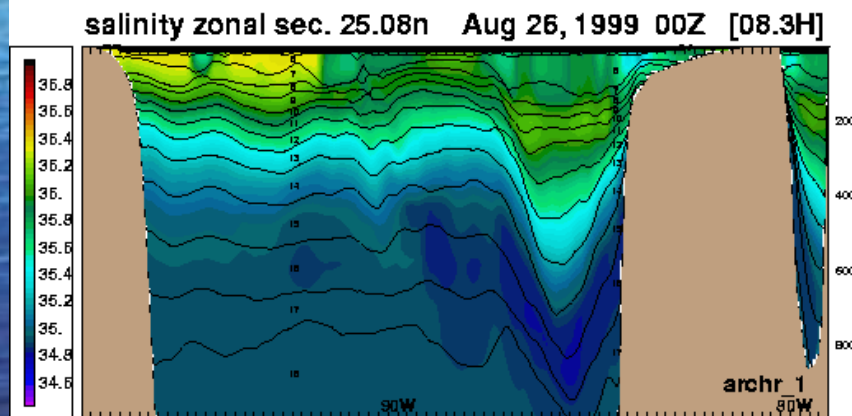
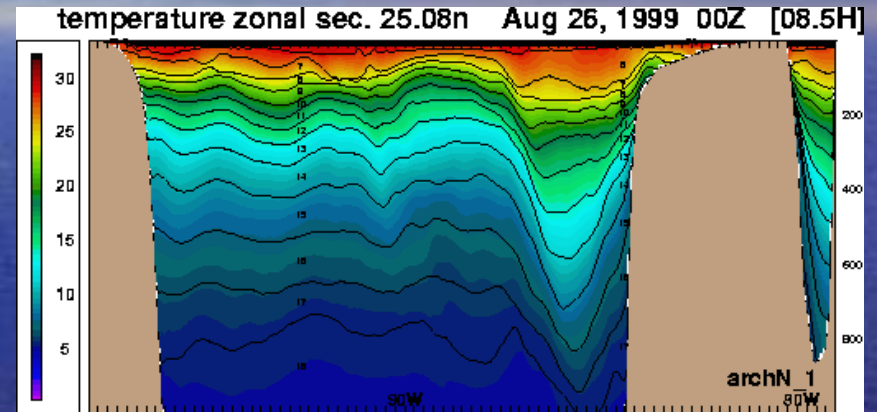
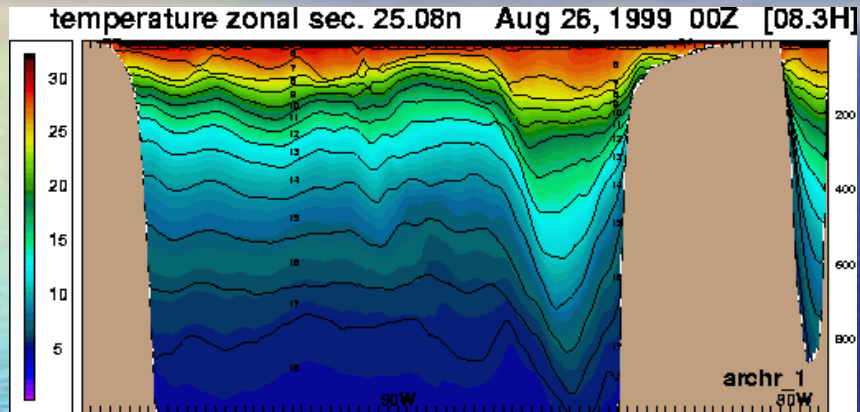
# T and S section along 25.08°N, 31 August 1999

## T and S updating

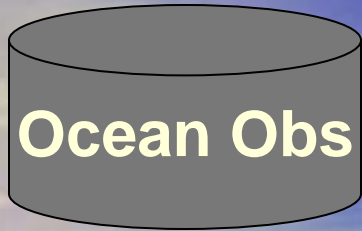


# T and S section along 25.08°N, 31 August 1999

## T and S updating

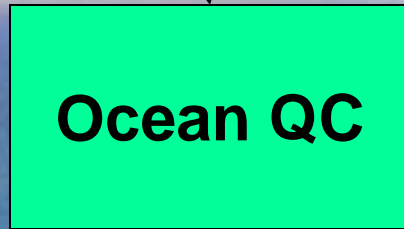


# NRL Coupled Ocean Data Assimilation (NCODA)

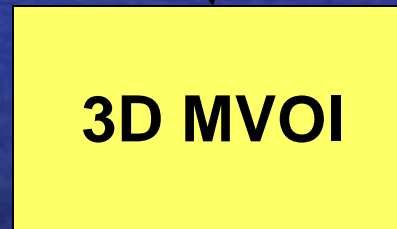


**SST:** GAC/LAC  
MCSST, GOES,  
Ship, Buoy  
**Profile:** XBT,  
CTD, PALACE  
Float, Fixed Buoy,  
Drifting Buoy  
**Altimeter SSHA**  
**SSM/I Sea Ice**

Sequential Incremental Update Cycle  
Analysis-Forecast-Analysis



Innovations



Increments



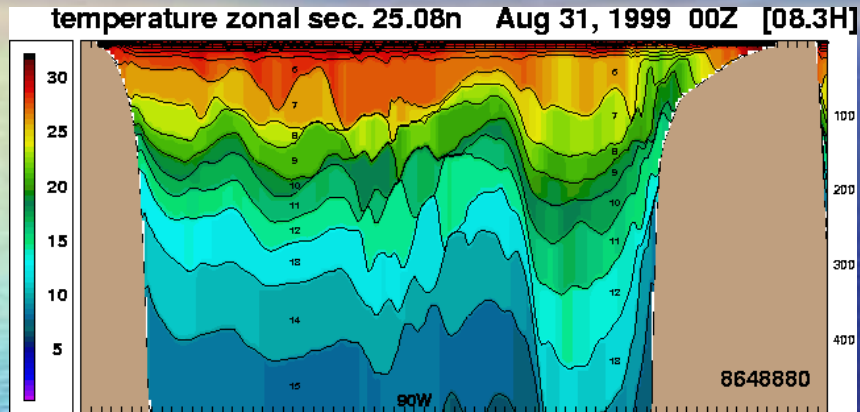
Forecast Fields  
Prediction Errors

First Guess

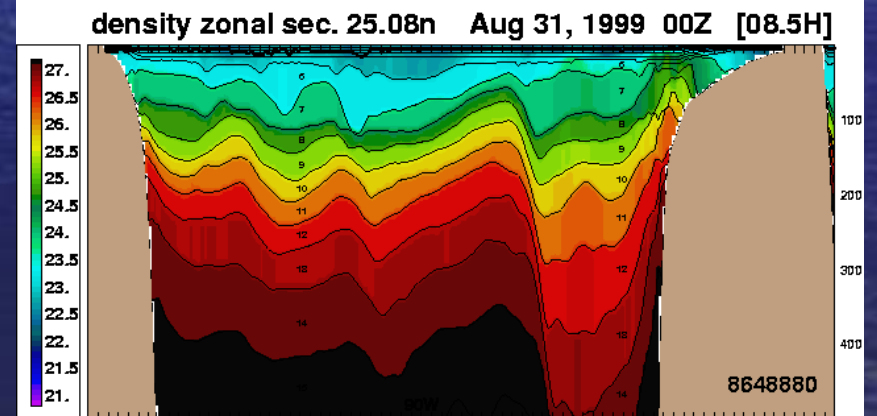
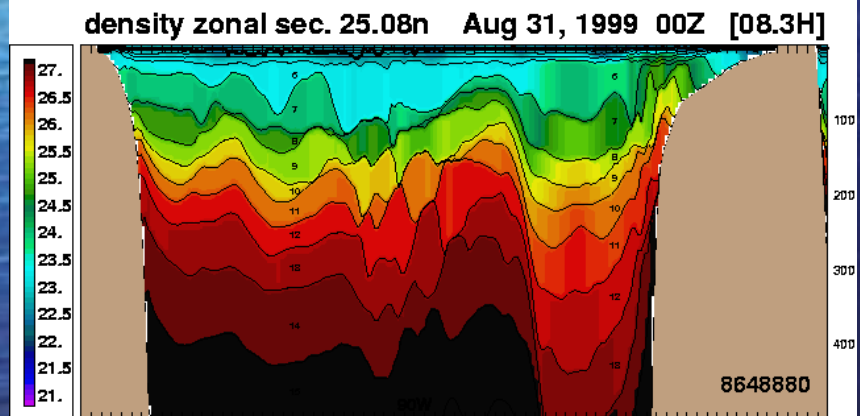
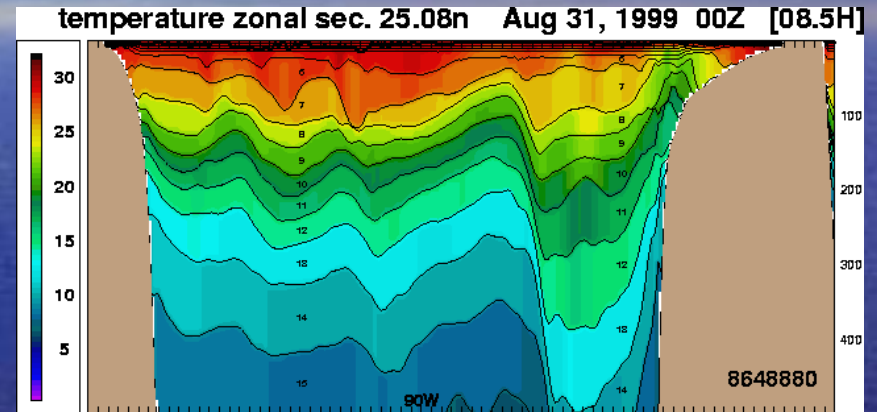
**MVOI - simultaneous analysis 5 ocean variables**  
temperature, salinity, geopotential, velocity (u,v)

# T and $\rho$ section along 25.08°N, 31 August 1999

T and S updating



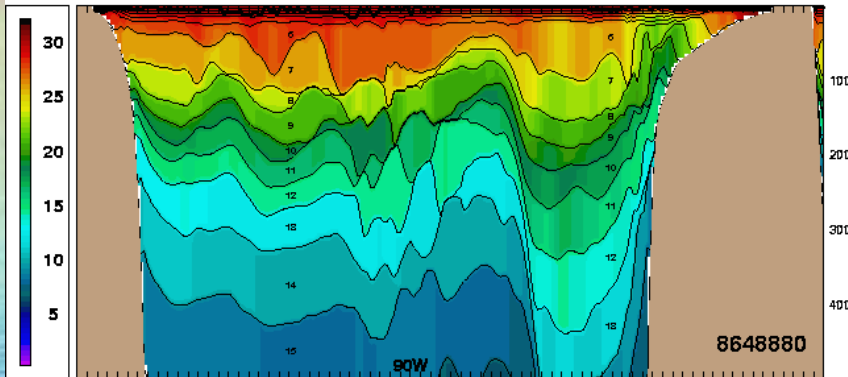
T, S and dp updating



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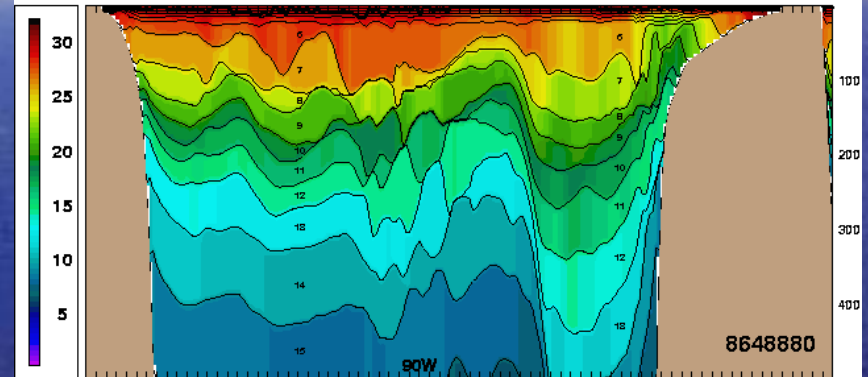
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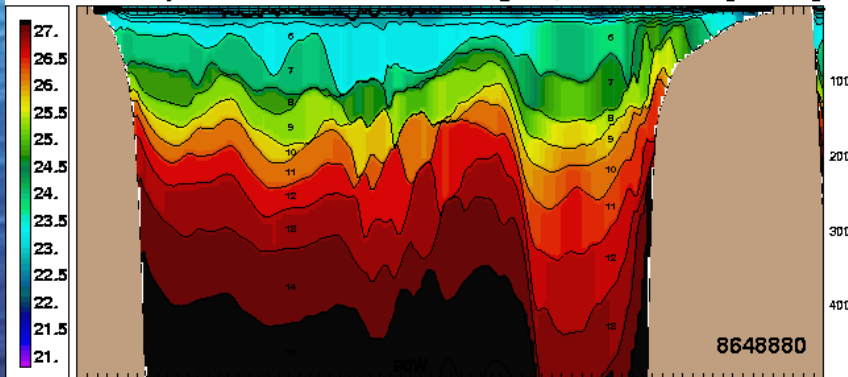


T and S updating, new hybgen

temperature zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]



density zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]



density zonal sec. 25.08n Aug 31, 1999 00Z [08.3H]

