

Evaluation of the 1/12° Global HYCOM Nowcast/Forecast System

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<http://www.hycom.org>

*Layered Ocean Model Workshop
1-3 June 2009
Miami, Florida*

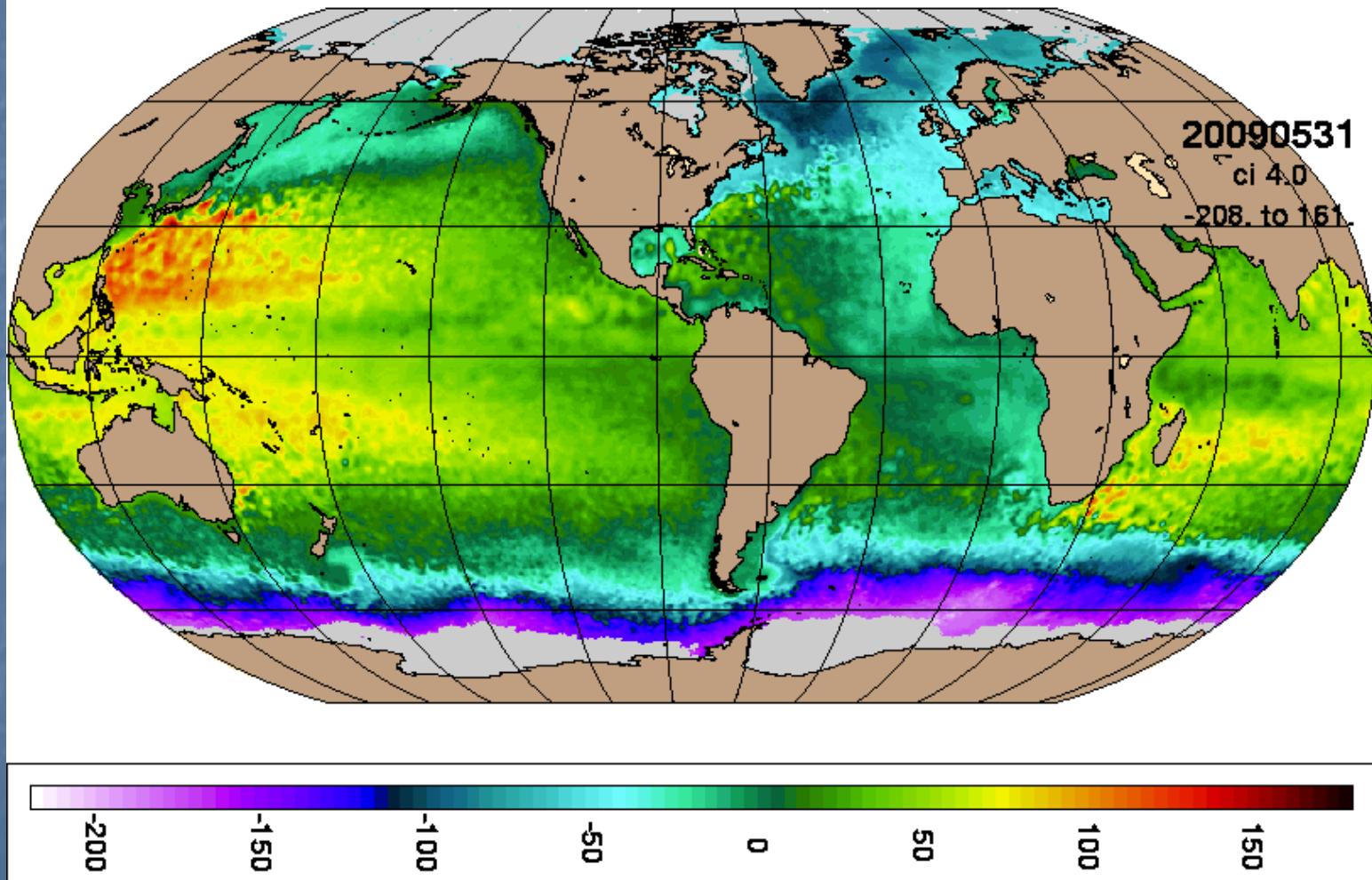
1/12° Global HYCOM Configuration

- Horizontal grid: 1/12° equatorial resolution
 - 4500 x 3298 grid points, ~6.5 km spacing on average, ~3.5 km at pole
- Mercator 79°S to 47°N, then Arctic dipole patch
- Vertical coordinate surfaces: 32 for σ_2^*
- KPP mixed layer model
- Thermodynamic (energy loan) sea-ice model
- Surface forcing: wind stress, wind speed, thermal forcing, precipitation, relaxation to climatological SSS
- Monthly river runoff (986 rivers)
- Initialize from January climatology (GDEM3) T and S, then SSS relaxation from PHC 3.0
 - No subsurface relaxation to climatology

1/12° Global HYCOM

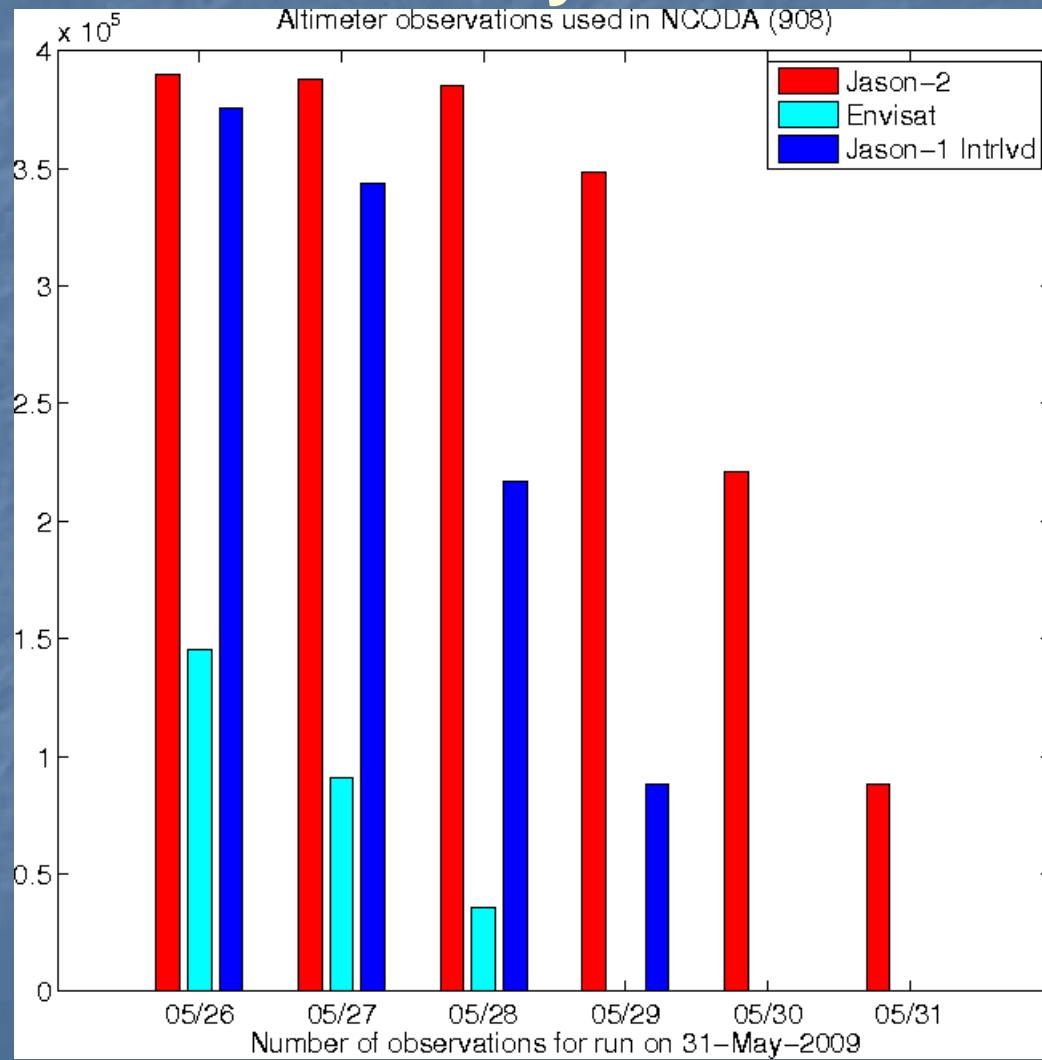
Real time run started 22 December 2006

SSH date: Jun 07, 2009 00Z 90.8

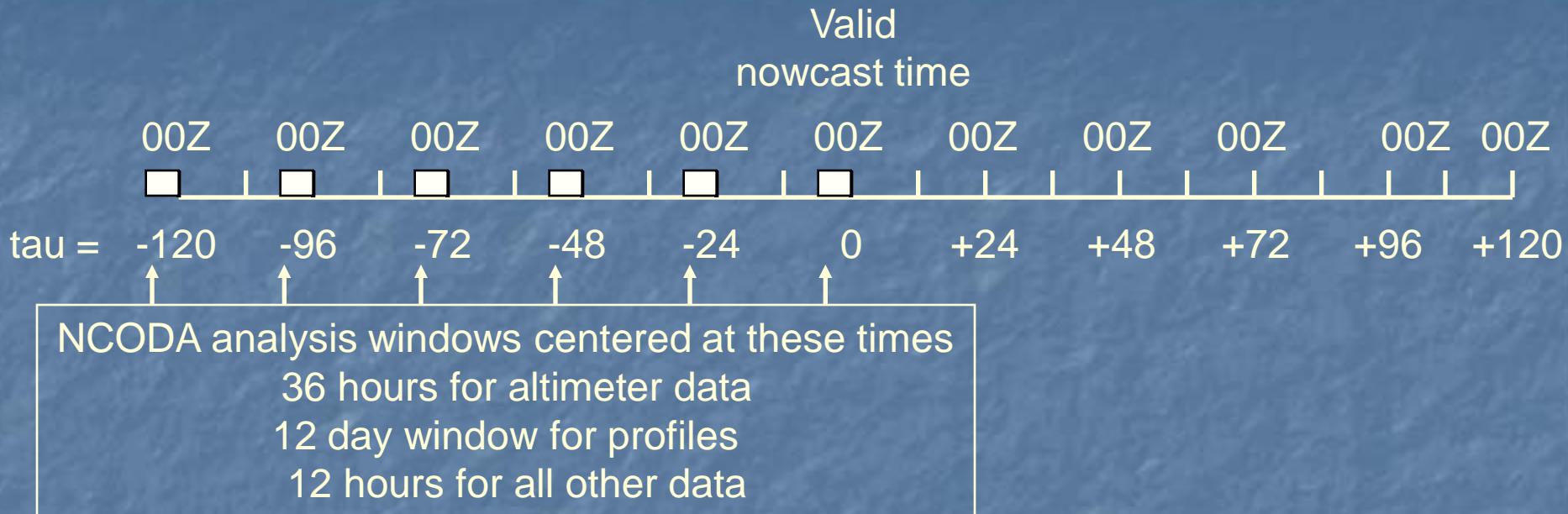


Available altimeter data

31 May 2009



HYCOM/NCODA Runstream

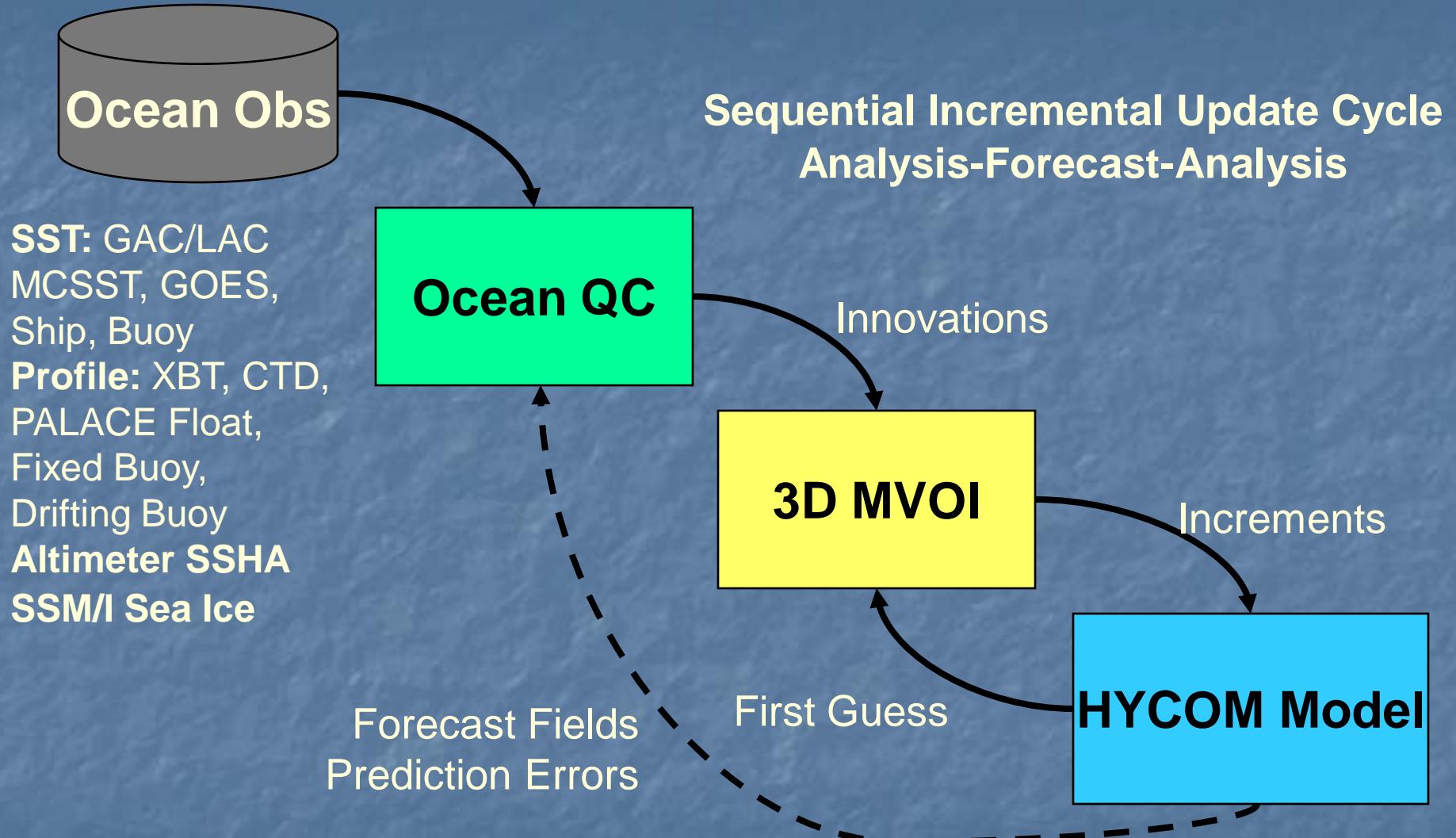


- 1) Perform first NCODA analysis centered on tau = -126, i.e., 18Z
- 2) Run HYCOM for 24 hours using incremental updating () over the first 6 hrs starting at 18Z
- 3) Repeat steps 1) and 2) until the nowcast time
- 4) Run HYCOM in forecast mode out to tau = 120

Approximate run times* (using 619 Cray XT5 processors):

- 1) Six NCODA analyses: 1.4 hrs/analysis = 8.4 hrs
- 2) Five HYCOM hindcast days @ 240 sec Δt: 0.5 hrs/day = 2.5 hrs
- 3) Four HYCOM forecast days @ 240 sec Δt: 0.5 hrs/day = 2.5 hrs
- 4) Total: 13.4 hrs

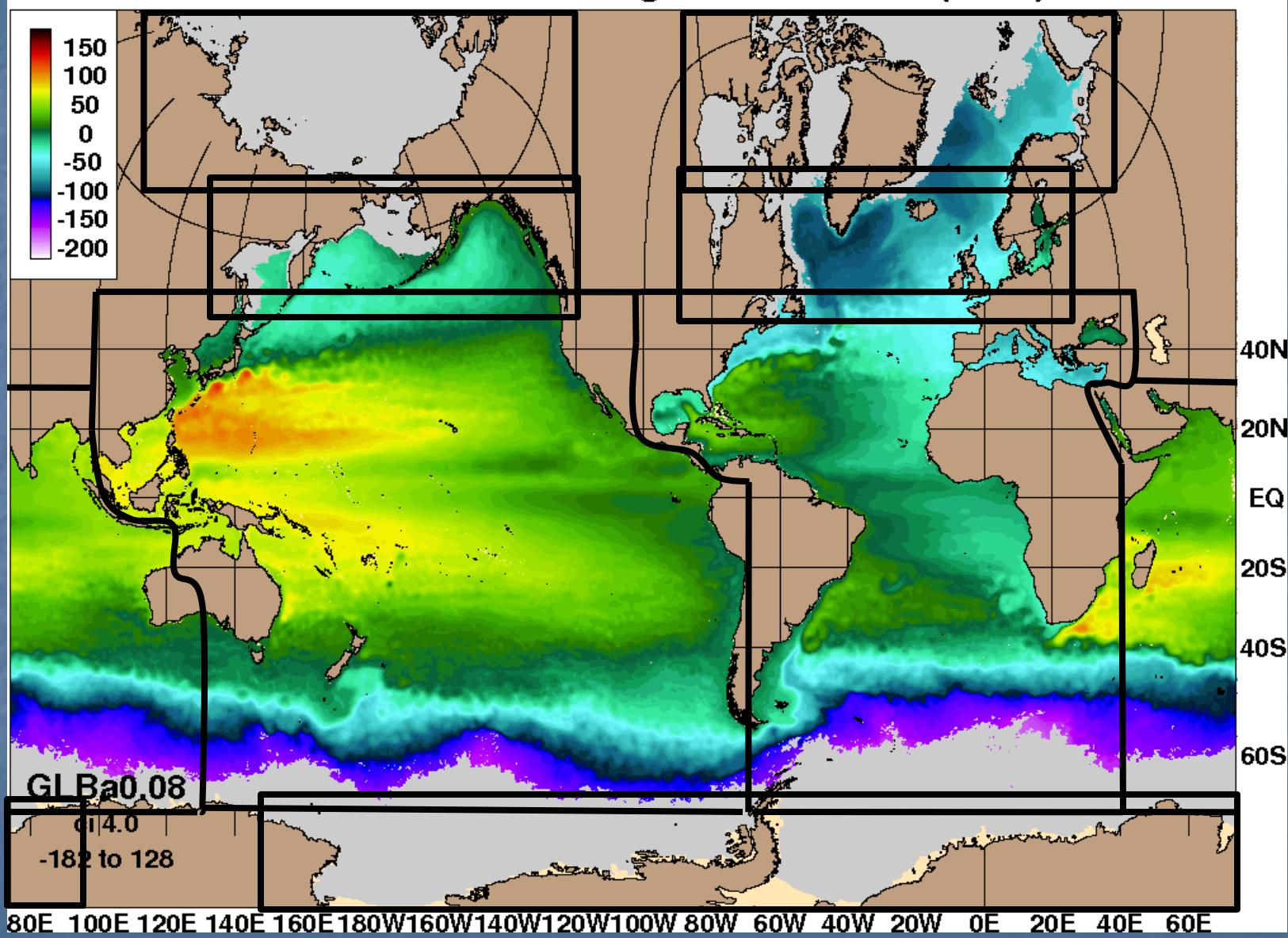
Navy Coupled Ocean Data Assimilation (NCODA)



MVOI - simultaneous analysis 5 ocean variables temperature, salinity, geopotential, layer pressure, velocity (u, v) and sea ice

Data Assimilation Subregions

mean sea surface height 2007-2008 (72.3)

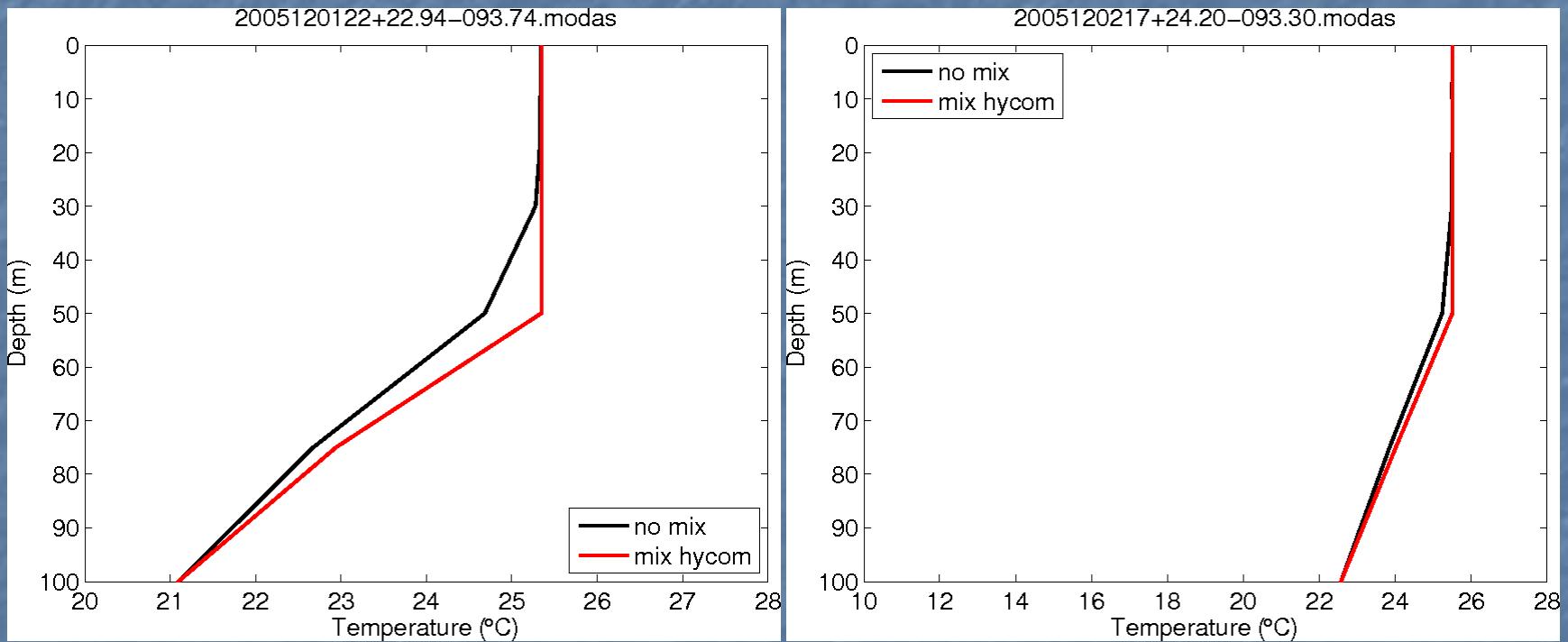


HYCOM/NCODA

- A modification to the NCODA MODAS synthetic profiles has been implemented. The synthetic profiles are modified to reflect the HYCOM mixed layer depth

HYCOM/NCODA

MODAS profile modified over the depth of the HYCOM mixed layer

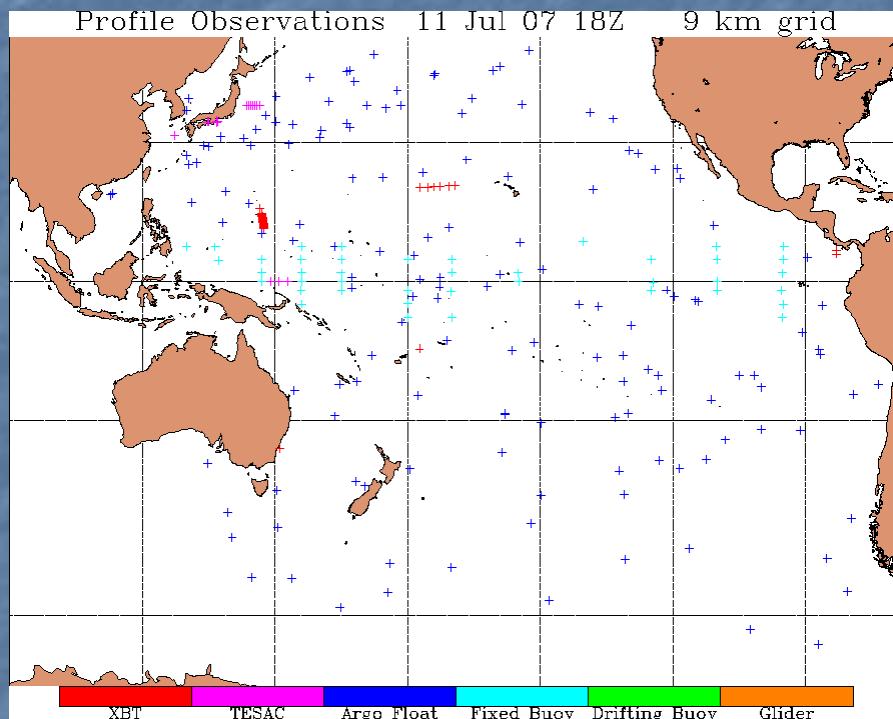


HYCOM/NCODA

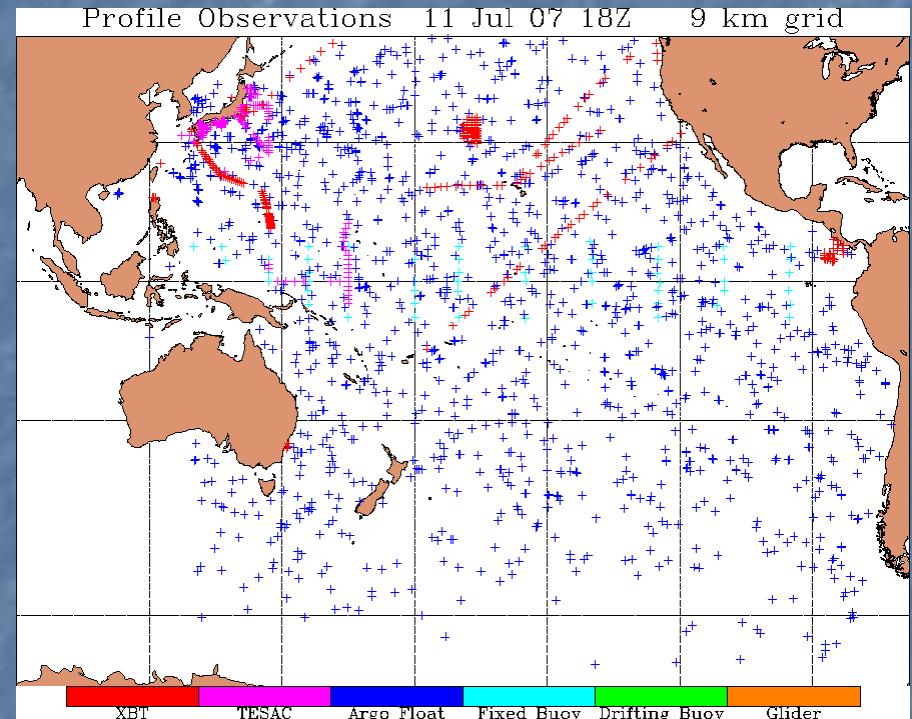
- The daily NCODA analysis is using an increased time window of profile observations (12 days, instead of 1 day)

NCODA Profile Observation Locations

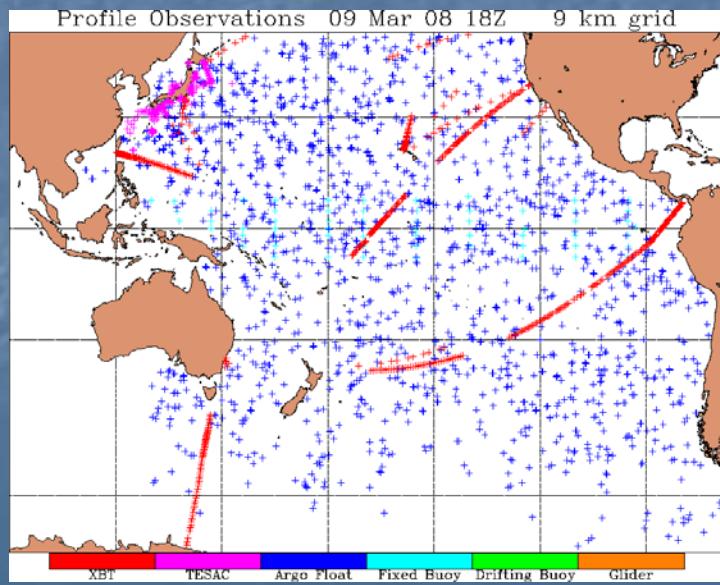
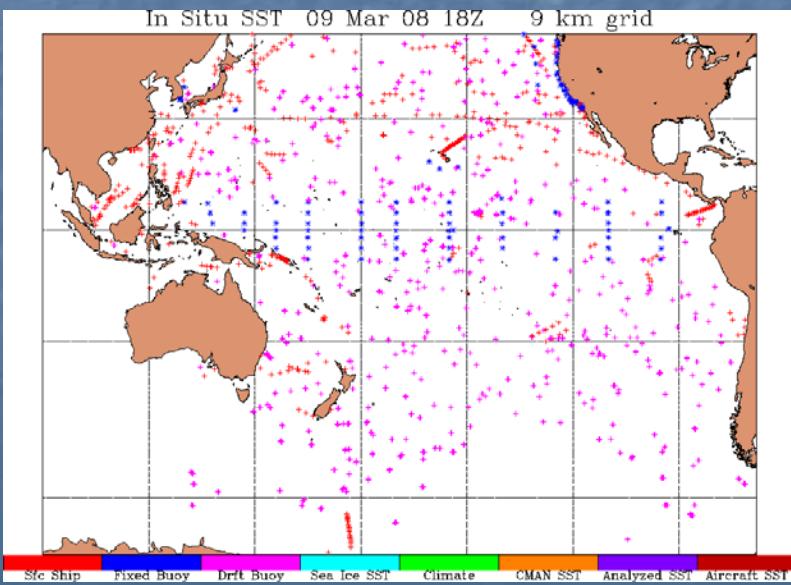
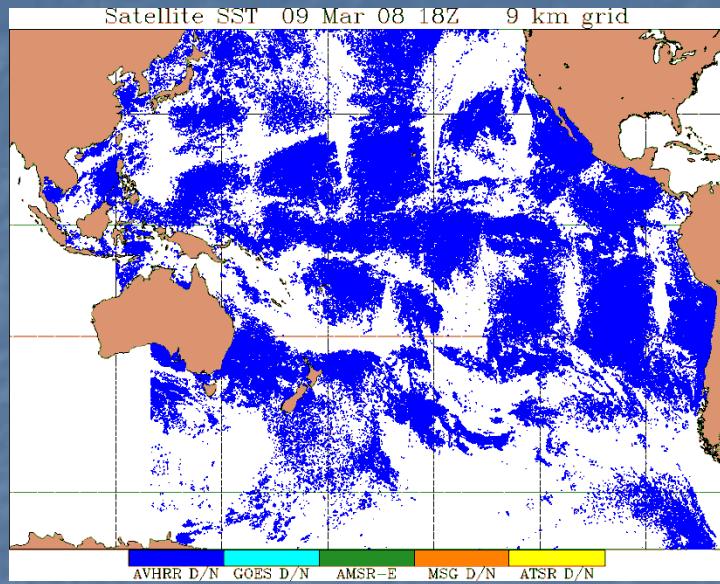
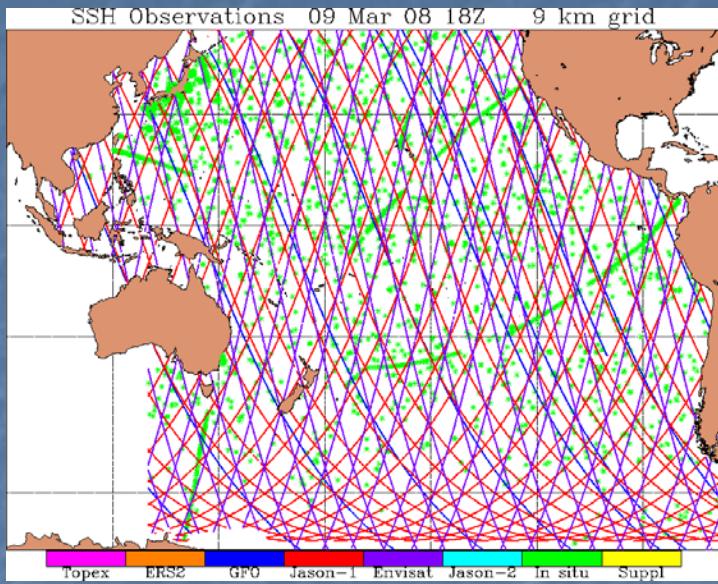
24 hour window



12 day window



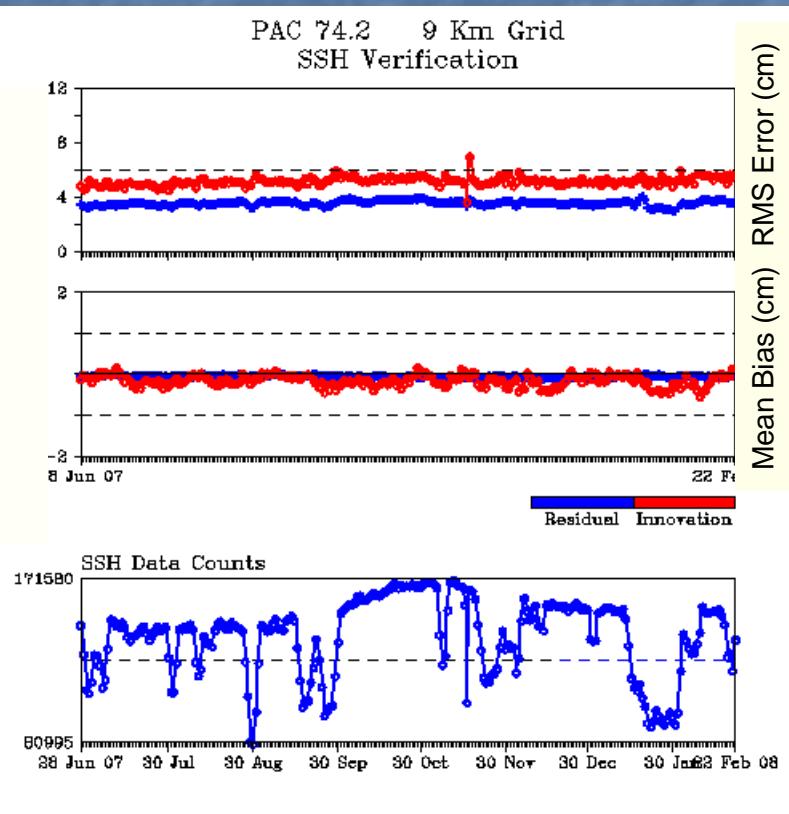
NCODA Observation Locations 9 March 2008



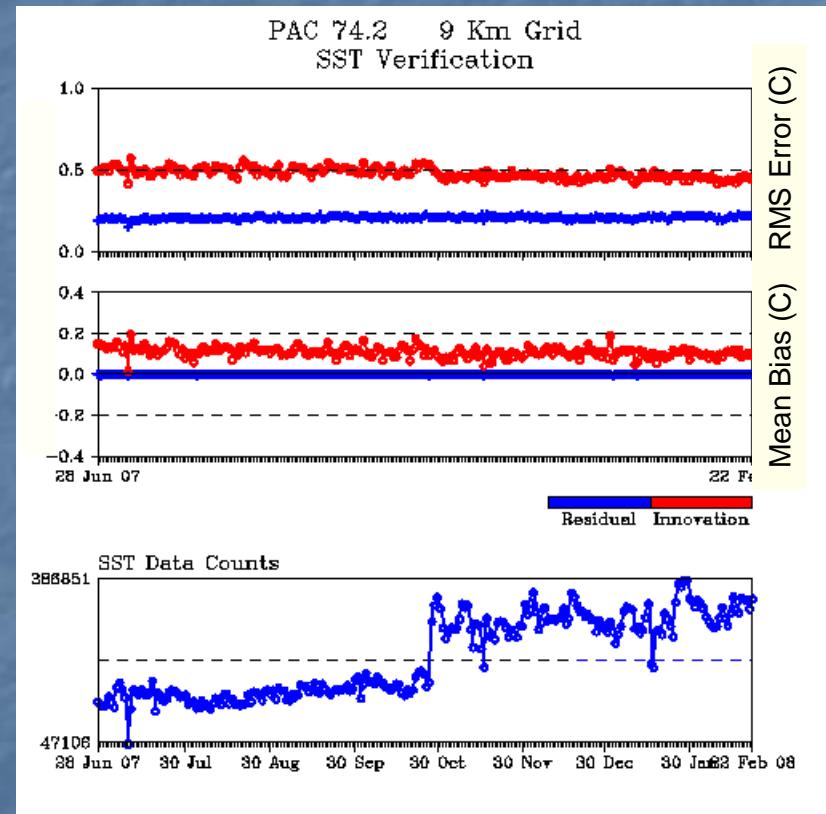
NCODA verification

Pacific Ocean

SSH verification



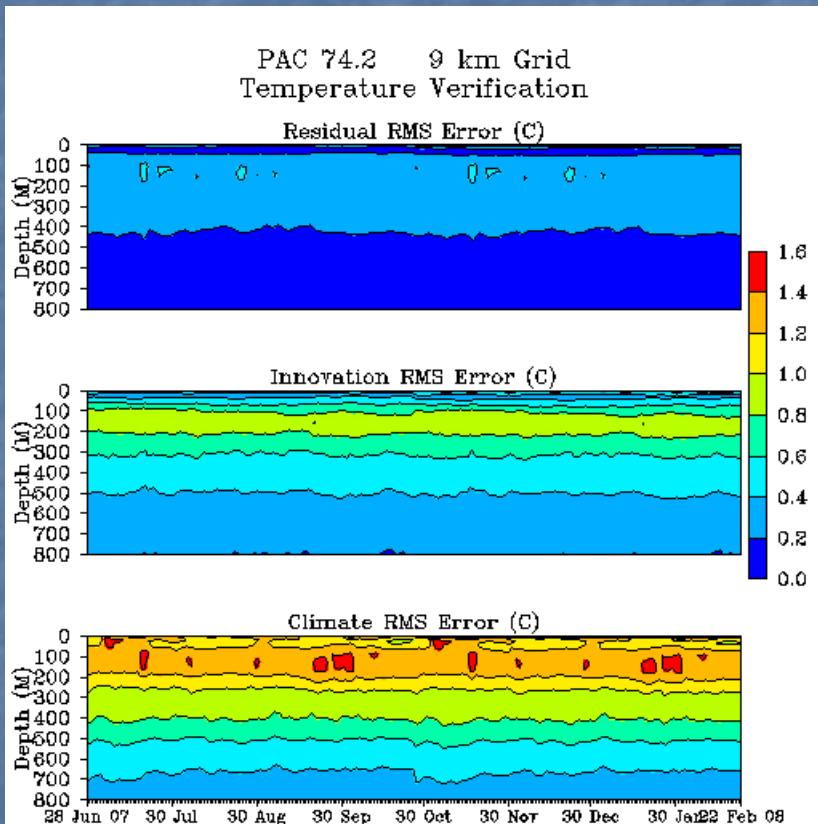
SST verification



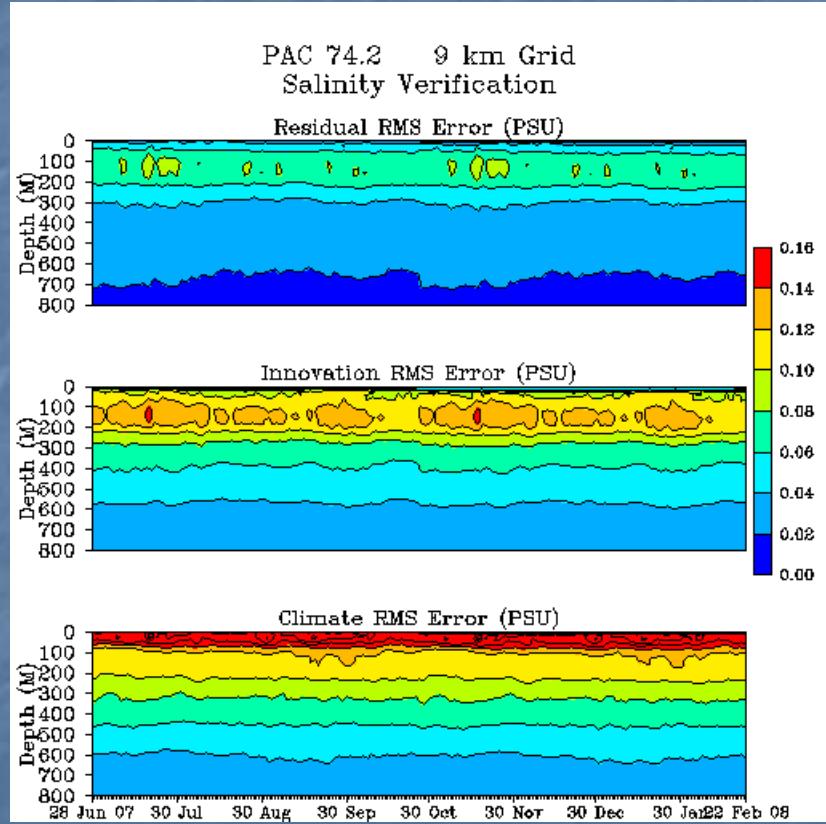
NCODA verification

Pacific Ocean

Temperature verification

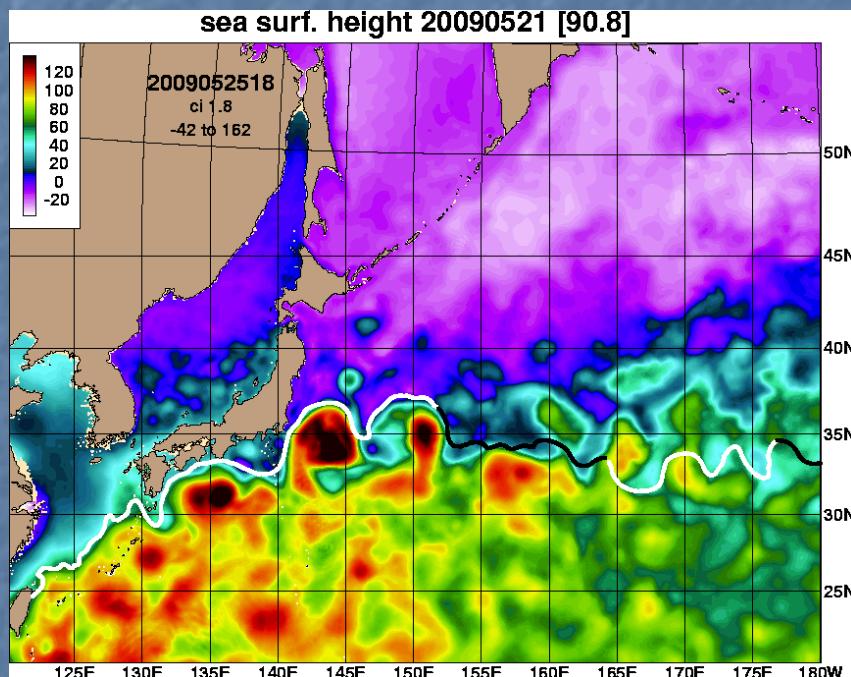


Salinity verification

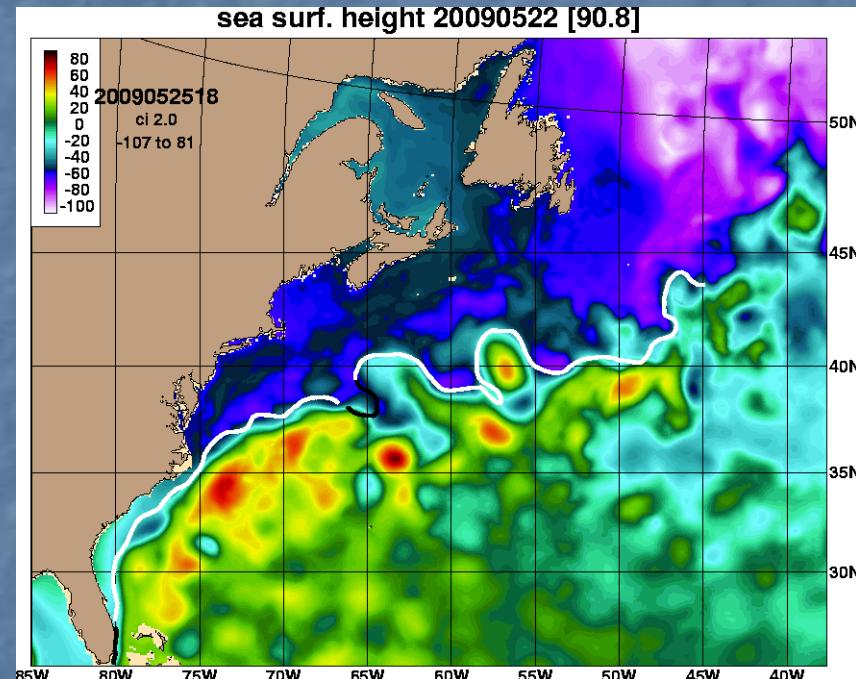


Gulf Stream and Kuroshio SSH with SST-based frontal analysis overlaid

21 May 2009



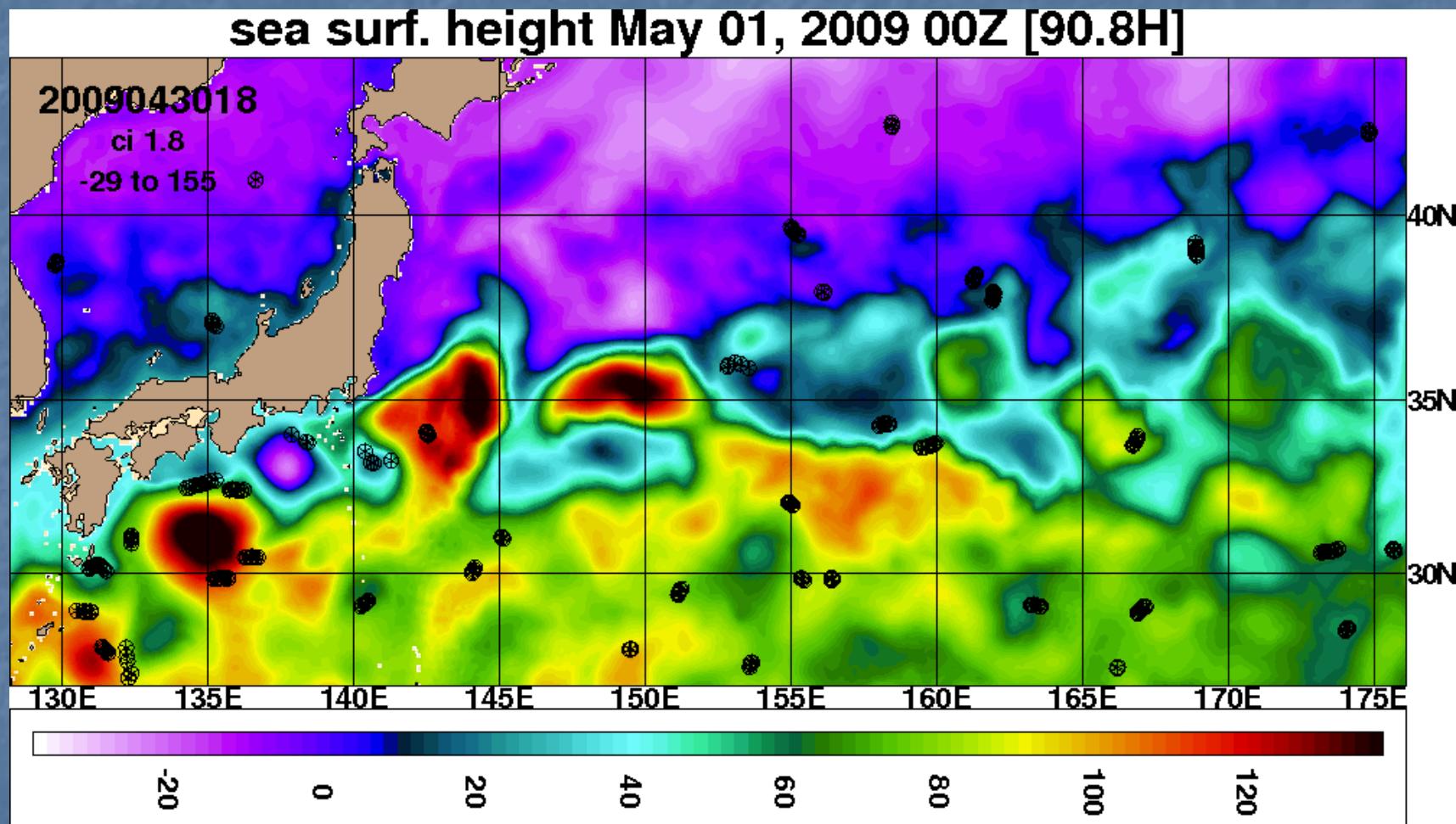
22 May 2009



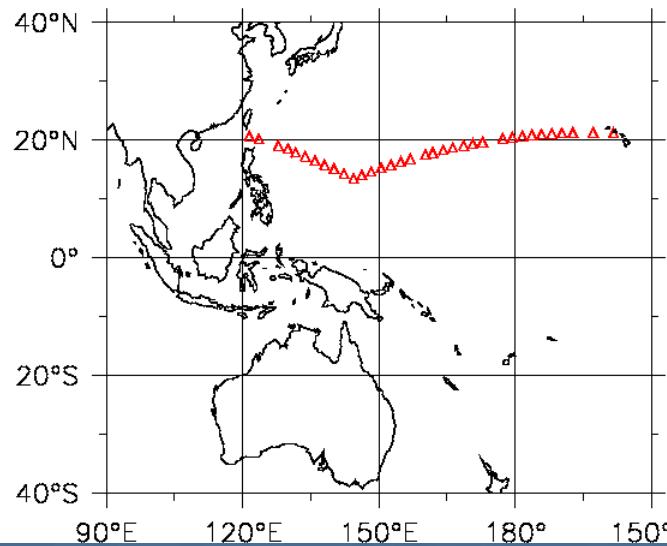
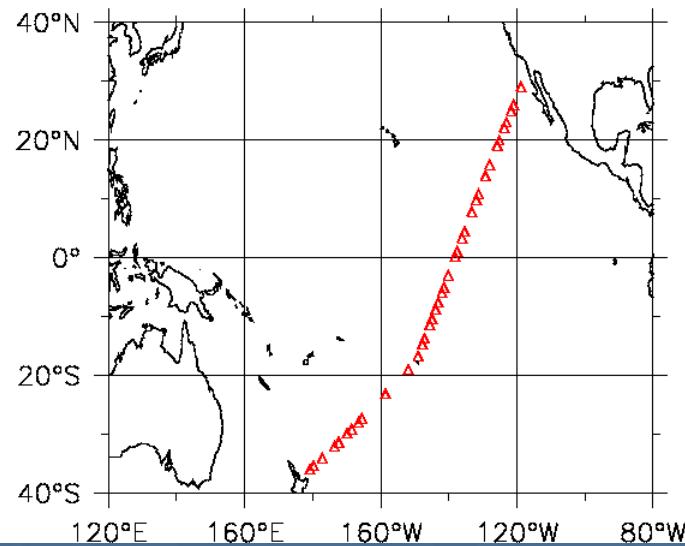
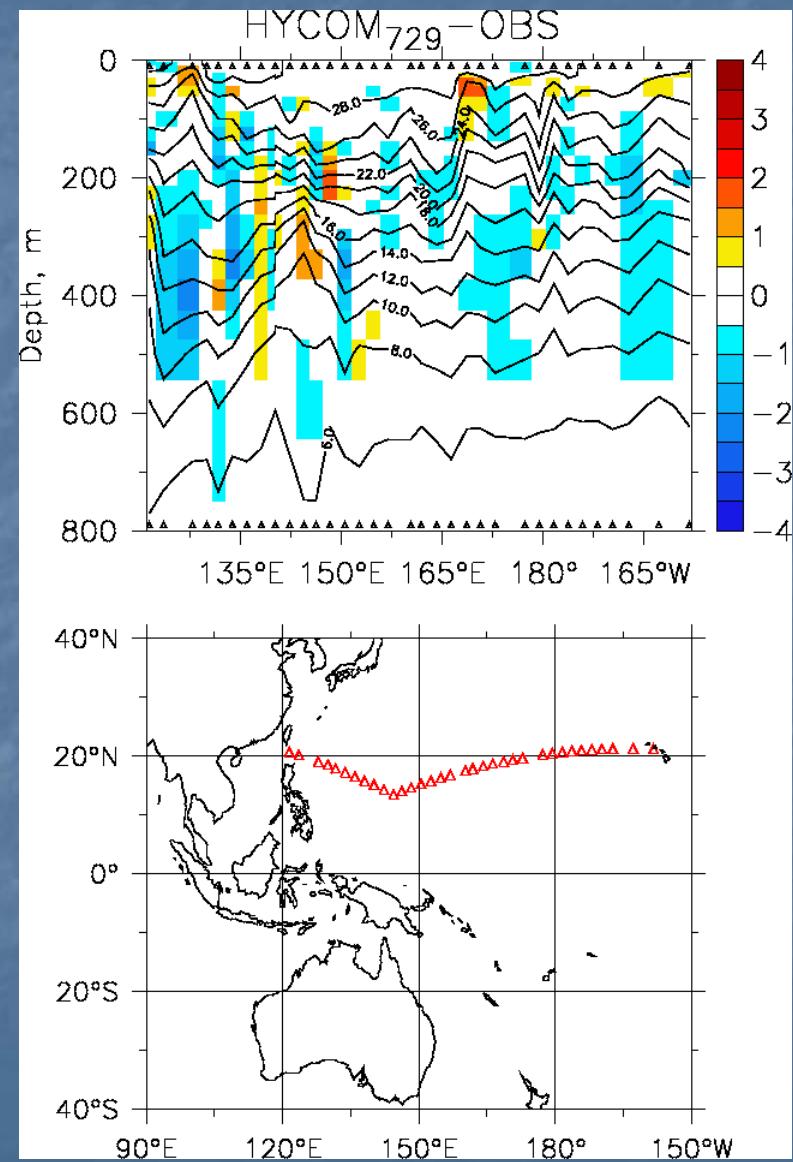
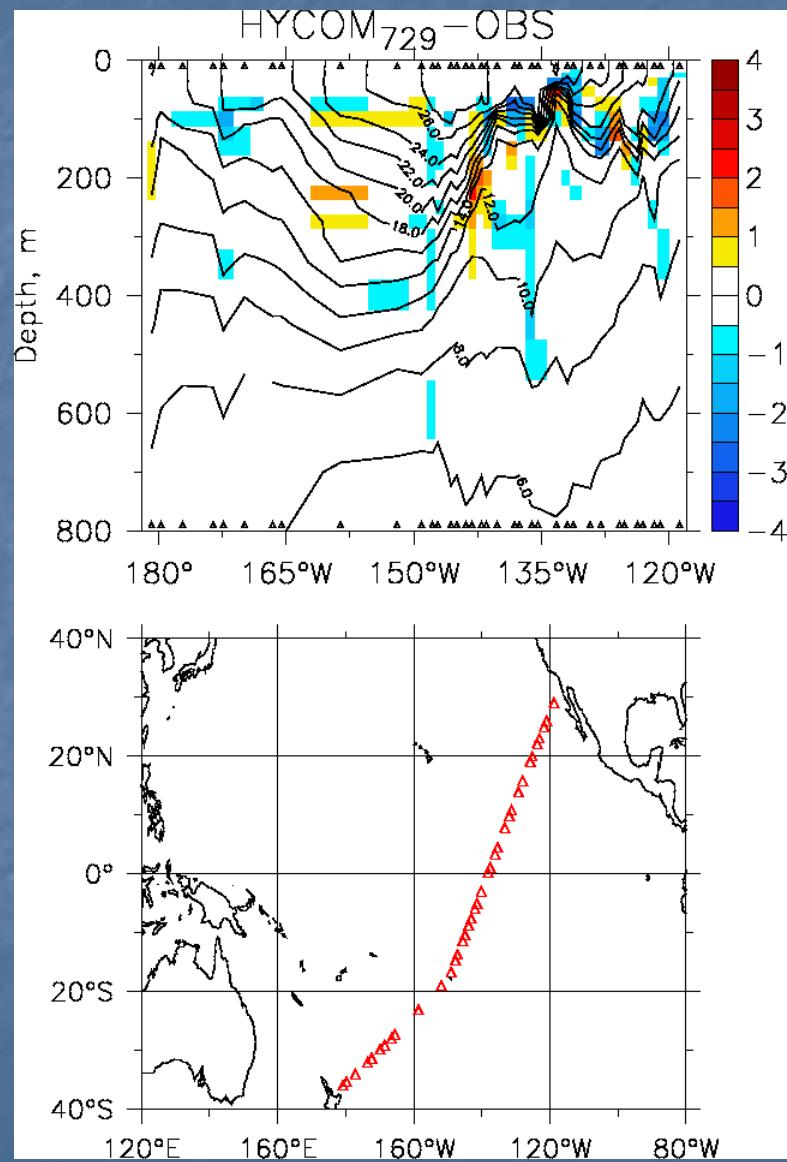
Frontal analysis < 4 days old = white,
analysis \geq 4 days old = black

1/12° Global HYCOM

SSH and surface drifters



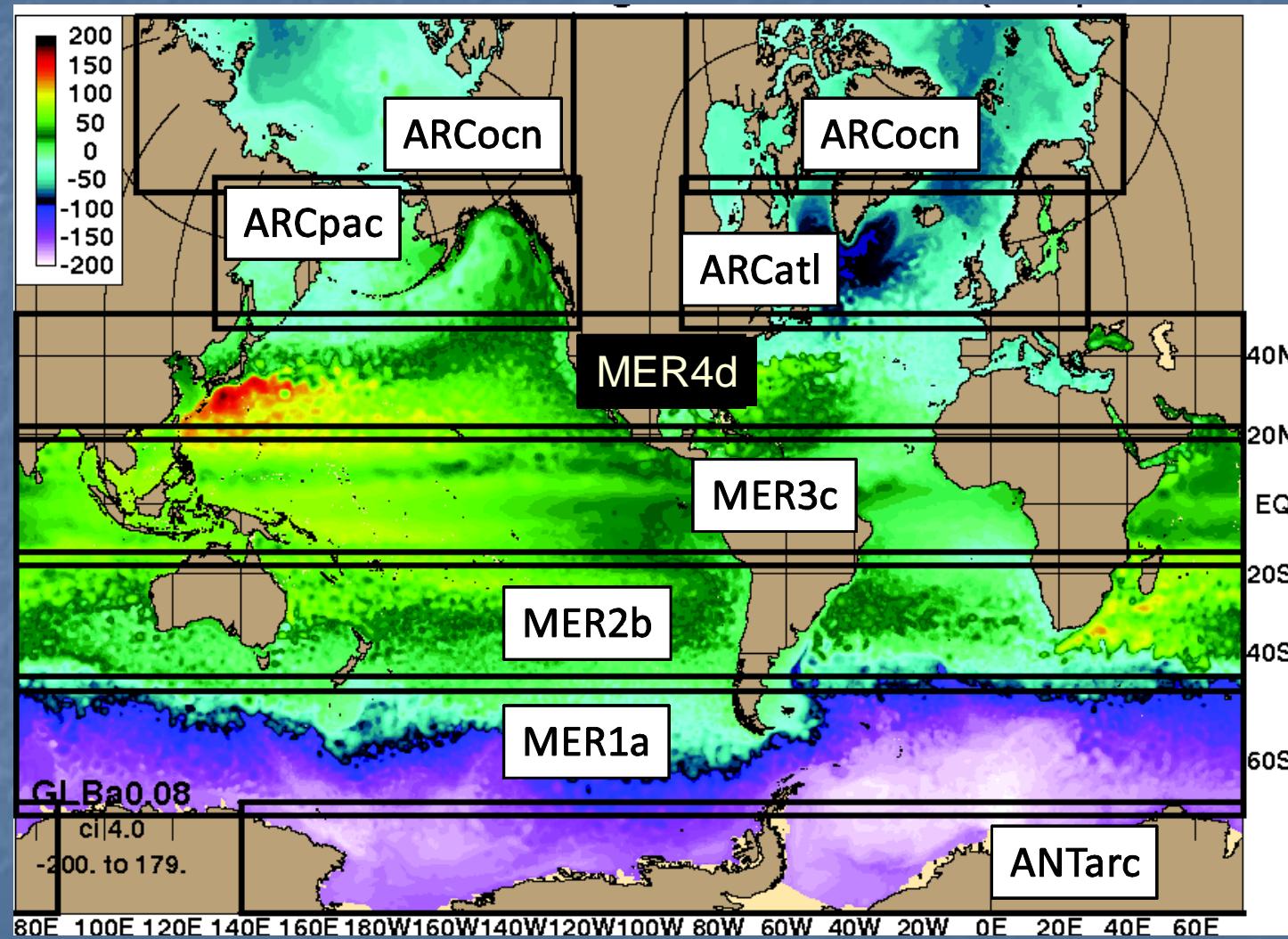
Comparison to XBT along ship track



Large Scale Prediction

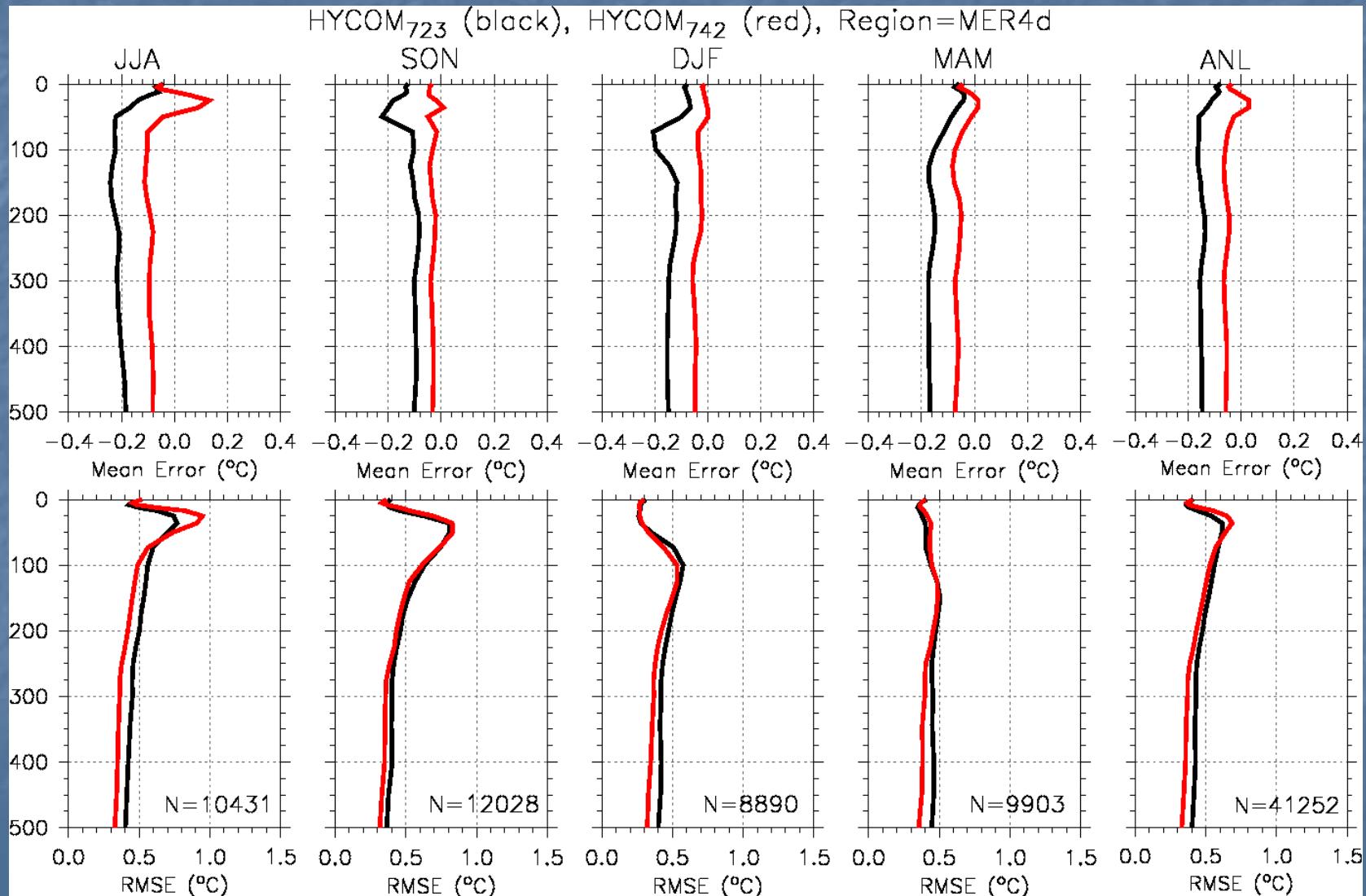
Old Assimilation Subregions

MERall



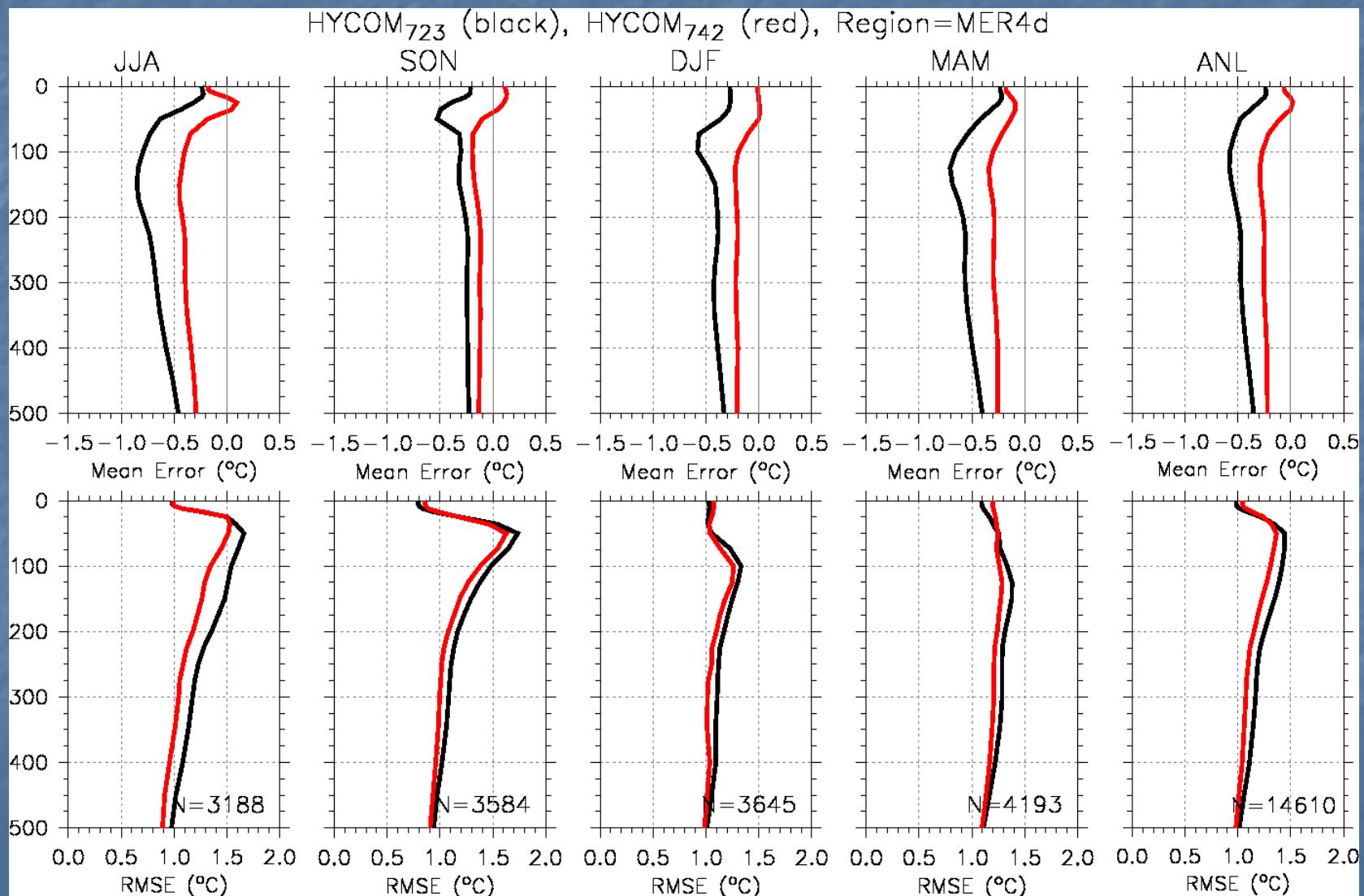
HYCOM/NCODA

Comparison to assimilated profiles (June 2007- May 2008)

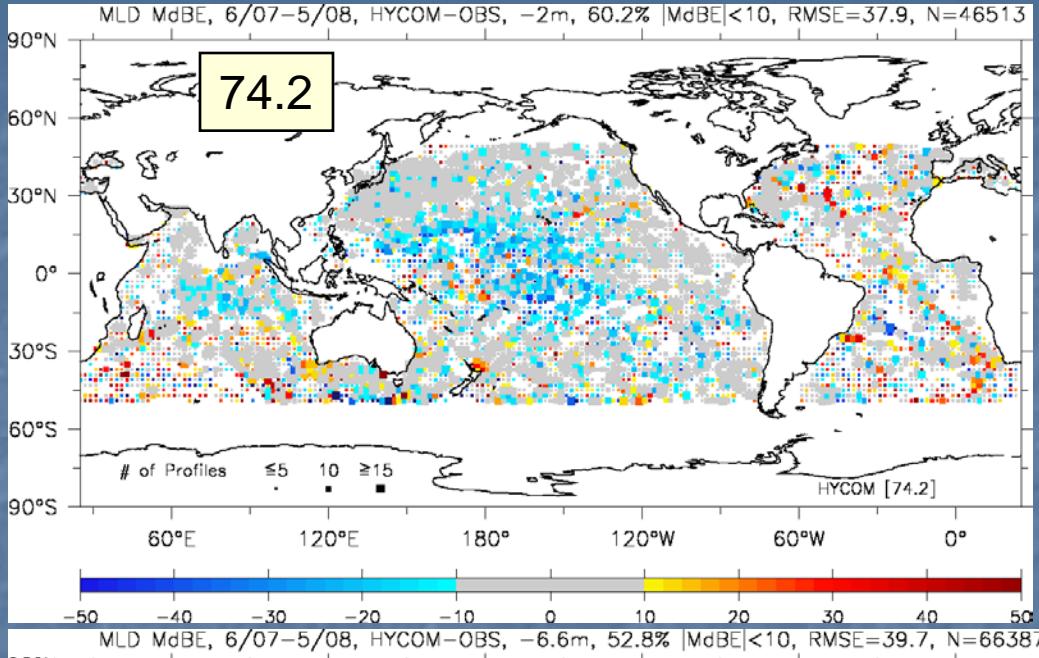


HYCOM/NCODA

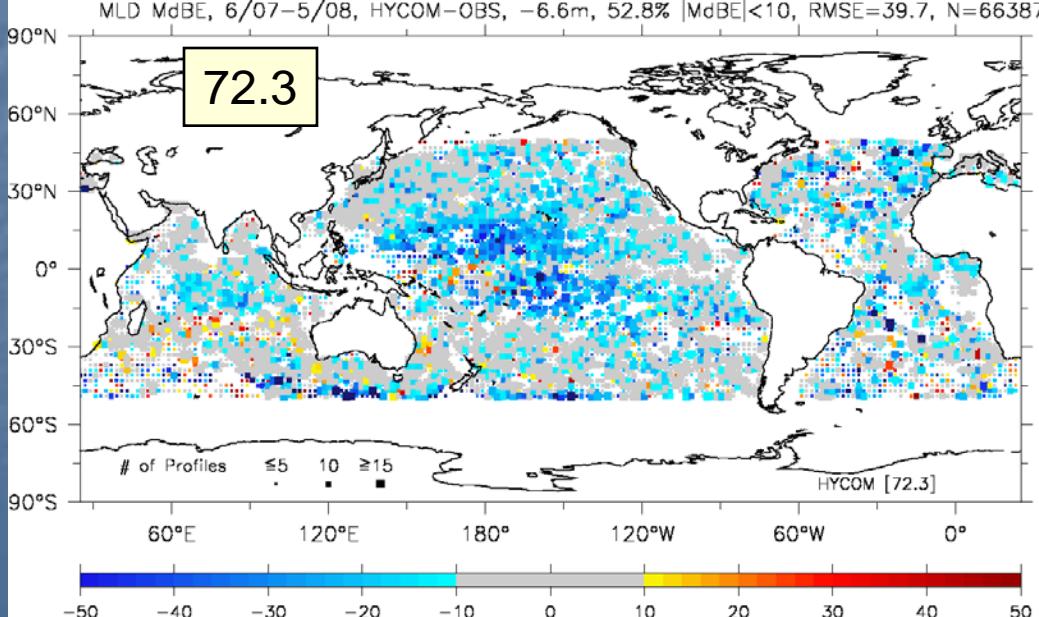
Comparison to non assimilated profiles (June 2007-May 2008)



Mixed Layer Depth Median Bias Error using unassimilated profiles



Overall shallow bias

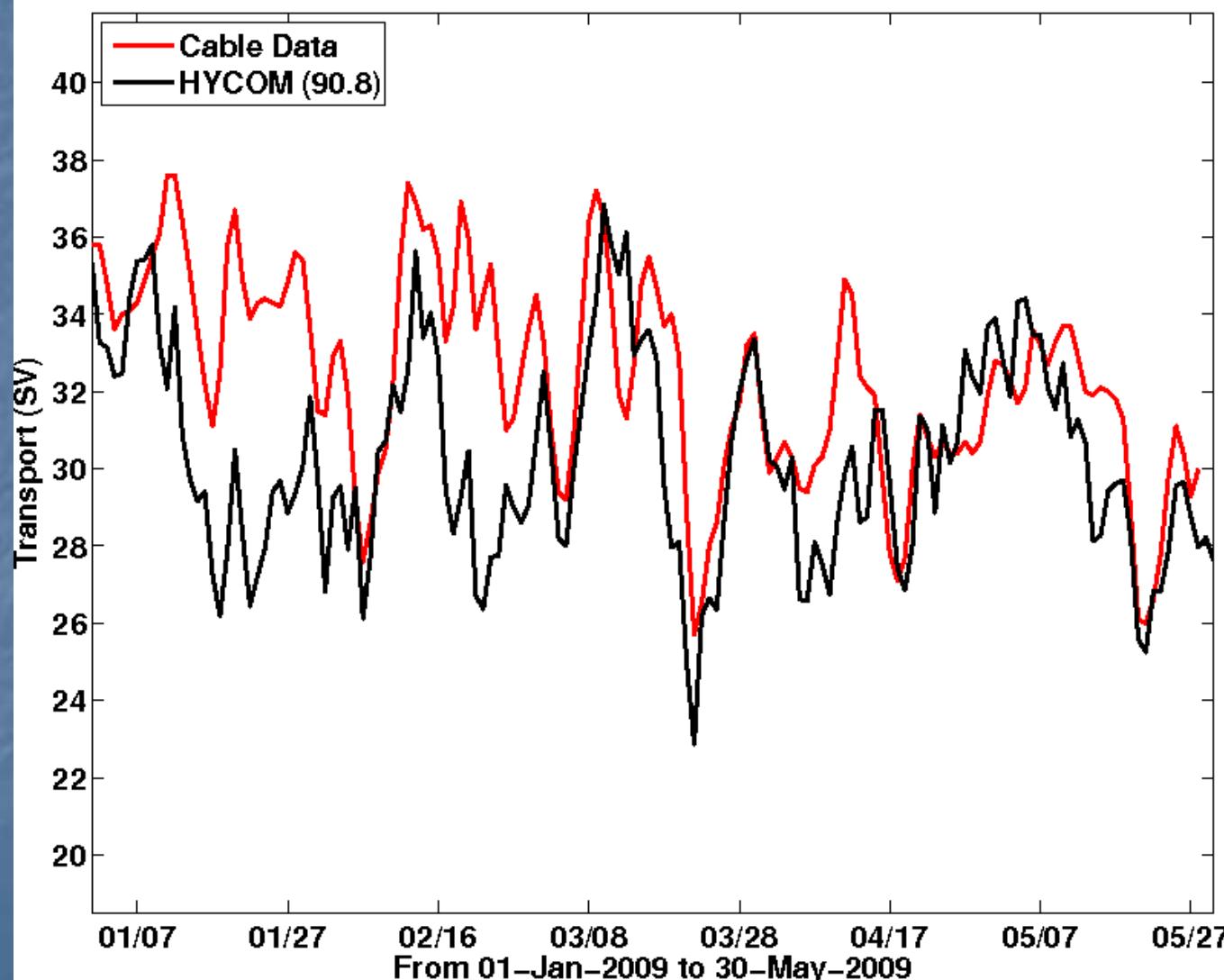


1/12° Global HYCOM

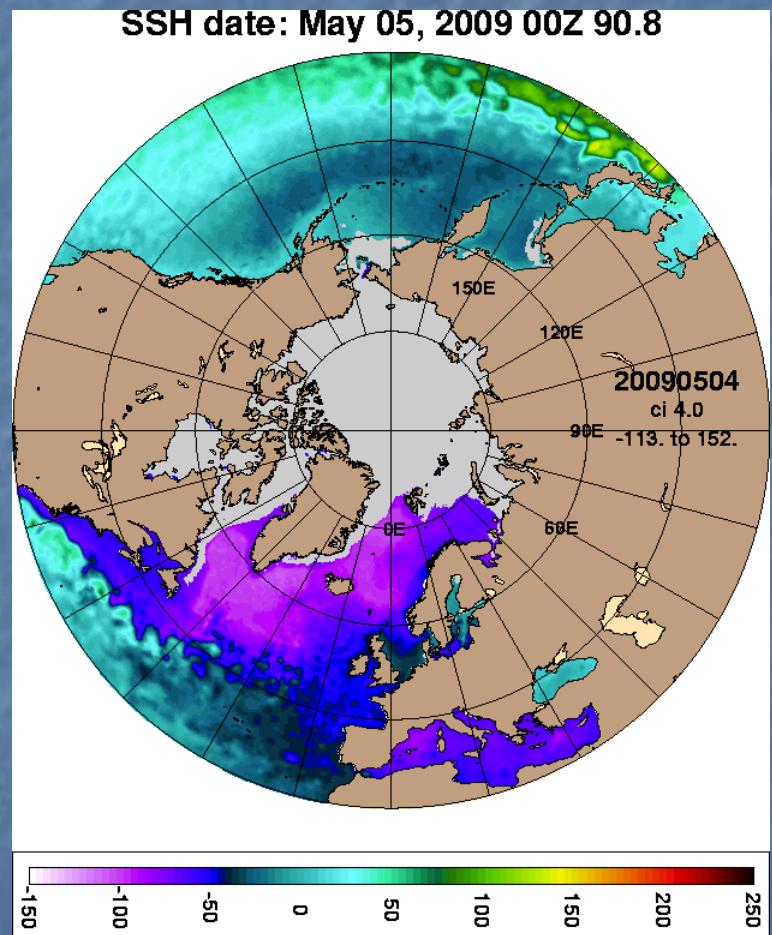
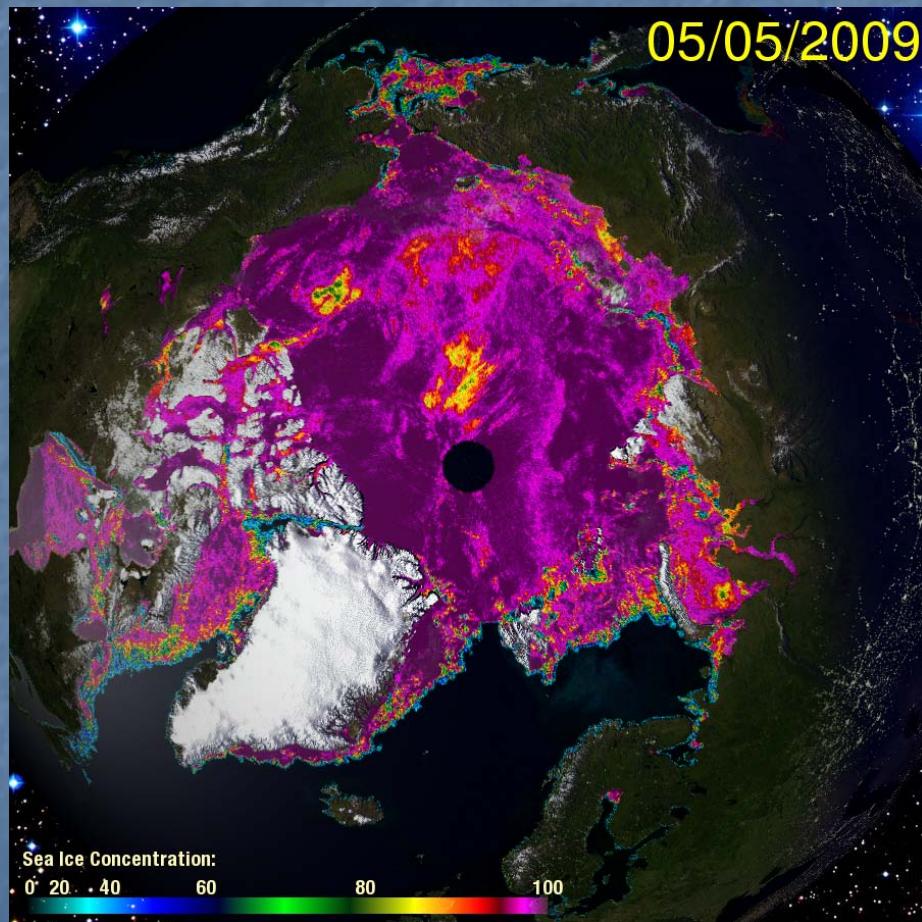
Transport at 27°N

HYCOM GLBa0.08–90.8–nowcast: Florida Strait at 27.02N

Layer 1–32 Mean: 30.26 Min: 22.87 Max: 36.84 Std: 2.72

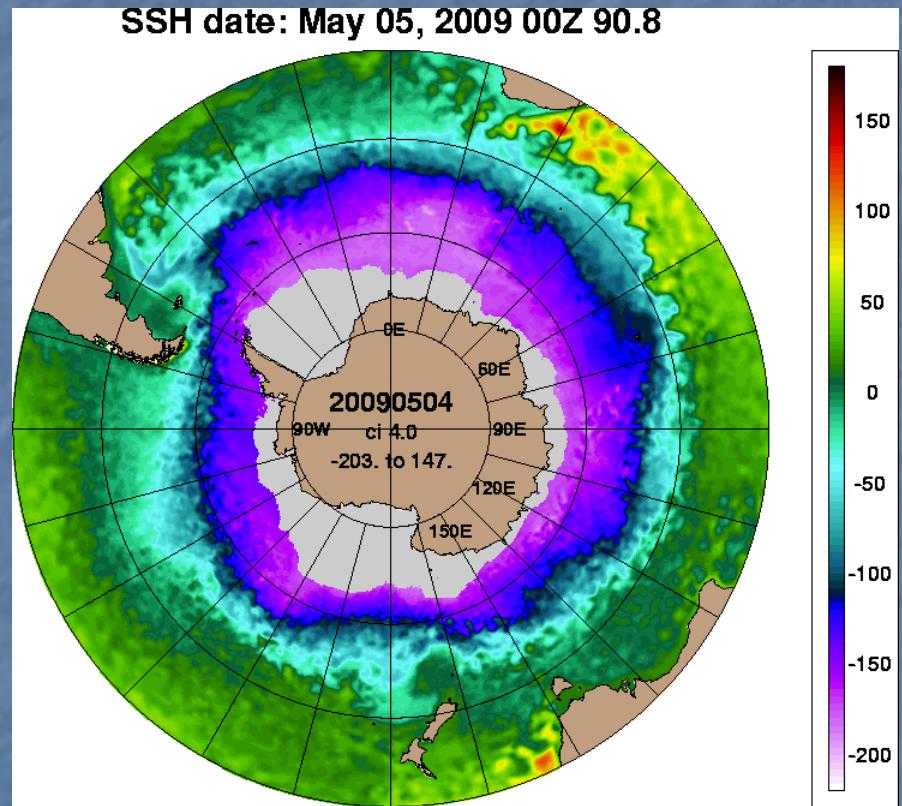
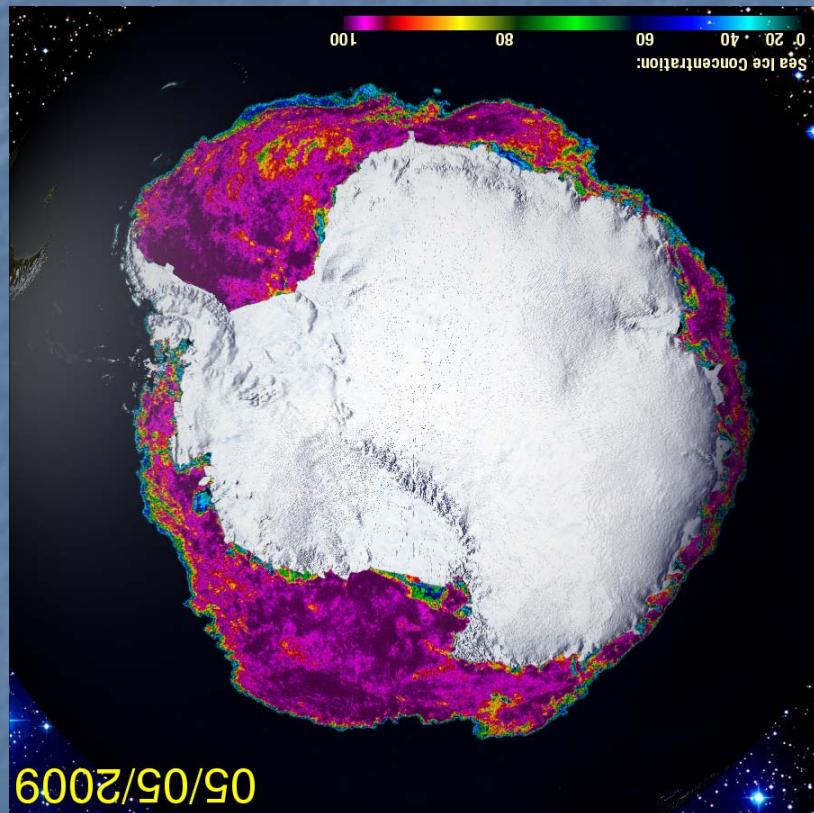


Sea Ice Arctic



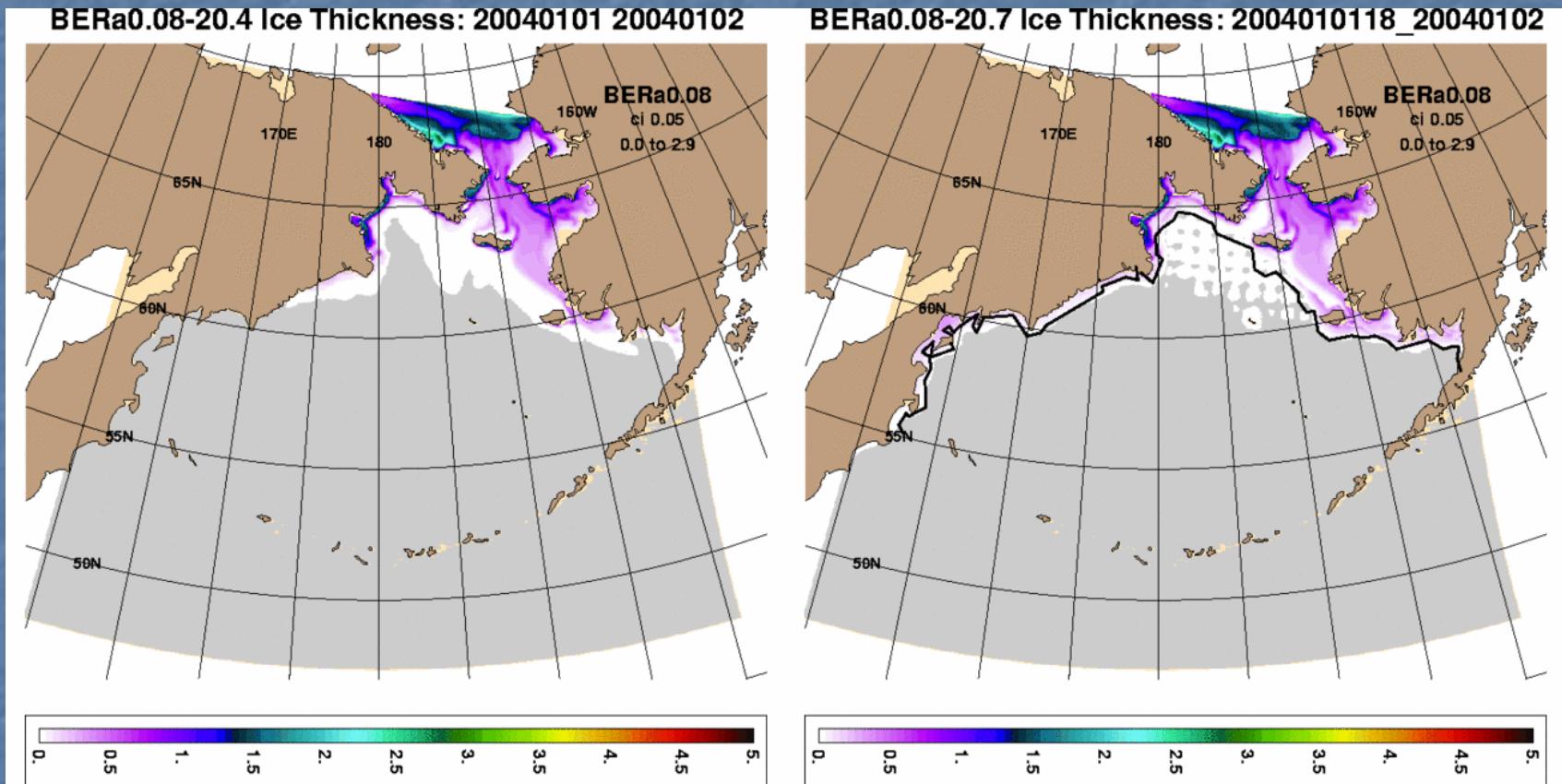
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Polar Research Group
DEPARTMENT OF ATMOSPHERIC SCIENCES

Sea Ice Antarctic



HYCOM/CICE/NCODA

Bering Sea



Black line represent the independent ice edge analysis performed at the National Ice Center.

END