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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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
Florida Current transport at 27°N

Cable data: http://www.aoml.noaa.gov/phod/floridacurrent/
GULF OF MEXICO MODEL CONFIGURATION

- Horizontal grid: 1/12° (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° 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

25.08°N
T and ρ section along 25.08°N, 31 August 1999

T and S updating

T and S updating, new hybgen
T and $\rho$ section along 25.08°N, 31 August 1999

T and S updating, new hybgen

T, S and dp updating
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

26.45°N, 93.82°W

22.75°N, 85.17°W
BT comparison October 1999
Mean Temperature Layer 1

Mean Temperature Layer 1

Temp (°C)

Time (Julian days 1999)

011 noassim (no fluxoff)
012 noassim (-50W fluxoff)
013 noassim (+50W fluxoff)
Mean Temperature Layer 1

The diagram shows the mean temperature over time for different temperature layers. The Y-axis represents temperature (°C) ranging from 27 to 30.5, and the X-axis represents time in Julian days from 240 to 260. Different colors and line styles indicate various simulation scenarios, such as 'noassim (no fixoff)' and 'noassim (-50W fixoff)'.
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

T, S and dp updating
Sequential Incremental Update Cycle
Analysis-Forecast-Analysis

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

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

Ocean QC
- Innovations
- 3D MVOI
- Increments
- Forecast Fields
- Prediction Errors

HYCOM Model
- First Guess

NRL Coupled Ocean Data Assimilation (NCODA)
T and \( \rho \) section along 25.08°N, 31 August 1999

T and S updating

T, S and dp updating
T and p section along 25.08°N, 31 August 1999

T and S updating

T and S updating, new hybgen