The 1/12º global HYCOM real-time nowcast/forecast system

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**Report Documentation Page**

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Standard Form 298 (Rev. 8-98)
Prepared by ASNL SDZ9-18
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 $\sigma_2^*$

- KPP mixed layer model

- Thermodynamic (energy loan) sea-ice model

- Surface forcing: FNMOC NOGAPS 0.5° wind stress, wind speed, thermal forcing, and NOGAPS 1.0° precipitation

- 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: Feb 20, 2008 90.4
**Navy Coupled Ocean Data Assimilation (NCODA)**

- **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**
  - MVOI - simultaneous analysis 6 ocean variables: temperature, salinity, geopotential, layer pressure, velocity (u,v)

- **3D MVOI**
  - Innovations
  - Increments

- **HYCOM Model**
  - First Guess

- **Sequential Incremental Update Cycle**
  - Analysis-Forecast-Analysis

MVOI - simultaneous analysis of 6 ocean variables: temperature, salinity, geopotential, layer pressure, velocity (u,v).
Available altimeter data
23 January 2008
1) Perform first NCODA analysis centered on tau = -126
2) Run HYCOM for 24 hours using incremental updating (■) over the first 6 hrs
3) Repeat steps 1) and 2) until the nowcast time
4) Run HYCOM in forecast mode out to tau = 120

Approximate run times* (using 379 IBM Power 5+ processors):
1) Six NCODA analyses: 1.1 hrs/analysis = 6.6 hrs
2) Five HYCOM hindcast days @ 240 sec Δt: 0.8 hrs/day = 4.0 hrs
3) Five HYCOM forecast days @ 240 sec Δt: 0.8 hrs/day = 4.0 hrs
4) Total: 14.6 hrs

* Timings do not include PIPS coupling
Data Assimilation Subregions
Overlaid on SSH valid on 21 February 2008

Sea surface height 21 February 2008 (90.4)
NCODA Observation Locations

19 January 2008

SSH Observations 19 Jan 08 18Z 9 km grid

Satellite SST 19 Jan 08 18Z 9 km grid
Sea Surface Height and Sea Surface Temperature Increments

19 January 2008

SSH Analyzed Increment (M)
19 Jan 08 18Z 9 km grid

SST Analyzed Increment (C)
19 Jan 08 18Z 9 km grid

-3 -2 -1 0 1 2 3 °C
-.3 -.2 -.1 0 .1 .2 .3 m
Temperature Increments

19 January 2008

Temperature Analyzed Increment (°C)
19 Jan 08 18Z  Tau 000  9 km grid

36 M Depth

Temperature Analyzed Increment (°C)
19 Jan 08 18Z  Tau 000  9 km grid

300 M Depth

°C

m
NCODA verification

SSH verification

Verification - Sea Surface Height Anomaly 9 km grid

19 Jan 08 16Z

Background SSH Anomaly

Analysis SSH Anomaly

RMS = 0.05
Bias = 0.00
N = 48273

SST verification

Verification - Sea Surface Temperature 9 km grid

19 Jan 08 16Z

Background Temperature

Analysis Temperature

RMS = 0.25
Bias = 0.00
N = 239988
Data Assimilation in Global HYCOM
Gulf Stream and Kuroshio SSH with SST-based frontal analysis overlaid

24 January 2008

2 February 2008

Frontal analysis < 4 days old = white,
analysis ≥ 4 days old = black
White lines are the mean position and +- 1 stdv
1/12° Global HYCOM
SSH and surface drifters
Vertical Temperature Profiles

Locations of TAO buoys

Mean sea surface temperature January 2004 (60.5)
Vertical temperature profiles

5ºS 165ºE

Temperature at: 165e05s

8ºN 110ºW

Temperature at: 110w08n