

# **Update on U.S. Navy Ocean Analysis and Prediction: Existing and Future Plans**

presented by

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# Present U.S. Navy Operational Capabilities Related to GODAE

## Viewable on the web

[http://www.ocean.nrlssc.navy.mil/global\\_nlom](http://www.ocean.nrlssc.navy.mil/global_nlom)

<http://www.fnmoc.navy.mil/PUBLIC>

<http://www.navo.navy.mil>

| Operational Global Ocean Product                              | Inputs                                                          | Run by |
|---------------------------------------------------------------|-----------------------------------------------------------------|--------|
| $\sim 1/2^\circ$ 2D MVOI SST Analysis <sup>1</sup>            | IR + in situ                                                    | FNMOCC |
| $1/8^\circ$ MODAS SST Analysis <sup>2</sup>                   | IR                                                              | NAVO   |
| $1/4^\circ$ MODAS SSH Analysis <sup>2</sup>                   | ENVISAT+GFO+JASON-1 <sup>3</sup>                                | NAVO   |
| $1/16^\circ$ global NLOM nowcast/forecast system <sup>2</sup> | ENVISAT+GFO+JASON-1 <sup>3</sup><br>SST<br>FNMOCC winds+thermal | NAVO   |

<sup>1</sup> T239 or  $\sim 1/2^\circ$  for atmospheric model boundary condition (on GODAE server)

<sup>2</sup> Provide subsurface temperature

<sup>3</sup> T/P is planned

- Real-time altimetry via NAVO Altimeter Data Fusion Center (ADFC)
- NLOM: NRL Layered Ocean Model
- GODAE: Global Ocean Data Assimilation Experiment
- FNMOCC operates a GODAE data server with data and products from a variety of sources, including real-time altimetry from the NAVO ADFC

# U.S. Navy Future Operational Transitions Related to GODAE

Participants: FNMOC, NAVO, NRL, ONR, Univ, Contractors

| Global Product                        | Mid-Lat Resolution | Vert. Coord.    | Inputs                                                  | Run By | Target Date |
|---------------------------------------|--------------------|-----------------|---------------------------------------------------------|--------|-------------|
| 1/8° NCOM <sup>1</sup>                | 15 km              | $\sigma/z$      | SSH, SST, hydro, FNMOC<br>NOGAPS<br>atmospheric forcing | NAVO   | 2004        |
| 1/32° NLOM <sup>2</sup>               | 3.5 km             | Layered         |                                                         | NAVO   | 2004        |
| 1/12° HYCOM                           | 7 km               | $\rho/\sigma/z$ |                                                         | NAVO   | 2007        |
| 1/4° HYCOM <sup>3</sup>               | 20 km              | $\rho/\sigma/z$ |                                                         | FNMOC  | 2009        |
| 1/25° HYCOM                           | 3.5 km             | $\rho/\sigma/z$ |                                                         | NAVO   | 2011        |
| Semi-operational Product <sup>4</sup> |                    |                 |                                                         |        |             |
| 1/12° Atl. HYCOM <sup>5</sup>         | 7 km               | $\rho/\sigma/z$ |                                                         | NAVO   | 2005        |
| 1/12° Pac. HYCOM                      | 7 km               | $\rho/\sigma/z$ |                                                         | NAVO   | 2005        |
| 1/25° Black Sea HYCOM                 | 3.2 km             | $\rho/\sigma/z$ |                                                         | NAVO   | 2005        |

<sup>1</sup> High vertical resolution for mixed layer prediction. Assimilates SSH from NLOM.

Running in real-time, see [http://www.ocean.nrlssc.navy.mil/global\\_ncom](http://www.ocean.nrlssc.navy.mil/global_ncom)

<sup>2</sup> Running in near real-time, see [http://www.ocean.nrlssc.navy.mil/global\\_nlom](http://www.ocean.nrlssc.navy.mil/global_nlom)

<sup>3</sup> For coupled ocean-atmosphere prediction.

<sup>4</sup> To give NAVO/Navy experience with HYCOM without official operational status; to be replaced by global HYCOM including the 1/25° Black Sea HYCOM

<sup>5</sup> Under the National Ocean Partnership Program (NOPP), 1/12° Atlantic HYCOM demo is already running in near real-time. Includes the Mediterranean Sea.

Results at [http://hycom.rsmas.miami.edu/ocean\\_prediction.html](http://hycom.rsmas.miami.edu/ocean_prediction.html)

## Nesting Strategy for Ocean Prediction

|        |   |          |   |          |   |           |
|--------|---|----------|---|----------|---|-----------|
| Global | → | Regional | → | Littoral | → | Nearshore |
|--------|---|----------|---|----------|---|-----------|

### Near-term: present-FY04 in R&D, FY04-FY07 operational, including transition

|                             |   |                          |   |                 |   |                                     |
|-----------------------------|---|--------------------------|---|-----------------|---|-------------------------------------|
| 1/8° NCOM                   | → | NCOM or SWAFS            | → | NCOM or SWAFS   | → | **ADCIRC                            |
| 15-16 km mid-lat resolution | → | 4 - 8 km, larger regions | → | < 1 to 2 km res | → | < 2 km resolution<br>finite element |

### Mid-term: FY04 - FY07 in R&D, FY07 – FY10 operational, including transition

|                         |   |                           |   |                |   |              |
|-------------------------|---|---------------------------|---|----------------|---|--------------|
| 1/12° HYCOM             | → | HYCOM                     | → | *NCOM or HYCOM | → | ADCIRC       |
| 7 km mid-lat resolution | → | 2 - 4 km, smaller regions | → | .5-1.5 km res  | → | < 1.5 km res |

### Long-term: FY07-FY11 in R&D, FY11 and beyond operational, including transition

|                             |   |                               |   |                |   |            |
|-----------------------------|---|-------------------------------|---|----------------|---|------------|
| <sup>+</sup> 1/25° HYCOM    | → | Regional generally not needed | → | *NCOM or HYCOM | → | ADCIRC     |
| 3 - 4 km mid-lat resolution | → | Not used                      | → | ≤ 1km res      | → | ≤ 1 km res |

\*Hogan and Kindle CO-NESTS project should provide research results needed to make the appropriate choice. An alternative model such as ROMS may also be considered.

Nested model may be a component of COAMPS.

<sup>+</sup>1/25° HYCOM gives useful littoral resolution globally.

\*\*ADCIRC needs a robust baroclinic capability before it can properly fill this role.

# User Interest in Real-time Global Ocean Products

NRL Oceanography Division Web Site Hit Statistics during 2003

|                                                     |            |
|-----------------------------------------------------|------------|
| <b>Total # hits</b>                                 | 18,327,137 |
| <b>Avg hits/day</b>                                 | 50,211     |
| <b># hits used in country breakdown</b>             | 16,322,753 |
| <b># countries with <math>\geq 1000</math> hits</b> | 59         |
| <b># countries with <math>\geq 100</math> hits</b>  | 100        |
| <b>Total number of countries</b>                    | 169        |

Includes the following real-time global  
Ocean products and other results

**Altimeter data**

**MODAS SSH & SST analyses**

**Ocean prediction systems**

1/16° global NLOM

1/8° global NCOM

1/12° Atlantic HYCOM

## Top 25 Countries and # Hits

|                    |            |
|--------------------|------------|
| United States      | 11,680,841 |
| Australia          | 1,919,691  |
| Japan              | 929,849    |
| South Africa       | 525,233    |
| China              | 311,852    |
| Taiwan             | 303,221    |
| Great Britain      | 56,025     |
| Canada             | 55,825     |
| Germany            | 50,895     |
| France             | 44,899     |
| Russian Federation | 44,408     |
| Spain              | 36,724     |
| South Korea        | 35,216     |
| Switzerland        | 34,809     |
| India              | 28,579     |
| Italy              | 20,987     |
| Netherlands        | 20,504     |
| Vietnam            | 16,747     |
| Peru               | 15,667     |
| Sweden             | 11,969     |
| Chile              | 10,965     |
| Puerto Rico        | 9,704      |
| New Zealand        | 9,540      |
| Mexico             | 8,100      |
| Ukraine            | 7,877      |