



## Background

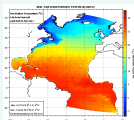
### Simulations at EMC in operation or going to operations:

Two simulations are in progress at EMC in the following domains:

1) **Atlantic domain, variable grid size**, from to 0.04° to 0.08° in the western Atlantic and 0.17° in the eastern Atlantic.  
Objective: short term prediction.

with SSH and SST data assimilation

This simulation has **issues** that previously prompted code modifications, and now comparisons and **future code and boundary condition modifications**.



**Future plan:** as result of the comparisons of this work among others, **use NRL source 2.2.18c or similar**

The simulation will be continued.  
Possibly, nested to the Global model below  
Used for testing data assimilation

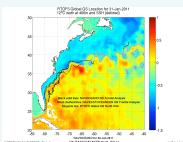
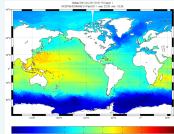
## 2) Global 1/12°

- uses NRL source 2.2.18c
- initialized **daily** from **NAVO's operational HYCOM analysis from two days before the present**
- run in **forecast mode**, with same HYCOM code as NAVO's model, but with NCEP forcing:

Global Data Assimilation System (GDAS) forcing for the past,  
and with Global Forecast System (GFS) for the future.

Each day the model is run for 10 days  
2 days in the past to the present, for adjustment of forcing,  
plus 8 days into the future.

- Each day the last **8 days of forecast** are disseminated



### Applications at EMC:

- Boundary conditions for Atlantic RTOFS model.
- Initialization and boundary conditions for hurricane model, first to be used in the Pacific.
- Future boundary condition for regional/coastal models.
- Used for wave prediction
- Some time in the future may be coupled to the atmospheric model.

# HYCOM simulations with NRL source at EMC

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## Abstract

Several simulations were done using HYCOM NRL's codes on two domains now in use at EMC:

- 1) **Atlantic domain, variable grid size** (0.4-0.8° in the western Atlantic, and 0.17° in the eastern Atlantic). The objective of the simulations is for short-term prediction.
- 2) **Global domain at 1/4°**. The objective of these simulations is for future seasonal climate prediction, in coupled simulations like Coupled Forecast System (CFS).

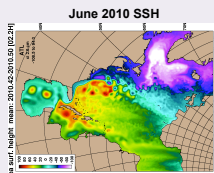
## Simulations in Atlantic domain(s)

- **Variable grid size (RTOFS domain)**  
**OBJECTIVE:** The first objective was for examining problems with the Atlantic simulations at EMC.

Simulations with NRL source 2.2.20 were produced, and results obtained using the Atlantic code at use in EMC were compared with these simulations. Model parameters were kept close to what is used in the previous EMC simulations, but the mixed scheme was changed from Giss to Kpp.

Forcing was from Global Data Assimilation System (GDAS) analysis.

- Short simulation
- Closed domain
- Domain covering Atlantic (0.4-0.8° in the western Atlantic, and 0.17° in the eastern Atlantic), no Mediterranean Sea.
- Grid dimensions 1200x1684
- 26 layers
- Initialized from climatology (Levitus based)
- KPP mixed layer
- Run with GDAS forcing (with only a correction for temperature under ice) July 2009-June 2010
- No data assimilation
- Normal results in terms of surface seasonal cycle, transports, and circulation patterns.



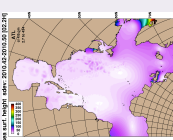
### Tides: simulation to estimate basic errors:

The Atlantic RTOFS operational model includes tides in some way. As a basis for acceptability of tides in future simulations in this domain, a **basic error estimation** was obtained by comparing the results of tides among the following cases

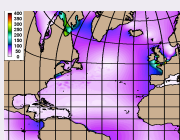
- simulation with NRL source 2.2.20, with **no bottom friction** with **(unacceptable) closed boundaries**
- to a state of the art model with tides (NRL global 1/12° expt 18.5 by Metzger et al.)

### Standard deviation of SSH

#### ATLa.ofs



#### GLBa0.08, NRL expt 18.5



### Work in progress and future work:

#### Tides: nested simulations

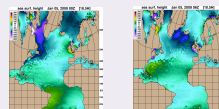
A series of simulations will be produced by nesting the Atlantic domain to a global model with tides:

- **ATLg0.08 domain** (which is a subset of the Global 1/12° domain, nested to GLBa0.08 expt\_18.5

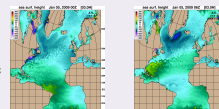
hourly barotropic nesting  
relaxation to the daily mean archive files

**Work has been started.**

#### GLB 18.5



#### First days of Nested Atlantic



- **Rtofs domain**, nested to GLBa0.08 expt\_18.5
- Possibly other global simulations for nesting conditions.



### Conclusion from the first Atlantic simulations

Comparing results using NRL source versions and those in use for RTOFS pointed more clearly to problems in the RTOFS version.

**A plan is being worked** for which the Atlantic RTOFS operational model will be transitioned to a source similar to NRL 2.2.18c (now also in use in the global 1/12° EMC simulation)

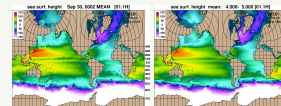
Data assimilation in RTOFS will be revised (EMC marine branch group)

Atlantic simulations nested to the global domain will be tested.

### Global 1/4th° domain

**A simulation produced at NRL was taken as basis.**

#### SSH, day and annual mean



- 1) CFSRR forcing functions will be obtained from the CFSRR data for years 1982-1992.
- 2) inter-annual simulations will be produced. After (approx 15 years of) spin up, the model will be run inter-annually for the period 1982-present, for examining El Niño features.

**The objective of the simulations is for future coupling with the atmospheric model (GFS) through NOAA Environmental Modeling System (NEMS), using tools and structure of Earth System Modeling Framework (ESMF).**