HYCOM/Quoddy Nested Baroclinic Nowcast/Forecast System for the South Atlantic Bight
(and other things)

Thomas Shay, Francisco Werner, Alfredo Aretxabaleta, Brian Blanton

Department of Marine Sciences
The University of North Carolina at Chapel Hill
SAB NC/FC System

- SAB regional baroclinic model is Quoddy
- HYCOM provides IC and open BC
- Tidal open BC from ADCIRC TDB
- NCEP ETA (now WRF/NMM) for surface forcing (AWIP12)
- 4-day diagnostic run (spin up tides + mixing), up to 21-day prognostic run
HYCOM/Quoddy NC/FC System
Quoddy SAB Domain

Longitude

Latitude

Cape Hatteras

Cape Canaveral
Quoddy output surface temperature, salinity, elevation, and velocity. Interpolated onto regular grid.
Temperature Sections

trans along transect 1: 30-Sep-2006 23:00:00

trans along transect 2: 30-Sep-2006 23:00:00

trans along transect 3: 30-Sep-2006 23:00:00

trans along transect 4: 30-Sep-2006 23:00:00
NC/FC System Timing

Ideal $t_1$ is $< 1$ day

Typical $t_1$ is 8-12 days owing to HYCOM posting delay
Effect of HYCOM Posting Delay

Typical

$t_1 = 8 \text{ days}$
- 20 Sep HYCOM nowcast
- 72 hour Quoddy forecast

Ideal

$t_1 < 1 \text{ day}$
- 27 Sep HYCOM nowcast
- 72 hour Quoddy forecast
HYCOM and Quoddy SST
2 Nov 2006 1100UTC
My Rookie Mistake
(NCEP Changed Sign of Heat Fluxes)

Using old sign convention after “stealth” change by NCEP

Using new sign convention
Summer 2003 Cold Event in SAB

- Observations: Fixed moorings, ship transects
- Quoddy with climatological IC and BC or nested HYCOM/Quoddy
- ADCIRC TDB tidal elevation
- NCEP EDAS (AWIP12) surface forcing
- USGS river input at 5 nodes (20psu)
Summer 2003 Cold Event

\[ \Delta T = \text{Near-surface } T \text{ minus long-terms means} \]

\[ \Delta T > -1^\circ C \]

\[ -2^\circ C < \Delta T < -1^\circ C \]

\[ \Delta T < -2^\circ C \]
Cold Event Study Domain
# Quoddy Cases

<table>
<thead>
<tr>
<th>CASE</th>
<th>Initial condition source and date</th>
<th>Open boundary conditions</th>
<th>River Discharge</th>
<th>EDAS forcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE 1</td>
<td>HYCOM (01-Jun-2003)</td>
<td>HYCOM (Jun-Sep)</td>
<td>2003</td>
<td>2003</td>
</tr>
<tr>
<td>CASE 2</td>
<td>CLIMAT (Feb)</td>
<td>CLIM (Feb-Sep)</td>
<td>2003</td>
<td>2003</td>
</tr>
<tr>
<td>CASE 3</td>
<td>CLIMAT (Feb)</td>
<td>CLIM (Feb-May), HYCOM (Jun-Sep)</td>
<td>2003</td>
<td>2003</td>
</tr>
<tr>
<td>CASE 5</td>
<td>CLIMAT (Jun)</td>
<td>CLIM (Jun-Sep)</td>
<td>2003</td>
<td>2003</td>
</tr>
<tr>
<td>CASE 9</td>
<td>CLIMAT (Jun)</td>
<td>CLIM (Jun-Sep)</td>
<td>NO</td>
<td>2003</td>
</tr>
<tr>
<td>CASE 10</td>
<td>CLIMAT (Jun)</td>
<td>CLIM (Jun-Sep)</td>
<td>2003</td>
<td>2002</td>
</tr>
</tbody>
</table>
Mid-shelf T Comparison

Bottom R2 Temperature

NDBC 41008 (GRAY'S REEF) Near-surface Temperature

Bottom R2

Surface Gray’s Reef
Shelf Temperature

17-Aug-2003 observations

Aug CLIM.

17-Aug-2003 HYCOM

17-Aug-2003 CASE1

17-Aug-2003 CASE2

17-Aug-2003 CASE5

Depth (m)

Temperature (°C)

Km seaward of 25m isobath
Shelf Salinity

• Aretxabaleta, et al., Cold event in the South Atlantic Bight during summer of 2003: Model simulations and implications, *JGR* (undergoing revisions after positive reviews)
Future Steps

• Make NC/FC system more automatic and robust
• Access to more timely HYCOM results
• Documentation
• Evaluate performance of system w.r.t. available data
• Explore transition to baroclinic version of ADCIRC (MPI = significant speed increase over Quoddy)