Northeast North American Shelf Heat and Freshwater Transport

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Comparisons with mean seasonal variability of MAB shelf water properties

Mid-Atlantic Bight regions defined by Mountain (JGR 2003) for analysis of shelf water properties from MARMAP data (1977-1987)

Seasonal temperature cycle is dominated locally by air-sea flux

ROMS southern MAB too warm, central and north agree well

HYCOM over-estimates summer max by ~6°C throughout MAB

MAB Cross-shelf Temperature Structure

Overall temperature simulations are good. Neither model captures a clearly distinct "Cold Pool" in summer. Both have water too cold off the shelf edge in winter.

Shelf water volume and freshwater transport

The volume of MAB Shelf Water (S<34) trapped inside the shelf/slope front varies. Observations show the volume anomaly propagates southward through MAB each year. Neither model captures this along-shelf transport signal.

NULL

ROMS Model Configuration

A Regional Ocean Modeling System (ROMS) model is embedded within open boundary values provided by GODAE North Atlantic operational model HYCOM

ROMS operational model configuration:
• Domain: Eastern Gulf of Mexico to Newfoundland, out to the Bahamas, New England Seamounts and the tail of the Grand Banks
• 10 km horizontal resolution; 30 vertical σ-levels weighted toward the surface
• NCEP daily average reanalysis u10 winds, \( T_a \), \( q_a \), cloud, \( P_r \), rainfall, shortwave and downward long-wave from OPeNDAP server http://www.cdc.noaa.gov/cgi-bin/nph-ncep.reanalysis.dailyavgs
• Monthly mean river flow from USGS gauges for 30 largest rivers + Belle Isle Passage low salinity flow into the Gulf of St Lawrence
• Boundary slides from OSU Topex/Poseidon/Jason model
• Open boundary data from HYCOM http://hycom.rsmas.miami.edu/dodsC/Atlantic Best Estimates
• daily \( T, S, u, v \) interpolated to ROMS grid for radiation/nudging open boundary conditions
• sea level, depth average \( u, v \) for Flower (1976) gravity wave open boundary conditions
• 3-day HYCOM average \( u, v \) for nudging in boundary buffer zone

Output:
• Output data on OPeNDAP server http://ahab.rutgers.edu:8080/dodsC/

Temperature and salinity of east coast shelf waters are affected by inflow from the Labrador Sea and Loop Current, cross-shelf exchange in the South Atlantic Bight (SAB) and Mid-Atlantic Bight (MAB), and the Gulf Stream.

Adequate simulation of the heat and freshwater budgets are a necessary condition for subsequently using the model for studies of shelf biogeochemistry and carbon cycling.

NOPP Project Objectives:
1) Develop practical strategies for nesting coastal ROMS within HYCOM open boundary data for stable long-term and operational integrations (year 1-2)
2) Quantify skill of nested ROMS and HYCOM-only at reproducing shelf heat and freshwater variability (year 1-2)
3) Explore open boundary sensitivity with ROMS adjoint sensitivity tools (year 3-4)
4) Examine value of internal data assimilation in ROMS to boundary-forced only simulations (year 4-5)

Mean salinity of shelf water in ROMS has strong freshening trend throughout 2004

RMS freshening trend is bringing summer salinity closer to L&G climatology

Climatology
RMS
HYCOM