Seasonal Transport on the Mid-Atlantic Bight

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Aim of this talk:

- Recent observational results: NJ shelf wind-driven seasonal surface circulation
- Formulating questions for modeling study based on observations
  - Effect of topography, stratification & winds on the whole water column transport?
- Seasonal behavior of along-shore and cross-shore transport on the shelf
- Discovery of a persistent transport pathway downstream of the Hudson Shelf Valley
3.1. Temperature

Results

Temperature variability. Consider the potential for atmospheric forcing of SHW temperature at New York City and at Norfolk, VA to series. Similar anomaly series were derived for monthly air vertical bars represent ±1 standard deviation of the residuals from data for the MARMAP period (1977–1987). The different regions in Figure 1. The curves were determined from data for the MARMAP period (1977–1987). The times of maximum Figure 2.

3.2. Salinity

The spatial and temporal patterns of the average anomalies averaged over the decade for three periods of the year temperature anomalies during the 1990s in each region were considerably warmer than during the MARMAP period. The southern regions, however, the winter temperatures were

3.3. Volume

During the 1990s the temperature patterns in the regions the mean salinity value was used as a reference for interannual variability overshadowed the seasonal variability. Significant annual cycles were found only for NYB1 and NYB2, where the nearby Hudson River inflow

Chapman et al. 1987

Chapman et al. 1986

The Hudson Shelf Valley

The Oleander line

5 cm s⁻¹

0.02 N m⁻²

Mountain 2003

NYB1

NYB2

SS1

SS2

SNE

NYB1

NYB2

SS1

Calendar Day
Background no-wind flow
NJ Shelf Seasonal Currents (2002 - 2007)

Winter: 3.49 m/s, 301 deg
Autumn: 1.05 m/s, 340 deg
Spring: 0.35 m/s, 300 deg
Summer: 1.6 m/s, 195 deg
Observation: seasonal flow patterns

- Flow on the shelf is affected by the presence of a cross-shelf valley, region to the south amplified.
- Shelf flow has a strong seasonal pattern driven by seasonal stratification and wind pattern.
- Flow mainly cross-shelf (offshore) during stratified and mixed seasons, and mainly along-shelf (downshelf) during transition seasons. The residence time is on the order of 1-5 weeks.
Modeling: Cross & along-shelf transport

- How does the model do compare to data?
- Mean flow
- Seasonal flow
- Hydrography
- *Quantifying flow in the whole water column and transport of key tracers*
- *Along & cross-shelf variability of the transport, role of the HSV?*
ROMS
5.5 km grid
36 levels

Forward Model Only

Realistic Met. Forcing

Boundary: MABGoM
CODAR (2002 - 2007)

ROMS (2006-2007)

“Seasonal Climatology of Wind Driven Circulation on the NJ Shelf”
Gong, Kohut, Glen. in press.
Data vs. Model: August 7-9, 2006
Along C
Cross C

Along S
Cross S

1 Year Current Velocities

Offshore Transport Pathway
Cross-shelf flow (Southern Section)
Cross-shelf flow (Central Section)

Spring

Summer

Winter

Autumn
Along-shelf variability (Summer 2006 Example)
• Along-shelf transport is concentrated at the mid-outershelf, especially during summer and winter.

• Identified a persistent offshore transport pathway just south of the Hudson Shelf Valley

• There is significant along-shelf variability in cross-shelf transport, more prominent at the offshore end

• Combined observatory data & modeling approach is very powerful for identifying large scale spatial patterns and longterm temporal patterns
Next steps:

• Look at the temporal variability of shelf flux of salt & heat, correlate with forcing mechanisms

• Seasonal mixing dynamics & effect on cross-shelf exchange

• Compare with data assimilative model runs, can a forward only model effectively capture seasonal transport?

• Effect of high energy, episodic events on cross-shelf exchange & transport (i.e. storms, major discharge, large offshore eddies)
Cross-shelf density