Mesoscale Processes over the Shelf and Slope in SW06

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Collaborators and Thanks

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Outline

• Overview of AWACS Program and coordinated sampling for SW06
• Alongshelf variability before TS Ernesto: Slope Water intrusions onto the shelf
• Acoustic implications: continuity of the Cold Pool duct
• Shelfbreak frontal structure due to warm core ring interactions
• Contrasting eddies: NEST May 2007
AWACS Program

Concept of **Autonomous Wide Aperture Cluster for Surveillance (AWACS)**

*Build-test-build components and algorithms for an AWACS of quiet surrogate targets operating in littoral, for Spring and Fall Experiments 2007*

Develop mobile acoustic sources
Explore capabilities of REMUS and Glider towed arrays
Develop algorithms for **adaptive sampling, search and data assimilation**
Explore the limits of **Detection Classification Localization (DCL) signal processing**
Explore and develop **command and control based on adaptive sampling**
Initial Plans-

Scanfish focuses on alongshelf sampling.
Gliders focus on cross-shelf sampling.

Preliminary Ocean Sampling Plans for AWACS/SW06
Glider, Scanfish Track and HU Low-Res Model
AWACS Objectives in SW06

- Night-time high-resolution Scanfish surveys to map front
- Use of Environmental keys (depth of mid-depth duct, foot of front, frontal position at 40 m depth) to determine mobile acoustic source track
- Determine impact of smaller-scale oceanographic features on TL
Primary Tools- Scanfish and OASIS Mobile Acoustic Source

Scanfish- Undulates 2-120 m
Ship Speed 6 knots
CTD, fluorescense, oxygen, light trans.

OASIS Mobile Acoustic Source
Operated at 150 dB
New Jersey Climatology

Salinity - MAB: NOAA, HB2 & SEEP

Foot of front at 80 m isobath in summer (34.0 Salinity)
SST: 8/25/06

Large Slope Eddy adjacent to Shelfbreak
Temperature and Salinity along 1000 m isobath

High salinities show that slope eddy is present over full 30 km of offshore transect.

Strong thermocline at 40 m depth with 14-18 Deg C water down to 120 m.
Water Mass Properties at 1000 m isobath and Velocities at 45 m depth

Blue and green points - T/S Points before Ernesto
T range - 13-26 Deg C
S range - 34.3-36.3

Slope eddy imposes onshore
Offshore flows at 1000 m isob.
Strengthens/Weakens SBF
August 25-Temperature at 40 m

Strongest cross-shelf Gradients between 80 and 100 m isobaths

High Values - 22 Deg C

Thermal boundary of front at 70 m isobath in Southwest portion of grid
High salinities over Upper slope- 35.6

Maximum gradients Between 80 and 100 m isobaths

Penetration of saline water reaches 80 m isobath in southwest portion of grid
Temperature and Salinity along 80 m isobath - August 25

Strong mid-depth temperature minimum (Cold Pool duct)
Much weaker thermocline in SW

Saline intrusion (> 35) along thermocline and along bottom
Recurrence of Saline Intrusions- August 28

Soundspeed along 80 m
High soundspeed= Saline Intrusion

Soundspeed at local minimum (K. Moore- URI)
OMAS Tracks- August 28 and 29

OMAS tracks along 80 m isobath running back and forth three times
TL vs. Range along 80 m isobath - August 28

Increased TL as OMAS crosses saline intrusion
Donglai Gong - Rutgers  Four types of Saline intrusions
Shelfbreak Frontal Structure  August 27

Temperature

Salinity

Density

Alongshelf Velocity

Jet Core

40 m depth
Saline Intrusions as an adjustment process

Salinity Field from Cross-shelf transect, August 29-30

Salinity field from Adjustment problem With observed T/S Profiles to initialize (“dam-break”)
New England Shelfbreak Test  May 2007

Slope Eddy adjacent to shelfbreak front

Core of eddy located at depths of 50-300 m
Cold Pool duct extends in upper 70 m above core of eddy
Duct is more pronounced in eastern section
Conclusions

- Slope eddy had large impact on along-shelf variability at 80 m isobath
- Pycnocline salinity intrusions also had temperature and density signals
- Increased TL as propagation crosses saline intrusion
- Sub-surface jet and reversal of density gradients from 10-40 m depth may drive saline intrusions
Density Along 80 m isobath  August 25
Along-shelf and Cross-shelf velocities at 80 m isobath August 25

Onshore velocity of 10 cm/s in SW- offshore velocity over most of the section

Alongshelf flow to SW peak of 30 cm/s consistent with onshore meandering of frontal jet
Alongslope and Cross-slope velocities at 1000 m isobath - August 25

Purple- to Northeast

NE alongslope flows of 20-30 cm/s

Contour interval 10 cm/s

Purple- Offshore

Onshore flow on SW side with maximum velocities of 30 cm/s