GLIDER-BASED OBSERVATIONS OF WINTERTIME BLOOMS ON THE OUTER SHELF AND SLOPE IN LONG BAY, SC, USA

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Stephen Lockhart[1], Harvey Seim[1], Chris Calloway[1], Catherine R. Edwards[2]

[1]University of North Carolina, Chapel Hill, North Carolina, USA
stephen_lockhart@med.unc.edu
[2]University of Georgia, Skidaway Institute of Oceanography, Savannah, Georgia, USA

Skidaway Institute of Oceanography

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Objective Analysis

For each bin, at time t_m, an estimate T * of the observed variable T is calculated as follows:

$$T^*(t = t_m) = < T > + \sum_{n=1}^{N} w_n (T_n - < T >)$$

Where

< T > is the mean of the observed variable at this bin over the duration of the 3rd deployment (mid March to early April 2012)

T_n is an individual observation

$w_n = w_{1n} w_{2n}$

$w_{1n} = e^{-(r_n - r_{bin})^2 / 2 r_c^2}$ (spatial weights)

$w_{2n} = e^{-(t_n - t_m)^2 / 2 t_c^2}$ (temporal weights)

$r_n = (x_n^2 + y_n^2)^{1/2}$

r_c = 9km

t_c = 3d

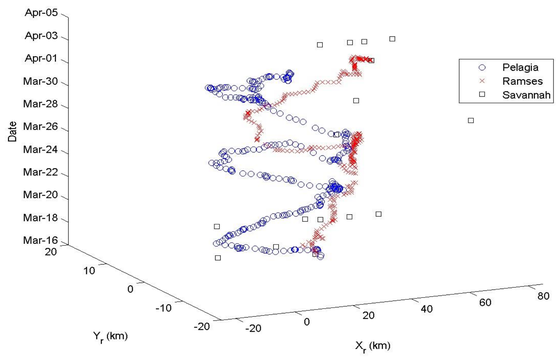
Limits: $|r_n - r_i| < r_c$ (T_n spatially close)

$|t_n - t_m| < t_c$ (T_n temporally close)

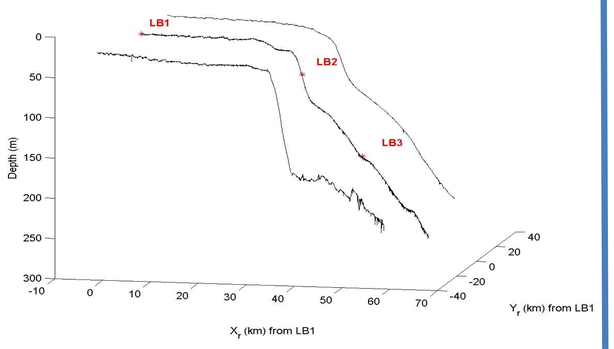
The error per bin is calculated as follows:

$$T_{err}(t = t_m) = 1 - (\frac{1}{N}) \sum_{n=1}^{N} w_n$$

In the Winter of 2012, two gliders (Pelagia and Ramses) were deployed, and shipboard surveys (R/V Savannah) were conducted. The figure below shows the locations of the ship and the gliders over the course of the 3rd deployment, mid-March to early-April 2012. (Objective analysis was performed on the 3rd deployment as this deployment had the best glider coverage.)

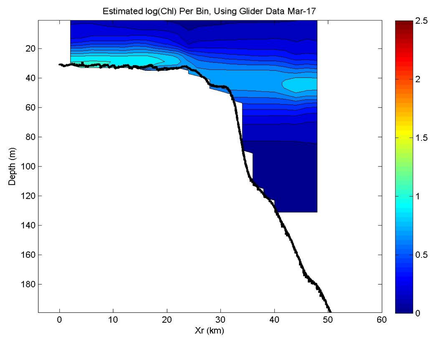


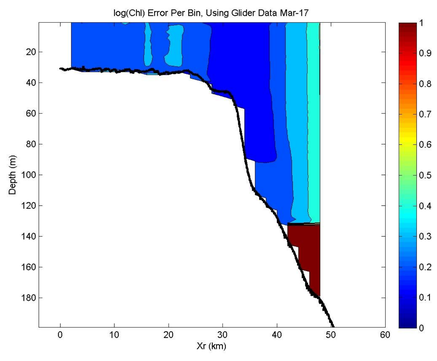
Three moorings, LB1 (30m), LB2 (75m), and LB3 (170m), were also deployed with CTD, ADCP, and Chlorophyll/Turbidity sensors. At LB1, a chain of thermistors was also deployed. The figure below shows the locations of the three moorings on the shelf/slope off Long Bay, SC. The rotated axis X_r is "across-shelf", on the line from LB1 to LB3, with origin at LB1. The axis Y_r is "along-shelf".



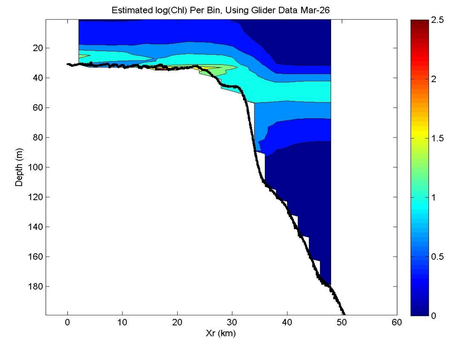
Chlorophyll (Log of µg/liter)

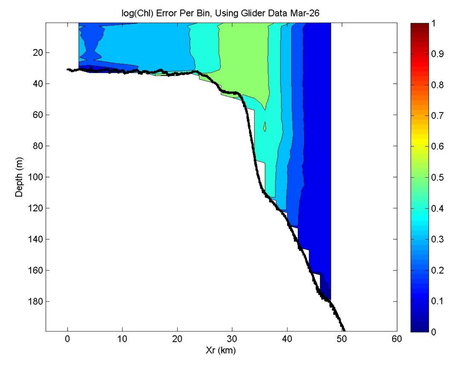
Around 3/17



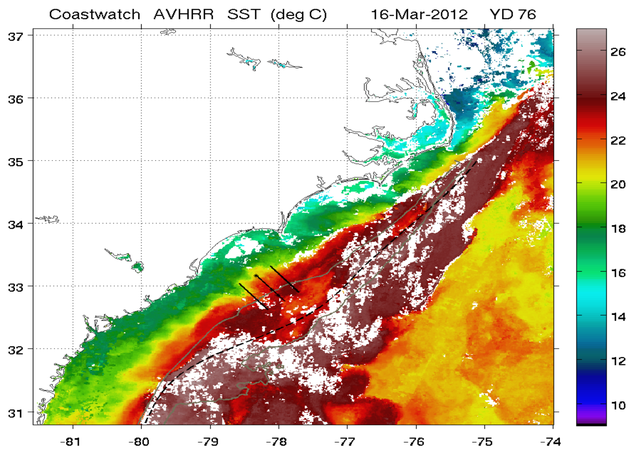


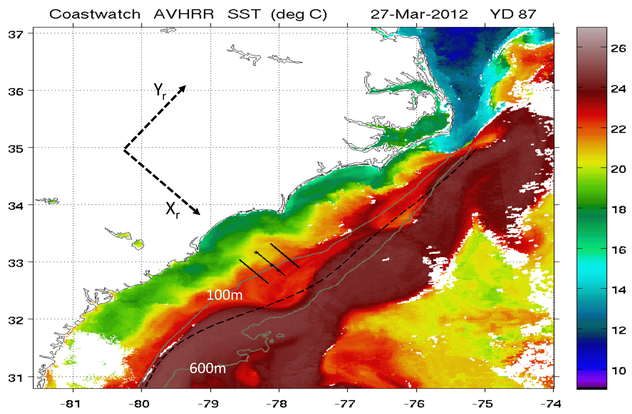
Around 3/26





Objective analysis shows the development of a sub-surface chlorophyll maximum (above), consistent with "slumping" of dense water from the shelf.

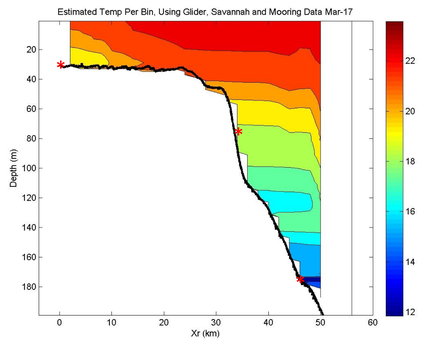


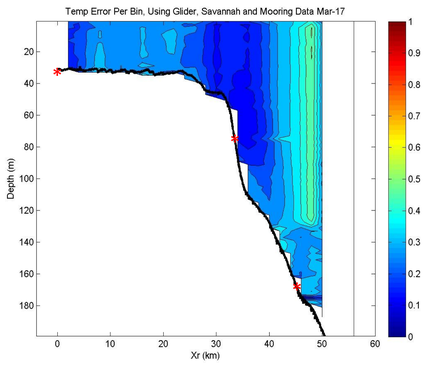


SST images also show the three moorings on the middle transect. The dashed line is the mean frontal position of the Gulf Stream (Miller, 1994). The rotated coordinate system (X_r parallel to the middle transect) is shown (where the origin should be at LB1).

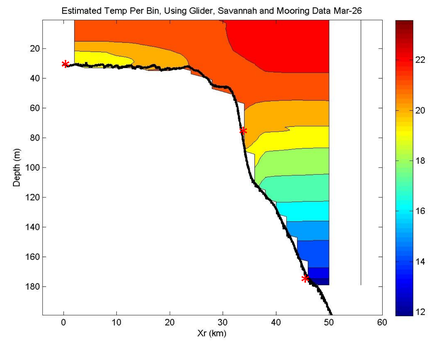
Temperature (°C)

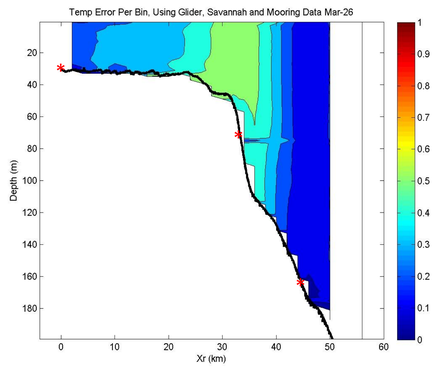
Around 3/17



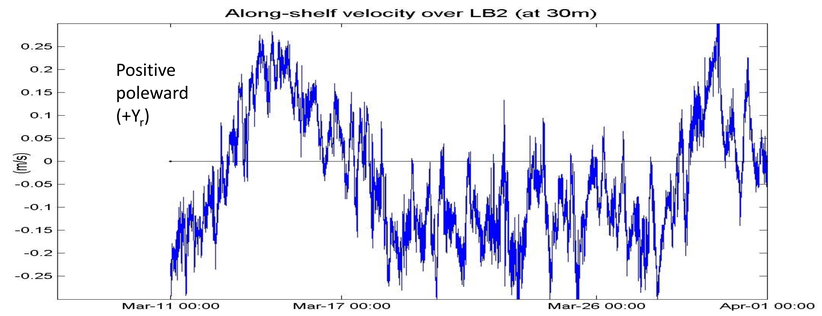


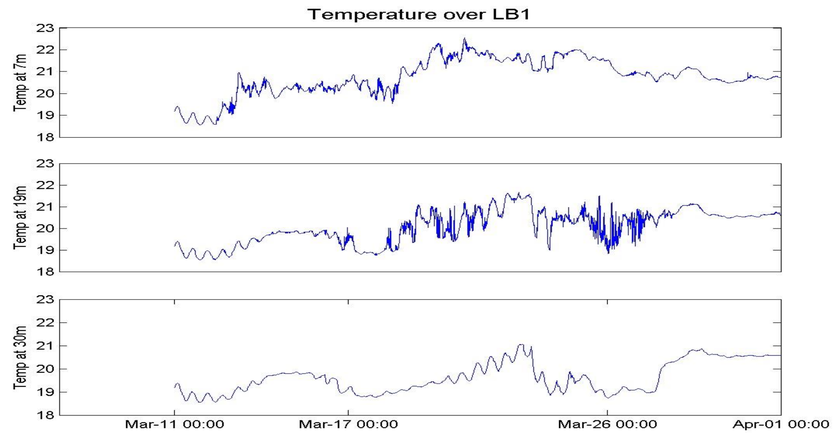
Around 3/26





Objective analysis of temperature data shows a change in the slope of the thermoclines over LB2 (above). This is consistent with an observed reversal of the along-shelf velocity, measured by ADCP (below). Furthermore, this change is also correlated with higher-frequency fluctuations of the temperature at mid-depth further onshore, over LB1 (below).





Acknowledgements

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References

Miller, J.L. Fluctuations of Gulf Stream frontal position between Cape Hatteras and the Straits of Florida, 1994. *Journal of Geophysical Research* 99: 5057-5064