Time series of current profiles from a vessel-mounted ADCP from R/V Savannah in the South Atlantic Bight (SAB) continental shelf off Long Bay, January-March 2012 (Long Bay Wintertime Bloom project)

Website: https://www.bco-dmo.org/dataset/638491
Data Type: Cruise Results
Version: 1
Version Date: 2016-02-15

Project
» Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump (Long Bay Wintertime Bloom)

Contributors	Affiliation	Role
Nelson, James	Skidaway Institute of Oceanography (SkIO)	Principal Investigator
Edwards, Catherine	Skidaway Institute of Oceanography (SkIO)	Co-Principal Investigator
Seim, Harvey E.	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Co-Principal Investigator
Haines, Sara	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Contact
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
A Teledyne RDI 300 kHz Work Horse Acoustic Doppler Current Profiler (RDI ADCP) was mounted looking downward on the R/V Savannah. Sampling rate was dynamic (based on water depth) and varied between 2-3 seconds. Depth resolution was set to 2 meters. Vessel navigation data was also recorded by the acquisition software and included heading and location information.

Table of Contents

Data Processing Description

Data were read from ADCP binary format using ADCPTools. Because bottom tracking did not work consistently over the cruises because of transects that extended over the upper slope, beyond the range of the ADCP, GPS data were also used to reference the velocities to earth. The processing steps were:
1. estimate surrogate bottom track velocities using GPS-derived vessel speed and heading,
2. find heading (-6.5 degrees) and pitch offsets (+3. degrees) that minimize difference between actual and surrogate bottom tracked velocities,
3. form estimate of bottom depth,
4. transform all data to earth coordinates and reference water velocities to earth using gps and bottom tracking,
5. bad flag data near-bottom and deeper based on water depth,
6. bad flag single ping solutions with error velocities > 0.3 m/s,
7. form 10 point (roughly 24 second) averages,
8. bad flag short-term averages where the absolute value of the vertical velocity exceeds 0.3 m/s, or where the

absolute value of either of the horizontal velocity components exceeds 1.5 m/s,
9. form 12 point averages (roughly 5 minute averages) then interpolate to the regular time grid of 5 minutes.

Bad data are flagged with Not-a-Number (NaN).

[table of contents | back to top]

Data Files

File
ADCP data from RV/Savannah cruise SAV-1202 filename: sav1202shipadcp.mat (MATLAB Data (.mat), 573.50 KB) MD5:f0c221744757403d2dedde8b92df3305
ADCP data from RV/Savannah cruise SAV-1203 filename: sav1203shipadcp.mat (MATLAB Data (.mat), 2.41 MB) MD5:df924c5dcc361117a559636f9bee8650
ADCP data from RV/Savannah cruise SAV-1205 filename: sav1205shipadcp.mat (MATLAB Data (.mat), 1.58 MB) MD5:33efdfeeea61f99f45a991b145321cc4
ADCP data from RV/Savannah cruise SAV-1211 filename: sav1211shipadcp.mat (MATLAB Data (.mat), 1.99 MB) MD5:aa8f8e68e6fe6a2d55b2459f04618342
ship_ADCP.csv (Comma Separated Values (.csv), 570 bytes) MD5:c09faeb0b1ae370def1e9aaeaf6b70f8 Primary data file for dataset ID 638491

[table of contents | back to top]

Related Publications

Rich Pawlowicz's Matlab Stuff – RDADCP, version Mar 2010, http://www.eos.ubc.ca/~rich/#RDADCP. December 17, 2014. https://www.eoas.ubc.ca/~rich/#RDADCP
Methods

Symonds, D. R. (2006). QA/QC Parameters for Acoustic Doppler Current Profilers. Teledyne RDI Application Note.
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
time	MATLAB datenum time	days since 0000-01-01T00:00
dep	Depth (positive below surface)	m
loni	longitude	digital degrees; positive west
lati	latitude	digital degrees; positive north
ugpsi	Eastward water velocity (gps referenced)	m s-1 -- relative to True N
vgpsi	Northward water velocity (gps referenced)	m s-1 -- relative to True N
wgpsi	Vertical Velocity (gps referenced)	m s-1
ubti	Eastward water velocity (bottom-track referenced)	m s-1 -- relative to True N
vbti	Northward water velocity (bottom-track referenced)	m s-1 -- relative to True N
wbti	Vertical Velocity (bottom-track referenced)	m s-1
erri	Error Velocity	m s-1
wdepi	Water depth	m

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Acoustic Doppler Current Profiler
Dataset-specific Description	Teledyne RDI 300 kHz Work Horse Acoustic Doppler Current Profiler (RDI ADCP)
Generic Instrument Description	The ADCP measures water currents with sound, using a principle of sound waves called the Doppler effect. A sound wave has a higher frequency, or pitch, when it moves to you than when it moves away. You hear the Doppler effect in action when a car speeds past with a characteristic building of sound that fades when the car passes. The ADCP works by transmitting "pings" of sound at a constant frequency into the water. (The pings are so highly pitched that humans and even dolphins can't hear them.) As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the instrument. Due to the Doppler effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to bounce back and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings. (More from WHOI instruments listing).

[table of contents | back to top]

Deployments

SAV-12-02

Website	https://www.bco-dmo.org/deployment/58862
Platform	R/V Savannah
Start Date	2012-01-18
End Date	2012-01-21
Description	Deployment of SKIO Seahorse profiler and bottom frame at LB2 (76 m); deployment of taunt line and bottom frame at LB1 (31 m); 12 CTD stations, starting at 271 m ending at 30 m. We kept a 5 km spacing from the offshore end until ~45 m. (Section run from ~1905 EST to 2320 EST on 01/19/12). Cruise information and original data are available from the NSF R2R data catalog.

SAV-12-03

Website	https://www.bco-dmo.org/deployment/58863
Platform	R/V Savannah
Start Date	2012-01-24
End Date	2012-02-02
Description	Glider deployments (Ramses and Pelagia), glider monitoring; Acrobat (towed package) surveys of 3 cross-shelf sections (25 km along-shelf spacing, mid-shelf to upper slope); CTD profiles for hydrography, bio-optical, oxygen; station sampling for chlorophyll, nutrients, flow cytometry; Deployment of 2 moorings off Georgia on return leg to SkIO (75 m and 30 m). Cruise information and original data are available from the NSF R2R data catalog.

SAV-12-05

Website	https://www.bco-dmo.org/deployment/58864
Platform	R/V Savannah
Start Date	2012-02-13
End Date	2012-02-24
Description	Glider recoveries (Ramses, Pelagia), shipboard replacement of batteries, ballast adjustments, then both units were redeployed. Survey work was conducted using the towed Acrobat package and CTD station section from upper slope to shelf. Deck incubation experiment for primary production, station sampling for various properties. Due to gale-force winds, the ship ran into Wilmington (docked at Cape Fear Community College) on 18 February. When heading back out on 20 February for an Acrobat survey and station work, a problem with a shaft coupling forced return to Wilmington on 21 February for repair work. When repairs were completed, strong SW winds had developed and were forecast to continue for several days, so offshore work was not possible the ship returned to SkIO along the coast. Cruise information and original data are available from the NSF R2R data catalog.

SAV-12-11

Website	https://www.bco-dmo.org/deployment/58865
Platform	R/V Savannah
Start Date	2012-03-13
End Date	2012-03-22
Description	Glider recoveries (Ramses, Pelagia), then battery replacement, reballasting, redeployment (at LB2). Acrobat surveys, upper slope to outer shelf CTD surveys, station sampling for water samples and primary productivity experiments (deck incubations and 'photosynthetron'). Attempted to survey a subsurface bloom in the mid-shelf (apparently Phaeocystis). During an Acrobat survey, the tow cable failed over upper slope. The Acrobat package was located with an acoustic range-finder but was too deep for a grapple attempt. With the very mild winter, shelf conditions were already post-winter (warm water across outer to mid-shelf) and not favorable for the winter bloom formation. Given the conditions the cruise was cut short by a few days. Cruise information and original data are available from the NSF R2R data catalog.

[table of contents | back to top]

Project Information

Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump (Long Bay Wintertime Bloom)

Website: http://nccoos.org/projects/long-bay-wintertime-blooms/

Coverage: outer South Atlantic Bight (SAB) continental shelf off Long Bay

NSF Project Title: Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump

Sustained phytoplankton blooms along the outer South Atlantic Bight (SAB) continental shelf off Long Bay are observed in winter in multi-year satellite chlorophyll imagery. This section of the shelf lies north of the "Charleston Bump" (between 32.5-33.5°N), where the Gulf Stream is often strongly deflected offshore. Due to this offshore deflection, this is not an area where nutrient input to the shelf would be enhanced by upwelling associated with Gulf Stream frontal eddies, a major mechanism of nutrient input in other parts of the SAB shelf (Lee et al., 1991). Yet prior in situ observations suggest that there is recurring input of nutrients from the upper slope to the outer shelf off Long Bay from winter to early spring. This project will investigate a fundamental aspect of physical-biological coupling in the outer shelf to upper slope region. The PIs will test the hypotheses that: 1) the persistence of winter blooms on the outer shelf off Long Bay results from repeated episodes of nutrient input and mixing which maintains nutrient-sufficient conditions for extended periods; 2) several physical mechanisms are involved, including enhanced mixing energy from the internal tide along this section of the upper slope/shelf break; 3) the relatively high nutrient, intermittently turbulent environment will favor larger bloom-forming phytoplankton. The latter could have important implications for higher trophic levels, including early life history strategies of fish that spawn along the shelf margin off Long Bay in winter to early spring.

This project will combine several maturing observational technologies to address the following:

1. What is the frequency and magnitude on on-shelf transport of nitrate from the upper slope?
2. What are the mechanisms of nutrient delivery from the upper slope to the outer continental shelf zone that are operating off Long Bay under the range of hydrographic and forcing conditions encountered in winter?
3. What is the 3-D structure of outer shelf hydrography and associated winter bloom features and how do these evolve through multiple nutrient input/mixing events?
4. What are the rates of nitrate utilization and primary production associated with the winter blooms?
5. Does the winter regime consistently favor a bloom assemblage dominated by larger diatom forms?

Near-continuous cross-shelf and upper slope observations will be obtained with two autonomous gliders, time-series measurements on the outer shelf and slope from a set of moored instruments (including a moored

profiling system at the shelf break), and repeated cross- and along-shelf ship surveys using a towed, undulating package. Ship station work will include measurements of primary production and on-board analyses of key functional characteristics of the phytoplankton assemblage (cell forms, abundance, size and bio-volume distributions) using a microfluidics/imaging system. In combination, these systems will provide a level of spatial and temporal resolution of physical, nutrient and biological fields that could not be achieved in earlier, station-based field studies and the basis for improved understanding of physical mechanisms of recurring nutrient input to the shelf, and how the nutrient, mixing, and circulation regime in winter structures the phytoplankton community. Coastal naturalists will be engaged through a seabird survey component of the field program that will augment existing information on pelagic seabirds in winter and define their association with oceanographic features on the central South Atlantic Bight shelf and slope.

This project will provide a deeper understanding of shelf/slope exchange processes and how these influence shelf ecosystems, generating information that will contribute to implementation of ecosystem-based management in the region.

References:
Lee, T. N., J. A. Yoder, and L. P. Atkinson, 1991: Gulf Stream frontal eddy influence on productivity of the southeast U.S. continental shelf. J. Geophys. Res, 96, 22191-22205.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1032285
NSF Division of Ocean Sciences (NSF OCE)	OCE-1032276

[table of contents | back to top]