

Chlorophyll and pheopigments from filtered water samples from R/V Savannah cruises in the South Atlantic Bight (SAB) continental shelf off Long Bay, January-April 2012 (Long Bay Wintertime Bloom project)

Website: <https://www.bco-dmo.org/dataset/638203>

Data Type: Cruise Results

Version: 1

Version Date: 2016-02-10

Project

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

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Abstract

Chlorophyll and pheopigments from filtered water samples from R/V Savannah cruises in the South Atlantic Bight (SAB) continental shelf off Long Bay, January-April 2012.

Table of Contents

- [Coverage](#)
 - [Dataset Description](#)
 - [Acquisition Description](#)
 - [Processing Description](#)
 - [Related Publications](#)
 - [Parameters](#)
 - [Instruments](#)
 - [Deployments](#)
 - [Project Information](#)
 - [Funding](#)
-

Coverage

Spatial Extent: N:33.312 E:-77.86 S:32.483 W:-78.748

Temporal Extent: 2012-01-20 - 2012-04-04

Acquisition Description

At selected stations and depths, Niskin water samples were collected using the ship's CTD/carousel water

sampler (Sea-Bird SBE 25 Sealogger CTD; Sea-Bird SBE 32C carousel pylon; 8-L Ocean Test Equipment Model 110 external-closure water sampling bottles). Samples were transferred to 2 L polycarbonate bottles from the Niskin bottles via Tycon tubing and processed in the ship's wet lab. Triplicate samples (250 mL) were filtered onto GF/F glass fiber filters. The filters were folded and inserted into screw-capped cyrovials labelled with a cyropen (date, station, depth, volume filtered, replicate number), then frozen in liquid nitrogen. Sample information was recorded on a sample log sheet that was scanned for an electronic pdf record after each cruise.

Samples were stored in liquid nitrogen until analyzed at the shore laboratory. Analysis was by the fluorometric method, based on JGOFS protocols (1996). Frozen filters were placed in a polyethylene tube to which 10 mL 90% acetone was added for extraction. After several hours extraction in the freezer, the filters were disrupted using a probe-type sonicator, with care to keep samples cold and in dim light. Filter debris was cleared by centrifugation and the cleared extracts were decanted into cylindrical glass cuvettes and read in a Turner Designs Model 10AU fluorometer, with readings recorded before and after addition of one drop 2 N HCl. Chlorophyll and phaeopigment concentrations were calculated as described in the JGOFS protocols (1996). The fluorometer scale factor (calibration factor) was determined using a chlorophyll reference solution (90% acetone extract of a filtered diatom culture) with the reference concentration determined spectrophotometrically (extinction at 664 nm) using a Cary Model 3 spectrophotometer. The stability of the laboratory fluorometer over time was tracked by periodic measurements of a stable fluorescence reference solution (Basic Blue 3 in Milli-Q water).

Processing Description

Water sample concentrations of particulate chlorophyll and pheopigments (in chlorophyll equivalents) were calculated as described in the JGOFS Protocols (1996).

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- changed ~ to nr_ ('near')
- changed blank flag cells to '-'

[[table of contents](#) | [back to top](#)]

Related Publications

Knap, A. H., Michaels, A., Close, A. R., Ducklow, H., & Dickson, A. G. (1996). Protocols for the joint global ocean flux study (JGOFS) core measurements. <http://hdl.handle.net/10013/epic.27912>
Methods

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
cruise_id	2012 cruise number for the R/V Savannah	unitless
year	year	yyyy
cast	cast number	unitless
month_gmt	GMT month	1-12
day_gmt	GMT day of month	1-31
time_gmt	GMT time	HH:MM:SS
yrday_gmt	year day: UTC day and decimal time; as 326.5 for the 326th day of the year or November 22 at 1200 hours (noon).	day.part of day
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted standard is based on ISO 8601:2004(E) and takes on any of the following forms: 2009-08-30T14:05:00Z (UTC time)	yyyy-mm-ddTHH:MM:SSZ
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
depth_max	maximum depth of cast	meters
station	station: LB# = Middle Transect; LBS# = South Transect; LBN# = North Transect; # = distance counter (km) starting with +00 inshore and increasing offshore	unitless
comment	comment	unitless
depth_sample	Depth of water sample	meters
Chl_Avg	average concentration of chlorophyll for replicate samples (n=3)	mg/m ³
Chl_SD	standard deviation of mean chlorophyll concentration	mg/m ³
Phaeo_Avg	concentration of phaeopigments (chlorophyll-equivalent mass)	mg/m ³
Phaeo_SD	standard deviation of mean phaeopigment concentration	mg/m ³

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD profiler
Dataset-specific Description	Sea-Bird SBE 25 Sealogger CTD; Sea-Bird SBE 33 deck box; Sea-Bird SBE 32C carousel pylon; Sea-Bird SBE 43 oxygen sensor; WET Labs ECO chlorophyll fluorometer; WET Labs ECO CDOM fluorometer; WET Labs ECO BB optical backscatter sensor; LI-COR 193SA PAR sensor; Sea-Bird SBE 5P pump. The carousel was equipped with eight 8-L external-closure water sampling bottles (Ocean Test Equipment Model 110).
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	CTD SBE 25
Generic Instrument Name	CTD Sea-Bird 25
Dataset-specific Description	Sea-Bird SBE 25 Sealogger CTD
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http://www.seabird.com .

Dataset-specific Instrument Name	
Generic Instrument Name	Fluorometer
Dataset-specific Description	Turner Designs Model 10AU fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Cary Model 3 spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	SBE 33
Generic Instrument Name	Sea-Bird SBE 33 Carousel Deck Unit
Generic Instrument Description	The rack-mountable SBE 33 provides power and real-time data acquisition and control for an SBE 32 Carousel Water Sampler that has the SBE 33 interface option installed in its pylon. The SBE 33 is compatible with all Carousel sizes - full size, compact, and sub-compact. When powered and controlled by the SBE 33, the Carousel can be used: - with an SBE 19, 19plus, 19plus V2, 25, 25plus, or 49 CTD - without a CTD - with a Neil Brown Mk III CTD (requires optional interface for both SBE 32 and 33) The SBE 33 can also provide power and real-time data acquisition and control for the smaller SBE 55 ECO Water Sampler used with an SBE 19, 19plus, 19plus V2, 25, 25plus, or 49 CTD, or no CTD. See http://www.seabird.com/sbe33-deck-unit for further details.

[[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	<p>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.</p>

SAV-12-14

Website	https://www.bco-dmo.org/deployment/58866
Platform	R/V Savannah
Start Date	2012-04-02
End Date	2012-04-05
Description	<p>Recovery of moored instrument packages at LB3 (150 kHz ADCP in large TRBM pod/frame, MicroCAT, ECO FLNTU fluorometer/turbidity), LB2 (ADCP, MicroCAT, ECOFLNTU), LB1 (two moorings – ADCP; Taut-line package with HOBO T-chain [two with C], 3 ECO FLNTU units); Recovery of Ramses and Pelagia gliders; CTD section from upper slope to outer shelf (stations at 5 km intervals, LB+60 to LB+30, also at LB2 site), with samples for nutrients at selected stations/depths, some chlorophyll samples; Inter-calibration of the ECO FLNTU fluorometer/turbidity instruments after recovery of moorings (mounted on CTD/carousel for co-located sampling at two depths. This is the last CTD station). Cruise information and original data are available from the NSF R2R data catalog.</p>

[[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](#)]