Dataset: Factory and field calibration data for float oxygen, beam transmission, backscatter, chlorophyll fluorescence and CDOM sensors from the Sargasso Sea from 2013-2014.

Project(s): Rapid, Autonomous Particle Flux Observations in the Oligotrophic Ocean (RapAutParticleFlux)

Abstract: Optical proxy measurements of sinking particle flux and water-column bio-optical profiles were obtained from profiling floats in the Sargasso Sea to expand the number of particle flux observations in the critical and under-sampled “twilight zone”. Factory and field calibration data for dissolved oxygen, beam transmission, optical backscatter, chlorophyll fluorescence and colored dissolved organic matter sensors are provided. Float oxygen, chlorophyll fluorescence, and backscatter sensors were additionally cross-calibrated to bottle samples for oxygen, HPLC chlorophyll, and particulate organic carbon collected during concurrent Bermuda Atlantic Time-series Study (BATS) cruises prior to months-long deployment of the floats in the Sargasso Sea. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: http://www.bco-dmo.org/dataset/728371

Description: Factory and field calibration data for float oxygen, beam transmission, backscatter, chlorophyll fluorescence and CDOM sensors from the Sargasso Sea from 2013-2014

Factory and field calibration data for float oxygen, beam transmission, backscatter, chlorophyll fluorescence and CDOM sensors from the Sargasso Sea from 2013-2014.

Acquisition Description: Multiple deployments of two Sea-Bird Scientific Navis BGCi floats (numbers F033 and F034) equipped with CTDs, transmissometers, O2 optodes, backscattering (700 nm), fluorescence (chlorophyll, colored dissolved organic matter), and tilt sensors were conducted between July 2013 and November 2014 in conjunction with Bermuda Atlantic Time-series Study cruises. Short-term deployments (1.5 – 3 days) followed by recovery of the floats were conducted during four monthly BATS cruises in July – October 2013 and one cruise in March 2014. Both floats were deployed during the July and August 2013 cruises and float F034 was deployed for the remaining cruises. Each float collected one profile per cruise with the exception of the August 2013 cruise, during which the two floats together collected 13 profiles. During short-term deployments, floats first completed an initial descent and ascent without parking, then completed 1 or 2 more profile cycles with different, consecutive target depths. Following the initial descent/ascent described above, the short-term profile cycles were structured as described below for long-term deployments. In addition to the short-term cruise deployments, F033 profiled

continuously from October 2013 until early April 2014, yielding 77 profiles, and F034 profiled continuously from March 2014 until late November 2014, yielding 139 profiles. During these long-term deployments, a typical cycle consisted of 1) the descent to the target park depth, 2) a park phase at the target depth lasting 1.5 – 2.5 days during which measurements are made every 15 minutes, 3) a descent to 1000 dbar, 4) an ascent to the surface during which measurements are made, and 5) a surface telemetry phase, during which a GPS fix is obtained, data are uploaded via Iridium, and instructions for the next cycle are downloaded. During long-term deployments, floats cycled through park phases at 150/200, 300, 500, and 1000 dbar every 7 days, spending 2.5 days at 1000 dbar and 1.5 days at the shallower depths. The sequence of park phase depth at the three shallowest depths was varied between each 7-day cycle over a 21-day period to avoid aliasing in particle flux profiles.

Refer to http://www.bco-dmo.org/project/2124 or http://bats.bios.edu for a description of BATS bottle sample acquisition.

Related References:

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Xing, X., Claustre, H., Boss, E., Roesler, C., Organelli, E., Poteau, A., Barbieux, M., D'Ortenzio, F., 2017. Correction of profiles of in-situ chlorophyll fluorometry for the contribution of fluorescence originating from non-algal matter: FDOM-based correction of Chla fluorescence. Limnol. Oceanogr.: Methods 15, 80–93. http://dx.doi.org/10.1002/lom3.10144.

Processing Description: The following are factory and field determined calibration coefficients for float oxygen, beam transmission, chlorophyll fluorescence, backscatter, and CDOM sensors. Calibrated float data are presented in the 'Profile data' (https://www.bco-dmo.org/dataset/728347) and 'Park phase data' (https://www.bco-dmo.org/dataset/728335) datasets'. Float oxygen, chlorophyll fluorescence, and backscatter data were additionally calibrated to BATS bottle samples from concurrent BATS cruises. When possible, each float sample collected in profile mode was matched to the BATS bottle sample nearest in potential density that was collected within a 10-km radius and ±15-m depth window of the float location within 1 d of the float sampling time. The BATS bottle data used for float calibration are provided for reference through the 'Get Data' link at the top of this page. Original BATS bottle data are available at http://www.bco-dmo.org/project/2124 or http://bats.bios.edu.

	F033	F034
TA0	7.47E-04	7.18E-04
TA1	2.40E-04	2.49E-04
TA2	1.66E-06	8.42E-07
TA3	6.64E-08	9.26E-08
A0	1.0513	1.0513
A1	-0.0015	-0.0015
A2	0.3933	0.3432
B0	-0.2298	-0.2313
B1	1.6127	1.5647
C0	0.1018	0.1048
C1	0.0044	0.0045
C2	5.92E-05	6.20E-05

Table 1. Factory calibration coefficients for SBE 63 dissolved oxygen sensors.

Float	Cruises	Sensor	Dark	Slope
F033	B295, B296	CHL	54	0.0040
		BB700	242	1.24E-06
		CDOM	73	0.0245
F034	B295, B296	CHL	50	0.0028
		BB700	285	6.36E-07
		CDOM	-	-
F034	B297, B298, B301	CHL	48	0.0032
		BB700	245	8.17E-07
		CDOM	115	0.0122

Table 2. Factory determined scale factors and field measured dark values for float chlorophyll fluorescence, backscatter (700 nm), and colored dissolved organic matter fluorescence sensors.

		F033	F034
Cruise	Profiles	Counts	Counts
B295	all	15587	15281
B296	1,2	15587	15281
	3-8	15510	15308
	9,10	15510	-
B297	1	-	15405
	2,3	-	15357
B298	all	-	15343
B301	all	-	15343

Table 3. Transmissometer counts measured with the optical path filled with Milli-Q water prior to deployment. The dark signal is 0

BCO-DMO Data Processing Description:

-Reformatted column names to comply with BCO-DMO standards.
-Data were originally organized into multiples files and have been consolidated for display here.

Project Information

Rapid, Autonomous Particle Flux Observations in the Oligotrophic Ocean

Particles settling into the deep ocean remove carbon and biologically-important trace elements from sunlit, productive surface waters and from contact with the atmosphere over short timescales. A shifting balance among physical, chemical, and biological processes determines the ultimate fate of most particles at depths between 100 and 1,000 m, where fluxes are hardest to measure. Our challenge is to expand the number of particle flux observations in the critical "twilight zone", something that has proven elusive with ship-based “snapshots” that have lengths of, at most, a few weeks. Here, we propose an optical, transmissometer-based method to make particle flux observations from autonomous, biogeochemical profiling floats. Novel developments in data interpretation, sensor operation, and platform control now allow flux measurements at hourly resolution and give us observational access to the water-column

processes driving particle flux over short timescales. The sensors and float platforms that we propose to use are simple, robust, and commercially-available, making them immediately compatible with community-scale efforts to implement other float-based biogeochemical measurements. We have two main goals: First, we will quantify particulate organic carbon (POC) flux using float-based optical measurements by validating our observations against fluxes measured directly with neutrally-buoyant, drifting sediment traps. Second, we will evaluate the contribution of rapid export events to total POC fluxes in the oligotrophic ocean by using a biogeochemical profiling float to collect nearly-continuous, depth-resolved flux measurements and coupled, water-column bio-optical profiles. To achieve these goals, we will implement a work plan consisting of 1) a set of laboratory-based sensor calibration experiments to determine detection limits and evaluate sensitivity to particle size; 2) a series of four sediment trap and biogeochemical float co-deployments during which we will collect POC flux and field calibration data; and 3) a long-term sampling and analysis period (approximately 1 year) during which data will be returned by satellite from the biogeochemical float. We will conduct calibration fieldwork in conjunction with monthly Bermuda Atlantic Time-series Study (BATS) cruises, taking advantage of the timeseries measurements and the context provided by the 25-year record of POC flux at that site. The data returned by the float will comprise the first quantitative particle flux observations made at high-enough temporal resolution to interpret in the context of short-term, upper-ocean production events.

Deployment Information

Deployment description for R/V Atlantic Explorer AE1320

BATS cruise

Deployment description for R/V Atlantic Explorer AE1318

BATS cruise

Deployment description for R/V Atlantic Explorer AE1315

BATS cruise

Deployment description for R/V Atlantic Explorer AE1323

Deployment description for R/V Atlantic Explorer AE1402

BATS cruise

Instrument Information

Instrument	SBE 41CP CTD
Description	Used for sampling
Generic Instrument Name	CTD Sea-Bird
Generic Instrument Description	Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics, no specific unit identified. This instrument designation is used when specific make and model are not known. See also other SeaBird instruments listed under CTD. More information from Sea-Bird Electronics.

Instrument	WET Labs MCOMS Chlorophyll Fluorometer
Description	Used for sampling
Generic Instrument Name	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.

Instrument	WET Labs MCOMS CDOM Fluorometer
Description	Used for sampling
Generic Instrument	Fluorometer

Name	
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.

Instrument	Transmissometer
Description	Used to measure fraction of light
Generic Instrument Name	Transmissometer
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

Instrument	SBE63 optode
Description	Used to sample dissolved oxygen
Generic Instrument Name	Dissolved Oxygen Sensor
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

Instrument	WET Labs MCOMS Scattering Meter
Description	Used to sample backscatter
Generic Instrument Name	Optical Backscatter Sensor
Generic Instrument Description	*local description not specified*