Primary productivity measurements from on-deck bottle incubations during R/V Knorr cruise KN193-03 and R/V Bjarni Saemundsson cruises B10-2008 and B4-2008 to the subpolar North Atlantic, Iceland Basin in 2008

Website: https://www.bco-dmo.org/dataset/746215
Data Type: Cruise Results
Version: 1
Version Date: 2018-09-17

Project
» North Atlantic Bloom Experiment 2008 (NAB 2008)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Perry, Mary Jane	University of Maine	Principal Investigator
Briggs, Nathan	National Oceanography Centre (NOC)	Contact
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Bottle samples were collected during R/V Knorr cruise KN193-03 and R/V Bjarni Saemundsson cruises B10-2008 and B4-2008 to the subpolar North Atlantic, Iceland Basin in 2008. Primary productivity and photosynthetically active radiation (PAR) measurements were generated from on-deck C-14 bottle incubations. Chlorophyll a measurements were generated from a fluorometric analysis of acetone extract.

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Coverage

Spatial Extent: **N**:61.877 **E**:-20.17983 **S**:58.835 **W**:-27.59144
Temporal Extent: 2008-04-03 - 2008-06-29

Dataset Description

These primary productivity data were published in Briggs et al., 2018.

Results papers for related research utilizing data from the NAB08 project Seaglider, CTD, biofloat, and bottle data are listed in the "Related Publications" section.

Methods & Sampling

CTD data are reported as cast number and not as station number.

CTD Rosette system profiled at 0.5 m s-1 between the surface and 200 m, and at 1 m s-1 below 200 m.

Bottles were fired on the upcasts, 60 s after the CTD stopped. Sensor data are averages of a 30-s stationary period immediately before the bottle was fired.

Data Processing:

Fluorometric chlorophyll a (chl_a_fluor):
Water samples for fluorometric analysis of chlorophyll and pheopigments were filtered through Whatman GF/F filters. Triplicate water samples were collected at 10 m. Filters were extracted in 5 ml of 90% acetone at -20□ C for 24 h and read on a Turner Designs Model 10-AU Digital fluorometer. The fluorometer was calibrated before and after the field program with Turner Designs chlorophyll standards. Chlorophyll was determined following JGOFS protocol procedures (Knap et al., 1996). For additional details on laboratory analysis of discrete water samples see Supplimental Document: Laboratory_analysis_report-NAB08.pdf.

C-14 primary productivity incubations (PP_C14 vs. PAR experiments):
Samples were collected a depth near to the Chl a maximum, as determined by in situ fluorometery. Each sample was subdivided into 14 50 ml transparent glass bottles and inoculated with known activity of H14CO3- (i.e. ~ 2 µ Ci pr. bottle). Subsamples were incubated in duplicate at 7 different PAR levels between 0-400 µmol m-2 s-1 in a temperature regulated incubator. Light was provided using a daylight simulating fluorescent tube panel and its intensity was adjusted using neutral, perforated metal screens. After 2 hours of incubation the content of each sub sample was filtered on Whatman GF/F glass fibre filter and the filter dried for storage until counting of the C-14 activity in a scintillation counter after finishing the series of cruises. Prior to counting of the activity, the filters were fumed in concentrated HCl in a desiccator for 5 minutes, and the scintillation readings were finally adjusted according to an established quenching correction curve for the sample treatment and instrument.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* lat lon values rounded from 13 decimal places to 5
* Added ISO timestamp (UTC) from date time columns

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Data Files

File
C14_PP.csv (Comma Separated Values (.csv), 44.43 KB) MD5:e5ed510fddb8a47969097ceb3a7a558d Primary data file for dataset ID 746215

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Supplemental Files

File
Laboratory analysis report for NAB08 filename: Laboratory_analysis_report-NAB08.pdf (Portable Document Format (.pdf), 1.96 MB) MD5:bdec560efa9089de0eded8c8e0405029 Laboratory analysis report for North Atlantic Bloom Experiment 2008 (NAB08) projects. Detailed procedure regarding the discrete measurements of nutrients, Winkler dissolved oxygen, absorption coefficients, particulate organic carbon, fluorometric and HPLC pigment analysis.

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Related Publications

Alkire, M. B., D'Asaro, E., Lee, C., Jane Perry, M., Gray, A., Cetinić, I., … González-Posada, A. (2012). Estimates of net community production and export using high-resolution, Lagrangian measurements of O2, NO3−, and POC through the evolution of a spring diatom bloom in the North Atlantic. Deep Sea Research Part I: Oceanographic Research Papers, 64, 157–174. doi:10.1016/j.dsr.2012.01.012
Related Research

Alkire, M. B., Lee, C., D'Asaro, E., Perry, M. J., Briggs, N., Cetinić, I., & Gray, A. (2014). Net community production and export from Seaglider measurements in the North Atlantic after the spring bloom. Journal of Geophysical Research: Oceans, 119(9), 6121–6139. doi:10.1002/2014jc010105 https://doi.org/10.1002/2014JC010105
Related Research

Bagniewski, W., Fennel, K., Perry, M. J., & D'Asaro, E. A. (2011). Optimizing models of the North Atlantic spring bloom using physical, chemical and bio-optical observations from a Lagrangian float. Biogeosciences, 8(5), 1291–1307. doi:10.5194/bg-8-1291-2011
Related Research

Briggs, N., Guðmundsson, K., Cetinić, I., D'Asaro, E., Rehm, E., Lee, C., & Perry, M. J. (2018). A multi-method autonomous assessment of primary productivity and export efficiency in the springtime North Atlantic. Biogeosciences, 15(14), 4515–4532. doi:10.5194/bg-15-4515-2018
Results

Briggs, N., Perry, M. J., Cetinić, I., Lee, C., D'Asaro, E., Gray, A. M., & Rehm, E. (2011). High-resolution observations of aggregate flux during a sub-polar North Atlantic spring bloom. Deep Sea Research Part I: Oceanographic Research Papers, 58(10), 1031–1039. doi:10.1016/j.dsr.2011.07.007
Related Research

Cetinić, I., Perry, M. J., Briggs, N. T., Kallin, E., D'Asaro, E. A., & Lee, C. M. (2012). Particulate organic carbon and inherent optical properties during 2008 North Atlantic Bloom Experiment. Journal of Geophysical Research: Oceans, 117(C6), n/a–n/a. doi:10.1029/2011jc007771 https://doi.org/10.1029/2011JC007771
Related Research

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

Mahadevan, A., D'Asaro, E., Lee, C., & Perry, M. J. (2012). Eddy-Driven Stratification Initiates North Atlantic Spring Phytoplankton Blooms. Science, 337(6090), 54–58. doi:10.1126/science.1218740
Related Research

Omand, M. M., D'Asaro, E. A., Lee, C. M., Perry, M. J., Briggs, N., Cetini , I., & Mahadevan, A. (2015). Eddy-driven subduction exports particulate organic carbon from the spring bloom. Science, 348(6231), 222–225. doi:10.1126/science.1260062
Related Research

Rehm, E., & Mobley, C. D. (2013). Estimation of hyperspectral inherent optical properties from in-water radiometry: error analysis and application to in situ data. Applied Optics, 52(4), 795. doi:10.1364/ao.52.000795 https://doi.org/10.1364/AO.52.000795
Related Research

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Parameters

Parameter	Description	Units
Cruise_ID	Cruise identifier	unitless
cast	CTD cast number (not station number)	integer
date	Date (UTC) in format yyyymmdd	unitless
time	Time (UTC) in format HHMM	unitless
yrday	Time when sample was taken. Elapsed time in units of days since year 0 (Matlab "datenum")	days
latitude	Latitude	decimal degrees (DD)
longitude	Longitude	decimal degrees (DD)
depth	Sampling depth	meters (m)
chl_a_fluor	Chlorophyll a. Fluorometric analysis of acetone extract	milligrams per meters cubed (mg m^-3)
PAR	Photosynthetically active radiation (PAR) from incubation experiment	photon micromoles per meters squared per second (µmol photon m^-2 s^-1)
PP_14C	14C primary productivity from incubation experiment	milligrams of carbon per meters cubed per hour (mg C m^-3 h^-1)
ISO_DateTime_UTC	Timestamp (UTC) in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MMZ	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - profiler
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. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a 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 term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Turner Designs Model 10-AU Digital fluorometer
Generic Instrument Name	Turner Designs Fluorometer 10-AU
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA).

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Deployments

KN193-03

Website	https://www.bco-dmo.org/deployment/58153
Platform	R/V Knorr
Start Date	2008-05-01
End Date	2008-05-22
Description	A three-week process cruise on the R/V Knorr operated in the vicinity of five autonomous platforms that had been deployed in early April by another vessel. A total of 10 simultaneous float and CTD calibration profiles were taken to calibrate sensors on the Lagrangian mixed layer float (Biofloat 48) and to validate proxy measurements (i.e., optical attenuation to particulate organic carbon, etc.). One simultaneous Seaglider and CTD calibration profile was collected for each of the four Seagliders. Knorr also carried out a number of bow-tie surveys around the Lagrangian mixed layer float. A second float, Biofloat 47, had ceased functioning shortly after deployment was rescued at the beginning of the cruise. Two SOLOPC floats were deployed but were damaged on deployment and sank. A number of successful short deployments of PELAGRA floating were made during the cruise. Core ship-board measurements supported by project funding were: 1) CTD profiles (temperature, conductivity, oxygen, chlorophyll fluorescence, optical backscatter, and beam transmission) on all four cruises; 133 CTD profiles were obtained on this cruise. 2) analysis of water samples collected with the CTD Rosette (chlorophyll, HPLC pigments, nutrients, particulate organic carbon, particulate absorption spectrum, phytoplankton, oxygen and other guest investigator measurements). Original cruise data are available from the NSF R2R data catalog Science personnel: Mary Jane Perry, University of Maine, Chief Scientist Witold Bagniewsk, University of Maine Nicole Bale, Plymouth Laboratory, UK Nathan Briggs, University of Maine David Checkley, Scripps Institution of Oceanography Giorgio Dall'Olmo, Oregon State University Andrea Drzewianowski, University of Maine Amanda Gray, University of Washington Jennifer Fortier, University of Maine Alba Gonzalez-Posada, University of East Anglia, UK Emily Kallin, University of Maine Kristinn Gudmundsson, Marine Research Institute, Reykjavik, Iceland Richard Lampitt, National Oceanography Centre, South Hampton, UK Patrick Martin, National Oceanography Centre, South Hampton, UK Maren Moltke Lyngsgaard, University of Copenhagen, Denmark Nicole Poulton, Bigelow Laboratory Eric Rehm, University of Washington Katherine Richardson, University of Copenhagen, Denmark Ryan Rykaczewski, Scripps Institution of Oceanography Michael Sauer, University of Maine Richard Sawyer, National Oceanography Centre, South Hampton, UK Michael Sieracki, Bigelow Laboratory Tatiana Rynearson, University of Rhode Island Toby Westberry, Oregon State University Dane Wojcicki, University of Maine Lin Zhang, University of Rhode Island

B10-2008

Website	https://www.bco-dmo.org/deployment/58146
Platform	R/V Bjarni Saemundsson
Start Date	2008-06-25
End Date	2008-07-01
Description	Recovery cruise: R/S Bjarni Saemundsson departed 25 June 2008 0930 from Reykjavik to recover Seagliders 140, 141, 142. Before the ship departed port, SG 142 stopped communicating; hence, a survey pattern was carried out to acoustically ping for the glider but was unsuccessful in locating it. CTD casts were made (n=12) and bottles samples collected for calibration of SG 140 and 141 before they were recovered. The ship steamed to near the original deployment site (59.02º, -20.49) on 29 June 2008 to deploy two bio-optical ARGO floats for Dr. H. Claustre, LOV, France. R/S Bjarni Saemundsson returned to Reykjavik on 1 July 2008.

B4-2008

Website	https://www.bco-dmo.org/deployment/58145
Platform	R/V Bjarni Saemundsson
Start Date	2008-04-01
End Date	2008-04-06
Description	Deployment cruise: R/S Bjarni Saemundsson departed 1 April 2008 10:00 from Reykjavik to deploy 2 floats (Biofloat 47 and 48 and 4 Seagliders (SG 140, 141, 142, 143); these were all successfully deployed on 4 April 2008. Biofloat 47 failed within a few weeks of deployment; therefore its data are not reported. CTD profiles (n=9) and water samples were collected before and after the autonomous platform deployment. R/S Bjarni Saemundsson returned to Reykjavik on 6 April 2008.

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Project Information

North Atlantic Bloom Experiment 2008 (NAB 2008)

Coverage: North Atlantic, 60 ° North

NAB2008 was a process experiment designed to study an important component of the oceanic carbon system - the North Atlantic spring bloom. The phytoplankton bloom occurring each spring in the North Atlantic, drives the uptake of carbon dioxide and is an important component of the biological pump (Bagniewski et al., 2010). Previous studies in this region have shown the importance of small temporal and spatial scales, i.e. ecosystem patchiness, during the bloom, but were restricted by the limitations of ship-based sampling. Recent advances in autonomous platforms and sensors presented an opportunity to study this important event in a new way. In addition to deployment of a diverse suite of *in situ* sampling devices, NAB2008 was also a test-bed for developing the strategies and knowledge needed to successfully use new methods to drive the next generation of ocean observations.

In 2008, a coordinated deployment of 1 float, 4 Seagliders and 2 research vessels sampled the evolution of the North Atlantic spring bloom along and surrounding the nearly Lagrangian path followed by the float. The autonomous measurements were continuous through the experimental period, and included CTD, chlorophyll fluorescence, optical backscatter, and oxygen on all platforms; and nitrate, optical attenuation, and various radiance measurements on the float. Velocities were determined from the vehicle motion, with the float extending to a depth of 230 meters and gliders to 1,000 meters. The autonomous vehicles were deployed, rescued, and recovered on three cruises of the Icelandic vessel Bjarni Saemundsson. A 21-day cruise of the R/V Knorr conducted more detailed measurements during the peak of the bloom in May. The R/V Knorr sampling program included optical profiles, ADCP data and analysis of water samples for nutrients, particulate organic carbon, pigments, micro-plankton composition, complemented by guest investigator analyses. Data from both ships were used to calibrate and validate the autonomous measurements.

References:
Bagniewski, W., Fennel, K., Perry, M. J., and D'Asaro, E. A. (2010) Optimizing models of the North Atlantic spring bloom using physical, chemical and bio-optical observations from a Lagrangian float, Biogeosciences Discuss., 7, pp. 8477-8520, doi:10.5194/bgd-7-8477-2010

NAB08 preprints

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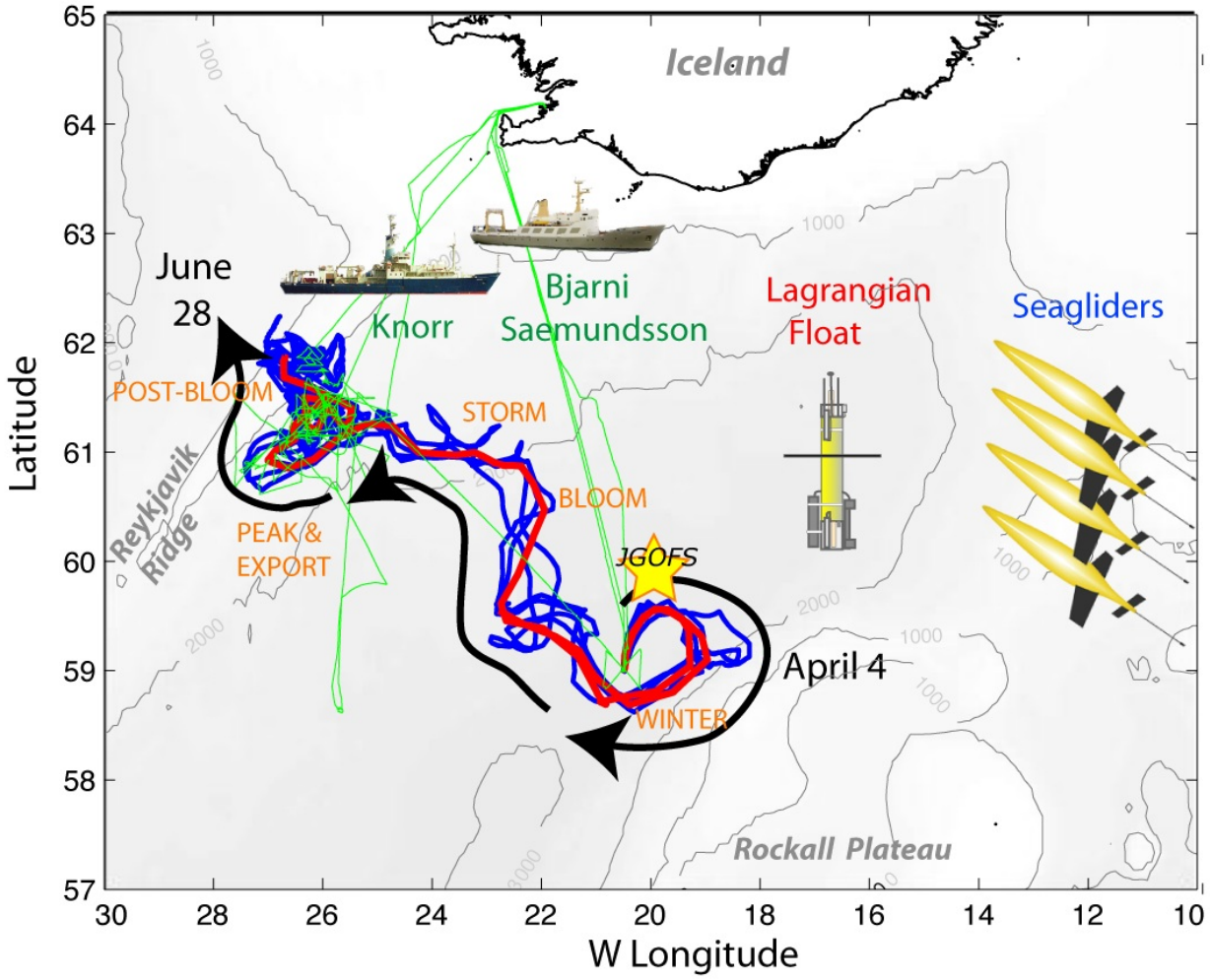

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-

pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0628107
National Aeronautics & Space Administration (NASA)	NNX08AL92G
NSF Division of Ocean Sciences (NSF OCE)	OCE-0628379

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