Water column Th-234 activities from 4-liter water samples at the Porcupine Abyssal Plain Sustained Observatory (PAP-SO) site in the Northeast Atlantic Ocean during RRS Discovery cruise DY077 in April of 2017

Website: https://www.bco-dmo.org/dataset/765859
Data Type: Cruise Results
Version: 1
Version Date: 2019-05-02

Project
» Collaborative Research: Are all traps created equal? A multi-method assessment of the collection and detection of sinking particles in the ocean (Are Traps Equal)

Contributors	Affiliation	Role
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Abstract
Water column Th-234 activities from 4-liter water samples at the Porcupine Abyssal Plain Sustained Observatory (PAP-SO) site in the Northeast Atlantic Ocean during RRS Discovery cruise DY077 in April of 2017.

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Coverage

Spatial Extent: **N**:48.7487 **E**:-16.2624 **S**:48.7487 **W**:-16.78
Temporal Extent: 2017-04-19 - 2017-04-28

Dataset Description

Water column Th-234 activities from water samples at the Porcupine Abyssal Plain Sustained Observatory (PAP-SO) site in the Northeast Atlantic Ocean during RRS Discovery cruise DY077 in April of 2017.

Related datasets collected during the same cruise:
In-situ pump: https://www.bco-dmo.org/dataset/765850
Sediment trap fluxes: https://www.bco-dmo.org/dataset/765835

Methods & Sampling

Samples were collected during two deployment cycles (termed “deployment 1” and “deployment 2”) occupied during the RRS Discovery cruise DY077 to the Porcupine Abyssal Plain Sustained Observatory (PAP-SO) Site in April 2017. In each of the cycles, we conducted particle flux sampling method intercomparisons between fluxes derived from upper water column deficits of 234Th vs. its parent isotope 238U, two types of neutrally buoyant sediment traps (NBST and PELAGRA), and a surface tethered array of sediment traps (STT).
234Th profiles were sampled at the beginning and end of each deployment, triangulated 10 km apart around the drifting trap location (Figure 1). A total of 161 234Th samples were collected (Table 1). A 4-L sample was collected from CTD casts, a stable Th yield monitor was added and the pH was adjusted to promote the formation of a Mn precipitate that scavenges Th. This was then filtered onto a 25-mm diameter quartz filter (Buesseler et al., 2009). The quartz filter was dried and mounted, then beta counted on board and again 6 months post-cruise to determine the amount of interfering beta activity and detector background that was not associated with 234Th in the sample.

Porcupine Abyssal Plain Sustained Observatory (PAP-SO) site in the Northeast Atlantic Ocean (49°N, 16.5°W)

Data Processing Description

Integrated 234Th fluxes were calculated as in Buesseler et al. (2009) using a 1-D steady state model.

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
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* added ISO_DateTime_UTC column from date and time columns

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Data Files

File
Th234.csv (Comma Separated Values (.csv), 13.53 KB) MD5:cc3391d064df5bdc3442b4cb4c5cd361 Primary data file for dataset ID 765859

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Supplemental Files

File
Figure 1. Locations of platforms filename: Fig1.png (Portable Network Graphics (.png), 945.63 KB) MD5:dc3d6d1d9c796de9027e51149381b31b Figure 1. Locations of platforms during deployment 1 (19-21 Apr) and deployment 2 (24-27 Apr).
Table 1. Locations and depth ranges filename: Table1.csv (Comma Separated Values (.csv), 830 bytes) MD5:3f7b594b18cae18c7c300bf9d6f827e0 Locations and depth ranges sampled for 234Th flux determinations.

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Related Publications

Buesseler, K. O., Pike, S., Maiti, K., Lamborg, C. H., Siegel, D. A., & Trull, T. W. (2009). Thorium-234 as a tracer of spatial, temporal and vertical variability in particle flux in the North Pacific. Deep Sea Research Part I:

Oceanographic Research Papers, 56(7), 1143–1167. doi:10.1016/j.dsr.2009.04.001
Methods

Owens, S. A., Buesseler, K. O., & Sims, K. W. W. (2011). Re-evaluating the 238U-salinity relationship in seawater: Implications for the 238U–234Th disequilibrium method. Marine Chemistry, 127(1-4), 31–39. doi:10.1016/j.marchem.2011.07.005
Results

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Parameters

Parameter	Description	Units
deployment	deployment cycle during cruise DY077	unitless
station	station occupied during cruise DY077	unitless
cast	CTD cast number	unitless
bottle	rosette bottle number	unitless
depth	depth of water sample collection	meters (m)
lat	latitude of CTD cast	decimal degrees (DD)
lon	longitude of CTD cast	decimal degrees (DD)
date	date of CTD cast (GMT) in ISO 8601 format yyyy-mm-dd	unitless
time	time of CTD cast (GMT) in ISO 8601 format hh:mm:ss	unitless
ISO_DateTime_UTC	date time (UTC) in ISO 8601 format yyyy-mm-ddTHH:MMZ	unitless
U238_tot	total uranium-238 activity calculated from CTD salinity as per Owens et al. 2011	disintegration per minute per liter (dpm/L)
U238_tot_err	total uranium-238 uncertainty, derived from the uncertainty in the relationship in Owens et al. 2011	disintegration per minute per liter (dpm/L)
Th234_tot	total uranium-238 activity determined from 4-liter water samples	disintegration per minute per liter (dpm/L)
Th234_tot_err	total uranium-238 uncertainty, derived from counting statistics and error propagation for mass/volume measurements and ICP-MS recovery analysis	disintegration per minute per liter (dpm/L)

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Instruments

Dataset-specific Instrument Name	CTD Seabird 911plus
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	
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Riso Beta Counter
Generic Instrument Name	Riso Laboratory Anti-coincidence Beta Counters
Generic Instrument Description	Low-level beta detectors manufactured by Riso (now Nutech) in Denmark. These instruments accept samples that can be mounted on a 25mm filter holder. These detectors have very low backgrounds, 0.17 counts per minute, and can have counting efficiencies as high as 55%.

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Deployments

DY077

Website	https://www.bco-dmo.org/deployment/765832
Platform	RRS Discovery
Start Date	2017-04-14
End Date	2017-05-01

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Project Information

Collaborative Research: Are all traps created equal? A multi-method assessment of the collection and detection of sinking particles in the ocean (Are Traps Equal)

Coverage: Porcupine Abyssal Plain Sustained Observatory (PAP-SO) site in the Northeast Atlantic Ocean (49°N, 16.5°W)

NSF Award Abstract:

There is considerable need to understand the biological and ecological processes that through net primary production fix dissolved carbon dioxide (CO2) into organic matter in the upper ocean, and the processes that subsequently transport this organic carbon in to the ocean's interior. Most of the particulate organic carbon flux to the deep ocean is thought to be mediated by sinking particles. Ultimately it is the deep organic carbon transport and its sequestration that define the impact of ocean biota on atmospheric CO2 levels and hence climate. Currently, various methods are available to measure the amount of particles in the ocean that sink over a specified period of time commonly referred to as particle flux. Unfortunately, all of these methods are used independently of each other with very little intercomparison, leaving some uncertainty as to which approach provides the most accurate estimates. This study seeks to be the first concerted effort to standardize particle flux measurements. Seeking to keep the cost modest, the researchers are taking advantage of a collaboration with scientists in the United Kingdom to participate in an already scheduled research cruise. The proposed research will have much greater impact that merely standardization of particle flux measurements because it will provide the science and modeling community the ability to quantify the transfer of carbon throughout the surface ocean. Also, this project provides a variety of mentoring and training opportunities for students. A PhD student at Woods Hole Oceanographic Institute will get their first sea-going experience and will learn all of the processing steps for the study of an isotope of thorium (234Th). Skidmore College will have an undergraduate participant in the research and the results from the cruise will also be an excellent additional component for undergraduate oceanography classes.

Researchers from Woods Hole Oceanographic Institution and Skidmore College, in collaboration with a scientist from the National Oceanography Centre, Southampton will inter-compare direct, tracer, and optical-sensor methods used to determine sinking particle fluxes in the surface ocean. To do this, they will firstly conduct a comparison of two types of neutrally buoyant traps and one surface-tethered, drifting array. Secondly, measured trap fluxes will be compared to predicted 234Th fluxes from a 3D time-series of data. Lastly, optical sediment trap measurements will be compared to particle size distributions in the water column and gel traps, as well as size-fractionated particles on filters from large volume pumps. With this research, global ocean models, particularly carbon, will have greater accuracy and stronger conclusions will be able to be drawn from them.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1659995
NSF Division of Ocean Sciences (NSF OCE)	OCE-1660012

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