Mass flux and concentrations of bulk components (Carbonate, Organic Carbon/Nitrogen, Lithogenics, Opal) and elements in the flux at 500m, 1500m and 3200m depths from the OFP sediment trap time-series in the northern Sargasso Sea

Website: https://www.bco-dmo.org/dataset/784396
Data Type: Other Field Results
Version: 1
Version Date: 2022-08-30

Project
» Time Series Particle Flux Measurements in the Sargasso Sea (OFP Sargasso Sea)

Program
» Oceanic Flux Program (OFP)

Contributors	Affiliation	Role
Conte, Maureen H.	Bermuda Institute of Ocean Sciences (BIOS)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes mass flux and concentrations of bulk components (Carbonate, Organic Carbon/Nitrogen, Lithogenics, Opal) and elements in the flux at 500m, 1500m, and 3200m depths from the Ocean Flux Program (OFP) sediment trap time-series in the northern Sargasso Sea.

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Coverage

Spatial Extent: **Lat**:31.9167 **Lon**:-64.0833
Temporal Extent: 2000-10-07 - 2015-03-31

Dataset Description

Mass flux and concentrations of bulk components (Carbonate, Organic Carbon/Nitrogen, Lithogenics, Opal) and elements in the flux at 500m, 1500m and 3200m depths from the OFP sediment trap time-series in the northern Sargasso Sea.

Access restrictions:
If you plan to use this data, please contact me, Maureen H. Conte @ mconte@mbl.edu. For the OFP time-series records, it is extremely important that we have a record of how the data are utilized, and by whom to support continued OFP funding. Also, talking with me will ensure that you are clear about the data naming conventions,

etc., and let you know if there are others using the data for similar research. I also can give you some valuable insights that should be valuable concerning the OFP flux data in general. Thank you! Maureen Conte, principal Investigator OFP time-series

Methods & Sampling

Sampling and analytical methodology for carbonate, and organic carbon/nitrogen are described in detail in the "2019_OFP_Methodologies" document (see Supplemental Files).

Analytical methodology for the element data are described in detail in Conte et al. (2019).

The LiBO2 fusion method is described in detail in Huang et al. (2007).

Briefly, the dried <1mm sediment trap material is processed by fusion with high purity lithium metaborate (LiBO2) flux at 1000 C in a dedicated combustion furnace. The sample to LiBO2 flux ratio for fusion is approximately1:2.5. The fused sample bead is subsequently dissolved in 1M HNO3 for ICPMS analysis. From 2000 to 2004, we used 1–2 mg of flux material for analysis, but in 2005 we increased this to ~6 mg to reduce analytical variability associated with particle heterogeneity. Blank analyses of the LiBO2 flux are run with each sample set to assess contamination. The final sample solution was analyzed on a high-resolution Finnigan Element 2 ICPMS. A matrix-matching multi-element external standard solution was used for determination of the trace element concentrations.

Data Processing Description

Processing information is described in detail in the "2019_OFP_methodologies" document (see Supplemental Files).

BCO-DMO Processing:
- modified parameter names: replaced % with "pcnt", > with "gt", < with "lt", and hyphens with underscores;
- replaced missing data and values of "-999" with "nd" (no data).

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Data Files

File
OFP_elemental.csv (Comma Separated Values (.csv), 113.52 KB) MD5:8d4ba3ed4e33da3208b1ea9c5add6c30 Primary data file for dataset ID 784396

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Supplemental Files

File
2019 OFP methodologies filename: 2019_OFP_methodologies.pdf (Portable Document Format (.pdf), 343.83 KB) MD5:f55e523dd54673cc38fd03aab1f4cbdc 2019 Ocean Flux Program methodologies document

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Related Publications

Conte, M. H., Carter, A. M., Koweek, D. A., Huang, S., & Weber, J. C. (2019). The elemental composition of the deep particle flux in the Sargasso Sea. Chemical Geology, 511, 279–313. doi:10.1016/j.chemgeo.2018.11.001
Methods

Huang, S., Sholkovitz, E. R., & Conte, M. H. (2007). Application of high-temperature fusion for analysis of major and trace elements in marine sediment trap samples. Limnology and Oceanography: Methods, 5(1), 13–22. doi:10.4319/lom.2007.5.13
Methods

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Parameters

Parameter	Description	Units
depth	sampling depth in meters	meters (m)
SampleID	The OFP naming convention uses the month of the mooring recovery cruise, the sequential number of the trap cup, and trap depth. E.g. %11/10-4 1500 denotes the sample was recovered in Nov 2010, was the fourth trap cup in the sampling rotation during the deployment and the sediment trap was located at 1500m depth. Samples collected using the single cup trap (prior to 1989), are named by the recovery date only (Please note: The Sample ID does NOT indicate the date of sample collection!! The start date of the sample collection is provided by the sequence day (Sequence Day 1 = 4 Apr 1978) and the start calendar date.	unitless
SeqDay	Number of days since the beginning of the OFP time-series (SeqDay 1=4 April 1978). The SeqDay is the first day of the sample collection period.	unitless
midSeqDay	Sequence day of the middle of the sample collection period	unitless
StartYr	Start year for sample	unitless
StartMo	Start month for sample	unitless
StartDay	Start day for sample	unitless
MidJDay	Mid Julian Day is the Julian Day (Day of Year) of the midpoint of the sample collection period.	unitless
MassFlux	Total mass Flux	milligrams per square meter per day (mg/m2/day)
pcnt_Carb_lt_125	percent carbonate by weight	unitless (percent)

pcnt_Corg_lt_125	percent organic carbon by weight	unitless (percent)
pcnt_N_lt_125	percent nitrogen by weight	unitless (percent)
pcnt_Lith_lt_1000est	estimated mass percent lithogenic material	unitless (percent)
pcnt_Opal_lt_1000est	estimated mass percent opal	unitless (percent)
Mg_lt_1000	Mg concentration by weight	milligrams per kilogram
Al_lt_1000	Al concentration by weight	milligrams per kilogram
Total_Si_lt_1000	Total Si (Biogenic Si + lithogenic Si) concentration by weight	milligrams per kilogram
P_lt_1000	P concentration by weight	milligrams per kilogram
Ca_lt_1000	Ca concentration by weight	milligrams per kilogram
Sc_lt_1000	Sc concentration by weight	milligrams per kilogram
Ti_lt_1000	Ti concentration by weight	milligrams per kilogram
V_lt_1000	V concentration by weight	milligrams per kilogram
Cr_lt_1000	Cr concentration by weight	milligrams per kilogram
Mn_lt_1000	Mn concentration by weight	milligrams per kilogram
Fe_lt_1000	Fe concentration by weight	milligrams per kilogram
Co_lt_1000	Co concentration by weight	milligrams per kilogram
Ni_lt_1000	Ni concentration by weight	milligrams per kilogram
Cu_lt_1000	Cu concentration by weight	milligrams per kilogram
Zn_lt_1000	Zn concentration by weight	milligrams per kilogram

Sr_lt_1000	Sr concentration by weight	milligrams per kilogram
Cd_lt_1000	Cd concentration by weight	milligrams per kilogram
Ba_lt_1000	Ba concentration by weight	milligrams per kilogram
Pb_lt_1000	Pb concentration by weight	milligrams per kilogram
Comments	notes/comments	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	McLane PARFLUX Mark 8 Sediment Trap
Generic Instrument Description	The Mark 8 Sediment Trap is a time-series instrument that autonomously collects the flux of settling particles on an operator-defined schedule. The wide top funnel accumulates particulate specimens into individual sample bottles. The cone interior is natural polyethylene. Deploys from a stand-alone mooring or a large high-tension vertical array. McLane Mark 8 Data Sheet (PDF) McLane website: https://mclanelabs.com/sediment-traps/

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Deployments

OFP_Time-Series

Website	https://www.bco-dmo.org/deployment/704779
Platform	OFP_mooring
Start Date	1978-04-06
Description	The Oceanic Flux Program (OFP) time-series began in 1978 at the Hydrostation S hydrographic time-series site (32 05N, 64 15W), located approximately 45 km southeast of Bermuda. The time-series was originally called the SCIFF (Seasonal Changes in Isotopes and Flux of Foraminifera) program. Location: 1978-1984: 31deg 10min N, 64deg 30min W, 3300m (SCIFF site) 1984-2010: 31deg 50min N, 64deg 10min W, 4500m 2011-present: 31deg 55 N, 64deg 05 W, 4550m

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Project Information

Time Series Particle Flux Measurements in the Sargasso Sea (OFP Sargasso Sea)

Website: https://www.mbl.edu/research/research-centers/ecosystems-center/research-projects/oceanic-flux-program-ofp

Coverage: Sargasso Sea

The Oceanic Flux Program (OFP) has continuously measured particle fluxes in the deep Sargasso Sea since 1978. The OFP is the longest running continuous time-series of its kind, and has produced a unique record of temporal variability in material transfer from the surface to the deep ocean (the “biological pump") resulting from the interplay between physical, biological and chemical processes. The OFP deploys a subsurface mooring anchored in 4500m of water with three McLane Research Parflux Mark 8 sediment traps located at 500m, 1500m and 3200m depths. These traps continuously collect the sinking particle flux at an approximate 2 week sampling resolution.

The most recent project awards and abstracts are listed below. A detailed history of funding with summary of all project awards for OFP can be found below.

October 2024 through September 2027
NSF Award OCE-2421112 Abstract:

This award provides an additional three years of support for the Oceanic Flux Program (OFP). The OFP was established in 1978 to measure the export flux of particles from the surface to the deep ocean in the deep Sargasso Sea near Bermuda. The OFP is the longest and most continuous particle flux time-series of its kind. Through collaboration with nearby upper ocean time-series programs, facilities, and other Bermuda-based sampling programs, OFP will continue to be a valuable resource for the oceanographic community in the effort to answer questions about the intricate relationship between deep ocean particle flux and climate, as well as biological, physical, and chemical oceanographic processes. Looking to the future, OFP will use increasingly advanced instrumentation and state-of-the-art analytical tools to investigate the nature and patterns of the material that sinks from the surface to deep ocean and the mechanisms that drive that process. The OFP provides education and training for students from high school to Ph.D. levels and supports early career researchers. OFP data and samples are broadly available to other researchers across the scientific disciplines.

Two overarching goals drive core activities funded under the OFP grant. The first is to extend the time-series by collecting new samples of the highest quality, while ensuring they have a comprehensive oceanographic context. The second is to elucidate the processes that drive oceanic particle flux through comparative studies of flux magnitude and composition with concurrent observations of external forcing (e.g., synoptic scale meteorology, climate patterns), surface water physics and biology (e.g., mesoscale features, blooms), and interior processes (e.g., biological particle aggregation/disaggregation, elemental scavenging, authigenic mineralization). The specific grant objectives are: (1) to provide for continuity of the particle flux measurements at 500, 1500 and 3200 m depths and continue to refine the quality of the time-series record and expand its oceanographic context, (2) to update/calibrate OFP sample processing and analytical methods to enhance the time-series data record, and to curate the time-series sample archives for future study, (3) to promote collaborative research to maximize interdisciplinary information obtained from the samples, (4) to conduct focused studies to identify deep flux temporal trends and their coherence with upper ocean forcing, to elucidate causal flux generation processes, and to develop proxies for climate studies,
(5) to provide education and training opportunities. A particular focus of this funding cycle will be to analyze the extensive OFP digital image archive with an automated (and/or semi-automated) approach, including classical methodologies and Deep Learning (DL) based tools for image classification, segmentation and archive, and a Graphical User Interface (GUI). The development of these new tools for identification, quantification, and characterization of the flux material will better exploit the image archive's potential, as fuller characterization of biological components will contribute new information on the ecosystem dynamics and responses to environmental forcing that drive flux generation.

October 2023 through September 2025
NSF Award OCE-2414704 Abstract:

This award provides an additional three years of support for the Oceanic Flux Program (OFP). This program was first established in 1978 to measure the export flux of particles from the surface to the deep ocean in the deep Sargasso Sea and represents the longest and most continuous particle flux time-series of its kind. This program and the time-series record will continue to help the oceanographic community to answer questions about the relationship between deep ocean particle flux and climate and biological, physical, and chemical oceanographic processes. In the past, the OFP has provided evidence for coupling between the upper and

deep ocean processes linked to seasonal, episodic (e.g., physical and meteorological forcing) and climate patterns. Looking to the future, this program will utilize increasingly advanced instrumentation and analytical tools to address questions about the material that sinks from the surface to deep ocean and its controls. The OFP provides education and training for students from the high school to Ph.D. level and supports early career researchers.

The OFP time-series represents a 43-year, nearly continuous record focused on particle fluxes in the deep ocean. With increasingly more data available from the lengthening record, investigators can put observed biogeochemical patterns into perspective to understand the interplay between climate and ocean functioning. The availability of data from complementary nearby Hydrostation S, the Bermuda Atlantic Time-Series (BATS), the Bermuda Testbed Mooring (1994-2007), the Tudor Hill atmospheric tower and other Bermuda sampling programs provide additional opportunities to study upper ocean physics and biogeochemistry coupled with deep ocean biogeochemical processes. The OFP record is becoming long enough to study deep flux linkages with gyre circulation and advective processes. The OFP's archive is an unparalleled resource for retrospective studies of temporal trends and the biogeochemical consequences of a changing ocean, including future impacts of ocean acidification. As the OFP heads into the future, increasingly sophisticated OFP mooring instrumentation (ADCP current profiling and backscatter; MicroCAT temperature, salinity, and oxygen measurements) and advances in digital imaging and analytical tools (both chemical and genomic) to probe the recovered flux materials continue to reveal novel, fundamental information about the oceanic particle flux and its controls

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Program Information

Oceanic Flux Program (OFP)

Website: http://www.mbl.edu/ecosystems/conte/ofp/

Coverage: Sargasso Sea

(Adapted from the NSF Project Summary)

Since 1978, the Oceanic Flux Program (OFP), originally founded and managed by at the Woods Hole Oceanographic Institution and now managed by the Bermuda Institute of Ocean Science (BIOS), has continuously measured particle fluxes in the deep Sargasso Sea. The 35+ year OFP time-series is, by far, the longest of its kind and unique in its focus on the deep ocean. OFP has produced a unique, albeit "edited", record of temporal variability in the "biological pump", a term loosely applied here to material transfer from the surface to the deep ocean. The OFP provided the first direct evidence for seasonality in the deep ocean and the tight coupling between deep fluxes and upper ocean processes. It has provided clear evidence of the intensity of biological reprocessing of flux and scavenging of suspended material in mesopelagic waters. The record has documented interannual and longer variations in deep fluxes and shorter term fluctuations driven by the interactions between mesoscale physical variability, meteorological forcing and ecosystem responses.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536644

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