Processed particulate backscatter data from the global Biogeochemical Argo array from 2010-2025

Website: https://www.bco-dmo.org/dataset/1001948
Data Type: Other Field Results
Version: 1
Version Date: 2026-06-26

Project
» Collaborative Research: Multi-Platform Approach to Evaluate Spring Bloom Timing and Carbon Export Processes in the North Atlantic Ocean (Argo Bio-Carbon)

Contributors	Affiliation	Role
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Abstract
This dataset is processed particulate backscatter (bbp) data from the global, open-ocean Biogeochemical Argo array. Data were quality-controlled using the Euro-Argo real-time quality control toolbox, following the methods outlined in Dall'Olmo et al., 2022. The bbp data were then decomposed into their small and large particle ("spike") components. These data are flagged by oceanographic biome (Fay and McKinley, 2014). These data, which are freely available, were processed and merged to quantify biological carbon pump transfer efficiencies using the global BGC-Argo array.

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Coverage

Location: Global, open ocean
Spatial Extent: **N**:78.855395 **E**:179.9995 **S**:-75.647 **W**:-179.9974
Temporal Extent: 2010-05-30 - 2025-08-28

Methods & Sampling

Data were collected and made freely available by the Global Ocean Biogeochemistry Array (GO-BGC) Project funded by the National Science Foundation, Division of Ocean Sciences (NSF OCE-1946578), and by the International Argo Program and the national programs that contribute to it. (http://www.argo.ucsd.edu, http://ocean-ops.org). The Argo Program is part of the Global Ocean Observing System.

Biogeochemical Argo particulate backscatter (BBP700) profiles were downloaded from the Argo Global Data Assembly Center (GDAC) (Argo, 2025). BBP700 profiles are provided by the Argo data management teams directly. Only profiles from global open ocean basins were included in this study. Profiles in marginal seas, like the Mediterranean, were excluded. Data from a total of 1,045 floats yielding 102,666 profiles are included in

this dataset.

There are a variety of different BGC-Argo float models and manufacturers. All floats used in this study were equipped with particulate backscatter sensors, but the exact sensor model depends on the float design.

Data Processing Description

At the time of data processing, the real-time quality control (RTQC) protocols for BGC-Argo backscatter were limited (Dall'Olmo et al., 2023). As a result, all profiles were quality controlled following the methods of Dall'Olmo et al., 2023 using the EuroArgo RTQC toolbox, which is available on GitHub (https://github.com/euroargodev/BBP_RTQC; DOI: 10.5281/zenodo.7934400). This toolbox processes and assigns QC flags to B-profiles. Only profiles with QC flags of 1 ("Good data") or 2 ("Probably good data") were used in this study.

After data QC, every profile backscatter (b_{bp}) profile was decomposed into its large (b_{bl}) and small particle (b_{bs}) backscatter components following a modified version of Briggs et al., 2020. This decomposition was done on a per-profile basis, and each profile was decomposed into 4 components--a large (b_{bl}), small (b_{bs}), refractory (b_{br}), and instrument noise component (b_{noise}):

$b_{bp} = b_{bl} + b_{bs} + b_{br} + b_{noise}$

Code to decompose backscatter profile is available on GitHub (https://github.com/ellenrpark/spike_decomp; doi: 10.5281/zenodo.19486817).

Profiles were then assigned to a Fay and McKinley biome based on year (Fay and McKinley, 2014). The biomes recreated from 2010-2024 (https://doi.org/10.5281/zenodo.14989532) were used for this study. Profiles were assigned a biome based on year and using nearest-neighbor to the closest grid point.

BCO-DMO Processing Description

- Loaded original file "processed_backscatter.csv" into the BCO-DMO system.
- Converted JULD column (format "%Y-%m-%d %H:%M:%S", UTC) to new ISO_DateTime_UTC column in ISO 8601 datetime format ("%Y-%m-%dT%H:%M:%SZ", UTC).
- Saved the final file as "1001948_v1_global_bgc-argo_bbp.csv".

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Related Publications

Dall'Olmo, G. (2023). *euroargodev/BBP_RTQC: BBP_RTQC_v2.0.0* (Version BBP_RTQC_v2.0.0) [Computer software]. Zenodo. https://doi.org/10.5281/zenodo.7934400
Software

Dall'Olmo, G., Bhaskar TVS, U., Bittig, H., Boss, E., Brewster, J., Claustre, H., Donnelly, M., Maurer, T., Nicholson, D., Paba, V., Plant, J., Poteau, A., Sauzède, R., Schallenberg, C., Schmechtig, C., Schmid, C., & Xing, X. (2023). Real-time quality control of optical backscattering data from Biogeochemical-Argo floats. Open Research Europe, 2, 118. https://doi.org/10.12688/openreseurope.15047.2
Methods

Dall'Olmo, G., Bhaskar Tvs, U., Bittig, H., Boss, E., Brewster, J., Claustre, H., Donnelly, M., Maurer, T. L., Nicholson, D., Paba, V., Plant, J. N., Poteau, A., Sauzède, R., Schallenberg, C., Schmechtig, C., Schmid, C., & Xing, X. (2023). *BGC Argo quality control manual for particles backscattering* (Version 1.0). Ifremer. https://doi.org/10.13155/60262
Methods

Ellen Park. (2026). *ellenrpark/faymckinleybiomes: v1.0.0* (Version v1.0.0) [Computer software]. Zenodo. https://doi.org/10.5281/zenodo.19486879
Software

Fay, A. R., & McKinley, G. A. (2014). Global open-ocean biomes: mean and temporal variability. Earth System Science Data, 6(2), 273–284. https://doi.org/10.5194/essd-6-273-2014
Methods

ellenrpark. (2026). *ellenrpark/spike_decomp: v1.0.0* (Version v1.0.0) [Computer software]. Zenodo. https://doi.org/10.5281/zenodo.19486817
Software

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Related Datasets

IsDerivedFrom

Argo. (2026). *Argo float data and metadata from Global Data Assembly Centre (Argo GDAC)* [Dataset]. SEANOE. https://doi.org/10.17882/42182 https://doi.org/10.17882/42182#119541

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Parameters

Parameter	Description	Units
FNAME	Biogeochemical Argo B-profile file name. This includes data-processing status, float WMO number, and profile number	unitless
LON	longitude	degrees E
LAT	latitude	degrees N
JULD	date	unitless
DEPTH	depth	meters (m)
BBP700	particulate backscatter signal at 700nm	1/m
bbl	large particle backscatter signal	1/m
bbs	small particle backscatter signal	1/m
bbr	refractory particle backscatter signal	1/m
BIOME	Fay and McKinley biome number	unitless
TBIN	time bin	unitless
DBIN	depth bin	unitless
ISO_DateTime_UTC	Date and time (UTC) converted to ISO 8601 format	unitless

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Instruments

Dataset-specific Instrument Name	BGC-Argo float
Generic Instrument Name	drifting subsurface profiling float
Dataset-specific Description	There are a variety of different BGC-Argo float models and manufacturers. All floats used in this study were equipped with particulate backscatter sensors, but the exact sensor model depends on the float design.
Generic Instrument Description	An unmanned instrumented platform drifting freely in the water column that periodically makes vertical traverses through the water column (e.g. Argo float).

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Project Information

Collaborative Research: Multi-Platform Approach to Evaluate Spring Bloom Timing and Carbon Export Processes in the North Atlantic Ocean (Argo Bio-Carbon)

Coverage: North Atlantic and Global

NSF Award Abstract:
Approximately one quarter of carbon emissions each year is taken up by the worlds' oceans, which play a critical role in the global carbon cycle. As the oceans continue to respond to climate change, it is important to understand the carbon cycle and how it will change as well. In the surface waters of the ocean, phytoplankton take up carbon through photosynthesis, and a small fraction of this material then sinks to the deeper ocean in a process referred to as the "biological pump." Current estimates of the global biological pump are similar in size to the amount of global carbon emissions, but uncertainties in these estimates are very large. This project will focus on understanding the role that marine phytoplankton in the North Atlantic Ocean play in the carbon cycle. The project will employ coordinated use of state-of-the-art, remote observational tools, namely biogeochemical profiling floats and ocean color observations from satellites. New techniques will be developed to maximize the information that can be glean from these observations and constrain biological carbon fluxes out of the sunlit upper ocean and through its deeper interior layers over basin-wide, seasonal, and annual scales. Finally, the performance of existing, satellite-based models of these biological fluxes will be evaluated in comparison with analogous estimates made from biogeochemical profiling float data, which can help to fill in satellite observing gaps below the surface and during periods of heavy cloud cover. The proposed effort will provide training and mentorship to a graduate student and a postdoctoral researcher. Outreach will be conducted through the 2021 Education And Research: Testing Hypotheses (EARTH) Workshop: A successful, ~15-year collaborative effort between MBARI and the Monterey Bay Aquarium to assist educators with incorporating ocean science information and real-time data into the classroom. To enhance diversity and inclusion in ocean science, a first-generation college student will be selected to participate in the 2021 MBARI Summer Intern Program.

Persistent and spatially-distributed in situ observations are needed to develop, and continuously train, more accurate models and remote-sensing algorithms to reduce the uncertainty (currently >100%) in estimates of the biological pump magnitude. The goals of the proposed effort are to develop, implement, and compare robust methods for quantifying biological carbon sequestration by leveraging the complementary information provided by bio-optical and chemical sensors on profiling floats deployed in the North Atlantic Ocean. This project will dovetail with several larger observational programs (EXPORTS, PACE, and pending Global Biogeochemical Argo) and leverage committed NOAA and NASA funding to deploy four biogeochemical profiling floats. Results from the analysis of float data will also be compared with estimates derived from satellite observations to assess the influences of 1) subpolar spring bloom timing and magnitude; and 2) more efficient subtropical carbon export processes, on the amount of carbon annually sequestered by the biological pump. Evaluating carbon production, recycling, and export from different perspectives (e.g., chemical, optical, and remote sensing), will capitalize on the strengths of different sensors and platforms using a combination of

standard and novel methods. Quality-control of the data from ~300 existing and four newly deployed profiling floats in the North Atlantic will result in a valuable resource for other investigators. Data handling and processing tools developed during this project will be made publicly available to reduce barriers to entry for other scientists and students interested in analyzing large volumes of BGC float and ocean color data.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023080
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023274
NSF Division of Ocean Sciences (NSF OCE)	OCE-2147809

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