Absorbance spectra from niskin bottle samples collected with depth profiles during R/V Hugh R. Sharp cruise HRS1608 Mid-Atlantic Bight in 2016

Website: https://www.bco-dmo.org/dataset/938783
Data Type: Cruise Results
Version: 1
Version Date: 2024-09-25

Project
» Collaborative Research: Phlorotannins - An Important Source of Marine Chromophoric Dissolved Organic Matter? (Sargassum DOM)

Contributors	Affiliation	Role
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Abstract
Absorbance spectra from niskin bottle samples collected with depth profiles during R/V Hugh R. Sharp cruise HRS1608 Mid-Atlantic Bight in 2016.

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Coverage

Location: Mid-Atlantic Bight
Spatial Extent: **N**:37.98133 **E**:-74.10417 **S**:34.34967 **W**:-75.8035
Temporal Extent: 2016-07-18 - 2016-07-22

Methods & Sampling

Samples were transferred from Niskin bottles to clean 10L low-density polyethylene cubitainers using silicon tubing. Containers were rinsed three times with sample before final collection.

Sampling and analytical procedures:

Subsamples for fluorescence and absorbance were 0.2 µm filtered using Whatman GD/X cellulose acetate syringe filters. Filters were rinsed with ~20mL sample before collecting samples in combusted 40mL amber glass vials. See "Related Datasets" section for the fluorescence data. Samples stored at 4°C until analysis (within 1 week of collection). For fluorescence and absorbance measurements, samples were transferred to 1 cm quartz fluorescence cuvette and analyzed using a Horiba Aqualog spectrofluorometer. Absorbance was recorded from excitation wavelengths 240 to 600 at 3 nm intervals. Fluorescence emission was recorded from ~243 to 297 nm at fixed ~3.3 nm intervals to created excitation-emission matrix (EEM) spectra. Integration time = 2s. Ultrapure water used as the fluorescence blank and was subtracted from all EEM spectra.

Data Processing Description

Absorbance .dat files (see "Supplemental Files" section): the only data used from these files for this dataset are the first column (Wavelength in nm) and the second to last column (column J, Abs, OD, which is the blank corrected absorbance, OD refers to optical density and is unitless).

Blank corrected absorbance spectra (A(λ)) were converted to Naperian absorption coefficient spectra (a(λ)) using the equation a(λ) = 2.303xa(λ)/L where L = 0.01 m. Spectral slopes were determined from 275-295 nm (S(275-295)) and from 350 – 400 nm (S(350-400)) as the slope of the log-normalized absorbance spectrum from 275-295 nm and 350-400 nm, respectively. Slope ratio (SR) is the ratio of S(275-295) to S(350-400) as defined previously (Helms et al. 2008). E2:E3 ratio is the ratio of absorbance at 250 nm to that 365 nm (De Haan and De Boer 1987).

BCO-DMO Processing Description

Preprocessing for version 1:
* Sheet "absorbance" of submitted file "Cruise_fluor_abs.xlsx" was imported into the BCO-DMO data system for this dataset. Values "NA" were imported as missing data values. The other sheet in the file "absorbance" was added to BCO-DMO as a related dataset.
** Missing data values are displayed differently based on the file format you download. They are blank in csv files, "NaN" in MatLab files, etc.

* Metadata for this dataset was extracted from file "DATASET_Cruise_optical_properties.rtf"

* Column (E2_to_E3,S275_to_295, S350_to_400, S_R) with values "BD" for below detection limit within the column had an additional _flag column added to indicate why data were blank in the numeric column.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* DateTime with timezone column added (ISO 8601 format).

* Lat lon columns converted to decimal degrees.

Dataset Version 1:

* Submitter used the revised data described above and resubmitted the data table as "938783_v1_cruise-opt-prop-abs REVISED.csv" which corrected three out of bounds latitudes (originally provided as decimal decimal minutes "345 56.14") with the correct value in decimal degree format 35.93567 (should have been 35 56.14 in "Cruise_fluor_abs.xlsx").

* raw .dat files were bundled into a .zip file and attached as a supplemental file to this dataset.

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Data Files

File
938783_v1_cruise-opt-prop-abs.csv (Comma Separated Values (.csv), 3.58 KB) MD5:894211a78c5a66498fbc7ecde9ced034 Primary data file for dataset ID 938783, version 1

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Supplemental Files

File
Raw absorbance Aqualog (.dat files) filename: SharpCruise_optics_abs.zip (ZIP Archive (ZIP), 318.91 KB) MD5:b3abbdb1e33bb0c181565ccf5e869e95 Raw absorbance data exported from Aqualog (.dat files). Columns are excitation wavelength (nm) and rows are emission wavelength (nm). The only data used from these .dat files for this dataset was the first column (Wavelength in nm) and the second to last column (column J, Abs, OD, which is the blank corrected absorbance, OD refers to optical density and is unitless). Column information for .dat files (colname, units, description): Wavelength,nm, I1,uA,Abs Detector Raw I1 dark,uA,Dark Offset for Abs Detector R1,uA,Ref Detector Raw R1dark,uA,Dark Offset for Ref Detector XCorrect,,Linear interp I1c,uA,Dark subtracted Abs Detector R1c,uA,Corrected Ref Detector I1c/R1c,uA/uA,Corrected Intensity Abs,OD,"""-LOG(T)""" Percent T,T*100,% Transmittance

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Related Publications

Coble, P. G. (1996). Characterization of marine and terrestrial DOM in seawater using excitation-emission matrix spectroscopy. Marine Chemistry, 51(4), 325–346. doi:10.1016/0304-4203(95)00062-3
Methods

De Haan, H., & De Boer, T. (1987). Applicability of light absorbance and fluorescence as measures of concentration and molecular size of dissolved organic carbon in humic Lake Tjeukemeer. Water Research, 21(6), 731–734. https://doi.org/10.1016/0043-1354(87)90086-8
Methods

Helms, J. R., Stubbins, A., Ritchie, J. D., Minor, E. C., Kieber, D. J., & Mopper, K. (2008). Absorption spectral slopes and slope ratios as indicators of molecular weight, source, and photobleaching of chromophoric dissolved organic matter. Limnology and Oceanography, 53(3), 955–969. doi:10.4319/lo.2008.53.3.0955
Methods

Huguet, A., Vacher, L., Relexans, S., Saubusse, S., Froidefond, J. M., & Parlanti, E. (2009). Properties of fluorescent dissolved organic matter in the Gironde Estuary. Organic Geochemistry, 40(6), 706–719. doi:10.1016/j.orggeochem.2009.03.002
Methods

Ohno, T. (2002). Fluorescence Inner-Filtering Correction for Determining the Humification Index of Dissolved Organic Matter. Environmental Science & Technology, 36(4), 742–746. doi:10.1021/es0155276
Methods

Zepp, R. G., Sheldon, W. M., & Moran, M. A. (2004). Dissolved organic fluorophores in southeastern US coastal waters: correction method for eliminating Rayleigh and Raman scattering peaks in excitation–emission matrices. Marine Chemistry, 89(1–4), 15–36. https://doi.org/10.1016/j.marchem.2004.02.006
Methods

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Related Datasets

IsRelatedTo

Gonsior, M., Blough, N. V., Del Vecchio, R., Powers, L. (2024) **Fluorescence spectra from niskin bottle samples collected with depth profiles during R/V Hugh R. Sharp cruise HRS1608 Mid-Atlantic Bight in 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-10-03 http://lod.bco-dmo.org/id/dataset/938774 [view at BCO-DMO]
Relationship Description: Data generated from measurements of the same samples.

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Parameters

Parameter	Description	Units
date	Sampling date	unitless
Time	Time of cast (in UTC time zone)	unitless
ISO_DateTime_UTC	DateTime of cast with time zone (in ISO 8601 format)	unitless
Lat	Latitude	decimal degrees
Long	Longitude	decimal degrees
Salinity	Salinity. Practical Salinity Scale 1978 (PSS-78)	unitless
depth_sample	sampling depth	meters (m)
depth_sample_comment	sampling depth description (e.g. "Chl max")	unitless
file_name	associated absorbance file (.dat). These files are included in SharpCruise_optics_abs.zip (See supplemental files).	unitless
E2_to_E3	E2:E3. Ratio of A(250)/A(364)	unitless
E2_to_E3_flag	Flag column for the E2_to_E3 column. "BD" indicates the E2_to_E3 value is missing due to being below the detection limit.	unitless
S275_to_295	S(275-295). spectral slope from 275-295 nm	1/nm
S275_to_295_flag	Flag column for the S275_to_295 column. "BD" indicates the S275_to_295 value is missing due to being below the detection limit.	unitless
S350_to_400	S(350-400). spectral slope from 350-400 nm	1/nm
S350_to_400_flag	Flag column for the S350_to_400 column. "BD" indicates the S350_to_400 value is missing due to being below the detection limit.	unitless
S_R	ratio of S(275-295)/S(350-400)	unitless
S_R_flag	Flag column for the S_R column. Indicates BD if the S_R value is missing due to being below the detection limit.	unitless

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Instruments

Dataset-specific Instrument Name	Horiba Aqualog spectrofluorometer
Generic Instrument Name	Spectrometer
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

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Deployments

HRS1608

Website	https://www.bco-dmo.org/deployment/938772
Platform	R/V Hugh R. Sharp
Start Date	2016-07-18
End Date	2016-07-22

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Project Information

Collaborative Research: Phlorotannins - An Important Source of Marine Chromophoric Dissolved Organic Matter? (Sargassum DOM)

Coverage: Mid-Atlantic Bight (July 2016), Sargasso Sea (July and September 2016), Coastal Bermuda (September/October 2016) and Coastal Puerto Rico (Laguna Grande, Fajardo; Las Croabas, Fajardo; Salinas; May/June 2018)

NSF Award Abstract:

Chromophoric dissolved organic matter (CDOM), the sunlight absorbing components in filtered water, is important in the study of marine and freshwater ecosystems as it can be used to trace the mixing of surface waters, as a proxy for carbon cycles, and other biogeochemical processes. Although its importance in ocean studies has been firmly established over the last several decades, sources and structural composition of CDOM within the oceans remains unclear and continues to be a subject of debate. Sargassum, a brown alga, is widely distributed in temperate and subtropical marine waters and may be important source of CDOM to the Sargasso Sea and Gulf of Mexico where Sargassum is abundant. This project will investigate the contribution of macro brown algae-derived compounds to the marine CDOM pool. Results from this study will have implications for the marine carbon cycle and satellite remote sensing of ocean color to assess mixing of surface water masses and biogeochemical processes. The project will provide educational opportunities for a postdoctoral scholar, summertime undergraduate internships (through a local NSF-sponsored Research Experiences for Undergraduates (REU) program), and workshop and research opportunities for local high schools students.

Sources of marine CDOM remain debatable and a comprehensive understanding of its origins, distribution and fate have been difficult. Marine CDOM, and in particular the "humic-like" component, have been suggested to originate from terrestrial sources, primarily lignins. However, recent evidence indicates that the exudation of phlorotannins produced by macro brown algae may contribute significantly to the marine CDOM pool.

Phlorotannins, a class of polyphenols that are only found in, and continuously exuded by macro brown algae such as Sargassum, strongly absorb ultraviolet light and may have been underestimated in their contribution to the marine CDOM pool within certain geographic locales. Upon partial oxidation, light absorption by these specific compounds extends into longer wavelengths in the visible creating an absorption spectrum similar to that of lignin. These phlorotannins and their transformation products absorb light that might explain in part the "humic-like" signatures observed in open ocean environments. This study aims to characterize the optical properties and molecular composition of Sargassum-derived CDOM including its aerobic oxidation and photochemical behavior, as well as quantify Sargassum-derived CDOM to better estimate its possible contribution to the CDOM pool in the Sargasso Sea and Gulf of Mexico.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536888
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536927

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