Excitation Emission Matrices (EEM) during long-term incubation experiments of Synechococcus DOM conducted from Nov 2020 to Nov 2021

Website: https://www.bco-dmo.org/dataset/982174
Data Type: experimental
Version: 1
Version Date: 2025-08-10

Project
» The fate of lysis products of picocyanobacteria contributes to marine humic-like chromophoric dissolved organic matter (Picocyanobacteria CDOM)

Contributors	Affiliation	Role
Gonsior, Michael	University of Maryland Center for Environmental Science (UMCES/IMET)	Principal Investigator
Chen, Feng	University of Maryland Center for Environmental Science (UMCES/IMET)	Co-Principal Investigator
Powers, Leanne	State University of New York College of Environmental Science and Forestry (SUNY ESF)	Co-Principal Investigator
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset contains the excitation emission matrix data that were collected on samples collected during a one-year incubation after the amendment of open ocean surface water with lysed Synechococcus cells from an open ocean strain.

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Coverage

Location: Laboratory-based incubation experiments
Temporal Extent: 2020-11 - 2021-11

Methods & Sampling

Field seawater samples for all incubation experiments were collected from the Gulf Stream off the Coast of Wilmington, North Carolina, in November of 2020.

Samples were filtered through Whatman GF/F filters prior to analyses. A Horiba Aqualog Fluoromeeter was used to acquire the EEM spectra. All spectra were inner filter corrected, scatter corrected and normalized to

the Water Raman peak area.

Data Processing Description

EEM data were collected using the Horiba Aqualog Fluorometer, and all Fluorescence spectra were blank corrected, inner filter corrected and normalized to the Water Raman scattering.

Software: Horiba Aqualog software version 4.3

Data are presented in two separate zip packages:
982174_v1_**CONTROL**.zip = All EEM data of the triplicate controls at each time point (no Synechococcus DOM added).
982174_v1_**VDOM**.zip = *All EEM data of the triplicate Synechococcus DOM added samples at each time point during the one-year incubation.*

All files are the direct exported files from the Horiba Aqualog software and can be opened directly in MS Excel or other software. The first part of the file name is indicative of the sample collection time in days. For example, T0 means beginning of incubation, T01 means day 1 of the experiment and so on. The s annotation is presenting the number of replicate. For example the control sample T0s1 is replicate one at the beginning of experiment, T0s2 is the second replicate, and T0S3 is the third replicate. For the VDOM samples, the replicate numbering is T0S4 for the first replicate.T0S5 for the second, and T0S6 for the third replicate, as an example. The remaining attributes of the file naming indicates the processing of the file prior to export. RM means scatter correction or Raleigh masking (RM), IFE corresponds to inner filter correction (IFE), which uses the simultaneously measured absorbance data, and NRM means it was normalized to the Water Raman Scattering.

BCO-DMO Processing Description

Version 1:
* Unix command "dos2unix" was used on the .dat files to fix some encoding issues in some of the files.
* .dat files zipped into two packages and attached to page 982174_v1_CONTROL.zip and 982174_v1_VDOM.zip
* File inventory with md5sum added as a supplemental file.

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Data Files

File	
982174_v1_VDOM.zip	(ZIP Archive (ZIP), 2.48 MB) MD5:f87a0a96ac20bc5338b25d7cada4c383 All Excitation Emission Matrices (EEM) data of the triplicate Synechococcus DOM added samples at each time point during the one-year incubation. This zip package contains .dat files direct exported files from the Horiba Aqualog software. See the "Methods & Sampling" section for more information.
982174_v1_Control.zip	(ZIP Archive (ZIP), 1.48 MB) MD5:38e77eb1d0124d2d5de10787a061b37d All Excitation Emission Matrices (EEM) data of the triplicate controls at each time point (no Synechococcus DOM added). This zip package contains .dat files direct exported files from the Horiba Aqualog software. See the "Methods & Sampling" section for more information.

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Supplemental Files

File	
file_inventory.csv	(Comma Separated Values (.csv), 8.76 KB) MD5:b0a60c9b2b50576bedc5e2ad4f12d330

Inventory of files contained in zip packages 982174_v1_VDOM.zip and 982174_v1_Control.zip

Inventory table columns:
Zip_Package, Name of the zip package containing the file "982174_v1_Control.zip" or "982174_v1_VDOM.zip"
Filename, File name (e.g. "T0s3 (01) - Processed Graph_ RM_IFE_NRM.dat")
filesize_bytes, Filesize in bytes
md5sum, checksum (md5sum) that can be used to verify file integrity before and after transfers

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Related Publications

HORIBA Scientific. (n.d.). The Aqualog. HORIBA. https://www.horiba.com/usa/scientific/products/fluorescence-spectrometers/the-aqualog/
Methods

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	Horiba Aqualog
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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Project Information

The fate of lysis products of picocyanobacteria contributes to marine humic-like chromophoric dissolved organic matter (Picocyanobacteria CDOM)

Coverage: Bermuda Atlantic Time Series Station (BATS) and station Aloha, Hawaii

NSF Award Abstract:
This study focuses on the sources and composition of colored dissolved organic matter (CDOM) in the ocean. CDOM is a part of water that absorbs sunlight. This material is important because it filters out harmful ultraviolet radiation. Scientists use it to track the movement of carbon and other important biological and chemical processes in the ocean. Organisms such as algae living in the open ocean have been shown to be sources of CDOM, but the chemical composition of these algal natural products remains to be discovered. Recent results from studying common algae show that viruses may break down algal cells and release material that looks like CDOM. This study will use new tools to find out if viruses and algae are creating this material and

study its chemical makeup. This project will support two graduate students and provide summer internships for undergraduates through the NSF Research Experiences for Undergraduates (REU) program. The investigators will participate in a range of education and outreach activities.

The sources and structural nature of marine CDOM within the oceans remain unclear and continue to be a subject of debate. Marine in situ sources of CDOM have been suggested and some have been confirmed, but thus far none could explain the ubiquitous appearance of the so called "humic-like" CDOM component. Unique features of this component include its unusual exponential behavior in ultraviolet-visible (UV-Vis) absorbance with the absorbance extending well above 400 nm, and the large Stoke's shift in fluorescence spectroscopy. Picocyanobacteria are ubiquitous in the World's Oceans and make up 50 % of the autotrophic marine primary production. Preliminary results showed that the picocyanobacteria Synechococcus and Prochlorococcus release CDOM that matched the "humic-like" appearance of globally observed marine CDOM after virus-induced lysis. The main focus of this study is the characterization of the optical properties and molecular composition of viral-lysed DOM (VDOM) from different strains of Synechococcus and Prochlorococcus and additionally Trichodesmium which was shown in a previous study to also release CDOM. Associations between the chemical characterization information and metagenomics and transcriptomics data will be investigated for picocyanobacteria in the Pacific and Atlantic Oceans. This study includes long-term incubation experiments to determine the persistence of picocyanobacteria-derived CDOM as well as changes in microbial communities and processes (gene expression) that are related to the degradation of VDOM during the incubation period.

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-1829888

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