Absorbance and Excitation Emission spectra (EEMs) measurements of the Tapajós River, Brazil from 2016-2023

Website: https://www.bco-dmo.org/dataset/986855
Data Type: Other Field Results
Version: 1
Version Date: 2026-01-20

Project
» RAPID: El Nino Event Impacts on Organic Matter Export and Composition in the Amazon River (ENSO impact on Amazon River DOC and DOM)

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Abstract
This dataset includes individual absorbance spectra and excitation emission fluorescence spectra from river water sampled near-monthly from the Tapajós River, Brazil between 2016-2023. Both absorbance and fluorescence data were collected on a Horiba Aqualog spectrophotometer. Trends in optical absorbance and fluorescence maxima reveal signatures for DOM sourcing into the river as well as evidence for in-stream processing and molecular stability of exported organic matter.

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Coverage

Location: Tapajós River, Brazil
Spatial Extent: **Lat**:-4.3375 **Lon**:-56.06953
Temporal Extent: 2016-01-28 - 2023-11-30

Methods & Sampling

Water samples were collected near-monthly from the Tapajós River upstream of Itaituba Brazil (-4.3375,-56.06953). Three water samples (1 L) were collected at 0.5 m depth from the river across the channel in equal spacing and combined into a 4 L acid-washed carboy to make a composite sample. The water was filtered through a 0.45 µm capsule filter with a peristaltic pump into acid-rinsed high-density polyethylene (HDPE) bottles. Filtered samples were kept cold during transport and immediately frozen upon transfer to the laboratory and kept in the dark until analysis.

Data Processing Description

EEMs were corrected for lamp intensity, inner filter effects, and normalized to Raman units. Absorbance spectra and EEMs for each sample were processed and visualized in MATLAB with the drEEM toolbox. Individual absorbance spectra and EEMs were exported as .dat files for each river water sample.

BCO-DMO Processing Description

* ABS .dat files zipped into Data File "Tapajos_ABS.zip" and EEM (PEM in filenames) added to Tapajos_EEM.zip

* Sheet 1 of the submitted file "Tapajos_filenames_sample dates.xlsx" was imported into the BCO-DMO data system for this dataset as a supplemental table 986855_v1_file-metadata.csv.

* ".dat" suffix added to columns ABS_Filename, and EEM_Filename to match the provided files in the dataset.

* 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]

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* Date converted to ISO 8601 format

* Location field contained both latitude and longitude in degrees minutes and seconds (e.g. '"4°20'15.0"S 56°04'10.3"W"') which was converted to separate lat_dd lon_dd columns (also converted to decimal degrees)

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Related Publications

Kurek, M. R., Muniz, R., Moura, J. M. S., Peucker-Ehrenbrink, B., Holmes, R. M., McKenna, A. M., & Spencer, R. G. M. (2025). Long-Term and Seasonal Drivers of Organic Matter in the Clearwater Tapajós River and Implications for the Amazon River Basin. Global Biogeochemical Cycles, 39(6). Portico. https://doi.org/10.1029/2025gb008545 https://doi.org/10.1029/2025GB008545
Results

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Related Datasets

IsRelatedTo

Kurek, M. (2025). Long-term and seasonal drivers of organic matter in the clearwater Tapajós River and implications for the Amazon River basin. *OSF*. https://doi.org/10.17605/OSF.IO/USH6Y

Kurek, M., Muniz, R., Moura, J. M., Peucker-Ehrenbrink, B., Holmes, R., McKenna, A., Spencer, R. (2026)

Dissolved organic matter, water quality, water isotopes, and discharge measurements of the Tapajós River, Brazil from 2016-2023. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2026-01-20 http://lod.bco-dmo.org/id/dataset/986798 [view at BCO-DMO]
Relationship Description: Related datasets from the same study published in Kurek et al. (2025, doi: 10.1029/2025GB008545).

Kurek, M., Muniz, R., Moura, J. M., Peucker-Ehrenbrink, B., Holmes, R., McKenna, A., Spencer, R. (2026) **Fourier Transform-Ion Cyclotron Resonance Mass spectrometry (FT-ICR MS) peaks lists from the Tapajós River, Brazil from 2016-2023.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2026-01-20 http://lod.bco-dmo.org/id/dataset/986858 [view at BCO-DMO]
Relationship Description: Related datasets from the same study published in Kurek et al. (2025, doi: 10.1029/2025GB008545).

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Horiba Aqualog spectrofluorometer
Dataset-specific Description	UV-visible absorbance spectra were measured at room temperature in a 1-cm quartz cuvette with a Horiba Scientific Aqualog (Horiba Ltd., Kyoto, Japan) at wavelengths of 230–800 nm. Excitation-Emission matrices (EEMs) from fluorescence spectra were measured at room temperature in a 1-cm quartz cuvette using a Horiba Scientific Aqualog (Horiba Ltd., Kyoto, Japan). EEMs were collected at 250– 500 nm excitation wavelengths and 300–600 nm emission wavelengths with 5 and 2 nm intervals, respectively, at integration times ranging from 3 to 6s.
Generic Instrument Description	A benchtop optical spectrometer suitable for measuring coloured dissolved organic matter (CDOM). Outputs include absorbance spectra, fluorescence emission spectra, and fluorescence excitation-emission matrices. This instrument simultaneously measures absorbance spectra and fluorescence Excitation-Emission Matrices. It employs the Absorbance-Transmission Excitation Emission Matrix (A-TEEM) technique to acquire an Excitation Emission Matrix.

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Project Information

RAPID: El Nino Event Impacts on Organic Matter Export and Composition in the Amazon River (ENSO impact on Amazon River DOC and DOM)

Coverage: Amazon River basin

NSF Award Abstract:
The Amazon River is one of the largest sources of freshwater and carbon to the ocean. Thus, understanding

the factors that influence freshwater delivery from the Amazon River is important for understanding the carbon cycle of the Amazon River and the receiving Atlantic Ocean. El Niño–Southern Oscillation (ENSO) is a periodic event that causes changes in winds and sea surface temperature over the tropical eastern Pacific Ocean and affects climate in the tropics and subtropics. The National Weather Service predicts that El Niño conditions are likely to form across the Pacific during Summer 2023. These conditions are expected to last through February 2024. This event is expected to impact precipitation and air temperatures in the Amazon Basin and freshwater delivery from the Amazon River. This project aims to study the amount and chemical composition of dissolved organic carbon delivered from the Amazon River to the Atlantic Ocean during the 2023-2024 El Niño event. Scientists involved in this project plan to collect samples from late Summer 2023 through late Summer 2024. The study will identify conditions before, during and after this event. This unique set of samples will enable the team of scientists to study how ENSO influences the delivery of organic carbon to the coastal ocean.
This project provides support for an early career researcher and promotes international cooperation and inclusivity between researchers from the United States of America and researchers in Brazil who are directly impacted by the changing Amazon River.

This project examines how El Niño Southern Oscillation (ENSO) anomalies impact the export of dissolved organic carbon (DOC) and composition of dissolved organic matter (DOM) from the Amazon River to the Atlantic Ocean. Based on recent studies, it has been hypothesized that the upcoming 2023 El Niño event will reduce the annual DOC flux and proportion of exported terrestrial DOM from the Amazon River compared to non-ENSO and La Niña years. This hypothesis will be examined by linking established state-of-the-art optical and molecular-level characterization techniques (e.g., Fourier-transform ion cyclotron resonance mass spectrometry; FT-ICR MS) with DOC flux calculations over the course of an El Niño year. Analyzing both bulk DOC fluxes and the molecular-level composition will reveal how the quantity and quality of DOM export will change monthly in response to reduced precipitation and higher temperature across the Amazon Basin and headwaters. DOC fluxes as well as detailed characterizations (FT-ICR MS, optical, fluorescence analysis) of DOM sampled from the furthest downstream Amazon River gauging station at Óbidos (Brazil) will be directly compared to results obtained from the 2011-2012 La Niña year and the following 2012-2013 hydrologically normal year to determine how global climate anomalies impact the DOC export to marine systems and to create a framework for future predictions. Data obtained from this proposed study will lay the foundations for larger studies investigating how ENSO cycles impact discharge and carbon export from other major tropical-subtropical rivers and ultimately, how ENSO cycles impact global land-ocean carbon export.

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-2333961

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