Physicochemical parameters, nutrients, radium and stable Isotopes, carbonate chemistry & organic alkalinity measurements from the West Florida Shelf, collected onboard R/V Hogarth and R/V Weatherbird II (2022–2023), following Hurricane Ian

Website: https://www.bco-dmo.org/dataset/990457
Version: 1
Version Date: 2025-12-11

Project
» RAPID: Collaborative Research: Remineralization effects of enhanced allochthonous dissolved organic matter in the West Florida Shelf impacted by Hurricane Ian (DOM Remineralization in WFS after Hurricane Ian)

Contributors	Affiliation	Role
Adhikari, Puspa	Florida Gulf Coast University (FGCU)	Principal Investigator
Chen, Huan	Florida State University (FSU)	Co-Principal Investigator
Romero, Isabel C.	University of South Florida (USF)	Co-Principal Investigator
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Abstract
This dataset includes a comprehensive suite of water-quality parameters, including alkalinity, organic alkalinity, dissolved inorganic carbon (DIC), short-lived radium isotopes (223Ra and 224Ra), stable isotopes (^13C and ^15N) and dissolved organic carbon. Samples were collected aboard the R/V Hogarth and R/V Weatherbird II during cruises in October 2022, January 2023, and March 2023 as part of the NSF RAPID (OCE-2309659) project following Hurricane Ian.

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Coverage

Location: Southwest Florida Shelf
Spatial Extent: **N**:27.54468 **E**:-81.74894 **S**:25.89909 **W**:-82.78273
Temporal Extent: 2022-10-18 - 2023-10-23

Methods & Sampling

Water samples were collected using a CTD rosette and processed for the analysis of organic contaminants following standard EPA protocols and previously published methods (Adhikari et al., 2017, 2019; Romero, 2018). Physicochemical parameters were measured with a YSI EXO II multiparameter water-quality sonde (SKU#: 599502-02) attached to the ship's CTD rosette. The samples collected in Niskin bottles were filtered onto pre-baked GFF filters (0.7 µm), and the filters were stored frozen for particulate organic contaminant analysis. The samples were solvent-extracted and analyzed at the University of South Florida (using modified

EPA methods; Romero, 2018) with Gas Chromatography Triple Quadrupole Mass Spectrometry (GC-MS/MS).

Problem Description

The October 2022 cruise conducted immediately after Hurricane Ian presented significant challenges, including limited site access, safety concerns from floating debris, and seafloor depth shifts caused by extensive sediment movement. As a result, some data points are missing from our dataset. Several samples collected for carbonate parameter analysis were also damaged during shipment via FedEx. Additionally, the National High Magnetic Field Laboratory at Florida State University—which houses the 21 Tesla Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (21T FT-ICR MS) used for DOM characterization—was severely impacted by multiple hurricanes (Helene and Milton) and a tornado. Furthermore, the 21T FT-ICR MS was unavailable to external users for approximately one year due to a major instrument upgrade, resulting in delays in organic matter characterization.

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Related Publications

Adhikari, P. L., Wong, R. L., & Overton, E. B. (2017). Application of enhanced gas chromatography/triple quadrupole mass spectrometry for monitoring petroleum weathering and forensic source fingerprinting in samples impacted by the Deepwater Horizon oil spill. Chemosphere, 184, 939–950. https://doi.org/10.1016/j.chemosphere.2017.06.077
Methods

D'Andrilli, J., Dittmar, T., Koch, B. P., Purcell, J. M., Marshall, A. G., & Cooper, W. T. (2010). Comprehensive characterization of marine dissolved organic matter by Fourier transform ion cyclotron resonance mass spectrometry with electrospray and atmospheric pressure photoionization. Rapid Communications in Mass Spectrometry, 24(5), 643–650. Portico. https://doi.org/10.1002/rcm.4421
Methods

He, S., Gordon, S., & Maiti, K. (2025). Carbonate and Nutrient Dynamics in a Mississippi River Influenced Eutrophic Estuary. Estuaries and Coasts, 48(3). https://doi.org/10.1007/s12237-025-01494-4
Methods

Moore, W. S., & Arnold, R. (1996). Measurement of 223Ra and224Ra in coastal waters using a delayed coincidence counter. Journal of Geophysical Research: Oceans, 101(C1), 1321–1329. doi:10.1029/95jc03139 https://doi.org/10.1029/95JC03139
Methods

Romero, I. C. (2018). A High-Throughput Method (ASE-GC/MS/MS/MRM) for Quantification of Multiple Hydrocarbon Compounds in Marine Environmental Samples. Marine Technology Society Journal, 52(6), 66–70. https://doi.org/10.4031/mtsj.52.6.6
Methods

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Related Datasets

IsRelatedTo

(2025) **Organic contaminant measurements of the water samples collected from West Florida Shelf onboard R/V Hogarth and R/V Weatherbird II (2022–2023), following Hurricane Ian.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-12-11 http://lod.bco-dmo.org/id/dataset/990455 [view at BCO-DMO]

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	Apollo SciTech AS-C5 Dissolved Inorganic Carbon Analyzer
Generic Instrument Name	Apollo SciTech AS-C5 dissolved inorganic carbon analyzer
Generic Instrument Description	The Apollo SciTech AS-C5 is a compact, automated analyzer for measuring dissolved inorganic carbon (DIC) in fresh and saltwater. This DIC analyzer uses small sample volumes (0.1 to 1.8 mL) with fast analytical rate (~3 mins), making it ideal for both lab and shipboard use in oceanography and climate studies. The AS-C5 DIC analyzer is comprised of a solid state infrared CO2 detector (LI-850, by LI-COR, USA), a digital syringe pump for precise delivery of reagent and sample solutions (Kloehn, USA), a mass flow controller to accurately regulate the carrier gas flow rate, a specifically designed CO2 stripping reactor that allows for an efficient and smooth stripping of CO2 from the water sample, an electronic cooling system for removing moisture, and a computer communication assembly to understand the marine carbon cycle. The AS-C5 DIC analyzer has a very large analytical range (0.2 – 20 mM) and therefore is ideal for DIC analysis (and has been tested) in a variety of aquatic conditions such as in river and lake waters, coastal and open ocean waters, sediment porewater, and groundwater. The sample's salt and hydrogen sulfide (H2S) contents have had no effect on DIC analyses.

Dataset-specific Instrument Name	Carlo Erba NA 1500 CNHS Elemental Analyzer
Generic Instrument Name	Carlo-Erba NA-1500 Elemental Analyzer
Dataset-specific Description	Elemental and isotopic analysis of carbon and nitrogen was conducted using a Thermo Electron DeltaV Advantage isotope mass spectrometer coupled with a ConFlo II interface linked to a Carlo Erba NA 1500 CNHS Elemental Analyzer
Generic Instrument Description	A laboratory instrument that simultaneously determines total nitrogen and total carbon from a wide range of organic and inorganic sediment samples. The sample is completely and instantaneously oxidised by flash combustion, which converts all organic and inorganic substances into combustion products. The resulting combustion gases pass through a reduction furnace and are swept into the chromatographic column by the carrier gas which is helium. The gases are separated in the column and detected by the thermal conductivity detector which gives an output signal proportional to the concentration of the individual components of the mixture. The instrument was originally manufactured by Carlo-Erba, which has since been replaced by Thermo Scientific (part of Thermo Fisher Scientific). This model is no longer in production.

Dataset-specific Instrument Name	ConFlo II interface
Generic Instrument Name	Continuous Flow Interface for Mass Spectrometers
Dataset-specific Description	Elemental and isotopic analysis of carbon and nitrogen was conducted using a Thermo Electron DeltaV Advantage isotope mass spectrometer coupled with a ConFlo II interface linked to a Carlo Erba NA 1500 CNHS Elemental Analyzer
Generic Instrument Description	A Continuous Flow Interface connects solid and liquid sample preparation devices to instruments that measure isotopic composition. It allows the introduction of the sample and also reference and carrier gases. Examples: Finnigan MATConFlo II, ThermoScientific ConFlo IV, and Picarro Caddy. Note: This is NOT an analyzer

Dataset-specific Instrument Name	21 Tesla Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (21T FT-ICR MS)
Generic Instrument Name	Fourier Transform Ion Cyclotron Resonance Mass Spectrometer
Dataset-specific Description	The 21 Tesla Fourier Transform Ion Cyclotron Resonance Mass Spectrometer (21T FT-ICR MS) used for DOM characterization is housed at the National High Magnetic Field Laboratory at Florida State University.
Generic Instrument Description	In Fourier Transform Ion Cyclotron Resonance Mass Spectrometry, the mass-to-charge ratio (m/z) of an ion is experimentally determined by measuring the frequency at which the ion processes in a magnetic field. These frequencies, which are typically in the 100 KHz to MHz regime, can be measured with modern electronics making it possible to determine the mass of an ion to within +/- 0.000005 amu or 5 ppm.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	SEAL AA500 autoanalyzer
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Nutrient analysis was measured using a SEAL AA500 autoanalyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

Dataset-specific Instrument Name	Radium Delayed Coincidence Counter (RaDeCC)
Generic Instrument Name	Radium Delayed Coincidence Counter
Dataset-specific Description	A Radium Delayed Coincidence Counter (RaDeCC) was used for radium isotopes analysis
Generic Instrument Description	The RaDeCC is an alpha scintillation counter that distinguishes decay events of short-lived radium daughter products based on their contrasting half-lives. This system was pioneered by Giffin et al. (1963) and adapted for radium measurements by Moore and Arnold (1996). References: Giffin, C., A. Kaufman, W.S. Broecker (1963). Delayed coincidence counter for the assay of actinon and thoron. J. Geophys. Res., 68, pp. 1749-1757. Moore, W.S., R. Arnold (1996). Measurement of 223Ra and 224Ra in coastal waters using a delayed coincidence counter. J. Geophys. Res., 101 (1996), pp. 1321-1329. Charette, Matthew A.; Dulaiova, Henrieta; Gonneea, Meagan E.; Henderson, Paul B.; Moore, Willard S.; Scholten, Jan C.; Pham, M. K. (2012). GEOTRACES radium isotopes interlaboratory comparison experiment. Limnology and Oceanography - Methods, vol 10, pg 451.

Dataset-specific Instrument Name	Shimadzu 5000A TOC Analyzer
Generic Instrument Name	Shimadzu TOC 5000A total organic carbon analyzer
Generic Instrument Description	The Shimadzu TOC-5000(A) Series instruments are capable of performing analysis on any high sensitivity applications such as pharmaceutical grade, semiconductor grade, steam power, and ultrapure waters, as well as less sensitive application such as drinking water and particulate analysis such as wastewater and industrial effluents, sea water, brines, ground water, and surface water. Shimadzu TOC-5000(A) Series instruments meet USP 23 (Fifth Supplement 643) for Pure Water (PW) and Water For Injection (WFI), Standard Methods 5310B, EPA 415.1, EPA 9060A, ASTM D2579, EPA Drinking Water ICR (D/DBP), and DIN Specifications

Dataset-specific Instrument Name	Thermo Electron DeltaV Advantage isotope mass spectrometer
Generic Instrument Name	Thermo Fisher Scientific DELTA V Advantage isotope ratio mass spectrometer
Dataset-specific Description	Elemental and isotopic analysis of carbon and nitrogen was conducted using a Thermo Electron DeltaV Advantage isotope mass spectrometer coupled with a ConFlo II interface linked to a Carlo Erba NA 1500 CNHS Elemental Analyzer
Generic Instrument Description	The Thermo Scientific DELTA V Advantage is an isotope ratio mass spectrometer designed to measure isotopic, elemental, and molecular ratios of organic and inorganic compounds. The DELTA V Advantage is the standard model of the DELTA V series of isotope ratio mass spectrometers, which can be upgraded to the DELTA V Plus. The DELTA V Advantage can be operated in Continuous Flow or Dual Inlet mode. The standard collector configuration is the Universal Triple Collector. H2 collectors with online hydrogen capability are optional. The DELTA V Advantage is controlled by an automated, integrated Isodat software suite. A magnet, whose pole faces determine the free flight space for the ions, eliminates the traditional flight tube. The magnet is designed for fast mass switching which is further supported by a fast jump control between consecutive measurements of multiple gases within one run. The sample gas is introduced at ground potential, eliminating the need for insulation of the flow path, ensuring 100 percent transfer into the ion source. The amplifiers register ion beams up to 50 V. The DELTA V Advantage has a sensitivity of 1200 molecules per ion (M/I) in Dual Inlet mode and 1500 M/I in Continuous Flow mode. It has a system stability of < 10 ppm and an effective magnetic detection radius of 191 nm. It has a mass range of 1 - 80 Dalton at 3 kV.

Dataset-specific Instrument Name	Trilogy fluorometer (Turner Designs model #7200-02)
Generic Instrument Name	Turner Designs Trilogy fluorometer
Dataset-specific Description	A Trilogy fluorometer (Turner Designs model #7200-02) was used for CDOM and chlorophyll analysis
Generic Instrument Description	The Trilogy Laboratory Fluorometer is a compact laboratory instrument for making fluorescence, absorbance, and turbidity measurements using the appropriate snap-in application module. Fluorescence modules are available for discrete sample measurements of various fluorescent materials including chlorophyll (in vivo and extracted), rhodamine, fluorescein, cyanobacteria pigments, ammonium, CDOM, optical brighteners, and other fluorescent compounds.

Dataset-specific Instrument Name	YSI EXO II muliparameter water-quality sonde (SKU# 599502-02)
Generic Instrument Name	YSI EXO multiparameter water quality sondes
Dataset-specific Description	Physicochemical parameters were measured with a YSI EXO II multiparameter water-quality sonde (SKU#: 599502-02) attached to the ship's CTD rosette.
Generic Instrument Description	Comprehensive multi-parameter, water-quality monitoring sondes designed for long-term monitoring, profiling and spot sampling. The EXO sondes are split into several categories: EXO1 Sonde, EXO2 Sonde, EXO3 Sonde. Each category has a slightly different design purpose with the EXO2 and EXO3 containing more sensor ports than the EXO1. Data are collected using up to four user-replaceable sensors and an integral pressure transducer. Users communicate with the sonde via a field cable to an EXO Handheld, via Bluetooth wireless connection to a PC, or a USB connection to a PC. Typical parameter specifications for relevant sensors include dissolved oxygen with ranges of 0-50 mg/l, with a resolution of +/- 0.1 mg/l, an accuracy of 1 percent of reading for values between 0-20 mg/l and an accuracy of +/- 5 percent of reading for values 20-50 mg/l. Temp ranges are from-5 to +50 degC, with an accuracy of +/- 0.001 degC. Conductivity has a range of 0-200 mS/cm, with an accuracy of +/-0.5 percent of reading + 0.001 mS/cm and a resolution of 0.0001 - 0.01 mS/cm.

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Project Information

RAPID: Collaborative Research: Remineralization effects of enhanced allochthonous dissolved organic matter in the West Florida Shelf impacted by Hurricane Ian (DOM Remineralization in WFS after Hurricane Ian)

Coverage: West Florida Shelf

NSF Award Abstract:
This project will study the fate of organic matter and nutrients delivered to the West Florida Shelf during Hurricane Ian in September 2022. The study will focus on three aspects of this hurricane event: (1) how do bacteria and light alter dissolved organic matter as it is transported offshore, (2) what is the effect of this large pulse of organic matter on inorganic carbon parameters and organic alkalinity, and (3) do nutrients derived from the recycling of this organic matter stimulate harmful algal blooms. Scientists involved in this project collected samples in late August/early September 2022 and in early October 2022, representing conditions just prior to and following Hurricane Ian. They will collect samples again in January 2023. This unique set of samples will enable the team of scientists to study how extreme events influence the carbon cycle in coastal waters. The project will support scientists from groups that are traditionally underrepresented in marine science, including two early career scientists. The broader impacts include student training and outreach activities at each institution.

The magnitude and frequency of tropical storms and extreme weather events is expected to increase in response to climate change. This project will add new insights about the effects of these events on the carbon cycle in a unique setting. Hurricane Ian made landfall west of Fort Myers FL on September 28, 2022 as a Category 4 storm and delivered large amounts of dissolved organic matter and nutrients to the West Florida Shelf (WFS). The investigators propose to examine whether the remineralization of allochthonous dissolved organic matter released during this extreme event alters water chemistry and ecological processes on the WFS. The project brings together an interdisciplinary team of scientists with diverse and complementary expertise including organic matter characterization, inorganic carbon measurements, remote sensing and satellite imaging analysis, and stable and radiogenic isotope measurements. The project will provide training opportunities for one graduate student, one undergraduate, and will contribute to education and outreach activities at each of the institutions.

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-2309659

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