Hurricane Harvey impacts on biogeochemistry of sediments assessed using samples collected in Mission-Aransas Estuary in south Texas from June 2017 to March 2019

Website: https://www.bco-dmo.org/dataset/839436
Data Type: Other Field Results
Version: 1
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Project
» RAPID: The impact of Hurricane Harvey on water column and sediment biogeochemistry of the Mission-Aransas Estuary in south Texas (Hurricane Harvey Biogeochemistry)

Contributors	Affiliation	Role
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Abstract
The impact of Hurricane Harvey on sediment biogeochemistry was assessed using sediment samples collected from June 2017 to March 2019 in Mission-Aransas Estuary in south Texas. Sediment core samples were sectioned and analyzed for mineral grain size, organic carbon and nitrogen, stable isotopic composition, pigments, plus sediment alkane and polycyclic aromatic hydrocarbons.

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Coverage

Spatial Extent: **N**:28.179 **E**:-96.831 **S**:27.923 **W**:-97.202
Temporal Extent: 2017-06-08 - 2019-03-07

Methods & Sampling

Surface sediments were sampled from 19 sites in the Mission Aransas Estuary using home-made core tubes, then sectioned and frozen immediately at -80 ºC until analysis. Sediment core samples were analyzed for mineral grain size, organic carbon and nitrogen, stable isotopic composition, pigments, plus sediment alkane and polycyclic aromatic hydrocarbons.

Mineral grain size
The grain size of surface sediment was measured using a Beckman-Coulter laser particle size analyzer (Wang et al., 2014). Briefly, 20 mL deionized water was added to 1 gram of freeze dried sediment in a beaker. After

soaking for 24 hours, the sediment was subjected to vortex mixing for 5 minutes to disaggregate loosely-attached aggregates. Neither organic matter nor carbonate was removed for the laser grain size analysis. The detected size range is from 0.02 to 2000 µm.

Organic carbon and nitrogen, and stable isotopes
Surface sediment (~2 g) was first freeze dried using Labconco FreeZone, and then also acidified to remove inorganic carbon. The organic carbon and nitrogen content and δ13C in these samples was measured using a Thermo FLASH 2000 CHN Elemental Analyzer coupled with a Thermo Delta V Plus isotope ratio mass spectrometer. The δ13C values were expressed relative to Vienna Pee Dee Belemnite standard. Precision for the C/N content is within 5% and for δ13C within 0.2‰.

Pigment analysis
Approximately 2 grams of frozen sediment was transferred into a 15 mL polypropylene centrifuge tube, to which 3 mL acetone was added for pigment extraction (Sun et al., 1991). The mixture was sonicated for 15 minutes, and then centrifuged for another 10 minutes. The acetone extract was filtered with a syringe filter (0.2 µm Nylon filter). The remaining sediment in the centrifuge was extracted again by the same procedure using fresh acetone, and the two extracts were combined before the high performance liquid chromatography (HPLC) analysis. Quantitative analysis of all pigments was conducted using a Shimadzu HPLC system with a reverse phase column (Agilent Eclipse XDB-C8, 3.5 µm particle size, 150-mm length × 4.6-mm diameter). Sediment water contents were used to convert the concentrations of pigment into micrograms per gram (µg/g) of dry sediment.

Sediment alkane and polycyclic aromatic hydrocarbons (PAHs)
PAHs extraction and analysis followed Rhind et al. (2009) and Wang et al. (2014). Briefly, about 1 gram sediment (dry weight) was added with surrogate standards (Ace-d10, Phe-d10, BaP-d12) and 8 mL ethanoic potassium hydroxide (1 M). The samples were heated to 90°C for 8 hours. The analytes were extracted by hexane and then purified with a column packed with activated silica gel and topped with 1 cm anhydrous sodium sulfate. The PAHs were then eluted with dichloromethane/hexane (1:4, v/v). The eluted solution was concentrated and exchanged by hexane to 1 mL with a rotary evaporator, and stored at 4°C until further analysis. PAHs were analyzed by gas chromatography– mass spectrometry (GC-MS, Shimadzu QP2010 plus). The GC-MS is equipped with a RXi-1MS capillary column (20 mÅ~0.18 mm i.d., film thickness 0.18 µ m), with helium as the carrier gas at a flow rate of 0.8 mL min−1, using a selective ion monitoring mode to detect PAH. The scan ions ranged from 126 to 279 atomic mass units, and the dwell time per ion was 200 milliseconds. The oven temperature was held at 60°C for 1 min, increased to 240°C at a rate of 10°C min−1, and then increased to 280°C at a rate of 4°C min−1 and held for 3 min. The temperatures of the injector and detector were 260°C and 275°C, respectively. The injection volume was 1 µl with a split ratio of 1/20. All of the 16 PAHs were eluted from 5 to 30 min in the GC column.

Acquisition notes:
Stations S15 and S19 were not sampled in April 2018 due to extremely low water level which impeded boat passage to the two sampling sites

Data Processing Description

BCO-DMO processing:
- Added a conventional header with dataset name, PI names, version date
- Adjusted parameter names to comply with database requirements
- Units removed and added to Parameter Description metadata section

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Data Files

File	
sediment_data.csv	(Comma Separated Values (.csv), 52.85 KB) MD5:c892e0c51915d447879a63494eab1990
Primary data file for dataset ID 839436	

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Related Publications

Hedges, J. I., & Stern, J. H. (1984). Carbon and nitrogen determinations of carbonate-containing solids. Limnology and Oceanography, 29(3), 657–663. doi:10.4319/lo.1984.29.3.0657
Methods

Lee, C., Wakeham, S. G., & I. Hedges, J. (2000). Composition and flux of particulate amino acids and chloropigments in equatorial Pacific seawater and sediments. Deep Sea Research Part I: Oceanographic Research Papers, 47(8), 1535–1568. doi:10.1016/s0967-0637(99)00116-8 https://doi.org/10.1016/S0967-0637(99)00116-8
Methods

Rhind, S. M., Kyle, C. E., Mackie, C., & McDonald, L. (2009). Accumulation of endocrine disrupting compounds in sheep fetal and maternal liver tissue following exposure to pastures treated with sewage sludge. Journal of Environmental Monitoring, 11(8), 1469. doi:10.1039/b902085c https://doi.org/https://doi.org/10.1039/B902085C
Methods

Sun, M., Aller, R. C., & Lee, C. (1991). Early diagenesis of chlorophyll-a in Long Island Sound sediments: A measure of carbon flux and particle reworking. Journal of Marine Research, 49(2), 379–401. doi:10.1357/002224091784995927
Methods

Wang, Z., Liu, Z., Xu, K., Mayer, L. M., Zhang, Z., Kolker, A. S., & Wu, W. (2014). Concentrations and sources of polycyclic aromatic hydrocarbons in surface coastal sediments of the northern Gulf of Mexico. Geochemical Transactions, 15(1). doi:10.1186/1467-4866-15-2 https://doi.org/https://doi.org/10.1186/1467-4866-15-2
Methods

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Related Datasets

IsRelatedTo

Liu, Z., Hardison, A., Xue, J. (2021) **Hurricane Harvey impacts on biogeochemistry of water assessed using samples collected in Mission-Aransas Estuary in south Texas from June 2017 to March 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-02-04 doi:10.26008/1912/bco-dmo.839385.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Estuary	National Estuarine Research Reserve (NERR) estuary name	unitless
Station	Station Name	unitless
ISO_Date	Sampling date (yyyy-mm-dd)	unitless
Latitude	Latitude	decimal degrees

Longitude	Longitude (West is negative)	decimal degrees
Depth	Sampling Depth interval	centimeters (cm)
Clay	Clay size fraction where grain size is >0.02um and <4um	percent (%)
Silt	Silt size fraction where grain size is between 4 and 63 microns	percent (%)
Sands	Sand size fraction where grain size is >63um and <2000um	percent (%)
Median	Median grain size	micron (µm)
Chlc2	Chlorophyll c2	micrograms per gram (µg/g) dry sediment
Chlb	Chlorophyll b	micrograms per gram (µg/g) dry sediment
DivChla	Divinyl Chlorophyll a	micrograms per gram (µg/g) dry sediment
Chla	Chlorophyll a	micrograms per gram (µg/g) dry sediment
Peridinin	Peridinin	micrograms per gram (µg/g) dry sediment
Nineteen_but	19'-but-fucoxanthin	micrograms per gram (µg/g) dry sediment
Fuco	Fucoxanthin	micrograms per gram (µg/g) dry sediment
Prasin	Prasinoxanthin	micrograms per gram (µg/g) dry sediment
Nineteen_hex	19'-hex fucoxanthin	micrograms per gram (µg/g) dry sediment
Diadinoxanthin	Diadinoxanthin	micrograms per gram (µg/g) dry sediment
Alloxanthin	Alloxanthin	micrograms per gram (µg/g) dry sediment
Zeaxanthin	Zeaxanthin	micrograms per gram (µg/g) dry sediment
Lutein	Lutein	micrograms per gram (µg/g) dry sediment

OC	Organic Carbon	percent (%)
delta13C	Stable isotope delta carbon 13 relative to Vienna PeeDee Belemnite standard	per mil
C8	C8 alkane	micrograms per gram (µg/g) dry sediment
C9	C9 alkane	micrograms per gram (µg/g) dry sediment
C10	C10 alkane	micrograms per gram (µg/g) dry sediment
C11	C11 alkane	micrograms per gram (µg/g) dry sediment
C12	C12 alkane	micrograms per gram (µg/g) dry sediment
C13	C13 alkane	micrograms per gram (µg/g) dry sediment
C14	C14 alkane	micrograms per gram (µg/g) dry sediment
C15	C15 alkane	micrograms per gram (µg/g) dry sediment
C16	C16 alkane	micrograms per gram (µg/g) dry sediment
C17	C17 alkane	micrograms per gram (µg/g) dry sediment
C18	C18 alkane	micrograms per gram (µg/g) dry sediment
C19	C19 alkane	micrograms per gram (µg/g) dry sediment
C20	C20 alkane	micrograms per gram (µg/g) dry sediment
C21	C21 alkane	micrograms per gram (µg/g) dry sediment
C22	C22 alkane	micrograms per gram (µg/g) dry sediment
C23	C23 alkane	micrograms per gram (µg/g) dry sediment
C24	C24 alkane	micrograms per gram (µg/g) dry sediment

C25	C25 alkane	micrograms per gram (µg/g) dry sediment
C26	C26 alkane	micrograms per gram (µg/g) dry sediment
C27	C27 alkane	micrograms per gram (µg/g) dry sediment
C28	C28 alkane	micrograms per gram (µg/g) dry sediment
C29	C29 alkane	micrograms per gram (µg/g) dry sediment
C30	C30 alkane	micrograms per gram (µg/g) dry sediment
C31	C31 alkane	micrograms per gram (µg/g) dry sediment
C32	C32 alkane	micrograms per gram (µg/g) dry sediment
C33	C33 alkane	micrograms per gram (µg/g) dry sediment

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Instruments

Dataset-specific Instrument Name	Thermo FLASH 2000 CHN Elemental Analyzer
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	The organic carbon and nitrogen content of the samples was measured using a Thermo FLASH 2000 CHN Elemental Analyzer. Precision for the C/N content is within 5%.
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	GC-MS, Shimadzu QP2010 plus
Generic Instrument Name	Gas Chromatograph Mass Spectrometer
Dataset-specific Description	The Shimadzu QP2010 plus GC-MS used for this study is equipped with a RXi-1MS capillary column (20 mÅ~0.18 mm i.d., film thickness 0.18 µ m), with helium as the carrier gas at a flow rate of 0.8 mL min−1, using a selective ion monitoring mode to detect PAHs.
Generic Instrument Description	Instruments separating gases, volatile substances or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay by a mass spectrometer.

Dataset-specific Instrument Name	Shimadzu HPLC system
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	Shimadzu HPLC with reverse phase column was used for pigment analysis. Reverse phase column was Agilent Eclipse XDB-C8, 3.5 µm particle size, 150-mm length × 4.6-mm diameter
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	Thermo Delta V Plus isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Stable carbon isotopes were measured with a Thermo Delta V Plus isotope ratio mass spectrometer (coupled from a Thermo FLASH 2000 CHN Elemental Analyzer). The δ13C values were expressed relative to Vienna Pee Dee Belemnite standard, with a precision within 0.2%.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Lachat QuikChem 8500
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Lachat QuikChem 8500 was used for Nutrient analyses (Silicate, Phosphorous, Ammonia, Nitrate+Nitrite)
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	Beckman-Coulter laser particle size analyzer
Generic Instrument Name	Particle Size Analyzer
Dataset-specific Description	The grain size of surface sediment was measured using a Beckman-Coulter laser particle size analyzer
Generic Instrument Description	Particle size analysis, particle size measurement, or simply particle sizing is the collective name of the technical procedures, or laboratory techniques which determines the size range, and/or the average, or mean size of the particles in a powder or liquid sample.

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Project Information

RAPID: The impact of Hurricane Harvey on water column and sediment biogeochemistry of the Mission-Aransas Estuary in south Texas (Hurricane Harvey Biogeochemistry)

Coverage: Mission-Aransas Estuary 28N 97W

NSF Award Abstract:

This project involves rapid-response research into the effects of Hurricane Harvey on the Mission-Aransas estuary system in south Texas. Hurricane Harvey passed directly over this region on August 25-26, 2017. Because these waters are the site of the Mission-Aransas National Estuarine Research Reserve (MANERR), the investigators have a history of data from before the storm with which to compare the data they will collect. They proposed to investigate the effect of the passage of the storm on carbon and nitrogen cycling, and thus the ecosystem, in the waters and sediments of Copano Bay and Aransas Bay. Their results will be important to understanding coastal processes both in general and in response to extreme events.

The investigators pose two hypotheses, which can be summarized broadly as 1) inputs of nutrients from river flooding will stimulate algal blooms in the estuary and 2) changes in sediment grain size distribution will affect sediment nitrogen cycling. They will collect water samples for nutrients, pigments, lipids, bulk carbon, and carbon isotope analyses, together with standard water quality parameters using a YSI Sonde (salinity, temperature, pH, chlorophyll a, dissolved oxygen and turbidity) at the five System Wide Monitoring Program sites of the MANERR on a biweekly to monthly basis. Sediment samples will be collected at all sites in the fall of 2017 and examined for grain size, pigments, carbon and nitrogen content, carbon isotopes, pigments, and lipids. The results will be used, in combination from data collected earlier this year, to examine physical, chemical, and biological responses to this major event. The project will support a graduate student research

assistant and three undergraduate student researchers. Communication with the public will occur through well-established and effective programs at the Mission-Aransas NERR and the University of Texas Marine Science Institute.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1763167

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