Carbonate chemistry, nutrient concentration, and dissolved oxygen concentration for discreet water samples collected during multiple cruises between June 2017 to Sept 2018 within Galveston Bay, TX

Website: https://www.bco-dmo.org/dataset/881549
Data Type: Cruise Results
Version: 2
Version Date: 2022-09-28

Project
» RAPID: The impact of increased fresh water input from Hurricane Harvey to the water quality and stratification of coastal and offshore waters of Texas. (Hurricane Harvey Water Quality)

Contributors	Affiliation	Role
Shamberger, Kathryn E.F.	Texas A&M University (TAMU)	Principal Investigator, Contact
DiMarco, Steven	Texas A&M University (TAMU)	Co-Principal Investigator
Fitzsimmons, Jessica N.	Texas A&M University (TAMU)	Co-Principal Investigator
Yvon-Lewis, Shari	Texas A&M University (TAMU)	Co-Principal Investigator
Hicks, Tacey	Texas A&M University (TAMU)	Student
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
These data include carbonate chemistry, nutrient concentration, and dissolved oxygen concentration for discreet water samples collected within Galveston Bay, TX. Eight single day cruises were conducted quarterly aboard the R/V Lithos or R/V Trident from June 2017 through September 2018. In addition, discreet water samples were collected at sites 10 - 60 km outside the mouth of the bay and up to 15m deep to characterize incoming seawater to the bay. These samples were collected on three cruises (WTX1 - R/V Manta, WTX3 - R/V Manta, WTX4 - R/V Pelican) in June, August, and November 2017. Discreet water samples were collected for total alkalinity and dissolved inorganic carbon, dissolved oxygen, and dissolved nutrients. CTD profiles were collected at each sampling site. Stochastic coastal acidification events in response to high volume rainfall and runoff that often accompanies tropical cyclone events has the potential to represent a significant threat to valuable calcifying reef ecosystems. Understanding acidification response and recovery to such events is critical to improving conservation and protection of coastal ecosystems, like oyster and coral reefs, particularly as climate change continues and tropical cyclone rainfall intensity increases. These data assess the impact of the rainfall and runoff from Hurricane Harvey on the acidification levels in Galveston Bay, TX. Samples were collected and analyzed primarily by Tacey Hicks, with assistance from other students in Dr. Katie Shamberger ’s research group, at Texas A&M University.

Table of Contents

Coverage

Spatial Extent: **N**:29.713 **E**:-94.2 **S**:28.4 **W**:-95.298
Temporal Extent: 2017-06-05 - 2018-09-22

Methods & Sampling

Methods & Sampling:

Samples were collected at 14 different sites quarterly from June 2017 through September 2018 in Galveston Bay and at 10 sites along the Texas coast in the Gulf of Mexico in June, August, and November of 2017 to investigate changes in water chemistry following Hurricane Harvey.

For cruises in Galveston Bay, discrete water samples were collected with a Niskin (General Oceanics) bottle at the surface (0.5 m) and ~1.2 m off the bottom. Samples collected for carbonate chemistry analysis (TA/DIC) were transferred from the Niskin to 250 mL narrow-mouth borosilicate glass bottles using a 0.2 mm polypropylene Whatman Polycap 36 Tissue Culture Grade (TC) in-line filter for total alkalinity (TA) and dissolved inorganic carbon (DIC) analysis, leaving approximately 5 mL headspace for thermal expansion. Some samples in September and November 2017 were collected using 0.2 mm Whatman Polycap 36 Aqueous Solution (AS) filters. However, no significant difference was found in the carbonate chemistry analysis for samples using either filter, therefore no distinction is made. Conductivity, temperature, and depth (CTD, SonTek Castaway™) profiles were conducted concurrently with Niskin samples at each station. Discrete water samples for TA/DIC on WTX cruises (WTX1/WTX2/WTX4) were collected using Niskin bottles (6L/6L/10L) on a Seabird CTD rosette. Carbonate chemistry water samples (TA/DIC) were collected similar to those from Galveston Bay, but no in-line filter was used. All TA/DIC samples was poisoned with 100 mL saturated mercuric chloride solution immediately after collection to inhibit biological activity, and then sealed with silicone-free type L Apiezon grease and ground glass stoppers with rubber bands and plastic clamps. TA and DIC were analyzed simultaneously on a Versatile INstrument for the Determination of Total inorganic carbon and titration Alkalinity (VINDTA) 3C in Dr. Kathryn Shamberger's lab at Texas A&M University. The VINDTA uses coulometric titration for DIC analysis and an open cell potentiometric titration for TA analysis. Dissolved inorganic nutrient samples from all fieldwork operations were transferred from the Niskins to a a polycarbonate flask using a GF/C 0.2 micron filter, frozen, and analyzed by the Geophysical Environmental Research Group at Texas A&M University on an Astoria Analyzer.

Cruises:

Galveston Bay Cruises: 8 single-day trips on R/V Lithos or R/V Trident; conducted quarterly in Galveston Bay, TX June 2017 - September 2018. (Cruise IDs: GB0617, GB0917, GB1117, GB0318, GB0618, GB0918).

Gulf of Mexico Research cruises: aboard R/V Manta and R/V Pelican (see "Deployments" section for multi-day cruise details, Cruise IDs: WTX1, WTX2, WTX4).

Instruments:

Galveston Bay:

- 5L General Oceanics Niskin bottles: Dissolved seawater samples collected using 2 individual 5L General Oceanics Niskin bottles
- Sontek Castaway: CTD profiles were recorded at each site in Galveston Bay at the time of Niskin deployment using a Sontek Castaway. Data processed using Sontek processing software.

WTX 1 and 2:

- 6 x 5L Niskin rosette: dissolved seawater samples collected using a 6-bottle rosette equipped with 6 5L-Niskin bottles and Sea-Bird SBE 25 CTD.

WTX 4:

- 12 x 10L Niskin rosette: dissolved seawater samples collected using 12-bottle rosette equipped with 12 10L-Niskin bottles and Sea-Bird SBE 911 CTD.

MARIANDA VINDTA 3C

Funding note:

See "Awards" section for details of NSF-OCE funding (OCE-1760381; OCE-1800913). Additional funding from TAMU T3 Triad Grant; Texas A&M University Department of Oceanography; Texas Governor's Fund through Texas OneGulf Center of Excellence; Texas Commission on Environmental Quality.

Data Processing Description

DIC and TA measurements were calibrated using certified reference materials (CRMs) obtained from Dr. Andrew Dickson at Scripps Institute of Oceanography (Dickson et al., 2007).

BCO-DMO Data Manager Processing Notes:
* Sheet "Data" from Galveston_CarbonateChemistry.xlsx imported into BCO-DMO data system.
* Renamed columns to meet BCO-DMO naming conventions (to support broader interoperability, see Data Processing Conventions https://www.bco-dmo.org/page/bco-dmo-data-processing-conventions)
* Added ISO 8601 formatted datetime with timezone (UTC)

Data version 2 replaces data version 1:
* replaced outlier lat,lons with values provided by the data submitter :

original file lines 47,48 (29.45,-140.62) corrected to (29.45, -94.78)

original file lines55,56 (60.52,-94.88) corrected to (29.53, -94.88)

[table of contents | back to top]

Data Files

File	
galveston_carb_chem.csv	(Comma Separated Values (.csv), 14.37 KB) MD5:b2fee169abdf648e475548dec76ad3ec
Primary data file for dataset ID 881549	

[table of contents | back to top]

Related Publications

Dickson, A.G.; Sabine, C.L. and Christian, J.R. (eds) (2007) Guide to best practices for ocean CO2 measurement. Sidney, British Columbia, North Pacific Marine Science Organization, 191pp. (PICES Special Publication 3; IOCCP Report 8). DOI: https://doi.org/10.25607/OBP-1342
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cruise_ID	cruise identifier for each fieldwork operations	unitless
Vessel	Cruise vessel name	unitless
Date	Date of sample collection (Time Zone: UTC)	unitless
Time_UTC	Time of sample collection in format hh:mm (Time Zone: UTC)	unitless
Lat	latitude of sampling site	decimal degrees
Long	longitude of sampling site	decimal degrees
Station	Site number (1, 2, 3, ...or 24) where water samples were collected	unitless
Depth	Depth at which discreet water samples were collected	meters (m)
Salinity	Salinity of water sample collected for analysis from CTD profile	unknown
Temp	Temperature of water sample collected for analysis from CTD profile	unitless
TA	Total Alkalinity, precision of +/- 2	micromole per kilogram (umol/kg)
DIC	Dissolved Inorganic Carbon, precision of +/- 2.5	micromole per kilogram (umol/kg)
HPO4	Dissolved nutrient concentration, Phosphate (dissolved orthophosphate).	micromole per kilogram (umol/kg)
HSiO3	Dissolved nutrient concentration, Silicate (silicic acid).	micromole per kilogram (umol/kg)
ISO_DateTime_UTC	Datetime with timezone (UTC) in ISO 8601 format	

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Sontek Castaway
Generic Instrument Name	CTD - fixed
Dataset-specific Description	Sontek CastAway-CTD by Xylem
Generic Instrument Description	A reusable instrument that always simultaneously measures conductivity and temperature (for salinity) and pressure (for depth). This term applies to CTDs that are fixed and do not measure by profiling through the water column. For profiling CTDs, see https://www.bco-dmo.org/instrument/417.

Dataset-specific Instrument Name	Seabird CTD
Generic Instrument Name	CTD Sea-Bird 25
Dataset-specific Description	For WTX1 and WTX2: Sea-Bird SBE 25 CTD
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http:www.seabird.com.

Dataset-specific Instrument Name	Sea-Bird SBE 911 CTD
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	For WTX4: Sea-Bird SBE 911 CTD
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	MARIANDA VINDTA 3C
Generic Instrument Name	MARIANDA VINDTA 3C total inorganic carbon and titration alkalinity analyser
Generic Instrument Description	The Versatile INstrument for the Determination of Total inorganic carbon and titration Alkalinity (VINDTA) 3C is a laboratory alkalinity titration system combined with an extraction unit for coulometric titration, which simultaneously determines the alkalinity and dissolved inorganic carbon content of a sample. The sample transport is performed with peristaltic pumps and acid is added to the sample using a membrane pump. No pressurizing system is required and only one gas supply (nitrogen or dry and CO2-free air) is necessary. The system uses a Metrohm Titrino 719S, an ORION-Ross pH electrode and a Metrohm reference electrode. The burette, the pipette and the analysis cell have a water jacket around them. Precision is typically +/- 1 umol/kg for TA and/or DIC in open ocean water.

Dataset-specific Instrument Name	Astoria Analyzer
Generic Instrument Name	Nutrient 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.

[table of contents | back to top]

Deployments

WTX1

Website	https://www.bco-dmo.org/deployment/881550
Platform	R/V Manta
Start Date	2017-06-11
End Date	2017-06-17

WTX2

Website	https://www.bco-dmo.org/deployment/881552
Platform	R/V Manta
Start Date	2017-08-07
End Date	2017-08-11

WTX4

Website	https://www.bco-dmo.org/deployment/881554
Platform	R/V Pelican
Start Date	2017-11-14
End Date	2017-11-22

[table of contents | back to top]

Project Information

RAPID: The impact of increased fresh water input from Hurricane Harvey to the water quality and stratification of coastal and offshore waters of Texas. (Hurricane Harvey Water Quality)

Coverage: Gulf Mexico, Louisiana and Texas coast

In late August 2017, Category 4 Hurricane Harvey made landfall on Coastal Texas, 2017 and stalled bringing 125 cm of rain to Southeastern Texas over a five-day period resulting in catastrophic flooding along most of the Gulf coast of Texas as well as the metropolitan Houston area and 18 surrounding counties. Dams and reservoirs filled and even on September 1st ? 3rd releases from these dams continued to flood the area releasing even more water. Approximately 11 trillion gallons were estimated to have fallen and eventually this freshwater will be released onto the broad Texas continental shelf. In the US alone there has never been so much fresh water impacting a coastal area other than the discharge of the Mississippi River, which divides between the Atchafalaya River and the Birdfoot Delta to the east and injects freshwater into a much narrower shelf and into much deeper water in the north-central Gulf. The main hypothesis of the Rapid response project is that freshwater from Hurricane Harvey has 1) reduced coastal water quality by increasing stratification, and thereby inhibiting ventilation of atmospheric oxygen to sub-surface waters and 2) increased respiration by transporting nutrients from terrestrially derived sources leading to increased biomass and microbial activity. Secondly, the ocean heat content of the Texas Bight region contributed to the intensification of Hurricane Harvey by supplying thermal heat to the storm as it passed from the deep Gulf of Mexico to the shelf region. This project will provide critical information on how freshwater runoff from hurricane Harvey is impacting the stratification, oxygen, nutrient budgets of the coastal waters and whether this could lead to hypoxia and other long-term ecological impacts along the Texas shelf. The data will be made available rapidly to other researchers, students and the public.

This project aims to answer two questions of importance which could not be answered without a major flood. Is the freshwater from Hurricane Harvey reducing coastal water quality by increasing stratification, thereby inhibiting ventilation of atmospheric oxygen to subpycnocline water and is it increasing respiration by transporting nutrients from terrestrially derived sources leading to increased biomass and microbial activity? The project will also seek to determine if the ocean heat content of the Texas Bight region contributed to the intensification of Hurricane Harvey by supplying thermal heat to the storm as it passed from the deep Gulf of Mexico to the shelf region. This Rapid response project will conduct two research cruises on the R/V Pelican, one in late September and one in mid-November to quantify the effects and potential impacts of the freshwater run-off from Hurricane Harvey along the southern coast of Texas. In addition to the two cruises using a suite of oceanographic physio-chemical measurements, an autonomous Wave Glider will sample a grid to follow the freshwater plume and a buoyancy-controlled ocean glider will determine the depth and characteristics of the freshwater intrusion and its evolution between cruises and after data from two cruises in June and August 2017 prior to Hurricane Harvey. The research cruises will use existing offshore observing systems, i.e., the Texas Automated Buoy System, the Texas HF Radar network, and the Texas A&M University buoyancy-controlled glider program, to integrate the observations into a comprehensive picture of how the coastal region responded to the impulsive freshwater resulting from the unprecedented terrestrial flooding event in southeastern Texas.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1800913
NSF Division of Ocean Sciences (NSF OCE)	OCE-1760381

[table of contents | back to top]