Carbonate chemistry effects from Hurricane Harvey in San Antonio Bay and Mission Aransas Estuary from 2017-02-22 to 2018-11-15

Website: https://www.bco-dmo.org/dataset/784673
Data Type: Cruise Results
Version: 1
Version Date: 2019-12-19

Project
» CAREER: The Impact of Hydrologic State on CO2 Flux and Acidification in Subtropical Estuaries (CO2 Flux and Acidification in Subtropical Estuaries)
» RAPID: Capturing the Signature of Hurricane Harvey on Texas Coastal Lagoons (Hurricane Harvey Texas Lagoons)

Contributors	Affiliation	Role
Hu, Xinping	Texas A&M, Corpus Christi (TAMU-CC)	Principal Investigator
Biddle, Mathew	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
A calibrated YSI 6920 multisonde was used to obtain in-situ temperature at both the surface (~0.5 m) and the bottom (within 0.5 m from the sediment-water interface) of the water column, and a Van Dorn water sampler was used to take water samples from both the surface and bottom of the water column.

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Coverage

Spatial Extent: **N**:28.39352 **E**:-96.68435 **S**:27.838056 **W**:-97.200833
Temporal Extent: 2017-02-22 - 2018-11-15

Dataset Description

A calibrated YSI 6920 multisonde was used to obtain in-situ temperature at both the surface (~0.5 m) and the bottom (within 0.5 m from the sediment-water interface) of the water column, and a Van Dorn water sampler was used to take water samples from both the surface and bottom of the water column.

Following the standard OA operating protocol, unfiltered water samples were collected in 250 mL borosilicate glass bottles for carbonate system characterization. 100 µL saturated mercuric chloride (HgCl2) was added into the samples bottles and bottle stoppers were replaced after the application the Apiezon® L grease and secured with a rubber band and hose clamp. These preserved samples were used for salinity, total alkalinity (TA), total dissolved inorganic carbon (DIC), and pH analyses within two months of sample collection.

Salinity was measured using a benchtop salinometer (Orion Star™ A12, Thermo Scientific) which was calibrated using MilliQ and know salinity certified reference material (CRM). TA was analyzed at 22±0.1°C using Gran titration on an automated titration system (AS-Alk2, Apollo Scitech Inc.). DIC was analyzed using infrared detection on a AS-C3 DIC analyzer (Apollo Scitech Inc.). CRM was used to ensure the quality of the analysis and

optimal performance of the instruments. Total scale pH for salinity ≥20 samples was measured at 25°C using purified m-cresol purple. The equation in Liu et al. (2011) was used in the calculation of pH values. For low salinity waters (<20), a potentiometric method was used to measure pH. A Orion® Ross™ high precision glass electrode was used and three pH standard (4.01, 7.00, and 10.01) were used to calibrate the electrode. Calcium concentration ([Ca2+]) was measured (from non-preserved water samples) using an automatic titration with an ethylene glycol tetraacetic acid (EGTA) titrant on a Metrohm Titrando. The end-point was detected using a Metrohm calcium ion-selective electrode.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- re-formatted date from d-Mon-yy to yyyy-mm-dd and added as ISO_Date column

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Data Files

File
carb_chem.csv (Comma Separated Values (.csv), 47.69 KB) MD5:f810241031bcb5f59ce4b48f3689950b Primary data file for dataset ID 784673

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Related Publications

Liu, X., Patsavas, M. C., & Byrne, R. H. (2011). Purification and Characterization of meta-Cresol Purple for Spectrophotometric Seawater pH Measurements. Environmental Science & Technology, 45(11), 4862–4868. doi:10.1021/es200665d
Methods

Patrick, C. J., Yeager, L., Armitage, A. R., Carvallo, F., Congdon, V. M., Dunton, K. H., … Wetz, M. (2020). A System Level Analysis of Coastal Ecosystem Responses to Hurricane Impacts. Estuaries and Coasts, 43(5), 943–959. doi:10.1007/s12237-019-00690-3
Results

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Parameters

Parameter	Description	Units
Station	station name	unitless
Longitude	longitude with negative values indicating West	decimal degrees
Latitude	latitude with negative values indicating South	decimal degrees
DATE	sample date in dd-mmm-yy format	unitless
DEPTH	sample depth	meters (m)
TEMP	Temperature	degrees C
SAL	Salinity	psu
DIC	total dissolved inorganic carbon	micromole per kilogram (umol/kg)
TA	Total titration alkalinity	micromole per kilogram (umol/kg)
Calcium	Calcium	milimole per kilogram (mmol/kg)
pH	pH at 25C	unitless
pH_Label	1-spectophotometric method; 4-potentiometric method	unitless
ISO_Date	Date in ISO format following yyyy-mm-dd format	unitless

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Instruments

Dataset-specific Instrument Name	Orion Star A12
Generic Instrument Name	Salinity Sensor
Dataset-specific Description	Salinity - Orion Star™ A12, Thermo Scientific
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

Dataset-specific Instrument Name	8453 UV-Vis spectrophotometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	pH - 8453 UV-Vis spectrophotometer, Agilent
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	Van Dorn Beta Horizontal Bottle
Generic Instrument Name	Van Dorn water sampler
Dataset-specific Description	Van Dorn Beta™ Horizontal Bottle, Aquatic Biotechnology
Generic Instrument Description	A free-flushing water sample bottle comprising a cylinder (polycarbonate, acrylic or PVC) with a stopper at each end. The bottle is closed by means of a messenger from the surface releasing the tension on a latex band and thus pulling the two stoppers firmly into place. A thermometer can be mounted inside the bottle. One or more bottles can be lowered on a line to allow sampling at a single or multiple depth levels. Van Dorn samplers are suitable for for physical (temperature), chemical and biological sampling in shallow to very deep water. Bottles are typically lowered vertically through the water column although a horizontal version is available for sampling near the seabed or at thermoclines or chemoclines. Because of the lack of metal parts the bottles are suitable for trace metal sampling, although the blue polyurethane seal used in the Alpha version may leach mercury. The Beta version uses white ASA plastic seals that do not leach mercury but are less durable.

Dataset-specific Instrument Name	YSI 6920 multisonde
Generic Instrument Name	YSI Sonde 6-Series
Dataset-specific Description	Water physical measurements - YSI 6920 multisonde, YSI
Generic Instrument Description	YSI 6-Series water quality sondes and sensors are instruments for environmental monitoring and long-term deployments. YSI datasondes accept multiple water quality sensors (i.e., they are multiparameter sondes). Sondes can measure temperature, conductivity, dissolved oxygen, depth, turbidity, and other water quality parameters. The 6-Series includes several models. More from YSI.

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Project Information

CAREER: The Impact of Hydrologic State on CO2 Flux and Acidification in Subtropical Estuaries (CO2 Flux and Acidification in Subtropical Estuaries)

Website: http://hulab.tamucc.edu/research.htm

Coverage: Gulf of Mexico

NSF Award Abstract:

This project is a CAREER award to Xinping Hu at Texas A&M University-Corpus Christi. Hu proposes to integrate research and education in an investigation of carbon cycling and ocean acidification in the Mission-Aransas Estuary in South Texas. This coastal system is strongly affected by changes in river flow between seasons and from year to year. The relationship of changing river flows to carbon cycling in estuaries is not well understood. This lack of understanding in turn contributes to uncertainty in estimating global estuarine carbon budgets. In addition, climate change and other human activities heavily influence riverine input into estuaries and the coastal ocean, which then affect biogeochemistry and metabolism in these environments. Despite the need for this information, long-term records that can help to address the change in the strength and directions of CO2 fluxes in these ecosystems are very rare. Using high-intensity field sampling and analysis of historical data, this project aims to improve understanding of carbon cycling in this estuary and in the coastal ocean in general. The results obtained from this study will also provide key information about the biogeochemical response of estuaries to changing hydrologic conditions, as the southwestern U.S. grows drier with overall declining precipitation.

The research objectives of this project include 1) investigating the relationship between hydrologic state and estuarine CO2 partial pressure (pCO2) in a case study of the Mission-Aransas Estuary, a subtropical semiarid estuary, 2) understanding the extent of CO2 flux and its hydrologic control in one of the world's largest lagoonal estuarine systems along the northwestern Gulf of Mexico, and 3) elucidating the mechanisms that lead to estuarine acidification and its feedback to CO2 fluxes. Intensive field campaigns for high-temporal resolution pCO2 and water carbonate chemistry sampling as well as sediment incubation will be carried out; analysis of multidecadal carbonate chemistry parameters that have been collected by Texas Commission on Environmental Quality will be used to obtain temporal trends of estuarine water pCO2 against the backdrop of increasing freshwater scarcity in this region. The education component of this CAREER award includes 1) creating an ocean and estuarine acidification research course and redesigning two existing courses for both undergraduate and graduate students, 2) collaborating with Foy Moody High School on their Aquatic Science education to engage high school students predominantly from underrepresented and economically challenged backgrounds in field and lab experiences. The ultimate educational goal is to encourage high school students to follow a STEM path for their college education, and undergraduate STEM students to pursue graduate degrees. This will be a part of the concerted effort to enhance diversity in the future workforce by increasing the number of underrepresented graduates with bachelor's or higher degrees in the STEM fields. This project will train one Ph.D. student. High school students and undergraduate interns from underrepresented and economically challenged backgrounds will also be supported to participate in summer research. Broader dissemination of the project findings will include undergraduate student presentations at symposiums organized by both TAMU-CC and the Texas A&M University System, public seminars by both the graduate students and the principal investigator at various meetings organized by regional estuarine programs, presentations at national and international meetings, and publications in peer-reviewed journals.

RAPID: Capturing the Signature of Hurricane Harvey on Texas Coastal Lagoons (Hurricane Harvey Texas Lagoons)

Coverage: Northwest Gulf of Mexico estuaries on Texas Coast

NSF Award Abstract:
Hurricane Harvey made landfall Friday 25 August 2017 about 30 miles northeast of Corpus Christi, Texas as a Category 4 hurricane with winds up to 130 mph. This is the strongest hurricane to hit the middle Texas coast since Carla in 1961. After the wind storm and storm surge, coastal flooding occurred due to the storm lingering over Texas for four more days, dumping as much as 50 inches of rain near Houston. This will produce one of the largest floods ever to hit the Texas coast, and it is estimated that the flood will be a one in a thousand year event. The Texas coast is characterized by lagoons behind barrier islands, and their ecology and biogeochemistry are strongly influenced by coastal hydrology. Because this coastline is dominated by open water systems and productivity is driven by the amount of freshwater inflow, Hurricane Harvey represents a

massive inflow event that will likely cause tremendous changes to the coastal environments. Therefore, questions arise regarding how biogeochemical cycles of carbon, nutrients, and oxygen will be altered, whether massive phytoplankton blooms will occur, whether estuarine species will die when these systems turn into lakes, and how long recovery will take? The investigators are uniquely situated to mount this study not only because of their location, just south of the path of the storm, but most importantly because the lead investigator has conducted sampling of these bays regularly for the past thirty years, providing a tremendous context in which to interpret the new data gathered. The knowledge gained from this study will provide a broader understanding of the effects of similar high intensity rainfall events, which are expected to increase in frequency and/or intensity in the future.

The primary research hypothesis is that: Increased inflows to estuaries will cause increased loads of inorganic and organic matter, which will in turn drive primary production and biological responses, and at the same time significantly enhance respiration of coastal blue carbon. A secondary hypothesis is that: The large change in salinity and dissolved oxygen deficits will kill or stress many estuarine and marine organisms. To test these hypotheses it is necessary to measure the temporal change in key indicators of biogeochemical processes, and biodiversity shifts. Thus, changes to the carbon, nitrogen and oxygen cycles, and the diversity of benthic organisms will be measured and compared to existing baselines. The PIs propose to sample the Lavaca-Colorado, Guadalupe, Nueces, and Laguna Madre estuaries as follows: 1) continuous sampling (via autonomous instruments) of salinity, temperature, pH, dissolved oxygen, and depth (i.e. tidal elevation); 2) bi-weekly to monthly sampling for dissolved and total organic carbon and organic nitrogen, carbonate system parameters, nutrients, and phytoplankton community composition; 3) quarterly measurements of sediment characteristics and benthic infauna. The project will support two graduate students. The PIs will communicate results to the public and to state agencies through existing collaborations.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1654232
NSF Division of Ocean Sciences (NSF OCE)	OCE-1760006

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