High-Frequency CO2-system observations from a moored sensor in the York River

Website: https://www.bco-dmo.org/dataset/890566
Data Type: Other Field Results
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Project
» Collaborative Research: Multiple Stressors in the Estuarine Environment: What drives changes in the Carbon Dioxide system? (Estuarine Stressors)

Contributors	Affiliation	Role
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Abstract
These are CO2-system data from a moored sensor in the York River, a tributary of the Chesapeake Bay. Temperature, salinity and pH were acquired hourly over two deployments lasting several months. Sensor data were then averaged to 24-hour resolution. Data were calibrated with discrete dissolved inorganic carbon (TCO2) and alkalinity samples analyzed at the Virginia Institute of Marine Science, following standard procedures. The pH sensor data were then combined with salinity data, and a relationship between alkalinity and salinity, to compute the remaining CO2-system parameters (TCO2, CO2 partial pressure (pCO2), and saturation state of aragonite. There is one file for each deployment (D1, and D2); the data are in a comma-separated (csv) format. Hourly measured temperature, salinity, and pH are given, as well as derived alkalinity, TCO2, pCO2, and saturation state of aragonite are included. Units are in the first row of each file.

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Coverage

Spatial Extent: **Lat**:37.2 **Lon**:-76.27
Temporal Extent: 2016-11 - 2018-06

Methods & Sampling

A SeapHOx sensor was deployed at the National Oceanic and Atmospheric Administration Chesapeake Bay Interpretive Buoy SystemYork River Buoy (latitude: 37.20°N, longitude 76.27°W) with roughly 8-m water depth. Two deployments can be found in the dataset: Deployment 1 (D1) between November 2016 and April

2017 and Deployment 2 (D2) between December 2017 and June 2018.

Temperature, salinity and pH were acquired hourly over two deployments lasting several months.

Data Processing Description

Sensor data were then averaged to 24-hour resolution. Data were calibrated with discrete dissolved inorganic carbon (TCO2) and alkalinity samples analyzed at the Virginia Institute of Marine Science, following standard procedures. The pH sensor data were then combined with salinity data, and a relationship between alkalinity and salinity, to compute the remaining CO2-system parameters (TCO2, CO2 partial pressure (pCO2), and saturation state of aragonite.

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Related Publications

Shadwick, E. H., Friedrichs, M. A. M., Najjar, R. G., De Meo, O. A., Friedman, J. R., Da, F., & Reay, W. G. (2019). High-Frequency CO 2 System Variability Over the Winter-to-Spring Transition in a Coastal Plain Estuary. Journal of Geophysical Research: Oceans, 124(11), 7626–7642. Portico. https://doi.org/10.1029/2019jc015246 https://doi.org/10.1029/2019JC015246
Results

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Related Datasets

IsRelatedTo

Shadwick, E. & De Meo, O. (2019). *High-Frequency CO2-system observations from a moored sensor in the York River* [Data set]. Virginia Institute of Marine Science, William & Mary. https://doi.org/10.25773/63NX-VZ39 https://doi.org/10.25773/63nx-vz39

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Parameters

Parameter	Description	Units
Date_Matlab	Matlab date in unknown format	unitless
DateTime	DateTime in ISO format, UTC Zone	unitless
Latitude	Latitude sampling location, south is negative	decimal degrees
Longitude	Longitude sampling location, west is negative	decimal degrees
Temp_degC	Water temperature	degrees Celsius (°C)
Salinity	Salinity	unitless
pH_total	Total pH	unitless
alkalinity_umol_kg	Alkalinity	micromole per Kilogram (umol/kg)
TCO2_umol_kg	Total dissolved inorganic carbon	micromole per Kilogram (umol/kg)
pCO2_uatm	CO2 partial pressure	microatmospheres (uatm)
War	Saturation state of aragonite	unitless
Deployment	Deployment 1 or deployment 2	unitless

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Instruments

Dataset-specific Instrument Name	SeapHOx sensor
Generic Instrument Name	SeapHOx/SeaFET
Dataset-specific Description	SeapHOx uses an integrated sensor package that consists of a Sea-Bird SBE-37 conductivity and temperature sensor, an Aanderaa oxygen optode, and a modified Honeywell Durafet pH electrode
Generic Instrument Description	The SeapHOx and SeaFET are autonomous sensors originally designed and developed by the Todd Martz Lab at Scripps Institution of Oceanography. The SeaFET was designed to measure pH and temperature. The SeapHOx, designed later, combined the SeaFET with additional integrated sensors for dissolved oxygen and conductivity. Refer to Martz et al. 2010 (doi:10.4319/lom.2010.8.172). The SeapHOx package is now produced by Sea-Bird Scientific and allows for integrated data collection of pH, temperature, salinity, and oxygen. Refer to Sea-Bird for specific model information.

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Project Information

Collaborative Research: Multiple Stressors in the Estuarine Environment: What drives changes in the Carbon Dioxide system? (Estuarine Stressors)

NSF Award Abstract:

Understanding the vulnerability of estuarine ecosystems to anthropogenic impacts requires a quantitative assessment of the dynamic drivers of change to the estuarine carbonate system. Estuaries are currently experiencing multiple environmental stressors that have significant impacts on their carbonate chemistry, making this assessment a major challenge. Although the effects of changes in nutrient run-off (i.e. eutrophication and hypoxia) have been long-studied in many estuaries, much less attention has been given to the impacts of global change on these systems. In this study, a team of field scientists and modelers will attempt to distinguish natural interannual variability in a major US estuary from the impacts of local anthropogenic changes (e.g., nutrient inputs, changing freshwater end member characteristics) and global change (increases in atmospheric temperature, atmospheric carbon dioxide, and sea level), by using numerical models calibrated with CO2-system observations at appropriate spatial and temporal scales. If successful, this will be the first study to quantitatively distinguish between local and global anthropogenic impacts on the CO2 system in an estuary. The results are expected to have important implications for management of Chesapeake Bay because the impact of local anthropogenic stressors on the system, once isolated, may be mitigated by appropriate environmental policy implemented at the regional scale. Two of the PIs have a strong history of proven relationships with Chesapeake Bay managers and policy makers, which will insure direct infusion of these scientific results into ongoing management decisions.

In this project researchers will study the diurnal, seasonal, and interannual variability of the CO2 system in the Chesapeake Bay, a non-pristine estuary, using a combination of conventional shipboard sampling (of dissolved inorganic carbon, and alkalinity) and new high-frequency autonomous instrumentation (for observations of pH and CO2 partial pressure) to assess the impact of extreme events, like tropical storms and nor?easters on carbonate chemistry. These high-quality observations will afford a rigorous assessment of the uncertainty associated with a 30-year water-quality monitoring time series of pH and alkalinity. The team will use an estuarine-carbon-biogeochemical model evaluated and calibrated with the new and long-term observations.

Sensitivity experiments will be applied to disentangle multiple impacts on the CO2 system in the estuary over the last 30 years, including increased atmospheric temperature and CO2, sea-level rise, eutrophication due to increases in nutrient run-off, and changing carbonate characteristics of riverine end-members.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1537013
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536996

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