Distance to air-sea interface at 6 locations in the SUSTAIN tank at the University of Miami Rosenstiel School of Marine and Atmospheric Science, Key Biscayne, FL in 2018

Website: https://www.bco-dmo.org/dataset/816821
Data Type: experimental
Version: 1
Version Date: 2022-02-15

Project
» Collaborative Research: RUI: Investigating Gas Exchange Processes using Noble Gases in a Controlled Environment (Gas Exchange at SUSTAIN)

Contributors	Affiliation	Role
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Abstract
Distance to air-sea interface at 6 locations in the SUSTAIN tank at the University of Miami Rosenstiel School of Marine and Atmospheric Science, Key Biscayne, FL in 2018.

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Coverage

Temporal Extent: 2018-07-10 - 2018-07-15

Methods & Sampling

SUSTAIN = SUrge STructure Atmosphere INteraction (SUSTAIN) Laboratory / SUSTAIN Wind-Wave Tank

Sampling rate of 20 Hz (20 samples/second)
5 Senix UDMs in cross-shaped arrangement at about 8m fetch, 1 Senix UDM in the mid-tank panel about 10.3m fetch

Data Processing Description

Raw data was provided without any modifications. No data processing; data were logged by Campbell Scientific logger and accessed via Campbell Scientific LoggerNet software.

BCO-DMO data manager processing notes:
* The 177 logger files TOA5_Repair_SUSTAIN_ELEVx7_20Hz.ELEV_*.dat
and TOA5_SUSTAIN_ELEVx7_20Hz.ELEV_*.dat were bundled in their original logger format and attached to this dataset in the "Data Files" section.
* 177 logger files imported into the BCO-DMO data system and combined into one data table for this dataset.
* In main data table, TIMESTAMP column converted to ISO8601 format YYYY-MM-DDThh:mm:ss.ffZ with time zone UTC.
* column added "source_file_name" added to main data table so it is clear which logger file each set of rows came from.
* Parentheses in column names removed to meet BCO-DMO naming convention (See https://www.bco-dmo.org/page/bco-dmo-data-processing-conventions).

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Supplemental Files

File
SUSTAIN Tank Instrument Inventory filename: TankInstrumentationInventory_SUSTAIN_Wellesley_2018.pdf (Portable Document Format (.pdf), 176.38 KB) MD5:50585954dcb1443882b519c4b829c23a A diagram of the SUSTAIN tank and list of the instruments. Instrument locations are given in centimeters.

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Related Datasets

IsRelatedTo

Haus, B., Stanley, R. H. R., Smith, A. W. (2020) **Bubble images captured at 1 fetch and over a sub-surface depth in the SUSTAIN tank at the University of Miami Rosenstiel School of Marine and Atmospheric Science, Key Biscayne, FL in 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-06-26 http://lod.bco-dmo.org/id/dataset/816806 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Haus, B., Stanley, R. H. R., Smith, A. W. (2020) **Water depth at 3 locations in an equilateral triangular array in the SUSTAIN tank at the University of Miami Rosenstiel School of Marine and Atmospheric Science, Key Biscayne, FL in 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-02-28 http://lod.bco-dmo.org/id/dataset/816812 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Haus, B., Stanley, R. H. R., Smith, A. W. (2022) **Conductivity, temperature, and water depth at 4 locations in the SUSTAIN tank at the University of Miami Rosenstiel School of Marine and Atmospheric Science, Key Biscayne, FL in 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-02-08 http://lod.bco-dmo.org/id/dataset/816799 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	ToughSonic
Generic Instrument Name	Water Level Sensor
Dataset-specific Description	Manufacturer: Senix Type(s): ToughSonic 30 (Distance1,2,4,5,6); ToughSonic 50 (Distance3) Serial Numbers: TSPC-15S-485 (ToughSonic 30); TSPC-21SRM-485 (ToughSonic 50) Calibrations: Typically diagnosed/calibrated by filling tank with water to a known depth and signals compared; wave tests also used to make sure signals return to resting water level distance Specifications: Max Range: 30ft (ToughSonic 30), 50ft (ToughSonic 50) Optimum Range: 10in-20ft (ToughSonic30), 1-33ft (ToughSonic 50) Resolution: (0.0068 in./0.0135 in. Serial or 4099 steps over 0-10 VDC Analog) Temperature: -40 to +70 degrees C Humidity: 0-100 percent
Generic Instrument Description	For measuring water level in fresh and salt water including tanks, wells, rivers, and the ocean.

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Project Information

Collaborative Research: RUI: Investigating Gas Exchange Processes using Noble Gases in a Controlled Environment (Gas Exchange at SUSTAIN)

Coverage: SUSTAIN wind-wave tank at University of Miami

NSF Abstract:

An exact description of gas exchange between the atmosphere and the ocean is not fully developed, yet it is a critical process for understanding climate change and ecosystem dynamics. This is particularly problematic when evaluating the important role of bubbles in air-sea gas exchange, especially in remote ocean locations where high winds and waves make direct measurements extremely difficult. This project seeks to provide needed fundamental, high wind/wave gas-exchange measurements by using a large, state-of-the-art, wind-wave tank. Here the PIs can apply their novel measurements of noble gases (neon, argon, krypton, and xenon) to calculate overall gas fluxes under precisely controlled conditions. This tank setting allows a systematic approach to define the physical and chemical parameters (temperature, salinity, pH, wind speed, turbulence, bubble size distribution, etc.) required to construct more accurate models without the great uncertainties inherent in making similar measurements from a ship in storm conditions. A significant outcome of this study, beyond improved understanding of air-sea gas exchange, could be greatly improved estimates of the critical ecological balance between photosynthesis and respiration. Current methods use carbon dioxide and oxygen dissolved in seawater as an indication of biological activity, but cannot distinguish between biological processes and atmospheric exchange, and estimates are especially inaccurate under high wind and wave conditions with strong bubble injection. This study will improve our ability to separate biological and physical processes in evaluation of dissolved gasses in seawater.

Also, this project will provide 15 female undergraduate students at Wellesley College with an exciting, on-site research experience using a state-of-the-art tank facility at the University of Miami, and results will be incorporated into general and advanced chemistry classes. The production of student-created, short format videos, and other public outreach activities will also be supported to disseminate information on the importance of marine gas exchange.

The study of gas exchange processes between the ocean and the atmosphere has been hindered by the lack of data required to define quantitative relationships that account for bubble processes under a variety of wind, wave, and temperature conditions. Current gas exchange models tend to be highly unreliable in their parameterization of bubble processes. In large part, this is due to the difficulty of making traditional measurements at sea in remote locations within well-defined conditions, especially with high winds and waves. By using the large SUSTAIN wind-wave tank (23 m x 6 m x 2 m), the researchers in this project plan to greatly advance our understanding of the effect of wind, wave, and temperature variability on gas transfer. The use of a recently developed, field-portable equilibrator mass spectrometer that allows nearly continuous measurements of noble gas ratios (Ne, Ar, Kr, and Xe) will result in these SUSTAIN tank experiments providing precisely characterized gas flux data under varying wind speeds from 10 to 40 m/s. In addition, an underwater shadowgraph system will image bubbles, allowing the researchers to quantify bubble size distributions, a key factor missing from bubble models. Current models use a greatly simplified, two size-class representation of bubbles; an approach that this research will re-evaluate in hopes of creating better parameterizations of the role of bubble size on gas flux, and consequently improved air-sea gas exchange models for oceanic and climatic applications.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1634467
NSF Division of Ocean Sciences (NSF OCE)	OCE-1634432

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