Temperature data profiles collected from the sediments off the South Atlantic Bight

Website: https://www.bco-dmo.org/dataset/882954
Version: 1
Version Date: 2022-10-25

Project
» Groundwater sources of "new" N for benthic microalgal production in the South Atlantic bight (SAB BMA)

Contributors	Affiliation	Role
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Abstract
These data include thermal profiles from sediments off the South Atlantic Bight offshore from Isle of Palms, Charleston County, South Carolina 32°45’N 79°45’W. Data from 2018 through 2020 were collected using temperature loggers that were inset in PVC stakes and jetted into the seafloor. Instruments used for temperature collection were Onset HOBO TidbiT v2 data loggers. Heat has been widely used as an inexpensive tracer in groundwater systems (Anderson 2005; Constanz 2008), including studies of submarine groundwater discharge (SGD) (Taniguchi 2000; Moore and Wilson 2005; Martin et al 2006).

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Coverage

Spatial Extent: **Lat**:32.75 **Lon**:-79.75
Temporal Extent: 2018-08-08 - 2020-11-16

Methods & Sampling

Heat has been widely used as an inexpensive tracer in groundwater systems (Anderson 2005; Constanz 2008), including studies of SGD (Taniguchi 2000; Moore and Wilson 2005; Martin et al 2006). In our system, the temperature of sub-seafloor porewaters differs from the temperature of overlying seawater owing to seasonal variations in surface temperature. We can thus use heat in two ways: (1) to measure the depth of rapid flushing events and (2) to estimate rates of long-term regional flow.

Instruments: Onset HOBO TidbiT v2 Water Temperature Data logger with 12-bit resolution and has ±0.2 °C accuracy. It is designed for outdoor and underwater environments and is waterproof to 300 m (1000 ft). Bluetooth transmission allows users to offload data.

Location: 10 - 20 kilometers offshore from the Isle of Palms, Charleston County, South Carolina 32°45’N 79°45’W. Day trips aboard a dive boat 2-4 times per summer during the years 2018-2020. Dive boat: Trinity, Charleston SC.

Data Processing Description

Raw data is taken from loggers via Bluetooth. Temperature loggers were calibrated before deployment and temperature error was removed from raw data.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	Onset HOBO TidbiT v2 Water Temperature Data logger
Generic Instrument Name	Onset HOBO Pro v2 temperature logger
Generic Instrument Description	The HOBO Water Temp Pro v2 temperature logger, manufactured by Onset Computer Corporation, has 12-bit resolution and a precision sensor for ±0.2°C accuracy over a wide temperature range. It is designed for extended deployment in fresh or salt water. Operation range: -40° to 70°C (-40° to 158°F) in air; maximum sustained temperature of 50°C (122°F) in water Accuracy: 0.2°C over 0° to 50°C (0.36°F over 32° to 122°F) Resolution: 0.02°C at 25°C (0.04°F at 77°F) Response time: (90%) 5 minutes in water; 12 minutes in air moving 2 m/sec (typical) Stability (drift): 0.1°C (0.18°F) per year Real-time clock: ± 1 minute per month 0° to 50°C (32° to 122°F) Additional information (http://www.onsetcomp.com/) Onset Computer Corporation 470 MacArthur Blvd Bourne, MA 02532

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Project Information

Groundwater sources of "new" N for benthic microalgal production in the South Atlantic bight (SAB BMA)

Coverage: South Atlantic Bight (32 N, 79 W)

NSF Award Abstract:
Continental shelves are highly productive, with both ecological and economic importance. Benthic microalgae (BMA) are key primary producers in these location. As much as 6x the water column biomass of primary producers is compressed into a layer only a few mm thick on the sediment surface. The source(s) of fixed nitrogen (N) supporting such highly concentrated BMA biomass is currently unknown. Recent studies of sub-seafloor groundwater flow at the University of South Carolina have demonstrated that upwelling saline groundwater likely supplies high concentrations of nutrients in the ridge-swale habitats in the South Atlantic Bight (SAB). The investigators suggest that groundwater input of fixed N into surficial sediments is the primary source of N supporting BMA biomass and production in the mid-shelf region of the SAB. The purpose of this project is to determine the primary source of fixed N supporting BMA biomass in the surface sediments of the shallow shelf waters (<30 m), using the SAB as a field area. A secondary objective is to apply novel and

innovative methods to directly quantify groundwater inputs of N into surficial sediments. Research results will fully document the spatio-temporal distributions of BMA and phytoplankton biomass and community structure in the mid-shelf region of the SAB and relate the observed patterns to groundwater inputs of fixed N sources as well as hydrographic and climatic conditions. This research will provide full support and tuition for 2 graduate students, summer support for undergraduate assistants, and involve upper level undergraduates as lab interns. The study team will also work with the Baruch Institute and other partners to develop an "Ocean Schoolyard" program to meet the needs of teachers, students, and community audiences. The project will also provide partial support for Girls Go for I.T., a coding summer camp designed to attract middle-school-aged girls to careers in I.T. and STEM fields.

The specific objectives of the study are to (1) quantify spatial and temporal variations in N fluxes associated with hydrodynamic exchange and upward groundwater flow (2) document spatial and temporal variations in BMA biomass and (3) measure the delta15N of fixed nitrogen sources (well water, porewater and water column ammonium and nitrate; sediments), the BMA, and phytoplankton. The sampling area will be restricted to the 10 - 30 m isobath region of the SAB off the coast of Charleston, SC. Samples will be collected at both the existing groundwater well field and other regions of the shelf. At each of the groundwater wells in the well field, SCUBA divers will collect fluids from the wells to determine well water inorganic nutrient concentrations (nitrate + nitrite, ammonium, orthophosphate, silicon) and the delta 15N of well water ammonium and nitrate (when present). In nearby sediments, samples will be collected for BMA biomass and community composition, surface porewater inorganic nutrients (nitrate + nitrite, ammonium, orthophosphate, silicon), C and N of sediments, sediment grain size analysis, and delta 15N of BMA, ammonium, nitrate (when present), and sediments. Line transects, consisting of 5 sampling locations along a 50 m transect, will be conducted in each of the 4 depth strata. At 10 m intervals along each transect, divers will collect samples the same as above for the well field. Water column samples will be collected for HPLC measurements of phytoplankton biomass and community composition, inorganic nutrient concentrations (nitrate + nitrite, ammonium, orthophosphate, silicon), seston CHN, delta 15N of phytoplankton, and the delta 15N of ammonium and nitrate. The researchers will use heat as a tracer to map the depth of hydrodynamic exchange and monitor the rate of vertical groundwater flow. Results from that analysis will also allow them to then simulate transport of a conservative tracer that can be compared to observed nutrient concentrations to BMA abundance and community composition.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1736557

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