# Temperature profiles collected from the sediments off the South Atlantic Bight from 2015-05-01 to 2017-05-10

**Website**: https://www.bco-dmo.org/dataset/785219
**Data Type**: Other Field Results
**Version**: 0
**Version Date**: 2019-12-30

**Project**
» Fluid and chemical fluxes across the seafloor of a passive margin (passive margin fluxes)

| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
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.

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## Coverage

**Spatial Extent**: **Lat**:32.75 **Lon**:-79.75
**Temporal Extent**: 2015-05-01 - 2017-05-10

## Dataset Description

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.

### Methods & Sampling

Temperature loggers were installed inside nominal 1 ¼-inch stainless steel wells that were screened over the bottom 30 cm to allow collection of water samples. The wells were sealed at the top (typically 50 cm above the seafloor) with PVC caps, from which HOBOware Tidbit temperature loggers were suspended on a 1.3 cm-wide a strip of polypropylene. Bottom water temperature was collected at each site by a temperature logger

protected by a casing made of nominal 1 ¼-inch PVC well screen and attached to the casing near the seafloor. In the spring of 2016 concerns about thermal overturn within the wells led us to install and instrument a second set of casings 2-3 m from the original wells. The new installations, referred to as stakes, were filled with sand after the instrument string was installed, to prevent thermal overturn.

**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 m/d/yyyy to ISO DateTime format following the convention YYYY-MM-DDTHH:MM:SS
- added lat, lon columns from metadata
- re-organized the data structure into one column for temperature and one column for depth

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| date_time | Date and Time in MM/DD/YYYY hh:mm format | unitless |
| file_name | name of the original file which the data was submitted | unitless |
| lat | latitude with positive values indicating North | decimal degrees |
| lon | longitude with negative values indicating West | decimal degrees |
| ISO_DateTime | Date and time following the ISO convention in YYYY-MM-DDTHH:mm:ss format | unitless |
| depth | Depth of logger in sediment | meters (m) |
| temp | water temperature | degrees Celsius (C) |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | Onset HOBO TidbiT v2 Water Temperature Data logger |
| **Generic Instrument Name** | Onset HOBO TidbiT v2 (UTBI-001) temperature logger |
| **Dataset-specific Description** | 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 (https://www.onsetcomp.com/products/hobo-data-loggers/waterproof) to 300 m (1000 ft). An optical USB (https://www.onsetcomp.com/products/data-loggers/usb-data-loggers) interface allows users to offload data. |
| **Generic Instrument Description** | A temperature logger that measures temperatures over a wide temperature range. It is designed for outdoor and underwater environments and is waterproof to 300 m. A solar radiation shield is required to obtain accurate air temperature measurements in sunlight (RS1 or M-RSA Solar Radiation Shield). With an operational temperature range between -20 degrees Celsius and +70 degrees Celsius, the TidbiT v2 has an accuracy of +/-0.21 and a resolution of 0.02 degrees Celsius. |

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## Project Information

**Fluid and chemical fluxes across the seafloor of a passive margin (passive margin fluxes)**

**Coverage**: Offshore from Isle of Palms, Charleston County, South Carolina 32°45'N 79°45'W

NSF Abstract:

Submarine groundwater discharge (SGD) is now recognized as an important pathway for the introduction of nutrients, carbon, and metals into coastal ocean waters. The full impact of SGD is uncertain, however, because we do not understand all the driving mechanisms. Whereas most studies of SGD have focused at the coastline, increasing evidence from the South Atlantic Bight indicates that the majority of SGD occurs far (1-70 km) offshore. Mechanisms for discharge far from shore are not yet well understood. Observations from a cluster of seafloor wells 20 km offshore of North Carolina suggest that this discharge reflects slow upward migration of saline fluids from depth. These porefluids are also affected by rapid flushing of sandy seafloor sediments by seawater during storms or migration of cold ocean currents. This project will test the hypothesis that these flow processes are common and drive significant fluid exchange over large areas of the continental shelf. The project will also estimate the geochemical fluxes of radium, nutrients and carbon across the seafloor. The study area will be a 150 square-km area that reaches 20 km offshore near Charleston, South Carolina. Geophysical surveys will map seafloor bathymetry and identify buried sedimentary structures that could channel groundwater traveling upward toward the seafloor. Thermal arrays will be installed to depths of 2-5 m below the seafloor at 10 locations. Data from these arrays will indicate the depth and frequency of rapid ocean-driven flushing and quantify possible long-term upward flow from depth. Three pairs of wells installed in a shore-perpendicular transect will supply pressure data that will provide independent estimates of fluid fluxes. The wells will also be sampled for nutrients, carbon, and radium tracers, which will indicate mixing between radium-poor seawater and radium-enriched pore waters. Geochemical fluxes across the seafloor will be determined based on calculated fluid fluxes and observed geochemical compositions.

The realization that groundwater discharging directly to the ocean supplies significant quantities of nutrients, carbon, and metals to coastal waters represents a paradigm shift in our understanding of geochemical fluxes to the coastal ocean systems. Previously, only inputs from rivers, the atmosphere, and upwelling (exchange with the deeper ocean) were considered. Now, increasing evidence suggests that the volume of saline groundwater that discharges across broad continental shelves is at least as large as river discharge, but the flow mechanisms and chemical compositions of groundwater discharge in offshore regions are very poorly understood. It is essential that studies of submarine groundwater discharge focus farther offshore in order to understand these processes. This work has the potential to spur significant revisions of textbook views of the hydrologic cycle and geochemical budgets for the ocean. In particular, saline groundwater may be supplying

significantly greater nutrients (nitrogen and phosphorus) than has previously been realized. These nutrients affect the fertility of coastal ecosystems, which include economically significant fisheries, and may contribute to outbreaks of harmful algae blooms as well as ocean 'dead zones'. The work is designed to include significant student participation, including participation by under-represented groups.

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## Funding


| Funding Source | Award |
| --- | --- |
| NSF Division of Earth Sciences (NSF EAR) | EAR-1316250 |


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