

# Oxygen data from 8 Wire Flyer deployments conducted on R/V Atlantis cruise AT42-03 in the Costa Rica Margin from October to November 2018

**Website:** <https://www.bco-dmo.org/dataset/879130>

**Data Type:** Cruise Results

**Version:** 1

**Version Date:** 2022-09-01

## Project

» [Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea](#) (Costa Rica Seeps)

Contributors	Affiliation	Role
<a href="#">Roman, Christopher Neil</a>	University of Rhode Island (URI)	Principal Investigator
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## Abstract

This dataset includes oxygen data from 8 Wire Flyer deployments conducted on R/V Atlantis cruise AT42-03 in the Costa Rica Margin from October to November 2018

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## Coverage

**Spatial Extent:** N:9.089472 E:-84.175327 S:8.538584 W:-85.143276

**Temporal Extent:** 2018-10-19 - 2018-11-03

## Methods & Sampling

Data were collected on R/V Atlantis cruise AT42-03 in the Costa Rica Margin from October to November 2018. The GPS data are from the ship's data stream. The data have not been corrected for any time lags. Oxygen data are from an Aanderaa Optode 4831F. See the [accompanying sensor manual](#) (PDF) for the field details.

The Wire Flyer position was calculated using measurements of the clump weight depth and the wire payout. The layback distance is the Flyer's distance behind the ship. Refer to the Supplemental Files for more information on the Wire Flyer.

## Known Problems/Issues:

There is a time lag in the data due to the sensor's foil response. This is noticeable on adjacent profiles, with similar O2 values appearing at different depths. The data can be lag shifted 5-7 seconds to remove most of the offset.

## Data Processing Description

### BCO-DMO Processing:

- concatenated data from 8 separate files into one dataset;
- replaced "NaN" with "nd" (no data);
- created new column "deployment\_id" (based on original file name);
- converted date/time field to ISO8601 format.

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## Supplemental Files

File	
<b>AT42-03 Wire Flyer Summary Plots</b> filename: summary_plots.zip	(ZIP Archive (ZIP), 8.85 MB) MD5:eb9054e1925496bf6f0522326dc96fa5
Summary plots of data from 8 Wire Flyer deployments conducted on R/V Atlantis cruise AT42-05. There is one PDF for each deployment. The file naming convention is YYYYMMDD_HHMMSS, set at the start of the deployment, e.g. 20170125_151748. The times are all in GMT, not local time.	
<b>TD 269 OPERATING MANUAL OXYGEN OPTODE 4330, 4835, 4831</b> filename: TD269v5_Operating_manual_Oxygen_Optode_4330_4835_and_4831.pdf	(Portable Document Format (.pdf), 5.72 MB) MD5:7a18b2248d363da076eedb61e2aed965
Operating manual for Aanderaa oxygen optodes 4330, 4835, and 4831.	
<b>Wire Flyer Launch and Recover Document</b> filename: flyer_launch_and_recover_document.pdf	(Portable Document Format (.pdf), 7.26 MB) MD5:f9274b8c8b003b9a39083191e4f2c76b
Document describing the Wire Flyer launch and recovery procedures.	
<b>Wire Flyer Overview 2019</b> filename: Wire_flyer_overview_2019.pdf	(Portable Document Format (.pdf), 15.84 MB) MD5:7c3c14f839142f115c5aa467894395d7
Slides from a presentation by Christopher Roman titled "The Wire Flyer vehicle system and high resolution hydrographic sections".	

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## Related Publications

Roman, C., Ullman, D. S., Hebert, D., & Licht, S. (2019). The Wire Flyer Towed Profiling System. Journal of Atmospheric and Oceanic Technology, 36(2), 161–182. doi:[10.1175/jtech-d-17-0180.1](https://doi.org/10.1175/jtech-d-17-0180.1)  
*Methods*

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## Parameters

Parameter	Description	Units
deployment_id	identifier for the deployment; indicates the start date and time of deployment in format: YYYYMMDD_hhmmss (time zone is GMT)	unitless
AirSaturation	air saturation (%) relative to the nominal air pressure	unitless (percent)
C2Amp	amplitude measurement with red excitation light	millivolts (mV)
Temperature	temperature	degrees Celsius
C2RPh	phase measurement with red excitation light	degrees
TCPhase	temperature compensated phase	degrees
timestamp	time stamp in microunix seconds	microunix seconds
C1RPh	phase measurement with blue excitation light	degrees
O2Concentration	partial pressure of dissolved oxygen in water	micromoles per liter
C1Amp	amplitude measurement with blue excitation light	millivolts (mV)
CalPhase	calibrated phase	degrees
RawTemp	voltage from thermistor bridge	millivolts (mV)
datestring	date-time string (GMT) in format where xxx represent milliseconds: YYYY-MM-DD hh:mm:ss.xxx	unitless
ISO_DateTime_UTC	date-time string converted to ISO8601 format: YYYY-MM-DDThh:mm:ss.xxxxxxZ. Note that data are accurate to milliseconds (not microseconds)	unitless
lat	Latitude. This is either the ship or the flyer position, but it is the best position available. If the Flyer position was known, accounting for the tow cable, this is the value used here. If the flyer position was not known (e.g. maybe the winch cable counter failed), the ship position was recorded.	degrees North
lon	Longitude. This is either the ship or the flyer position, but it is the best position available. If the Flyer position was known, accounting for the tow cable, this is the value used here. If the flyer position was not known (e.g. maybe the winch cable counter failed), the ship position was recorded	degrees East
lcmlog_timestamp	time stamp in deployment 20181028_235258 only	?

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## Instruments

<b>Dataset-specific Instrument Name</b>	Aanderaa Optode 4831F
<b>Generic Instrument Name</b>	Aanderaa 4831F (fast-response) oxygen optode
<b>Generic Instrument Description</b>	A stand-alone oxygen optode with integrated temperature sensor, manufactured by Aanderaa. This instrument exploits the physio-chemical principle of dynamic fluorescence quenching to measure absolute oxygen concentration and percent saturation. Depth rating: 300 m, 3000 m or 6000 m; oxygen concentration accuracy of < 8 $\mu$ M or 5 %, and resolution of < 1 $\mu$ M; air saturation accuracy of < 5 %, and resolution of 0.4 %; response time (63 %): < 8 s.

<b>Dataset-specific Instrument Name</b>	Wire Flyer
<b>Generic Instrument Name</b>	Wire Flyer Towed Profiling System
<b>Generic Instrument Description</b>	Description from Roman et al. (2019): The Wire Flyer towed vehicle is a platform able to collect high-resolution water column sections. The vehicle is motivated by a desire to effectively capture spatial structures at the submesoscale. The Wire Flyer profiles up and down along a ship-towed cable autonomously using controllable wings for propulsion. At ship speeds between 2 and 5 kt (1.02–2.55 m s <sup>−1</sup> ), the vehicle is able to profile over prescribed depth bands down to 1000 m. The vehicle carries sensors for conductivity, temperature, depth, oxygen, turbidity, chlorophyll, pH, and oxidation reduction potential. During normal operations, the vehicle is typically commanded to cover vertical regions between 300 and 400 m in height with profiles that repeat at kilometer spacing. The vertical profiling speed can be user-specified up to 150 m min <sup>−1</sup> . During operations, an acoustic modem is used to communicate with the vehicle to provide status information, data samples, and the ability to modify the sampling pattern. Detailed information can be found in the following publication: Roman, C., Ullman, D. S., Hebert, D., & Licht, S. (2019). The Wire Flyer Towed Profiling System. Journal of Atmospheric and Oceanic Technology, 36(2), 161–182. doi:10.1175/jtech-d-17-0180.1

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## Deployments

### AT42-03

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/777903">https://www.bco-dmo.org/deployment/777903</a>
<b>Platform</b>	R/V Atlantis
<b>Start Date</b>	2018-10-17
<b>End Date</b>	2018-11-06
<b>Description</b>	More cruise information is available from Rolling Deck to Repository (R2R): * <a href="https://www.rvdata.us/search/cruise/AT42-03">https://www.rvdata.us/search/cruise/AT42-03</a> * <a href="https://doi.org/10.7284/908473">https://doi.org/10.7284/908473</a>

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## Project Information

**Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea (Costa Rica Seeps)**

*NSF abstract:*

If life were to disappear from the deep sea, would we notice? We only have a cursory understanding of this vast region and the connectivity among its communities and the rest of the oceans, and yet the ecosystems of the deep sea have been implicated in the larger function of the global marine ecosystems. We now rely on the deep ocean for food, energy, novel drugs and materials, and for its role in the global cycling of carbon, as well as for supporting services such as habitat creation, nutrient replenishment for shallow waters, and the maintenance of biodiversity. Cold seeps, active areas of the seafloor where methane and other chemicals are released, are key features along the continental margins worldwide. To characterize how methane seep communities interact with the surrounding ecosystems and vice versa, we will study methane seeps off the Pacific coast of Costa Rica in 2017 and 2018. It is the sphere of influence around the seep, both along the seafloor and up into the water column, that we seek to better understand. We will map the structure and the chemistry surrounding these habitats using a novel 3-dimensional framework, combining typical transects with vertical characterizations of the water column just above the seafloor. This will include measurements of methane flux into the water column and changes in the overlying carbonate chemistry and oxygen levels that are critical to our understanding of the effect of warming, oxygen loss and ocean acidification in this region. Within this framework, we will collect seep organisms in sediments and on rocks (including all sizes from microbes to large animals), and transplant some of these from within the area of seep influence to the background deep sea, and vice-versa. Together, these studies will help us to measure the size of the seep sphere of influence, and also demonstrate the role of these seeps within the deep sea and the greater, global, marine ecosystem. We will share this information with a group of teachers during a series of workshops in the San Diego area, at an exhibit at the Birch Aquarium, and through the work of an artist who has worked extensively with marine organisms in extreme environments.

Chemosynthetic ecosystems are inextricably linked to the broader world-ocean biome and global biogeochemical cycles in ways that we are just beginning to understand. This research will identify the form, extent, and nature of the physical, chemical, and biological linkages between methane seeps and the surrounding deep-sea ecosystem. The proposed research builds critical understanding of the structural and functional processes that underpin the ecosystem services provided by chemosynthetic ecosystems. We target a critical continental margin, Costa Rica, where methane fates and dynamics loom large and play out in an setting that reflects many oceanographic stressors. We will use quantitative sampling and manipulative studies within a 3-dimensional oceanographic framework. We will ask what are the shapes of the diversity and density functions for organisms of different size classes and trophic position over the transition from the seep habitat through the ecotone to the background deep sea? Further, we will ask how do depth, dissolved oxygen concentrations, pH and carbonate ion availability, relative rates of fluid flux, and substrate (biogenic, authigenic carbonate, sediments) alter these linkages and interactions with the surrounding deep sea? Evidence for distinct transitional communities and biotic patterns in density and alpha and beta diversity will be quantified and placed in a global biogeographic context. All of these investigations will occur across biological size spectra: for microorganisms (archaea, bacteria, microeukaryotes), the macrofauna, and the megafauna that form biogenic habitats. Our research results will be interpreted in the context of potential effects of global ocean change in the equatorial Pacific to determine how the linkages with the surrounding deep sea will be altered as anthropogenic impacts proceed in the future.

**Related publications:**

Levin, L.A., V.J. Orphan, G.W. Rouse, W. Ussler, A. E. Rathburn, G. S. Cook, S. Goffredi, E. Perez, A. Waren, B. Grupe, G. Chadwick, B. Strickrott. (2012). A hydrothermal seep on the Costa Rica margin: Middle ground in a continuum of reducing ecosystems. *Proc. Royal Soc. B.* 279: 2580-88 doi: [10.1098/rspb.2012.0205](https://doi.org/10.1098/rspb.2012.0205)

Sahling, H., Masson, D. G., Ranero, C. R., Hühnerbach, V., Weinrebe, W., Klauke, I., & Suess, E. (2008). Fluid seepage at the continental margin offshore Costa Rica and southern Nicaragua. *Geochemistry, Geophysics, Geosystems* 9: doi: [10.1029/2008GC001978](https://doi.org/10.1029/2008GC001978)

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1634559</a>

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