Sally Ride STOX Oxygen Profiles

Website: https://www.bco-dmo.org/dataset/984383
Data Type: Cruise Results
Version: 1
Version Date: 2025-09-15

Project
» Collaborative Research: Multiyear autonomous measurement of N-loss in the ETNP ODZ (N-loss in the ETNP ODZ)

Contributors	Affiliation	Role
D'Asaro, Eric	University of Washington Applied Physics Laboratory (UW APL)	Principal Investigator
McNeil, Craig L.	University of Washington Applied Physics Laboratory (UW APL)	Principal Investigator
Altabet, Mark A.	University of Massachusetts Dartmouth (UMass Dartmouth)	Co-Principal Investigator
Cunningham, Clifford	Duke University Department of Biology (Duke - Bio)	Scientist
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Coverage

Location: Eastern Tropical Pacific Oxygen Depletion Zone
Spatial Extent: **N**:22.865 **E**:-86.6267 **S**:7.7093 **W**:-114.64
Temporal Extent: 2020-12-20 - 2022-12-01

Dataset Description

STOX oxygen profiles from two RV Sally Ride cruises, including time, depth, location, STOX oxygen, CTD temperature, salinity and oxygen.

BCO-DMO Processing Description

* The primary data file of this dataset (984383_v1_sally_ride_stox_oxygen_profiles.csv) is comprised of two originally separate STOX-generated data files. A new column has been added to this data file that indicates the name of the original source file (column "SourceFileName").
* A "DateTime" column has been added to the primary datafile, which merges the originally column-seperated Year, Month, Day, Hour and Minute values.
* Latitude and longitude values have been rounded to 6 degrees of precision.

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Related Publications

McNeil, C. L., D'Asaro, E. A., Altabet, M. A., Hamme, R. C., & Garcia-Robledo, E. (2023). Autonomous observations of biogenic N2 in the Eastern Tropical North Pacific using profiling floats equipped with gas tension devices. Frontiers in Marine Science, 10. https://doi.org/10.3389/fmars.2023.1134851 https://doi.org/doi:10.3389/fmars.2023.1134851
Results

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Related Datasets

IsRelatedTo

D'Asaro, E., McNeil, C. L., Altabet, M. A., Cunningham, C. (2025) **Oxygen and Gas Tension data collected from Argo Floats Deployed from the RV Sally Ride Cruises SR2011 and SR2114 in the Eastern Tropical North Pacific from 2020 to 2023 (N-loss in the ETNP ODZ project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-08-26 http://lod.bco-dmo.org/id/dataset/983497 [view at BCO-DMO]
Relationship Description: This dataset is supplemental to Argo and ODZ float oxygen datasets created during the same R/V Sally Ride cruises, providing calibration and validation reference points derived from shipboard STOX sensors.

D'Asaro, E., McNeil, C. L., Altabet, M. A., Cunningham, C. (2025) **Oxygen and Gas Tension data collected from ODZ Floats Deployed from the RV Sally Ride Cruises SR2011 and SR2114 in the Eastern Tropical North Pacific from 2020 to 2023 (N-loss in the ETNP ODZ project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-08-26 http://lod.bco-dmo.org/id/dataset/983583 [view at BCO-DMO]
Relationship Description: This dataset is supplemental to Argo and ODZ float oxygen datasets created during the same R/V Sally Ride cruises, providing calibration and validation reference points derived from shipboard STOX sensors.

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Parameters

Parameter	Description	Units
Datetime	Concatonated datetime from the originally provided Year, Month, Day, Hour and Minute columns.	unitless
Year	Year of measurement capture recorded by STOX sensor.	unitless
Day	Day of measurement capture recorded by STOX sensor.	unitless
Hour	Hour of measurement capture recorded by STOX sensor.	unitless
Minute	Minute of measurement capture recorded by STOX sensor.	unitless

Month	Month of measurement capture recorded by STOX sensor.	unitless
Latitude	Latitude of STOX sensor at the time of measurement capture in decimal degrees; a positive value indicates a northern coordinate.	decimal degrees
Longitude	Longitude of STOX sensor at the time of measurement capture in decimal degrees; a negative value indicates a western coordinate.	decimal degrees
Cruise	Cruise ID from which the CTD mounted STOX sensor was deployed.	unitless
Station	Station ID associated with the CTD cast.	unitless
Cast	Cast number associated with the CTD cast.	unitless
Depth	Depth at which measurement was captured.	meters (m)
Temperature	Temperature measurement recorded by the ship's CTD.	degrees Celcius (c)
Salinity	Salinity measurement recorded by the ship's CTD.	PSU
Oxygen_SBE	Oxygen measured by the Seabird CTD on the ship's CTD.	micromoles per kg (umol/kg)
Oxygen_STOX	Oxygen measured by the STOX sensor on the ship's CTD.	micromoles per kg (umol/kg)
STOX_SD	Standard deviation of STOX data.	micromoles per kg (umol/kg)
STOX_n	Number of samples averaged into STOX data.	count
SourceFileName	Original file name from which the BCO-DMO prmary data file (984383_v1_sally_ride_stox_oxygen_progiles.csv) was compiled.	unitless

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Deployments

SR2011

Website	https://www.bco-dmo.org/deployment/955215
Platform	R/V Sally Ride
Start Date	2020-12-16
End Date	2021-01-06
Description	More information is available from R2R: https://www.rvdata.us/search/cruise/SR2011

SR2114

Website	https://www.bco-dmo.org/deployment/931391
Platform	R/V Sally Ride
Start Date	2021-12-23
End Date	2022-01-21
Description	Additional cruise information is available from R2R: https://www.rvdata.us/search/cruise/SR2114

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Project Information

Collaborative Research: Multiyear autonomous measurement of N-loss in the ETNP ODZ (N-loss in the ETNP ODZ)

NSF Award Abstract:
Several regions of the deep ocean naturally contain almost no oxygen. Because of this lack of oxygen, microbes living in these regions live in ways that differ from those in oxygenated waters consuming nitrate ions instead of oxygen for respiration. Use of nitrate for microbial respiration results in the production of nitrogen gas which is called denitrification. The resulting removal of nitrate has consequences for the whole ocean as nitrogen is an important nutrient controlling plant growth; however, whereas plants can use nitrogen in the form of nitrate, they cannot, with a few exceptions, use nitrogen gas. There remains a number of uncertainties regarding how much denitrification occurs in the ocean, what controls it, and how it varies in time and space. Traditional studies of ocean denitrification have been limited by the time ships can be at sea and the relatively small proportion of the ocean they can observe. Our project plans to remedy this problem by using vehicles called floats that can operate autonomously in the ocean for three years or more as they drift with currents over hundreds of kilometers. We will outfit ten floats with sensors to measure oxygen and nitrogen gas which will be placed throughout the oxygen-depleted region of the Pacific Ocean to the west of Mexico. This is the largest such region in the ocean from which we have two years of results from a prototype float which validated our approach. This study may well transform our understanding of ocean denitrification and ultimately benefit society as a whole through greater confidence in predictions of the ocean's nitrogen cycle and capacity to fix carbon dioxide under current and future conditions. Application and further development of float systems using commercially available technology will directly benefit successor studies, and more broadly showcase the use of water-following platforms to tackle difficult oceanographic problems. Advances from this study are expected to carry over to other disciplines including ocean biogeochemical modeling. Outreach activities, support for an early career scientist, and student training are included in the project. For the outreach activities, the investigators plan to tie into well-established after-school programs serving underrepresented populations in Massachusetts and established opportunities for public presentations using float related display materials at the University of Washington.

Oxygen deficient zones (ODZs), despite constituting a small fraction of total oceanic volume, play important roles in regulating global ocean carbon and nitrogen cycles including hosting 30 to 50% of the global loss of fixed nitrogen. Unfortunately, current uncertainty in ODZ nitrogen loss derives from substantial temporal and spatial variability in rates that remain under-sampled by ship-based measurements. While local regulation of nitrogen loss by oxygen and organic matter availability are well accepted, temporal/spatial variability in the nitrogen flux is likely a result of the influence of physical forcings such as remote ventilation, seasonal variability, and mesoscale eddies. Understanding how the impact of physical forcings on nitrogen loss as mediated through oxygen and organic flux will be required to fully understand the causes and consequences of any future ODZ expansion. To improve our understanding of ODZ nitrogen loss, we will carry out a multiyear, autonomous float-based observational program to address outstanding questions regarding bioavailable nitrogen loss in ODZs. As the largest ODZ and region of our pilot deployments, our operation area will be the Eastern Tropical N. Pacific (ETNP) where our study will determine over a multi-year period, in-situ nM-level oxygen and biogenic nitrogen on float profiles spanning geographic gradients in oxygen and surface productivity. For the first time, our study will also determine in situ nitrogen loss rates from changes in

nitrogen concentration during 1 to 2 week Lagrangian float drifts along a constant density surface. A pilot 2 yr float deployment in the ETNP documents our ability to do so. Critically, our float-based approach more closely matches the frequency and distribution of observations to the expected variability in biogenic nitrogen production as compared to prior work and will dramatically increase the data density for this region by acquiring >500 profiles/drifts for nitrogen and >1000 profiles for nM oxygen.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1154741
NSF Division of Ocean Sciences (NSF OCE)	OCE-1153295
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851361
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851210
Office of Naval Research (ONR)	N00014-20-1-2849

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