

Sensor data from the conventional (ODF) CTD rosette on the US GEOTRACES GP17-ANT cruise in the Amundsen Sea on RVIB Nathaniel B. Palmer (NBP2401) from November 2023 to January 2024

Website: <https://www.bco-dmo.org/dataset/1009934>

Data Type: Cruise Results

Version: 1

Version Date: 2026-10-16

Project

» [US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin \(GP17-ANT\)](#) (GP17-ANT)

Program

» [U.S. GEOTRACES](#) (U.S. GEOTRACES)

Contributors	Affiliation	Role
Sedwick, Peter N.	Old Dominion University (ODU)	Principal Investigator
Anderson, Robert F.	Lamont-Doherty Earth Observatory (LDEO)	Co-Principal Investigator
Lam, Phoebe J.	University of California-Santa Cruz (UCSC)	Co-Principal Investigator
Sherrell, Robert M.	Rutgers University	Co-Principal Investigator
Giulivi, Claudia	Lamont-Doherty Earth Observatory (LDEO)	Scientist
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset comprises the sensor data from conventional CTD rosette ("ODF rosette") deployments in the Amundsen Sea and adjacent Southern Ocean during US GEOTRACES cruise GP17-ANT (RVIB Nathaniel B. Palmer cruise NBP24-01) in December 2023 and January 2024. The clean, processed sensor data from the ODF rosette downcasts are averaged (binned) over 2-decibar pressure intervals. The averaged data include sensor-based measurements of temperature, salinity, dissolved oxygen concentration, beam transmission (uncalibrated), chlorophyll fluorescence (uncalibrated), and turbidity (uncalibrated). The sensor data were processed and compiled by personnel of the Scripps Institution of Oceanography Oceanographic Data Facility (SIO-ODF).

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [BCO-DMO Curation Notes](#)
 - [Problem Description](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

Coverage

Location: Amundsen Sea sector of Southern Ocean

Spatial Extent: N:-66.9247 E:-99.6089 S:-74.3808 W:-133.026

Temporal Extent: 2023-12-08 - 2024-01-13

Methods & Sampling

Water-column sensor data were collected during downcast deployments of a conventional CTD rosette ("ODF rosette") system. The ODF rosette casts were performed using a 36-bottle rosette frame, a 36-place carousel and 36 x 10.6 liter (L) Bullister-style Niskin sampler bottles. The system included a SeaBird Electronics (SBE) housing unit with pressure sensor, temperature sensors, conductivity sensors and membrane oxygen sensor, as well as a transmissometer, chlorophyll-a fluorometer, altimeter and turbidity sensor. The package was deployed on a conducting steel hydrowire using the winch in the Baltic Room of RVIB Nathaniel B. Palmer. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024) and in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Instrumentation Details:

The ODF rosette casts were performed with a package consisting of a 36-bottle rosette frame and carousel, and 36 (plus spares) x 10.6 L Bullister-style Niskin bottles. Underwater electronic components consisted of an SBE-9plus housing unit with Digiquartz pressure sensor, dual SBE-3plus temperature sensors and SBE-4C conductivity sensors, an SBE-43 membrane oxygen sensor, SBE-35 reference thermometer, JFE-Advantech RINKO oxygen optode, WetLabs C-Star transmissometer, ECO-FL-RTD chlorophyll-a fluorometer, Valeport VA500 altimeter, and SeaPoint turbidity sensor.

The CTD pressure, temperature, conductivity, and oxygen sensors were calibrated prior to the cruise, whereas the transmissometer was calibrated before the start and after the end of science operations. The CTD data acquisition system consisted of an SBE-11plus (V1) deck unit and a networked generic PC workstation running Windows 10. SBE SeaSave7 v.7.26.7.121 software was used for data acquisition and to close bottles on the rosette. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Note: Cruise reports are attached as Supplemental Files and available at <https://usgeotraces.ideo.columbia.edu/content/gp17-ant>.

Data Processing Description

Shipboard CTD data processing was performed after deployment using SIO/ODF CTD processing software ctdcal v. 0.1.4b. CTD acquisition data were copied onto a Macintosh OS X system, then processed, and a downcast pressure series of sensor measurements averaged over 2-decibar pressure bins created. The pressure-series dataset was submitted for CTD data distribution after corrections were applied. The CTD data were examined at the completion of each deployment for clean corrected sensor response and any calibration shifts. As bottle salinity and oxygen results became available (see GEOTRACES GP17-ANT Bottle Data for Nutrients and Hydrographic Parameters), they were used to refine conductivity and oxygen sensor calibrations. Temperature, salinity and dissolved oxygen comparisons were made between downcasts and upcasts, as well as between groups of adjacent deployments. Further details of the CTD data processing are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

BCO-DMO Curation Notes

This section documents curation actions performed prior to publication review with the submitter, and additional information relevant to understanding and reusing this dataset. It distinguishes changes made to the submitted (meta)data from unresolved issues and/or enhancements that improve future reuse and interoperability.

CURATION ACTIONS PERFORMED ON DATA

- Imported all 58 CTD cast files (.csv) into the BCO-DMO data processing system.
- Treated row 13 as header, skipped row 14 (units row); captured metadata key value lines (rows above header) into new columns EXPCODE, SECT_ID, STNNBR, CASTNO, DATE, TIME, LATITUDE, LONGITUDE, INSTRUMENT_ID, and cast_depth via regex pattern matching.
- Concatenated all 58 files into a single table, mapping identical column names across tables and adding a file_name column captured from each source file name.
- Filtered out END_DATA sentinel rows (removed rows where CTDPRS equals 'END_DATA').
- Converted combined DATE (format %Y%m%d) and TIME (format %H%M) columns into a new ISO_DateTime_UTC string column in ISO 8601 UTC format (%Y-%m-%dT%H:%M).
- Reordered columns.
- Saved the final file as "1009934_v1_gp17-ant_odf_ctd.csv".

CURATION ACTIONS PERFORMED ON METADATA

- BCO-DMO's standard metadata entry and text formatting steps were performed. See: <https://www.bco->

ISSUES POTENTIALLY IMPACTING REUSE

- N/A

Problem Description

The CTD data analysis was impacted by a number of issues with the temperature, conductivity, and oxygen sensors, with further details provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

The data quality flags used for the CTD sensor parameters are as follows:

- 1: Not calibrated.
- 2: Acceptable measurement.
- 3: Questionable measurement.
- 4: Bad measurement.
- 5: Not reported.
- 6: Interpolated over a pressure interval larger than 2 dbar (typically applies to values for 0-2 dbar or 2-4 dbar).
- 7: Despiked.
- 9: Not sampled.

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
EXPOCODE	cruise Expocode number	unitless
SECT_ID	cruise identifier	unitless
STNNBR	station number	unitless
CASTNO	CTD cast number	unitless
ISO_DateTime_UTC	Date and time (UTC) of CTD cast at bottom in ISO 8601 format	unitless
DATE	CTD cast at bottom date	unitless
TIME	CTD cast at bottom time	unitless
LATITUDE	CTD cast at bottom latitude	decimal degrees

LONGITUDE	CTD cast at bottom longitude	decimal degrees
INSTRUMENT_ID	INSTRUMENT_ID = 569 (ODF rosette)	unitless
cast_depth	CTD cast maximum depth	meters
CTDPRS	pressure defining upper boundary of 2-decibar bin over which sensor readings are averaged	decibar
CTDTMP	processed sensor temperature (ITS-90 scale) averaged over 2-dbar pressure bin	degrees Celsius
CTDTMP_FLAG_W	data quality flag for CTDTMP (see Problems/Issues for quality flag definitions)	unitless
CTDSAL	processed sensor salinity (PSS-78 scale) averaged over 2-dbar pressure bin	unitless
CTDSAL_FLAG_W	data quality flag for CTDSAL (see Problems/Issues for quality flag definitions)	unitless
CTDOXY	processed sensor measurements of dissolved oxygen concentration ($\mu\text{mol kg}^{-1}$) averaged over 2-dbar pressure bin	micromoles per kilogram
CTDOXY_FLAG_W	data quality flag for CTDOXY (see Problems/Issues for quality flag definitions)	unitless
CTDXMISS	processed uncalibrated measurements of beam transmission (0-5 volt DC scale) averaged over 2-dbar pressure bin	volts
CTDXMISS_FLAG_W	data quality flag for CTDXMISS (see Problems/Issues for quality flag definitions)	unitless
CTDFLUOR	processed uncalibrated measurements of chlorophyll-a fluorescence (0-5 volt DC scale) averaged over 2-dbar pressure bin	volts
CTDFLUOR_FLAG_W	data quality flag for CTDFLUOR (see Problems/Issues for quality flag definitions)	unitless
CTDTURB	processed uncalibrated measurements of turbidity (0-5 volt DC scale) averaged over 2-dbar pressure bin	volts
CTDTURB_FLAG_W	data quality flag for CTDTURB (see Problems/Issues for quality flag definitions)	unitless

file_name	name of the original CTD file for the cast	unitless
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[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	JFE-Advantech RINKO oxygen optode
Generic Instrument Name	JFE Advantech Rinko III {ARO-CAV} oxygen sensor
Generic Instrument Description	A fast-response optical dissolved oxygen and temperature sensor. The DO sensor is coated with photostimulable phosphor (PSP) on the outside of the pressure-resistant acrylic optical window, measuring phosphorescence quenching phase shift. The excitation blue LED pulse generates a red phosphorescence pulse, which in turn has an inverse correlation with the oxygen partial pressure in the water. It is an analogue output version. It has a response time of less than 1 second in air, enabling dissolved oxygen measurements with continuous profiling at high speeds. The dissolved oxygen sensor has a non-linear accuracy of +/-2% of full scale (at 1atm, 25 deg C) and the temperature sensor +/-0.02 deg C. It has a pressure rating of 7000 m.

Dataset-specific Instrument Name	36 x 10.6 L Bullister-style Niskin sampler bottles
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	SBE-35 reference thermometer
Generic Instrument Name	Sea-Bird SBE 35 thermometer
Generic Instrument Description	An oceanographic thermometer with a measurement range of -5 to +35 deg C; an initial accuracy of 0.001 deg C; and a resolution of 0.000025 deg C. The sensor is an ultra-stable aged thermistor with a drift rate of less than 0.001deg C per year. It can be used both in fixed point cells and at depths up to 6800 metres in combination with an SBE water sampling carousel.

Dataset-specific Instrument Name	SBE-43 membrane oxygen sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. More information from the manufacturer: https://www.seabird.com/products/sbe-43-dissolved-oxygen-sensor

Dataset-specific Instrument Name	conventional ODF rosette system
Generic Instrument Name	Sea-Bird SBE 911plus CTD
Dataset-specific Description	The ODF rosette casts were performed with a package consisting of a 36-bottle rosette frame and carousel, and 36 (plus spares) x 10.6 L Bullister-style Niskin bottles. Underwater electronic components consisted of an SBE-9plus housing unit with Digiquartz pressure sensor, dual SBE-3plus temperature sensors and SBE-4C conductivity sensors, an SBE-43 membrane oxygen sensor, SBE-35 reference thermometer, JFE-Advantech RINKO oxygen optode, WetLabs C-Star transmissometer, ECO-FL-RTD chlorophyll-a fluorometer, Valeport VA500 altimeter, and SeaPoint turbidity sensor. The CTD data acquisition system consisted of an SBE-11plus (V1) deck unit and a networked generic PC workstation running Windows 10. SBE SeaSave7 v.7.26.7.121 software was used for data acquisition and to close bottles on the rosette.
Generic Instrument Description	[tethered, real-time] The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	SeaPoint turbidity sensor
Generic Instrument Name	Seapoint Turbidity Meter
Generic Instrument Description	The Seapoint Turbidity Meter detects light scattered by particles suspended in water, generating an output voltage proportional to turbidity or suspended solids.

Dataset-specific Instrument Name	Valeport VA500 altimeter
Generic Instrument Name	Valeport VA500 altimeter
Generic Instrument Description	A titanium-housed acoustic altimeter used for underwater positioning to determine distance to or height above the seabed. Can be mounted and used on ROVs, AUVs, and other such platforms for various underwater construction and hydrographic applications. The VA500 features a 500kHz broadband transducer offering a range of 0.1m to 100m, a resolution of 1mm and a beam angle +/- 3 degrees. It features RS232 and RS485 digital output as standard, and is supplied with free DataLog X2 software for instrument setup and data display. An optional Valeport miniIPS pressure sensor can be added. The pressure sensor is a temperature compensated piezo-resistive sensor with various ranges available, an accuracy +/- 0.01 percent FS, and a resolution of 0.001 percent FS. The VA500 is depth-rated to 6000m.

Dataset-specific Instrument Name	WetLabs C-Star transmissometer
Generic Instrument Name	WET Labs {Sea-Bird WETLabs} C-Star transmissometer
Generic Instrument Description	The C-Star transmissometer has a novel monolithic housing with a highly integrated opto-electronic design to provide a low cost, compact solution for underwater measurements of beam transmittance. The C-Star is capable of free space measurements or flow-through sampling when used with a pump and optical flow tubes. The sensor can be used in profiling, moored, or underway applications. Available with a 6000 m depth rating. More information on Sea-Bird website: https://www.seabird.com/c-star-transmissometer/product?id=60762467717

Dataset-specific Instrument Name	ECO-FL-RTD chlorophyll-a fluorometer
Generic Instrument Name	WET Labs {Sea-Bird WETLabs} ECO FL(RT)D fluorometer
Generic Instrument Description	A single-channel fluorometer used to measure fluorescence from chlorophyll-a, CDOM, uranine, rhodamine, phycocyanin and phycoerythrin in marine environments. The (RT) in the designation signifies both an analog and RS-232 serial output with an approximate 16,300-count range. The D designation signifies this instrument is depth rated to 6000 m. This 'Real Time' instrument is able to provide continuous operation when powered. The fluorometer can measure phytoplankton chlorophyll-a concentrations in the range 0-125 ug/l, with a sensitivity of 0.02 ug/l. The instrument can operate over the temperature range 0-30 degC.

[[table of contents](#) | [back to top](#)]

Deployments

NBP2401

Website	https://www.bco-dmo.org/deployment/969543
Platform	RVIB Nathaniel B. Palmer
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/nathanielbpalmer_nbp2401.pdf
Start Date	2023-11-29
End Date	2024-01-28
Description	See more information at: R2R https://www.rvdata.us/search/cruise/NBP2401 BODC https://www.bodc.ac.uk/resources/inventories/cruise_inventory/report/18091/ US GEOTRACES https://usgeotraces.ideo.columbia.edu/content/gp17-ant Description: The U.S. GEOTRACES GP17-ANT expedition departed Punta Arenas, Chile on November 29th, 2023 and arrived in Lyttelton, New Zealand on January 28th, 2024. The cruise took place in the Amundsen Sea aboard the R/V Nathaniel B. Palmer with a team of 35 scientists led by Peter Sedwick (Old Dominion University), Phoebe Lam (University of California, Santa Cruz), and Robert Sherrell (Rutgers University). GP17 was planned as a two-leg expedition, with its first leg (GP17-OCE) as a southward extension of the 2018 GP15 Alaska-Tahiti expedition and this second leg (GP17-ANT) into coastal and shelf waters of Antarctica's Amundsen Sea.

[[table of contents](#) | [back to top](#)]

Project Information

US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin (GP17-ANT) (GP17-ANT)

Website: <https://www.geotraces.org/>

Coverage: Amundsen Sea Sector of the Antarctic Continental Margin

U.S. GEOTRACES extended its meridional transect, initiated on the 2018 GP15 Alaska-Tahiti expedition, south to the Antarctic ice edge and then east to Chile with GP17-OCE (December 2022 - January 2023). Because of the potentially important trace elements and isotopes (TEIs) inputs and transformations occurring in Antarctic waters and shelves, GP17 also had a second leg, GP17-ANT (November 29, 2023 - January 30, 2024) into coastal and shelf waters of Antarctica's Amundsen Sea. Further information is available on the [US GEOTRACES website](https://www.geotraces.org/).

NSF Project Title: Collaborative Research: Management and Implementation of US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin (GP17-ANT)

NSF Award Abstract:

This project will support the management and implementation of a 60-day research cruise to the Amundsen Sea sector of the Antarctic continental margin to collect samples for measurements of a broad suite of trace elements and isotopes ('TEIs'), as part of the U.S. GEOTRACES program. GEOTRACES is a global effort in the field of Chemical Oceanography, the goal of which is to understand the distributions of trace elements and their isotopes in the ocean. Determining the distributions of these elements and isotopes will increase the understanding of processes that shape their distributions and also the processes that depend on these elements. Key TEIs include essential micronutrients such as iron and zinc; 'tracers' such as aluminum, manganese, and isotopes of nitrogen, thorium and neodymium that can be used to investigate modern and ancient ocean processes; and elements such as lead that are indicative of human activities. In the Southern Ocean, the Antarctic continental margins are important as sources of micronutrient trace elements such as iron, which is required to support biological production and carbon export over the Antarctic shelf and in offshore waters of the Antarctic Circumpolar Current. Moreover, these regions are experiencing rapid environmental changes that are expected to impact oceanic circulation and biogeochemical cycles, for which TEIs provide crucial data needed to test and refine numerical models of the Earth system. The Amundsen Sea sector holds particular interest because of the pronounced, decadal-scale increases in the melting rates of glacial ice shelves that border the region, driven by intrusions of warm Circumpolar Deep Water onto the continental shelf. This melting has potentially major impacts on global sea level, on the formation of Antarctic Bottom Water in the Ross Sea, and on the regional ecosystem.

The cruise will comprise essential sampling operations (collection and shipboard processing) and ancillary measurements (hydrography, nutrients, algal pigments) in support of multiple, individual science projects, following the successful model of previous U.S. GEOTRACES cruises in the Atlantic, Pacific and Arctic ocean basins. The cruise will sample the ocean region between 100°W and 135°W, with stations ranging from 67°S in the Antarctic Circumpolar Current southward to the Amundsen Sea continental shelf, including stations adjacent to several rapidly melting ice shelves and in highly-productive shelf polynyas. Water column samples will be collected using conventional and trace-metal clean CTD-rosette systems, in-situ high-volume pumps, and a towed fish sampler or small boat, using established methods. Sampling time will also be provided for collection of sea ice, floating glacial ice, and seafloor sediments. To facilitate coordination with a complementary open-ocean cruise and ensure access to the study region to document the impact of biological processes, the cruise is planned for late austral summer (late January-late March). Beyond the disciplinary contributions, the proposed research will contribute knowledge concerning the cryosphere and its impacts on global sea level and ocean circulation, regional ecosystems and biological processes, ocean-atmosphere interactions, and past and future environmental change. The project will contribute to STEM education and outreach through the participation of an NSF-funded PolarTREC education professional, and a K-12 STEM program for students from underserved and underrepresented schools run by Rutgers University education specialists. To foster public engagement, the investigators will partner with the UCSC Science Communication Program to engage freelance science journalists to profile research in this spectacular and harsh Antarctic environment.

[[table of contents](#) | [back to top](#)]

Program Information

U.S. GEOTRACES (U.S. GEOTRACES)

Website: <http://www.geotraces.org/>

Coverage: Global

GEOTRACES is a [SCOR](#) sponsored program; and funding for program infrastructure development is provided by the [U.S. National Science Foundation](#).

GEOTRACES gained momentum following a special symposium, S02: Biogeochemical cycling of trace elements and isotopes in the ocean and applications to constrain contemporary marine processes (GEOSECS II), at a 2003 Goldschmidt meeting convened in Japan. The GEOSECS II acronym referred to the Geochemical Ocean Section Studies To determine full water column distributions of selected trace elements and isotopes, including their concentration, chemical speciation, and physical form, along a sufficient number of sections in each ocean basin to establish the principal relationships between these distributions and with more traditional hydrographic parameters;

- * To evaluate the sources, sinks, and internal cycling of these species and thereby characterize more completely the physical, chemical and biological processes regulating their distributions, and the sensitivity of these processes to global change; and

- * To understand the processes that control the concentrations of geochemical species used for proxies of the past environment, both in the water column and in the substrates that reflect the water column.

GEOTRACES will be global in scope, consisting of ocean sections complemented by regional process studies. Sections and process studies will combine fieldwork, laboratory experiments and modelling. Beyond realizing the scientific objectives identified above, a natural outcome of this work will be to build a community of marine scientists who understand the processes regulating trace element cycles sufficiently well to exploit this knowledge reliably in future interdisciplinary studies.

Expand "Projects" below for information about and data resulting from individual US GEOTRACES research projects.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Antarctic Sciences (NSF ANT)	ANT-2023214
NSF Antarctic Sciences (NSF ANT)	ANT-2023230
NSF Antarctic Sciences (NSF ANT)	ANT-2023363

[[table of contents](#) | [back to top](#)]