ASPIRE station data used to develop 1-D and 3-D numerical models from the Nathaniel B. Palmer in the Amundsen Sea from 2010-12-14 through 2011-01-05

Website: https://www.bco-dmo.org/dataset/765081
Data Type: Cruise Results
Version: 1
Version Date: 2019-04-17

Project
» Collaborative Research: Investigating the Role of Mesoscale Processes and Ice Dynamics in Carbon and Iron Fluxes in a Changing Amundsen Sea (INSPIRE) (INSPIRE)

Contributors	Affiliation	Role
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Abstract
Hydrographic profiles and discrete water samples were collected from each station using a conventional shipboard conductivity-temperature-depth (CTD; Sea-Bird 911+) sensor and a 24 × 10 L Niskin bottle rosette sampler (General Oceanics). Potential temperature (θ) and salinity (S) were recorded continuously as a function of depth and at the moment of Niskin bottle closure (see Yager et al., 2016). Trace-metal samples were collected similarly using a trace-metal-clean CTD-rosette system (see Sherrell et al., 2015) that was deployed at the same location just before or after the conventional CTD.

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Coverage

Spatial Extent: **N**:-72.72 **E**:-112 **S**:-73.97 **W**:-118.03
Temporal Extent: 2010-12-14 - 2011-01-05

Dataset Description

Hydrographic profiles and discrete water samples were collected from each station using a conventional shipboard conductivity-temperature-depth (CTD; Sea-Bird 911+) sensor and a 24 × 10 L Niskin bottle rosette sampler (General Oceanics). Potential temperature (θ) and salinity (S) were recorded continuously as a function of depth and at the moment of Niskin bottle closure (see Yager et al., 2016).

Trace-metal samples were collected similarly using a trace-metal-clean CTD-rosette system (see Sherrell et al., 2015) that was deployed at the same location just before or after the conventional CTD.

Methods & Sampling

Dissolved inorganic nutrient samples were pre-filtered through 0.45-µm polycarbonate syringe filters, kept refrigerated, and analyzed onboard the ship within 1 day of sampling. Nitrate (NO_3^-), nitrite (NO_2^-), ammonium (NH_4^+), phosphate (HPO_4^{2-}), and silicic acid ($Si(OH)_4$) were measured using a five-channel Lachat Instruments QuikChem FIA+ 8000s series autoanalyzer in conjunction with a Lachat Instruments XYZ AutoSampler (ASX-500 Series), two Lachat Instruments RP-100 Series peristaltic Reagent Pumps, and Omnion Software, version 3.0.220.02.

Seawater samples were analyzed for dissolved Fe over the period of January to August 2012, using an automated flow injection ICP-MS method developed at Rutgers University (Lagerström et al., 2013). Briefly, the automated device loaded a 9 mL aliquot of seawater, buffered online to pH 7.0 with 3 mL of acetic acid/ammonium hydroxide buffer, onto a column packed with Nobias PA1 chelating resin (Hitachi High-Technologies). The column was eluted with 1.5 M nitric acid directly into the nebulizer of an Element-1 sector field ICP-MS (Thermo-Finnigan, Bremen, Germany). The eluate, a 200-fold concentrate of the sample, was analyzed in medium resolution and temporal peak integration was performed in Matlab using a script written in-house. Quantification was carried out using isotope dilution (Fe, Ni, Cu and Zn) or a matrix-matched external standard curve (Mn).

Samples for particulate organic carbon (POC) and nitrogen (PN) were collected by cleanly filtering 100–600 mL of seawater onto a 25-mm diameter, combusted GF/F filter (nominal pore size of 0.7 µm) which was then folded sample side in and frozen at −80°C. Samples were processed at Rutgers University and analyzed using a Carlo-Erba CHN analyzer (Hedges and Stern, 1984).

Water column Chl a concentration (used as a proxy for algal biomass) was measured onboard ship using acetone extraction and a spectrofluorometer (Alderkamp et al., 2015). Shipboard values were calibrated against a second set of samples collected similarly, flash-frozen in liquid N2, stored at −80°C, and analyzed at Mote Marine Lab using HPLC (Wright et al., 1991; see Alderkamp et al., 2015).

Data Processing Description

BCO-DMO Processing Notes:
- combined data files on columns LocalDate, Station, and Depth
- appended latitude and longitude coordinates for each station
- sorted data by LocalDate, Station, Depth
- added conventional header with dataset name, PI name, version date

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Data Files

File
combined.csv (Comma Separated Values (.csv), 12.21 KB) MD5:bab82fc18adae4a0ff01a06b10aab864 Primary data file for dataset ID 765081

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Related Publications

Alderkamp, A.-C., van Dijken, G. L., Lowry, K. E., Connelly, T. L., Lagerström, M., Sherrell, R. M., … Arrigo, K. R. (2015). Fe availability drives phytoplankton photosynthesis rates during spring bloom in the Amundsen Sea Polynya, Antarctica. Elementa: Science of the Anthropocene, 3, 000043. doi:10.12952/journal.elementa.000043 *Results*

Sherrell, R. M., Lagerström, M. E., Forsch, K. O., Stammerjohn, S. E., & Yager, P. L. (2015). Dynamics of

dissolved iron and other bioactive trace metals (Mn, Ni, Cu, Zn) in the Amundsen Sea Polynya, Antarctica. Elementa: Science of the Anthropocene, 3, 000071. doi:10.12952/journal.elementa.000071
Results

St-Laurent, P., Yager, P. L., Sherrell, R. M., Stammerjohn, S. E., & Dinniman, M. S. (2017). Pathways and supply of dissolved iron in the Amundsen Sea (Antarctica). Journal of Geophysical Research: Oceans, 122(9), 7135–7162. doi:10.1002/2017jc013162 https://doi.org/10.1002/2017JC013162
Methods

St-Laurent, P., Yager, P. L., Sherrell, R. M., Oliver, H., Dinniman, M. S., & Stammerjohn, S. E. (2019). Modeling the Seasonal Cycle of Iron and Carbon Fluxes in the Amundsen Sea Polynya, Antarctica. Journal of Geophysical Research: Oceans, 124(3), 1544–1565. doi:10.1029/2018jc014773 https://doi.org/10.1029/2018JC014773
Methods

Yager, P., Sherrell, R., Stammerjohn, S., Ducklow, H., Schofield, O., Ingall, E., … van Dijken, G. (2016). A carbon budget for the Amundsen Sea Polynya, Antarctica: Estimating net community production and export in a highly productive polar ecosystem. Elementa: Science of the Anthropocene, 4, 000140. doi:10.12952/journal.elementa.000140
Results

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Parameters

Parameter	Description	Units
Station	ASPIRE station identifier	unitless
LocalDate	Date of ASPIRE sampling in yyyy-mm-dd format	unitless
Depth	Depth of sampling	meters (m)
Chla	Chlorophyll a concentration	miligram per meter cubed (mg m-3)
DissFe	Particulate organic nitrogen.	milimole per meter cubed (mmol m-3)
TotalDIN	Total dissolved inorganic nitrogen	milimole per meter cubed (mmol m-3)
PON	Particulate organic nitrogen.	mmol m-3
lons	longitude with east values positive	decimal degrees
lats	latitude with north values positive	decimal degrees

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Instruments

Dataset-specific Instrument Name	Carlo-Erba CHN analyzer
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	Samples were processed at Rutgers University and analyzed using a Carlo-Erba CHN analyzer (Hedges and Stern, 1984).
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	Sea-Bird 911+
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Hydrographic profiles and discrete water samples were collected from each station using a conventional shipboard conductivity-temperature-depth (CTD; Sea-Bird 911+) sensor.
Generic Instrument Description	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	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	24 × 10 L Niskin bottle rosette sampler (General Oceanics)
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	Lachat Instruments QuikChem FIA+ 8000s series autoanalyzer
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Nitrate (NO3−), nitrite (NO2−), am- monium (NH4+), phosphate (HPO42−), and silicic acid (Si(OH)4) were measured using a five-channel Lachat Instruments QuikChem FIA+ 8000s series autoanalyzer in conjunction with a Lachat Instruments XYZ AutoSampler (ASX-500 Series)
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

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Deployments

NBP1005

Website	https://www.bco-dmo.org/deployment/58154
Platform	RVIB Nathaniel B. Palmer
Start Date	2010-11-26
End Date	2011-01-16
Description	Expedition by the USAP RV Nathaniel B. Palmer during austral summer 2010-11 to sampled the Amundsen Sea Polynya during the Amundsen Sea Polynya International Research Expedition (ASPIRE). Also identified as OSO 2010-11 (Oden Southern Ocean – two vessel operation 2010-11) The US Research Icebreaker Nathaniel B. Palmer was joined by the Swedish Icebreaker Oden for a two-vessel expedition to the Amundsen Sea. Scientists on the Palmer focused on understanding the climate-sensitive dynamics of the open water region, known as a "polynya." Oden scientists investigated the sea ice ecosystem nearby. The aim of both groups was to improve our understanding of how climate change will impact this important ecosystem. Note R2R Link takes user to Marine Geoscience Data System (MGDS):NBP1005NBP1005A Data at MGDS were available as NBP1005 and NBP1005A. The data are from the same expedition and are combined in BCO-DMO into the one deployment - NBP1005. Nathaniel B. Palmer Systems and Specifications

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Project Information

Collaborative Research: Investigating the Role of Mesoscale Processes and Ice Dynamics in Carbon and Iron Fluxes in a Changing Amundsen Sea (INSPIRE) (INSPIRE)

Coverage: The study area is the continental shelf of the Amundsen Sea, Antarctica, 71-75S, 100-130W.

The Amundsen Sea, in the remote Pacific sector of the Southern Ocean, is one of the least well studied Antarctic continental shelf regions. It shares characteristics in common with other Antarctic ice shelf regions, but exhibits unique aspects also. The Amundsen Sea Polynya (ASP), an open region at the base of several of the terminal glaciers draining the West Antarctic Ice sheet exhibits: 1) large intrusions of heat delivered from the warming modified circumpolar deep water (mCDW) rising up onto the continental shelf, 2) the fastest melting ice sheets in Antarctica, 3) the most productive coastal polynya (161 g C m-2) together with a significant atmospheric CO2 sink, and 4) some of the most rapidly declining regions of seasonal off-shore sea ice on Earth.

Following on from an earlier oceanographic field program, the Amundsen Sea Polynya International Research Expedition (ASPIRE; 2011), this study seeks to better synthesize and model the relative contributions of both physical ocean-ice linkages and biological production and carbon export terms and to compare these with other circumpolar Antarctic regions. A central feature will be the use of a regionally coupled physical-biogeochemical model to follow the dynamics of the large phytoplankton blooms that occur annually in the Amundsen Sea Polyna. This study will provides a means to locate the Amundsen Sea properties along the continuum of Antarctic ice shelf systems, and to understand how these system might change in response to climate change.

Pedagogical techniques will be used to provide educational outreach for three distinct target populations: secondary students, pre-service science teachers, and in-service science teachers. Partnerships will be developed with science teacher educators to implement the STEM career-development lessons in undergraduate and graduate level science teacher education courses.

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Funding

Funding Source	Award
NSF Antarctic Sciences (NSF ANT)	ANT-0839069
NSF Antarctic Sciences (NSF ANT)	ANT-0944727
NSF Antarctic Sciences (NSF ANT)	ANT-0839012
NSF Antarctic Sciences (NSF ANT)	ANT-0838995
NSF Antarctic Sciences (NSF ANT)	ANT-0838975
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443657
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443604
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443315
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443569

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