CTD profile data from R/V Melville cruise MV1310 in the North Pacific Gulf of Alaska; 48N to 59N and 129W to 153W in 2013 (North Pacific RDOC project)

Website: https://www.bco-dmo.org/dataset/527102
Version: 1
Version Date: 2014-09-02

Project
» Characterizing a refractory DOC sink in the deep northern North Pacific (North Pacific RDOC)
» Quantifying the Photochemical Reactivity of Deep Ocean Water (DORC PhotoChem)

Program
» United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)

Contributors	Affiliation	Role
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Dataset Description

'Continuous' data from the CTD sensors, binned to 1 meter intervals from MV1310 cruise

Methods & Sampling

Sampling and Analytical Methodology:
A single SBE9*plus* CTD (S/N 831) was used for all casts and was deployed with all sensors and pumps as recommended by SBE. In situ salinity and dissolved oxygen check samples were collected to calibrate conductivity and dissolved oxygen sensors (see MV1310 Preliminary Cruise Report).

The primary conductivity and temperature sensors failed on the up-casts of stations 19, 21-27 and on the down-cast of stations 28 and 29. The secondary sensors were chosen for consistent reporting.

In addition to the 0.0073 second temperature and conductivity standard alignment factor an offset of 0.08 seconds was applied for each station and sensor configuration.

On casts 1/1, 2/1, 3/1, 3/2, 10/1, 12/2, 13/1, 14/1, 15/1, 17/2, 17/3, 17/4, 21/1, 33/1 the temperature, conductivity or oxygen sensors had not stabilized before casts had started. A delayed start was applied to the cast pressure sequence to reduce spiking and smooth fits from surface. No more than 10 m of surface data was interpolated from any of the aforementioned casts.

CTD Pressure: Paroscientific Digiquartz pressure transducer (S/N 831-99677) last calibrated in November 2012 at the SIO/STS Calibration Facility. Residual pressure offsets indicated that an offset of -0.84350 dbar be applied to pressure sensor calibration.

CTD Temperature: A SBE35RT Digital Reversing Thermometer sensor was not used, therefore only standard laboratory calibrations were used for T1 and T2 sensors. The secondary sensors were chosen for consistency. An offset observed in cast 12/3 was adjusted based on data from adjacent casts at the same station. Sensors used: The SBE3plus secondary (T2/03-2309) was swapped for (T2/03-4307) after cast 12/1. The SBE3plus secondary (T2/03-4307) was swapped for (T2/03-2309) after cast 12/3. The SBE3plus secondary (T2/03-2309) was swapped for (T2/03-2322) after cast 28/1.

The 95% confidence limits for the MV1310 data mean low-gradient differences are ± 0.00137°C for T1-T2 .The 95% confidence limit for deep temperature residuals (where pressure > 1800 dbars) is ± 0.00105°C for T1-T2 .

CTD Conductivity: Pre-cruise calibration coefficients were applied to convert raw frequencies to conductivity. Secondary sensors were compared to conductivity calculated from check sample salinities using CTD pressure and temperature. Sensors used: The SBE4C secondary (C2/04-2819) was swapped for (C2/04-2765) after cast 28/1. The 95% confidence limits are ± 0.00445 relative to bottle salinities for all salinities, where T1-T2 is within ± 0.01°C; and ± 0.000781 relative to bottle salinities for deep salinities, where pressure is more than 1800 decibars. Within the context of having only a small number of salinity check samples, when questionable check samples were ignored, the final CTD salinities (and temperatures) appear to meet a reasonable standard, though less reliable than the reference cruises (P16N (2009) and P17N (2001)).

CTD Dissolved Oxygen: SBE43 dissolved oxygen sensor (DO/43-0275) was calibrated to dissolved oxygen bottle samples taken at bottle stops. At the end of the cruise, standard and blank values for bottle oxygen data were smoothed, and the bottle oxygen values were recalculated (changes were less than 0.01 ml/l for most stations). Standard deviations were 3.142 µmol/kg for all oxygen and 1.365 µmol/kg for deep oxygen. CTD dissolved oxygen ml/l data are converted to µmol/kg units.

Data Processing Description

Data Processing:
CTD data were processed by Alejandro D. Quintero and Courtney M. Schatzman at the Oceanographic Data Facility (ODF) at Scripps Institution of Oceanography (SIO). ODF performs systematic standard processes on all hydrographic data sets. The 0.5-second time series data were checked for consistency, clean sensor response and calibration shifts. A 1-decibar pressure series was generated from the down cast data. On-deck pressure values were observed at the start and end of each cast for potential drift. Alignment of temperature and conductivity sensor data (in addition to the default 0.073-second conductivity "advance" applied by the SBE11plus deck unit) was optimized for each pump/sensor combination to minimize salinity spiking by using data from multiple casts of various depths after acquisition. If the pressure offset or conductivity "advance" values were altered after data acquisition, the CTD data were re-averaged from the 24Hz stored data.

The primary and secondary temperature sensors (SBE3plus) were compared to each other. CTD conductivity sensors (SBE4C) were compared to each other, then calibrated by examining differences between CTD and check-sample conductivity values. CTD dissolved oxygen sensor data were fit to check-sample data.

Bottle salinity and oxygen were used to refine shipboard conductivity and oxygen sensor calibrations.

Theta-salinity and theta-oxygen comparisons were made between down and up-casts, between groups of adjacent deployments and finally with the most recent global repeat hydrographic program data collected in the Gulf of Alaska (P16N -2009 and P17N -2001).

BCO-DMO Processing Notes
- Generated from original files: "MV1310 CTD DATASET.zip" contributed by Meredith Jennings
- Parameter names edited to conform to BCO-DMO naming convention found at [Choosing Parameter Name]

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Data Files

File
CTD_Profiles.csv (Comma Separated Values (.csv), 12.06 MB) MD5:9942a1305ad881bd613e32eeea8ff14d Primary data file for dataset ID 527102

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Related Datasets

IsSupplementTo

Miller, W., Medeiros, P. M. (2020) **CDOM and FDOM full-depth Nisken profiles from high-resolution surveys of DOM optical properties conducted during the R/V Melville cruise MV1310 in the Gulf of Alaska (August 4–21, 2013).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). Version Date 2020-08-14 http://lod.bco-dmo.org/id/dataset/820932 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Station	Station number	dimensionless
Cast	Cast number per station	dimensionless
Latitude	Latitude (South is negative)	decimal degrees
Longitude	Longitude (West is negative)	decimal degrees
Date	Date of cast (GMT)	yyyymmdd
Time	Time of cast (GMT)	hhmm
CTDETIME	CTD elapsed time at measurement depth	SECONDS
CTDPRS	Water pressure at measurement depth; depth reported as pressure; positive number increasing with water depth	DBAR
CTDPRS_FLAG_W	Water pressure at measurement depth; depth reported as pressure; positive number increasing with water depth	dimensionless
CTDTMP	Water temperature at measurement depth; ITS-90	degrees Celsius
CTDTMP_FLAG_W	Water temperature at measurement depth data quality flag	dimensionless
CTDSAL	Salinity calculated from CTD sensors (conductivity and temperature) at measurement depth; PSS-78	PSU
CTDSAL_FLAG_W	Salinity calculated from CTD sensors (conductivity and temperature) at measurement depth data quality flag	dimensionless
CTDOXY	CTD dissolved oxygen at measurement depth	UMOL/KG
CTDOXY_FLAG_W	CTD dissolved oxygen at measurement depth data quality flag	dimensionless

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Instruments

Dataset-specific Instrument Name	CTD SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	A single SBE9plus CTD (S/N 831) was used for all casts and was deployed with all sensors and pumps as recommended by SBE. In situ salinity and dissolved oxygen check samples were collected to calibrate conductivity and dissolved oxygen sensors (see MV1310 Preliminary Cruise Report).
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	Pressure Sensor
Generic Instrument Name	Pressure Sensor
Dataset-specific Description	CTD Pressure: Paroscientific Digiquartz pressure transducer (S/N 831-99677)
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	SBE-43 DO
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	CTD Dissolved Oxygen: SBE43 dissolved oxygen sensor (DO/43-0275)
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 Sea-Bird Electronics

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Deployments

MV1310

Website	https://www.bco-dmo.org/deployment/526876
Platform	R/V Melville
Report	http://dmoserv3.whoi.edu/data_docs/NorthPacific_RDOC/MV1310_Preliminary_Report_2.pdf
Start Date	2013-08-04
End Date	2013-08-23
Description	Original data are available from the NSF R2R data catalog

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Project Information

Characterizing a refractory DOC sink in the deep northern North Pacific (North Pacific RDOC)

Website: http://yyy.rsmas.miami.edu/groups/biogeochem/

Coverage: North Pacific, Gulf of Alaska: 48ºN to 59ºN and 129ºW to 153ºW

Extracted from the NSF award abstract:

Refractory dissolved organic carbon (RDOC) in the ocean has long been recognized as highly resistant to removal. It has a mean lifetime in the ocean of thousands of years, so it is generally thought of as a recalcitrant pool that is transported mostly conservatively with the thermohaline circulation. But unlike RDOC in the present-day ocean, this vast reservoir has been implicated by paleoceanographic research as a relatively rapid-turnover carbon source/sink involved in past climate changes. Accordingly, the RDOC reservoir in ancient oceans must at times have been much larger than today, and that large reservoir must have been rapidly mobilized to release its carbon to the atmosphere. There is a clear need to understand how RDOC source and sink processes operate in the modern ocean in order to understand its potential role in past or future oceans.

In this project, a researcher at the Rosenstiel School of Marine and Atmospheric Science of the University of Miami hopes to fill knowledge gaps in the RDOC-climate connection. Inasmuch as mapping of its global distribution was accomplished only within the past few years, few solid facts about processes controlling the RDOC pool have been established. One particularly important RDOC sink is in the northern North Pacific. The PI believes that RDOC carried in bottom waters from the Southern Ocean to the far north is conserved, but once in the vicinity of Pacific Deep Water formation there is a rather abrupt loss of carbon. His immediate goal in this project is to characterize the RDOC sink in the North Pacific, an objective that is one part of the larger goal of understanding the role of ocean RDOC in global climate.

Quantifying the Photochemical Reactivity of Deep Ocean Water (DORC PhotoChem)

Coverage: Sub-Arctic Pacific, Gulf of Alaska, Line P

NSF award abstract:
Because 70% of marine dissolved organic carbon (DOC) is found in the deep ocean, it is important to determine its sources and sinks to understand its role in the global carbon cycle. Unfortunately, the sinks for DOC at depth remain largely unknown; however, limited data has suggested that photochemistry may influence the removal of deep refractory DOC. A scientist from the University of Georgia will use field and laboratory irradiation experiments to quantify the photochemical rates controlling (1) direct loss of DOC and photoproduction of carbon monoxide, a significant product resulting from DOC oxidation, (2) common optical tracers of organic carbon such as colored dissolved organic matter and fluorescent dissolved organic matter fading; and (3) two reactive oxygen species (hydrogen peroxide and superoxide) that reflect the role of oxygen in DOC photochemistry. The study will focus on the north Pacific, where the lowest deep ocean DOC concentrations are found which most likely reflect the presence of an aged and refractory carbon pool.

Layered in the top 1000m above this deep DOC is a concentration gradient that will allow comparison of waters with different DOC concentrations, ages and apparent refractivity. Results from the study will be used to quantitatively reevaluate this basic question that now constrains global DOC models: Does photochemistry have a significant role in the removal of the massive amount of refractory DOC that is pooled in the deep sea?

In terms of the broader impacts, based on established links with K-12 teachers, the scientist and his students plan visits to local schools to present their science, as well as have a website entitled "ask the oceanographer" and maintain a live blog during their cruise. Results from this study will be included into class materials dealing with the carbon cycle. One graduate and three undergraduate students would be supported and trained as part of this project. It is anticipated that undergraduate students from historically underrepresented groups would be recruited via the University of Georgia's Summer Undergraduate Research Program.

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Program Information

United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)

Website: http://www.us-solas.org/

Coverage: Global

The Surface Ocean Lower Atmosphere Study (SOLAS) program is designed to enable researchers from different disciplines to interact and investigate the multitude of processes and interactions between the coupled ocean and atmosphere.

Oceanographers and atmospheric scientists are working together to improve understanding of the fate, transport, and feedbacks of climate relevant compounds, and also weather and hazards that are affected by processes at the surface ocean.

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Physical, chemical, and biological research near the ocean-atmosphere interface must be performed in synergy to extend our current knowledge to adequately understand and forecast changes on short and long time frames and over local and global spatial scales.

The findings obtained from SOLAS are used to improve knowledge at process scale that will lead to better quantification of fluxes of climate relevant compounds such as CO2, sulfur and nitrogen compounds, hydrocarbons and halocarbons, as well as dust, energy and momentum. This activity facilitates a fundamental understanding to assist the societal needs for climate change, environmental health, weather prediction, and national security.

The US SOLAS program is a component of the International SOLAS program where collaborations are forged with investigators around the world to examine SOLAS issues ubiquitous to the world's oceans and atmosphere.

Â» International SOLAS Web site

Science Implementation Strategy Reports

US-SOLAS (4 MB PDF file)
Other SOLAS reports are available for download from the US SOLAS Web site

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1153930

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