Carbonate chemistry and isotopes from multiple M/V OOCL Tianjin and M/V OOCL Tokyo cruises between Hong Kong and Long Beach in the Pacific Basin from 2008-2012 (NPac Cont Ship project)

Website: https://www.bco-dmo.org/dataset/665195 Data Type: Cruise Results Version: Version Date: 2016-11-21

Project

» <u>North Pacific Surface Carbon, Oxygen and Isotope Measurements from Container Ships (2008-)</u> (NPac Cont Ship)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: N:49.67 E:-120 S:22.133 W:120 Temporal Extent: 2008-10-06 - 2012-12-11

Dataset Description

This dataset includes dissolved inorganic carbon (DIC), del13C-DIC, and total alkalinity (TA). Samples were collected during transects across the Pacific Ocean from Hong Kong to Long Beach, CA on commercial container ships starting in 2008.

Related Dataset: <u>O2/Ar and triple oxygen isotopes</u>

Methods & Sampling

Samples for carbonate chemistry analysis were collected from shipboard seawater intake (10 m depth) on basin-wide transects of the North Pacific between Hong Kong and Long Beach, California onboard the M/V OOCL Tianjin and the M/V OOCL Tokyo (each individual transect has a unique Cruise ID). Sea surface temperature and salinity at the time of sample collection were determined using a Sea-Bird Electronics SBE45 thermosalinograph installed in the ship's seawater intake. To prevent biofouling that could cause respiration in the ship's seawater lines [Juranek et al., 2010], intake lines between the anticorrosive sea chest and the

sampling port were purged with bleach and freshwater between every cruise.

Samples for both dissolved inorganic carbon (DIC) and total alkalinity (TA) analysis were collected into 250 mL bottles with greased ground glass stoppers and poisoned with 100 μ L of saturated mercuric chloride solution. DIC concentrations were determined in the laboratory through a combination of manometric measurements (DIC_SIL, *Quay and Stutsman*, 2003) and measurements with an Apollo SciTech AS-C3 IR-based DIC analyzer (DIC_IR). Certified reference materials (Andrew Dickson, UCSD) were used for calibration and determination of sample-specific measurement error for all DIC measurements using the AS-C3 analyzer (DIC_IR_uncert), with mean uncertainty of ± 4 µmol kg⁻¹ for the entire dataset. Comparison of duplicate samples analyzed both manometrically and with the AS-C3 analyzer (n = 111) agree to within 1 ± 9 µmol kg⁻¹ and indicate uncertainty of ± 8 µmol kg⁻¹ in the manometric measurements (DIC_SIL). δ^{13} C of the DIC samples measured manometrically was determined following the methods detailed in *Quay and Stutsman* (2003). TA samples were measured using an automated, open-cell potentiometric titration system (*Dickson et al.*, [2007]; SOP 3b), with sample-specific measurement error quantified based on certified reference materials (Andrew Dickson, UCSD) measured with each sample batch (TA_uncert, mean uncertainty of ± 2 µeq kg⁻¹ for the entire dataset).

Data Processing Description

Data are only reported for samples that meet quality control standards (any with problems in the laboratory extraction and measurement process have been omitted in the data spreadsheet).

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard
- split date/time into two columns
- reformatted date from m/d/yyyy to yyyy-mm-dd
- replaced blank cells with nd (no data)

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Data Files

```
File
carbonate_chemistry.csv(Comma Separated Values (.csv), 99.12 KB)
MD5:b4f2b5cf77b933a03f99dadcfe813ac1
```

Primary data file for dataset ID 665195

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Related Publications

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to Best Practices for Ocean CO2 Measurements. PICES Special Publication 3, 191 pp <u>https://isbnsearch.org/isbn/1-897176-07-4</u> *Methods*

Juranek, L. W., Hamme, R. C., Kaiser, J., Wanninkhof, R., & Quay, P. D. (2010). Evidence of O2 consumption in underway seawater lines: Implications for air-sea O2 and CO2 fluxes. Geophysical Research Letters, 37(1), n/a-n/a. doi:10.1029/2009gl040423 <u>https://doi.org/10.1029/2009GL040423</u> *Methods*

Quay, P., & Stutsman, J. (2003). Surface layer carbon budget for the subtropical N. Pacific: constraints at station ALOHA. Deep Sea Research Part I: Oceanographic Research Papers, 50(9), 1045–1061. doi:10.1016/s0967-0637(03)00116-x https://doi.org/10.1016/S0967-0637(03)00116-X Methods

Parameters

Parameter	Description	Units
cruise_id	cruise identification	unitless
station	station number	unitless
date	date; UTC	yyyy-mm-dd
time	time; UTC	HH:MM
sal	sea surface salinity	PSU
temp	sea surface temperature	degrees Celsius
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
yrday_utc	UTC day and decimal time. e.g. 326.5 for the 326th day of the year or November 22 at 1200 hours (noon)	days
ISO_DateTime_UTC	UTC time formatted as ISO 8601:2004 standard YYYY-mm- ddTHH:MM:SS[.xx]Z	year-month-day-hour- minute-second
DIC_Sil	dissolved inorganic carbon measured manometrically	micromolar/kilogram (umol/kg)
del13C_DIC	Carbon 13 to Carbon 12 ratio of DIC: 1000*[(13C/12C)sample - (13C/12C)standard]/ (13C/12C)standard	per mil
TAIk	total alkalinity	micro- microequivalents/kilogram (ueq/kg)
TAlk_uncert	sample batch specific measurement uncertainty	micro- microequivalents/kilogram (ueq/kg)
DIC_IR	dissolved inorganic carbon measured with an Apollo SciTech AS-C3 analyzer	micromolar/kilogram (umol/kg)
DIC_IR_uncert	sample batch specific measurement uncertainty	micromolar/kilogram (umol/kg)

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Instruments

Dataset-specific Instrument Name	automated, open-cell potentiometric titration system
Generic Instrument Name	Automatic titrator
Dataset-specific Description	To measure total alkalinity
Generic Instrument Description	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Dataset-specific Instrument Name	Apollo SciTech AS-C3 IR-based DIC analyzer
Generic Instrument Name	CO2 Analyzer
Dataset-specific Description	To measure dissolved inorganic carbon (DIC) and total alkalinity.
Generic Instrument Description	Measures atmospheric carbon dioxide (CO2) concentration.

Dataset- specific Instrument Name	Finnigan MAT 251
Generic Instrument Name	Mass Spectrometer
Dataset- specific Description	To measure del13C-DIC
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

Dataset- specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 45 MicroTSG Thermosalinograph
Generic Instrument Description	A small externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. It is constructed of plastic and titanium to ensure long life with minimum maintenance. It may optionally be interfaced to an external SBE 38 hull temperature sensor. Sea Bird SBE 45 MicroTSG (Thermosalinograph)

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Deployments

TJ1

-) -	
Website	https://www.bco-dmo.org/deployment/626889
Platform	OOCL Tianjin
Start Date	2008-10-06
End Date	2008-10-17
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TI2

1]2	
Website	https://www.bco-dmo.org/deployment/626891
Platform	OOCL Tianjin
Start Date	2008-11-13
End Date	2008-11-21
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Website	https://www.bco-dmo.org/deployment/626893
Platform	OOCL Tianjin
Start Date	2008-11-27
End Date	2008-12-11
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ4

Website	https://www.bco-dmo.org/deployment/626896
Platform	OOCL Tianjin
Start Date	2009-01-20
End Date	2009-01-30
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ5

Website	https://www.bco-dmo.org/deployment/626897
Platform	OOCL Tianjin
Start Date	2009-04-01
End Date	2009-04-10
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ6

Website	https://www.bco-dmo.org/deployment/626898
Platform	OOCL Tianjin
Start Date	2009-09-24
End Date	2009-09-27
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ7	
Website	https://www.bco-dmo.org/deployment/626900
Platform	OOCL Tianjin
Start Date	2009-10-28
End Date	2009-11-07
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Website	https://www.bco-dmo.org/deployment/626904
Platform	OOCL Tianjin
Start Date	2010-02-13
End Date	2012-02-21
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_1

Website	https://www.bco-dmo.org/deployment/626918
Platform	OOCL Tianjin
Start Date	2012-04-30
End Date	2012-05-13
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_2

Website	https://www.bco-dmo.org/deployment/626920
Platform	OOCL Tianjin
Start Date	2012-07-24
End Date	2012-08-06
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_3

Website	https://www.bco-dmo.org/deployment/626922
Platform	OOCL Tianjin
Start Date	2012-11-28
End Date	2012-12-11
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_0	
Website	https://www.bco-dmo.org/deployment/626906
Platform	OOCL Tokyo
Start Date	2011-02-23
End Date	2011-03-07
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Website	https://www.bco-dmo.org/deployment/626908
Platform	OOCL Tokyo
Start Date	2011-05-16
End Date	2011-05-29
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_2

Website	https://www.bco-dmo.org/deployment/626910
Platform	OOCL Tokyo
Start Date	2011-06-27
End Date	2011-07-10
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_3

Website	https://www.bco-dmo.org/deployment/626912
Platform	OOCL Tokyo
Start Date	2011-09-20
End Date	2011-10-02
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_4

Website	https://www.bco-dmo.org/deployment/626914
Platform	OOCL Tokyo
Start Date	2012-01-25
End Date	2012-02-06
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

ТЈ8	
Website	https://www.bco-dmo.org/deployment/626902
Platform	OOCL Tianjin
Start Date	2009-12-03
End Date	2009-12-12
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Project Information

North Pacific Surface Carbon, Oxygen and Isotope Measurements from Container Ships (2008-) (NPac Cont Ship)

Coverage: Transects across the North Pacific from Hong Kong to Long Beach, California, USA; ~25-50N, 115E-120W

This project is an ongoing time-series beginning in 2008 of measurements relevant to ocean carbon cycling and productivity on basin-wide container ship transects across the North Pacific from Hong Kong to Long Beach, California, with transects made throughout the seasonal cycle beginning in October 2008. The goal of this project is to improve our understanding of the rates and mechanisms of ocean carbon uptake from the atmosphere throughout the seasonal cycle and across spatial gradients across the basin. Sampling includes both discrete samples and continuous underway measurements. Tracers sampled in this program include triple oxygen isotopes (δ 170 and δ 180), a tracer of gross primary production, oxygen/argon dissolved gas ratios, a tracer of net community production or carbon export, and carbonate system parameters (pCO2, total alkalinity, DIC, and 13C-DIC) as tracers of ocean carbon uptake and carbon cycling.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	<u>OCE-0628663</u>
NSF Division of Ocean Sciences (NSF OCE)	<u>OCE-1259055</u>
NOAA Oceanic and Atmospheric Research (OAR) Climate Program Office (NOAA OAR Climate Program)	A100AR4310088

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