DIC and del13C-DIC from nine M/S Columbus Waikato cruises between New Zealand and Long Beach, CA in the Pacific Basin from 2004-2006

Website: https://www.bco-dmo.org/dataset/700907
Data Type: Cruise Results
Version: 1
Version Date: 2017-05-24

Project
» Time-Series Measurements of the 13C/12C of Dissolved Inorganic Carbon (13C/12C DIC Time-Series)

Contributors	Affiliation	Role
Quay, Paul	University of Washington (UW)	Principal Investigator, Contact
Juranek, Laurie	Oregon State University (OSU-CEOAS)	Co-Principal Investigator
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Abstract
Carbonate chemistry and isotopes from nine M/S Columbus Waikato cruises between New Zealand and Long Beach, CA in the Pacific Basin from 2004-2006. This dataset includes dissolved inorganic carbon (DIC), and del13C-DIC.

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Coverage

Spatial Extent: **N**:46.4 **E**:179.7 **S**:-39.11 **W**:-179.93
Temporal Extent: 2004-03-03 - 2005-10-08

Dataset Description

Carbonate chemistry and isotopes from nine M/S Columbus Waikato cruises between New Zealand and Long Beach, CA in the Pacific Basin from 2004-2006. This dataset includes dissolved inorganic carbon (DIC), and del13C-DIC.

Methods & Sampling

Shipboard Sample Collection Methods: Samples were collected in pre-washed and baked 250 ml ground glass stoppered bottles that were poisoned with 100 ul of a saturated HgCl2 solution. The stored sealed samples were returned to the Stable Isotope Laboratory at the University of Washington for extraction and measurement.

Laboratory Methods: CO2 was extracted from the DIC seawater samples using a modification of the helium stripping technique described in Quay and Stutsman (2003). The del13C is measured on a Thermo Finnigan MAT 253 mass spectrometer.

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). Blank cells have been replaced with nd (no data).

BCO-DMO Data Processing:
- re-formatted time to HHMM;
- modified parameter names to conformw ith BCO-DMO naming conventions (replaced hyphens with underscores);
- added ISO_DateTime_UTC using original date and time fields.

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Data Files

File
Waikato_carbon.csv (Comma Separated Values (.csv), 34.21 KB) MD5:f744da5125126171be08cb08b165e4a1 Primary data file for dataset ID 700907

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Related Publications

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

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Parameters

Parameter	Description	Units
SIL_cruise_id	UW Stable Isotope Lab cruise identification	unitless
PMEL_cruise_id	NOAA Pacific Marine Environmental Lab cruise identification	unitless
ISO_DateTime_UTC	Date and time (UTC) formatted to ISO8601 standard (yyyy-mm-ddTHH:MM:SSxx)	unitless
date	Year, month, and day (UTC) in yyyy-mm-dd format	unitless
time	Time (UTC) in HHMM format	unitless
lat	Latitude; north is positive	decimal degrees
lon	Longitude; east is positive	decimal degrees
DIC	Dissolved inorganic carbon measured manometrically	micromoles/kilogram (umol/kg)
d13C_DIC	Carbon 13 to Carbon 12 ratio of DIC: 1000*[(13C/12C)sample - (13C/12C)standard]/ (13C/12C)standard	per mil

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Instruments

Dataset-specific Instrument Name	Thermo Finnigan MAT 253 mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	del13C was measured on a Thermo Finnigan MAT 253 mass spectrometer.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

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Deployments

CW2004_02

Website	https://www.bco-dmo.org/deployment/701003
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2004_02_Readme.pdf
Start Date	2004-03-03
End Date	2004-03-18
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2004_06

Website	https://www.bco-dmo.org/deployment/701004
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2004_06_Readme.pdf
Start Date	2004-06-10
End Date	2004-06-23
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2004_09

Website	https://www.bco-dmo.org/deployment/701007
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2004_09_Readme.pdf
Start Date	2004-09-20
End Date	2004-10-04
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2005_02

Website	https://www.bco-dmo.org/deployment/701012
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2005_02_Readme.pdf
Start Date	2005-02-16
End Date	2005-02-28
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2005_04

Website	https://www.bco-dmo.org/deployment/701081
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2005_04_Readme.pdf
Start Date	2005-04-06
End Date	2005-04-17
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2005_07

Website	https://www.bco-dmo.org/deployment/701295
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2005_07_Readme.pdf
Start Date	2005-07-02
End Date	2005-07-15
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2005_08

Website	https://www.bco-dmo.org/deployment/701428
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2005_08_Readme.pdf
Start Date	2005-08-17
End Date	2005-08-31
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

CW2005_09

Website	https://www.bco-dmo.org/deployment/701483
Platform	M/S Columbus Waikato
Report	http://dmoserv3.whoi.edu/data_docs/DIC_Time-Series/cw2005_09_Readme.pdf
Start Date	2005-09-23
End Date	2005-10-08
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Both the readme file and cruise report were obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF)

PWZ04C

Website	https://www.bco-dmo.org/deployment/701530
Platform	M/S Columbus Waikato
Start Date	2004-08-01
End Date	2004-08-12
Description	In 2004, PMEL installed an underway pCO2 system on the container ship Columbus Waikato to monitor atmospheric and surface water CO2 concentrations as the ship traversed the Pacific Ocean from the western united states to New Zealand. In the time period between Feb 2004 and Feb 2006, 13 data sets were along this ship track. In March, 2006, the ship changed it's route to as well as it's name. The ship is now the Cap Victor. More information: Columbus Waikato/Cap Victor Master Readme File (Obtained from https://www.pmel.noaa.gov/co2/uwpco2/waikato_data.html and converted to PDF) Note that PMEL did not collect data on this cruise, however, data were collected as part of the project "Time-Series Measurements of the 13C/12C of Dissolved Inorganic Carbon".

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Project Information

Time-Series Measurements of the 13C/12C of Dissolved Inorganic Carbon (13C/12C DIC Time-Series)

NSF Award Abstract:
The 13C/12C isotopic ratio of dissolved inorganic carbon (DIC) has been shown to be a very useful tracer of anthropogenic CO2 uptake in the ocean (Quay et al., 1992; Heimann and Maier-Reimer, 1996; Sonnerup et al., 2000; Quay et al., 2003). Seasonal changes in the d13C of DIC, coupled with corresponding changes in DIC concentration and pCO2, have been used to close the surface ocean.s carbon budget (Zhang and Quay, 1997; Gruber et al., 1998, Quay and Stutsman, in press). Time- series measurements of d13C, DIC and pCO2, therefore, allow one to separate biological from physical causes for interannual variations in the rate of oceanic CO2 uptake as Gruber et al. (2002) recently demonstrated at BATS. Despite these advantages, there are only two sites in the subtropical N. Atlantic (BATS) and N. Pacific (HOT) oceans where such records exist. This lack of ocean time series records has severely limited our ability to understand the causes of interannual variations in the ocean uptake of anthropogenic CO2 (Quay, 2002). In stark contrast, continuous records of atmospheric CO2 and d13C are being measured at over 100 sites.

In this project, researchers at the University of Washington will initiate monthly d13C measurements at a third time-series site (ESTOC) in the eastern subtropical N. Atlantic. The d13C record at ESTOC, which will complement on-going measurements of DIC, pCO2 and alkalinity at the site, offers a very useful comparison to the BATS d13C record. Gruber et al. (2002) concluded that interannual variations in CO2 uptake at Bermuda correlated strongly with sea surface temperature (SST) and the North Atlantic Oscillation (NAO) index of atmospheric circulation. They used their d13C record at BATS to conclude that interannual variations in the rate of net community production (NCP) correlated with NAO. The researchers of this project intend to use the proposed d13C measurements at ESTOC to calculate NCP and determine whether interannual variations in the eastern subtropical N. Atlantic correlate with variations at Bermuda.

The research team will also continue its program of d13C measurements at HOT. Our decade-long d13C record at HOT shows that the d13C decrease rate in the surface ocean has doubled since 1995. The DIC increase rate has tripled since 1995. However, this apparent acceleration of anthropogenic CO2 uptake and d13C decrease occurred during a period (post 1998) when salinity is the highest ever measured at HOT and summertime SST has decreased significantly. These dramatic changes at HOT correlate with a shift in the Pacific Decadal Oscillation (PDO) climate index in 1998 from positive (since the late 1970s) to negative. This correlation suggests that changes in physical forcing (e.g., thermocline depth, mixed layer depth, gyre circulation rates) in the N. Pacific may have changed the subtropical ocean.s carbon budget. If so, the situation at HOT may be similar to that found by Gruber et al. (2002) at Bermuda. The team intends to use d13C measurements at HOT to determine whether the accelerated DIC increase is a result of changes in the NCP rate at HOT.

The proposed research addresses a major societal issue, that is, how natural variability affects the ocean.s uptake of anthropogenically produced CO2. The largest single human-controlled factor in future climate change is the production of CO2 from fossil fuel combustion and deforestation. The research is expected to yield an ocean d13C data set that will be made available to the broad scientific community and serve as a useful validation test for models predicting future atmospheric CO2 concentrations. The proposed research addresses one of the specific goals of the US Carbon Cycle Science Plan (1999), that is, to better quantify and understand the uptake of anthropogenic CO2 in the oceans. The proposed work enhances infrastructure for research and education in two ways. It establishes collaboration with scientists at the Universidad de Las Palmas in the Grand Canary Islands studying the ocean's carbon cycle. It tests equipment that could be broadly used by the oceanographic community to remotely collect seawater samples for carbon analysis.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0327006
National Oceanic and Atmospheric Administration (NOAA)	NA17RJ1232

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