

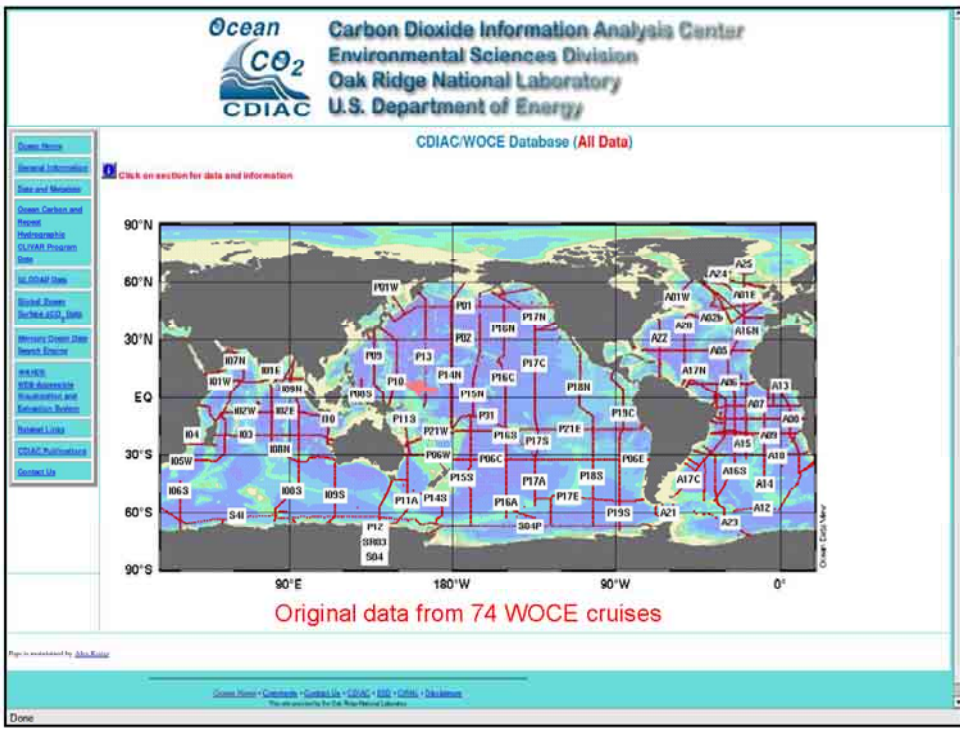
Ocean Carbon Dioxide: Importance of Observations, Data Management, and Data Synthesis Projects in the Ocean processes predictions

Alex Kozyr
Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
USA

Strategic Workshop on "Impacts of Ocean Acidification"
Gran Canary, Spain, 28-30 January 2008

CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database



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http://cdiac.ornl.gov/oceans/woce_p10.html

Ocean CO₂ CDIA Carbon Dioxide Information Analysis Center
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WOCE Section P10

Data Set Name	Graphics	Research Vessel	Place	Period	Chief Scientist	Carbon-related data Contributor	Variables in Data Set	Data	NDP No.	Date of Publication
WOCE Section P10	See map and section plots	R/V Thomas Thompson	Pacific ocean	3 Oct - 10 Nov, 1993	Melinda Hall / AWJHJ	Chris Sabine / NOAA/PMEL	Hydrog., Nit., CFC11, CFC12, ¹³ C, TCO ₂ , TALK, underway pCO ₂	Data files Metadata	NDP-071 read online	August, 1999

CLIVAR Repeat Section P10_2005

Data Set Name	Country/Status	Research Vessel	Place	Period	Chief Scientist	Carbon-related data PI(s)	Variables in Data Set	Data/Availability NDP No.
P10_2005 (49MR0502_1)	Japan/ Completed	R/V Mizu	Pacific Ocean	25 May - 2 July, 2005	Takeshi Kawano / JAMSTEC, Japan	Akihiro Murata / JAMSTEC, Japan	CTD, Hydrog., Nit., TCO ₂ , TALK, pH, pCO ₂ (und), CFCs, δ ¹³ C	Data files Metadata


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Done

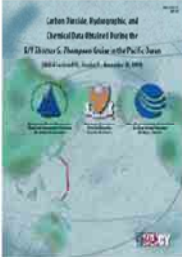
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http://cdiac.ornl.gov/oceans/ndp_071/ndp071.html Go Testa reader

NDP-071 (1999)

Download the [Data](#) and [ASCII Documentation files](#) of NDP-071

Download  of NDP-071

Carbon Dioxide, Hydrographic, and Chemical Data Obtained During the R/V *Thomas G. Thompson* Cruise in the Pacific Ocean (WOCE Section P10, October 5 - November 10, 1993)



Contributed by
Christopher L. Sabine¹, Robert M. Key¹,
and Melinda Hall²

¹Department of Geosciences
Princeton University
Princeton, New Jersey

²Department of Physical Oceanography
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

Prepared by
Alexander Kozyr
Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee, U.S.A.

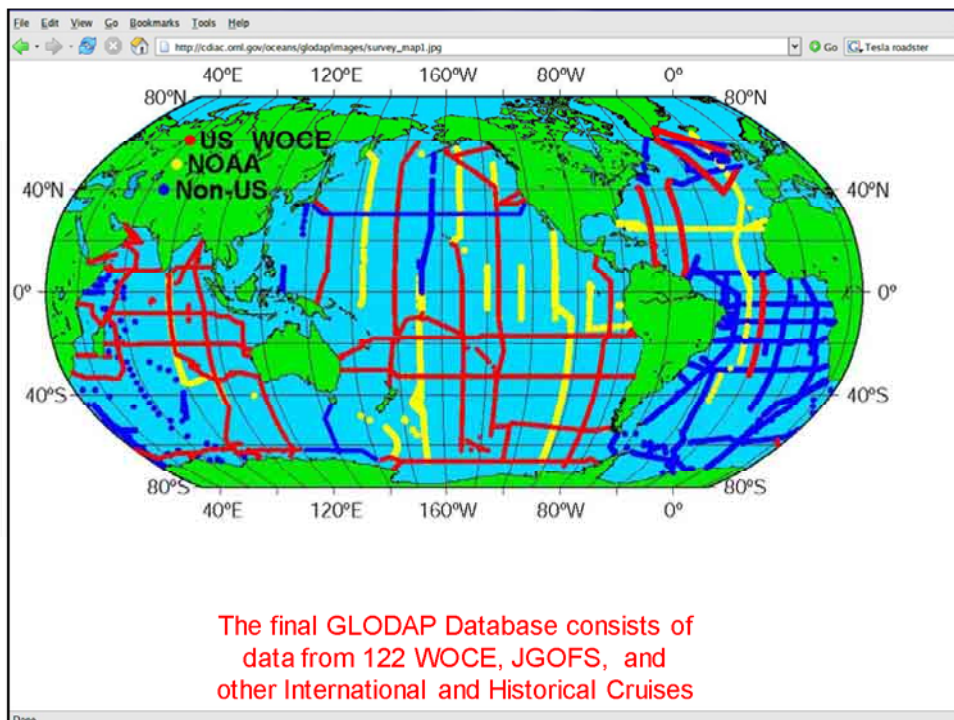
CDIAC Global Ocean CO₂ Database Components

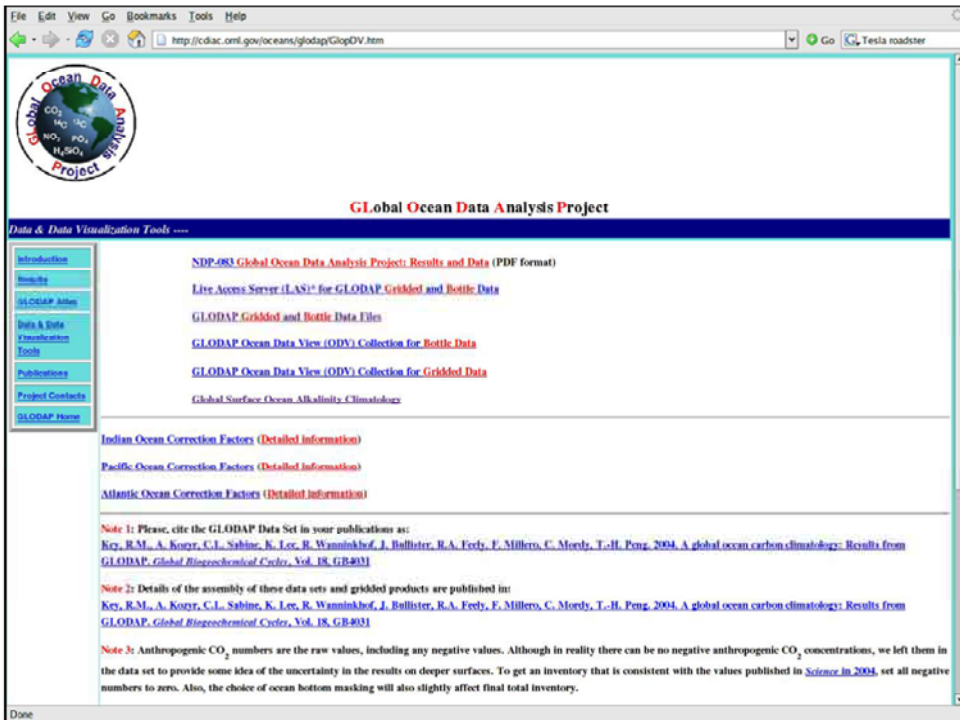
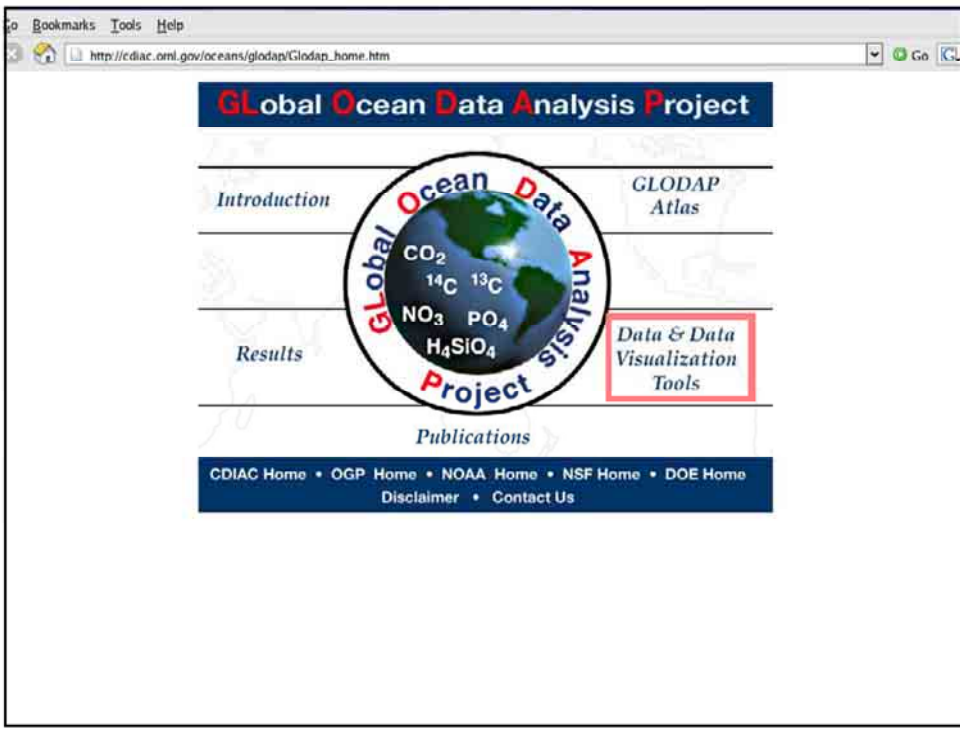
- **WOCE** Database
- **GLODAP** Database

GLobal Ocean Data Analysis Project

A cooperative effort to coordinate global synthesis projects funded through the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Energy (DOE), and the National Science Foundation (NSF)

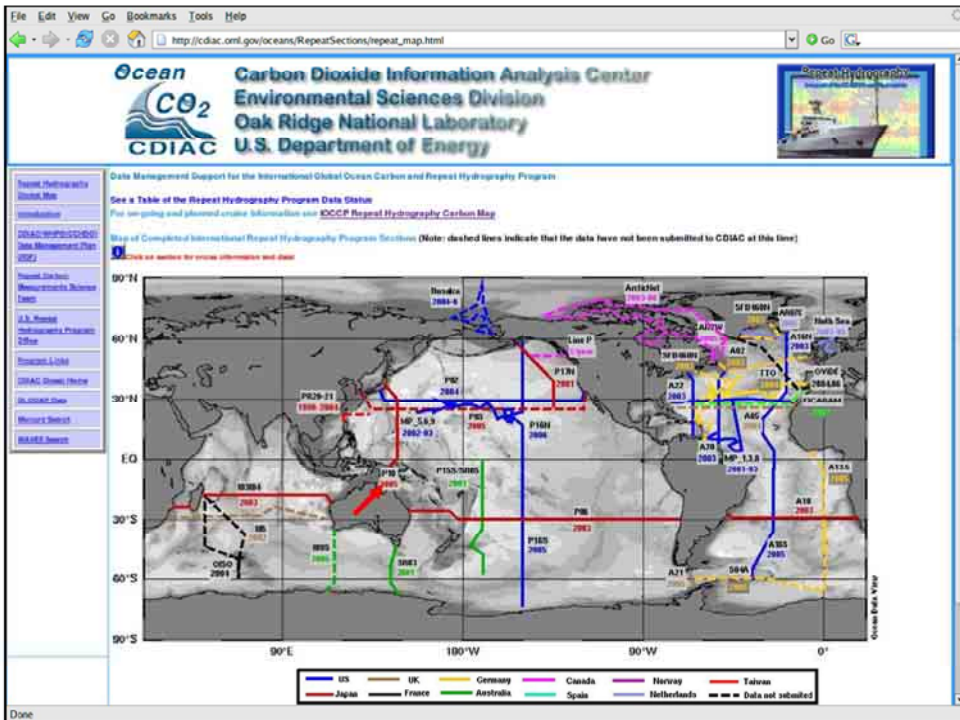
- First task of the GLODAP synthesis project was to assemble a merged data set for each basin
- The quality assurance/quality control (QA/QC) procedure involved a careful examination using the following techniques:
 - ANALYTICAL AND CALIBRATION TECHNIQUES
 - RESULTS OF SHIPBOARD ANALYSIS OF CERTIFIED REFERENCE MATERIALS
 - REPLICATE SAMPLES
 - CONSISTENCY OF DEEP CARBON DATA AT THE LOCATIONS WHERE CRUISES CROSS OR OVERLAP
 - MULTIPLE LINEAR REGRESSION ANALYSIS
 - ISOPYCNAL ANALYSES
 - INTERNAL CONSISTENCY OF MULTIPLE CARBON MEASUREMENTS
 - FINAL EVALUATION OF OFFSETS AND DETERMINATION OF CORRECTION TO BE APPLIED





CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
- **GLODAP** Database
- **CLIVAR** Repeat Hydrography and Carbon Database



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http://cdiac.ornl.gov/oceans/RepeatSections/clivar_p10.html

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U.S. Department of Energy

Repeat Hydrography Global Map
Introduction
CDIAC WHP/OCHDO
Data Management Plan (DMP)
Repeat Carbon Measurements Science Team
U.S. Repeat Hydrography Program Office
Program Links
CDIAC Ocean Home
GLODAP Data
Mosaic Search
WAVE2 Search

Data Management Support for the International Global Ocean Carbon and Repeat Hydrography Program

CLIVAR Repeat Section P10_2005

Data Set Name	Country/Status	Research Vessel	Place	Period	Chief Scientist	Carbon-related data PI(s)	Variables in Data Set	Data/Availability NDP No.
P10_2005 (49MR0502_1) See map	Japan/ Completed	R/V Mizu	Pacific Ocean	25 May - 2 July, 2005	Takeshi Kawano/ JAMSTEC, Japan	Akihiko Murata/ JAMSTEC, Japan	CTD, Hydrogr., Nutr., TCO ₂ , TALK, pH, pCO ₂ (und), CFCs, δ ¹³ C, δ ¹⁵ C	Data files Metadata

Historical Data: WOCE Section P10

Data Set Name	Country/Status	Research Vessel	Place	Period	Chief Scientist	Carbon-related data PI(s)	Variables in Data Set	Data/Availability NDP No.
WOCE Section P10 See map	USA/Completed	R/V Thomas Thompson	Pacific Ocean	5 Oct.-10 Nov, 1993	Melinda Hall/ WHOI, USA	Chris Sabine/ NOAA-PMEL, USA	Hydrogr., Nutr., CFC11, CFC12, ¹⁴ C, TCO ₂ , TALK, underway pCO ₂	Data files NDP-071, 1999

Updated 03/28/2007

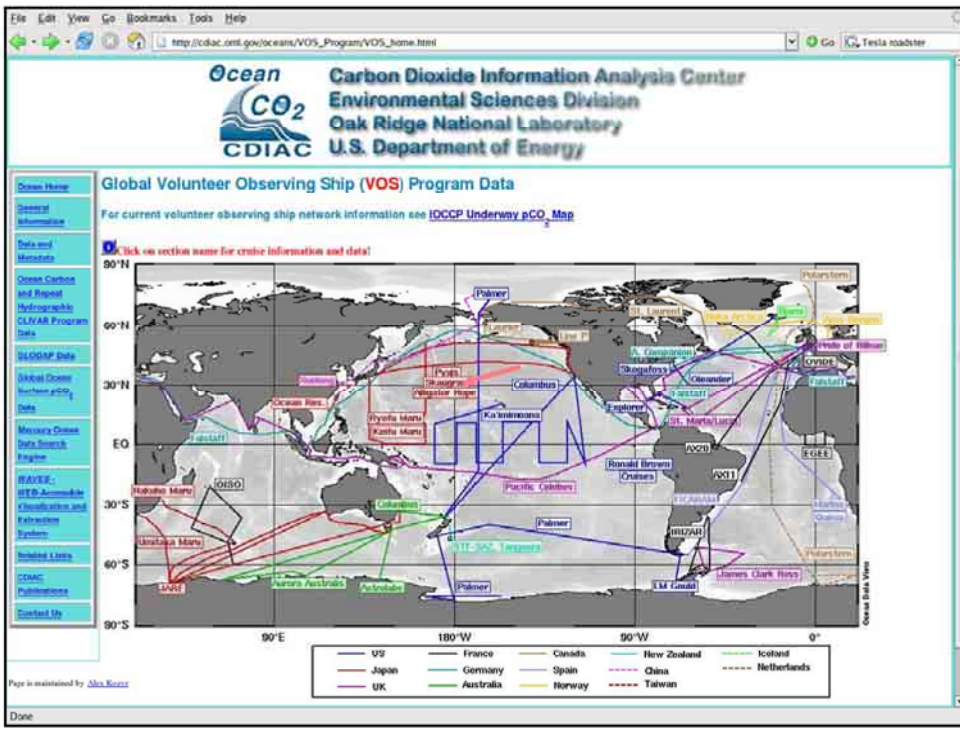
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Funded by the U.S. Department of Energy

Date

CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
- **GLODAP** Database
- **CLIVAR** Repeat Hydrography and Carbon Database
- **VOS** Underway pCO₂ Database



Skaugran Line

Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Skaugran	Japan		Chiba, Japan - Vancouver, BC - San Diego, USA	03/29/1995 - 09/29/1999	1-3/Month	Y. Nishizawa / Japan	Hum. Atmos Press, SST, SSS, sCO ₂ , Eq. pCO ₂ , SST, ΔpCO ₂ , XCO ₂ , atm, pCO ₂ , atm	Data files	NIES Monitoring Web site

Alligator Hope Line

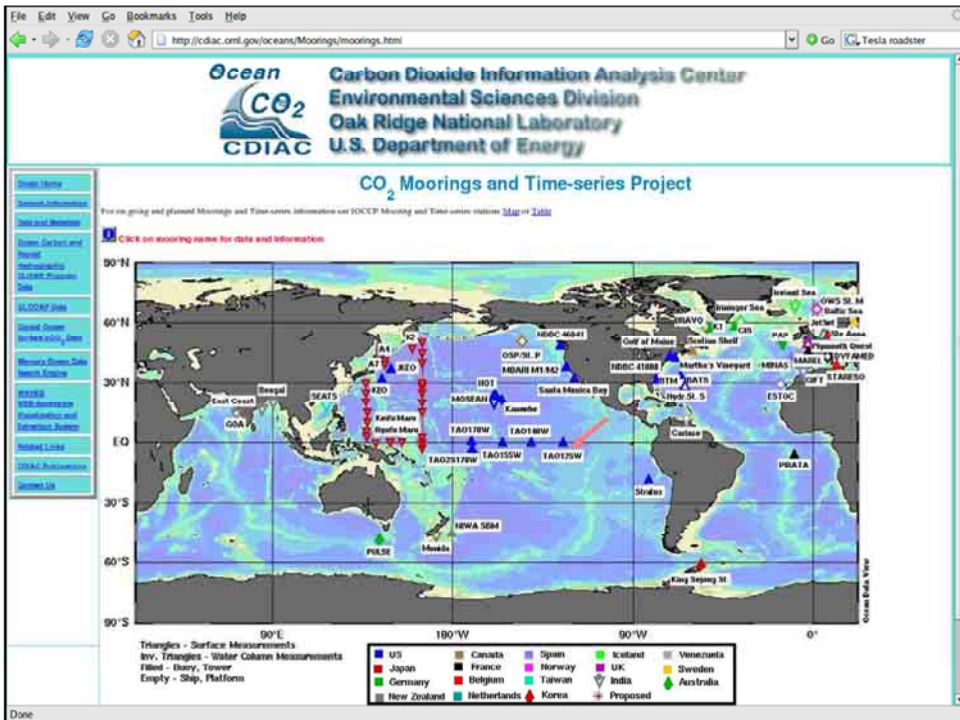
Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Alligator Hope	Japan		Osaka, Tokyo, Japan - Vancouver, BC, CA	11/12/1999 - 05/11/2001	1-2/Month	Y. Nishizawa / Japan	Hum. Atmos Press, SST, SSS, sCO ₂ , Eq. pCO ₂ , SST, ΔpCO ₂ , XCO ₂ , atm, pCO ₂ , atm	Data files	NIES Monitoring Web site

Pyxis Line

Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Pyxis	Japan		Nagoya, Japan - Portland, Oregon - Los Angeles - Toyohashi, Japan - US East coast - Japan	11/09/2001 - 04/07/2006	Monthly	Y. Nishizawa / Japan	Ambient Temp, Hum, Solar Radiation, Ref WV, Ship Speed, Air WV, Atmos Press, Air sCO ₂ , Air fCO ₂ , Air pCO ₂ , Eq Temp, SST, sCO ₂ , Eq, fCO ₂ , Eq, fCO ₂ , SST, sCO ₂ , SST, pCO ₂ , SST, ΔfCO ₂ , ΔsCO ₂ , ΔpCO ₂ , Sat.	Data files	NIES Monitoring Web site

CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
- **GLODAP** Database
- **CLIVAR** Repeat Hydrography and Carbon Database
- **VOS** Underway pCO₂ Database
- **Moorings** and **Time Series** Database



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http://cdiac.ornl.gov/oceans/Mooring/TAO125W.html

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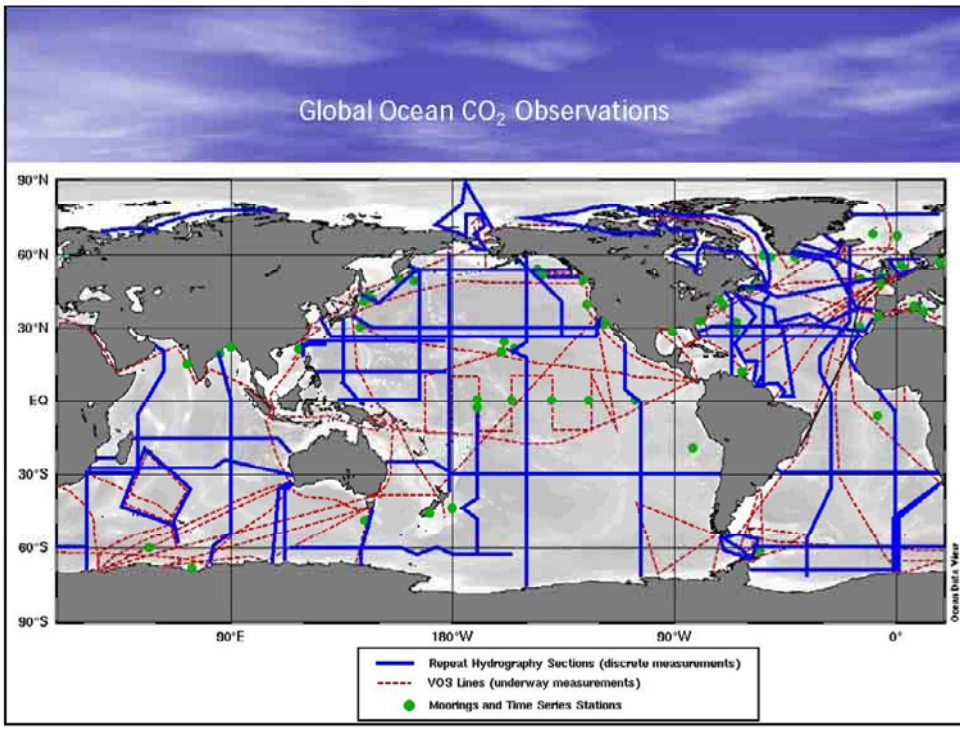
CO₂ Moorings Project

Mooring TAO125W (Buoy Position: 0.2° S, 124.4° W)

Data Set Name	Graphics	Platform	Place	Period	Carbon-related data Contributor	Variables in Data Set	Data	NDP No.	Date of Publication
TAO125W 2004-2005	See graphics for this mooring	TAO125W	Equatorial Pacific Ocean	8 May 2004 - 15 Sep 2005	Chris Sabine / PMEL	SST, SSS, Atm. press, α CO ₂ water, α CO ₂ air, CO ₂ water, CO ₂ air	Data files		

Ocean Home
General Information
Data and Metadata
Ocean Carbon and Repeat Hydrography
CLIVAR Program Data
GLOCEP Data
Global Ocean Surface pCO₂ Data
Mercury Ocean Data Search Engine
WAVES: WEB-Accessible Visualization and Extraction System
Related Links
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CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
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- **Moorings** and **Time Series** Database
- **CARINA** Database


The screenshot shows a web browser window with the URL http://cdiac.ornl.gov/oceans/CARINA/Carina_inv.html. The page header includes the logos for CARINA, Ocean CO₂ CDIAC, and Carbon Dioxide Information Analysis Center Environmental Sciences Division Oak Ridge National Laboratory U.S. Department of Energy. The main content area is titled "Carbon in Atlantic Ocean" and features a navigation menu on the left with links to "Ocean Home", "General Information", "Data and Metadata", "Ocean Carbon and Repeat Hydrography CLIVAR Program Data", "GLODAP Data", "Global Ocean Surface pCO₂ Data", "Murray Ocean Data Search Engine", "WAVE3", "WFB Accounts Classification and Extraction System", "Related Links", "CDIAC Publications", and "Contact Us". The main content area contains a link to "CARINA Data Assembly (CARBOOCEAN)" and "CARINA Cruise Summary Table and Data" (indicated by a red arrow). Below this is a section titled "CARINA Map of available data locations" with the note "Map will be updated as more data become available". The map shows a globe with red lines and dots indicating data collection locations, primarily in the Atlantic Ocean.

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http://cdiac.ornl.gov/oceans/CARINA/Carina_table.html Go Tesla noabster





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CARINA Cruise Summary Table and Data

Notes:

1. Until all the cruises are finalized by the CARINA working group, data pooled here should be considered preliminary. Individual data changes will not be noted other than in the file date. Users should record the file date as part of their own metadata.
2. Many details to this table will be added as footnotes once all cruise data are final.
3. Users are requested to report any data or metadata errors in the CARINA cruise files to CDIAc.
4. Parameter units in all CARINA data files are "WOCE standard". The final version of the files will have WOCE "exchange format" headers.

Last updated: 10 May 2007

Cruise Name	No. Sta.	Date ^a	Ship	Chief Scientist	Carbon PI	TCO ₂	TALK	pCO ₂ ^b	pH	GFC	Other Measurements	Data Files
Iceland Sea [See map]	2	8/15/1991 10/2/2006	A. Fridriksson & Saemundsson	J. Olafsson	J. Olafsson	80	0	66	0	0		Not available
Imringer Sea [See map]	2	8/8/1991 2/2/2006	A. Fridriksson & Saemundsson	J. Olafsson	J. Olafsson	56	0	34	0	0		Not available
TUNDRA 94		7/5 - 8/8/1994	A. Fedorov		L. Anderson							Not available
Good Hope		11/4-12/8/2004	A. S. Vavilov	S. Speich	M. Alvarez A. Dickson							Not available
34AR97_12 WOCE AR18f [See map]	180	8/5 - 9/25/1997	Aranda	H. Gronvall J. Launainen		0	0	0	0	170		Data files
31AN119 [See map]	51	4/20 - 6/6/1989	Atlantis 2	P. Brewer ??	C. Goyet P. Brewer	48	30	49	49	0		Data files
09AR20011029 WOCE SR03_2001b		11/4-12/8/2004	A. Australis		B. Tibbrook							Not available
09AR9001_1 WOCE SR03			A. Australis		B. Tibbrook							Not available
												Not available

Done

CDIAC Global Ocean CO₂ Database Components


- **WOCE** Database
- **GLODAP** Database
- **CLIVAR** Repeat Hydrography and Carbon Database
- **VOS** Underway pCO₂ Database
- **Moorings** and **Time Series** Database
- **CARINA** Database
- **PICES** Database

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http://cdiac.ornl.gov/oceans/PICES/PICES_table.html





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PICES Cruise Summary Table and Data

Last updated: 04-June-2007

Cruise Name	No. Sta.	Date ^a	Ship	Chief Scientist	Carbon PI	TCO ₂	TALK	pCO ₂ ^b	pH	CFC	Other Measurements	Data Files
09AR20011029 CLIVAR SR03_2001 (See map)	135	10/29 – 11/22/2001	Aurora Australis	S. Rintoul	B. Tilbrook	97	96	0	0	88	CFC113	Data files
09FA20010524 CLIVAR P155_2001 (See map)	129	05/24 – 07/08/2001	Franklin	S. E. Wijffels	B. Tilbrook	126	125	0	0	107	CFC113, CCl ₄	Data files
49NZ20010725 CLIVAR P17N_2001 (See map)	79	07/25 – 08/28/2001	Mirai	M. Fukasawa	A. Murata	37	37	0	37	0	¹⁴ C, ¹³ C	Data files
33KK20020701 MP-5 (See map)	17	07/01 – 07/15/2002	Kaimikai-O-Kanaloa	R. Siebert	P. Yager	17	17	0	0	0	No nutrients	Data files
33KB20020923 M P6 (See map)	34	09/23 – 10/15/2002	Kila Moana	D. Capone	P. Yager	34	34	0	0	0	No Nutrients	Data files
33RR20030714 MP-9 (See map)	32	07/14 – 08/21/2003	Roger Revelle	R. Siebert	P. Yager	32	32	0	0	0	No Nutrients	Data files

Done

CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
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- **VOS** Underway pCO₂ Database
- **Moorings** and **Time Series** Database
- **CARINA** Database
- **PICES** Database
- **Global Surface Ocean Alkalinity Climatology** Database
(calculated by Kitack Lee using the relationships of total alkalinity with salinity and temperature)

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 http://cdiac.ornl.gov/oceans/lee_Surface_Alk_Climatol.html Go Testa madster

Ocean CO₂ CDIA **Carbon Dioxide Information Analysis Center**
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Global Surface Ocean Alkalinity Climatology
 (calculated by Kitack Lee* using the relationships of total alkalinity with salinity and temperature)

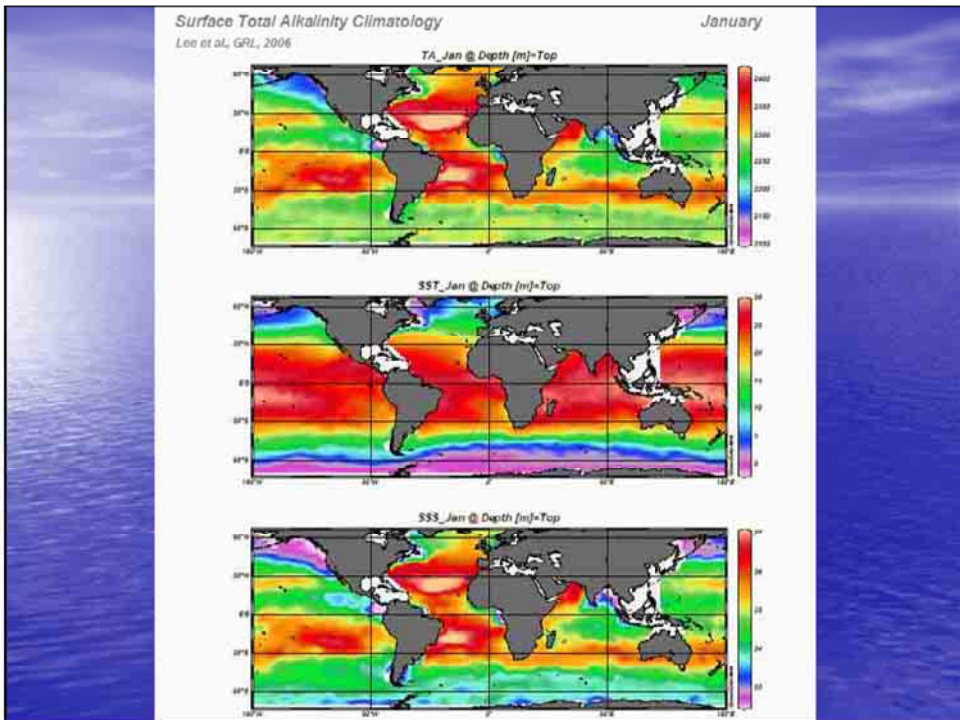


Surface Total Alkalinity fields were estimated from five regional TA relationships presented in Lee et al., 2006*, using monthly mean sea surface temperature and salinity from the *World Ocean Atlas 2001*. The data file consists of 36 columns, including latitude, longitude, sea surface temperature(SST_Jan-Dec), sea surface salinity(SSS_Jan-Dec), calculated total alkalinity from January through December (TA_Jan-Dec).

- Global Surface Ocean Alkalinity Climatology Data File
- CDIAC Collection for Global Surface Ocean Alkalinity Climatology
- Open Access Server (OAS) for Global Surface Ocean Alkalinity Climatology

*Please see his bio at: http://www.cdiac.gov/people/lee/lee_kitack.html

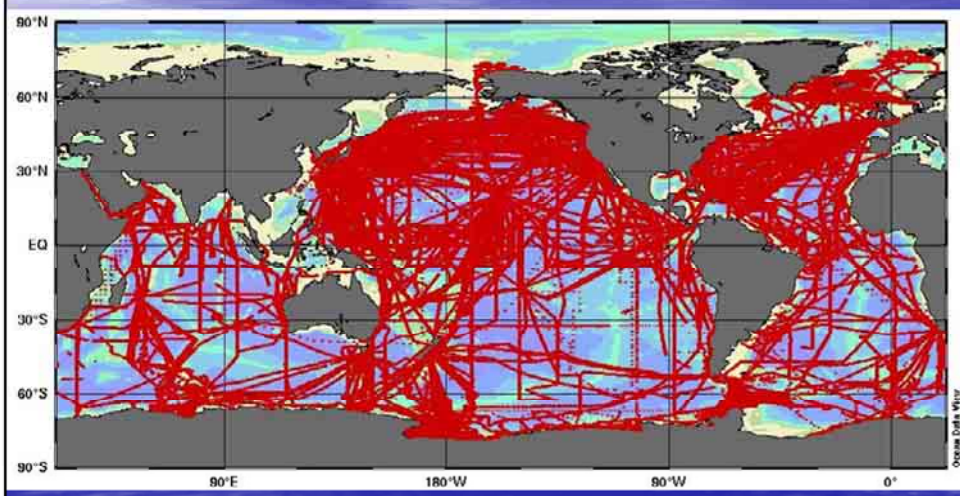
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CDIAC Global Ocean CO₂ Database Components

- **WOCE** Database
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- **VOS** Underway pCO₂ Database
- **Moorings** and **Time Series** Database
- **CARINA** Database
- Global Surface Ocean **Alkalinity Climatology** Database (K. Lee)
- **LDEO** (Takahashi) Global Surface pCO₂ Database

LDEO Underway pCO₂ Database
(> 3,200,000 points)

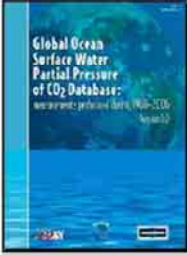


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http://cdiac.ornl.gov/oceans/ndp_088/ndp088.html

NDP-088 (2007)

Download the [Global Ocean Surface Water Partial Pressure of CO₂ Database files](#)
[Global Ocean Surface Water Partial Pressure of CO₂ Database WAVES search](#)
Download of NDP-088

Global Ocean Surface Water Partial Pressure of CO₂ Database: Measurements Performed During 1968 - 2006 (Version 1.0)



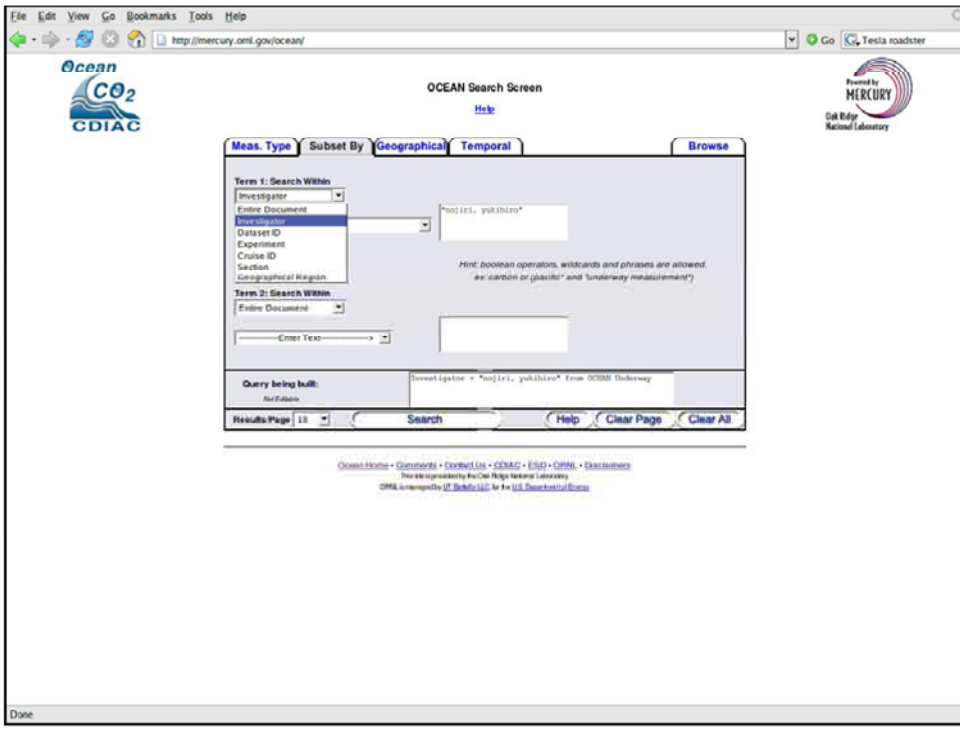
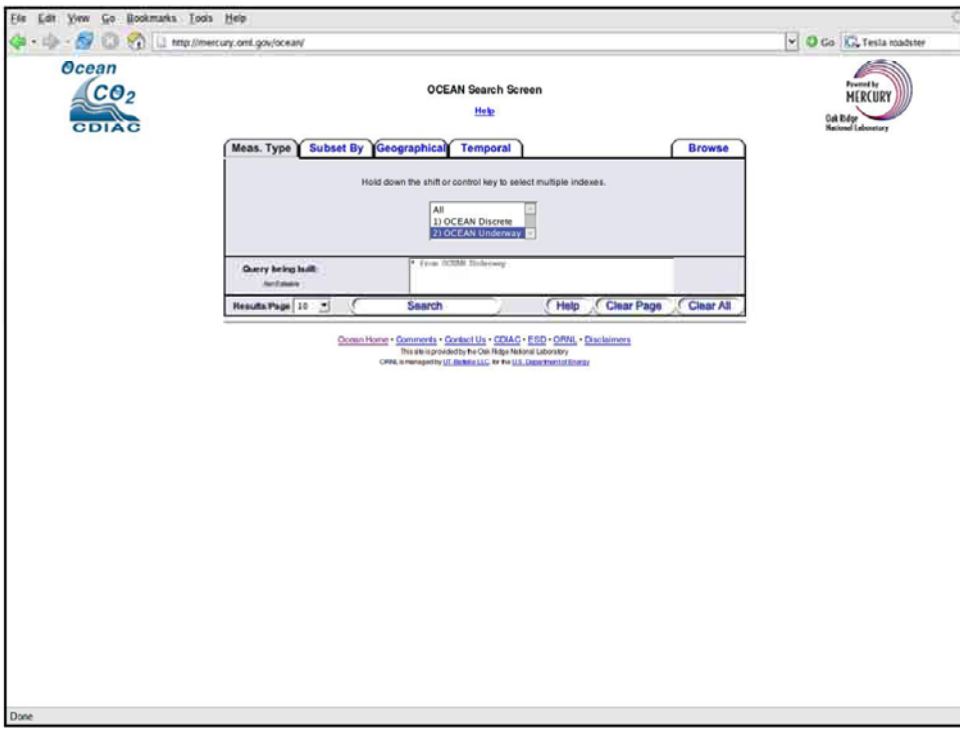
Contributed by
Taro Takahashi and Stewart C. Sutherland
Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY

Prepared by
Alex Kozyr
Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory
Oak Ridge, Tennessee, U.S.A.

[Abbreviations and Acronyms](#)
[Abstract](#)
Done

CDIAC Ocean Data Search Engines

- *Mercury (metadata and data search engine)*



Ocean Search Screen

Investigator: nojiri, yukihiro

Meas. Type | Subset By | Geographical | Temporal | Browse

Term 1: Search Within

nojiri, yukihiro

Hint: boolean operators, wildcards and phrases are allowed
ex: carbon or plastic and "underway measurement"

Investigator = "nojiri, yukihiro" from OCEAN Underway

Search

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OCEAN Metadata Summary

QUERY:
Investigator = "nojiri, yukihiro" from OCEAN Underway

Current Database: OCEAN Underway

Viewing documents 1-3 out of 3
Results Page: Prev 1 Next


1. Dataset ID: VOS Alligator Hope Line
[Access data and documentation...](#)
2. Dataset ID: VOS Pyxis Line
[Access data and documentation...](#)
3. Dataset ID: VOS Skaugran Line
[Access data and documentation...](#)

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OCEAN

Metadata Report
[Help](#)

QUERY:
 Investigator = "nojiri, yukihiko" from OCEAN Underway

Current Database: OCEAN Underway



Dataset ID: VOS Alligator Hope Line

Investigator(s):

Name: Nojiri, Yukihiko
Organization: National Institute for Environmental Studies (NIES)
Address: Center for Global Environment Research (CGER) 16-2, Orogawa, Tsukuba, Ibaraki 305-8508, JAPAN
Email: nojiri@nies.go.jp

Dataset Info:

Dataset ID: VOS Alligator Hope Line
Submission Dates:
Initial Submission: 20070413
Revised Submission: 20070414

Cruise Info:

Experiment:
Experiment Name: Volunteer Observing Ship (VOS) Project

Cruise:

Cruise ID: AH01-AH16
Section: VOS Alligator Hope Line

Geographical Coverage:
Geographical Region: Pacific Ocean
Bounds: W: 120 E: -115 N: 60 S: -20
Temporal Coverage: Start Date: 19991112 End Date: 20010511

Ports of Call: Oki, Tokyo, Japan
Ports of Call: Vancouver, BC

Vessel:
Vessel Name: M/C Alligator Underway

Date

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 http://mercury.ornl.gov/ocean/full.jsp?index=06&records=06&pageMax=10

Variables Info:

Variable Name	Description of Variable
Hum	(%RH)
Atmos Press	(hPa)
Air xCO2	ppm
Air pCO2	uatm
SST	Deg. C
vCO2_Eq	ppm
pCO2_SST	uatm
delta pCO2	uatm
Salinity	

Method Description:

Equilibrator Design:
Equilibrator Type: Tandem Type Equilibrator
Equilibrator Volume:
Water Flow Rate: 5-10 L/min
Headspace Gas Flow Rate:
Vented:
Measurement Method: NDIR
Manufacturer of Calibration Gas: Calibration: once in 12 hrs every day using standard gases. Nippon Sanso Corporation, Japan. Concentrations of calibration gases used: 250, 320, 390, 460 ppm

CO2 Sensors:
CO2 Sensor:
Manufacturer: Manufacture: Fisher-Rosemount * Type: Model 880A * Reference cell: N2 gas flow through
Model:
Environmental Control:
Resolution: 10 minutes
Uncertainty:
CO2 Sensor Calibration:

Method References: Murphy, P. P., K. K. Kelly, R. A. Feely, and R. H. Gammon (1995): Carbon dioxide concentrations in surface water and the atmosphere during 1986-1989 NOAA-PMEL cruises in the Pacific and Indian Oceans (Oak Ridge Natl. Lab., Oak Ridge, TN), Rep. NREL/CDIAC-75, NDP-047.

Data Set References:
Citation: Nojiri, Y. 2007. Monitoring of the atmosphere-ocean carbon dioxide exchange by ship of opportunity. http://cdiac.ornl.gov/oceans/VOS_Program/VOS_PX_SK_AH.html. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, Tennessee.

Data Set Link(s): [VOS Alligator Hope Line](#)

Date

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Skaugran Line

Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Skaugran	Japan	Map	Chiba, Japan - Vancouver, BC - San Diego, USA	05/28/1995 - 09/28/1999	1-3/Month	Y. Niimi / Japan	Hum. Atmos Press, SST, SSS, α CO ₂ , Eq, pCO ₂ , SST, δ pCO ₂ , XCO ₂ , atm, pCO ₂ , atm	Data	NIES Monitoring Web site

Alligator Hope Line

Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Alligator Hope	Japan	Map	Oka, Tokyo, Japan - Vancouver, BC, CA	1/12/1999 - 05/11/2001	1-2/Month	Y. Niimi / Japan	Hum. Atmos Press, SST, SSS, α CO ₂ , Eq, pCO ₂ , SST, δ pCO ₂ , XCO ₂ , atm, pCO ₂ , atm	Data	NIES Monitoring Web site

Pyxis Line

Vessel	Country	Map	Ports	Dates of Operation	Frequency of Repeat	PI/Chief Scientist	Measurements	Data	Project Link
MS Pyxis	Japan	Map	Nagoya, Japan - Portland, Oregon - Los Angeles - Toyohashi, Japan - US East coast - Japan	11/06/2001 - 04/07/2006	Monthly	Y. Niimi / Japan	Ambient Temp, Hum, Solar Radiation, Ref WV, Ship Speed, Abs WV, Atmos Press, Air XCO ₂ , Air fCO ₂ , Air pCO ₂ , Eq Temp, SST, α CO ₂ , Eq, fCO ₂ , Eq, pCO ₂ , SST, α CO ₂ , SST, pCO ₂ , SST, δ fCO ₂ , δ α CO ₂ , δ pCO ₂ , Sal	Data	NIES Monitoring Web site

Page is maintained by Alex Kozyr
 Date

File Edit View Go Bookmarks Tools Help
 http://mercury.ornl.gov/ocean/

Ocean CO₂ CDIAAC OCEAN Search Screen
 Help

Meas. Type Subset By Geographical Temporal Browse

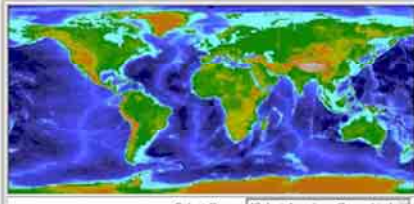
Select Ocean: [Select Area from Ocean List]

North
 West East
 Map
 South

Search Area
 Overlaps Enclosure

Give West Longitude and East Longitude negative values for West.

Map 10/15/07 1:05:04
 File Edit View Go Bookmarks Tools Help
 http://mercury.ornl.gov/ocean/map.html



30.0 N
 180.0 W 180.0 E
 30.0 S
 Zoom In Zoom Out

Select Ocean: [Select Area from Ocean List]

return coordinates Cancel

Copyright
 Mercury
 ORNL
 National Laboratory

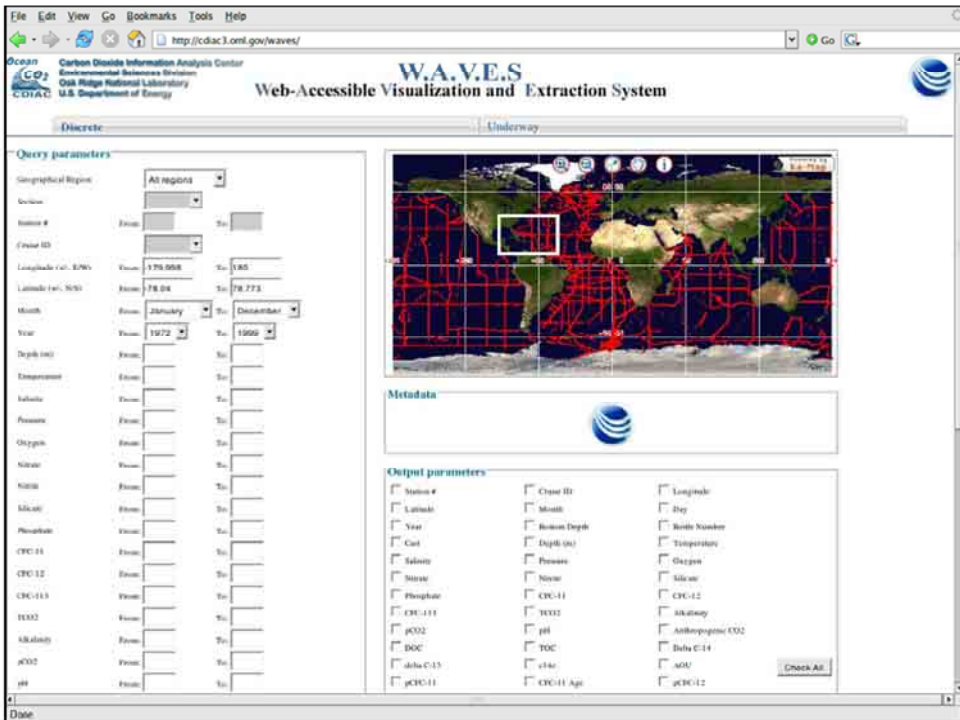
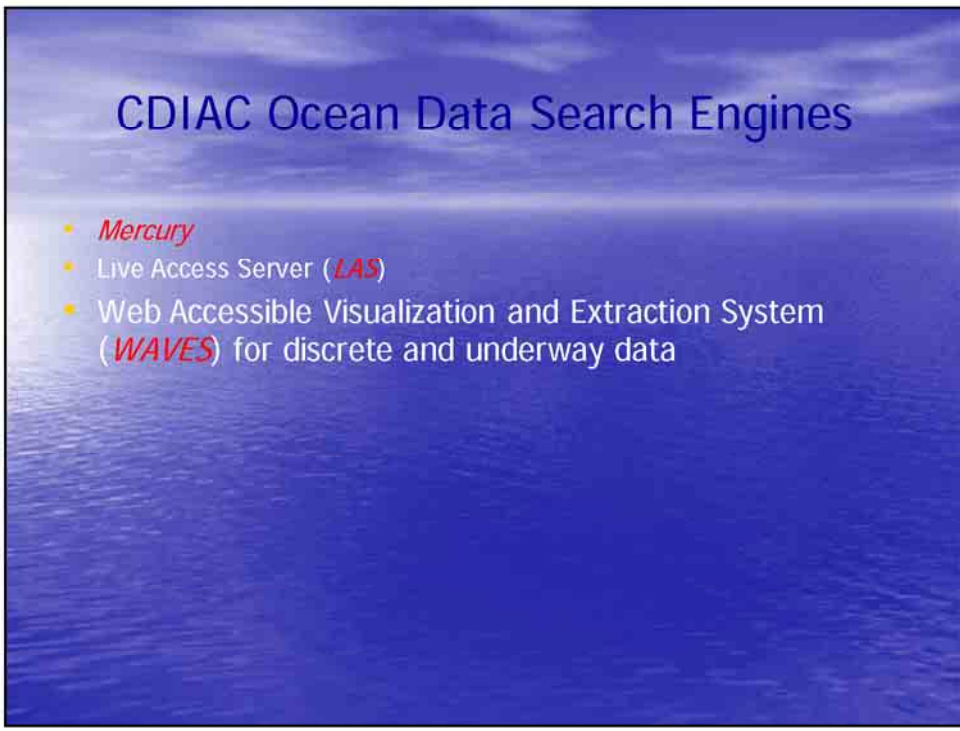
Clear Page Clear All

Linking JAVA applet is provided courtesy of Jonathan Callahan at PMO

CDIAC Ocean Data Search Engines

- Mercury
- Live Access Server (*LAS*)

The screenshot shows the 'Ocean Carbon' web application interface. The browser window title is 'Ocean Carbon - Mozilla Firefox'. The address bar shows the URL: http://ferret.pmel.noaa.gov/las_OCDSMS/servlets/c. The page content includes a search bar, a sidebar with navigation links (Datasets, Variables, Constraints, Previous Output, About, Contact), and a main configuration area. The main area has a 'Select view' dropdown set to 'Latitude-longitude (xy)', a 'Select output' dropdown set to '(1 var) measured values', and a 'Select region' dropdown set to 'Full Region'. Below these is a world map with a red box around a 'Next >' button. The 'Select time range' section shows dates from '01 Jan 1968' to '31 Dec 2008'. The 'Data Options' section includes checkboxes for 'Subsampling', 'pCO2_eq', 'Ship', and 'Season'. The 'Product Options' section includes a 'Palette' dropdown set to 'temperature rainbow'. A 'Next >' button is also visible at the bottom right of the configuration area. The status bar at the bottom left says 'Applet map started'.



The screenshot shows the W.A.V.E.S. (Web-Accessible Visualization and Extraction System) interface. The browser address bar shows <http://cdiac3.ornl.gov/waves/>. The page header includes the logos for CO₂ and CDIAE, and the text "Carbon Dioxide Information Analysis Center Environmental Sciences Division Oak Ridge National Laboratory U.S. Department of Energy". The main title is "W.A.V.E.S. Web-Accessible Visualization and Extraction System".

The interface is divided into several sections:

- Query parameters:** A form with various input fields for geographical and temporal data. The "Geographical Region" is set to "Atlantic Ocean". The "Year" is set to "1972" and "December".
- Map:** A satellite-style map of the Atlantic Ocean with a red dashed box indicating the query area.
- Metadata:** A section with a red arrow pointing to a link: [Access to DATA sets: WWW.ARI\(102\) DATA sets: 2008_11\) NAME: AN GEOPHYS. Atmos. TIT: 514 TID: 13\) 2008_112](#).
- Output parameters:** A list of checkboxes for selecting data fields such as "Station #", "Longitude", "Year", "Bottom Depth", "Salinity", "pH", etc.

The screenshot shows the "OCEAN Metadata Report" page. The browser address bar shows <http://mercury.ornl.gov/ocean/full.jsp?index=0&record=0&pageMax=10>. The page header includes the logos for Ocean CO₂ CDIAE and Mercury National Laboratory.

The main content area displays the following information:

- Investigator:** "sabine, christopher" and Dataset ID = "clivar_p16n_2008" from OCEAN Discrete.
- Current Database:** OCEAN Discrete.
- Investigator(s):** A list of names and contact information for Christopher Sabine, Richard A. Feely, Mark Foyel, and Henrik Donne. The names and organization details for Sabine, Feely, and Foyel are circled in red.
- Dataset Info:** Dataset ID: CLIVAR_P16N_2008, Submission Date: 10/05/02, Initial Submission: 10/05/02, Revised Submission: 10/05/02.

File Edit View Go Bookmarks Tools Help

http://mercury.ornl.gov/ocean/full.jsp?index=06&recid=06pageMax=10

Crucial Info:

Experiment:
 Experiment Name: CLIVAR_002 REPEAT HYDROGRAPHY
 Cruise: 070000002
 Section: CLIVAR_P16N_2006

Geographical Coverage:
 Geographical Region: Pacific Ocean
 Bounds: W: 155 E: 149 N: 57 S: 18
 Temporal Coverage: Start Date: 20060214 End Date: 20060330

Parts of Cell:
 Parts of Cell: Papuaia, Tahiti
 Parts of Cell: Honolulu, Hawaii
 Parts of Cell: Kodiak, Alaska

Vessel:
 Vessel Name: R/V Thomas Thompson
 Vessel ID: 200
 Country: United States
 Vessel Owner: School of Oceanography, University of Washington

Variables Info:

Variable Name	Description of Variable
Temperature	deg. C
Salinity	
Oxygen	umol/kg
Nitrate	umol/kg
Nitrite	umol/kg
Silicate	umol/kg
Phosphate	umol/kg
CDC11, CDC12	umol/kg
TOC2	umol/kg
TALK	umol/kg
DO2	umol/kg
pH	

Method Description:

TOC2 Data:

TOC2 Analysis Method:

Standardization Technique:

Technique Description: The TOC2 analysis was done by coinjectivity with two analytical systems (FML1 and FML2) used simultaneously on the cruise. Each system consisted of a coulometer (DC, Inc.) coupled with a SOMMA. The coulometers were each calibrated by injecting aliquots of pure OOD (99.99%) by means of an 8 port valve outfitted with two sample loops. The instruments were calibrated at the beginning and end of each station with a set of the gas loop injections.

Sample Volume: 200 mL

CRM Info:

Correction Magnitude:

Batch Number: 73

Date

File Edit View Go Bookmarks Tools Help

http://mercury.ornl.gov/ocean/full.jsp?index=06&recid=06pageMax=10

Magnitude of Blank Correction:

Accuracy Info: 1) 1) (Moles) 1x (mol) - 1.11 +/- 0.34 umol/kg with n=23 2) 1) (Moles) 1 +/- 1.76 +/- 1.30 umol/kg with n=17 3) (Moles) 1x (mol) +/- 0.79 +/- 0.88 umol/kg with n=124

Units:

pCO2 Data:

pCO2 Analysis Method: The closed pCO2 system is constructed after the instrument described in (Froehner et al. (1995) and is discussed in detail in Wernickel and Thompson (1995) and Chen et al. (1995). The main difference between the two systems is that Wernickel's instrument uses a LI-COR LiD (model 1202) non-dispersive infrared analyzer, while the Claydon instrument utilizes a gas chromatograph with a flame ionization detector.

Sample Volume: 500 mL

Headspace Volume: 70 mL

Measurement Temperature: 20C

Temperature Normalization: 20C

Temperature Correction Method: See Peng et al., 1987

Variable Reported: pCO2@20C

Gas:

Standard Gas Concentrations: CAS09 205.1 ppm CAS09 079.7 ppm CAS09 600.0 ppm CAS09 792.6 ppm CAS09 1007.0 ppm CAS09 1899.7 ppm

Frequency of Standardization: In order to maintain analytical accuracy, a set of six gas standards is run through the analyzer before and after every ten analyzer samples.

Field Replicate Info: Generally when samples were taken, blanks were done on all the blanks including four duplicates. Two of the duplicates were analyzed at different temperatures.

Storage Method: Samples were drawn from 1000 bottles into 500 mL volumetric flasks using Tygon® tubing with a 3/16 inch adapter that fit over the neck of the flask to avoid contamination of OOM samples. Ruffles were stored while inverted and filled with the solvent, avoiding head a volume while being kept out to avoid any bubbles. About 1 mL of water was added to allow for expansion of the water as it warms and to provide space for the stopper tubing, and fit in the analyzer system. Dissolved oxygen (0.2 mL) was added as a preservative. The sample bottles were sealed with a screw cap containing a polypropylene liner. The samples were stored in coolers at room temperature generally for no more than 5 hours.

Accuracy Info: Three types of duplicates were taken. The average difference (SD) (sample 1 sample 2) / (sample 1 + sample 2) * 100, for all three types are listed below. Duplicates run at 20 C are: pH +/- 0.23% n = 23 one water control Duplicates run at 12 C are: pH +/- 0.31% n = 18 % n = 23 one water control Duplicates run at 12 C and 20 C are: pH +/- 0.7 +/- 0.23% n = 19 two water control. The control values were because of a problem in analysis in one of the duplicates. The duplicate run at different temperatures were normalized to 20 C and compared. Normalization was performed using the constants and procedure as outlined in Peng et al. 1997 as implemented in the GW EASDC data reduction program. Of note is that using the constants as left by Dehnen and Munn and the activity dependence of bicarbonate as postulated by Dehnen gave an average difference of 1%, that is, these constants yielded better agreement in temperature normalization.

Method References: Wernickel, R., and Thompson, R., 1995. Measurement of fugacity of CO2 in surface water using continuous and discrete sampling methods. Mar. Chem., v. 44, no. 2-4, p. 199-205.

Chen, H., Wernickel, R., Rupp, H. A., and Clowry, D., 1995. Measurement of fugacity of carbon dioxide in sub-surface waters: an evaluation of a method based on infrared analysis. NOAA technical report ERL AOML-45, 52 pp. NOAA/CIRES, ERL AOML-45.

Peng, T. H., Takahashi, T., Swadlow, W. E., and Clowry, D., 1987. Seasonal variability of carbon dioxide, nutrients and oxygen in the western North Atlantic surface water observations and a model. Tellus, v. 39B, p. 430-458.

pH Data:

pH_Sensor: moseley model w/ 25C

pH_Analysis Method: The pH measurements of analyzer were made using the spectrophotometric technique of Clayton and Byrne (1992). The pH of the samples using the normal buffer (NBP).

Calibration Info:

Calibration Description: The instrument was calibrated using TRIS (Banerjee et al., 1977) and CRM 73 which pH value was measured in the lab prior to going at sea.

In_Situ_Temperature: NA

Temperature_of_Analysis: 25C

Temperature_Normalization: 25C

In_Situ_Pressure: NA

Accuracy Info: pH(CRM 73) = 7.8417(A ± 0.0020 pH(TRI)) + 0.0225 (A ± 0.0033 with n=32

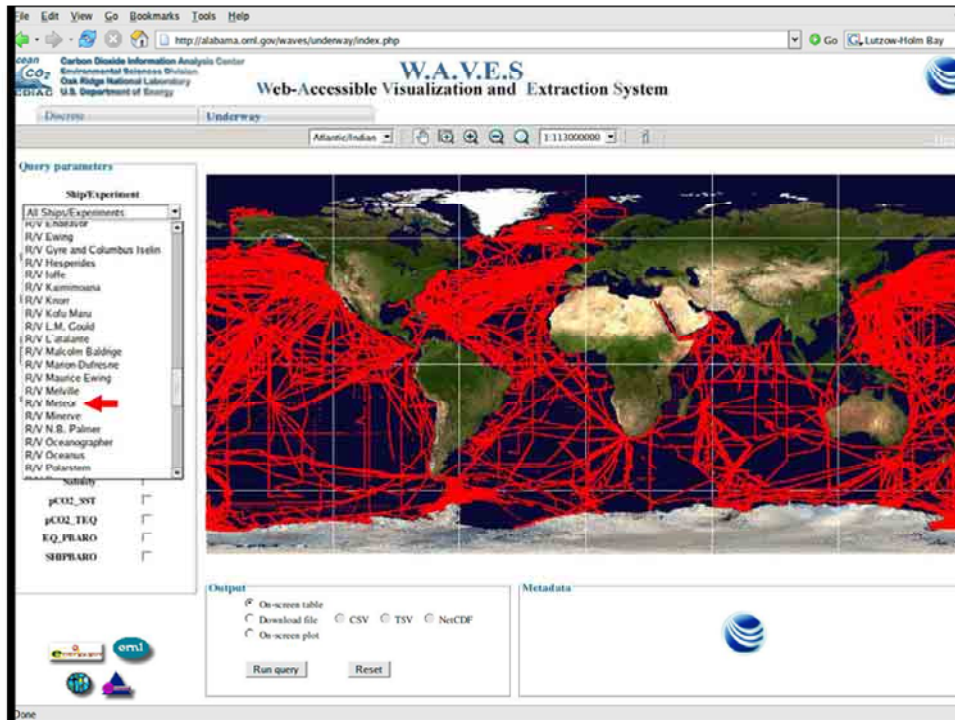
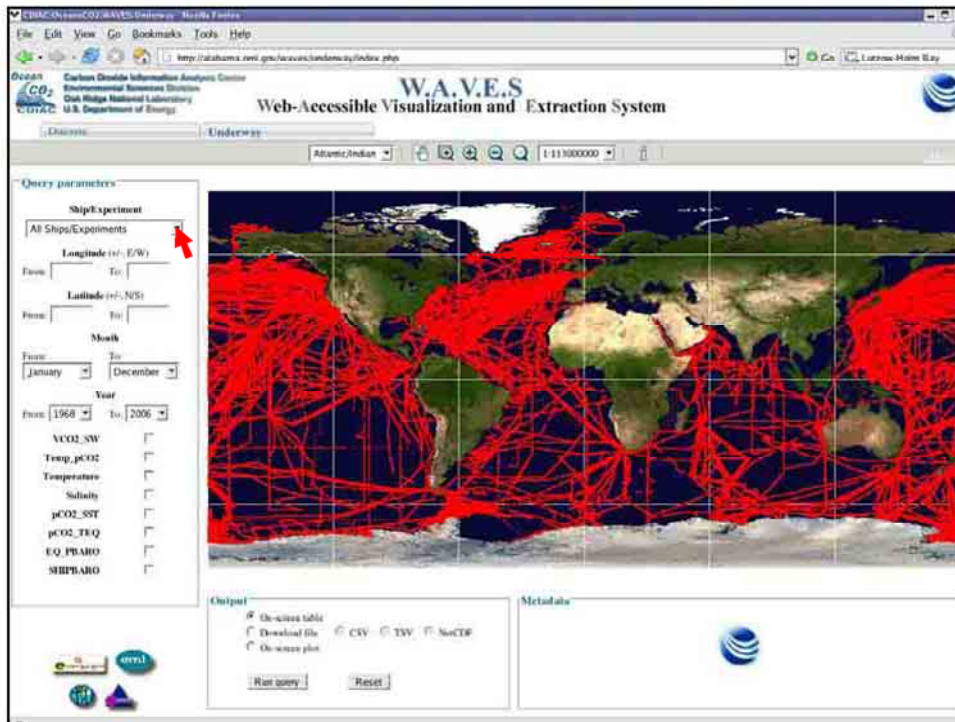
Method References: Byrne, 1987. Clayton and Byrne (1992), Banerjee et al., 1977

Data set References:

Crucial: Park, R., C. Salton, F. Millero, R. Wernickel, D. Hammett, 2006. Carbon Dioxide, Hydrographs, and Chemical Data Observed During the R/V Thomas Thompson Cruise in the Pacific Ocean on CLIVAR Repeat Hydrography Section P16N_2006 (Jan. 14 - Mar. 30, 2006). <http://co2sci.ornl.gov/co2sci/RepeatSection/p16n.html>. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee

Data Set Link(s): CLIVAR_002 Repeat Section P16N_2006

Date



The screenshot shows the W.A.V.E.S. (Web-Accessible Visualization and Extraction System) interface. The browser address bar shows the URL: <http://atlas.cgd.cornell.edu/waves/index.php>. The page title is "W.A.V.E.S. Web-Accessible Visualization and Extraction System".

Query parameters:

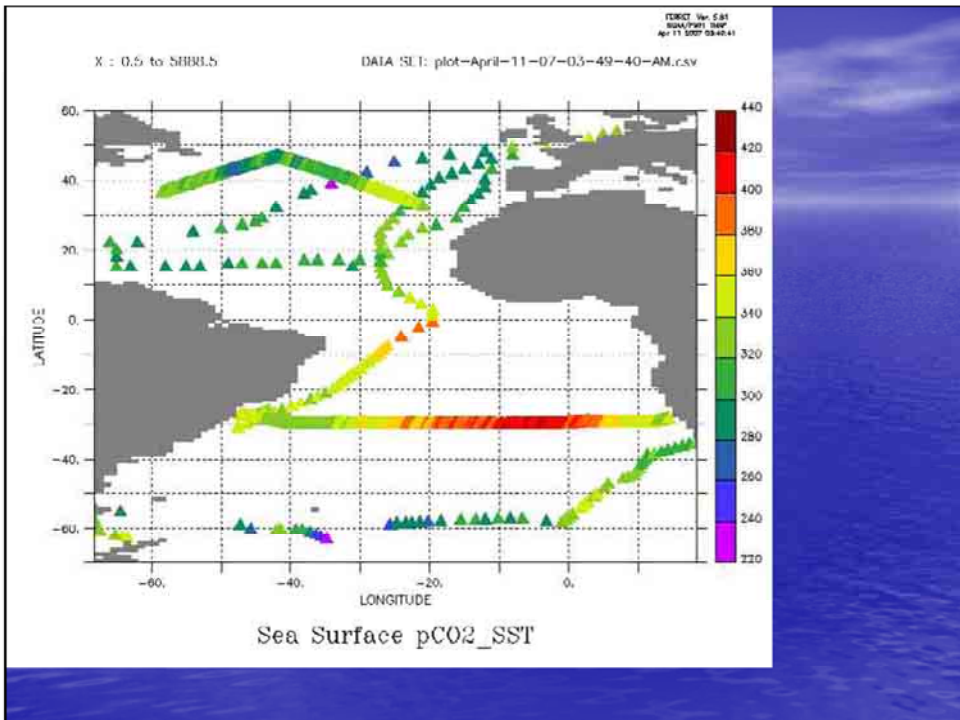
- Ship/Experiment: R/V Meteor
- Longitude (°E/W): From 80.3288 To 20.72627
- Latitude (°N/S): From -77.4900 To 61.70505
- Month: From January To December
- Year: From 1968 To 2006
- Variables: VCO2_SW, Temp_pCO2, Temperature, Salinity, pCO2_SST (highlighted with a red arrow), pCO2_TEQ, EQ_PHARO, SHIPARO.

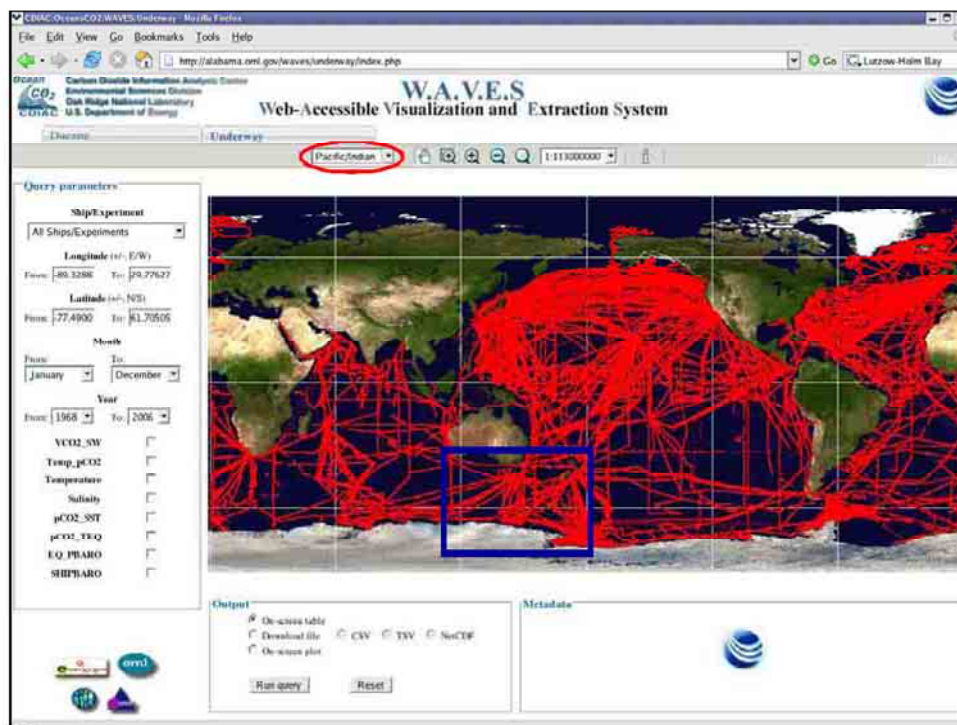
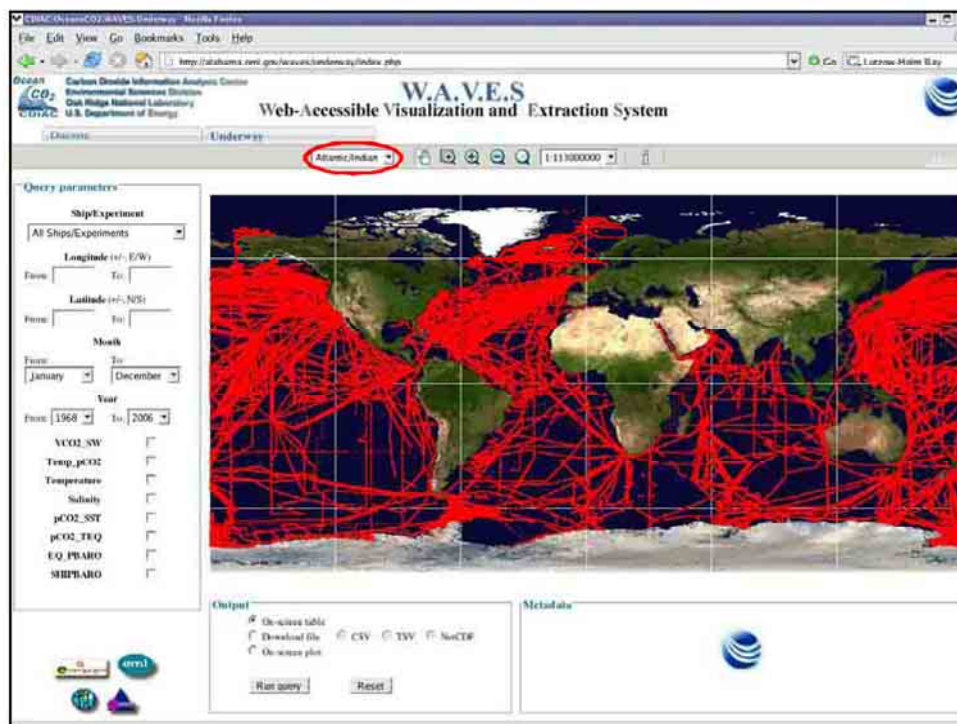
Output:

- On-screen table
- Download file
- CSV
- TSV
- NetCDF
- On-screen plot

Metadata:

- Ship/Experiment: R/V Meteor; Leg: 5
- Cruise name: Cruise 11/5 WOCE Line A21/A12
- Observer: Tam Takahashi
- Departure port: Ushuaia Argentina; Departure date: 23 Jan 99
- Arrive port: Ushuaia Argentina; Arrive date: 8 Mar 99
- Comments: Extracted from HYDR File





W.A.V.E.S. Web-Accessible Visualization and Extraction System

Carbon Dioxide Information Analysis Center
Environmental Sciences Division
Oak Ridge National Laboratory
U.S. Department of Energy

Atlantic Ocean | 1:2500000

Query parameters:

- ShipExperiment: All ShipExperiments
- Longitude (±): E/W: From 129.8676 To 175.4289
- Latitude (±): N/S: From 70.2836 To 31.9287
- Month: From January To December
- Year: From 1968 To 2006
- Parameters: VCO2_SW, Temp_pCO2, Temperature, Salinity, pCO2_SST, pCO2_FFQ, EQ_PBARO, SHIPBARO

Output: Database table, CSV, XML, NetCDF, Database plot

Metadata: ShipExperiment: R/V N/R, Paloma, Leg: 1
Cruise name: 003 Atlantic Pycnocline
Observer: Suzanne O'Hara
Departure port: Hobart AUS; Departure date: 20 Dec 00
Arrive port: Hobart AUS; Arrive date: 25 Jan 01
Comments: Air from S.Pole Extrapolation

W.A.V.E.S. Web-Accessible Visualization and Extraction System

Underway measurements query results
Created on: 30th of March 2007 10:35:26 AM
The following parameters were used:

Latitude Longitude Date IDate VCO2_SW Temp_pCO2 Temperature Salinity pCO2_SST pCO2_FFQ EQ_PBARO SHIPBARO

Latitude	Longitude	Date	IDate	VCO2_SW	Temp_pCO2	Temperature	Salinity	pCO2_SST	pCO2_FFQ	EQ_PBARO	SHIPBARO
-40.93	146.54	2000-12-27	397.1344	306.6	0.0	9.92	34.17	346.75	351.0	0.00000	980.94
-40.92	146.54	2000-12-27	397.1398	306.15	0.0	9.91	34.08	346.33	350.9	0.00000	980.99
-40.94	146.53	2000-12-27	397.1367	304.9	0.0	9.94	34.19	348.0	350.2	0.00000	980.83
-40.95	146.52	2000-12-27	397.1222	306.26	0.0	9.94	34.17	345.98	350.4	0.00000	980.80
-40.98	146.26	2000-12-27	397.1239	306.26	0.0	9.94	34.17	346.23	350.7	0.00000	980.76
-40.98	146.29	2000-12-27	397.1276	306.36	0.0	9.94	34.17	348.64	350.2	0.00000	980.90
-40.97	146.23	2000-12-27	397.1280	305.94	0.0	9.93	34.18	346.22	350.1	0.00000	980.56
-40.97	146.24	2000-12-27	397.1279	305.99	0.0	9.93	34.18	346.27	350.1	0.00000	980.55
-40.94	146.23	2000-12-27	397.1283	306.20	0.0	9.97	34.18	348.73	349.7	0.00000	980.91
-40.98	146.29	2000-12-27	397.1282	306.33	0.0	9.97	34.18	346.11	350.4	0.00000	980.80
-40.94	146.23	2000-12-27	397.1337	306.10	0.0	9.93	34.18	345.83	350.1	0.00000	980.43
-40.98	146.29	2000-12-27	397.1322	305.79	0.0	9.97	34.18	345.69	349.9	0.00000	980.79
-40.97	146.23	2000-12-27	397.1370	306.07	0.0	9.93	34.19	345.44	349.1	0.00000	980.51
-40.93	146.23	2000-12-27	397.1346	306.08	0.0	9.93	34.19	344.84	349.1	0.00000	980.51
-40.92	146.22	2000-12-27	397.1364	307.22	0.0	9.97	34.20	344.73	349.3	0.00000	980.26
-40.93	146.23	2000-12-27	397.1276	305.97	0.0	9.97	34.20	344.90	349.0	0.00000	980.19
-40.92	146.23	2000-12-27	397.1284	304.91	0.0	9.93	34.20	344.74	349.0	0.00000	980.20
-40.96	146.24	2000-12-27	397.1286	304.08	0.0	9.93	34.21	345.18	349.0	0.00000	980.20
-40.92	146.26	2000-12-27	397.1417	309.27	0.0	9.95	34.21	345.23	349.2	0.00000	980.13
-40.98	146.29	2000-12-27	397.1414	308.62	0.0	9.98	34.22	346.17	349.7	0.00000	980.64
-40.92	146.24	2000-12-27	397.1473	306.00	0.0	9.93	34.22	345.08	349.0	0.00000	980.85
-40.98	146.23	2000-12-27	397.1446	306.73	0.0	9.98	34.22	345.08	349.7	0.00000	980.95
-40.98	146.23	2000-12-27	397.1454	305.94	0.0	9.98	34.21	345.39	349.4	0.00000	980.94
-40.98	146.24	2000-12-27	397.1540	306.08	0.0	9.98	34.22	345.77	350.9	0.00000	979.69
-40.97	146.26	2000-12-27	397.1530	304.40	0.0	9.93	34.22	344.45	348.4	0.00000	979.77
-40.11	146.30	2000-12-27	397.1506	303.36	0.0	9.93	34.21	343.41	347.3	0.00000	979.71
-40.12	146.26	2000-12-27	397.1573	304.74	0.0	9.94	34.21	343.00	347.7	0.00000	979.68
-40.15	146.36	2000-12-27	397.1599	304.66	0.0	9.94	34.20	343.15	347.6	0.00000	979.66
-40.15	146.33	2000-12-27	397.1604	303.72	0.0	9.93	34.20	343.22	347.4	0.00000	979.56
-40.18	146.38	2000-12-27	397.1682	304.31	0.0	9.93	34.20	343.40	347.7	0.00000	979.32
-40.12	146.40	2000-12-27	397.1620	303.94	0.0	9.93	34.20	343.56	347.4	0.00000	979.34

Total rows: 250847, not more than 5000 rows per page

← FIRST | PREV | Page 1 of 51 | NEXT | LAST →

