Water column DOC, Chl, PN, PC, PON, and POC data from CTD casts from R/V Tangaroa cruise VDT0410 in the South East of New Zealand, S.W. Bounty Trough in 2004 (SAGE project)

Website: https://www.bco-dmo.org/dataset/3329
Version: 01April2010
Version Date: 2010-04-01

Project
» Surface-Ocean Lower-Atmosphere Studies Air-Sea Gas Exchange (Experiment) (SAGE)

Programs
» United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)
» Iron Synthesis (FeSynth)

Contributors	Affiliation	Role
Nodder, Scott	New Zealand National Institute of Water and Atmospheric Research (NIWA)	Principal Investigator
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Water column DOC, Chl, PN, PC, PON, POC data from CTD casts

A summary of methods used and detection limits is below under 'Data Processing Description'.

Methods & Sampling

Refer to SAGE Voyage Report

CTD-related instrumentation consisted of:
- a Seabird Electronics (SBE) 911plus CTD with:
- SBE-5 pumped SBE-3 temperature, SBE-4 conductivity and SBE-43 dissolved oxygen sensors.
- SBE-5 pumped secondary SBE-3 temperature and SBE-4 conductivity sensors.
- Seapoint Sensors, Inc. SCF chlorophyll fluorometer.
- 25-cm Wetlabs C-star transmissometer.
- Biosherical Instruments Inc. photosynthetic ally active radiation (PAR) sensor, model QSP200L4S.
- Datasonics sonar altimeter, model PSA-900D.
- a SBE 32 24x10-litre Carousel water sampler.

- Ocean Test Equipment Standard BES external-spring Niskin-type water-sampling bottles.
- Salinity sample bottles.
- CTD winch with 10-km 10.5-mm single-core seacable.

Performance: With the exception of issues noted below, the CTD-related instrumentation apparently functioned to specification and was operated essentially according to accepted practices for the duration of the voyage. A total of 85 one-cast CTD stations were completed, labelled u3502 to u3743.

PAR Sensor: The initial CTD PAR sensor experienced an intermittent fault that manifested as a time variable offset, both cast to cast and, less evidently, within casts. It was eventually replaced with a formally identical spare unit for station u3719 cast 1 and subsequent casts.

Secondary Conductivity Sensor: The initial secondary conductivity sensor eventually developed a clear fault (during station u3740 cast 1). It was replaced with a formally identical spare unit for station u3740 cast 1 and subsequent casts. The development of this fault was perhaps somewhat progressive, as possibly indicated by slight shifts in the primary-secondary conductivity difference on casts before station u3740 cast 1.

Data Processing Description

Water column DOC, Chl, PN, PC, PON, POC data from CTD casts

NIWA HAMILTON INORGANIC CHEMISTRY LABORATORY

CLIENT :Scott Nodder LOT NUMBER : 2004000218 CHECKED : MC
NIWA Wellington SF NUMBER : KX 7303 APPROVED : MC
JOB NUMBER : OEBI032 REPORT DATE : 5/10/2006
JOB : TAN 0403

A summary of methods used and detection limits is as follows.

Parameter	Description	Detection Limit	Method
Chlorophyll a(Chla-Av)	Acetone pigment extraction, spectrofluorometric measurement.	0	A*10200H
Chlorophyll a(Chla-2)	Acetone pigment extraction, spectrofluorometric measurement.	0	A*10200H
Chlorophyll a(Chla-1)	Acetone pigment extraction, spectrofluorometric measurement.	0	A*10200H
Chlorophyll a(Chla)	Acetone pigment extraction, spectrofluorometric measurement.	0	A*10200H
Dissolved Organic Carbon(DOC)	Dissolved Organic Carbon(low level) using TOC analyser	100	APHA5310B
Particulate Nitrogen Filter 1(PN-1)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	2	MAM, 01-1090
Particulate Carbon Filter 2(PC-2)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	1	MAM, 01-1090
Particulate Carbon Filter 1(PC-1)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	1	MAM, 01-1090
Particulate Nitrogen Filter 2(PN-2)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	2	MAM, 01-1090
Particulate Organic Carbon Filter 1(POC-1)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	1	MAM, 01-1090
Particulate Organic Nitrogen Filter 2(PON-2)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	2	MAM, 01-1090
Particulate Organic Nitrogen Filter 1(PON-1)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	2	MAM, 01-1090
Particulate Organic Carbon Filter 2(POC-2)	Catalytic comb @900°C, sep, TCD, CE Instruments C/N analyser	1	MAM, 01-1090
Particulate Phosphorus(PartP-2)	Acid digest, NH4-N, DRP auto analysis	0.1	Searle
Particulate Phosphorus(PartP-1)	Acid digest, NH4-N, DRP auto analysis	0.1	Searle
Particulate Nitrogen(PartN-2)	Acid digest, NH4-N, DRP auto analysis	0.1	Searle
Particulate Nitrogen(PartN-1)	Acid digest, NH4-N, DRP auto analysis	0.1	Searle

These samples were analysed as received at the laboratory.

BCO-DMO Processing Description

Generated from original spreadsheet TAN0403_water col_chlPOCPNPPDOC.xls

BCO-DMO Edits
- station_CTD, date, time, lat, lon, SAGEtime and Patch merged in from CTD station data
- 'nd' added to blank cells
- lat/lon for station U740 from position for Northern Biophysical Mooring in voyage report and is approximate

- no date/time for station U740 located to date, date of 20040414 is estimated
- U741 (U3741) has no date, time or position
- U741 (U23741) is in SAGE_watercol_chlPOCPNPPDOC.xls and SAGE_BCODMO_ARCHER_DMS.xls
- U741 (U3741) not found in any other data
- parameter names modified to conform to BCO-DMO convention

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Data Files

File
CTD_WaterCol.csv (Comma Separated Values (.csv), 29.86 KB) MD5:fc6bb7e32708f5c64b72a1f20397b431 Primary data file for dataset ID 3329

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Parameters

Parameter	Description	Units
station_CTD	text	text
date_NZST	YYYYMMDD	YYYYMMDD
time_local	HHMM	HHMM
SAGEtime	Custom project time pre/post 25March2004 19:00 Local Time (NZST)	dd.xxxx
lon	Station longitude (West is negative)	decimal degrees
lat	Station latitude (South is negative)	decimal degrees
NIWA_ID	NIWA Sample ID	text
Client_ID	Client Sample ID (cast id + depth in m)	text
depth	Sample Depth	meters
Date_Collected	Date Sample Collected	YYYYMMDD
Date_Received	Date Sample Received	YYYYMMDD
Patch	Patch designation (In/Out/Pre)	text
DOC	Dissolved Organic Carbon(DOC) Dissolved Organic Carbon(low level) using TOC analyser	mg/m3
Chla	Chlorophyll a(Chla) Acetone pigment extraction; spectrofluorometric measurement.	mg/m3
Chla_1	Chlorophyll a(Chla_1) Replicate 1 Acetone pigment extraction; spectrofluorometric measurement	mg/m3
Chla_2	Chlorophyll a(Chla_2) Replicate 2 Acetone pigment extraction; spectrofluorometric measurement	mg/m3
Chla_Av	Chlorophyll a (Chla_Av) Acetone pigment extraction; spectrofluorometric measurement	mg/m3
PN_1	Particulate Nitrogen Filter 1 (PN_1) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
PN_2	Particulate Nitrogen Filter 2 (PN_2) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3

PC_1	Particulate Carbon Filter 1 (PC_1) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
PC_2	Particulate Carbon Filter 2 (PC_2) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
PON_1	Particulate Organic Nitrogen Filter 1 (PON_1) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
PON_2	Particulate Organic Nitrogen Filter 2 (PON_2) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
AV_PON	Average Particulate Organic Nitrogen	mg/m3
POC_1	Particulate Organic Carbon Filter 1 (POC_1) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
POC_2	Particulate Organic Carbon Filter 2 (POC_2) Catalytic comb @900°C; sep; TCD; CE Instruments C/N analyser	mg/m3
AV_POC_mg	Average POC mg/m3	mg/m3
AV_POC_mmol	Average POC mmol/m3	mmol/m3
Int_POC	Int POC	mg/m2
AV_C_to_N	Average C:N	molar
PartN_1	Particulate Nitrogen (PartN_1) Acid digest; NH4-N; DRP auto analysis	mg/m3
PartN_2	Particulate Nitrogen (PartN_2) Acid digest; NH4-N; DRP auto analysis	mg/m3
AV_PN	Average Particulate Nitrogen	mg/m3
PartP_1	Particulate Phosphorus (PartP_1) Acid digest; NH4-N; DRP auto analysis	mg/m3
PartP_2	Particulate Phosphorus (PartP_2) Acid digest; NH4-N; DRP auto analysis	mg/m3

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Instruments

Dataset-specific Instrument Name	CTD Seabird 911
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	CTD-related instrumentation consisted of: - a Seabird Electronics (SBE) 911plus CTD with: - SBE-5 pumped SBE-3 temperature, SBE-4 conductivity and SBE-43 dissolved oxygen sensors. - SBE-5 pumped secondary SBE-3 temperature and SBE-4 conductivity sensors. - Seapoint Sensors, Inc. SCF chlorophyll fluorometer. - 25-cm Wetlabs C-star transmissometer. - Biosherical Instruments Inc. photosynthetic ally active radiation (PAR) sensor, model QSP200L4S. - Datasonics sonar altimeter, model PSA-900D. - a SBE 32 24x10-litre Carousel water sampler. - Ocean Test Equipment Standard BES external-spring Niskin-type water-sampling bottles. - Salinity sample bottles. - CTD winch with 10-km 10.5-mm single-core seacable.
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

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Deployments

VDT0410

Website	https://www.bco-dmo.org/deployment/57828
Platform	R/V Tangaroa
Report	http://bcodata.whoi.edu/Fe_Synthesis/SAGE/SAGE_Voyage_Report.pdf
Start Date	2004-03-17
End Date	2004-04-15
Description	Surface-Ocean Lower-Atmosphere Studies Air-Sea Gas Experiment Phytoplankton blooms, either natural or stimulated, provide effective natural laboratories in which to study the pronounced biogeochemical fluxes and gradients associated with their evolution and decline. These phytoplankton-mediated signals are mainly expressed in the ocean, but also result in enhanced fluxes of carbon dioxide (CO2), dimethylsulfide (DMS) and other biogenic gases across the air-sea interface. The Southern Ocean is a net sink region for atmospheric CO2, yet uncertainties remain in the strength of this sink because few measurements of the efficiency of ocean-atmosphere gas exchange have been made under turbulent windy open-ocean conditions. During SAGE, in a similar fashion to SOIREE in 1999, we proposed to stimulate a phytoplankton bloom through addition of iron fertiliser to iron-limited Sub-Antarctic waters. The fertilisation was marked with the addition of two inert dissolved gas tracers, sulfur hexafluoride (SF6) and Helium-3 (3He), creating a lagrangian patch/dual-tracer study with the tracer SF6 providing a control volume, vertical and lateral diffusion rates and estimates of air-sea gas exchange in association with 3He. The enhanced gas fluxes associated with the bloom should provide optimal conditions for measuring the rate of gas exchange and the key physical processes governing the exchange. These processes include near-surface turbulence (typically generated by breaking waves), temperature microstructure, stratification, wave field, wave breaking and wind speed. In conjunction with these patch scale and surface physics measurements, the micrometeorologic al relaxed eddy accumulation technique (REA) was deployed to make direct atmospheric measurements of gas fluxes. A combination of gas concentration measurement and REA flux potentially allows the efficiency of gas exchange to be calculated at the local scale. These local scale measurements can be compared with exchange rates derived from the dual tracer technique for the larger labelled patch. Experimental goals Determine drivers and controls of ocean-atmosphere gas exchange quantifying: - biological production and utilisation of climatic relevant gases in particular CO2 and DMS) - in the surface ocean - physical control of exchange across the interfaces of the surface mixed layer - production of aerosols resulting from interaction of biological and physical processes Objectives: This experiment combined seven main research objectives considering: 1. quantification of gas transfer fluxes and velocities for a variety of gases 2. physical processes affecting gas transfer 3. ecosystem interactions controlling dissolved DMS concentration and CO2 removal 4. the impact of iron availability upon phytoplankton productivity and its influence upon dissolved - gas concentration 5. the impact of photochemistry in the surface ocean on dissolved gas concentration and air-sea exchange 6. the fate of DMS in the atmosphere and aerosol condensation nuclei production from chemical - transformation in the atmospheric boundary-layer. 7. Role of aggregation in the timing and magnitude of export processes Additional objectives were the: 1. servicing of NIWA biophysical moorings: 41°11.28'S 178°28.62'E Northern Biophysical Mooring - (NBM) and approximately 46°38.202'S 178°33.486'E Southern Biophysical Mooring (SBM) 2. final release of 2 Carioca Buoys at SBM SAGE Cruise Track from SST data

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Project Information

Surface-Ocean Lower-Atmosphere Studies Air-Sea Gas Exchange (Experiment) (SAGE)

Website: http://www.niwascience.co.nz/rc/atmos/sage/

Coverage: South-East of New Zealand in the vicinity of the S.W. Bounty Trough; Sub-Antarctic waters near 46.5°S 172.5°E

While not officially funded as a U.S. SOLAS project, SAGE included significant U.S. participation and it's science themes were consistent with those of the International SOLAS program.

[from http://www.us-solas.org:8080/Plone/projects/the-us-solas-in-the-sage-study (26 may 2008)]
SAGE was a mesoscale Fe addition experiment run after the seasonal autumnal bloom of the sub-Antarctic showed a small biological response to Fe addition. The SF6/3He dual-tracer experiment extended the range of gas exchange measurement into stronger wind regimes typical of the Southern Ocean.

A goal of the SAGE project was to increase understanding of air-water Gas Exchange, Mixed Layer structure, skin/surface properties, biogenic gases and atmospheric fluxes. Core measurements included Carbon, N2/O2, noble gas, DMS(P), SO2, N2O, CO, CDOM CN and aerosol chemistry.

One cruise was conducted aboard the Research Vessel Tangaroa and instrumentation included CARIOCA pCO2 Buoys, Shipboard Gill R3A Anemometer mast, SAMI pCO2 sensors, SkinDeep vertical profiler, MAERI, SCAMP/TRAMP temperature microstructure profiler, sparbuoy, ADCP, S-band radar, FRRF, flow cytometer, primary production, nutrients, Fe, Meteorology and radiosondes.

from "DSR intro.doc"; by Mike Harvey described as in preparation for Deep Sea Research II
The SOLAS air-sea gas exchange experiment (SAGE) was a combined gas-transfer process study and iron fertilisation experiment conducted in sub-Antarctic waters of the south-west Bounty Trough (46.5°S 172.5°E) to the south-east of New Zealand between mid-March and mid-April 2004.

The experiment was designed as a lagrangian study of air-sea gas exchange processes of CO2, DMS and other biogenic gases associated with an iron-induced phytoplankton bloom. In conjunction with the iron fertilisation a dual tracer SF6/3He release served quantify both patch evolution and air-sea tracer exchange at the 10's of km's scale. Within this patch local/micrometeorological (100's m scale) gas exchange process studies quantified physical variables such as near-surface turbulence, temperature microstructure at the interface, wave properties and wind speed to enable development of improved gas exchange models for the frequently windy Southern Ocean.

After 15 days and four iron additions totalling 1.1 tonne Fe2+ there was a doubling in both column chlorophyll-a and primary productivity; a very modest response compared with other mesoscale iron enrichment. An investigation of factors limiting bloom development considered co-limitation by light, other nutrients, phyto-plankton seed-stocks and grazing regulation.

Related files

SAGE precruise Science Plan
SAGE precruise Voyage Plan
SAGE Voyage Report
SAGE Release Times
SAGE Surface Physics Metadata Report

SAGE Cruise Track from SST data (.jpg image)
Note:
SAGEtime/Experiment time zero (0.0000) is: 25 March 2004, 19:00 Local Time (NZST) *(from SAGE Voyage Report, Voyage Timetable, Pages 5-6)*

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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.

Oceanographers and atmospheric scientists are working together to improve understanding of the fate, transport, and feedbacks of climate relevant compounds.

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

Iron Synthesis (FeSynth)

Coverage: Global

The two main objectives of the Iron Synthesis program (SCOR Working Group proposal, 2005), are:
1. Data compilation: assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIREE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP); similarly for the natural fertilizations S.O.JGOFS (1992), CROZEX (2004/2005) and KEOPS (2005).

2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO2 budgeting,

nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

SCOR Working Group proposal, 2005. "The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling".
http://www.scor-int.org/Working_Groups/wg131.htm

See also: SCOR Proceedings Vol. 42 Concepcion, Chile October 2006, pgs: 13-16 2.3.3 Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling.

The first objective of the Iron Synthesis program involves a data recovery effort aimed at assembling a common, open-access database of data and metadata from a series of *in-situ* ocean iron fertilization experiments conducted between 1993 and 2005. Initially, funding for this effort is being provided by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

Through the combined efforts of the principal investigators of the individual projects and the staff of Biological and Chemical Oceanography Data Management Office (BCO-DMO), data currently available primarily through individuals, disparate reports and data agencies, and in multiple formats, are being collected and prepared for addition to the BCO-DMO database from which they will be freely available to the community.

As data are contributed to the BCO-DMO office, they are organized into four overlapping categories:
1. Level 1, basic metadata
(e.g., description of project/study, general location, PI(s), participants);
2. Level 2, detailed metadata and basic shipboard data and routine ship's operations
(e.g., CTDs, underway measurements, sampling event logs);
3. Level 3, detailed metadata and data from specialized observations
(e.g., discrete observations, experimental results, rate measurements) and
4. Level 4, remaining datasets
(e.g., highest level of detailed data available from each study).

Collaboration with BCO-DMO staff began in March of 2008 and initial efforts have been directed toward basic project descriptions, levels 1 and 2 metadata and basic data, with detailed and more detailed data files being incorporated as they become available and are processed.

Related file

Program Documentation

The Iron Synthesis Program is funded jointly by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

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Funding

Funding Source	Award
New Zealand International Science and Technology Fund (ISAT)	unknown SAGE ISAT
New Zealand Foundation for Research, Science and Technology (FRST)	C01X0204
New Zealand Foundation for Research, Science and Technology (FRST)	C01X0223
National Science Foundation (NSF)	unknown SAGE NSF

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