

Underway surface water and atmospheric pCO₂ including SST and SSS 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/3325>

Version: 30March2010

Version Date: 2010-03-30

Project

» [Surface-Ocean Lower-Atmosphere Studies Air-Sea Gas Exchange \(Experiment\)](#) (SAGE)

Programs

» [Iron Synthesis](#) (FeSynth)

» [United States Surface Ocean Lower Atmosphere Study](#) (U.S. SOLAS)

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Dataset Description

Underway surface water and atmospheric pCO₂ including SST and SSS

[For a complete report on these data, refer to SAGE pCO₂ Data Report](#)

Note:

**SAGEtime/ExperimentDay time zero (0.0000) is:
25 March 2004, 19:00 Local Time (NZST) from
SAGE Voyage Report, Voyage Timetable, Pages 5-6**

Methods & Sampling

[Refer to SAGE Voyage Report](#)

Data Gaps (ship's DAS was down):

- 2004/03/30 00:05 <--> 2004/03/30 13:10
- 2004/04/07 08:45 <--> 2004/04/07 16:00

Data Processing Description

BCO-DMO Processing Notes

Generated from original spreadsheet SAGE pCO2 for NIWA database.xls

BCO-DMO Edits

- 'nd' inserted into blank cells
- date reformatted to YYYYMMDD
- time reformatted to HHMM
- parameter names modified to conform to BCO-DMO convention
- **Note: additional work is needed to refine the parameters for these data**

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Data Files

File
pCO2_Underway.csv (Comma Separated Values (.csv), 972.11 KB) MD5:eac7b974003ff2ca5b4edc1196aae6b8
Primary data file for dataset ID 3325

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Parameters

Parameter	Description	Units
Cruise	Cruise Id (SAGE)	text
Station	Station Id	text
Type	Station Type	text
date_gmt	Date (GMT)	YYYYMMDD
time_gmt	Time (GMT)	HHMM
lon	longitude (West is negative)	decimal degrees
lat	latitude (South is negative)	decimal degrees
depth_bottom	depth bottom	meters
depth	depth	meters

Wind_Speed	Wind Speed (ms-1) at 10 m height with stability	ms-1
Wind_Direction	Wind Direction	degrees
temp_Air	Air temperature	degrees celcius
SSS	Sea Surface Salinity from the SBE21 thermosalinograph	dimensionless
Rel_Hum	Relative Humidity	percentage
Press_Atm	Atmospheric pressure	mbar
VOG	Velocity Over Ground?? (vessel's SOG??)	knots
Heading	Heading	degrees
gyro_heading	Gyro Heading	degrees
Hull_T	Hull Temperature: seawater temperature measured with a thermistor located in the hull	degrees celcius
pCO2	Surface Seawater Carbon Dioxide Partial Pressure	micro atmospheres
temp_SBE21	Sea Surface Temperature from the SBE-21 Thermosalinograph (direct from DAS)	degrees celcius
pCO2_air	Atmospheric Carbon Dioxide Partial Pressure (parameter note from original data: XCO2 = 374.0)	micro atmospheres
Flux	Flux	mmol m-2 day-1
ExperimentDay	Custom project time pre/post 25March2004 19:00 Local Time (NZST) 25 March 19:00 NZST = 25 March 07:00 GMT	dd.xx

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Instruments

Dataset-specific Instrument Name	NIWA Underway pCO2 system
Generic Instrument Name	NIWA Underway pCO2 system
Dataset-specific Description	NIWA Underway pCO2 system
Generic Instrument Description	This partial pressure of carbon dioxide (pCO ₂) analysis system sampled from the vessel R/V Tangaroa's underway system. The pCO ₂ was measured by infrared analysis of the carbon dioxide of air continuously equilibrated with pumped seawater. The pCO ₂ rig was located on a bench in the temperature controlled laboratory off the fish factory, beside the pH systems (continuous and discrete) and the alkalinity system. additional details are available in the SAGE pCO ₂ Data Report

Dataset-specific Instrument Name	Thermosalinograph
Generic Instrument Name	Thermosalinograph
Dataset-specific Description	R/V Tangaroa's SBE-21 thermosalinograph
Generic Instrument Description	A thermosalinograph (TSG) is used to obtain a continuous record of sea surface temperature and salinity. On many research vessels the TSG is integrated into the ship's underway seawater sampling system and reported with the underway or alongtrack data.

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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	<p>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.</p> <p>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</p>

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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 its 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

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, SOREE, 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).



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

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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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