Air and sea-surface temperatures from MAERISST 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/3318
Version: 24March2010
Version Date: 2010-03-24

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)

Contributors	Affiliation	Role
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Dataset Description

Air and Sea-surface Temperatures from MAERISST

The data are measurements of the ocean skin SST and near-surface air-temperature derived from the natural infrared emission from the ocean and atmosphere, measured by the Marine-Atmospheric Emitted Radiance Interferometer (MAERI). M-AERI is a Fourier Transform Infrared (FTIR) sprectoradiometer. Calibration is traceable to NIST standards.

Relevant references are:

Minnett, P. J., R. O. Knuteson, F. A. Best, B. J. Osborne, J. A. Hanafin and O. B. Brown, 2001. The Marine-Atmospheric Emitted Radiance Interferometer (M-AERI), a high-accuracy, sea-going infrared spectroradiometer. Journal of Atmospheric and Oceanic Technology, 18: 994-1013.

Minnett, P. J., K. A. Maillet, J. A. Hanafin and B. J. Osborne, 2005. Infrared interferometric measurements of the near surface air temperature over the oceans. Journal of Atmospheric and Oceanic Technology, 22: 1016-1029.

Rice, J. P., J. J. Butler, B. C. Johnson, P. J. Minnett, K. A. Maillet, T. J. Nightingale, S. J. Hook, A. Abtahi, C. J. Donlon and I. J. Barton, 2004. The Miami2001 Infrared Radiometer Calibration and Intercomparison: 1. Laboratory Characterization of Blackbody Targets. Journal of Atmospheric and Oceanic Technology, 21: 258-267.

Barton, I. J., P. J. Minnett, C. J. Donlon, S. J. Hook, A. T. Jessup, K. A. Maillet and T. J. Nightingale, 2004. The Miami2001 infrared radiometer calibration and inter-comparison: 2. Ship comparisons. Journal of Atmospheric and Oceanic Technology, 21: 268-283.

Methods & Sampling

Refer to SAGE Voyage Report, pgs 36-37

Data Processing Description

BCO-DMO Processing Notes
Generated from original file Tangaroa_SAGE_MAERI.dat

BCO-DMO Edits
- date, as YYYYMMDD, generated from yrday and added as a data field
- parameter names modified to conform to BCO-DMO convention

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Data Files

File
MAERI_Air_SST.csv (Comma Separated Values (.csv), 202.15 KB) MD5:5818306381b21df55b5ed9e263da68a0 Primary data file for dataset ID 3318

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Parameters

Parameter	Description	Units
date	Date (UTC)	YYYYMMDD
yrday	Day of Year	DDD.xxxx
hour_gmt	Hour (UTC)	HH.xxxxxx
temp_air	Air temperature	degrees Kelvin
temp_air_StdDev	Air temperature Std Dev	degrees Kelvin
temp_air_MeanUncertainty	Air temperature Mean Uncertainty	degrees Kelvin
temp_ss	Sea Surface temperature	degrees Kelvin
temp_ss_StdDev	Sea Surface temperature Std Dev	degrees Kelvin
temp_ss_MeanUncertainty	Sea Surface temperature Mean Uncertainty	degrees Kelvin
lon	longitude (West is negative)	decimal degrees
lat	latitude (South is negative)	decimal degrees

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Instruments

Dataset-specific Instrument Name	Marine-Atmospheric Emitted Radiance Interferometer
Generic Instrument Name	Marine-Atmospheric Emitted Radiance Interferometer
Dataset-specific Description	The M-AERI is a Fourier transform infrared interferometric spectroradiometer that measures spectra in the infrared (? ~3 to ~18 µm) with a resolution of ~0.5 cm-1. It uses two infrared detectors cooled to 78 K by a Stirling cycle cooler to reduce the noise equivalent temperature difference to levels well below 0.1 K. The radiometric calibration of the M-AERI is done continuously using two internal black-body cavities, each with an effective emissivity of >0.998. The mirror scan sequence includes measurements of the reference cavities before and after each set of spectra from the ocean and atmosphere. The absolute accuracy of the M-AERI calibration is monitored by episodic use in the laboratory of a NIST-certified water-bath black-body calibration target and residual errors in the M-AERI spectral brightness temperature measurements at temperatures typical of the ocean surface and lower troposphere are typically
Generic Instrument Description	The the Marine-Atmospheric Emitted Radiance Interferometer (M-AERI) is a Fourier Transform Infrared (FTIR) sprectoradiometer with calibrations traceable to NIST standards. The M-AERI measures spectra in the infrared (about 3 to 18 micrometers) range with a resolution of about 0.5 cm-1. It uses two infrared detectors cooled to 78 K by a Stirling cycle cooler to reduce the noise equivalent temperature difference to levels well below 0.1 K. The radiometric calibration of the M-AERI is done continuously using two internal black-body cavities, each with an effective emissivity of greater than 0.998. The mirror scan sequence includes measurements of the reference cavities before and after each set of spectra from the ocean and atmosphere. The absolute accuracy of the M-AERI calibration is monitored by episodic use in the laboratory of a NIST-certified water-bath black-body calibration target and residual errors in the M-AERI spectral brightness temperature measurements at temperatures typical of the ocean surface and lower troposphere are typically less than 0.03K. The interferometer integrates measurements over a pre-selected time interval, usually a few tens of seconds, to obtain a satisfactory signal to noise ratio, and a typical cycle of measurements including two view angles to the atmosphere, one to the ocean, and calibration measurements, takes about ten minutes. The absolute accuracy of the spectral measurements (when expressed as a brightness temperature) is 20-30 mK. The measured spectra are processed in real-time to generate measurements of the skin SST and air temperature at the height of the instrument to accuracies much better than 0.1K. Reference: Minnett, P. J., R. O. Knuteson, F. A. Best, B. J. Osborne, J. A. Hanafin and O. B. Brown, 2001. The Marine-Atmospheric Emitted Radiance Interferometer (M-AERI), a high-accuracy, sea-going infrared spectroradiometer. Journal of Atmospheric and Oceanic Technology, 18: 994-1013.

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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

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).

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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