Surface underway pCO2 from NOAA Ship Ronald H. Brown cruise RB-08-02 in the Southwest Atlantic sector of the Southern Ocean near South Georgia Island in 2008 (SO_GasEx project)

Website: https://www.bco-dmo.org/dataset/3303
Version: 17 Feb 2010
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Project
» Southern Ocean Gas Exchange Experiment (SO_GasEx)

Programs
» Ocean Carbon and Biogeochemistry (OCB)
» United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)

Contributors	Affiliation	Role
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Dataset Description

CO2 - Surface Underway pCO2 Reduced

Data columns:
Note: Contains additional information about the individual parameters
beyond what is entered in the BCO-DMO parameter metadata

DOY_UTC: Decimal day of year on UTC. 0000h on 1Jan = 1.00000.
Time stamp from CPU clock, set automatically by a web-based NTP server.

Lat: signed latitude in decimal degrees

Lon: signed longitude in decimal degrees

SST: Sea Surface Temperature, as determined by RHB surface intake sensor.

Equilibrator T was about 0.8° warmer than SST, and lagged SST by about 30 seconds.
SSS: Salinity (PSS) as measured by the SBE45 TSG unit plumbed to the outlet of the equilibrator.

pCO2_SST: CO2 partial pressure in µatm, at SST. xCO2 of any kind, wet or dry, is not reported.

P_atm_kPa: The ambient atmospheric pressure recorded by the LI840, directly vented to the lab air.

xCO2atm_wet_ppm: The mixing ratio of CO2 in ambient air at ambient humidity,

drawn from an inverted u-tube intake with a shrouded intake on the 02 deck. Raw data was calibrated exactly as for equilibrator pCO2, but not corrected for pressure. Periodic spikes in the data were most likely associated with exhaust contamination, and account for all observations above 385 ppm. Final data have ejected values higher than 385 ppm for this field.

Vxmis: Uncalibrated voltage from Wetlabs CStar transmissometer.

VO2: Uncalibrated voltage from SBE43 O2 sensor.

VFl: Uncalibrated voltage from WetLabs WetStar chlorophyll fluorometer.

Bad data: Bad data were replaced by NaN.
Note: NaN replaced by BCO-DMO standard of 'nd' in BCO-DMO processing

Methods & Sampling

See: SO-GasEx cruise report, Section 5.4.3 ppgs 21-23

System configuration:
Water was supplied from the ship's surface intake supply, tapped in the main lab. Flow went through CStar, WetStar, SBE43, membrane-contactor equilibrator, SBE45, and then to over-board-draining sink. Analog sensors were logged via a NI USB6009 14-bit A/D card.

CO2 measurement approach:
Atmospheric air was introduced to the equilibrator (LiquiCel 2.5x8) in counter-flow arrangement at a controlled 300 ml/min. Wet equilibrator effluent was delivered to a custom pCO2 analyzer unit centered on a LICOR LI840 NDIR unit. The NDIR unit vented directly to the room atmosphere.

The linearized xCO2 LI840 output data was calibrated with three dry gases of known xCO2 (tied to primary Takahashi standards), and a linear calibration function. Calibration gas mixtures were 197.8, 405, and 616 ppm, each known to about ± 2ppm.

Calibrated xCO2 data was converted to pCO2 by multiplying by the total gas-side equilibrator pressure. Equilibrator pressure was determined by adding the gauge pressure in the equilibrator to the LI840 cell pressure. Gauge pressure was determined with a Honeywell ASCX05DN compensated pressure sensor with a 31.7V/atmosphere pressure sensitivity. Equilibrator differential pressure was typically about 0.005 atm.

Data reduction:
Raw data was collected at 1 Hz. Data was reduced to 21.6 second (0.00025 day) intervals using a running cubic polynomial smoothing function originating on each time interval. Data from ± 0.0025 day from each interval were allowed in the smoothing function. Smoothing was performed if there were raw data bracketing each time interval, and if the polynomial was more than 5x over-constrained with raw observations. All entries were reduced in this way except xCO2_atm, which was only sampled about once every 4 hours during standard sequences. This data was interpolated to the full 1-Hz resolution of the raw samples, and subsequently smoothed as the other entries.

Data uncertainties:
Data are believed to be accurate to within about ±4 µatm. About half of this is due to calibration uncertainties, and a little less due to temperature correction uncertainties (assuming a 0.1°C total temperature correction uncertainty). The pressure correction term is estimated to contribute less than 0.3 µatm to the uncertainty.

Data Processing Description

See: SO-GasEx cruise report, Section 5.4.3 ppgs 21-23

BCO-DMO Processing Notes
- Generated from original file sgsx_SrfUnd_pco2_reduced

BCO-DMO Edits
- parameter names modified to conform to BCO-DMO convention
- 'NaN' (No data flag in original) changed to 'nd'

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Data Files

File
su_pCO2.csv (Comma Separated Values (.csv), 9.07 MB) MD5:1bd7366fdd89aeb9302a7dfec5c01e85 Primary data file for dataset ID 3303

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Parameters

Parameter	Description	Units
DOY_UTC	Decimal day of year on UTC. 0000h on 1Jan = 1.00000	DD.xxxxx
lon	signed longitude	decimal degrees
lat	signed latitude	decimal degrees
SST	Sea Surface Temperature as determined by RHB surface intake sensor	degrees Celcius
SSS	Salinity (PSS) as measured by the SBE45 TSG unit plumbed to the outlet of the equilibrator	dimensionless
pCO2_SST	CO2 partial pressure at SST	microatm
P_atm_kPa	ambient atmospheric pressure recorded by the LI840	kPa
xCO2atm_wet_ppm	mixing ratio of CO2 in ambient air at ambient humidity	ppm
Vxmis	Uncalibrated voltage from Wetlabs CStar transmissometer	voltage
VO2	Uncalibrated voltage from SBE43 O2 sensor	voltage
VFl	Uncalibrated voltage from WetLabs WetStar chlorophyll fluorometer	voltage

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Instruments

Dataset-specific Instrument Name	A/D Data Logging Card
Generic Instrument Name	A/D Data Logging Card
Dataset-specific Description	NI USB6009 14-bit A/D card
Generic Instrument Description	Analog to Digital cards used for logging data from analog sensors (voltages, etc)

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	WetLabs WetStar chlorophyll fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	LICOR LI840 NDIR Gas Analyzer
Generic Instrument Name	LI-COR LI-840 NDIR Gas Analyzer
Dataset-specific Description	Wet equilibrator effluent was delivered to a custom pCO2 analyzer unit centered on a LICOR LI840 NDIR unit. The NDIR unit vented directly to the room atmosphere.
Generic Instrument Description	The LI-COR LI-840 is specifically designed for continuous monitoring of CO2 and H2O over a wide range of environmental conditions. The LI-840 is an absolute, non-dispersive, infrared (NDIR) gas analyzer based on a single, interchangeable optical path, and a dual wavelength infrared detection system.

Dataset-specific Instrument Name	Pressure Sensor
Generic Instrument Name	Pressure Sensor
Dataset-specific Description	Honeywell SCX05DN compensated pressure sensor with a 31.7V/atmosphere pressure sensitivity
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	SBE 43 Dissolved Oxygen Sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Sea Bird SBE-43 DO Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Thermosalinograph
Generic Instrument Name	Thermosalinograph
Dataset-specific Description	Seabird Electronics 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.

Dataset-specific Instrument Name	Transmissometer
Generic Instrument Name	Transmissometer
Dataset-specific Description	Wetlabs CStar transmissometer
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

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Deployments

RB-08-02

Website	https://www.bco-dmo.org/deployment/57846
Platform	NOAA Ship Ronald H. Brown
Report	http://bcodata.whoi.edu/SO-GasEx/SO_GasEx_Cruise_Report.pdf
Start Date	2008-02-29
End Date	2008-04-12
Description	The Southern Ocean GasEx experiment was conducted aboard the NOAA ship Ronald H. Brown with 31 scientists representing 22 institutions, companies and government labs. The cruise departed Punta Arenas, Chile on 29 February, 2008 and transited approximately 5 days to the nominal study region at 50°S, 40°W in the Atlantic sector of the Southern Ocean. The scientific work concentrated on quantifying gas transfer velocities using deliberately injected tracers, measuring CO2 and DMS fluxes directly in the marine air boundary layer, and elucidating the physical, chemical, and biological processes controlling air-sea fluxes with measurements in the upper-ocean and marine air. The oceanic studies used a Lagrangian approach to study the evolution of chemical and biological properties over the course of the experiment using shipboard and autonomous drifting instruments. The first tracer patch was created and studied for approximately 6 days before the ship was diverted from the study site, 350 miles to the south, to wait near South Georgia Island for calmer seas. After more than 4 days away, we returned to the study area and managed to find some remnants of the tracer patch. After collecting one final set of water column samples and recovering the two drifting buoys deployed with the patch, we relocated to the northwest, closer to the area where the first patch was started. A second tracer patch was created and studied for approximately 15 days before we had to break off the experiment and transit to Montevideo, Uruguay for the completion of the cruise.

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Project Information

Southern Ocean Gas Exchange Experiment (SO_GasEx)

Website: http://so-gasex.org/

Coverage: Southwest Atlantic sector of the Southern Ocean (nominally at 50°S, 40°W, near South Georgia Island)

The Southern Ocean Gas Exchange Experiment (SO-GasEx; also known as GasEx III) took place in the Southwest Atlantic sector of the Southern Ocean (nominally at 50°S, 40°W, near South Georgia Island) in austral fall of 2008 (February 29-April 12, 2008) on the NOAA ship *Ronald H. Brown*. SO-GasEX is funded by NOAA, NSF and NASA.

The research objectives for Southern Ocean GasEx are to answer the following questions:

- What are the gas transfer velocities at high winds?
- What is the effect of fetch on the gas transfer?
- How do other non-direct wind effects influence gas transfer?
- How do changing pCO2 and DMS levels affect the air-sea CO2 and DMS flux, respectively in the same locale?
- Are there better predictors of gas exchange in the Southern Ocean other than wind?
- What is the near surface horizontal and vertical variability in turbulence, pCO2, and other relevant biochemical and physical parameters?
- How do biological processes influence pCO2 and gas exchange?
- Do the different disparate estimates of fluxes agree, and if not why?
- With the results from Southern Ocean GasEx, can we reconcile the current discrepancy between model based CO2 flux estimates and observation based estimates?

Related files

SO-GasEx cruise report
SO-GasEx Science Plan
SO-GasEx Implementation Plan

The SO-GasEx cruise report and Science and Implementation plans, may also be available at the SO-GasEx science Web page.

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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
National Oceanic and Atmospheric Administration (NOAA)	unknown SO_GasEx NOAA
National Aeronautics & Space Administration (NASA)	unknown SO_GasEx NASA
National Science Foundation (NSF)	unknown SO_GasEx NSF

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