Gas transfer velocities (QuikSCAT normalized radar backscatter) 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/2978
Version: 5 December 2008
Version Date: 2008-12-05

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

SO-GasEx Gas transfer velocities (QuikSCAT normalized radar backscatter)

Gas transfer velocities (normalized to Sc=660) derived from QuikSCAT normalized radar backscatter (QSk1p4p1 data set)

Each day's worth of data has (as columns):
date, time, lon, lat, u, v, k, num_k, k46, num_k46, k54, num_k54, kLM, kW, kWM, kN

u and v are the east-west and north-south U10 wind velocities for that time and location.
k is the Glover radar-based estimate for transfer velocity.
num_* refers to the number of individual QuikSCAT radar returns used.
46 and 54 refer to the inner and outer dual, conically scanning radar pencil beams.

kLM, kW, kWM, and kN refer to transfer velocities derived from QuikSCAT wind speeds [sqrt(u2+v2)] using Liss-Merlivat'86, Wanninkhof'92, Wanninkhof and McGillis'99, and Nightingale'00 respectively.

The data are spatially distributed in Wind Vector Cells (WVC) of roughly 25 km2.
There are 4 to 6 views of at least part of the SO GasEx area each day

For these data, the area is defined as 30-50° W, 40-60° S.
Potentially, there are 6400 data points per time/date data set.

The times are given in UTC.

Methods & Sampling

An empirical relationship between normalized radar backscatter (sigma-naught) and mean square slope is used in a field determined quadratic relationship between mean square slope and gas transfer velocity. QuikSCAT scatterometer sigma-naughts are obtained from a 13.4 GHz twin beam radar that scans the surface in a circular motion at 18 rpm. Reflected signals are binned into 25 km wind vector cells with a cross-track width of 1,800 km at the satellite's nominal altitude of 803 km.

PI Note: This is a research quality product and has not been completely ground truthed.

Data Processing Description

DMO notes for QuikSCAT Sigma-0 Gas Transfer Velocities

BCO-DMO Processing of Original Data

Files

1149 data files and one header file delivered to DMO by Dave Glover and Alisdair Tullo
Original space delimited data files reformatted to BCO-DMO convention and output as csv files
Data reformatting (add BCO-DMO header record and o/p as csv files) done with awk script

"date_rev" field (date and revolution number for each data file) added to original header file

Data
Individual year, month, day fields combined into one date field and output as YYYYMMDD
Individual hour, minute, seconds fields combined into one time field and output as HHMMSS.xxx
longitude value converted to degrees East/West using value -= 360.0
"NaN" converted to "nd" (BCO-DMO convention for "No Data")
Other data values output unchanged

Header File Parameters
"date_rev" - date and revolution number
"date_start" - start date of file
"time_start" - start time of file
"date_end" - end date of file
"time_end" - end time of file
"filename" - data filename

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Data Files

File
QuikSCAT_GTV.csv (Comma Separated Values (.csv), 364.86 MB) MD5:35ba9ce052702aa4131e7a45815c7933 Primary data file for dataset ID 2978

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Parameters

Parameter	Description	Units
date	Date UTC	YYYYMMDD
time	Time UTC as HHMMSS.xxx	HHMMSS.xxx
lon	longitude, negative denotes West	decimal degrees
lat	latitude, negative denotes South	decimal degrees
u	zonal wind component	m/s
v	meridonial wind component	m/s
k	averaged gas transfer velocity	cm/hr
num_k	number of sigma-0's used	counts
k46	the inner beam k only	cm/hr
num_k46	number of inner sigma-0's used	counts
k54	the outer beam k only	cm/hr
num_k54	number of outer sigma-0's used	counts
kLM	k from Liss&Merlivat relation and QS wind speed	cm/hr
kW	k from Wanninkhof relation and QS wind speed	cm/hr
kWM	k from Wanninkhof&McGillis relation and QS wind	cm/hr
kN	k from Nightingale et al. relation and QS wind	cm/hr

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Instruments

Dataset-specific Instrument Name	Quick Scatterometer
Generic Instrument Name	Quick Scatterometer
Dataset-specific Description	An empirical relationship between normalized radar backscatter (sigma-naught) and mean square slopeis used in a field determined quadratic relationship between mean square slope and gas transfer velocity. QuikSCAT scatterometer sigma-naughts are obtained from a 13.4 GHz twin beam radar that scans thesurface in a circular motion at 18 rpm. Reflected signals are binned into 25 km wind vector cells with across-track width of 1,800 km at the satellite's nominal altitude of 803 km.
Generic Instrument Description	The QuikSCAT is a polar orbiting satellite with an 1800 km wide measurement swath on the earth's surface. Generally, this results in twice per day coverage over a given geographic region. This specialized microwave radar measures near-surface wind speed and direction under all weather and cloud conditions over Earth's oceans. Wind retrievals are done on a 25km x 25km spatial scale.

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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.

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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 Aeronautics & Space Administration (NASA)	NNX08AB73G

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