Underway Data (SAS) from R/V Roger Revelle KNOX22RR in the Patagonian Shelf (SW South Atlantic) from 2008-2009 (COPAS08 project)

Website: https://www.bco-dmo.org/dataset/3356
Version: 28 June 2010
Version Date: 2010-06-28

Project
» Coccolithophores of the Patagonian Shelf 2008 (COPAS08)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Balch, William M.	Bigelow Laboratory for Ocean Sciences	Principal Investigator, Contact
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Along track temperature, Salinity, backscatter, Chlorophyll Fluoresence, and normalized water leaving radiance (nLw).

On the bow of the R/V Roger Revelle was a Satlantic SeaWiFS Aircraft Simulator (MicroSAS) system, used to estimate water-leaving radiance from the ship, analogous to to the nLw derived by the SeaWiFS and MODIS satellite sensors, but free from atmospheric error (hence, it can provide data below clouds).

The system consisted of a down-looking radiance sensor and a sky-viewing radiance sensor, both mounted on a steerable holder on the bow. A downwelling irradiance sensor was mounted at the top of the ship's meterological mast, on the bow, far from any potentially shading structures. These data were used to estimate normalized water-leaving radiance as a function of wavelength. The radiance detector was set to view the water at 40deg from nadir as recommended by Mueller et al. [2003b]. The water radiance sensor was able to view over an azimuth range of ~180deg across the ship's heading with no viewing of the ship's wake. The direction of the sensor was adjusted to view the water 90-120deg from the sun's azimuth, to minimize sun glint. This was continually adjusted as the time and ship's gyro heading were used to calculate the sun's position using an astronomical solar position subroutine interfaced with a stepping motor which was attached to the radiometer mount (designed and fabricated at Bigelow Laboratory for Ocean Sciences). Protocols for operation and calibration were performed according to Mueller [Mueller et al., 2003a; Mueller et al., 2003b; Mueller et al., 2003c]. Before 1000h and after 1400h, data quality was poorer as the solar zenith angle was too low. Post-cruise, the 10Hz data were filtered to remove as much residual white cap and glint as possible (we accept the lowest 5% of the data). Reflectance plaque measurements were made several times at local apparent noon on sunny days to verify the radiometer calibrations.

Within an hour of local apparent noon each day, a Satlantic OCP sensor was deployed off the stern of the R/V Revelle after the ship oriented so that the sun was off the stern. The ship would secure the starboard Z-drive, and use port Z-drive and bow thruster to move the ship ahead at about 25cm s-1. The OCP was then trailed aft and brought to the surface ~100m aft of the ship, then allowed to sink to 100m as downwelling spectral irradiance and upwelling spectral radiance were recorded continuously along with temperature and salinity. This procedure ensured there were no ship shadow effects in the radiometry.

Instruments include a WETLabs wetstar fluorometer, a WETLabs ECOTriplet and a SeaBird microTSG.
Radiometry was done using a Satlantic 7 channel microSAS system with Es, Lt and Li sensors.

Chl data is based on inter calibrating surface discrete Chlorophyll measure with the temporally closest fluorescence measurement and applying the regression results to all fluorescence data.

Data have been corrected for instrument biofouling and drift based on weekly purewater calibrations of the system. Radiometric data has been processed using standard Satlantic processing software and has been checked with periodic plaque measurements using a 2% spectralon standard.

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sensor were looking straight down". Since our sensors are mounted at
40o, based on various NASA protocols, we need to do that conversion.

Lwn adds Es to the mix. Es is used to normalize Lw. NIw is related to Rrs, Remote Sensing Reflectance

Techniques used are as described in:
Balch WM, Drapeau DT, Bowler BC, Booth ES, Windecker LA, Ashe A (2008) Space-time variability of carbon standing stocks and fixation rates in the Gulf of Maine, along the GNATS transect between Portland, ME, USA, and Yarmouth, Nova Scotia, Canada. J Plankton Res 30:119-139

Methods & Sampling

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Sample Header Information

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/contact=bbalch@bigelow.org

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BCO-DMO Processing Notes
Generated from original text file "copas08-merged-SAS-flow.out" contributed by Bruce Bowler

BCO-DMO Edits
- Parameter names modified to conform to BCO-DMO convention
- time reformatted to HHMMSS
- "-999" no data flag changed to "nd"

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Data Files

File
underway_data.csv (Comma Separated Values (.csv), 1.56 MB) MD5:644193f41c2e3388f1d91ddc45fc5c04 Primary data file for dataset ID 3356

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Parameters

Parameter	Description	Units
date	date (GMT)	yyyymmdd
time	time(GMT)	hhmmss
lon	longitude (West is negative)	degrees
lat	latitude (South is negative)	degrees
Wt	along track water temperature	degreesC
sal	salinity	PSU
chl	chlorophyll	mg/m^3
bbp532	backscatter at 532nm	1/m
es443	irradiance at 443nm	uW/cm^2/nm
es491	irradiance at 491nm	uW/cm^2/nm
es510	irradiance at 510nm	uW/cm^2/nm
es556	irradiance at 556nm	uW/cm^2/nm
es670	irradiance at 670nm	uW/cm^2/nm
es781	irradiance at 781nm	uW/cm^2/nm
es866	irradiance at 866nm	uW/cm^2/nm
Lt443	water radiance at 443nm	uW/cm^2/nm/sr
Lt491	water radiance at 491nm	uW/cm^2/nm/sr
Lt510	water radiance at 510nm	uW/cm^2/nm/sr
Lt556	water radiance at 556nm	uW/cm^2/nm/sr
Lt670	water radiance at 670nm	uW/cm^2/nm/sr
Lt781	water radiance at 781nm	uW/cm^2/nm/sr
Lt866	water radiance at 866nm	uW/cm^2/nm/sr
Lsky443	sky radiance at 443nm	uW/cm^2/nm/sr
Lsky491	sky radiance at 491nm	uW/cm^2/nm/sr
Lsky510	sky radiance at 510nm	uW/cm^2/nm/sr
Lsky556	sky radiance at 556nm	uW/cm^2/nm/sr
Lsky670	sky radiance at 670nm	uW/cm^2/nm/sr
Lsky781	sky radiance at 781nm	uW/cm^2/nm/sr
Lsky866	sky radiance at 866nm	uW/cm^2/nm/sr
Lw443	water leaving radiance radiance at 443nm	uW/cm^2/nm/sr
Lw491	water leaving radiance radiance at 491nm	uW/cm^2/nm/sr
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Lw670	water leaving radiance radiance at 670nm	uW/cm^2/nm/sr
Lw781	water leaving radiance radiance at 781nm	uW/cm^2/nm/sr
Lw866	water leaving radiance radiance at 866nm	uW/cm^2/nm/sr
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Lwn491	Normalized water leaving radiance radiance at 491nm (sometimes called nLw)	uW/cm^2/nm/sr
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Lwn556	Normalized water leaving radiance radiance at 556nm (sometimes called nLw)	uW/cm^2/nm/sr
Lwn670	Normalized water leaving radiance radiance at 670nm (sometimes called nLw)	uW/cm^2/nm/sr
Lwn781	Normalized water leaving radiance radiance at 781nm (sometimes called nLw)	uW/cm^2/nm/sr
Lwn866	Normalized water leaving radiance radiance at 866nm (sometimes called nLw)	uW/cm^2/nm/sr
relaz	relative azimuth	degrees

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Instruments

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	WETLabs wetstar fluorometerProduct Brochure
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	MicroTSG Thermosalinograph
Generic Instrument Name	MicroTSG Thermosalinograph
Dataset-specific Description	SBE 45 MicroTSG ThermosalinographProduct Brochure
Generic Instrument Description	An externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. Salinity and sound velocity can also be computed.

Dataset-specific Instrument Name	Radiometer
Generic Instrument Name	Radiometer
Dataset-specific Description	Radiometry was done using a Satlantic 7 channel microSAS system with Es, Lt and Li sensorsProduct Brochure
Generic Instrument Description	Radiometer is a generic term for a range of instruments used to measure electromagnetic radiation (radiance and irradiance) in the atmosphere or the water column. For example, this instrument category includes free-fall spectral radiometer (SPMR/SMSR System, Satlantic, Inc), profiling or deck cosine PAR units (PUV-500 and 510, Biospherical Instruments, Inc). This is a generic term used when specific type, make and model were not specified.

Dataset-specific Instrument Name	Triplet
Generic Instrument Name	Wet Labs ECO Triplet
Dataset-specific Description	WETLabs ECOTripletProduct Brochure
Generic Instrument Description	The Wet Labs ECO Triplet is a special-order, three-optical-sensor instrument available from WET Labs (wetlabs.com) in a user-defined configuration. The Triplet addresses the need for multiple simultaneous scattering and fluorescence sensors for autonomous vehicles and unattended measurement platforms. For example, possible configurations include any combination of three of the following: Blue scattering, Green scattering, Red scattering, Chlorophyll fluorescence, CDOM fluorescence, Phycoerythrin fluorescence, Phycocyanin fluorescence, Rhodamine fluorescence, or Uranine (fluorescein) fluorescence.

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Deployments

KNOX22RR

Website	https://www.bco-dmo.org/deployment/57987
Platform	R/V Roger Revelle
Report	http://bcodata.whoi.edu/COPAS08/COPAS08_Cruise_Report_V4.pdf
Start Date	2008-12-04
End Date	2009-01-02
Description	Cruise KNOX22RR was an expedition to study the Patagonian Shelf coccolithophorid bloom. A total of 168 CTD profiles at 152 stations were completed during the cruise, including 25 dawn primary productivity casts. Depths of the profiles varied from less than 10 m for carboy experiments to a maximum of 5204 m. Most casts, however, extended to 1000 m offshore and were limited by topography along the shelf break and inshore. Profile casts down to 1000 m were interspersed with water casts to increase the along-track resolution of the hydrographic data and to resolve the deeper structure beyond the euphotic zone. On such casts, water was not sampled. On casts where water was taken, sampling from Niskin bottles took place in the following order: oxygen, DIC/Alk, DMS, DOC, nutrients, primary productivity, PIC/POC/Chl, cyanobacteria distribution, HPLC, virus abundance, salts. Sampling was carried out at the following fixed light depths: 50%, 30%, 20%, 10%, 5%, 3%, 1%, 0.1%. The depths were calculated based on one of two methods: (a) during the day, percentages of surface irradiance taken from the downcast profile immediately preceding bottle firing or, (b) at night, based on the measured beam transmittance and previously determined relationships between beam transmittance and diffuse attenuation of photosynthetically available radiation (PAR). Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Coccolithophores of the Patagonian Shelf 2008 (COPAS08)

Website: http://www.bigelow.org/research/srs/william_m_balch/barney_balch_laboratory/

Coverage: Patagonian Shelf (SW South Atlantic) 35-55°S, 55-65°W.

A main focus of the COPAS project is to study coccolithophores at the fringes of the Southern Ocean on the Patagonian Shelf (PS) east of Argentina. Some of the most extensive coccolithophore blooms in the world occur on the PS but the remoteness of the region has impeded their study. In this part of the southern ocean, the most basic knowledge is lacking about a) the relationships between coccolithophores and other species of phytoplankton, b) the impact of coccolithophores on the carbon cycle and c) how environmental changes affect bloom taxonomy and function.

This will be the first multi-disciplinary ship-based investigation of these mesoscale blooms, building on an understanding of

coccolithophore ecology derived almost exclusively from northern hemisphere bloom studies. This study will document the ecological factors regulating the spatial-temporal distribution of the coccolithophore blooms (the largest recurring coccolithophorid bloom in the sounthern hemisphere) using a combination of underway, satellite and discrete sampling. Satellite measurements will provide quantitative estimates of particulate inorganic carbon (PIC) and particulate organic carbon (POC) in coccolithophore blooms while underway hydrographic and optical sampling will allow real-time evaluation of coccolithophores in both bloom and surrounding non-bloom waters. Vertical casts across the shelf front will provide depth resolved coccolithophore abundance as well as estimates of phytoplankton species richness.

Another goal is to examine the effects of ocean acidification on algal optical properties, coccolithophore concentrations and PIC concentrations (to be determined from deck experiments). Dilution experiments will provide key estimates on phytoplankton growth rates, coccolithophore growth rates and calcification rates, plus the intrinsic loss rates (i.e. phytoplankton grazing, coccolithophore grazing and dissolution associated with zooplankton grazing). PIC has not been examined in dilution experiments heretofore. The project will yield fundamental insights into a) our understanding of coccolithophore ecology (not just Emiliania huxleyi) and b) the utility of the "functional group" concept to describe coccolithophore variability over the PS. Such knowledge is critical to model complex biogeochemical processes that regulate phytoplankton production and the biological pump. It is also worthy of note that the PS coccolithophore populations are at the western edge of a southern hemisphere belt of enhanced coccolithophores thought to extend from the southern tip of South America to waters south of Australia, (~180 degrees of longitude).

The burning of fossil fuels is predicted to increase atmospheric CO2 to 750 p.p.m.v. or more under various future scenarios. As a large fraction of the anthropogenic CO2 diffuses into seawater, the ocean is becoming more acidic; it is predicted that the pH of the surface ocean will drop by up to 0.7 units by year 2300, a 5-fold increase in the proton concentration. A major goal is to examine the effects of ocean acidification on coccolithophores, in a region of low calcite saturation. This study will provide the first detailed analysis of the coccolithophores in this enormous area of high suspended calcite water. The results will be highly relevant to our basic understanding of the marine carbon cycle.

Financial support for the participating UK scientists was also provided by the Luminescence and Marine Plankton project funded by the Defence Science and Technology Laboratory under the Joint Grant Scheme programme via Proposal Ref. 1166 to Dr. John Allen.

COPOAS'08 Cruise Report

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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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0728582
Defence Science and Technology Laboratory (DSTL)	JGS 1166
National Aeronautics & Space Administration (NASA)	NNX08AJ88A

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