

Dataset Expocode 33RO20131111

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Dataset **Funding Info:** NOAA Climate Program Office
Initial Submission (yyyymmdd): 20170110
Revised Submission (yyyymmdd): 20170110

Campaign/Cruise **Expocode:** 33RO20131111
Campaign/Cruise Name: RB1306
Campaign/Cruise Info: PNE, AOML_SOOP_CO2
Platform Type:
CO2 Instrument Type: Equilibrator-IR
Survey Type: Research Cruise
Vessel Name: R/V Ronald H. Brown
Vessel Owner: NOAA
Vessel Code: 33RO

Coverage **Start Date (yyyymmdd):** 20131112
End Date (yyyymmdd): 20131207
Westernmost Longitude: 56.2 W
Easternmost Longitude: 22.4 W
Northernmost Latitude: 20.5 N
Southernmost Latitude: 8.1 S
Port of Call: Bridgetown, Barbados
Port of Call: Recife, Brazil

Variable **Name:** xCO2_EQU_ppm
Unit: ppm
Description: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Variable **Name:** xCO2_ATM_ppm
Unit: ppm
Description: Mole fraction of CO2 measured in dry outside air (ppm)

Variable **Name:** xCO2_ATM_interpolated_ppm
Unit: ppm
Description: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)

Variable **Name:** PRES_EQU_hPa
Unit: hPa
Description: Barometric pressure in the equilibrator headspace (hPa)

Variable **Name:** PRES_ATM@SSP_hPa
Unit: hPa

Description: Barometric pressure measured outside, corrected to sea level (hPa)

Variable

Name: TEMP_EQU_C

Unit: Degree C

Description: Water temperature in equilibrator (°C)

Variable

Name: SST_C

Unit: Degree C

Description: Sea surface temperature (°C)

Variable

Name: SAL_permil

Unit: ppt

Description: Sea surface salinity on Practical Salinity Scale (o/oo)

Variable

Name: fCO2_SW@SST_uatm

Unit: µatm

Description: Fugacity of CO2 in sea water at SST and 100% humidity (µatm)

Variable

Name: fCO2_ATM_interpolated_uatm

Unit: µatm

Description: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)

Variable

Name: dfCO2_uatm

Unit: µatm

Description: Sea water fCO2 minus interpolated air fCO2 (µatm)

Variable

Name: WOCE_QC_FLAG

Unit: None

Description: Quality control flag for fCO2 values (2=good, 3=questionable)

Variable

Name: QC_SUBFLAG

Unit: None

Description: Quality control subflag for fCO2 values, provides explanation when QC flag=3

Sea Surface Temperature

Location: Bow thruster room, before sea water pump, ~5 m below water line.

Manufacturer: Seabird

Model: SBE-21

Accuracy: 0.01 (°C if units not given)

Precision: 0.001 (°C if units not given)

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity

Location: Attached to underway system at sea water input.

Manufacturer: Seabird

Model: SBE 45

Accuracy: ± 0.005 o/oo

Precision: 0.0002 o/oo

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision

Atmospheric Pressure

Location: On bulkhead exterior on the port side of the radio room aft of the bridge at ~14 m above the sea surface.

Normalized to Sea Level: yes

Manufacturer: Vaisala

Model: PTB330

Accuracy: ± 0.2 hPa (hPa if units not given)

Precision: ± 0.08 hPa (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's resolution is taken as precision. Maintained by ship.

Atmospheric CO2

Measured/Frequency: Yes, 5 readings in a group every 3.5 hours
Intake Location: Bow tower ~10 m above the sea surface.
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Atmospheric CO2 Accuracy: ± 0.5 μ atm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 μ atm in fCO2_ATM

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 5 meters
Intake Location: Bow
Equilibration Type: Spray head above dynamic pool, with thermal jacket
Equilibrator Volume (L): 0.95 L (0.4 L water, 0.55 L headspace)
Headspace Gas Flow Rate (ml/min): 70 - 150 ml/min
Equilibrator Water Flow Rate (L/min): 1.5 - 2.0 L/min
Equilibrator Vented: Yes
Equilibration Comments: Primary equilibrator is vented through a secondary equilibrator.
Drying Method: Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Aqueous CO2 Sensor Details

Measurement Method: IR
Method details: details of CO2 sensing (not required)
Manufacturer: LI-COR
Model: 6262
Measured CO2 Values: xco2(dry)
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ± 2 μ atm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 μ atm in fCO2_SW
Sensor Calibrations:
Calibration of Calibration Gases: The analyzer is calibrated every 3.5 hours using field standards that were calibrated with primary standards that are directly traceable to the WMO scale. Ultra-High Purity air (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.
Number Non-Zero Gas Standards: 4
Calibration Gases:

Std 1: CA06709, 284.75 ppm, owned by ESRL, used every ~ 3.5 hours.
Std 2: CA02813, 363.24 ppm, owned by ESRL, used every ~3.5 hours.
Std 3: CA07921, 423.57 ppm, owned by ESRL, used every ~3.5 hours.
Std 4: CA07931, 545.88 ppm, owned by ESRL, used every ~3.5 hours.
Std 5: 0.00 ppm, owned by AOML, used every ~20.0 hours.

Comparison to Other CO2 Analyses:

Comments:

Method Reference:

Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Equilibrator **Location:** Inserted into equilibrator ~5 cm below water level
Temperature Sensor **Manufacturer:** Hart
Model: 1521
Accuracy: 0.025 (°C if units not given)
Precision: 0.01 (°C if units not given)
Calibration: Factory calibration
Comments: Resolution is taken as Precision.

Equilibrator **Location:** Attached to equilibrator headspace. Differential pressure reading from
Pressure Sensor Setra 239 attached to the equilibrator headspace is added to the pressure reading
from the LICOR, which is measured by an external Setra 270 connected to the exit
of the analyzer.
Manufacturer: Setra
Model: 270
Accuracy: 0.15 (hPa if units not given)
Precision: 0.015 (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Additional **Suggested QC flag from Data Provider:** NA
Information **Additional Comments:** 1. It was determined that there was a 2.68 minute offset
between the SST data record from the SBE-21 in the bow and the Hart 1571
temperature sensor in the equilibrator. The SST data were interpolated using this
offset to determine the SST at the time of the equilibrator measurement. 2. A total
of 13443 measurements were taken with 13307 flagged as good, 3 flagged as
questionable, and 131 flagged as bad. All measurements flagged as 4 (bad) have
been removed from the final data. 3. There were 2 instances of low water flow: on
11/15 from 1409 to 1803 and on 11/27 from 2200 to 2352. All equ values in these
periods were flagged as bad (4). Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html
Citation for this Dataset:
Other References for this Dataset: