Dataset Expocode	**33RO20110721**
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Dataset	**Funding Info:** NOAA Climate Program Office **Initial Submission (yyyymmdd):** 20120728 **Revised Submission (yyyymmdd):** 20170221
Campaign/Cruise	**Expocode:** 33RO20110721 **Campaign/Cruise Name:** RB1101 **Campaign/Cruise Info:** AOML_SOOP_CO2, PNE **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):** 20110721 **End Date (yyyymmdd):** 20110820 **Westernmost Longitude:** 78.3 W **Easternmost Longitude:** 16.6 E **Northernmost Latitude:** 32.3 N **Southernmost Latitude:** 32.9 S **Port of Call:** Charleston, SC **Port of Call:** Cape Town, South Africa
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 ~21 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 µatm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 µatm 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 µatm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 µatm 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 ~23.0 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 Temperature Sensor

Location: Inserted into equilibrator ~5 cm below water level
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 Pressure Sensor

Location: Attached to equilibrator headspace. Differential pressure reading from Setra 239 attached to the equilibrator headspace is added to the pressure reading from the LICOR. The LICOR pressure transducer has the limiting accuracy.
Manufacturer: LICOR
Model: 6262
Accuracy: 01.2 (hPa if units not given)
Precision: 0.02 (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Additional Information

Suggested QC flag from Data Provider: NA
Additional Comments: 1. The pCO2 system was removed from the ship on May, 2010 and reinstalled on September. After that, recorded Licor pressure values were 7 hPa higher than sea level pressures. However, historical data showed that Licor pressure values were slightly lower than sea level pressures. It was concluded that the recorded Licor pressure values were incorrect, and so, they were estimated from the sea level pressures using a constant offset of -0.80 hPa. The offset was calculated from data collected for the 5 previous cruises (RB0901, RB0902, RB0903, RB0904 in 2009 and RB2010_PNE in 2010, n=48,953). 2. During the processing of the data, it was determined that there is a 2.5 minute offset between the SST data record (i.e. SBE21 in the instrument chest) and the equilibrator temperature data record. The water takes about 2.5 minutes to travel from the inlet at the hull to the analytical equilibrator. 3. During January and February 2017, minor format changes were made to the header, the expocode was added to the data file, and the value for missing data was changed to -999. Additional raw data were found, and all the data was recalculated. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html
Citation for this Dataset:
Other References for this Dataset: