

Dataset Expocode	33RO20170718
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Dataset	Funding Info: NOAA Climate Program Office Initial Submission (yyyymmdd): 20200924 Revised Submission (yyyymmdd): 20200924
Campaign/Cruise	Expocode: 33RO20170718 Campaign/Cruise Name: RB1704 Campaign/Cruise Info: AOML_SOOP_CO2, GOMECC3 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): 20170718 End Date (yyyymmdd): 20170821 Westernmost Longitude: 97.8 W Easternmost Longitude: 79.1 W Northernmost Latitude: 30.1 N Southernmost Latitude: 18.8 N Port of Call: Key West, FL Port of Call: Port Everglades, FL
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-38 Accuracy: 0.001 (°C if units not given) Precision: 0.0003 (°C if units not given) Calibration: Factory calibration Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.
Sea Surface Salinity	Location: The AOML SBE45 was attached to CO2 underway system. 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 X2007 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: CA04957, 282.55 ppm, owned by ESRL, used every ~5.0 hours. Std 2: CC105863, 380.22 ppm, owned by ESRL, used every ~5.0 hours. Std 3: CB09696, 453.04 ppm, owned by ESRL, used every ~5.0 hours. Std 4: CB09032, 539.38 ppm, owned by ESRL, used every ~5.0 hours. Std 5: 0.00 ppm, owned by AOML, used every ~19.5 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 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.

Pressure Sensor

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
Information**

Suggested QC flag from Data Provider: NA

Additional Comments: The analytical system performed well during this cruise. Within the first day of the cruise, the values from the SBE38 SST sensor were greater than other temperature sensors in the flowing seawater and did not show the smaller scale details of the other sensors. The SST was estimated using a relationship between the equilibrator temperature (EqT) and CTD temperature. $SST(\text{estimated}) = 1.00895 * EqT - 0.350881$; standard deviation of the differences between the CTD temperatures and the SST(estimated) is +/- 0.072 degree Celsius. The TSG (SBE-45) attached to the AOML CO₂ system performed better than the ship's TSG and so was used for determining the SSSalinity. A relationship between the AOML SBE-45 salinity (TSG-S) and the CTD salinity was used to adjust SSS. $SSS(\text{adjusted}) = 0.972269 * TSG-S + 1.02428$; standard deviation of the differences between the CTD salinities and the SSS(adjusted) is +/- 0.071 . The procedures to estimate SST and to adjust the SSS values are described in the supplemental read me file. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html Full unprocessed data files from analytical instrument including flow information and ship's meteorological and TSG data at time of sampling can be obtained upon request.

Citation for this Dataset:

Other References for this Dataset: