

Dataset Expocode 33RR20160519

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Dataset **Funding Info:** NOAA Climate Program Office
Initial Submission (yyyymmdd): 20160727
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Campaign/Cruise **Expocode:** 33RR20160519
Campaign/Cruise Name: RR1606
Campaign/Cruise Info: AOML_SOOP_CO2; RR1606, FLEAT1
Platform Type:
CO2 Instrument Type: Equilibrator-IR or CRDS or GC
Survey Type: Research Cruise
Vessel Name: Roger Revelle
Vessel Owner: U.S. Navy; operated by Scripps Institute of Oceanography
Vessel Code: 33RR

Coverage **Start Date (yyyymmdd):** 20160519
End Date (yyyymmdd): 20160528
Westernmost Longitude: 133.7 E
Easternmost Longitude: 135.6 E
Northernmost Latitude: 9.0 N
Southernmost Latitude: 7.2 N
Port of Call: Malakal, Palau, Micronesia

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:** Hydro Lab, near CO2 system
Manufacturer: Seabird
Model: 45
Accuracy: 0.002 (°C if units not given)
Precision: 0.0002 (°C if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Typical Stability is taken as Precision; Maintained by ship. A regression fit between the average temperature measured in the Hydro Lab and the CTD surface temperature during a prior cruise was done to estimate the SST. See additional comments below.

Sea Surface Salinity **Location:** In Hydro lab, near CO2 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; Maintained by ship.

Atmospheric Pressure

Location: On MET mast, ~17 m above the sea surface water

Normalized to Sea Level: yes

Manufacturer: RMYoung

Model: 61302V

Accuracy: ± 0.3 hPa (hPa if units not given)

Precision: 0.01 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 4.5 hours

Intake Location: Bow mast, ~18 meters above 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, or engine room sea chest (mid ship)

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): 1.3 - 2.5 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 4.5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.

Number Non-Zero Gas Standards: 4

Calibration Gases:

Std 1: JA02280, 233.46 ppm, owned by AOML, used every ~4.5 hours.

Std 2: JA02264, 326.18 ppm, owned by AOML, used every ~4.5 hours.

Std 3: JA02285, 406.06 ppm, owned by AOML, used every ~4.5 hours.

Std 4: JA02646, 463.00 ppm, owned by AOML, used every ~4.5 hours.

Std 5: 0.00 ppm, owned by AOML, used every ~23.5 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
Temperature Sensor**

Location: Inserted into equilibrator ~5 cm below water level

Manufacturer: Hart

Model: 1523

Accuracy: 0.015 (°C if units not given)

Precision: 0.001 (°C if units not given)

Calibration: Factory calibration

Comments: Resolution is taken as Precision.

**Equilibrator
Pressure Sensor**

Location: Attached to equilibrator headspace. The differential pressure reading from Setra 239, which is attached to the equilibrator headspace, is added to the pressure reading from the LICOR analyzer, 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
Information**

Suggested QC flag from Data Provider: NA

Additional Comments: The analytical system performed well throughout this cruise. Values for the ship's sensors were appended to the CO₂ data record in real-time. Missing real-time values were taken from the MET files logged by the ship. During a prior cruise (RR1604, I09N) the temperature data from the CTD casts and shipboard sensors were used to estimate SSTemperature. A regression fit between the average temperature measured in the Hydro Lab (HLT, average of equilibrator and TSG temperatures) and the CTD temperature (average over top 8 db) was done for all 117 casts. After eliminating eleven outlying data, the resulting second degree polynomial equation was used to estimate the SST. $SST(\text{estimated}) = 0.001424 \cdot HLT^2 + 0.950053 \cdot HLT + 0.048227$; standard deviation of the differences between the CTD temperatures and the SST(estimated) was +/- 0.061 degree Celcius. The temperatures measured during this cruise fall within the range covered by the regression equation. The same temperature sensors in the hydro lab were used on both cruises.

Citation for this Dataset:

Other References for this Dataset: