

Dataset Expocode 33RR20160208

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Dataset **Funding Info:** NOAA Climate Program Office
Initial Submission (yyyymmdd): 20160721
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Campaign/Cruise **Expocode:** 33RR20160208
Campaign/Cruise Name: I08S
Campaign/Cruise Info: AOML_SOOP_CO2; I08S A.McDonald (WHOI) chief scientist
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):** 20160208
End Date (yyyymmdd): 20160315
Westernmost Longitude: 76.4 E
Easternmost Longitude: 115.6 E
Northernmost Latitude: 28.3 S
Southernmost Latitude: 66.7 S
Port of Call: Fremantle, Australia

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 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 was done for all casts to estimate the SST. See additional comments below and supplemental ReadMe file.
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. A regression fit between the average salinity measured in the Hydro Lab and the CTD surface salinity was done for all casts to adjust the SSS. See additional comments below and supplemental ReadMe file.

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

Location: Inserted into equilibrator ~5 cm below water level

Temperature Sensor

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

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.

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 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. Because of time-sync issues with the MET computer, the merging of CO₂ and MET data was based on position for the first six days and then based on time for the rest of the cruise. After merging, there remained 584 analyses without atmospheric pressure nor salinity values. Missing atmospheric pressures were estimated by subtracting 0.11 mbar from the LICOR pressures. Missing salinity values were interpolated from surrounding good data and were flagged as 3. The temperature and salinity data from the CTD casts were used to estimate SSTemperature and to adjust the SSSalinity used in the fCO₂ processing. A regression fit between the average temperature measured in the Hydro Lab (HLT) and the CTD surface temperature was done for all casts. After eliminating six outlying data, the resulting second degree polynomial equation was used to estimate the SST. $SST(\text{estimated}) = 0.002753 \cdot HLT^2 + 0.948538 \cdot HLT - 0.439656$; standard deviation of the differences between the CTD temperatures and the SST(estimated) is +/- 0.158 degree Celcius. A regression fit between the average salinity measured in the Hydro Lab (HLS) and the CTD surface salinity was done for all casts. After eliminating one outlying datum, the resulting linear equation was used to adjust the SSS. $SSS(\text{adjusted}) = 1.000346 \cdot HLS + 0.006326$; standard deviation of the differences between the CTD salinities and the SSS(adjusted) is +/- 0.0082 psu. See supplemental ReadMe file.

Citation for this Dataset:

Other References for this Dataset: