

Dataset Expocode 33RO20160505

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Dataset **Funding Info:** NOAA Climate Program Office
Initial Submission (yyyymmdd): 20160831
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Campaign/Cruise **Expocode:** 33RO20160505
Campaign/Cruise Name: RB1604A
Campaign/Cruise Info: West Coast Ocean Acidification/AOML_SOOP_CO2
Platform Type:
CO2 Instrument Type: Equilibrator-IR
Survey Type: >Research Cruise
Vessel Name: Ronald H. Brown
Vessel Owner: NOAA
Vessel Code: 33RO

Coverage **Start Date (yyyymmdd):** 20160505
End Date (yyyymmdd): 20160521
Westernmost Longitude: 123.6 W
Easternmost Longitude: 112.6 W
Northernmost Latitude: 38.0 N
Southernmost Latitude: 25.1 N
Port of Call: San Diego, CA
Port of Call: San Francisco, CA

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	<p>Name: PRES_EQU_hPa Unit: hPa Description: Barometric pressure in the equilibrator headspace (hPa)</p>
Variable	<p>Name: PRES_ATM@SSP_hPa Unit: hPa Description: Barometric pressure measured outside, corrected to sea level (hPa)</p>
Variable	<p>Name: TEMP_EQU_C Unit: Degree C Description: Water temperature in equilibrator (°C)</p>
Variable	<p>Name: SST_C Unit: Degree C Description: Sea surface temperature (°C)</p>
Variable	<p>Name: SAL_permil Unit: ppt Description: Sea surface salinity on Practical Salinity Scale (o/oo)</p>
Variable	<p>Name: fCO2_SW@SST_uatm Unit: µatm Description: Fugacity of CO2 in sea water at SST and 100% humidity (µatm)</p>
Variable	<p>Name: fCO2_ATM_interpolated_uatm Unit: µatm Description: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)</p>
Variable	<p>Name: dfCO2_uatm Unit: µatm Description: Sea water fCO2 minus interpolated air fCO2 (µatm)</p>
Variable	<p>Name: WOCE_QC_FLAG Unit: None Description: Quality control flag for fCO2 values (2=good, 3=questionable)</p>
Variable	<p>Name: QC_SUBFLAG Unit: None Description: Quality control subflag for fCO2 values, provides explanation when QC flag=3</p>
Sea Surface Temperature	<p>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.</p>
Sea Surface Salinity	<p>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</p>

Atmospheric Pressure	<p>Location: On bulkhead exterior on the port side of the radio room aft of the bridge at ~14 m above the sea surface.</p> <p>Normalized to Sea Level: yes</p> <p>Manufacturer: Vaisala</p> <p>Model: PTB330</p> <p>Accuracy: ± 0.2 hPa (hPa if units not given)</p> <p>Precision: ± 0.08 hPa (hPa if units not given)</p> <p>Calibration: Factory calibration</p> <p>Comments: Manufacturer's resolution is taken as precision. Maintained by ship.</p>
Atmospheric CO2	<p>Measured/Frequency: Yes, 5 readings in a group every 3.5 hours</p> <p>Intake Location: Bow tower ~10 m above the sea surface.</p> <p>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).</p> <p>Atmospheric CO2 Accuracy: ± 0.5 µatm in fCO2_ATM</p> <p>Atmospheric CO2 Precision: ± 0.01 µatm in fCO2_ATM</p>
Aqueous CO2 Equilibrator Design	<p>System Manufacturer:</p> <p>Intake Depth: 5 meters</p> <p>Intake Location: Bow</p> <p>Equilibration Type: Spray head above dynamic pool, with thermal jacket</p> <p>Equilibrator Volume (L): 0.95 L (0.4 L water, 0.55 L headspace)</p> <p>Headspace Gas Flow Rate (ml/min): 70 - 150 ml/min</p> <p>Equilibrator Water Flow Rate (L/min): 1.5 - 2.0 L/min</p> <p>Equilibrator Vented: Yes</p> <p>Equilibration Comments: Primary equilibrator is vented through a secondary equilibrator.</p> <p>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).</p>
Aqueous CO2 Sensor Details	<p>Measurement Method: IR</p> <p>Method details: details of CO2 sensing (not required)</p> <p>Manufacturer: LI-COR</p> <p>Model: 6262</p> <p>Measured CO2 Values: xco2(dry)</p> <p>Measurement Frequency: Every 140 seconds, except during calibration</p> <p>Aqueous CO2 Accuracy: ± 2 µatm in fCO2_SW</p> <p>Aqueous CO2 Precision: ± 0.01 µatm in fCO2_SW</p> <p>Sensor Calibrations:</p> <p>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.</p> <p>Number Non-Zero Gas Standards: 4</p> <p>Calibration Gases:</p> <p>Std 1: CA04957, 282.55 ppm, owned by ESRL, used every 3.5 hours. Std 2: CC105863, 380.22 ppm, owned by ESRL, used every 3.5 hours. Std 3: CB09696, 453.04 ppm, owned by ESRL, used every 3.5 hours. Std 4: CB09032, 539.38 ppm, owned by ESRL, used every 3.5 hours. Std 5: 0.0 ppm, owned by AOML, used every ~20 hours.</p> <p>Comparison to Other CO2 Analyses:</p> <p>Comments:</p>

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 Information

Suggested QC flag from Data Provider: NA

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 1521 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 7840 measurements were taken with 7384 flagged as good, 431 flagged as questionable, and 25 flagged as bad. All measurements flagged as 4 (bad) have been removed from the final data file. There were several instances of very high variability in temperature, salinity, and xCO₂. 420 of the points were given a flag of 3 because they were outside the range of the standard gases. 3. On 5/10 at 1537 the system was shut down for repairs and was restarted on 5/11 at 2046. 4. On 5/12 at 1552 the system was shut down for repairs and was restarted on 5/12 at 1715. 5. The equilibrator thermistor gave bad readings that were approximately 3 C too high from 5/9 at 1854 to 5/12 at 1552. All of these readings have been replaced with temperature measurements from the SBE-45 attached to the underway system. The average difference (SBE-45 - EqT) when the equilibrator thermistor was giving good data was 0.01 C for ~6900 measurements. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html

Citation for this Dataset:

Other References for this Dataset: