

**Dataset Expocode** 33RO20160112

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**Dataset** **Funding Info:** NOAA Climate Program Office  
**Initial Submission (yyyymmdd):** 20160912  
**Revised Submission (yyyymmdd):** 20170111

**Campaign/Cruise** **Expocode:** 33RO20160112  
**Campaign/Cruise Name:** RB1601-Leg2  
**Campaign/Cruise Info:** AOML\_SOOP\_CO2, Palmyra  
**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):** 20160112  
**End Date (yyyymmdd):** 20160209  
**Westernmost Longitude:** 166 W  
**Easternmost Longitude:** 157.2 W  
**Northernmost Latitude:** 21.2 N  
**Southernmost Latitude:** 2.6 N  
**Port of Call:** Pearl Harbor, HI  
**Port of Call:** Pearl Harbor, HI

**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)

<b>Variable</b>	<b>Name:</b> PRES_EQU_hPa <b>Unit:</b> hPa <b>Description:</b> Barometric pressure in the equilibrator headspace (hPa)
<b>Variable</b>	<b>Name:</b> PRES_ATM@SSP_hPa <b>Unit:</b> hPa <b>Description:</b> Barometric pressure measured outside, corrected to sea level (hPa)
<b>Variable</b>	<b>Name:</b> TEMP_EQU_C <b>Unit:</b> Degree C <b>Description:</b> Water temperature in equilibrator (°C)
<b>Variable</b>	<b>Name:</b> SST_C <b>Unit:</b> Degree C <b>Description:</b> Sea surface temperature (°C)
<b>Variable</b>	<b>Name:</b> SAL_permil <b>Unit:</b> ppt <b>Description:</b> Sea surface salinity on Practical Salinity Scale (o/oo)
<b>Variable</b>	<b>Name:</b> fCO2_SW@SST_uatm <b>Unit:</b> µatm <b>Description:</b> Fugacity of CO2 in sea water at SST and 100% humidity (µatm)
<b>Variable</b>	<b>Name:</b> fCO2_ATM_interpolated_uatm <b>Unit:</b> µatm <b>Description:</b> Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
<b>Variable</b>	<b>Name:</b> dfCO2_uatm <b>Unit:</b> µatm <b>Description:</b> Sea water fCO2 minus interpolated air fCO2 (µatm)
<b>Variable</b>	<b>Name:</b> WOCE_QC_FLAG <b>Unit:</b> None <b>Description:</b> Quality control flag for fCO2 values (2=good, 3=questionable)
<b>Variable</b>	<b>Name:</b> QC_SUBFLAG <b>Unit:</b> None <b>Description:</b> Quality control subflag for fCO2 values, provides explanation when QC flag=3
<b>Sea Surface Temperature</b>	<b>Location:</b> Bow thruster room, before sea water pump, ~5 m below water line. <b>Manufacturer:</b> Seabird <b>Model:</b> SBE-21 <b>Accuracy:</b> 0.01 (°C if units not given) <b>Precision:</b> 0.001 (°C if units not given) <b>Calibration:</b> Factory calibration <b>Comments:</b> Manufacturer's Resolution is taken as Precision; Maintained by ship.
<b>Sea Surface Salinity</b>	<b>Location:</b> Attached to ship's water system in the Hydro lab <b>Manufacturer:</b> Seabird <b>Model:</b> SBE 45 <b>Accuracy:</b> ± 0.005 o/oo <b>Precision:</b> 0.0002 o/oo <b>Calibration:</b> Factory calibration <b>Comments:</b> Manufacturer's Resolution is taken as Precision

<b>Atmospheric Pressure</b>	<p><b>Location:</b> On bulkhead exterior on the port side of the radio room aft of the bridge at ~14 m above the sea surface.</p> <p><b>Normalized to Sea Level:</b> yes</p> <p><b>Manufacturer:</b> Vaisala</p> <p><b>Model:</b> PTB330</p> <p><b>Accuracy:</b> ± 0.2 hPa (hPa if units not given)</p> <p><b>Precision:</b> ± 0.08 hPa (hPa if units not given)</p> <p><b>Calibration:</b> Factory calibration</p> <p><b>Comments:</b> Manufacturer's resolution is taken as precision. Maintained by ship.</p>
<b>Atmospheric CO2</b>	<p><b>Measured/Frequency:</b> Yes, 5 readings in a group every 3.5 hours</p> <p><b>Intake Location:</b> Bow tower ~10 m above the sea surface.</p> <p><b>Drying Method:</b> 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><b>Atmospheric CO2 Accuracy:</b> ± 0.5 µatm in fCO2_ATM</p> <p><b>Atmospheric CO2 Precision:</b> ± 0.01 µatm in fCO2_ATM</p>
<b>Aqueous CO2 Equilibrator Design</b>	<p><b>System Manufacturer:</b></p> <p><b>Intake Depth:</b> 5 meters</p> <p><b>Intake Location:</b> Bow</p> <p><b>Equilibration Type:</b> Spray head above dynamic pool, with thermal jacket</p> <p><b>Equilibrator Volume (L):</b> 0.95 L (0.4 L water, 0.55 L headspace)</p> <p><b>Headspace Gas Flow Rate (ml/min):</b> 70 - 150 ml/min</p> <p><b>Equilibrator Water Flow Rate (L/min):</b> 1.5 - 2.0 L/min</p> <p><b>Equilibrator Vented:</b> Yes</p> <p><b>Equilibration Comments:</b> Primary equilibrator is vented through a secondary equilibrator.</p> <p><b>Drying Method:</b> Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).</p>
<b>Aqueous CO2 Sensor Details</b>	<p><b>Measurement Method:</b> IR</p> <p><b>Method details:</b> details of CO2 sensing (not required)</p> <p><b>Manufacturer:</b> LI-COR</p> <p><b>Model:</b> 6262</p> <p><b>Measured CO2 Values:</b> xco2(dry)</p> <p><b>Measurement Frequency:</b> Every 140 seconds, except during calibration</p> <p><b>Aqueous CO2 Accuracy:</b> ± 2 µatm in fCO2_SW</p> <p><b>Aqueous CO2 Precision:</b> ± 0.01 µatm in fCO2_SW</p> <p><b>Sensor Calibrations:</b></p> <p><b>Calibration of Calibration Gases:</b> 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><b>Number Non-Zero Gas Standards:</b> 4</p> <p><b>Calibration Gases:</b></p> <p>Std 1: CA04957, 282.55 ppm, owned by ESRL, used every ~3.5 hours.</p> <p>Std 2: CC105863, 380.22 ppm, owned by ESRL, used every ~3.5 hours.</p> <p>Std 3: CB09696, 453.04 ppm, owned by ESRL, used every ~3.5 hours.</p> <p>Std 4: CB09032, 539.38 ppm, owned by ESRL, used every ~3.5 hours.</p> <p>Std 5: 0.00 ppm, owned by AOML, used every ~20.0 hours.</p> <p><b>Comparison to Other CO2 Analyses:</b></p>

**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 pCO<sub>2</sub> 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, 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 for most of the cruise. The SBE-45 attached to the CO<sub>2</sub> system failed; salinity values from the ship's SBE-45 were used instead. The first ~18 hours of data were removed due to high variability in flows, temperatures, and xCO<sub>2</sub> readings. Additional raw data files were recovered, processed, and submitted in 2017. Original Data Location: [http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html)

**Citation for this Dataset:**

**Other References for this Dataset:**