

**Dataset Expocode** 33RO20141006

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**Dataset** **Funding Info:** NOAA Climate Program Office  
**Initial Submission (yyyymmdd):** 20160131  
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**Campaign/Cruise** **Expocode:** 33RO20141006  
**Campaign/Cruise Name:** RB1405  
**Campaign/Cruise Info:** AOML\_SOOP\_CO2 , TAO 170W, 165E  
**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):** 20141007  
**End Date (yyyymmdd):** 20141031  
**Westernmost Longitude:** 179.4 W  
**Easternmost Longitude:** 190.0 E  
**Northernmost Latitude:** 21.1 N  
**Southernmost Latitude:** 14.4 S  
**Port of Call:** Honolulu, HI  
**Port of Call:** Kwajalein, RMI

**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)

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| <b>Variable</b>                | <b>Name:</b> PRES_EQU_hPa<br><b>Unit:</b> hPa<br><b>Description:</b> Barometric pressure in the equilibrator headspace (hPa)  |
| <b>Variable</b>                | <b>Name:</b> PRES_ATM@SSP_hPa<br><b>Unit:</b> hPa<br><b>Description:</b> Barometric pressure measured outside, corrected to sea level (hPa)   |
| <b>Variable</b>                | <b>Name:</b> TEMP_EQU_C<br><b>Unit:</b> Degree C<br><b>Description:</b> Water temperature in equilibrator (°C)  |
| <b>Variable</b>                | <b>Name:</b> SST_C<br><b>Unit:</b> Degree C<br><b>Description:</b> Sea surface temperature (°C)   |
| <b>Variable</b>                | <b>Name:</b> SAL_permil<br><b>Unit:</b> ppt<br><b>Description:</b> Sea surface salinity on Practical Salinity Scale (o/oo)  |
| <b>Variable</b>                | <b>Name:</b> fCO2_SW@SST_uatm<br><b>Unit:</b> µatm<br><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<br><b>Unit:</b> µatm<br><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<br><b>Unit:</b> µatm<br><b>Description:</b> Sea water fCO2 minus interpolated air fCO2 (µatm)   |
| <b>Variable</b>                | <b>Name:</b> WOCE_QC_FLAG<br><b>Unit:</b> None<br><b>Description:</b> Quality control flag for fCO2 values (2=good, 3=questionable)   |
| <b>Variable</b>                | <b>Name:</b> QC_SUBFLAG<br><b>Unit:</b> None<br><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.<br><b>Manufacturer:</b> Seabird<br><b>Model:</b> SBE-21<br><b>Accuracy:</b> 0.01 (°C if units not given)<br><b>Precision:</b> 0.001 (°C if units not given)<br><b>Calibration:</b> Factory calibration<br><b>Comments:</b> Manufacturer's Resolution is taken as Precision; Maintained by ship. |
| <b>Sea Surface Salinity</b>    | <b>Location:</b> Attached to underway system at sea water input.<br><b>Manufacturer:</b> Seabird<br><b>Model:</b> SBE 45<br><b>Accuracy:</b> ± 0.005 o/oo<br><b>Precision:</b> 0.0002 o/oo<br><b>Calibration:</b> Factory calibration<br><b>Comments:</b> Manufacturer's Resolution is taken as Precision   |

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| <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:** (1.) It was determined that there was a 2.45 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.) The system was shut down on 10/12 at 0000 to repair a leaking valve. It was restarted on 10/12 at 2332. The system was stopped on 10/18 at 0001 for an unknown reason. It was restarted on 10/18 at 1859. The system was shut down on 10/19 at 1856 when the ship went into port for repairs to the A-frame. It was restarted on 10/21 at 0607. (3.) When the system was restarted on 10/21, the SCS data feed to the system was not working and TSG21 and barometer data were not recorded. The recording of the ship's SCS data restarted on 10/25 at 2029. For the period when the SCS feed was not working, barometric pressure data was calculated from on Licor pressure readings. The equation used was  $\text{Baro} = \text{Licor pressure} * 1.0677 - 68.147$ ,  $n = 287$ ,  $r^2 = 0.97447$ . For SST values, 2.45 minute time offset was applied within the Matlab data reduction program and then an offset in the temperatures was determined: 0.130 (+/-0.016) deg C. The missing ~1640 SST values were estimated by subtracting 0.13 deg from the equilibrator temperatures. In Jan, 2017, some additional raw data files were discovered and processed. 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:**