

<b>Dataset Expocode</b>	<b>33RO20170101</b>
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<b>Dataset</b>	<b>Funding Info:</b> NOAA Climate Program Office <b>Initial Submission (yyyymmdd):</b> 20171017 <b>Revised Submission (yyyymmdd):</b> 20171017
<b>Campaign/Cruise</b>	<b>Expocode:</b> 33RO20170101 <b>Campaign/Cruise Name:</b> RB1606-Leg2 <b>Campaign/Cruise Info:</b> AOML_SOOP_CO2 , GO-SHIP P18, Leg2 <b>Platform Type:</b> <b>CO2 Instrument Type:</b> Equilibrator-IR <b>Survey Type:</b> Research Cruise <b>Vessel Name:</b> R/V Ronald H. Brown <b>Vessel Owner:</b> NOAA <b>Vessel Code:</b> 33RO
<b>Coverage</b>	<b>Start Date (yyyymmdd):</b> 20010101 <b>End Date (yyyymmdd):</b> 20170202 <b>Westernmost Longitude:</b> 103.1 W <b>Easternmost Longitude:</b> 75.3 W <b>Northernmost Latitude:</b> 23.8 S <b>Southernmost Latitude:</b> 70.1 S <b>Port of Call:</b> Easter Island, Chile <b>Port of Call:</b> Punta Arenas, Chile
<b>Variable</b>	<b>Name:</b> xCO2_EQU_ppm <b>Unit:</b> ppm <b>Description:</b> Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
<b>Variable</b>	<b>Name:</b> xCO2_ATM_ppm <b>Unit:</b> ppm <b>Description:</b> Mole fraction of CO2 measured in dry outside air (ppm)
<b>Variable</b>	<b>Name:</b> xCO2_ATM_interpolated_ppm <b>Unit:</b> ppm <b>Description:</b> 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 underway system at sea water input. <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

**Atmospheric  
Pressure**

**Location:** On bulkhead exterior on the port side of the radio room aft of the bridge at ~14 m above the sea surface.  
**Normalized to Sea Level:** yes  
**Manufacturer:** Vaisala  
**Model:** PTB330  
**Accuracy:**  $\pm 0.2$  hPa (hPa if units not given)  
**Precision:**  $\pm 0.08$  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 3.5 hours  
**Intake Location:** Bow tower ~10 m above the 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:**  $\pm 0.5$   $\mu$ atm in fCO2\_ATM  
**Atmospheric CO2 Precision:**  $\pm 0.01$   $\mu$ atm in fCO2\_ATM

**Aqueous CO2  
Equilibrator Design**

**System Manufacturer:**  
**Intake Depth:** 5 meters  
**Intake Location:** Bow  
**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):** 1.5 - 2.0 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:**  $\pm 2$   $\mu$ atm in fCO2\_SW  
**Aqueous CO2 Precision:**  $\pm 0.01$   $\mu$ atm in fCO2\_SW  
**Sensor Calibrations:**  
**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 X2007 scale. Ultra-High Purity air (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.  
**Number Non-Zero Gas Standards:** 4  
**Calibration Gases:**  
  
Std 1: CA04957, 282.55 ppm, owned by ESRL, used every ~4.5 hours.  
Std 2: CC105863, 380.22 ppm, owned by ESRL, used every ~4.5 hours.  
Std 3: CB09696, 453.04 ppm, owned by ESRL, used every ~4.5 hours.  
Std 4: CB09032, 539.38 ppm, owned by ESRL, used every ~4.5 hours.  
Std 5: 0.00 ppm, owned by AOML, used every ~19.0 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 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 throughout this cruise. The ship sensors for measuring SST were not operating well during this cruise, so SST was estimated from good data further from the bow. The temperature and salinity data from the CTD casts from Legs 1 and 2 of P18 were used to estimate SSTemperature and to adjust the SSSalinity used in the fCO<sub>2</sub> processing. A regression fit between the average temperature measured from the seawater supply in the Hydro Lab (HLT) and the CTD surface temperature was done for all casts. After eliminating twelve outlying data, the resulting linear equation was used to estimate the SST.  $SST(\text{estimated}) = 1.01399 * HLT - 0.48039$  ; standard deviation of the differences between the CTD temperatures and the SST(estimated) is +/- 0.054 degree Celsius. A regression fit between the salinity measured in the Hydro Lab (HLS) and the CTD surface salinity was done for all casts. After eliminating nine outlying data, the resulting linear equation was used to adjust the SSS.  $SSS(\text{adjusted}) = 0.998584 * HLS + 0.064605$  ; standard deviation of the differences between the CTD salinities and the SSS(adjusted) is +/- 0.0090 . See Supplemental ReadMe file. During 25 Jan, the inlet for air sampling became blocked with ice. The inlet was unblocked after noon on 26 Jan, 2017. Note: There was a multi-day port stop with personnel change in Easter Island between RB1606 Leg1 and Leg2; and so the ExpoCode or CruiseID for RB1606 Leg2 is given as 33RO20170101. The ExpoCode or CruiseID for RB1606-Leg1 is given as 33RO20161119; and in some data archiving locations the ExpoCode of 33RO20161119 covers both Leg1 and Leg2. Original Data Location: [http://www.aoml.noaa.gov/oce/oceweb/brown/brown\\_introduction.html](http://www.aoml.noaa.gov/oce/oceweb/brown/brown_introduction.html) Full unprocessed data file from analytical instrument including flow information and ship's meteorological and TSG data at time of sampling can be obtained upon request.

**Citation for this Dataset:**

## Other References for this Dataset: