

<b>Dataset Expocode</b>	<b>33GG20120822</b>
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<b>Dataset</b>	<b>Funding Info:</b> NOAA Climate Program Office; NOAA Ocean Acidification Program <b>Initial Submission (yyyymmdd):</b> 20160329 <b>Revised Submission (yyyymmdd):</b> 20160329
<b>Campaign/Cruise</b>	<b>Expocode:</b> 33GG20120822 <b>Campaign/Cruise Name:</b> GU1203_Leg1 <b>Campaign/Cruise Info:</b> AOML_SOOP_CO2 <b>Platform Type:</b> <b>CO2 Instrument Type:</b> Equilibrator-IR or CRDS or GC <b>Survey Type:</b> Research Cruise <b>Vessel Name:</b> R/V Gordon Gunter <b>Vessel Owner:</b> NOAA <b>Vessel Code:</b> 33GG
<b>Coverage</b>	<b>Start Date (yyyymmdd):</b> 20120823 <b>End Date (yyyymmdd):</b> 20120906 <b>Westernmost Longitude:</b> 97.1 W <b>Easternmost Longitude:</b> 88.4 W <b>Northernmost Latitude:</b> 30.1 N <b>Southernmost Latitude:</b> 26.0 N <b>Port of Call:</b> Pascagoula, MS
<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

**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:** hull mounted, ~3 m below sea surface  
**Manufacturer:** Furuno  
**Model:** T2000  
**Accuracy:** 0.2 (°C if units not given)  
**Precision:** 0.1 (°C if units not given)  
**Calibration:** Factory calibration  
**Comments:** Manufacturer's Resolution is taken as Precision; Maintained by ship.

**Sea Surface Salinity**      **Location:** In Chem lab, next to CO2 system  
**Manufacturer:** Seabird  
**Model:** SBE 21  
**Accuracy:** ± 0.05 o/oo  
**Precision:** 0.002 o/oo  
**Calibration:** Factory calibration  
**Comments:** Manufacturer's Resolution is taken as Precision; Maintained by ship.

**Atmospheric Pressure**      **Location:** Next to the bridge, ~15 m above the sea surface water  
**Normalized to Sea Level:** yes

**Manufacturer:** RMYoung  
**Model:** 61201  
**Accuracy:**  $\pm 0.5$  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 3 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:**  $\pm 0.5$   $\mu$ 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, no 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:** 7000  
**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 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:** 3  
**Calibration Gases:**

Std 1: LL100000, 0.00 ppm, owned by AOML, used every ~3.0 hours.  
Std 2: JA02267, 247.72 ppm, owned by AOML, used every ~3.0 hours.  
Std 3: FA02258, 399.25 ppm, owned by AOML, used every ~3.0 hours.  
Std 4: JA02689, 520.79 ppm, owned by AOML, used every ~3.0 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:** 0.001 (°C if units not given)

**Calibration:** Factory calibration

**Comments:** Resolution is taken as Precision.

**Equilibrator  
Pressure Sensor**

**Location:** Attached to equilibrator headspace. Combined with Licor Pressure

**Manufacturer:** Licor

**Model:** None

**Accuracy:** 1.2 (hPa if units not given)

**Precision:** 0.02 (hPa if units not given)

**Calibration:** Factory calibration

**Comments:** Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the LICOR analyzer to yield equilibrator pressure. Manufacturer's Resolution is taken as Precision.

**Additional  
Information**

**Suggested QC flag from Data Provider:** NA

**Additional Comments:** LICOR xH<sub>2</sub>O values were negative so they were adjusted up to make standard values around 0.2 ppt. xCO<sub>2</sub> have then be recalculated using these xH<sub>2</sub>O values. Standard xCO<sub>2</sub> values were varying greatly ( $\pm$  50 ppm). The data was deemed good when the standards co-varied. SST data is from Furuno T-2000 whose resolution is 0.1 °C only so all data has been flagged 3-other. All original data can be found at: [http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter_introduction.html)

**Citation for this Dataset:**

**Other References for this Dataset:**