

**Dataset Expocode** 33GG20190508

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**Dataset** **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program  
**Initial Submission (yyyymmdd):** 20190808  
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**Campaign/Cruise** **Expocode:** 33GG20190508  
**Campaign/Cruise Name:** GU1900-test  
**Campaign/Cruise Info:** AOML\_SOOP\_CO2  
**Platform Type:**  
**CO2 Instrument Type:** Equilibrator-IR or CRDS or GC  
**Survey Type:** Research Cruise  
**Vessel Name:** R/V Gordon Gunter  
**Vessel Owner:** NOAA  
**Vessel Code:** 33GG

**Coverage** **Start Date (yyyymmdd):** 20190508  
**End Date (yyyymmdd):** 20190517  
**Westernmost Longitude:** 89.4 W  
**Easternmost Longitude:** 87.2 W  
**Northernmost Latitude:** 30.4 N  
**Southernmost Latitude:** 28.5 N  
**Port of Call:** Pascagoula, MS

**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** **Name:** 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:** In engine room, about 2 m after the seachest, before the SW pumps.  
**Manufacturer:** Seabird, Inc.  
**Model:** SBE 38  
**Accuracy:** 0.001 (°C if units not given)  
**Precision:** 0.0003 (°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 45  
**Accuracy:** ± 0.005 o/oo  
**Precision:** 0.0002 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 4 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO X2007 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 ~4.5 hours.  
Std 2: JA02140, 234.21 ppm, owned by AOML, used every ~4.5 hours.  
Std 3: JA02689, 406.90 ppm, owned by AOML, used every ~4.5 hours.  
Std 4: JB03276, 471.65 ppm, owned by AOML, used every ~4.5 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.  
**Manufacturer:** Setra  
**Model:** 270  
**Accuracy:** 0.05 (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 operated fine during this test cruise. The serial connection to the ship sensors were not always working. Original Data Location: [http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter_introduction.html)  
Full unprocessed data files 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:**