

Dataset Expocode	33GG20210709
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Dataset	Funding Info: NOAA Climate Program Office; NOAA Ocean Acidification Program Initial Submission (yyyymmdd): 20210913 Revised Submission (yyyymmdd): 20210913
Campaign/Cruise	Expocode: 33GG20210709 Campaign/Cruise Name: GU2103-Leg2, AMAPPS Campaign/Cruise Info: AOML_SOOP_OA 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): 20210709 End Date (yyyymmdd): 20210721 Westernmost Longitude: 79.5 W Easternmost Longitude: 72.5 W Northernmost Latitude: 37.0 N Southernmost Latitude: 30.8 N Port of Call: Charleston, SC Port of Call: Norfolk, VA
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: ± 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: ± 0.5 μ atm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 μ 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: 6262
Measured CO2 Values: xco2(dry)
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ± 2 μ atm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 μ 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 pCO₂ measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Equilibrator

Location: Inserted into equilibrator ~5 cm below water level

Temperature Sensor

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

Location: Attached to equilibrator headspace.

Pressure Sensor

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 cruise; unfortunately, the equilibrator pressure transducer did not work. The equilibrator pressure was estimated by adding 0.638 mbar to the LICOR pressure. The difference between the equilibrator and LICOR pressures determined for the previous cruise was 0.638 (+/- 0.301) mbar. The uncertainty in estimating the equilibrator pressure from the LICOR pressure was determined for two prior cruises. The impact of this uncertainty increases the uncertainty of the calculated fCO₂_SW@SST to greater than 2 uatm, but not greater than 5 uatm. For 8.5 hours starting at 03:00 on 11 July, the atmospheric barometer was not recorded. Missing atmospheric barometer values were estimated by adding 1.51 mbar to the LICOR pressure. The difference between the atmospheric and LICOR pressures during this cruise when both were recorded was 1.51 (+/-0.30) mbar. For 3.2 days starting at 11:00 on 11 July, the SST and SSS values were not recorded. Missing SST values were estimated by subtracting 0.36 deg Celsius from the equilibrator temperature. The difference between the measured equilibrator and sea surface temperatures during this cruise was 0.359 (+/-0.316) degree Celsius. Original Data Location: 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: