

Dataset Expocode 33GG20110414

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Dataset **Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial Submission (yyyymmdd): 20160130
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Campaign/Cruise **Expocode:** 33GG20110414
Campaign/Cruise Name: GU1102_leg2
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):** 20110422
End Date (yyyymmdd): 20110428
Westernmost Longitude: 87.4 W
Easternmost Longitude: 81.7 W
Northernmost Latitude: 24.6 N
Southernmost Latitude: 19.6 N
Port of Call: Cozumel, MX
Port of Call: Key West, FL
Port of Call: George Town, Grand Cayman

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: Usually Sea surface temperature (°C). Here, it was replaced by the equilibrator temperature.
Variable	Name: SAL_permil Unit: ppt Description: Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	Name: fCO ₂ _SW@EQU_T_uatm Unit: μatm Description: Fugacity of CO ₂ in sea water at Equilibrator T and 100% humidity (μatm)
Variable	Name: fCO ₂ _ATM_interpolated_uatm Unit: μatm Description: Fugacity of CO ₂ in air corresponding to the interpolated xCO ₂ at SST and 100% humidity (μatm)
Variable	Name: dfCO ₂ _uatm Unit: μatm Description: Sea water fCO ₂ minus interpolated air fCO ₂ (μatm)
Variable	Name: WOCE_QC_FLAG Unit: None Description: Quality control flag for fCO ₂ values (2=good, 3=questionable)
Variable	Name: QC_SUBFLAG Unit: None Description: Quality control subflag for fCO ₂ 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 CO ₂ 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: ± 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, ~15 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: 7000
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 4.5 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 2: JA02280, 248.73 ppm, owned by AOML, used every ~2.5 hours.
Std 3: JA02292, 372.88 ppm, owned by AOML, used every ~2.5 hours.
Std 4: JA02689, 520.79 ppm, owned by AOML, used every ~2.5 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
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: Issues with the zeroing standard skewed the licor calibration. All xCO₂ have been recalculated. The water channel was reading negative values. They have been adjusted by shifting the standard H₂O concentration to 0.2 ppt before the xCO₂ recalibration. Applied LI-7000 Firmware 2.0 bug correction and re-calculated all licor xCO₂. Re-did all calculations to fCO₂. All original data can be found at: http://www.aoml.noaa.gov/oce/oceweb/gunter/gunter_introduction.html

Citation for this Dataset:

Other References for this Dataset: