

Dataset Expocode	33WA20240404
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Dataset	Funding Info: NOAA Climate Program Office; NOAA Ocean Acidification Program Initial Submission (yyyymmdd): 20241218 Revised Submission (yyyymmdd): 20241218
Campaign/Cruise	Expocode: 33WA20240404 Campaign/Cruise Name: WS24095, 27N 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 F.G. Walton Smith Vessel Owner: University of Miami Vessel Code: 33WA
Coverage	Start Date (yyyymmdd): 20240404 End Date (yyyymmdd): 20240405 Westernmost Longitude: 80.2 W Easternmost Longitude: 79.1 W Northernmost Latitude: 27.1 N Southernmost Latitude: 25.6 N Port of Call: Miami, FL, USA
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:** After sea water pump in the forward, port hull
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:** Near the sea water pump in the forward, port hull.
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

**Atmospheric
Pressure**

Location: On mast above bridge at ~13 m above sea surface.
Normalized to Sea Level: yes
Manufacturer: R.M. Young
Model: 61302
Accuracy: ± 0.3 hPa (hPa if units not given)
Precision: 0.1 hPa (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Atmospheric CO2

Measured/Frequency: Yes, 5 readings in a group every 4.5 hours
Intake Location: On mast above the bridge at ~13 meters 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: ± 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: 1.5 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: ± 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 using field standards that were calibrated with primary standards at AOML that are directly traceable to the WMO X2019 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: 3
Calibration Gases:

Std 1: FF4297, 213.57 ppm, owned by RSMAES, used every ~4.5 hours.
Std 2: FF40429, 385.31 ppm, owned by RSMAES, used every ~4.5 hours.
Std 3: FF36858, 607.37 ppm, owned by RSMAES, used every ~4.5 hours.

Std 5: LL100000, 0.00 ppm, owned by AOML, used every ~4.5 hours.

Comparison to Other CO₂ Analyses:

Comments: Instrument is located in an air-conditioned laboratory.

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: 1523

Accuracy: ± 0.015 (°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. Differential pressure reading from

Pressure Sensor

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 operated well during the cruise. The seawater pump for the underway system was not operating for ~5 hours during the cruise. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/wsmith/wsmith_introduction.html . Full unprocessed data files from analytical instrument including flow information plus meteorological and TSG data at time of sampling can be obtained upon request.

Citation for this Dataset:

Other References for this Dataset: