

Contact Person:

Name: Sullivan, Kevin
Organization: AOML/NOAA
Address: 4301 Rickenbacker Causeway
Phone: 305-361-4382
Email: Kevin.Sullivan@noaa.gov

Investigator(s):

Name: Millero, Frank
Organization: RSMAS/University of Miami
Address: 4600 Rickenbacker Causeway, Miami Fl, 33149
Phone: 305-421-4707
Email: FMillero@rsmas.miami.edu

Name: Wanninkhof, Rik
Organization: AOML/NOAA
Address: 4301 Rickenbacker Causeway, Miami Fl, 33149
Phone: 305-361-4379
Email: Rik.Wanninkhof@noaa.gov

Name: Woosley, Ryan
Organization: RSMAS/University of Miami
Address: 4600 Rickenbacker Causeway, Miami Fl, 33149
Phone: 305-421-4708
Email: RWoosley@rsmas.miami.edu

Dataset Information:

Funding_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial_Submission: 20160130
Revised_Submission: 20160130

Cruise Information:

Experiment Name: WS1404
Experiment Type: Research Cruise
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC
Cruise ID: 33WA20140426
Cruise Info: Student Cruise; SOOP_CO2
Geographical Region:
 Westernmost Longitude: -80.2
 Easternmost Longitude: -79.9
 Northernmost Latitude: 25.8
 Southernmost Latitude: 25.6
Cruise Dates (YYYYMMDD)
 Start_Date: 20140426
 End_Date: 20140426

Ports of Call:

Miami, FL

Vessel Name: F.G. Walton Smith

Vessel ID: 33WA

Vessel Owner: University of Miami

Variables Information:

Variable Name: xCO2_EQU_ppm

Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Unit of Variable: ppm

Variable Name: xCO2_ATM_ppm

Description of Variable: Mole fraction of CO2 measured in dry outside air (ppm)

Unit of Variable: ppm

Variable Name: xCO2_ATM_interpolated_ppm

Description of Variable: 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)

Unit of Variable: ppm

Variable Name: PRES_EQU_hPa

Description of Variable: Barometric pressure in the equilibrator headspace (hectopascals)

Unit of Variable: hPa

Variable Name: PRES_ATM@SSP_hPa

Description of Variable: Barometric pressure measured outside, corrected to sea level (hectopascals)

Unit of Variable: hPa

Variable Name: TEMP_EQU_C

Description of Variable: Water temperature in equilibrator (degrees Celsius)

Unit of Variable: Degree C

Variable Name: SST_C

Description of Variable: Sea surface temperature (degrees Celsius)

Unit of Variable: Degree C

Variable Name: SAL_permil

Description of Variable: Sea surface salinity on Practical Salinity Scale (permil)

Unit of Variable: ppt

Variable Name: fCO2_SW@SST_uatm

Description of Variable: Fugacity of CO2 in sea water at SST and 100% humidity (microatmospheres)

Unit of Variable: μ atm

Variable Name: fCO2_ATM_interpolated_uatm

Description of Variable: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (microatmospheres)

Unit of Variable: μ atm

Variable Name: dfCO2_uatm

Description of Variable: Sea water fCO2 minus interpolated air fCO2 (microatmospheres)

Unit of Variable: μ atm

Variable Name: WOCE_QC_FLAG

Description of Variable: Quality control flag for fCO₂ values (2=good, 3=questionable)

Unit of Variable: None

Variable Name: QC_SUBFLAG

Description of Variable: Quality control subflag for fCO₂ values, provides explanation when QC flag=3

Unit of Variable: None

Method Description:

Equilibrator Design:

Depth of Seawater Intake: 1.5 meters

Location of Seawater Intake: Bow

Equilibrator Type: Sprayhead above dynamic pool, with thermal jacket

Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)

Water Flow Rate: 1.5 - 2.0 L/min

Headspace Gas Flow Rate: 70 - 150 ml/min

Vented: Yes

Drying Method for CO₂ in Water:

Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Additional Information: Primary equilibrator is vented through a secondary equilibrator

CO₂ in Marine Air:

Measurement: Yes, 5 readings in a group every 4 hours

Location and Height: Mast above the bridge, ~13 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).

CO₂ Sensor:

Measurement Method: Infrared absorption of dry sample gas

Manufacturer: LI-COR

Model: 6262

Frequency: Every 140 seconds, except during calibration

Resolution Water: 0.01 microatmosphere

Uncertainty Water: ± 1 microatmospheres

Resolution Air: 0.01 ppm

Uncertainty Air: ± 0.2 ppm

Manufacturer of Calibration Gas:

Airgas, Inc. - Std 1: 202.52 ppm / Std 2: 391.28 ppm / Std 3: 628.68 ppm / Std 4: 1537.18 ppm / Std 5: 0.00 ppm

Number of Non Zero Gas Standards: 4

CO₂ Sensor Calibration:

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 scale. The zero gas is ultra-high purity air.

Other Comments:

Instrument is located in an air-conditioned laboratory. Ultra-High Purity air (0.0 ppm CO₂) and the high standard gas are used to zero and span the LI-COR analyzer.

Method References:

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.

Details Co₂ Sensing:

details of CO₂ sensing (not required)

Measured Co₂ Params:

xco₂(dry)

Sea Surface Temperature:

Location: After sea water pump

Manufacturer: Seabird

Model: SBE-38

Accuracy Degrees Celsius: 0.001

Precision Degrees Celsius: 0.00025

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Equilibrator Temperature:

Location: Inserted into equilibrator ~5 cm below water level

Manufacturer: Hart

Model: 1523

Accuracy Degrees Celsius: 0.015

Precision Degrees Celsius: 0.001

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure:

Location: Attached to equilibrator headspace

Manufacturer: Setra

Model: 239

Accuracy hPa: 0.052

Precision hPa: 0.01

Calibration: Factory calibration

Comments:

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

Atmospheric Pressure:

Location: On mast above the bridge at ~13 m above the sea surface water

Manufacturer: R.M. Young

Model: 61302

Accuracy: ± 0.3 hPa

Precision: 0.1 hPa

Calibration: Factory calibration

Normalized: yes

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity:

Location: In dry lab

Manufacturer: Seabird

Model: SBE 45

Accuracy: ± 0.005 permil

Precision: 0.0002 permil

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Additional Information:

The pCO₂ analytical system operated well during this cruise.

Preliminary Quality Control:

NA

Form Type:

underway