

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

Dataset Information:

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

Cruise Information:

Experiment Name: WS1211
Experiment Type: Research Cruise
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC

Cruise ID: 33WA20120717
Cruise Info: SOOP_CO2

Geographical Region:

Westernmost Longitude: -89.4
Easternmost Longitude: -80.0
Northernmost Latitude: 30.4
Southernmost Latitude: 24.1

Cruise Dates (YYYYMMDD)

Start_Date: 20120717
End_Date: 20120803

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: 840A

Frequency: Every 140 seconds, except during calibration

Resolution Water: 0.01 microatmosphere

Uncertainty Water: ± 2 microatmospheres

Resolution Air: 0.01 ppm

Uncertainty Air: ± 0.8 ppm

Manufacturer of Calibration Gas:

Airgas, Inc. - Std 1: 202.52 ppm / Std 2: 391.28 ppm / Std 3: 628.67 ppm / Std 4: 1479.07 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.

Other Comments:

Instrument is located in an air-conditioned laboratory.

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 pressure transducer in the LICOR analyzer operated well, though the atmospheric pressure recorded by the ship had a resolution of 1 mbar. A simple linear regression was done between the measured LICOR and atmospheric pressures and was used to estimate atmospheric pressure values with 0.1 mbar resolution. No data from the ship sensors were recorded during the first 15.5 hours and the last 2 hours of CO₂ data. The missing

salinity data were assigned a value of 35 psu. The SST was estimated by subtracting 0.11 from the equilibrator temperature. For the 9580 analyses during this cruise with complete data records, the difference between the equilibrator temperature and the (SBE-38) measured SST value was 0.11 +/-0.07 degree C.

Preliminary Quality Control:

NA

Form Type:

underway