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Dataset Information:

Funding_Info: NOAA Climate Program Office
Initial_Submission: 20121220
Revised_Submission: 20160131

Cruise Information:

Experiment Name: RB1203
Experiment Type: Research Cruise
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR
Cruise ID: 33RO20120721
Cruise Info: GOMECC 2, AOML_SOOP_CO2
Geographical Region:
Westernmost Longitude: -90.9
Easternmost Longitude: -68.5
Northernmost Latitude: 43.1
Southernmost Latitude: 24.3
Cruise Dates (YYYYMMDD)
Start_Date: 20120721
End_Date: 20120813
Ports of Call:
Charleston, SC
Boston, MA
Vessel Name: R/V Ronald H. Brown
Vessel ID: 33RO

Vessel Owner: NOAA

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 (hPa)

Unit of Variable: hPa

Variable Name: PRES_ATM@SSP_hPa

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

Unit of Variable: hPa

Variable Name: TEMP_EQU_C

Description of Variable: Water temperature in equilibrator (°C)

Unit of Variable: Degree C

Variable Name: SST_C

Description of Variable: Sea surface temperature (°C)

Unit of Variable: Degree C

Variable Name: SAL_permil

Description of Variable: Sea surface salinity on Practical Salinity Scale (o/oo)

Unit of Variable: ppt

Variable Name: fCO2_SW@SST_uatm

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

Unit of Variable: μatm

Variable Name: fCO2_ATM_interpolated_uatm

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

Unit of Variable: μatm

Variable Name: dfCO2_uatm

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

Unit of Variable: μatm

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: 5 meters

Location of Seawater Intake: Bow

Equilibrator Type: Spray head 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 3.5 hours

Location and Height: Bow tower ~10 m 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).

CO₂ Sensor:

Measurement Method: IR

Manufacturer: LI-COR

Model: 6262

Frequency: Every 140 seconds, except during calibration

Resolution Water: ± 0.01 µatm in fCO₂_SW

Uncertainty Water: ± 2 µatm in fCO₂_SW

Resolution Air: ± 0.01 µatm in fCO₂_ATM

Uncertainty Air: ± 0.5 µatm in fCO₂_ATM

Manufacturer of Calibration Gas:

Std 1: CA06709, 284.75 ppm, owned by ESRL, used every ~ 3.5 hours. Std 2: CA02813, 363.24 ppm, owned by ESRL, used every ~3.5 hours. Std 3: CA07921, 423.57 ppm, owned by ESRL, used every ~3.5 hours. Std 4: CA07931, 545.88 ppm, owned by ESRL, used every ~3.5 hours. Std 5: 0.00 ppm, owned by AOML, used every ~20.0 hours.

Number of Non Zero Gas Standards: 4

CO₂ Sensor Calibration:

The analyzer is calibrated every 3.5 hours using field standards that were calibrated with primary standards that are directly traceable to the WMO scale. Ultra-High Purity air (0.0 ppm CO₂) and the high standard are used to zero and span the LI-COR analyzer.

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: Bow thruster room, before sea water pump, ~5 m below water line.

Manufacturer: Seabird

Model: SBE-21

Accuracy Degrees Celsius: 0.01

Precision Degrees Celsius: 0.001

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: 1521

Accuracy Degrees Celsius: 0.025

Precision Degrees Celsius: 0.01

Calibration: Factory calibration

Comments: Resolution is taken as Precision.

Equilibrator Pressure:

Location: Attached to equilibrator headspace. Differential pressure reading from 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 hPa: 0.15

Precision hPa: 0.015

Calibration: Factory calibration

Comments:

Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:

Location: On bulkhead exterior on the port side of the radio room aft of the bridge at ~14 m above the sea surface.

Manufacturer: Vaisala

Model: PTB330

Accuracy: ± 0.2 hPa

Precision: ± 0.08 hPa

Calibration: Factory calibration

Normalized: yes

Comments: Manufacturer's resolution is taken as precision. Maintained by ship.

Sea Surface Salinity:

Location: Attached to underway system at sea water input.

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

Additional Information:

(1.) On 25 July at 15:00, there was a ship-wide power loss. The CO2 system was restarted approximately 90 minutes later. The opportunity was taken to zero and span the CO2 channel and to zero the water channel of the LICOR 6262 analyzer. (2.) The SBE-21 thermosalinograph in the ship's instrument chest behaved well the first four days of the cruise. Afterwards, the conductivity sensor became erratic. The temperature sensor behaved well, though the entire TSG-21 was replaced a couple times and was undergoing testing at other times. The salinity used for the CO2 data reduction was from the SBE-45 that was attached to the CO2 instrument. The temperature from the SBE-21 was used for the data reduction. There were two extended periods of testing when the SBE-21 temperature was not available, so the SBE-45 temperature was used for data reduction (14:20 on 7 Aug to 00:30 on 8 Aug; and 22:25 on 5 Aug to 00:55 on 6 Aug). Location: http://www.aoml.noaa.gov/ocd/ocdweb/brown/brown_introduction.html

Preliminary Quality Control:

NA

Form Type:

underway