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Dataset Information:

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

Cruise Information:

Experiment Name: GU1104_Leg2
Experiment Type: Research Cruise
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC

Cruise ID: 33GG20110913
Cruise Info: AOML_SOOP_CO2
Geographical Region:

Westernmost Longitude: -88.1
Easternmost Longitude: -81.6
Northernmost Latitude: 30.4
Southernmost Latitude: 24.9

Cruise Dates (YYYYMMDD)

Start_Date: 20110914
End_Date: 20110927

Ports of Call:

Pascagoula, MS

Vessel Name: R/V Gordon Gunter
Vessel ID: 33GG
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, no 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 hours

Location and Height: 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).

CO₂ Sensor:

Measurement Method: IR

Manufacturer: LI-COR

Model: 7000

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: LL100000, 0.00 ppm, owned by AOML, used every ~2.5 hours. Std 2: JA02267, 247.72 ppm, owned by AOML, used every ~2.5 hours. Std 3: FA02258, 399.25 ppm, owned by AOML, used every ~2.5 hours. Std 4: JA02689, 520.79 ppm, owned by AOML, used every ~2.5 hours.

Number of Non Zero Gas Standards: 3

CO₂ Sensor Calibration:

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.

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: hull mounted, ~3 m below sea surface
Manufacturer: Furuno
Model: T2000
Accuracy Degrees Celsius: 0.2
Precision Degrees Celsius: 0.1
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: 0.001
Calibration: Factory calibration
Comments: Resolution is taken as Precision.

Equilibrator Pressure:

Location: Attached to equilibrator headspace. Combined with Licor Pressure
Manufacturer: Licor
Model: None
Accuracy hPa: 1.2
Precision hPa: 0.02
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.

Atmospheric Pressure:

Location: Next to the bridge, ~15 m above the sea surface water
Manufacturer: RMYoung
Model: 61201
Accuracy: ± 0.5 hPa
Precision: 0.01 hPa
Calibration: Factory calibration
Normalized: yes
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity:

Location: In Chem lab, next to CO2 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.

Additional Information:

This data set presented several issues with the analyzer showing large jumps in the readings, water flow being

problematic in the middle of the cruise. For these reasons, the LI-7000 Firmware 2.0 bug correction was not applied and all values that could be saved have been flagged 3. We estimate that their accuracy might be in the range of 5-10 ppm. All original data can be found at: http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter_introduction.html

Preliminary Quality Control:

NA

Form Type:

underway