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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: GU1502-Leg1
Experiment Type: Research Cruise
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC
Cruise ID: 33GG20150414
Cruise Info: Northern Right Whale, AOML_SOOP_CO2
Geographical Region:
Westernmost Longitude: -88.2
Easternmost Longitude: -67.9
Northernmost Latitude: 41.3
Southernmost Latitude: 24.2
Cruise Dates (YYYYMMDD)
Start_Date: 20150414
End_Date: 20150427
Ports of Call:
Pascagoula, MS
Newport, RI
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 3 hours. Std 2: JA02267, 247.72 ppm, owned by AOML, used every 3 hours. Std 3: JB03296, 382.61 ppm, owned by AOML, used every 3 hours. Std 4: JB03673, 510.35 ppm, owned by AOML, used every 3 hours.

Number of Non Zero Gas Standards: 3

CO₂ Sensor Calibration:

The analyzer is calibrated every 3 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: In engine room, about 2m after the seachest, before the SW pumps.
Manufacturer: Seabird, Inc.
Model: SBE 38
Accuracy Degrees Celsius: 0.001
Precision Degrees Celsius: 0.0003
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: Druck
Model: RPT350
Accuracy: ± 0.08 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 45
Accuracy: ± 0.005 o/oo
Precision: 0.0002 o/oo
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Additional Information:

During this transit leg the ship did not record the SCS data, therefore the gaps in the real-time acquisition of the SCS data were interpolated.

Preliminary Quality Control:

NA

Form Type:

underway