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**Dataset Information:**

Funding\_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program  
Initial\_Submission: 20121127  
Revised\_Submission: 20160130

**Cruise Information:**

Experiment Name: HB1206-Legs1-4  
Experiment Type: Research Cruise  
Platform Type: Ship  
Co2 Instrument Type: Equilibrator-IR or CRDS or GC  
Cruise ID: 33HH20120907  
Cruise Info: Autumn Bottom Trawl Survey, AOML\_SOOP\_CO2  
Geographical Region:  
    Westernmost Longitude: -76.4  
    Easternmost Longitude: -68.1  
    Northernmost Latitude: 42.2  
    Southernmost Latitude: 34.3  
Cruise Dates (YYYYMMDD)  
    Start\_Date: 20120907  
    End\_Date: 20121111  
Ports of Call:  
    Newport, RI  
Vessel Name: R/V Henry B. Bigelow  
Vessel ID: 33HH  
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: 3 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 CO<sub>2</sub> 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.

CO<sub>2</sub> in Marine Air:

Measurement: Yes, 5 readings in a group every 4.5 hours

Location and Height: Mast above the bridge, ~18 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).

CO<sub>2</sub> Sensor:

Measurement Method: IR

Manufacturer: LI-COR

Model: 6262

Frequency: Every 140 seconds, except during calibration

Resolution Water:  $\pm 0.01 \mu\text{atm}$  in fCO<sub>2</sub>\_SW

Uncertainty Water:  $\pm 2 \mu\text{atm}$  in fCO<sub>2</sub>\_SW

Resolution Air:  $\pm 0.01 \mu\text{atm}$  in fCO<sub>2</sub>\_ATM

Uncertainty Air:  $\pm 0.5 \mu\text{atm}$  in fCO<sub>2</sub>\_ATM

Manufacturer of Calibration Gas:

Std 1: JA02645, 204.74 ppm, owned by AOML, used every ~4.5 hours. Std 2: JA02273, 317.49 ppm, owned by AOML, used every ~4.5 hours. Std 3: JA02285, 372.23 ppm, owned by AOML, used every ~4.5 hours. Std 4: JA02647, 518.24 ppm, owned by AOML, used every ~4.5 hours.

Number of Non Zero Gas Standards: 4

CO<sub>2</sub> 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 CO<sub>2</sub>) 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 pCO<sub>2</sub> measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Details Co<sub>2</sub> Sensing:

details of CO<sub>2</sub> sensing (not required)

Measured Co<sub>2</sub> Params:

xco<sub>2</sub>(dry)

Sea Surface Temperature:

Location: After sea water pump, ~3 m below sea surface

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: 1523

Accuracy Degrees Celsius: 0.015

Precision Degrees Celsius: 0.0003

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 mast above the bridge at ~18 m above sea surface water

Manufacturer: Vaisala

Model: PTB220

Accuracy:  $\pm 0.15$  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 dry lab after a debubbler, next to CO2 system

Manufacturer: Seabird

Model: SBE 45

Accuracy:  $\pm 0.005$  o/oo

Precision: 0.0002 o/oo

Calibration: Factory calibration

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

**Additional Information:**

The analytical system operated well throughout this cruise. During leg three, the reading from the ship's barometer was not available for approximately one hour starting at 15:15 on 19 October. The outside barometric pressure for this interval was estimated by subtracting 1.14 mbar from LICOR pressure. This offset, 1.14 (+/- 0.18) mbar, was calculated from the 100 data records before and after the gap. During leg

four, the sea water flow reaching the TSG and CO<sub>2</sub> instruments in the dry lab was very low for approximately thirty hours starting at 13:30 on 3 November. Only outside air analyses are reported for this interval. For the majority of the four legs of this cruise, the water flow through the pCO<sub>2</sub> instrument was generous (1.6 - 2.1 L/min). For two days during leg four starting at 12:00 on 7 November, the ship sought protection from a severe storm. In the relative calm of Cape Cod Bay, the flowing sea water system was secured and the CO<sub>2</sub> data acquisition was interrupted. The cruise was completed with no additional disruptions. Original Data Location: [http://www.aoml.noaa.gov/ocd/ocdweb/bigelow/bigelow\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/bigelow/bigelow_introduction.html)

**Preliminary Quality Control:**

NA

**Form Type:**

underway