Dataset Expocode	**74X120110720**
Primary Contact	**Name:** Pierrot, Denis **Organization:** NOAA/Atlantic Oceanographic & Meteorological Laboratory **Address:** 4301 Rickenbacker Causeway, Miami Fl, 33149 **Phone:** 305-361-4441 **Email:** Denis.Pierrot@noaa.gov
Investigator	**Name:** Wanninkhof, Rik **Organization:** NOAA/AOML **Address:** 4301 Rickenbacker Causeway, Miami Fl, 33149 **Phone:** 305-361-4379 **Email:** Rik.Wanninkhof@noaa.gov
Investigator	**Name:** Pierrot, Denis **Organization:** NOAA/Atlantic Oceanographic & Meteorological Laboratory **Address:** 4301 Rickenbacker Causeway, Miami Fl, 33149 **Phone:** 305-361-4441 **Email:** Denis.Pierrot@noaa.gov
Dataset	**Funding Info:** NOAA Climate Program Office; NOAA Ocean Acidification Program **Initial Submission (yyyymmdd):** **Revised Submission (yyyymmdd):**
Campaign/Cruise	**Expocode:** 74X120110720 **Campaign/Cruise Name:** LasC09-11 **Campaign/Cruise Info:** AOML_SOOP_CO2 **Platform Type:** **CO2 Instrument Type:** Equilibrator-IR or CRDS or GC **Survey Type:** SOOP Line **Vessel Name:** M/V Las Cuevas **Vessel Owner:** Greenlight Transport S.A **Vessel Code:** 74X1
Coverage	**Start Date (yyyymmdd):** 20110720 **End Date (yyyymmdd):** 20110807 **Westernmost Longitude:** 97.1 W **Easternmost Longitude:** 61.5 W **Northernmost Latitude:** 29.6 N **Southernmost Latitude:** 10.3 N
Variable	**Name:** xCO2_EQU_ppm **Unit:** **Description:** Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
Variable	**Name:** xCO2_ATM_ppm **Unit:** **Description:** Mole fraction of CO2 measured in dry outside air (ppm)
Variable	**Name:** xCO2_ATM_interpolated_ppm **Unit:** **Description:** 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)
Variable	**Name:** PRES_EQU_hPa **Unit:**

	Description: Barometric pressure in the equilibrator headspace (hPa)
Variable	**Name:** PRES_ATM@SSP_hPa **Unit:** **Description:** Barometric pressure measured outside, corrected to sea level (hPa)
Variable	**Name:** TEMP_EQU_C **Unit:** **Description:** Water temperature in equilibrator (°C)
Variable	**Name:** SST_C **Unit:** **Description:** Sea surface temperature (°C)
Variable	**Name:** SAL_permil **Unit:** **Description:** Sea surface salinity on Practical Salinity Scale (o/oo)
Variable	**Name:** fCO2_SW@EQUT_uatm **Unit:** **Description:** Fugacity of CO2 in sea water at equilibrator temperature and 100% humidity (µatm)
Variable	**Name:** fCO2_ATM_interpolated_uatm **Unit:** **Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
Variable	**Name:** dfCO2_uatm **Unit:** **Description:** Sea water fCO2 minus interpolated air fCO2 (µatm)
Variable	**Name:** WOCE_QC_FLAG **Unit:** **Description:** Quality control flag for fCO2 values (2=good, 3=questionable)
Variable	**Name:** QC_SUBFLAG **Unit:** **Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3
Sea Surface Temperature	**Location:** From Beginning to 16 Nov 2011, a SBE48 (Magnetic Hull mounted) sensor was used. It was located on the wall of the sea chest. **Manufacturer:** Seabird **Model:** SBE-48 (11July2009-16Nov2011) **Accuracy:** 0.001 (°C if units not given) **Precision:** 0.00025 (°C if units not given) **Calibration:** Factory calibration. **Comments:** Manufacturer's Resolution is taken as Precision.
Sea Surface Salinity	**Location:** In the ship's engine room 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.

Atmospheric Pressure

Location: On deck above bridge at ~20 m above sea surface.
Normalized to Sea Level: yes
Manufacturer: Druck
Model: RPT350
Accuracy: ± 0.08 hPa (hPa if units not given)
Precision: ± 0.01 hPa (hPa if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Atmospheric CO2

Measured/Frequency: Yes, 5 readings in a group every ~4.5 hours
Intake Location: On mast above the bridge at ~20 meters 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).
Atmospheric CO2 Accuracy: ± 0.5 µatm in fCO2_ATM
Atmospheric CO2 Precision: ± 0.01 µatm in fCO2_ATM

Aqueous CO2 Equilibrator Design

System Manufacturer:
Intake Depth: 7 meters
Intake Location: Sea chest under the engine room
Equilibration Type: Sprayhead above dynamic pool, no thermal jacket
Equilibrator Volume (L): 0.95 L (0.4 L water, 0.55 L headspace)
Headspace Gas Flow Rate (ml/min): 70 - 150 ml/min
Equilibrator Water Flow Rate (L/min): 1.5 - 2.0 L/min
Equilibrator Vented: Yes
Equilibration Comments: Primary equilibrator is vented through a secondary equilibrator.
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).

Aqueous CO2 Sensor Details

Measurement Method: IR
Method details: details of CO2 sensing (not required)
Manufacturer: LI-COR
Model: 840A (13June2010-end)
Measured CO2 Values: xco2(dry)
Measurement Frequency: Every 140 seconds, except during calibration
Aqueous CO2 Accuracy: ± 2 µatm in fCO2_SW
Aqueous CO2 Precision: ± 0.01 µatm in fCO2_SW
Sensor Calibrations:
Calibration of Calibration Gases: The analyzer is calibrated every ~4.5 hours using ESRL 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.
Number Non-Zero Gas Standards:
Calibration Gases:

Std 1: CA3095, 247.01 ppm, owned by AOML, used every 4.5 hours.
Std 2: CA3880, 318.94 ppm, owned by AOML, used every 4.5 hours.
Std 3: CA5979, 381.89 ppm, owned by AOML, used every 4.5 hours.
Std 4: CA6380, 448.29 ppm, owned by ESRL, used every 4.5 hours.
Comparison to Other CO2 Analyses:
Comments: Instrument is located next to a walkway in the engine room.
Method Reference:

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.

Equilibrator Temperature Sensor

Location: Inserted into equilibrator ~ 5 cm below the water level.
Manufacturer: Hart
Model: 1521
Accuracy: 0.025 (°C if units not given)
Precision: 0.001 (°C if units not given)
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure Sensor

Location: Attached to equilibrator headspace. Combined with Licor Pressure
Manufacturer: Licor
Model: None
Accuracy: 15 (hPa if units not given)
Precision: 1 (hPa if units not given)
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.

Additional Information

Suggested QC flag from Data Provider: NA
Additional Comments: Atm P shows large swings of about 8 mbar. EQU gas flow was close to 0 most of the time. However there is indication that the headspace gas still circulates (xCO2 seems to vary normally). Around JDay 207-208, the spread of xCO2 values increases and occasionally an xCO2 value will be off by ~20-30 ppm for undetermined reasons (unrelated to changes in P, T, licor voltage). The frequency of these outliers increases with time, which casts doubt on the validity of the data. fCO2 was calculated using equilibrator temperature and the fCO2 header was changed to fCO2_SW@EQU_T_uatm.
Citation for this Dataset:
Other References for this Dataset: