

**Dataset Expocode** 74X120111210

**Primary Contact** **Name:** Pierrot, Denis  
**Organization:** NOAA/Atlantic Oceanographic & Meteorological Laboratory  
**Address:** 4301 Rickenbacker Causeway, Miami FI, 33149  
**Phone:** 305-361-4441  
**Email:** Denis.Pierrot@noaa.gov

**Investigator** **Name:** Wanninkhof, Rik  
**Organization:** NOAA/AOML  
**Address:** 4301 Rickenbacker Causeway, Miami FI, 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 FI, 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:** 74X120111210  
**Campaign/Cruise Name:** LasC14-11  
**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):** 20111210  
**End Date (yyyymmdd):** 20111231  
**Westernmost Longitude:** 94.6 W  
**Easternmost Longitude:** 62 W  
**Northernmost Latitude:** 29.3 N  
**Southernmost Latitude:** 10.1 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@SST\_uatm

**Unit:**

**Description:** Fugacity of CO2 in sea water at SST 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:** In ship's engine room at a side port off the piping carrying cooling water for the engines. Between the sea chest and the side port there is ~5 meters of pipe (~0.25 diameter). During the transit, the seawater warms an estimated 0.2-0.5 deg C. The reported SST is the value measured at the side port.

**Manufacturer:** Seabird, Inc.

**Model:** SBE 38

**Accuracy:** 0.001 (°C if units not given)

**Precision:** 0.0003 (°C if units not given)

**Calibration:** Factory calibration

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

**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:**  $\pm 0.08$  hPa (hPa if units not given)  
**Precision:**  $\pm 0.01$  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:**  $\pm 0.5$   $\mu$ atm in fCO2\_ATM  
**Atmospheric CO2 Precision:**  $\pm 0.01$   $\mu$ atm 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:** Self-propelled surface platform  
**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:**  $\pm 2$   $\mu$ atm in fCO2\_SW  
**Aqueous CO2 Precision:**  $\pm 0.01$   $\mu$ atm 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 pCO<sub>2</sub> measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

**Equilibrator**

**Location:** Inserted into equilibrator ~ 5 cm below the water level.

**Temperature Sensor**

**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**

**Location:** Attached to equilibrator headspace. Combined with Licor Pressure

**Pressure Sensor**

**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:** SST or EQU temp were interpolated in ~700 cases. Offset between intake and EQU temperature was set at 3.76 minutes. Atm P shows large swings 15+ mbar. Was replaced by the LICOR pressure. H<sub>2</sub>O flow was unstable, often dropping to 0 (values discarded - flagged 4). Original Data Location: [http://www.aoml.noaa.gov/ocd/gcc/lascuevas\\_introduction.php](http://www.aoml.noaa.gov/ocd/gcc/lascuevas_introduction.php)

**Citation for this Dataset:**

**Other References for this Dataset:**