Contact Person:

Name: Sullivan, Kevin  
Organization: NOAA/Atlantic Oceanographic & Meteorological Laboratory  
Address: 4301 Rickenbacker Causeway  
Phone: 305-361-4382  
Email: Kevin.Sullivan@noaa.gov

Investigator(s):

Name: Wanninkhof, Rik  
Organization: NOAA/AOML  
Address: 4301 Rickenbacker Causeway, Miami Fl, 33149  
Phone: 305-361-4379  
Email: Rik.Wanninkhof@noaa.gov

Dataset Information:

Funding_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program  
Initial_Submission: 20150703  
Revised_Submission: 20160130

Cruise Information:

Experiment Name: EX1431  
Experiment Type: SOOP Line  
Platform Type: Ship  
Co2 Instrument Type: Equilibrator-IR or CRDS or GC  
Cruise ID: 33KF20140814  
Cruise Info: AOML_SOOP_CO2  
Geographical Region:  
Westernmost Longitude: -74.1  
Easternmost Longitude: -63.0  
Northernmost Latitude: 40.6  
Southernmost Latitude: 18.0  
Cruise Dates (YYYYMMDD)  
Start_Date: 20140814  
End_Date: 20140823  
Ports of Call:  
Bayonne, NJ  
Kings Wharf, Bermuda  
Phillipsburg, St. Maarten  
San Juan, Puerto Rico  
Labadee, Haiti  
Vessel Name: Explorer of the Seas  
Vessel ID: 33KF  
Vessel Owner: Royal Caribbean International

Variables Information:
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description of Variable</th>
<th>Unit of Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>xCO2_EQU_ppm</td>
<td>Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)</td>
<td>ppm</td>
</tr>
<tr>
<td>xCO2_ATM_ppm</td>
<td>Mole fraction of CO2 measured in dry outside air (ppm)</td>
<td>ppm</td>
</tr>
<tr>
<td>xCO2_ATM_interpolated_ppm</td>
<td>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)</td>
<td>ppm</td>
</tr>
<tr>
<td>PRES_EQU_hPa</td>
<td>Barometric pressure in the equilibrator headspace (hectopascals)</td>
<td>hPa</td>
</tr>
<tr>
<td>PRES_ATM@SSP_hPa</td>
<td>Barometric pressure measured outside, corrected to sea level (hectopascals)</td>
<td>hPa</td>
</tr>
<tr>
<td>TEMP_EQU_C</td>
<td>Water temperature in equilibrator (degrees Celsius)</td>
<td>Degree C</td>
</tr>
<tr>
<td>SST_C</td>
<td>Sea surface temperature (degrees Celsius)</td>
<td>Degree C</td>
</tr>
<tr>
<td>SAL_permil</td>
<td>Sea surface salinity on Practical Salinity Scale (permil)</td>
<td>ppt</td>
</tr>
<tr>
<td>fCO2_SW@SST_uatm</td>
<td>Fugacity of CO2 in sea water at SST and 100% humidity (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>fCO2_ATM_interpolated_uatm</td>
<td>Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>dfCO2_uatm</td>
<td>Sea water fCO2 minus interpolated air fCO2 (microatmospheres)</td>
<td>μatm</td>
</tr>
<tr>
<td>WOCE_QC_FLAG</td>
<td>Quality control flag for fCO2 values (2=good, 3=questionable)</td>
<td>None</td>
</tr>
<tr>
<td>QC_SUBFLAG</td>
<td>Quality control subflag for fCO2 values, provides explanation when QC flag=3</td>
<td>None</td>
</tr>
</tbody>
</table>

**Method Description:**
Equilibrator Design:

- Depth of Seawater Intake: 5 meters
- Location of Seawater Intake: Forward port side, just above the bow thruster tunnel
- Equilibrator Type: Sprayhead above dynamic pool, with thermal jacket
- Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)
- Water Flow Rate: 1.5 - 2.5 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 3.2 hours
- Location and Height: On bow mast 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).

CO2 Sensor:

- Measurement Method: Infrared absorption of dry sample gas
- Manufacturer: LI-COR
- Model: 6262
- Frequency: Every 140 seconds, except during calibration
- Resolution Water: 0.01 microatmosphere
- Uncertainty Water: ± 1 microatmospheres
- Resolution Air: 0.01 ppm
- Uncertainty Air: ± 0.2 ppm
- Manufacturer of Calibration Gas:
  - ESRL, Boulder - Std 1: Commercial UHP Nitrogen, 0.00 ppm / Std 2: CA04890, 282.59 ppm / Std 3: CC115007, 381.54 ppm / Std 4: CB09022, 537.45 ppm
- Number of Non Zero Gas Standards: 3
- CO2 Sensor Calibration:
  - The analyzer is calibrated every 3.2 hours using standards directly traceable to the WMO scale.
- Other Comments:
  - Instrument is located in the ship's air-conditioned bow thruster space. Ultra-High Purity nitrogen gas (0.0 ppm CO2) and the high standard are used to zero and span the LI-COR analyzer.
- Method References:
- Details Co2 Sensing:
  - details of CO2 sensing (not required)
- Measured Co2 Params:
  - xco2(dry)

Sea Surface Temperature:

- Location: In bow thruster room between the inlet and sea water pump
Manufacturer: Seabird  
Model: SBE-38  
Accuracy Degrees Celsius: 0.001  
Precision Degrees Celsius: 0.00025  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Equilibrator Temperature:  
Location: Inserted into equilibrator ~ 5 cm below the water level.  
Manufacturer: Hart  
Model: 1523  
Accuracy Degrees Celsius: 0.015  
Precision Degrees Celsius: 0.001  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision.

Equilibrator Pressure:  
Location: Attached to equilibrator headspace  
Manufacturer: Setra  
Model: 239  
Accuracy hPa: 0.052  
Precision hPa: 0.01  
Calibration: Factory calibration  
Comments:  
Differential pressure reading from Setra-239 attached to the equilibrator headspace was added to the pressure reading from the Setra-270 on the exit of the analyzer to yield equilibrator pressure.  
Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:  
Location: On mast above bridge and atmospheric lab, ~59 m above sea surface.  
Manufacturer: R.M.Young  
Model: 61302V  
Accuracy: ± 0.3 hPa  
Precision: 0.15 hPa  
Calibration: Factory calibration  
Normalized: yes  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Sea Surface Salinity:  
Location: In bow thruster space, next to CO2 system.  
Manufacturer: Seabird  
Model: SBE 45  
Accuracy: ± 0.005 permil  
Precision: 0.0002 permil  
Calibration: Factory calibration  
Comments: Manufacturer's Resolution is taken as Precision; Maintained by other scientists.

Additional Information:  
The CO2 analytical system performed well throughout this cruise.

Preliminary Quality Control:  
NA
<table>
<thead>
<tr>
<th>Form Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>underway</td>
</tr>
</tbody>
</table>