

<b>Dataset Expocode</b>	<b>28AQ20190728</b>
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<b>Dataset</b>	<b>Funding Info:</b> NOAA Climate Program Office; NOAA Ocean Acidification Program <b>Initial Submission (yyyymmdd):</b> 20200110 <b>Revised Submission (yyyymmdd):</b> 20200110
<b>Campaign/Cruise</b>	<b>Expocode:</b> 28AQ20190728 <b>Campaign/Cruise Name:</b> Flora_20190728 <b>Campaign/Cruise Info:</b> AOML_SOOP_CO2, Inner Loop <b>Platform Type:</b> <b>CO2 Instrument Type:</b> Equilibrator-IR or CRDS or GC <b>Survey Type:</b> SOOP Line <b>Vessel Name:</b> Flora <b>Vessel Owner:</b> Royal Caribbean International <b>Vessel Code:</b> 28AQ
<b>Coverage</b>	<b>Start Date (yyyymmdd):</b> 20190728 <b>End Date (yyyymmdd):</b> 20190804 <b>Westernmost Longitude:</b> 91.7 W <b>Easternmost Longitude:</b> 89.2 W <b>Northernmost Latitude:</b> 0.3 N <b>Southernmost Latitude:</b> 0.9 S <b>Port of Call:</b> Baltra, Galapagos
<b>Variable</b>	<b>Name:</b> xCO2_EQU_ppm <b>Unit:</b> ppm <b>Description:</b> Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
<b>Variable</b>	<b>Name:</b> xCO2_ATM_ppm <b>Unit:</b> ppm <b>Description:</b> Mole fraction of CO2 measured in dry outside air (ppm)
<b>Variable</b>	<b>Name:</b> xCO2_ATM_interpolated_ppm <b>Unit:</b> ppm <b>Description:</b> 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)
<b>Variable</b>	<b>Name:</b> PRES_EQU_hPa

**Unit:** hPa  
**Description:** Barometric pressure in the equilibrator headspace (hPa)

**Variable**      **Name:** PRES\_ATM@SSP\_hPa  
**Unit:** hPa  
**Description:** Barometric pressure measured outside, corrected to sea level (hPa)

**Variable**      **Name:** TEMP\_EQU\_C  
**Unit:** Degree C  
**Description:** Water temperature in equilibrator (°C)

**Variable**      **Name:** SST\_C  
**Unit:** Degree C  
**Description:** Sea surface temperature (°C)

**Variable**      **Name:** SAL\_permil  
**Unit:** ppt  
**Description:** Sea surface salinity on Practical Salinity Scale (o/oo)

**Variable**      **Name:** fCO2\_SW@SST\_uatm  
**Unit:** µatm  
**Description:** Fugacity of CO2 in sea water at SST and 100% humidity (µatm)

**Variable**      **Name:** fCO2\_ATM\_interpolated\_uatm  
**Unit:** µatm  
**Description:** Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)

**Variable**      **Name:** dfCO2\_uatm  
**Unit:** µatm  
**Description:** Sea water fCO2 minus interpolated air fCO2 (µatm)

**Variable**      **Name:** WOCE\_QC\_FLAG  
**Unit:** None  
**Description:** Quality control flag for fCO2 values (2=good, 3=questionable)

**Variable**      **Name:** QC\_SUBFLAG  
**Unit:** None  
**Description:** Quality control subflag for fCO2 values, provides explanation when QC flag=3

**Sea Surface Temperature**      **Location:** In starboard technical room, about 2m after the intake which is directly through the ship's hull, before the SW pump.  
**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 University of Miami's MTG group.

**Sea Surface Salinity**      **Location:** Near the pCO2 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 University of Miami's MTG group.

## Atmospheric Pressure

**Location:** On deck of radar mast (deck 8) above bridge, 16 m above sea level

**Normalized to Sea Level:** no

**Manufacturer:** R.M. Young

**Model:** 61302V

**Accuracy:**  $\pm 0.2$  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; Maintained by University of Miami's MTG group.

## Atmospheric CO2

**Measured/Frequency:** no

**Intake Location:** none

**Drying Method:** none

**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:** 2 meters

**Intake Location:** Bow

**Equilibration Type:** Spray head 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):** 1.8 - 2.5 L/min

**Equilibrator Vented:** Yes

**Equilibration Comments:** Primary equilibrator is vented through a secondary equilibrator.

**Drying Method:** Gas stream passes through a thermoelectric condenser ( $\sim 5^\circ\text{C}$ ) 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

**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 5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO X2007 scale. The zero gas is ultra-high purity air.

**Number Non-Zero Gas Standards:** 4

**Calibration Gases:**

Std 1: CC721827, 241.25 ppm, owned by AOML, used every  $\sim 4.5$  hours.

Std 2: CC721759, 371.52 ppm, owned by AOML, used every  $\sim 4.5$  hours.

Std 3: CC721740, 421.37 ppm, owned by AOML, used every  $\sim 4.5$  hours.

Std 4: CC721760, 583.81 ppm, owned by AOML, used every  $\sim 4.5$  hours.

Std 5: LL100000, 0.00 ppm, owned by AOML, used every  $\sim 18.0$  hours.

**Comparison to Other CO2 Analyses:**

**Comments:****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  
Temperature Sensor**

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

**Manufacturer:** Hart

**Model:** 1521

**Accuracy:** 0.015 (°C if units not given)

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

**Calibration:** Factory calibration

**Comments:** Resolution is taken as Precision.

**Equilibrator  
Pressure Sensor**

**Location:** Attached to equilibrator headspace.

**Manufacturer:** Setra

**Model:** 270

**Accuracy:** 0.15 (hPa if units not given)

**Precision:** 0.015 (hPa if units not given)

**Calibration:** Factory calibration

**Comments:** Manufacturer's Resolution is taken as Precision.

**Additional  
Information**

**Suggested QC flag from Data Provider:** NA

**Additional Comments:** The analytical system operated well during this cruise. Original Data Location: [http://www.aoml.noaa.gov/ocd/ocdweb/allure/allure\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/allure/allure_introduction.html) Full unprocessed data files from analytical instrument including flow information and TSG data at time of sampling can be obtained upon request.

**Citation for this Dataset:**

**Other References for this Dataset:**