

<b>Dataset Expocode</b>	<b>28AQ20190515</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> 28AQ20190515 <b>Campaign/Cruise Name:</b> Flora_20190515 <b>Campaign/Cruise Info:</b> AOML_SOOP_CO2 <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> 20190518 <b>End Date (yyyymmdd):</b> 20190604 <b>Westernmost Longitude:</b> 79.9 W <b>Easternmost Longitude:</b> 10.8 W <b>Northernmost Latitude:</b> 41.8 N <b>Southernmost Latitude:</b> 9.5 N <b>Port of Call:</b> Rotterdam, Netherlands <b>Port of Call:</b> Las Palmas, Grand Canaria <b>Port of Call:</b> Philipsburg, St. Maarten <b>Port of Call:</b> Colon, Panama
<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

**Description:** Mole fraction of CO<sub>2</sub> in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO<sub>2</sub>\_ATM analyses (ppm)

<b>Variable</b>	<b>Name:</b> PRES_EQU_hPa <b>Unit:</b> hPa <b>Description:</b> Barometric pressure in the equilibrator headspace (hPa)
<b>Variable</b>	<b>Name:</b> PRES_ATM@SSP_hPa <b>Unit:</b> hPa <b>Description:</b> Barometric pressure measured outside, corrected to sea level (hPa)
<b>Variable</b>	<b>Name:</b> TEMP_EQU_C <b>Unit:</b> Degree C <b>Description:</b> Water temperature in equilibrator (°C)
<b>Variable</b>	<b>Name:</b> SST_C <b>Unit:</b> Degree C <b>Description:</b> Sea surface temperature (°C)
<b>Variable</b>	<b>Name:</b> SAL_permil <b>Unit:</b> ppt <b>Description:</b> Sea surface salinity on Practical Salinity Scale (o/oo)
<b>Variable</b>	<b>Name:</b> fCO <sub>2</sub> _SW@SST_uatm <b>Unit:</b> µatm <b>Description:</b> Fugacity of CO <sub>2</sub> in sea water at SST and 100% humidity (µatm)
<b>Variable</b>	<b>Name:</b> fCO <sub>2</sub> _ATM_interpolated_uatm <b>Unit:</b> µatm <b>Description:</b> Fugacity of CO <sub>2</sub> in air corresponding to the interpolated xCO <sub>2</sub> at SST and 100% humidity (µatm)
<b>Variable</b>	<b>Name:</b> dfCO <sub>2</sub> _uatm <b>Unit:</b> µatm <b>Description:</b> Sea water fCO <sub>2</sub> minus interpolated air fCO <sub>2</sub> (µatm)
<b>Variable</b>	<b>Name:</b> WOCE_QC_FLAG <b>Unit:</b> None <b>Description:</b> Quality control flag for fCO <sub>2</sub> values (2=good, 3=questionable)
<b>Variable</b>	<b>Name:</b> QC_SUBFLAG <b>Unit:</b> None <b>Description:</b> Quality control subflag for fCO <sub>2</sub> values, provides explanation when QC flag=3
<b>Sea Surface Temperature</b>	<b>Location:</b> In starboard technical room, about 2m after the intake which is directly through the ship's hull, before the SW pump. <b>Manufacturer:</b> Seabird, Inc. <b>Model:</b> SBE 38 <b>Accuracy:</b> 0.001 (°C if units not given) <b>Precision:</b> 0.0003 (°C if units not given) <b>Calibration:</b> Factory calibration <b>Comments:</b> Manufacturer's Resolution is taken as Precision; Maintained by University of Miami's MTG group.
<b>Sea Surface Salinity</b>	<b>Location:</b> Near the pCO <sub>2</sub> System. <b>Manufacturer:</b> Seabird <b>Model:</b> 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 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:** Yes  
**Intake Location:** ship provided clean air, source likely 15m above sea surface  
**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).  
**Atmospheric CO2 Accuracy:**  $\pm 0.5$   $\mu\text{atm}$  in fCO2\_ATM  
**Atmospheric CO2 Precision:**  $\pm 0.01$   $\mu\text{atm}$  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:**  $\pm 2$   $\mu\text{atm}$  in fCO2\_SW  
**Aqueous CO2 Precision:**  $\pm 0.01$   $\mu\text{atm}$  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 ~4.5 hours.  
Std 3: CC721740, 421.37 ppm, owned by AOML, used every ~4.5 hours.  
Std 4: CC721760, 583.81 ppm, owned by AOML, used every ~4.5 hours.  
Std 5: LL100000, 0.00 ppm, owned by AOML, used every ~18.5 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. Different version of data acquisition software were tested and various components of systems were optimized during this inaugural 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:**