

Dataset Expocode	28AQ20190630
Primary Contact	Name: Sullivan, Kevin Organization: NOAA/Atlantic Oceanographic & Meteorological Laboratory Address: 4301 Rickenbacker Causeway, Miami FL, 33149 Phone: 305-361-4382 Email: Kevin.Sullivan@noaa.gov
Investigator	Name: Wanninkhof, Rik Organization: NOAA/Atlantic Oceanographic & Meteorological Laboratory 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): 20200110 Revised Submission (yyyymmdd): 20200110
Campaign/Cruise	Expocode: 28AQ20190630 Campaign/Cruise Name: Flora_20190630 Campaign/Cruise Info: AOML_SOOP_CO2, Inner Loop Platform Type: CO2 Instrument Type: Equilibrator-IR or CRDS or GC Survey Type: SOOP Line Vessel Name: Flora Vessel Owner: Royal Caribbean International Vessel Code: 28AQ
Coverage	Start Date (yyyymmdd): 20190701 End Date (yyyymmdd): 20190707 Westernmost Longitude: 91.7 W Easternmost Longitude: 89.2 W Northernmost Latitude: 0.3 N Southernmost Latitude: 0.9 S Port of Call: Baltra, Galapagos
Variable	Name: xCO2_EQU_ppm Unit: ppm Description: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
Variable	Name: xCO2_ATM_ppm Unit: ppm Description: Mole fraction of CO2 measured in dry outside air (ppm)
Variable	Name: xCO2_ATM_interpolated_ppm Unit: ppm 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: 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: ± 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: ± 0.5 μ atm in fCO2_ATM

Atmospheric CO2 Precision: ± 0.01 μ 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 (~ 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

Measured CO2 Values: xCO2(dry)

Measurement Frequency: Every 140 seconds, except during calibration

Aqueous CO2 Accuracy: ± 2 μ atm in fCO2_SW

Aqueous CO2 Precision: ± 0.01 μ 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 ~ 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 ~ 17.0 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 pCO₂ 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.

Before this cruise, the outside air inlet was repositioned by ship personnel and

unfortunately the ATM analyses no longer provides good values. Original Data

Location: 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: