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

Cruise Information:
Experiment Name: EX1432
Experiment Type: SOOP Line
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC
Cruise ID: 33KF20140823
Cruise Info: AOML_SOOP_CO2
Geographical Region:
  Westernmost Longitude: -74.1
  Easternmost Longitude: -64.5
  Northernmost Latitude: 40.6
  Southernmost Latitude: 32.3
Cruise Dates (YYYYMMDD)
  Start_Date: 20140823
  End_Date: 20140828
Ports of Call:
  Bayonne, NJ
  Kings Wharf, Bermuda
Vessel Name: Explorer of the Seas
Vessel ID: 33KF
Vessel Owner: Royal Caribbean International

Variables Information:
Variable Name: xCO2_EQU_ppm
Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description of Variable</th>
<th>Unit of Variable</th>
</tr>
</thead>
<tbody>
<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:
A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring
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: 0.01
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. During the return transit from Bermuda, the seawater pump was intermittent.

Preliminary Quality Control:
NA
Form Type:
underway