Dataset Expocode: 316420190510

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Dataset
Funding Info: NOAA
Initial Submission (yyyyymmdd): 01/05/2022
Revised Submission (yyyyymmdd):

Campaign/Cruise
Expocode: 316420190510
Campaign/Cruise Name:
Campaign/Cruise Info:
Platform Type:
CO2 Instrument Type:
Survey Type: Moored Buoy
Vessel Name:
Vessel Owner:
Vessel Code: CCE1

Coverage
Start Date (yyyyymmdd): 20190510
End Date (yyyyymmdd): 20200611
Westernmost Longitude: 122.528 W
Easternmost Longitude: 122.528 W
Northernmost Latitude: 33.463 N
Southernmost Latitude: 33.463 N

Variable
Name: Date Time
Unit:
Description: Date and Time (UTC)

Variable
Name: xCO2 SW (wet)
Unit:
Description: (umol/mol) Mole fraction of CO2 in air in equilibrium with the seawater at sea surface temperature and measured humidity.

Variable
Name: CO2 SW QF
Unit:
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2O SW</td>
<td></td>
<td>(mmol/mol) Mole fraction of H2O in air from equilibrator.</td>
</tr>
<tr>
<td>xCO2 Air (wet)</td>
<td>umol/mol</td>
<td>Mole fraction of CO2 in air from airblock, 4 feet above the sea surface at measured humidity.</td>
</tr>
<tr>
<td>CO2 Air QF</td>
<td></td>
<td>Quality Flag for xCO2 Air (wet)</td>
</tr>
<tr>
<td>H2O Air</td>
<td></td>
<td>(mmol/mol) Mole fraction of H2O in air from airblock, 4 feet above the sea surface.</td>
</tr>
<tr>
<td>Licor Atm Pressure</td>
<td>hPa</td>
<td>Atmospheric pressure at the airblock, 4 feet above the sea surface.</td>
</tr>
<tr>
<td>Licor Temp</td>
<td>(C)</td>
<td>Temperature of the Infrared Licor 820 in degrees Celsius.</td>
</tr>
<tr>
<td>MAPCO2 %O2</td>
<td></td>
<td>The percent oxygen of the surface seawater divided by the percent oxygen of the atmosphere at 4 feet above the sea surface. Disclaimer: The oxygen measurement is made in the equilibrated air. We have found that the oxygen does not come to complete equilibrium so any rapid changes in oxygen do not get properly captured using this system. Therefore, we tend to use the oxygen data only as a qualitative sense of the biology. It is not a quantitative measure.</td>
</tr>
<tr>
<td>SST</td>
<td>(C)</td>
<td>Sea Surface Temperature.</td>
</tr>
<tr>
<td>Salinity</td>
<td>(PSU)</td>
<td>Sea Surface Salinity.</td>
</tr>
<tr>
<td>xCO2 SW (dry)</td>
<td>umol/mol</td>
<td>Mole fraction of CO2 in air in equilibrium with the seawater at sea surface temperature (dry air).</td>
</tr>
<tr>
<td>xCO2 Air (dry)</td>
<td>umol/mol</td>
<td>Mole fraction of CO2 in air at the airblock, 4 feet above the sea surface (dry air).</td>
</tr>
<tr>
<td>fCO2 SW (sat)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Description: (uatm) Fugacity of CO2 in air in equilibrium with the seawater at sea surface temperature (100% humidity). Since the measurements are taken at the sea surface, warming calculations are not necessary.

Variable Name: fCO2 Air (sat)
Unit:
Description: (uatm) Fugacity of CO2 in air at the airblock, 4 feet above the sea surface (100% humidity).

Variable Name: dfCO2
Unit:
Description: Difference of the fugacity of the CO2 in seawater and the fugacity of the CO2 in air (fCO2 SW - fCO2 Air).

Variable Name: pCO2 SW (wet)
Unit:
Description: (uatm) Partial Pressure of CO2 in air in equilibrium with the seawater at sea surface temperature (100% humidity)

Variable Name: pCO2 Air (wet)
Unit:
Description: (uatm) Partial Pressure of CO2 in air at the airblock, 4 feet above the sea surface (100% humidity).

Variable Name: dpCO2
Unit:
Description: Difference of the partial pressure of CO2 in seawater and air (pCO2 SW - pCO2 Air

Variable Name: pH SW
Unit:
Description: pH of Seawater (total scale)

Variable Name: pH QF
Unit:
Description: Quality Flag for pH

Variable Name: CHL
Unit:
Description: Total Chlorophyll (ug/l)

Variable Name: CHL QF
Unit:
Description: Quality Flag for CHL

Variable Name: NTU
Unit:
Description: Nephelometric Turbidity Unit(NTU Units)

Variable Name: NTU QF
Unit:
Description: Quality Flag for NTU

Variable Name: DOXY
Unit:
Description: Salinity-Compensated dissolved oxygen(umol/kg)

Variable Name: DOXY QF
Unit:
**Sea Surface Temperature**

**Location:** 1m

**Manufacturer:** SeaBird

**Model:** SBE 16

**Accuracy:** < 0.01 (°C if units not given)

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

**Calibration:** ~ Annually by SeaBird

**Comments:** Temperature data are internally recorded and collected during the equilibration period. Data are not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO2 and pCO2 calculations (within the degree of accuracy of the CO2 measurement). Contact us if you would like the CTD post-calibration information.

**Sea Surface Salinity**

**Location:** 1m

**Manufacturer:** SeaBird

**Model:** SBE 16

**Accuracy:** < 0.05

**Precision:**

**Calibration:** ~ Annually by SeaBird

**Comments:** Conductivity data are internally recorded and collected during the equilibration period. Data are not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO2 and pCO2 calculations (within the degree of accuracy of the CO2 measurement). Contact us if you would like the CTD post-calibration information.

**Atmospheric Pressure**

**Location:** 1m height

**Normalized to Sea Level:**

**Manufacturer:** LICOR

**Model:** LICOR 820

**Accuracy:** 2 hPA (hPa if units not given)

**Precision:** 1 hPA (hPa if units not given)

**Calibration:** Compared annually with Paros 765 Pressure Standard

**Comments:**

**Atmospheric CO2**

**Measured/Frequency:** yes, 3hr cycle

**Intake Location:** unused

**Drying Method:** unused

**Atmospheric CO2 Accuracy:** 1 uatm

**Atmospheric CO2 Precision:** 0.6 uatm

**Aqueous CO2 Equilibrator Design**

**System Manufacturer:**

**Intake Depth:** 14cm - 20cm

**Intake Location:**

**Equilibration Type:** Bubble Equilibrator

**Equilibrator Volume (L):** N/A

**Headspace Gas Flow Rate (ml/min):** ~600 cc/min

**Equilibrator Water Flow Rate (L/min):** N/A

**Equilibrator Vented:** Yes

**Equilibration Comments:**

**Drying Method:**

**Aqueous CO2 Sensor Details**

**Measurement Method:** Absolute, non-dispersive infrared (NDIR) gas analyzer

**Method details:**

**Manufacturer:** Licor

**Model:** LI-820
Measured CO2 Values:
Measurement Frequency: 3hr cycle
Aqueous CO2 Accuracy: 2 uatm
Aqueous CO2 Precision: 0.7 uatm

Sensor Calibrations:
**Calibration of Calibration Gases:** At the beginning of each sample, the instrument self-calibrates using a zero and high standard. The zero standard is generated by cycling a small amount of air through a soda lime chamber. The high standard is from a cylinder of calibrated standard reference gas, 466.87 umol/mol, from ESRL. ESRL standards are traceable to WMO scale. All standard values were obtained from the most current WMO/GAW scale at the time of the start of the deployment. For more information on estimates of accuracy and precision of the MAPCO2 system, see Sutton et al. 2014 (reference below).

**Number Non-Zero Gas Standards:**

**Calibration Gases:**
NOAA Earth System Research Laboratory (ESRL)

**Comparison to Other CO2 Analyses:**

**Comments:**

**Method Reference:**

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**Equilibrator Temperature Sensor**

**Location:**

**Manufacturer:**

**Model:**

**Accuracy:** (°C if units not given)

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

**Calibration:**

**Comments:**

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**Equilibrator Pressure Sensor**

**Location:**

**Manufacturer:**

**Model:**

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

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

**Calibration:**

**Comments:**

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**Other Sensor**

**Description:**

**Manufacturer:** Maxtec Oxygen Sensor

**Model:** Max-250

**Accuracy:** 2.0% Full Scale over operating temperature range. 1.0% Full Scale @ constant temperature and pressure

**Precision:**

**Calibration:** Factory calibrated before purchase. Recalibrated to sea level atmospheric air every 7 days

**Comments:**

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**Other Sensor**

**Description:**

**Manufacturer:** Sensirion Humidity Sensor

**Model:** SHT71
Accuracy: > 0.01%
Precision:
Calibration: Factory calibrated before purchase.
Comments:

Other Sensor
Description:
Manufacturer: Seabird/Satlantic
Model: SeaFET pH Sensor
Accuracy:
Precision:
Calibration: ~ Annually by Seabird/Satlantic
Comments: pH data are collected and internally recorded during the CO2 equilibration period. Data are salinity compensated with salinity collected by the Seabird SBE16, using the program SeaFET.com 1.1.2. Sensor resolution and uncertainty were provided by the manufacturer.

Other Sensor
Description:
Manufacturer: Wet Labs
Model: ECO FLNTUS
Accuracy:
Precision:
Calibration: ~ Annually by Wet Labs, Inc
Comments: The community-established calibration bias of 2 for the WET Labs ECO-series fluorometer was applied to these in situ fluorometric chlorophyll values (Roesler et al. 2017). Sensor resolution was provided by the manufacturer. The accuracy of fluorescence-based chlorophyll is unknown.

Other Sensor
Description:
Manufacturer: Seabird
Model: SBE63
Accuracy:
Precision:
Calibration: ~ Annually by Seabird Electronics, Inc
Comments: Sensor resolution and uncertainty were provided by the manufacturer.

Additional Information
Suggested QC flag from Data Provider:
Additional Comments: o All measurements are at sea surface temperature and atmospheric pressure. o During the equilibration cycle, a closed loop of air equilibrates with seawater for 10 minutes. Once the equilibration period is complete, the pump stops and the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged. o During the air cycle, fresh air is pumped through the detector for 1 minute. Once the pump stops, the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged. o The gas streams for both the air cycle and equilibrator cycle are partially dried before entering the detector. The values listed as wet xCO2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment. o Sampling occurs every 3 hours. The infrared detector is calibrated at the beginning of every sampling period. Averaged data and standard deviations for each measurement are transmitted back daily. o To calculate the dry measurements, the water mole fraction in the Licor detector must be known. A relative humidity sensor is located immediately downstream of the detector. o As part of the QC process, each data set is compared with the Marine
Boundary Layer (MBL) data from GlobalView-CO2. As part of the QC process, xCO2 air measurements are compared to the following data sets when available: previous MAPCO2 deployment if overlap on recovery/deployment, following MAPCO2 deployment if overlap on recovery/deployment, and Marine Boundary Layer (MBL) xCO2 air data from GlobalView-CO2. The available comparison data sets are in good agreement with the MAPCO2 air data and no adjustment was made. Dlugokencky, E.J., K.W. Thoning, P.M. Lang, and P.P. Tans (2019), NOAA Greenhouse Gas Reference from Atmospheric Carbon Dioxide Dry Air Mole Fractions from the NOAA ESRL Carbon Cycle Cooperative Global Air Sampling Network. Data Path: ftp://aftp.cmdl.noaa.gov/data/trace_gases/co2/flask/surface/.

MBL Data were last downloaded from ESRL on 01/05/2022.

During the QC process, an adjustment to the Licor pressure is also made based on each sensor's bias to barometric pressure as measured in the lab. This system has Licor pressure bias of -0.100 applied. The standard reference gas ran out between 12/10/2019 00:00 and 06/11/2020 15:00. Missing reference gas coefficients were computed using the correlation between Licor temperature and the coefficients in the time range of good span values. xCO2 air and sw (wet) from 05/09/2019 18:00 to 06/11/2020 15:00 were then recalculated using these computed coefficients. Post calculation correlation between Licor temperature and coefficient is: Licor coef = -0.001389 * Temp + 0.9392 r^2 = 0.76.


Only nighttime measurements of chlorophyll (defined as 21:00 to 03:00 local time) are published, given the lack of validation data for correcting daytime quenching. All daytime measurements are flagged as missing (QF = 5). pH failed on deployment.

No data = -999

These data are made freely available to the public and the scientific community in the belief that their wide dissemination will lead to greater understanding and new scientific insights. The availability of these data does not constitute publication of the data. We rely on the ethics and integrity of the user to assure that PMEL receives fair credit for our work. Please send manuscripts using this data to PMEL for review before they are submitted for publication so we can insure that the quality and limitations of the data are accurately represented.

**Citation for this Dataset:**

**Other References for this Dataset:**
None